



City of League City, Texas Standard Construction Specification Documents

SECTION 00 00 00

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[Text in Blue is for information or guidance. Remove all blue text in the project final document.]

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To be provided by Engineer of Record.

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To be provided by Engineer of Record.

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- *Add bold and underlined “Revised” next to any Specifications which have been revised by the Engineer specifically for this project*
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To be provided by Engineer of Record.

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Appendix

To be provided by Engineer of Record.

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Summary of Work to be performed in accordance with the Contract Documents

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various items bid.
No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Work Covered by Contract Documents

1. Work is to include furnishing all labor, materials, and equipment, and performing all Work necessary for this construction project as detailed in the Drawings and Specifications.

B. Incidental Work

1. Any and all Work specifically governed by documentary requirements for the project, such as conditions imposed by the Contract Documents in which no specific item for bid has been provided for in the Proposal, then the item shall be considered as an incidental item of Work, the cost of which shall be included in the price bid in the Proposal for various bid items.

C. Use of Premises

1. Coordinate uses of premises under direction of the City.
2. Assume full responsibility for protection and safekeeping of materials and equipment stored on the Site.
3. Use and occupy only portions of the public streets and alleys, or other public places or other rights-of-way as provided for in the ordinances of the City, as shown in the Contract Documents, or as may be specifically authorized in writing by the City.
 - a. A reasonable amount of tools, materials, and equipment for construction purposes may be stored in such space, but no more than is necessary to avoid delay in the construction operations.
 - b. Excavated and waste materials shall be stored in such a way as not to interfere with the use of spaces that may be designated to be left free and unobstructed and so as not to inconvenience occupants of adjacent property.
 - c. If the street is occupied by railroad tracks, the Work shall be carried on in such manner as not to interfere with the operation of the railroad.

- 1) All Work shall be in accordance with railroad requirements set forth in Division 0 as well as the railroad permit.

D. Work within Easements

1. Do not enter upon private property for any purpose without having previously obtained permission from the owner of such property.
2. Do not store equipment or material on private property unless and until the specified approval of the property owner has been secured in writing by the Contractor and a copy furnished to the City.
3. Unless specifically provided otherwise, clear all rights-of-way or easements of obstructions which must be removed to make possible proper prosecution of the Work as a part of the project construction operations.
4. Preserve and use every precaution to prevent damage to, all trees, shrubbery, plants, lawns, fences, culverts, curbing, and all other types of structures or improvements, to all water, sewer, and gas lines, to all conduits, overhead pole lines, or appurtenances thereof, including the construction of temporary fences and to all other public or private property adjacent to the Work.
5. Notify the proper representatives of the owners or occupants of the public or private lands of interest in lands which might be affected by the Work.
 - a. Such notice shall be made at least 48 hours in advance of the beginning of the Work.
 - b. Notices shall be applicable to both public and private utility companies and any corporation, company, individual, or other, either as owners or occupants, whose land or interest in land might be affected by the Work.
 - c. Be responsible for all damage or injury to property of any character resulting from any act, omission, neglect, or misconduct in the manner or method or execution of the Work, or at any time due to defective work, material, or equipment.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

EXECUTION [NOT USED]

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to 1 or more of the following:
 - a. Name of manufacturer
 - b. Name of vendor
 - c. Trade name
 - d. Catalog number
2. Substitutions are not "or-equals".

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Request for Substitution - General

1. Within 30 days after award of Contract (unless noted otherwise), the City will consider formal requests from Contractor for substitution of products in place of those specified.
2. Certain types of equipment and kinds of material are described in Specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
 - a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by City.
3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
 - a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,
 - b. Contractor proposes a cost and/or time reduction incentive to the City.

1.5 SUBMITTALS

- A. See Request for Substitution Form (attached)
- B. Procedure for Requesting Substitution
 - 1. Substitution shall be considered only:
 - a. Under the conditions stated herein
 - 2. Submit one PDF copy via email to the Project Manager and their duly appointed representative, including:
 - a. Documentation
 - 1) Complete data substantiating compliance of proposed substitution with Contract Documents
 - 2) Data relating to changes in construction schedule, when a reduction is proposed
 - 3) Data relating to changes in cost
 - b. For products
 - 1) Product identification
 - a) Manufacturer's name
 - b) Telephone number and representative contact name
 - c) Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents
 - 2) Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents
 - 3) Itemized comparison of original and proposed product addressing product characteristics including, but not necessarily limited to:
 - a) Size
 - b) Composition or materials of construction
 - c) Weight
 - d) Electrical or mechanical requirements
 - 4) Product experience
 - a) Location of past projects utilizing product
 - b) Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product
 - c) Available field data and reports associated with proposed product
 - 5) Samples
 - a) Provide at request of City.
 - b) Samples become the property of the City.
 - c. For construction methods:
 - 1) Detailed description of proposed method
 - 2) Illustration drawings
- C. Approval or Rejection
 - 1. Written approval or rejection of substitution given by the City
 - 2. City reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.
 - 3. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

4. No additional contract time will be given for substitution.
5. Substitution will be rejected if:
 - a. Submittal is not through the Contractor with his stamp of approval
 - b. Request is not made in accordance with this Specification Section
 - c. In the City's opinion, acceptance will require substantial revision of the original design
 - d. In the City's opinion, substitution will not perform adequately the function consistent with the design intent

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. In making request for substitution or in using an approved product, the Contractor represents that the Contractor:
 1. Has investigated proposed product, and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended
 2. Will provide same guarantee for substitute item as for product specified
 3. Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects
 4. Waives all claims for additional costs related to substitution which subsequently arise

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

EXHIBIT A
REQUEST FOR SUBSTITUTION FORM:

TO: _____
PROJECT: _____ DATE: _____

We hereby submit for your consideration the following product instead of the specified item for the above project:

SECTION	PARAGRAPH	SPECIFIED ITEM

Proposed Substitution: _____

Reason for Substitution: _____

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Fill in Blanks Below:

A. Will the undersigned contractor pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

B. What effect does substitution have on other trades? _____

C. Differences between proposed substitution and specified item? _____

D. Differences in product cost or product delivery time? _____

E. Manufacturer's guarantees of the proposed and specified items are: _____

_____ Equal _____ Better (explain on attachment)

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By: _____

For Use by City

Signature _____

_____ Recommended _____ Recommended as noted

Firm _____

_____ Not recommended _____ Received late

Address _____

By _____

Date _____

Date _____

Telephone _____

Remarks _____

For Use by City:

_____ Approved

_____ Rejected

City _____

Date _____

SECTION 01 29 76

STORED MATERIALS (MATERIALS ON HAND)

[Text in Blue is for information or guidance. Remove all blue text in the project final document.]

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The procedure for requesting payment for stored materials and equipment (materials on hand).
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this item is considered incidental to the various items bid. No separate payment will be allowed for this item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Request for Payment of Stored Materials and Equipment
 - 1. Provide written request to City, if payment is requested on the basis of approved materials and equipment delivered and stored at the Site, or other agreed upon location, in accordance with the Contract Documents, and which will not be incorporated into the Work for a minimum of thirty (30) days from delivery.
- B. Payment for Materials and Equipment
 - 1. Payment will be made in accordance with Article 14 of the General Conditions, less retainage.
 - 2. Payment will not exceed the total estimated quantity required to complete the Work.
 - 3. The amounts advanced for stored materials and equipment will be deducted from payments to the Contractor as the materials or equipment are incorporated into the Work.
 - 4. Payment for stored materials and equipment will not constitute acceptance of the relevant portion of the Work which the materials will be incorporated into.
- C. Allowed Materials and Equipment
 - 1. Payment for stored materials and equipment will be limited to major items associated with the Work. Perishable articles and small warehouse items will not be considered for payment for this item. Examples of major items associated with the Work include the following items:
 - a. *<Provide limitations for stored material payment, i.e. 24-inch and larger valves, 24-inch and larger piping, 36-inch and larger steel casing pipe, pre-cast units, etc.>*

2. All items submitted for payment will be subject to approval for payment by relevant City departments and the City Project Manager.
- D. Returned Materials/Equipment
 1. Should stored materials/equipment that have been paid for under this Section need to be returned for any reason, the Contractor shall bear any fees associated with the return.
- E. Contractor shall save the City harmless in the event of loss or damage of materials/equipment for which advance payments have been made in accordance with this Section.

1.5 SUBMITTALS

- A. Provide a certified inventory of the quantity of each stored item and accompanying invoice.
- B. Within thirty (30) days after the Contractor receives payment for stored materials or equipment, provide a copy of a certified paid invoice statement for each item for which payment has been made by Contractor.
 1. If certification of payment is not presented within the thirty (30) day period, the advanced payment will be deducted from the next progress payment.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements
- B. Storage and Handling Requirements
 1. Secure and maintain a location to store the materials and equipment in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 31 19

PRECONSTRUCTION MEETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provisions for the preconstruction meeting to be held prior to the start of Work to clarify construction contract administration procedures.

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Attend preconstruction meeting.
2. Representatives of Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
3. Meeting administered by City may be tape recorded.
 - a. If recorded, audio files will be used to prepare minutes and retained by City for future reference.
4. Project Manager will establish their duly authorized representative(s) authorized to make decisions as identified in the Contract Documents.

B. Preconstruction Meeting

1. A preconstruction meeting will be held within 14 days, unless otherwise coordinated after the execution of the Agreement and before Work is started.
 - a. The meeting will be scheduled and administered by the City.
2. The Project Manager will preside at the meeting, prepare the notes of the meeting and distribute copies of same to all participants who so request by fully completing the attendance form to be circulated at the beginning of the meeting.
3. Attendance shall include:
 - a. Project Manager
 - b. Project Manager's duly authorized representative (if any)
 - c. Contractor's project manager
 - d. Contractor's superintendent
 - e. Any subcontractor or supplier representatives whom the Contractor may desire to invite, or the City may request

- f. Other City representatives
- g. Others as appropriate
- 4. Construction Schedule
 - a. Prepare baseline construction schedule in accordance with Section 01 32 16 and provide at Preconstruction Meeting.
 - b. City will notify Contractor of any schedule changes upon Notice of Preconstruction Meeting.
- 5. Preliminary Agenda may include:
 - a. Introduction of Project Personnel
 - b. General Description of Project
 - c. Status of right-of-way, utility clearances, easements or other pertinent permits
 - d. Contractor's work plan and schedule
 - e. Contract Time
 - f. Notice to Proceed
 - g. Construction Staking
 - h. Progress Payments
 - i. Extra Work and Change Order Procedures
 - j. Field Orders
 - k. Disposal Site Letter for Waste Material
 - l. Insurance Renewals
 - m. Payroll Certification
 - n. Material Certifications and Quality Control Testing
 - o. Public Safety and Convenience
 - p. Documentation of Pre-Construction Conditions
 - q. Weekend Work Notification
 - r. Legal Holidays
 - s. Trench Safety Plans
 - t. Confined Space Entry Standards
 - u. Coordination with the City's representative for operations of existing facility during construction
 - v. Storm Water Pollution Prevention Plan
 - w. Coordination with other Contractors
 - x. Early Warning System
 - y. Contractor Evaluation
 - z. Special Conditions applicable to the project
 - aa. Damages Claims
 - bb. Submittal Procedures
 - cc. Substitution Procedures
 - dd. Correspondence Routing
 - ee. Record Drawings
 - ff. Temporary construction facilities
 - gg. Final Acceptance
 - hh. Final Payment
 - ii. Communications Plan
 - jj. Questions or Comments
 - kk. Franchise utility and pipeline companies' coordination
 - ll. permits
 - mm. Power supply and coordination with provider

- nn. Use of city water, wastewater, storm sewer systems
- oo. Construction traffic control
- pp. Coordination with HOA's, as applicable

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 31 20
PROJECT MEETINGS

[Text in Blue is for information or guidance. Remove all blue text in the project final document.]

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provisions for project meetings throughout the construction period to enable orderly review of the progress of the Work and to provide for systematic discussion of potential problems

B. Deviations this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Schedule, attend and administer as specified, periodic progress meetings, and specially called meetings throughout progress of the Work.
2. Representatives of Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
3. Meetings administered by City may be recorded.
4. Meetings, in addition to those specified in this Section, may be held when requested by the City, Engineer or Contractor.

[Delete if not required for this Contract]

B. Pre-Construction Neighborhood Meeting

- 1. After the execution of the Agreement, but before construction is allowed to begin, attend 1 Public Meeting with affected residents to:*
 - a. Present projected schedule, including construction start date*
 - b. Answer any construction related questions*
- 2. Meeting Location*
 - a. Location of meeting to be determined by the City.*
- 3. Attendees*
 - a. Contractor*
 - b. Project Manager*
 - c. Other City representatives*
- 4. Meeting Schedule*

- a. *In general, the neighborhood meeting will occur within the 2 weeks, unless otherwise coordinated, following the pre-construction conference.*
- b. *In no case will construction be allowed to begin until this meeting is held.*

C. Progress Meetings

1. Formal project coordination meetings will be held *<Insert anticipated frequency, i.e. weekly, monthly, etc.>*. Meetings will be scheduled and administered by Project Manager.
 - a. Additional meetings may be held at the request of the :
 - 1) City
 - 2) Engineer
 - 3) Contractor
2. Additional progress meetings to discuss specific topics will be conducted on an as-needed basis. Such additional meetings shall include, but not be limited to:
 - a. Coordinating shutdowns
 - b. Installation of piping and equipment
 - c. Coordination between other construction projects
 - d. Resolution of construction issues
 - e. Equipment approval
3. The Project Manager will preside at progress meetings, prepare the notes of the meeting and distribute copies of the same to all participants who so request by fully completing the attendance form to be circulated at the beginning of each meeting.
4. Attendance shall include:
 - a. Contractor's project manager
 - b. Contractor's superintendent
 - c. Any subcontractor or supplier representatives whom the Contractor may desire to invite, or the City may request
 - d. Engineer's representatives
 - e. City's representatives
 - f. Others, as requested by the Project Manager
5. Preliminary Agenda may include:
 - a. Review of Work progress since previous meeting
 - b. Field observations, problems, conflicts
 - c. Items which impede construction schedule
 - d. Review any pending utility and pipeline relocations, as applicable.
 - e. Review of off-site fabrication, delivery schedules
 - f. Review of construction interfacing and sequencing requirements with other construction contracts
 - g. Corrective measures and procedures to regain projected schedule
 - h. Revisions to construction schedule
 - i. Progress, schedule, during succeeding Work period
 - j. Coordination of schedules
 - k. Review submittal schedules
 - l. Maintenance of quality standards
 - m. Pending changes and substitutions
 - n. Review proposed changes for:
 - 1) Effect on construction schedule and on completion date
 - 2) Effect on other contracts of the Project
 - o. Review Record Documents

- p. Review monthly pay request
- q. Review status of Requests for Information
- 6. Meeting Location
 - a. The City will establish a meeting location.
 - 1) To the extent practicable, meetings will be held at the Site.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 32 16 CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for the preparation, submittal, updating, status reporting and management of the Construction Progress Schedule

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES

A. Definitions

1. **Baseline Schedule** - Initial schedule submitted before work begins that will serve as the baseline for measuring progress and departures from the schedule.
2. **Progress Schedule** - Monthly submittal of a progress schedule documenting progress on the project and any changes anticipated.
3. **Schedule Narrative** - Concise narrative of the schedule including schedule changes, expected delays, key schedule issues, critical path items, etc

B. Reference Standards

1. None

1.4 ADMINISTRATIVE REQUIREMENTS

A. Baseline Schedule

1. General

- a. Prepare a baseline Schedule using approved software and the Critical Path Method (CPM).
- b. Review the draft baseline Schedule with the City to demonstrate understanding of the work to be performed and known issues and constraints related to the schedule.
- c. Designate an authorized representative (Project Scheduler) responsible for developing and updating the schedule and preparing reports.

B. Progress Schedule

1. Update the progress Schedule monthly.
2. Prepare the Schedule Narrative to accompany the monthly progress Schedule.
3. Change Orders

- a. Incorporate approved change orders, resulting in a change of contract time, in the baseline Schedule.

C. Responsibility for Schedule Compliance

1. Whenever it becomes apparent from the current progress Schedule and CPM Status Report that delays to the critical path have resulted and the Contract completion date will not be met, or when so directed by the City, make some or all of the following actions at no additional cost to the City
 - a. Submit a Recovery Plan to the City for approval revised baseline Schedule outlining:
 - 1) A written statement of the steps intended to take to remove or arrest the delay to the critical path in the approved schedule
 - 2) Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work and return current Schedule to meet projected baseline completion dates
 - 3) Increase the number of working hours per shift, shifts per day, working days per week, the amount of construction equipment, or any combination of the foregoing, sufficiently to substantially eliminate the backlog of work
 - 4) Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule
2. If no written statement of the steps intended to take is submitted when so requested by the City, the City may direct the Contractor to increase the level of effort in manpower (trades), equipment and work schedule (overtime, weekend and holiday work, etc.) to be employed by the Contractor in order to remove or arrest the delay to the critical path in the approved schedule.
 - a. No additional cost for such work will be considered.

D. The Contract completion time will be adjusted only for causes specified in this Contract.

- a. Requests for an extension of any Contract completion date must be supplemented with the following:
 - 1) Furnish justification and supporting evidence as the City may deem necessary to determine whether the requested extension of time is entitled under the provisions of this Contract.
 - a) The City will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor, in writing thereof.
 - 2) If the City finds that the requested extension of time is entitled, the City's determination as to the total number of days allowed for the extensions shall be based upon the approved total baseline schedule and on all data relevant to the extension.
 - a) Such data shall be included in the next updating of the Progress schedule.
 - b) Actual delays in activities which, according to the Baseline schedule, do not affect any Contract completion date shown by the critical path in the network will not be the basis for a change therein.
2. Submit each request for change in Contract completion date to the City within 30 days after the beginning of the delay for which a time extension is requested but before the date of final payment under this Contract.
 - a. No time extension will be granted for requests which are not submitted within the foregoing time limit.

- b. From time to time, it may be necessary for the Contract schedule or completion time to be adjusted by the City to reflect the effects of job conditions, weather, technical difficulties, strikes, unavoidable delays on the part of the City or its representatives, and other unforeseeable conditions which may indicate schedule adjustments or completion time extensions.
 - 1) Under such conditions, the City will direct the Contractor to reschedule the work or Contract completion time to reflect the changed conditions and the Contractor shall revise his schedule accordingly.
 - a) No additional compensation will be made to the Contractor for such schedule changes except for unavoidable overall contract time extensions beyond the actual completion of unaffected work, in which case the Contractor shall take all possible action to minimize any time extension and any additional cost to the City.
 - b) Available float time in the Baseline schedule may be used by the City as well as by the Contractor.
 - 3. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Baseline Schedule.
 - a. Float or slack time is not for the exclusive use or benefit of either the Contractor or the City.
 - b. Proceed with work according to early start dates, and the City shall have the right to reserve and apportion float time according to the needs of the project.
 - c. Acknowledge and agree that actual delays, affecting paths of activities containing float time, will not have any effect upon contract completion times, providing that the actual delay does not exceed the float time associated with those activities.
- E. Coordinating Schedule with Other Contract Schedules
- 1. Where work is to be performed under this Contract concurrently with or contingent upon work performed on the same facilities or area under other contracts, the Baseline Schedule shall be coordinated with the schedules of the other contracts.
 - a. Obtain the schedules of the other appropriate contracts from the City for the preparation and updating of Baseline schedule and make the required changes in his schedule when indicated by changes in corresponding schedules.
 - 2. In case of interference between the operations of different contractors, the City will determine the work priority of each contractor and the sequence of work necessary to expedite the completion of the entire Project.
 - a. In such cases, the decision of the City shall be accepted as final.
 - b. The temporary delay of any work due to such circumstances shall not be considered as justification for claims for additional compensation.

1.5 SUBMITTALS

A. Baseline Schedule

- 1. Submit Schedule in native file format and pdf format.
 - a. Native file format shall be:
 - 1) Microsoft Project
- 2. Submit draft baseline Schedule to City prior to the pre-construction meeting and bring in hard copy to the meeting for review and discussion.

B. Progress Schedule

1. Submit progress Schedule in native file format and pdf format.
 2. Submit progress Schedule monthly no later than the 25th day of the month.
- C. Schedule Narrative
1. Submit the schedule narrative in pdf format.
 2. Submit schedule narrative monthly no later than the 25th day of the month.
- D. Submittal Process
- 1.
 2. Contractor shall submit one (1) hard copy of documents to the Project Manager's duly appointed representative.
 3. Contractor shall submit documents via email to the Project Manager and their duly appointed representative.
 4. Once the project has been completed and Final Acceptance has been issued by the City, no further progress schedules are required.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. The person preparing and revising the construction Progress Schedule shall be experienced in the preparation of schedules of similar complexity.
- B. Schedule and supporting documents addressed in this Specification shall be prepared, updated and revised to accurately reflect the performance of the construction.
- C. Contractor is responsible for the quality of all submittals in this section meeting the standard of care for the construction industry for similar projects.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 32 33
PRECONSTRUCTION VIDEO

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for:
 - a. Preconstruction Videos
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preconstruction Video
 - 1. Produce a preconstruction video of the site/alignment, including all areas in the vicinity of and to be affected by construction. Provide a digital copy of video upon request by the City.
 - 2. Retain a copy of the preconstruction video until the end of the maintenance surety period.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. General methods and requirements of submissions applicable to the following Work-related submittals:
 - a. Shop Drawings
 - b. Product Data (including Project Material Submittal Checklist submittals)
 - c. Samples
 - d. Mock Ups
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination
 - 1. Notify the City in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.
 - 2. Coordination of Submittal Times
 - a. Prepare, prioritize and transmit each submittal sufficiently in advance of performing the related Work or other applicable activities, or within the time specified in the individual Work Sections, of the Specifications.
 - b. Contractor is responsible such that the installation will not be delayed by processing times including, but not limited to:
 - a) Disapproval and resubmittal (if required)
 - b) Coordination with other submittals
 - c) Testing
 - d) Purchasing
 - e) Fabrication
 - f) Delivery
 - g) Similar sequenced activities

- c. No extension of time will be authorized because of the Contractor's failure to transmit submittals sufficiently in advance of the Work.
- d. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.

B. Submittal Numbering

- 1. When submitting shop drawings or samples, utilize a submittal cross-reference identification numbering system in the following manner:
 - a. Use the applicable Specification Section Number.
 - b. For the next 2 digits number use numbers 01-99 to sequentially number each initial separate item or drawing submitted under each specific Section number.
 - c. Last use a letter, A-Z, indicating the resubmission of the same drawing (i.e. A=2nd submission, B=3rd submission, C=4th submission, etc.). A typical submittal number would be as follows:

303-02-B

- 1) 303 is the Specification Section for Portland Cement Concrete Pavement
- 2) 02 is the second initial submittal under this Specification Section
- 3) B is the third submission (second resubmission) of that particular shop drawing

C. Contractor Certification

- 1. Review shop drawings, product data and samples, including those by subcontractors, prior to submission to determine and verify the following:
 - a. Field measurements
 - b. Field construction criteria
 - c. Catalog numbers and similar data
 - d. Conformance with the Contract Documents
- 2. Provide each shop drawing, sample and product data submitted by the Contractor with a Certification Statement affixed including:
 - a. The Contractor's Company name
 - b. Signature of submittal reviewer
 - c. Certification Statement
 - 1) "By this submittal, I hereby represent that I have determined and verified field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings."

D. Submittal Format

- 1. Fold shop drawings larger than 8 ½ inches x 11 inches to 8 ½ inches x 11 inches.

2. Bind shop drawings and product data sheets together.
3. Order
 - a. Cover Sheet
 - 1) Description of Packet
 - 2) Contractor Certification
 - b. List of items / Table of Contents
 - c. Product Data /Shop Drawings/Samples /Calculations
- E. Submittal Content
 1. The date of submission and the dates of any previous submissions
 2. The Project title and number
 3. Contractor identification
 4. The names of:
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 5. Identification of the product, with the Specification Section number, page and paragraph(s)
 6. Field dimensions, clearly identified as such
 7. Relation to adjacent or critical features of the Work or materials
 8. Applicable standards, such as ASTM or Federal Specification numbers
 9. Identification by highlighting of deviations from Contract Documents
 10. Identification by highlighting of revisions on resubmittals
 11. An 8-inch x 3-inch blank space for Contractor and City stamps
- F. Shop Drawings
 1. As specified in individual Work Sections includes, but is not necessarily limited to:
 - a. Custom-prepared data such as fabrication and erection/installation (working) drawings
 - b. Scheduled information
 - c. Setting diagrams
 - d. Actual shopwork manufacturing instructions
 - e. Custom templates
 - f. Special wiring diagrams
 - g. Coordination drawings
 - h. Individual system or equipment inspection and test reports including:
 - 1) Performance curves and certifications
 - i. As applicable to the Work
 2. Details
 - a. Relation of the various parts to the main members and lines of the structure

- b. Where correct fabrication of the Work depends upon field measurements
 - 1) Provide such measurements and note on the drawings prior to submitting for approval.

G. Product Data

- 1. For submittals of product data for products included on the City's Product Material Submittal Checklist, highlight each item selected for use on the Project.
- 2. For submittals of product data for products not included on the City's Product Material Submittal Checklist, submittal data may include, but is not necessarily limited to:
 - a. Standard prepared data for manufactured products (sometimes referred to as catalog data)
 - 1) Such as the manufacturer's product specification and installation instructions
 - 2) Availability of colors and patterns
 - 3) Manufacturer's printed statements of compliances and applicability
 - 4) Roughing-in diagrams and templates
 - 5) Catalog cuts
 - 6) Product photographs
 - 7) Standard wiring diagrams
 - 8) Printed performance curves and operational-range diagrams
 - 9) Production or quality control inspection and test reports and certifications
 - 10) Mill reports
 - 11) Product operating and maintenance instructions and recommended spare-parts listing and printed product warranties
 - 12) As applicable to the Work
- 3. Submittals of product data for products not included on the City's Product Material Submittal Checklist may be considered a Substitution in accordance with Section 01 25 00.
- 4. All deviations from City's Product Material Submittal Checklist shall require approval by the Engineer of Record for the Project.

H. Samples

- 1. As specified in individual Sections, include, but are not necessarily limited to:
 - a. Physical examples of the Work such as:
 - 1) Sections of manufactured or fabricated Work
 - 2) Small cuts or containers of materials

- 3) Complete units of repetitively used products color/texture/pattern swatches and range sets
 - 4) Specimens for coordination of visual effect
 - 5) Graphic symbols and units of Work to be used by the City for independent inspection and testing, as applicable to the Work
- I. Do not start Work requiring a shop drawing, sample or product data nor any material to be fabricated or installed prior to the approval or qualified approval of such item.
1. Fabrication performed, materials purchased, or on-site construction accomplished which does not conform to approved shop drawings and data is at the Contractor's risk.
 2. The City will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
 3. Complete project Work, materials, fabrication, and installations in conformance with approved shop drawings, applicable samples, and product data.
- J. Submittal Distribution
1. Electronic Distribution
 - a. Provide all submittals in electronic form via email to Project Manager and their duly appointed representative.
 - b. Shop Drawings
 - 1) Email submittal to Project Manager and their duly appointed representative.
 - 2) Hard Copies
 - a) Not required
 - c. Product Data
 - 1) Email submittal to Project Manager and their duly appointed representative.
 - 2) Hard Copies
 - a) Not required
 - d. Samples
 - 1) Distributed to the Project Manager
- K. Submittal Review
1. The review of shop drawings, data and samples will be for general conformance with the design concept and Contract Documents. This is not to be construed as:
 - a. Permitting any departure from the Contract requirements
 - b. Relieving the Contractor of responsibility for any errors, including details, dimensions, and materials
 - c. Approving departures from details furnished by the City, except as otherwise provided herein

2. The review and approval of shop drawings, samples or product data by the City does not relieve the Contractor from his/her responsibility with regard to the fulfillment of the terms of the Contract.
 - a. All risks of error and omission are assumed by the Contractor, and the City will have no responsibility, therefore.
3. The Contractor remains responsible for details and accuracy, for coordinating the Work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly and for performing Work in a safe manner.
4. If the shop drawings, data or samples as submitted describe variations and show a departure from the Contract requirements which City finds to be in the interest of the City and to be so minor as not to involve a change in Contract Price or time for performance, the City may return the reviewed drawings without noting an exception.
5. Submittals will be returned to the Contractor under 1 of the following codes:
 - a. Code 1
 - 1) "NO EXCEPTIONS TAKEN" is assigned when there are no notations or comments on the submittal.
 - a) When returned under this code the Contractor may release the equipment and/or material for manufacture.
 - b. Code 2
 - 1) "EXCEPTIONS NOTED". This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor.
 - a) The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
 - c. Code 3
 - 1) "EXCEPTIONS NOTED/RESUBMIT". This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the package.
 - a) This resubmittal is to address all comments, omissions and non-conforming items that were noted.
 - b) Resubmittal is to be received by the City within 15 Calendar Days of the date of the City's transmittal requiring the resubmittal.
 - d. Code 4
 - 1) "NOT APPROVED" is assigned when the submittal does not meet the intent of the Contract Documents.
 - a) The Contractor must resubmit the entire package revised to bring the submittal into conformance.

- b) It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.

6. Resubmittals

- a. Handled in the same manner as first submittals
 - 1) Corrections other than requested by the City
 - 2) Marked with revision triangle or other similar method
 - a) At Contractor's risk if not marked
- b. Submittals for each item will be reviewed no more than twice at the City's expense.
 - 1) All subsequent reviews will be performed at times convenient to the City and at the Contractor's expense, based on the City's or City Representative's then prevailing rates.
 - 2) Provide Contractor reimbursement to the City within 30 Calendar Days for all such fees invoiced by the City.
- c. The need for more than 1 resubmission or any other delay in obtaining City's review of submittals, will not entitle the Contractor to an extension of Contract Time.

7. Partial Submittals

- a. City reserves the right to not review submittals deemed partial, at the City's discretion.
 - b. Submittals deemed by the City to be not complete will be returned to the Contractor, and will be considered "Not Approved" until resubmitted.
 - c. The City may at its option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.
8. If the Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, then written notice must be provided thereof to the City at least 7 Calendar Days prior to release for manufacture.
9. When the shop drawings have been completed to the satisfaction of the City, the Contractor may carry out the construction in accordance therewith and no further changes therein except upon written instructions from the City.
10. Each submittal, appropriately coded, will be returned within 30 Calendar Days following receipt of submittal by the City.

L. Mockups

- 1. Mockup units as specified in individual Sections, include, but are not necessarily limited to, complete units of the standard of acceptance for that type of Work to be used on the Project. Remove at the completion of the Work or when directed.

M. Qualifications

- 1. If specifically required in other Sections of these Specifications, submit a P.E. Certification for each item required.

N. Request for Information (RFI)

1. Contractor Request for additional information
 - a. Clarification or interpretation of the contract documents
 - b. When the Contractor believes there is a conflict between Contract Documents
 - c. When the Contractor believes there is a conflict between the Drawings and Specifications
 - 1) Identify the conflict and request clarification
 - d. When the Contractor encounters an unknown condition in the field
2. Use the Request for Information (RFI) form provided by the City (attached).
3. Numbering of RFI
 - a. Prefix with "RFI" followed by series number, "-xxx", beginning with "01" and increasing sequentially with each additional transmittal.
4. Sufficient information shall be attached to permit a written response without further information.
5. The City will log each request and will review the request.
 - a. If review of the project information request indicates that a change to the Contract Documents is required, the City will issue a Field Order or Change Order, as appropriate.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

REQUEST FOR INFORMATION

Project:	RFI #:
Engineering Project No.:	Date Sent:
Sender:	Receiver:
Copies To:	

Subject:
Request:
Sender's Proposed Answer/Solution:

THE PROPOSED ANSWER/SOLUTION ☐ IS, ☐ IS NOT, INCLUDED IN THE CONTRACT.

Receiver's Response:

Response By:

Company:

Date:

DISTRIBUTION:

SECTION 01 35 13

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The procedures for special project circumstances that includes, but is not limited to:
 - a. Coordination with the Texas Department of Transportation
 - b. Work near High Voltage Lines
 - c. Confined Space Entry Program
 - d. Excavation Protection
 - e. Air Pollution Watch Days
 - f. Use of Explosives, Drop Weight, Etc.
 - g. Water Utilities Notification
 - h. Public Notification Prior to Beginning Construction
 - i. Coordination with United States Army Corps of Engineers
 - j. Coordination within Railroad permits areas
 - k. Dust Control
 - l. Employee Parking
 - m. Coordination with North Central Texas Council of Governments Clean Construction Specification
 - n. Tree Protection

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Coordination within Railroad permit areas
 - a. Measurement
 - 1) Measurement for this Item will be by lump sum.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this Item will be paid for at the lump sum price bid for Railroad Coordination.
 - c. The price bid shall include:
 - 1) Mobilization
 - 2) Inspection
 - 3) Safety training
 - 4) Additional Insurance
 - 5) Insurance Certificates
 - 6) Other requirements associated with general coordination with Railroad, including additional employees required to protect the right-of-way and property of the Railroad from damage arising out of and/or from the construction of the Project.
2. Railroad Flagmen
 - a. Measurement

- 1) Measurement for this Item will be per working day.
- b. Payment
 - 1) The work performed and materials furnished in accordance with this Item will be paid for each working day that Railroad Flagmen are present at the Site.
- c. The price bid shall include:
 - 1) Coordination for scheduling flagmen
 - 2) Flagmen
 - 3) Other requirements associated with Railroad
3. All other items
 - a. Work associated with these Items is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. Health and Safety Code, Title 9. Safety, Subtitle A. Public Safety, Chapter 752. High Voltage Overhead Lines.
3. North Central Texas Council of Governments (NCTCOG) – Clean Construction Specification
4. Occupational Health and Safety Administration (OSHA) Standards – 29 CFR Part 1910.146 – Permit-Required Confined Spaces

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination with the Texas Department of Transportation

1. When work in the right-of-way which is under the jurisdiction of the Texas Department of Transportation (TxDOT):
 - a. Notify the Texas Department of Transportation prior to commencing any work therein in accordance with the provisions of the permit
 - b. All work performed in the TxDOT right-of-way shall be performed in compliance with and subject to approval from the Texas Department of Transportation

B. Work near High Voltage Lines

1. Regulatory Requirements
 - a. All Work near High Voltage Lines (more than 600 volts measured between conductors or between a conductor and the ground) shall be in accordance with Health and Safety Code, Title 9, Subtitle A, Chapter 752.
2. Warning sign
 - a. Provide sign of sufficient size meeting all OSHA requirements.
3. Equipment operating within 10 feet of high voltage lines will require the following safety features
 - a. Insulating cage-type of guard about the boom or arm
 - b. Insulator links on the lift hook connections for back hoes or dippers
 - c. Equipment must meet the safety requirements as set forth by OSHA and the safety requirements of the owner of the high voltage lines
4. Work within 6 feet of high voltage electric lines

- a. Notification shall be given to:
 - 1) The power company
 - a) Maintain an accurate log of all such calls to power company and record action taken in each case.
 - b. Coordination with power company
 - 1) After notification coordinate with the power company to:
 - a) Erect temporary mechanical barriers, de-energize the lines, or raise or lower the lines
 - c. No personnel may work within 6 feet of a high voltage line before the above requirements have been met.
- C. Confined Space Entry Program
- 1. Provide and follow approved Confined Space Entry Program in accordance with OSHA 29 CFR Part 1910.146 requirements.
 - 2. Confined Spaces include:
 - a. Manholes
 - b. All other confined spaces in accordance with OSHA's Permit Required for Confined Spaces
- D. Air Pollution Watch Days
- 1. General
 - a. Observe the following guidelines relating to working on City construction sites on days designated as "AIR POLLUTION WATCH DAYS".
 - b. Typical Ozone Season
 - 1) May 1 through October 31.
 - c. Critical Emission Time
 - 1) 6:00 a.m. to 10:00 a.m.
 - 2. Watch Days
 - a. The Texas Commission on Environmental Quality (TCEQ), in coordination with the National Weather Service, will issue the Air Pollution Watch by 3:00 p.m. on the afternoon prior to the WATCH day.
 - b. Requirements
 - 1) Begin work after 10:00 a.m. whenever construction phasing requires the use of motorized equipment for periods in excess of 1 hour.
 - 2) However, the Contractor may begin work prior to 10:00 a.m. if:
 - a) Use of motorized equipment is less than 1 hour, or
 - b) If equipment is new and certified by EPA as "Low Emitting", or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.
- E. TCEQ Air Permit
- 1. Obtain TCEQ Air Permit for construction activities per requirements of TCEQ.
- F. Use of Explosives, Drop Weight, Etc.
- 1. When Contract Documents permit on the project the following will apply:
 - a. Public Notification
 - 1) Submit notice to City and proof of adequate insurance coverage, 24 hours prior to commencing.
 - 2) Minimum 24-hour public notification in accordance with paragraph 1.4.H of this Section.

G. Water Utilities Coordination

1. During the construction of this project, it may be necessary to deactivate, for a period of time, existing lines. The Contractor shall be required to coordinate with Water Utilities to determine the best times for deactivating and activating those lines.
2. Coordinate any event that will require connecting to or the operation of an existing City water line system with the City's representative.
 - a. If needed, obtain a hydrant water meter from Water Utilities for use during the life of named project.
 - b. In the event that a water valve on an existing live system is required to be turned off or on to accommodate the construction of the project is required, coordinate this activity through the appropriate City representative.
 - 1) Do not operate water line valves of existing water system.
 - a) Failure to comply will render the Contractor in violation of Texas Penal Code Title 7, Chapter 28.03 (Criminal Mischief) and the Contractor will be prosecuted to the full extent of the law.
 - b) In addition, the Contractor will assume all liabilities and responsibilities as a result of these actions.

H. Public Notification Prior to Beginning Construction

1. Prior to beginning construction on any block in the project, on a block-by-block basis, prepare and deliver a notice or flyer of the pending construction to the front door of each residence or business that will be impacted by construction. The notice shall be prepared as follows:
 - a. Post notice or flyer 7 days prior to beginning any construction activity on each block in the project area.
 - 1) Prepare flyer on the Contractor's letterhead and include the following information:
 - a) Name of Project
 - b) Engineering Project Number (EPN)
 - c) Scope of Project (i.e. type of construction activity)
 - d) Actual construction duration within the block
 - e) Name of the contractor's foreman and phone number
 - f) Name of the City's inspector and phone number
 - g) City's after-hours phone number
 - 2) A sample of the 'pre-construction notification' flyer is attached as Exhibit A.
 - 3) Submit schedule showing the construction start and finish time for each block of the project to the inspector.
 - 4) Deliver flyer to the City Inspector for review prior to distribution.
 - b. No construction will be allowed to begin on any block until the flyer is delivered to all residents of the block.

I. Public Notification of Temporary Water Service Interruption during Construction

1. In the event it becomes necessary to temporarily shut down water service to residents or businesses during construction, prepare and deliver a notice or flyer of the pending interruption to the front door of each affected resident.
2. Prepared notice as follows:
 - a. The notification or flyer shall be posted 24 hours prior to the temporary interruption.
 - b. Prepare flyer on the contractor's letterhead and include the following information:
 - 1) Name of the project
 - 2) Date of the interruption of service

- 3) Period the interruption will take place
 - 4) Name of the contractor's foreman and phone number
 - 5) Name of the City's inspector and phone number
 - c. A sample of the temporary water service interruption notification is attached as Exhibit B.
 - d. Deliver a copy of the temporary interruption notification to the City inspector for review prior to being distributed.
 - e. No interruption of water service can occur until the flyer has been delivered to all affected residents and businesses.
 - f. Electronic versions of the sample flyers can be obtained from the Project Construction Inspector.
- J. Coordination with United States Army Corps of Engineers (USACE)
1. At locations in the Project where construction activities occur in areas where USACE permits are required, meet all requirements set forth in each designated permit.
- K. Coordination within Railroad Permit Areas
1. At locations in the project where construction activities occur in areas where railroad permits are required, meet all requirements set forth in each designated railroad permit. This includes, but is not limited to, provisions for:
 - a. Flagmen
 - b. Inspectors
 - c. Safety training
 - d. Additional insurance
 - e. Insurance certificates
 - f. Other employees required to protect the right-of-way and property of the Railroad Company from damage arising out of and/or from the construction of the project. Proper utility clearance procedures shall be used in accordance with the permit guidelines.
 2. Obtain any supplemental information needed to comply with the railroad's requirements.
 3. Railroad Flagmen
 - a. Submit receipts to City for verification of working days that railroad flagmen were present on Site.
- L. Dust Control
1. Use acceptable measures to control dust at the Site.
 - a. If water is used to control dust, capture and properly dispose of waste water.
 - b. If wet saw cutting is performed, capture and properly dispose of slurry.
- M. Employee Parking
1. Provide parking for employees at locations approved by the City.
- N. Coordination with North Central Texas Council of Governments (NCTCOG) Clean Construction Specification
1. Equipment Requirements

- a. All construction equipment being used to perform work on the Contract shall meet EPA emissions standards of Tier 3 or equivalent, or cleaner. Model Form A.14. Schedule for Phase-In of Tier 1-Tier 4 Non-Road Engines is included in Appendix A. Compliance may be achieved through the use of equipment powered by an EPA-certified engine, through engine repowers, or through the use of retrofits which have been verified by the EPA and/or California Air Resources Board. A list of available retrofits is available online at EPA's website "Verified Technologies List for Clean Diesel."
 - b. Equipment that meets one or more of the following conditions may be exempt from these requirements:
 - 1) Equipment powered by an engine that is less than or equal to ten (10) years old.
 - 2) Equipment that must be used to fulfill use or reporting requirements for a grant program or other clean air initiative. Documentation of such obligations must be submitted to City for verification.
 - 3) Equipment that is designated as low-use equipment, which is defined as any piece of construction equipment which is used for less than ten (10) hours per week on a single public works contract. A Low-Use Exemption Weekly Reporting Form will be required for all equipment for which this exemption is claimed.
 - 4) Equipment that is being used to address a critical or emergency public works need, including, but not limited to, broken water mains or sanitary sewer lines. This exemption is limited to work performed in a situation in which the procurement of construction services is performed on an emergency basis, as provided for by State law.
2. Operational Requirements
- a. All diesel fuel used to perform work on the public works contract shall be Ultra-Low Sulfur Diesel (ULSD) fuel which also complies with Texas Low Emission Diesel (TxLED) program requirements. This may include TxLED- compliant Biodiesel blends.
 - b. The Contractor shall limit idling of equipment to no more than five (5) minutes, unless the idling is applicable to one or more of the following exceptions:
 - 1) is being used for emergency response purposes;
 - 2) is idling as a necessary component of mechanical operation, maintenance, or diagnostic purposes; or
 - 3) is idling for the health or safety of the equipment operator.
 - c. To the greatest extent possible, Contractor shall stage equipment away from, and minimize operation near, sensitive receptors including, but not limited to, fresh air intakes, hospitals, schools, licensed day care facilities, and residences.
3. Reporting Requirements
- a. On or before the day construction activity commences, the Contractor shall submit to the City an inventory report containing identifying data for each piece of equipment to be used on the worksite. A form for submitting such information will be provided by the City. This inventory may be used by the City to conduct site inspections and/or verify compliance with specification elements.
 - b. If additional equipment is brought on-site after construction begins, the Contractor shall provide this same inventory information to the City for the new equipment on or before the day it begins work on-site.
 - c. Reports shall be provided for all equipment used on-site.
4. Enforcement Requirements

- a. All construction equipment used at the Site is subject to inspection by the City at random. Contractor is responsible for ensuring that all subcontractors meet the requirements of this specification.

O. Tree Protection

1. Install tree protection in accordance with the Drawings, if applicable.
2. Coordinate with City Building Inspections prior to commencing and earthwork activities to perform an initial tree protection inspection.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Construction Notice Flyer
- B. Notice of Temporary Water Service Interruption

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

EXHIBIT A

(To be printed on Contractor's Letterhead)

Date: _____

EPN No.: _____

Project Name:

Limits of Construction:

NOTICE OF CONSTRUCTION

THIS IS TO INFORM YOU THAT UNDER A CONTRACT WITH THE CITY OF LEAGUE CITY, OUR COMPANY WILL WORK ON UTILITY LINES ON OR AROUND YOUR PROPERTY.

CONSTRUCTION WILL BEGIN APPROXIMATELY SEVEN DAYS FROM THE DATE OF THIS NOTICE.

IF YOU HAVE QUESTIONS ABOUT ACCESS, SECURITY, SAFETY OR ANY OTHER ISSUE, PLEASE CALL:

<CONTRACTOR'S SUPERINTENDENT> AT <TELEPHONE NO.>

OR

<CITY INSPECTOR> AT < TELEPHONE NO.>

PLEASE KEEP THIS FLYER HANDY WHEN YOU CALL

EXHIBIT B



Date: _____

EPN No.: _____

Project Name: _____

NOTICE OF TEMPORARY WATER SERVICE INTERRUPTION

Due to utility improvements in your neighborhood, your water service will be interrupted on

between the hours of _____ and _____.

IF YOU HAVE QUESTIONS ABOUT THIS DISRUPTION, PLEASE CALL:

<CONTRACTOR'S SUPERINTENDENT> AT <TELEPHONE NO.>

OR

<CITY INSPECTOR> AT < TELEPHONE NO.>

THIS SERVICE INTERRUPTION WILL BE AS SHORT AS POSSIBLE

Thank you,

_____, **Contractor**

SECTION 01 45 23

TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing and inspection services procedures and coordination
- B. Deviations from this City of League City Standard Specification
 - 1. None

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.
 - a. In accordance with Article 4 of the General Conditions, Contractor is responsible for performing, coordinating, and payment of all inspections, tests, re-tests, or approvals.
 - b. In accordance with Article 4 of the General Conditions, City is responsible for performing and payment for first set of additional independent testing chosen by the City to be performed.
 - 1) If the first independent test performed by the City fails, the Contractor is responsible for payment of subsequent testing until a passing test occurs.
 - a) Final acceptance will not be issued by City until all required payments for testing by Contractor have been paid in full.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Testing
 - 1. Complete testing in accordance with the Contract Documents.
 - 2. Coordination
 - a. When testing is required to be performed by the City, notify City, sufficiently in advance, when testing is needed.
 - b. When testing is required to be completed by the Contractor, notify City, sufficiently in advance, that testing will be performed.
 - 3. Distribution of Testing Reports
 - a. Electronic Distribution
 - 1) Provide all reports to Project Manager and their duly appointed representative electronically via email.
 - 4. Provide Project Manager's duly appointed representative with trip tickets for each delivered load of Concrete or Lime material including the following information:
 - a. Name of Supplier
 - b. Date of delivery
 - c. Material delivered
- B. Inspection

1. Inspection or lack of inspection does not relieve the Contractor from obligation to perform work in accordance with the Contract Documents.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Materials Testing Reports sealed by a Professional Engineer or Professional Geoscientist licensed in the State of Texas.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide temporary facilities and controls needed for the Work including, but not necessarily limited to:
 - a. Temporary utilities
 - b. Sanitary facilities
 - c. Storage Sheds and Buildings
 - d. Dust control
 - e. Temporary fencing of the construction site

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Temporary Utilities

1. Obtaining Temporary Service
 - a. Make arrangements with utility service companies for temporary services.
 - b. Abide by rules and regulations of utility service companies or authorities having jurisdiction.
 - c. Be responsible for utility service costs until Work is approved for Final Acceptance.
 - 1) Included are fuel, power, light, heat and other utility services necessary for execution, completion, testing and initial operation of Work.
2. Construction Water
 - a. Contractor to provide water required for and in connection with Work to be performed and for specified tests of piping, equipment, devices or other use as required for the completion of the Work.
 - b. Provide and maintain adequate supply of potable water for domestic consumption by Contractor, if required.
 - c. Coordination
 - 1) Contact City 1 week before water for construction is desired.
 - d. Metering and Payment for Construction Water
 - 1) For water system improvements:
 - a) Obtain construction water meter from City to track water usage. Water will be provided at no cost to Contractor for Capital Improvement Projects.

- 2) For all other projects:
 - a) Obtain construction water meter from City for payment as billed by City's established rates.
3. Electricity and Lighting
 - a. Provide and pay for electric powered service as required for Work, including testing of Work.
 - 1) Provide power for lighting, operation of equipment, or other use.
 - b. Electric power service includes temporary power service or generator to maintain operations during scheduled shutdown.
4. Telephone
 - a. Provide emergency telephone service at Site for use by Contractor personnel and others performing work or furnishing services at Site.
5. Temporary Heat and Ventilation
 - a. Provide temporary heat as necessary for protection or completion of Work.
 - b. Provide temporary heat and ventilation to assure safe working conditions.
- B. Sanitary Facilities
 1. Provide and maintain sanitary facilities for persons on Site.
 - a. Comply with regulations of State and local departments of health.
 2. Enforce use of sanitary facilities by construction personnel at job site.
 - a. Enclose and anchor sanitary facilities.
 - b. No discharge will be allowed from these facilities.
 - c. Collect and store sewage and waste so as not to cause nuisance or health problem.
 - d. Haul sewage and waste off-site at no less than weekly intervals and properly dispose in accordance with applicable regulation.
 3. Locate facilities near Work Site and keep clean and maintained throughout Project.
 4. Remove facilities at completion of Project.
- C. Storage Sheds and Buildings
 1. Provide adequately ventilated, watertight, weatherproof storage facilities with floor above ground level for materials and equipment susceptible to weather damage.
 2. Storage of materials not susceptible to weather damage may be on blocks off ground.
 3. Store materials in a neat and orderly manner.
 - a. Place materials and equipment to permit easy access for identification, inspection and inventory.
 4. Equip building with lockable doors and lighting and provide electrical service for equipment space heaters and heating or ventilation as necessary to provide storage environments acceptable to specified manufacturers.
 5. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.
 6. Remove building from site prior to Final Acceptance.
- D. Temporary Fencing
 1. Provide and maintain for the duration or construction when required in contract documents.
- E. Dust Control
 1. Contractor is responsible for maintaining dust control through the duration of the project.
 - a. Contractor remains on-call at all times.

b. Must respond in a timely manner.

F. Temporary Protection of Construction

1. Contractor or subcontractors are responsible for protecting Work from damage due to weather.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Temporary Facilities

1. Maintain all temporary facilities for duration of construction activities as needed.

3.5 [REPAIR] / [RESTORATION]

3.6 RE-INSTALLATION

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES

A. Temporary Facilities

1. Remove all temporary facilities and restore area after completion of the Work, to a condition equal to or better than prior to start of Work.

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 57 13

STORM WATER POLLUTION PREVENTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Procedures for Storm Water Pollution Prevention Plans
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Construction Activities resulting in less than 1 acre of disturbance.
 - a. Work associated with this Item is considered subsidiary to the various Items bid. No separate payment will be allowed for this Item.
 - 2. Construction Activities resulting in greater than 1 acre of disturbance.
 - a. Measurement for this Item shall be by lump sum.
 - b. The price bid shall include:
 - 1) Preparation of Storm Water Pollution Prevention Plan
 - 2) Implementation

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. Notice of Intent: NOI
 - 2. Notice of Termination: NOT
 - 3. Storm Water Pollution Prevention Plan: SWPPP
 - 4. Texas Commission on Environmental Quality: TCEQ
 - 5. Notice of Change: NOC
- A. Reference Standards
 - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
 - 2. Integrated Storm Management (iSWM) Technical Manual for Construction Controls

1.4 ADMINISTRATIVE REQUIREMENTS

- A. General
 - 1. Contractor is responsible for resolution and payment of any fines issued associated with compliance to Stormwater Pollution Prevention Plan.
 - 2. Refer to TCEQ website for further information about stormwater permits at https://www.tceq.texas.gov/permitting/stormwater/construction/TXR15_AIR.html.

B. Construction Activities resulting in:

1. Less than 1 acre of disturbance
 - a. Provide erosion and sediment control in accordance with Section 31 25 14.
2. 1 to less than 5 acres of disturbance
 - a. Texas Pollutant Discharge Elimination System (TPDES) General Construction Permit is required.
 - b. Complete SWPPP in accordance with TCEQ requirements
 - 1) TCEQ Small Construction Site Notice Required under general permit TXR150000
 - a) Sign and post at job site
 - b) Prior to Preconstruction Meeting, send 1 copy to City Engineer
 - 2) Provide erosion and sediment control in accordance with Section 31 25 14.
3. 5 acres or more of Disturbance
 - a. Texas Pollutant Discharge Elimination System (TPDES) General Construction Permit is required.
 - b. Complete SWPPP in accordance with TCEQ requirements
 - 1) Prepare a TCEQ NOI form and submit to TCEQ along with required fee
 - a) Sign and post at job site
 - b) Send copy to City Engineer
 - 2) TCEQ Notice of Change required if making changes or updates to NOI
 - 3) Provide erosion and sediment control in accordance with Section 31 25 14.
 - 4) Once the project has been completed and all the closeout requirements of TCEQ have been met a TCEQ Notice of Termination can be submitted.
 - a) Send copy to City Engineer

1.5 SUBMITTALS

A. SWPPP

1. Submit in accordance with Section 01 33 00, except as stated herein.
 - a. Prior to the Preconstruction Meeting, submit a draft copy of SWPPP to the City Engineer as follows:
 - 1) 1 copy to the Project Manager

B. Modified SWPPP

1. If the SWPPP is revised during construction, resubmit modified SWPPP to the City Engineer in accordance with Section 01 33 00.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 58 13
TEMPORARY PROJECT INFORMATION SIGNS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary Project Signage Requirements
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Temporary Project Sign
 - a. Measurement
 - 1) Measurement for this Item will be per each project sign installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Temporary Project Sign."
 - c. The price bid shall include:
 - 1) Installation of Temporary Project Sign
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess Materials
 - 5) Maintenance and Repair of Signs During Construction
 - 6) Removal and Disposal of Temporary Project Sign

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

A. Design Criteria

1. Provide free standing Project Designation Sign with the following information:
 - a. City of League City
 - b. Project Name
 - c. Contractor Information (name, address, and phone number)
 - d. City Engineer Information

B. Materials

1. Sign
 - a. Constructed of 3/4-inch fir plywood, grade A-C (exterior) or better

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Provide vertical installation at extents of project.
2. Signs shall be placed prior to beginning the Work and maintained until the end of the project.
3. Relocate sign as needed, upon request of the City.

B. Mounting shall be with firmly buried posts

3.5 -- 3.12 [NOT USED]

3.6 MAINTENANCE

A. General

1. Maintenance will include painting and repairs as needed or directed by the City.

3.7 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. References for Product Requirements and City Standard Products List
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. A list of City approved products
- B. Only products specifically included on City's Standard Product List in these Contract Documents shall be allowed for use on the Project.
 - 1. Any subsequently approved products will only be allowed for use upon specific approval by the City.
- C. Any specific product requirements in the Contract Documents supersede similar products included on the City's Standard Product List.
 - 1. The City reserves the right to not allow products to be used for certain projects even though the product is listed on the City's Standard Product List.
- D. Although a specific product is included on City's Standard Product List, not all products from that manufacturer are approved for use, including but not limited to, that manufacturer's standard product.
- E. See Section 01 33 00 for submittal requirements of Product Data included on City's Standard Product List.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Scheduling of product delivery
 - 2. Packaging of products for delivery
 - 3. Protection of products against damage from:
 - a. Handling
 - b. Exposure to elements or harsh environments
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY AND HANDLING

- A. Delivery Requirements
 - 1. Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.
 - 2. Provide appropriate personnel and equipment to receive deliveries.
 - 3. Delivery trucks will not be permitted to wait extended periods of time on the Site for personnel or equipment to receive the delivery.
 - 4. Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.
 - 5. Clearly and fully mark and identify as to manufacturer, item and installation location.
 - 6. Provide manufacturer's instructions for storage and handling.

B. Handling Requirements

1. Handle products or equipment in accordance with these Contract Documents and manufacturer's recommendations and instructions.

C. Storage Requirements

1. Store materials in accordance with manufacturer's recommendations and requirements of these Specifications.
2. Make necessary provisions for safe storage of materials and equipment.
 - a. Place loose soil materials and materials to be incorporated into Work in a manner that prevents damage to any part of Work or existing facilities and that maintains free access at all times to all parts of Work and to utility service company installations in vicinity of Work.
3. Keep materials and equipment neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants and occupants.
 - a. Arrange storage to provide easy access for inspection.
4. Restrict storage to areas available on construction site for storage of material and equipment as shown on Drawings or approved by Project Manager or their duly authorized representative.
5. Provide off-site storage and protection when on-site storage is not adequate.
 - a. Provide addresses of and access to off-site storage locations for inspection by City Engineer or their duly authorized representative.
6. Do not use lawns, grass plots or other private property for storage purposes without written permission of owner or other person in possession or control of premises.
7. Store in manufacturers' unopened containers.
8. Neatly, safely and compactly stack materials delivered and stored along line of Work to avoid inconvenience and damage to property owners and general public and maintain at least 3 feet from fire hydrant.
9. Keep public and private driveways and street crossings open.
10. Repair or replace damaged lawns, sidewalks, streets or other improvements to satisfaction of Project Manager or their duly authorized representative.
 - a. Total length which materials may be distributed along route of construction at one time is 1,000 linear feet, unless otherwise approved in writing by City Engineer.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.1 -3.6 [NOT USED]

3.2 FIELD [or] SITE QUALITY CONTROL

A. Tests and Inspections

1. Inspect all products or equipment delivered to the site prior to unloading.

B. Non-Conforming Work

1. Reject all products or equipment that are damaged, used or in any other way unsatisfactory for use on the project.

3.3 SYSTEM STARTUP [NOT USED]

3.4 ADJUSTING [NOT USED]

3.5 CLEANING [NOT USED]

3.6 CLOSEOUT ACTIVITIES [NOT USED]

3.7 PROTECTION

- A. Protect all products or equipment in accordance with manufacturer's written directions.
- B. Store products or equipment in location to avoid physical damage to items while in storage.
- C. Protect equipment from exposure to elements and keep thoroughly dry if required by the manufacturer.

3.8 MAINTENANCE [NOT USED]

3.9 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 70 00
MOBILIZATION AND REMOBILIZATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mobilization and Demobilization
 - a. Mobilization
 - 1) Transportation of Contractor's personnel, equipment, and operating supplies to the Site
 - 2) Establishment of necessary general facilities for the Contractor's operation at the Site
 - 3) Premiums paid for performance, payment, and maintenance bonds
 - 4) Transportation of Contractor's personnel, equipment, and operating supplies to another location within the designated Site
 - 5) Relocation of necessary general facilities for the Contractor's operation from 1 location to another location on the Site.
 - b. Demobilization
 - 1) Transportation of Contractor's personnel, equipment, and operating supplies away from the Site including disassembly
 - 2) Site Clean-up
 - 3) Removal of all buildings and/or other facilities assembled at the Site for this Contract.
 - c. Mobilization and Demobilization do not include activities for specific items of work that are for which payment is provided elsewhere in the contract.
2. Remobilization
 - a. Remobilization for Suspension of Work specifically required in the Contract Documents or as required by City includes:
 - 1) Demobilization
 - a) Transportation of Contractor's personnel, equipment, and operating supplies from the Site including disassembly or temporarily securing equipment, supplies, and other facilities as designated by the Contract Documents necessary to suspend the Work.
 - b) Site Clean-up as designated in the Contract Documents
 - 2) Remobilization
 - a) Transportation of Contractor's personnel, equipment, and operating supplies to the Site necessary to resume the Work.
 - b) Establishment of necessary general facilities for the Contractor's operation at the Site necessary to resume the Work.

- 3) No Payments will be made for:
 - a) Mobilization and Demobilization from one location to another on the Site in the normal progress of performing the Work.
 - b) Stand-by or idle time
 - c) Lost profits

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Mobilization and Demobilization

a. Measurement

- 1) This Item will be measured by the lump sum as the work progresses.

b. Payment

- 1) For this Item, the adjusted Contract amount will be calculated as the total Contract amount less the lump sum for mobilization. Mobilization shall be made in partial payments as follows:
 - a) When 1% of the adjusted Contract amount for construction Items is earned, 25% of the mobilization lump sum bid will be paid.
 - b) When 25% of the adjusted Contract amount for construction Items is earned, 50% of the mobilization lump sum bid will be paid. Previous payments under the Item will be deducted from this amount.
 - c) When 50% of the adjusted Contract amount for construction Items is earned, 75% of the mobilization lump sum bid will be paid. Previous payments under the Item will be deducted from this amount.
 - d) When 75% of the adjusted Contract amount for construction Items is earned, 100% of the mobilization lump sum bid will be paid. Previous payments under the Item will be deducted from this amount.
 - e) **A bid containing a total for "Mobilization" in excess of 4% of total adjusted contract amount shall be considered unbalanced and a cause for consideration of rejection.**

c. The price bid shall include:

- 1) Mobilization of equipment to Site
- 2) Performance Bond
- 3) Payment Bond
- 4) Maintenance Bond
- 5) Remobilization as identified in the Contract Documents
- 6) Demobilization

- d. No payments will be made for standby, idle time, or lost profits associated this Item.

2. Remobilization for suspension of Work not identified in the Contract Documents, as required by City
 - a. Measurement and Payment
 - 1) This shall be approved in writing by the City Engineer prior to work.
 - 2) No payments will be made for standby, idle time, or lost profits associated with this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 71 23

CONSTRUCTION STAKING AND SURVEY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for construction staking to be provided by the Contractor.
 - 2. Requirements for coordination with City to allow performance of as-built survey at the Site.
- B. Deviations from this City of League City Standard Specification
 - 1. None

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Construction Staking
 - a. Measurement and Payment
 - 1) Work associated with this Item is considered incidental to the various Items bid.
No separate payment will be allowed for this Item.
 - 2. As-Built Survey
 - a. Measurement and Payment
 - 1) Work associated with this Item is considered incidental to the various Items bid. No
separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals, if required, shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Certificates
 - 1. Provide certificate certifying that elevations and locations of improvements are in conformance or non-conformance with requirements of the Contract Documents.
 - a. Certificate must be sealed by a registered professional land surveyor in the State of Texas.
- B. Field Quality Control Submittals
 - 1. Documentation verifying accuracy of field engineering work.
- C. As-built Survey Submittal:
 - 1. AutoCAD (.dwg)
 - 2. ESRI Shapefile (.shp)

3. CSV file (.csv), formatted with X and Y coordinates in separate columns
4. Include vertical and horizontal data tied to original project control and benchmarks, and feature descriptions

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Construction Staking

1. Construction staking will be performed by the Contractor.
2. Coordination
 - a. It is the Contractor's responsibility to coordinate staking such that construction activities are not delayed or negatively impacted.
3. General
 - a. Contractor is responsible for preserving and maintaining staking.
 - b. If in the opinion of the City, a sufficient number of stakes or markings have been lost, destroyed or disturbed, by Contractor's neglect, such that the contracted Work cannot take place, then the Contractor will be required to re-stake the deficient areas.

B. As-built Survey

1. As-built Survey will be performed by the Contractor.
2. Coordination
 - a. Contractor to verify that control data established in the design survey and required for construction remains intact.
 - b. It is the Contractor's responsibility to coordinate As-built Survey such that construction activities are not delayed or negatively impacted.
 - c. Contractor shall restore or replace all necessary control data damaged during construction operations.
 - d. For sewer mains and water lines 12-inch and smaller in diameter, if permitted by City in writing, Contractor may physically measure depth and mark the location during the progress of construction and perform As-built Survey after the facility has been buried. The Contractor is responsible for the quality control required to ensure accuracy if this approach is permitted.
3. General
 - a. As-built survey will be performed in order to maintain complete and accurate logs of control and survey work as it progresses for Project Records.
 - b. The Contractor perform as-built survey to obtain construction features including, but not limited to, the following:
 - 1) All Utility Lines
 - a) Rim and flowline elevations and coordinates for each manhole or junction structure
 - 2) Water Lines
 - a) Top of pipe elevations and coordinates for water lines at the following locations:
 - (1) Every 250 linear feet
 - (2) Horizontal and vertical points of inflection, curvature, etc. (All Fittings)
 - (3) Cathodic protection test stations

- (4) Sampling stations
- (5) Meter boxes/vaults (All sizes)
- (6) Fire lines
- (7) Fire hydrants and valves
- (8) Gate valves and Butterfly Valves
- (9) Plugs, stubouts, dead-end lines
- (10) Air Release valves (Manhole rim and vent pipe)
- (11) Blow off valves (Manhole rim and valve lid)
- (12) Pressure plane valves
- (13) Cleaning wyes
- (14) Casing pipe (each end)
- b) Storm Sewer
 - (1) Top of pipe elevations and coordinates at the following locations:
 - (a) Every 250 linear feet
 - (b) Horizontal and vertical points of inflection, curvature, etc.
- c) Sanitary Sewer
 - (1) Top of pipe elevations and coordinates for sanitary sewer lines at the following locations:
 - (a) Every 250 linear feet
 - (b) Horizontal and vertical points of inflection, curvature, etc.
 - (c) Cleanouts
- c. As-built survey will be performed in order to maintain complete and accurate logs of control and survey work associated with meeting or exceeding the line and grade required by these Specifications.
 - 1) The Contractor remains fully responsible for the accuracy of the work and the correction of it, as required.
 - 2) Monitor line and grade continuously during construction.
 - 3) Record deviation with respect to design line and grade once at each pipe joint and submit daily records to City.
 - 4) If the installation does not meet the specified tolerances, immediately notify the City and correct the installation in accordance with the Contract Documents.
- d. Submit to the City Engineer copies of field notes, if requested, used to establish all lines and grades and allow the City Engineer to check guidance system setup prior to beginning each tunneling drive.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 APPLICATION

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL

A. It is the Contractor's responsibility to maintain all stakes and control data in accordance with this Specification.

B. Do not change or relocate stakes or control data without approval from the City Engineer.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 74 23

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intermediate and final cleaning for Work not including special cleaning of closed systems specified elsewhere

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling

1. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.
2. Schedule final cleaning upon completion of Work and immediately prior to final inspection.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [or] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Cleaning Agents

1. Compatible with surface being cleaned
2. New and uncontaminated
3. For manufactured surfaces
 - a. Material recommended by manufacturer

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 APPLICATION [NOT USED]

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. General

1. Prevent accumulation of wastes that create hazardous conditions.
2. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.
3. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains or sewers.
4. Dispose of degradable debris at an approved solid waste disposal site.

5. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by City Engineer and regulatory agencies.
6. Transport and deposit vegetative material removed as a result of work operations off-site at a legal site in accordance with all applicable federal, state, and local laws and regulations.
 - a. Removed vegetation will not be allowed to remain in piles or mounds on the easement or surrounding property.
7. Handle materials in a controlled manner with as few handlings as possible.
8. Thoroughly clean, sweep, wash and polish all Work and equipment associated with this project.
9. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.
10. If project is not cleaned to the satisfaction of the City Engineer, the City Engineer reserves the right to have the cleaning completed at the expense of the Contractor.
11. Do not burn on-site.

B. Intermediate Cleaning during Construction

1. Keep Work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
2. At maximum weekly intervals, dispose of waste materials, debris and rubbish.
3. Confine construction debris daily in strategically located container(s):
 - a. Cover to prevent blowing by wind
 - b. Store debris away from construction or operational activities
 - c. Haul from site at a minimum of once per week
4. Vacuum clean interior areas when ready to receive finish painting.
 - a. Continue vacuum cleaning on an as-needed basis, until Final Acceptance.
5. Prior to storm events, thoroughly clean site of all loose or unsecured items, which may become airborne or transported by flowing water during the storm.

C. Interior Final Cleaning

1. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed surfaces.
2. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
3. Wash and shine glazing and mirrors.
4. Polish glossy surfaces to a clear shine.
5. Ventilating systems
 - a. Clean permanent filters and replace disposable filters if units were operated during construction.
 - b. Clean ducts, blowers and coils if units were operated without filters during construction.
6. Replace all burned out lamps.
7. Broom clean process area floors.
8. Mop office and control room floors.

D. Exterior (Site or Right of Way) Final Cleaning

1. Remove trash and debris containers from site.
 - a. Re-seed areas disturbed by location of trash and debris containers.

2. Sweep roadway to remove all rocks, pieces of asphalt, concrete or any other object that may hinder or disrupt the flow of traffic along the roadway.
3. Clean any interior areas including, but not limited to, vaults, manholes, structures, junction boxes and inlets.
4. If no longer required for maintenance of erosion facilities, and upon approval by City, remove erosion control from site.
5. Clean signs, lights, signals, etc.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 77 00 CIP
WARRANTY OF WORK (CIP)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Compliance and administrative procedures for completion and warranty of work. For developer driven projects the Engineer of Record shall assume the responsibilities of Project Manager, unless otherwise noted.
2. Compliance and administrative procedures for completion and warranty of work. For City driven projects the City of League City Engineer shall assume the responsibilities of Project Manager, unless otherwise noted.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES

A. Reference Standards

1. Texas Department of Licensing and Regulation (TDLR) inspection for Texas Accessibility Standards (TAS) compliance.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Compliance

1. Comply with Approved Construction Documents regarding Date of Substantial Completion when Contractor considers the Work, or portion thereof designated by Project Manager, to be substantially complete.
2. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Project Manager for issuance of a Certificate of Substantial Completion:
 - a. Cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by Contract documents for each item.
 - b. Construction of, and repairs to, pavement, driveways, sidewalks, and curbs and gutters.
 - c. Sodding and hydromulch seeding, unless waived by Project Manager in writing.
 - d. General clean up including pavement markings, transfer of services, successful testing and landscape.
 - e. Additional requirements contained in Section 01 11 00 - Summary of Work.
3. Assist Project Manager with inspection of Contractor's list of items and complete or correct the items, including items added by Project Manager, within specified time period. For developer driven projects this will
4. Should Project Manager's inspection show failure of Contractor to comply with requirements to obtain Date of Substantial Completion, including those items in Paragraph 1.02 B. of this section, Contractor shall complete or correct the items, before requesting another inspection by Project Manager.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. Approval Process
 - 1. For CIP projects: All submittals shall be approved by the Project Management Office prior to delivery.
 - 2. For developer-driven projects: All submittals shall be confirmed by the City Engineer after review and recommendation from the Engineer of Record. City Engineer confirmational shall be obtained prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data
 - 1. Submit O&M data as noted in Section 01 33 00.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts
 - 1. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification sections.
 - 2. Deliver to a location within the City limits as directed by Project Manager. Applicable items must be delivered prior to issuance of a final Certificate for Payment.

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Licensed Professionals
 - a. Prior to requesting inspection by the ENGINEER, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 SITE CONDITIONS [NOT USED]

1.12 WARRANTY

- A. Manufacturer Warranty
 - 1. Provide one original of each warranty from Subcontractors, Suppliers, and manufacturers.
 - 2. Provide Table of Contents and assemble warranties in a 3-ring/D binder with durable plastic cover or submitted digitally in pdf format.
 - 3. Warranty Submission
 - a. For CIP projects: Submit warranties prior to final progress payment.
 - b. For developer-driven projects: Submit warranties prior to final approval.

B. Warranty of Work

1. The Developer, the contractor and/or his surety will be required by the City Engineer to repair, replace restore and/or make to comply strictly in all things with these specifications and the plans and any and all work and/or materials, which within a period of two year from and after the date of the passing approval and/or acceptance of any such work or material, are found to be defective or to fail in any way to comply with these specifications.
2. Effective date for beginning one-year guarantee shall be the date of the City acceptance or the permit of occupancy for the facility.
3. Should the Developer/Contractor fail to remedy the defects as outlined herein within a reasonable length of time, the City may have such work done and charge the cost to the Developer/Contractor or the surety company.

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

- A. New Products
- B. Existing Products

2.2 PRODUCT TYPES [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION [NOT USED]

3.5 RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING

A. Equipment (CIP Projects Only)

1. Adjust operating equipment to ensure smooth and unhindered operation. Value of this testing and adjusting is five percent of Lump Sum Price in the Schedule of Values for item being tested.

3.10 CLEANING

A. Procedures

1. Execute final cleaning prior to final inspection.
2. For facilities, clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
3. Clean equipment and fixtures to sanitary condition.
4. Clean or replace filters of operating equipment.
5. Clean debris from roofs, gutters, down spouts, and drainage systems.
6. Clean site: sweep paved areas and rake clean landscaped surfaces.
7. Remove waste and surplus materials, rubbish, SWPPP equipment, and temporary construction facilities from site following final test of utilities and completion of the Work.

3.11 CLOSEOUT ACTIVITIES

A. Procedures

1. Provide Project Record Documents in accordance with Section 01 78 39 - Project Record Documents.
2. Complete or correct items on punch list, with no new items added.
3. The City will occupy portions of the Work as specified in other sections.

B. Final Walk Through

1. The ENGINEER and the CONTRACTOR will prepare a list of items to be completed by the CONTRACTOR.
2. Within a reasonable time after receipt of the list, the ENGINEER will inspect to determine status of completion.
3. Should the ENGINEER determine that the Work is not substantially complete:
 - a. The ENGINEER promptly will so notify the CONTRACTOR, in writing, giving the reasons, therefore.
 - b. Remedy the deficiencies and notify the ENGINEER when ready for re-inspection.
 - c. The ENGINEER will re-inspect the Work.
4. When the ENGINEER concurs that the Work is substantially complete:
 - a. The ENGINEER will prepare a Letter accompanied by the CONTRACTOR's list of items to be completed or corrected, as verified by the ENGINEER.
 - b. The ENGINEER will submit the Letter to the OWNER and to the CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Letter.
 - c. CONTRACTOR shall have a maximum of 30 calendar days to complete the assigned tasks on the final punch list.

C. Final Completion

1. Prepare and submit notice.
2. Verify the Work is complete.

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 77 00 NDI
WARRANTY OF WORK (NEW DEVELOPMENT INFRSTRUCTURE)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Compliance and administrative procedures for completion and warranty of work. For developer driven projects the Engineer of Record shall assume the responsibilities of Project Manager, unless otherwise noted.
2. Compliance and administrative procedures for completion and warranty of work. For City driven projects the City of League City Engineer shall assume the responsibilities of Project Manager, unless otherwise noted.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES

A. Reference Standards

1. Texas Department of Licensing and Regulation (TDLR) inspection for Texas Accessibility Standards (TAS) compliance.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Compliance

1. Comply with Approved Construction Documents regarding Date of Substantial Completion when Contractor considers the Work, or portion thereof designated by Project Manager, to be substantially complete.
2. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Project Manager for issuance of a Certificate of Substantial Completion:
 - a. Cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by Contract documents for each item.
 - b. Construction of, and repairs to, pavement, driveways, sidewalks, and curbs and gutters.
 - c. Sodding and hydromulch seeding, unless waived by Project Manager in writing.
 - d. General clean up including pavement markings, transfer of services, successful testing and landscape.
 - e. Additional requirements contained in Section 01 11 00 - Summary of Work.
3. Assist Project Manager with inspection of Contractor's list of items and complete or correct the items, including items added by Project Manager, within specified time period. For developer driven projects this will
4. Should Project Manager's inspection show failure of Contractor to comply with requirements to obtain Date of Substantial Completion, including those items in Paragraph 1.02 B. of this section, Contractor shall complete or correct the items, before requesting another inspection by Project Manager.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. Approval Process
 - 1. For CIP projects: All submittals shall be approved by the Project Management Office prior to delivery.
 - 2. For developer-driven projects: All submittals shall be confirmed by the City Engineer after review and recommendation from the Engineer of Record. City Engineer confirmational shall be obtained prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data
 - 1. Submit O&M data as noted in Section 01 33 00.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts
 - 1. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification sections.
 - 2. Deliver to a location within the City limits as directed by Project Manager. Applicable items must be delivered prior to issuance of a final Certificate for Payment.

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Licensed Professionals
 - a. Prior to requesting inspection by the ENGINEER, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 SITE CONDITIONS [NOT USED]

1.12 WARRANTY

- A. Manufacturer Warranty
 - 1. Provide one original of each warranty from Subcontractors, Suppliers, and manufacturers.
 - 2. Provide Table of Contents and assemble warranties in a 3-ring/D binder with durable plastic cover or submitted digitally in pdf format.
 - 3. Warranty Submission
 - a. For CIP projects: Submit warranties prior to final progress payment.
 - b. For developer-driven projects: Submit warranties prior to final approval.

B. Warranty of Work

1. The Developer, the contractor and/or his surety will be required by the City Engineer to repair, replace restore and/or make to comply strictly in all things with these specifications and the plans and any and all work and/or materials, which within a period of two year from and after the date of the passing approval and/or acceptance of any such work or material, are found to be defective or to fail in any way to comply with these specifications.
2. Effective date for beginning two-year guarantee shall be the date of the City acceptance or the permit of occupancy for the facility.
3. Should the Developer/Contractor fail to remedy the defects as outlined herein within a reasonable length of time, the City may have such work done and charge the cost to the Developer/Contractor or the surety company.

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 PRODUCT TYPES [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION [NOT USED]

3.5 RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Procedures

1. Execute final cleaning prior to final inspection.
2. For facilities, clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
3. Clean equipment and fixtures to sanitary condition.

4. Clean or replace filters of operating equipment.
5. Clean debris from roofs, gutters, down spouts, and drainage systems.
6. Clean site: sweep paved areas and rake clean landscaped surfaces.
7. Remove waste and surplus materials, rubbish, SWPPP equipment, and temporary construction facilities from site following final test of utilities and completion of the Work.

3.11 CLOSEOUT ACTIVITIES

A. Procedures

1. Provide Project Record Documents in accordance with Section 01 78 39 - Project Record Documents.
2. Complete or correct items on punch list, with no new items added.
3. The City will occupy portions of the Work as specified in other sections.

B. Final Walk Through

1. The ENGINEER and the CONTRACTOR will prepare a list of items to be completed by the CONTRACTOR.
2. Within a reasonable time after receipt of the list, the ENGINEER will inspect to determine status of completion.
3. Should the ENGINEER determine that the Work is not substantially complete:
 - a. The ENGINEER promptly will so notify the CONTRACTOR, in writing, giving the reasons, therefore.
 - b. Remedy the deficiencies and notify the ENGINEER when ready for re-inspection.
 - c. The ENGINEER will re-inspect the Work.
4. When the ENGINEER concurs that the Work is substantially complete:
 - a. The ENGINEER will prepare a Letter accompanied by the CONTRACTOR's list of items to be completed or corrected, as verified by the ENGINEER.
 - b. The ENGINEER will submit the Letter to the OWNER and to the CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Letter.
 - c. CONTRACTOR shall have a maximum of 30 calendar days to complete the assigned tasks on the final punch list.

C. Final Completion

1. Prepare and submit notice.
2. Verify the Work is complete.

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 77 19 CIP
CLOSEOUT REQUIREMENTS (CIP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The procedure for closing out a contract.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Guarantees, Bonds and Affidavits
 - 1. No application for final payment will be accepted until all guarantees, bonds, certificates, as-builts, licenses and affidavits required for Work or equipment as specified are satisfactorily filed with the City Engineer.
- B. Release of Liens or Claims
 - 1. No application for final payment will be accepted until satisfactory evidence of release of liens has been submitted to the City Engineer.

1.5 SUBMITTALS

- A. Submit all required documentation to Project Manager.

1.6 INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 CLOSEOUT PROCEDURE

- A. Prior to requesting Final Inspection, submit:
 - 1. Project Record Documents in accordance with Section 01 78 39
 - 2. Operation and Maintenance Data, if required, in accordance with Section 01 78 23
- B. Prior to requesting Final Inspection, perform final cleaning in accordance with Section 01 74 23.
- C. Final Inspection
 - 1. After final cleaning, provide notice to the Project Manager and their duly appointed representative that the Work is completed.
 - a. City reserves the right to deny request for Final Inspection if City determines that the entire Work is not sufficiently complete to warrant a Final Inspection
 - b. The City will make an initial Final Inspection with the Contractor present.
 - c. Upon completion of this inspection, the City will notify the Contractor, in writing within 10 business days of any particulars in which this inspection reveals that the Work is defective or incomplete.
 - 2. Upon receiving written notice from the City Engineer, immediately undertake the Work required to remedy deficiencies and complete the Work to the satisfaction of the City.
 - 3. Upon completion of Work associated with the items listed in the City's written notice, inform the City, that the required Work has been completed. Upon receipt of this notice, the City, in the presence of the Contractor, will make a subsequent Final Inspection of the project.
 - 4. Provide all special accessories required to place each item of equipment in full operation. These special accessory items include, but are not limited to:
 - a. Specified spare parts.
 - b. Adequate oil and grease as required for the first lubrication of the equipment.
 - c. Initial fill up of all chemical tanks and fuel tanks
 - d. Light bulbs
 - e. Fuses
 - f. Vault keys
 - g. Handwheels
 - h. Other expendable items as required for initial start-up and operation of all equipment.
- D. Supporting Documentation
 - 1. Coordinate with the City Project Representative to complete the following additional forms:
 - a. Final Payment Request
 - b. Statement of Contract Time
 - c. Affidavit of Payment and Release of Liens
 - d. Consent of Surety to Final Payment
 - e. As-builts

E. Letter of Final Acceptance

1. When City has deemed the Work has been completed, and upon receiving all Supporting Documentation, in accordance with General Conditions, City will issue Letter of Final Acceptance and release the final payment request for payment.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 77 19 NDI
CLOSEOUT REQUIREMENTS (NEW DEVELOPMENT INFRASTRUCTURE)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. The procedure for closing out a contract.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Guarantees, Bonds and Affidavits
 - 1. No application for final payment will be accepted until all guarantees, bonds, certificates, as-builts, licenses and affidavits required for Work or equipment as specified are satisfactorily filed with the City Engineer.
- B. Release of Liens or Claims
 - 1. No application for final payment will be accepted until satisfactory evidence of release of liens has been submitted to the City Engineer.

1.5 SUBMITTALS

- A. Submit all required documentation to Project Manager.

1.6 INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 CLOSEOUT PROCEDURE

- A. Prior to requesting Final Inspection, submit:
 - 1. Project Record Documents in accordance with Section 01 78 39
 - 2. Operation and Maintenance Data, if required, in accordance with Section 01 78 23
- B. Prior to requesting Final Inspection, perform final cleaning in accordance with Section 01 74 23.
- C. Final Inspection
 - 1. After final cleaning, provide notice to the Project Manager and their duly appointed representative that the Work is completed.
 - a. City reserves the right to deny request for Final Inspection if City determines that the entire Work is not sufficiently complete to warrant a Final Inspection
 - b. The City will make an initial Final Inspection with the Contractor present.
 - c. Upon completion of this inspection, the City will notify the Contractor, in writing within 10 business days of any particulars in which this inspection reveals that the Work is defective or incomplete.
 - 2. Upon receiving written notice from the City Engineer, immediately undertake the Work required to remedy deficiencies and complete the Work to the satisfaction of the City.
 - 3. Upon completion of Work associated with the items listed in the City's written notice, inform the City, that the required Work has been completed. Upon receipt of this notice, the City, in the presence of the Contractor, will make a subsequent Final Inspection of the project.
 - 4. Provide all special accessories required to place each item of equipment in full operation. These special accessory items include, but are not limited to:
 - a. Specified spare parts.
 - b. Adequate oil and grease as required for the first lubrication of the equipment.
 - c. Initial fill up of all chemical tanks and fuel tanks
 - d. Light bulbs
 - e. Fuses
 - f. Vault keys
 - g. Handwheels
 - h. Other expendable items as required for initial start-up and operation of all equipment.
- D. Supporting Documentation
 - 1. Coordinate with the City Project Representative to complete the following additional forms:
 - a. Final Payment Request
 - b. Statement of Contract Time
 - c. Affidavit of Payment and Release of Liens
 - d. Consent of Surety to Final Payment
 - e. As-builts

E. Letter of Final Acceptance

1. When City has deemed the Work has been completed, and upon receiving all Supporting Documentation, in accordance with General Conditions, City will issue Letter of Final Acceptance and release the final payment request for payment.

F. Warranty Inspection for Wastewater Mains

1. A second television inspection conforming to the standards laid out in Section 33 01 15 shall be started by the Contractor no sooner than 630 calendar days and finished no later than 690 calendar days after the date of issuance of the Letter of Final Acceptance for the project by the City of League City.
2. The second inspection shall include a complete televised inspection of each manhole interior constructed or installed on the project (including cored manholes).
 - a. Should the second inspection indicate repairs that need to be made, these will be performed by the Contractor at no cost to the City.
3. Failure of the Contractor to perform the second inspection or to make repairs indicated by the second inspection shall be sufficient grounds for the City to take action through the terms of the Maintenance Bond for the project to perform the second inspection and make any repairs indicated.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Product data and related information appropriate for City's operation and maintenance of products furnished under Contract
2. Such products may include, but are not limited to:
 - a. Traffic Controllers
 - b. Irrigation Controllers (to be operated by the City)
 - c. All Valves
 - d. All Pumps
 - e. Auxiliary Generator
 - f. All process & odor treatment components
 - g. All electrical and mechanical equipment and controllers
 - h. Others as necessary

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS

A. Schedule

1. Submit manuals in final form to the City within 30 calendar days of substantial completion of product shipment to the project site.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00. All submittals shall be approved by the City prior to delivery.

1.6 INFORMATIONAL SUBMITTALS

A. Submittal Form

1. Prepare data in form of an instructional manual for use by City personnel.
2. Format
 - a. Size: 8 ½ inches x 11 inches
 - b. Paper
 - 1) 40 pound minimum, white, for typed pages

- 2) Holes reinforced with plastic, cloth or metal.
- c. Text: Manufacturer's printed data, or neatly typewritten
- d. Drawings
 - 1) Provide reinforced punched binder tab, bind in with text.
 - 2) Reduce larger drawings and fold to size of text pages.
- e. Provide flyleaf for each separate product, or each piece of operating equipment.
 - 1) Provide typed description of product, and major component parts of equipment.
 - 2) Provide indexed tabs.
- f. Cover
 - 1) Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
 - 2) List:
 - a) Title of Project
 - b) Identity of separate structure as applicable
 - c) Identity of general subject matter covered in the manual.
- 3. Binders
 - a. Commercial quality 3-ring binders with durable and cleanable plastic covers
 - b. When multiple binders are used, correlate the data into related consistent groupings.
- 4. Provide an electronic form of the O&M Manual.

B. Manual Content

- 1. Neatly typewritten table of contents for each volume, arranged in systematic order.
 - a. Contractor, name of responsible principal, address, and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List, with each product:
 - 1) The name, address and telephone number of the subcontractor or installer
 - 2) A list of each product required to be included, indexed to content of the volume.
 - 3) Identify area of responsibility of each
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
- 2. Product Data
 - a. Include only those sheets which are pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Clearly identify specific product or part installed.
 - 2) Clearly identify data applicable to installation
 - 3) Delete references to inapplicable information.
- 3. Drawings
 - a. Supplement product data with drawings as necessary to clearly illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Drawings as maintenance drawings.
- 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions of each procedure.
- 5. Copy of each warranty, bond and service contract issued.

- a. Provide information sheet for City personnel giving:
 - 1) Proper procedures in event of failure
 - 2) Instances which might affect validity of warranties or bonds.
- C. Manual for Materials and Finishes
 - 1. Submit 5 hard copies and 1 digital copy of complete manual in final form.
 - 2. Content, for architectural products, applied materials and finishes:
 - a. Manufacturer's data, giving full information on products.
 - 1) Catalog number, size, composition
 - 2) Color and texture designations
 - 3) Information required for reordering special manufactured products.
 - b. Instructions for care and maintenance
 - 1) Manufacturer's recommendation for types of cleaning agents and methods
 - 2) Cautions against cleaning agents and methods which are detrimental to product.
 - 3) Recommended schedule for cleaning and maintenance
 - 3. Content, for moisture protection and weather exposure products:
 - a. Manufacturer's data, giving full information on products.
 - 1) Applicable standards
 - 2) Chemical composition
 - 3) Details of installation
 - b. Instructions for inspection, maintenance, and repair
- D. Manual for Equipment and Systems
 - 1. Submit 5 hard copies and 1 digital copy of complete manual in final form.
 - 2. Content, for each unit of equipment and system, as appropriate:
 - a. Description of unit and component parts
 - 1) Function, normal operating characteristics and limiting conditions.
 - 2) Performance curves, engineering data and tests
 - 3) Complete nomenclature and commercial number of replaceable parts
 - b. Operating procedures
 - 1) Start-up, break-in, routine, and normal operating instructions
 - 2) Regulation, control, stopping, shut-down and emergency instructions.
 - 3) Summer and winter operating instructions
 - 4) Special operating instructions
 - c. Maintenance procedures
 - 1) Routine operations
 - 2) Guide to "trouble shooting."
 - 3) Disassembly, repair, and reassembly
 - 4) Alignment, adjusting and checking.
 - d. Servicing and lubrication schedule
 - 1) List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions
 - f. Description of sequence of operation by control manufacturer
 - 1) Predicted life of parts subject to wear
 - 2) Items recommended to be stocked as spare parts.
 - g. As installed control diagrams by controls manufacturer
 - h. Each contractor's coordination drawings
 - 1) As installed color coded piping diagrams
 - i. Charts of valve tag numbers, with location and function of each valve

- j. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
- k. Other data as required under pertinent Sections of Specifications
- 3. Content, for each electric and electronic system, as appropriate:
 - a. Description of system and component parts
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests
 - 3) Complete nomenclature and commercial number of replaceable parts
 - b. Circuit directories of panelboards
 - 1) Electrical service
 - 2) Controls
 - 3) Communications
 - c. As installed color coded wiring diagrams
 - d. Operating procedures
 - 1) Routine and normal operating instructions
 - 2) Sequences required.
 - 3) Special operating instructions
 - e. Maintenance procedures
 - 1) Routine operations
 - 2) Guide to "trouble shooting."
 - 3) Disassembly, repair and reassembly
 - 4) Adjustment and checking
 - f. Manufacturer's printed operating and maintenance instructions
 - g. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 - h. Other data as required under pertinent Sections of Specifications
- 4. Prepare and include additional data when the need for such data becomes apparent during instruction of City's personnel.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Provide operation and maintenance data by personnel with the following criteria:
 - 1. Trained and experienced in maintenance and operation of described products.
 - 2. Skilled as technical writer to the extent required to communicate essential data.
 - 3. Skilled as draftsman competent to prepare required drawings.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work associated with the documenting the project and recording changes to project documents, including:
 - a. Record Drawings

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Work associated with this Item is considered incidental to the various Items bid. No separate payment will be allowed for this Item.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Prior to submitting a request for Final Inspection, deliver Project Record Documents to Project Manager. Record Documents to be reviewed in field as part of final inspection. Final documents to be submitted to City prior to request for final payment.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that future search for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.
3. To facilitate accuracy of records, make entries within 24 hours after receipt of information that the change has occurred.

4. Provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation and examination.

1.10 STORAGE AND HANDLING

A.Storage and Handling Requirements

1. Maintain the job set of Record Documents, which shall include the Drawings and the Project Manual, completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.
2. In the event of loss of recorded data, use means necessary to again secure the data to the City's approval.
 - a. In such case, provide replacements to the standards originally required by the Contract Documents.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED [OR] OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 RECORD DOCUMENTS

A.Job set

1. Promptly following receipt of the Notice to Proceed, secure from the City, at no charge to the Contractor, 1 complete set of all Documents comprising the Contract.

B.Final Record Documents

1. At a time nearing the completion of the Work and prior to Final Inspection, provide the City 1 complete set of all Final Record Drawings in the Contract. Record Documents to be reviewed in field as part of final inspection. Final documents to be submitted to City prior to request for final payment.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 MAINTENANCE DOCUMENTS

A.Maintenance of Job Set

1. Immediately upon receipt of the job set, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET". The Job set shall include the Drawings and the Project Manual.
2. Preservation
 - a. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set.
 - b. Do not use the job set for any purpose except entry of new data and for review by the City, until start of transfer of data to final Project Record Documents.
 - c. Maintain the job set at the site of work.
3. Coordination with Construction Survey
 - a. At a minimum, in accordance with the intervals set forth in Section 01 71 23, clearly mark any deviations from Contract Documents associated with installation of the infrastructure.
4. Making entries on Drawings and Specifications
 - a. Record any deviations from Contract Documents on Drawings and in the Specifications if applicable.
 - b. Use an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
 - c. Date all entries.
 - d. Call attention to the entry by a "cloud" drawn around the area or areas affected.
 - e. In the event of overlapping changes, use different colors for the overlapping changes.
5. Conversion of schematic layouts
 - a. In some cases, on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, are shown schematically and are not intended to portray precise physical layout.
 - 1) Final physical arrangement is determined by the Contractor, subject to the City's approval.
 - 2) However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings.
 - b. Show on the job set of Record Drawings, by dimension accurate to within 1 inch, the centerline of each run of items.
 - 1) Final physical arrangement is determined by the Contractor, subject to the City's approval.
 - 2) Show, by symbol or note, the vertical location of the Item ("under slab", "in ceiling plenum", "exposed", and the like).
 - 3) Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
 - c. The City may waive the requirements for conversion of schematic layouts where, in the City's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the City.

B. Final Project Record Documents

1. Transfer of data to Drawings and Specifications

- a. Carefully transfer change data shown on the job set of Record Drawings and Project Manual if applicable, to the corresponding final documents, coordinating the changes as required.
 - b. Clearly indicate at each affected detail and other Drawing a full description of changes made during construction, and the actual location of items.
 - c. Call attention to each entry by drawing a "cloud" around the area or areas affected.
 - d. Make changes neatly, consistently and with the proper media to assure longevity and clear reproduction.
2. Transfer of data to other Documents
 - a. If the Documents, other than Drawings, have been kept clean during progress of the Work, and if entries thereon have been orderly to the approval of the City, the job set of those Documents, other than Drawings, will be accepted as final Record Documents.
 - b. If any such Document is not so approved by the City, secure a new copy of that Document from the City at the City's usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the approval of the City.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 02 41 13

SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removal and disposal of:
 - a. Items identified on construction plan Fence
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Removal of Stairs
 - a. Measurement
 - 1) Measured per square foot of horizontal surfaces only of Removal of Stairs.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot of horizontal surfaces only for Removal of Stairs.
 - c. The price bid shall include:
 - 1) Removal of stairs constructed of any material (i.e. concrete, wood, metal, etc)
 - 2) Sawing
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Disposal
 - 8) Clean-up
 - 9) Repair adjacent sidewalk or pavement damaged by the removal of steps
 - 2. Removal of Fence
 - a. Measurement
 - 1) Measured per linear foot of Removal of Fence.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Removal of Fence.
 - c. The price bid shall include:
 - 1) Removal of all post types
 - 2) Removal of all fence types
 - 3) Removal of all gate types
 - 4) Removal of post foundations
 - 5) Loading
 - 6) Unloading

- 7) Storing
- 8) Hauling
- 9) Disposal
- 10) Clean-up
- 3. Removal of Guardrail
 - a. Measurement
 - 1) Measured per linear foot of Removal of Guardrail.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Removal of Guardrail.
 - c. The price bid shall include:
 - 1) Removal of all post types
 - 2) Removal of all guardrail types
 - 3) Removal of post foundations
 - 4) Removal of concrete mow strip
 - 5) Removal of all end terminal types
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Disposal
 - 11) Clean-up
- 4. Removal of Mailbox
 - a. Measurement
 - 1) Measured per each Removal of Mailbox.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Removal of Mailbox.
 - c. The price bid shall include:
 - 1) Removal of all post types
 - 2) Removal of post foundations
 - 3) Removal of all mailbox types
 - 4) Removal of mailbox bank
 - 5) Removal of all brick, concrete block, stone façade, or any other decorative and structural material used to construct a mailbox
 - 6) Temporary mailbox, mailbox bank, or other form of mail access
 - 7) Coordination with USPS and property owner
 - 8) Loading
 - 9) Unloading
 - 10) Storing
 - 11) Hauling
 - 12) Salvaging or disposal
 - 13) Clean-up
- 5. Removal of Riprap
 - a. Measurement
 - 1) Measured per square yard of Removal of Riprap

- b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for Removal of Riprap.
 - c. The price bid shall include:
 - 1) Removal of all rock at all sizes and types
 - 2) Removal of concrete at all depths
 - 3) Removal of reinforcing
 - 4) Removal of grout
 - 5) Removal of bedding material and filter fabric
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Salvaging or disposal
 - 11) Clean-up
6. Removal of Stormwater Structure
- a. Measurement
 - 1) Measured per each Removal of Stormwater Structure
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Removal of Stormwater Structure.
 - c. The price bid shall include:
 - 1) Removal of all headwalls, wingwalls, and end treatments at all sizes and types
 - 2) Removal of concrete at all depths
 - 3) Removal of reinforcing
 - 4) Removal of grout
 - 5) Removal of bedding material and filter fabric
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Backfilling
 - 11) Salvaging or disposal
 - 12) Clean-up
7. Removal of Retaining Wall Less Than 4 Feet
- a. Measurement
 - 1) Measured per linear foot of Removal of Retaining Wall Less Than 4 Feet.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Removal of Retaining Wall Less Than 4 Feet.
 - c. The price bid shall include:
 - 1) Removal of footings of all types and depths
 - 2) Removal of wall
 - 3) Removal of reinforcing
 - 4) Shoring wall construction and design (if needed)

- 5) Loading
 - 6) Unloading
 - 7) Storing
 - 8) Hauling
 - 9) Salvaging or disposal
 - 10) Clean-up
8. Removal of Retaining Wall Greater Than 4 Feet
- a. Measurement
 - 1) Measured per linear foot of Removal of Retaining Wall Greater Than 4 Feet.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Removal of Retaining Wall Greater Than 4 Feet.
 - c. The price bid shall include:
 - 1) Removal of footings of all types and depths
 - 2) Removal of wall
 - 3) Removal of reinforcing
 - 4) Shoring wall construction and design (if needed)
 - 5) Loading
 - 6) Unloading
 - 7) Storing
 - 8) Hauling
 - 9) Salvaging or disposal
 - 10) Clean-up

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. TXMUTCD – Texas Manual on Uniform Traffic Control Devices

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing

1. Pedestrian Traffic

- a. Where existing sidewalks are to be closed during Paving Removal activities:
 - 1) Utilize pedestrian/sidewalk detour route specified in the Drawings
 - a) If no detour route is provided, submit a pedestrian/sidewalk detour route that has been signed and sealed by a registered professional engineer to City for review.
 - 2) The pedestrian/sidewalk detour route will be subsidiary to pertinent Traffic Control items included with the project.
- b. Install all sidewalk detours and closures in accordance with the TXMUTCD, State, and local guidelines.
- c. Provide any traffic control devices as required by the City. .

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Temporary Shoring Design

- a. Submit a temporary shoring design for review and approval prior to removal of retaining walls or any other removal activities requiring a shoring wall.
- b. The design of a shoring wall is considered subsidiary to the appropriate bid item.
- c. Provide a signed and sealed shoring wall design by an engineer licensed in the state of Texas for all shoring walls unless otherwise specified in the Drawings or directed by City.

B. Informational Submittal

1. Equipment Information

- a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Surface Preparation

1. Verify all removal limits prior to construction unless otherwise directed by the City.

3.4 SITE DEMOLITION

A. Disposal of materials

1. Accept ownership and dispose of all materials removed.
2. Dispose of all material in accordance with Federal, State, and local laws and regulations.
3. The disposal of any material removed as part of Selective Site Demolition is considered subsidiary to the applicable items.

B. Removal of Stairs

1. Sawing
 - a. Perform sawing activities for concrete paving and sidewalk in accordance with Section 02 41 15.
2. Minimum Limits of Stair Removal
 - a. If adjacent stairs are to remain, remove stair to the nearest whole stair. Do not saw cut an existing stair.
 - b. If stairs to be removed are adjacent to a sidewalk, remove stairs to the nearest sidewalk joint.

C. Removal of Fence

1. Remove all fence components above and below ground.
2. Backfill holes with acceptable fill material.
3. Compact per Drawings.
4. Use caution in removing any fence material.
5. Coordinate with property owners as needed to maintain a fenced area at all times especially when animals are kept within the fencing.
6. Contractor is responsible for maintaining fencing and installing temporary fencing as needed during construction.
7. Contractor is responsible for providing fencing at all times.
8. Installing and removing temporary fencing when necessary is subsidiary to Removal of Fence.

D. Removal of Guardrail

1. Remove rail elements in original lengths.
2. Remove fittings from the posts and the metal rail prior to removing the posts. Once the fittings and metal railing is removed, remove the posts.
3. Remove and replace any guardrail to remain that is damaged during construction activities at no cost to the City.
4. Completely remove posts and any paving material surrounding the posts.
5. Backfill any holes with acceptable fill material.

E. Removal of Mailbox

1. Advance Coordination:
 - a. Coordinate with property owner prior to removal of mailbox.
 - b. Coordinate with local post office prior to removal. Provide approach and access space in accordance to post office requirements.
 - c. Provide the City and the property owner with a written confirmation of the timeframe.
2. For non-custom or decorative postal mailboxes, salvage existing materials for reuse when possible.
3. For all custom and/or decorative mailboxes:

- a. Replace the custom mailbox with a standard post office approved mailbox. No custom mailboxes will be constructed unless specified in the Drawings or directed by the City.
- b. If property owner wishes to remove or salvage a custom mailbox, determine an agreed upon timeframe with the City, the Contractor, and the property owner for removal.
4. The Contractor is responsible for providing a temporary mailbox during construction for any mailbox that is proposed to be removed and relocated, reinstalled, or replaced.
5. Maintain mailbox and/or mail delivery for duration of project. No separate pay will be provided.

F. Removal of Riprap

1. Remove concrete riprap to the nearest joint.
2. Conform to concrete sawing requirements in Section 02 41 15.

G. Removal of Stormwater Structure

1. Remove entire structure or to the nearest joint as specified in the Drawings.
2. Removal includes all components of the stormwater structure including footings, toe walls, and mitered RCP ends.
 - a. In accordance with utility pipe removal requirements in Section 02 41 14.
 - b. In accordance with concrete sawing requirements in Section 02 41 15.
3. Provide temporary erosion control protection for adjacent side slopes, drainage channels, and ditches. Temporary erosion control is considered subsidiary to the Removal of Stormwater Structures.
4. Repair or replace any portion of remaining structure that is damaged as a result of removal activities.
5. Do not use explosives to remove portions of the existing structure.
6. Do not use a demolition ball, other swinging weight, or impact equipment unless approved in writing by City.
7. Use pneumatic or hydraulic tools for final removal of concrete at the removal limits.
8. Use removal equipment that will not damage any remaining portion of the stormwater structure.

H. Removal of Retaining Wall Less Than 4 Feet

1. Any decorative or landscape retaining wall within the City's right-of-way will not be replaced unless required for grading purposes.
2. A retaining wall is required if the slope to tie back to existing ground within the City's right-of-way is steeper than 4:1.
3. If a retaining wall is required:
 - a. Determine if a retaining wall is required before removing any decorative or landscape retaining walls.
 - b. Request approval from City before removing decorative or landscape retaining wall.
4. If a retaining wall is not required:
 - a. Remove any decorative or landscape retaining wall within the City's right-of-way and re-grade to a maximum of 4:1 slope.
 - b. Do not replace the decorative or landscape retaining wall.
5. Remove wall to the nearest existing joint where possible. If not possible, obtain approval from the City for removal limits.

6. In accordance with concrete sawing requirements in Section 02 41 15.
7. Removal includes all components of the retaining wall.
8. Do not use explosives to remove portions of the existing structure.
9. Do not use a demolition ball, other swinging weight, or impact equipment unless approved in writing.
10. Use pneumatic or hydraulic tools for final removal of concrete at the removal limits.
11. Use removal equipment that will not damage any remaining portion of the retaining wall.
12. Construct an approved shoring wall when necessary to provide a safe environment for workers and the travelling public.

I. Removal of Retaining Wall Greater Than 4 Feet

1. Any decorative or landscape retaining wall within the City's right-of-way will not be replaced unless required for grading purposes.
2. A retaining wall is required if the slope to tie back to existing ground within the City's right-of-way is steeper than 4:1.
3. If a retaining wall is required:
 - a. Determine if a retaining wall is required before removing any decorative or landscape retaining walls.
 - b. Request approval from City before removing decorative or landscape retaining wall.
4. If a retaining wall is not required:
 - a. Remove any decorative or landscape retaining wall within the City's right-of-way and re-grade to a maximum of 4:1 slope.
 - b. Do not replace the decorative or landscape retaining wall.
5. Remove wall to the nearest existing joint.
6. In accordance with concrete sawing requirements in Section 02 41 15.
7. Removal includes all components of the retaining wall including footings.
8. Do not use explosives to remove portions of the existing structure.
9. Do not use a demolition ball, other swinging weight, or impact equipment unless approved in writing.
10. Use pneumatic or hydraulic tools for final removal of concrete at the removal limits.
11. Use removal equipment that will not damage any remaining portion of the retaining wall.
12. Construct an approved shoring wall when necessary to provide a safe environment for workers and the travelling public.

3.5 REPAIR

- A. Repair the following at no cost to the City if any damage is caused due to Selective Site Demolition activities:
1. Adjacent concrete or asphalt pavement
 2. Adjacent sidewalk
 3. Adjacent curb or curb and gutter
 4. Remaining portions of stormwater structures
 5. Remaining portions of retaining walls
 6. Subgrade or base material

7. Utility piping, structures, and appurtenances
8. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
9. Landscape beds or planters
10. Decorative hardscape or landscape features

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 02 41 13

MATERIAL DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Disposal of waste material and salvageable material.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Unless provided for in a specific pay item, material disposal is considered subsidiary to other items.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.
- C. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.
- D. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize
- E. exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP).
- F. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

3.4 MATERIAL DISPOSAL

A. Disposal of materials

1. Accept ownership and dispose of all materials removed.
2. Dispose of all material in accordance with Federal, State, and local laws and regulations.
3. The disposal of any material removed as part of Selective Site Demolition is considered subsidiary to the applicable items.

3.5 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

1. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into City trucks.
2. Pipe Culvert: Load culverts designated for salvage into City trucks.
3. Other Salvageable Materials: Conform to requirements of individual Specification Sections.
4. Coordinate loading of salvageable material on City trucks with Project Manager.

3.6 EXCESS MATERIAL

1. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.
2. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner.
3. Verify floodplain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year and 500-year Standard Flood Hazard Areas unless "Development Permit" has been obtained. Remove excess material placed in "100-year and 500-year Standard Flood Hazard Areas" within the City without "Development Permit", at no additional cost to the City.
4. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

3.7 RE-INSTALLATION [NOT USED]

3.8 SITE QUALITY CONTROL [NOT USED]

3.9 SYSTEM STARTUP [NOT USED]

3.10 ADJUSTING [NOT USED]

3.11 CLEANING [NOT USED]

3.12 CLOSEOUT ACTIVITIES [NOT USED]

3.13 PROTECTION [NOT USED]

3.14 MAINTENANCE [NOT USED]

3.15 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 02 41 14
UTILITY REMOVAL AND ABANDONMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal, abandonment, or salvaging of the following utilities:
 - a. General Utility Items:
 - 1) Utility Line Abandonment by Grout Fill – Water, Sanitary Sewer, Stormwater
 - 2) Utility Line Removal, Separate Trench – Water, Sanitary Sewer, Stormwater
 - 3) Utility Line Removal, Same Trench – Water, Sanitary Sewer, Stormwater
 - 4) Utility Manhole Abandonment – Water, Sanitary Sewer, Stormwater
 - 5) Utility Manhole Removal – Water, Sanitary Sewer, Stormwater
 - 6) Plugging of Utility Lines – Water, Sanitary Sewer, Stormwater
 - 7) Utility Junction Structure Removal – Sanitary Sewer, Stormwater
 - b. Water Specific Items:
 - 1) Water Valve Removal
 - 2) Water Valve Removal and Salvage
 - 3) Water Valve Abandonment
 - 4) Fire Hydrant Removal and Salvage
 - 5) Water Meter Removal and Salvage
 - 6) Concrete Water Vault Removal
 - 7) Cathodic Test Station Abandonment
 - c. Stormwater Specific Items:
 - 1) Stormwater Inlet Removal
 - 2) Headwall/SET Removal
 - 3) Trench Drain Removal

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. General Utility Items
 - a. Utility Line Abandonment by Grout Fill
 - 1) Measurement
 - a) Measured horizontally along the ground surface of existing utility line to be abandoned.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Grout Fill Utility Line” for:
 - (1) Various Sizes.
 - 3) The price bid shall include:

- a) Dewatering (as required)
 - b) disposal of sewage (as required)
 - c) Furnishing and installing low density cellular grout or CLSM
 - d) Water
 - e) Pavement Removal
 - f) Excavation
 - g) Hauling
 - h) Disposal of excess materials
 - i) Furnishing, placement, and compaction of backfill.
 - j) Clean-up
- b. Utility Line Removal, Separate Trench
- 1) Measurement
 - a) Measured horizontally along the ground surface of existing utility line to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Remove Utility Line” for:
 - (1) Various Sizes.
 - 3) The price bid shall include:
 - a) Dewatering (as required)
 - b) Disposal of sewage (as required)
 - c) Pavement Removal
 - d) Excavation
 - e) Hauling
 - f) Disposal of excess materials
 - g) Furnishing, placement, and compaction of backfill
 - h) Clean-up
- c. Utility Line Removal, Same Trench
- 1) Measurement
 - a) This item is considered subsidiary to the proposed utility line being installed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per linear foot of utility pipe installed.
- d. Utility Manhole Abandonment
- 1) Measurement
 - a) Measured per each manhole to be abandoned.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Abandon Utility Manhole” for:
 - (1) Various diameters.
 - 3) The price bid shall include:
 - a) Disposal of sewage (as required)
 - b) Removal and disposal of manhole cone
 - c) Removal and disposal of frame and cover
 - d) Cutting and plugging of existing utility lines
 - e) Concrete
 - f) Sand

- g) Pavement removal
- h) Excavation
- i) Hauling
- j) Disposal of excess materials
- k) Furnishing, placement, and compaction of backfill
- l) Surface restoration
- m) Clean-up
- e. Utility Manhole Removal
 - 1) Measurement
 - a) Measured per each manhole to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Remove Utility Manhole" for:
 - (1) Various diameters.
 - 3) The price bid shall include:
 - a) Environmentally approved Disposal of sewage (as required)
 - b) Removal and disposal of manhole
 - c) Removal and disposal of frame and cover
 - d) Cutting and plugging of existing utility lines
 - e) Pavement removal
 - f) Excavation
 - g) Hauling
 - h) Disposal of excess materials
 - i) Furnishing, placement, and compaction of backfill
 - j) Surface restoration
 - k) Clean-up
- f. Plugging of Utility Lines
 - 1) Measurement
 - a) Measurement for this item shall be by lump sum.
 - 2) Payment
 - a) The work performed and the materials furnished in accordance with this item shall be paid for at the lump sum price bid for all "Utility Line Plugging".
 - 3) The price bid shall include:
 - a) Furnishing and installing all utility line pressure plugs
 - b) Furnishing and installing all utility line abandonment plugs
 - c) Ductile iron fittings (for pressure plugs)
 - d) Gaskets (for pressure plugs)
 - e) Nuts and bolts (for pressure plugs)
 - f) Pavement removal
 - g) Excavation
 - h) Hauling
 - i) Disposal of excess material
 - j) Furnishing, placement, and compaction of embedment
 - k) Furnishing, placement, and compaction of backfill
 - l) Disinfection (for pressure plugs)
 - m) Testing (for pressure plugs)
 - n) CLSM (for abandonment plugs)
 - o) Clean-up

- g. Utility Junction Structure Removal
 - 1) Measurement
 - a) Measured per each junction structure to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Remove Utility Junction Structure”.
 - 3) The price bid shall include:
 - a) Disposal of sewage (as required)
 - b) Removal and disposal of junction structure
 - c) Removal and disposal of frames and covers.
 - d) Removal and disposal of hatches
 - e) Cutting and plugging of existing utility lines
 - f) Pavement removal
 - g) Excavation
 - h) Hauling
 - i) Disposal of excess materials
 - j) Furnishing, placement, and compaction of backfill.
 - k) Surface restoration
 - l) Clean-up
- 2. Water Specific Items
 - a. Water Valve Removal
 - 1) Measurement
 - a) Measured per each water valve to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Remove Water Valve” for:
 - (1) Various sizes.
 - 3) The price bid shall include:
 - a) Removal and disposal of valve
 - b) Removal and disposal of valve box
 - c) Removal and disposal of water sampling station (if required)
 - d) Removal and disposal of water manhole, frame, cover, and grade rings (if required)
 - e) CLSM
 - f) Pavement removal
 - g) Excavation
 - h) Hauling
 - i) Disposal of excess materials
 - j) Furnishing, placement, and compaction of backfill.
 - k) Clean-up
 - b. Water Valve Removal and Salvage
 - 1) Measurement
 - a) Measured per each water valve to be removed and salvaged.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Salvage Water Valve” for:

- (1) Various sizes.
- 3) The price bid shall include:
 - a) Removal and salvage of valve
 - b) Removal and disposal of valve box
 - c) Removal and disposal of water sampling station (if required)
 - d) Removal and disposal of water manhole, frame, cover, and grade rings (if required)
 - e) CLSM
 - f) Delivery to City
 - g) Pavement removal
 - h) Excavation
 - i) Hauling
 - j) Disposal of excess materials
 - k) Furnishing, placement, and compaction of backfill
 - l) Clean-up
- c. Water Valve Abandonment
 - 1) Measurement
 - a) Measured per each water valve to be abandoned.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Abandon Water Valve” for:
 - (1) Various sizes.
 - 3) The price bid shall include:
 - a) Abandonment of valve
 - b) Removal and disposal of valve box
 - c) Removal and disposal of water sampling station (if required)
 - d) CLSM
 - e) Pavement removal
 - f) Excavation
 - g) Hauling
 - h) Disposal of excess materials
 - i) Furnishing, placement, and compaction of backfill
 - j) Clean-up
- d. Fire Hydrant Removal and Salvage
 - 1) Measurement
 - a) Measured per each fired hydrant to be removed and salvaged.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Salvage Fire Hydrant”.
 - 3) The price bid shall include:
 - a) Removal of fire hydrant
 - b) Salvage of fire hydrant (if required)
 - c) Delivery to City (if required)
 - d) Disposal of fire hydrant (if required)
 - e) Pavement removal
 - f) Excavation
 - g) Hauling

- h) Disposal of excess materials
 - i) Furnishing, placement, and compaction of backfill
 - j) Clean-up
- e. Water Meter Removal and Salvage
 - 1) Measurement
 - a) Measured per each water meter to be removed and salvaged.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” shall be paid for at the unit price bid per each “Salvage Water Meter”.
 - 3) The price bid shall include:
 - a) Coordination with City for City performed disconnection, removal, and salvage of water meter
 - b) Removal of existing water meter box
 - c) Salvage of existing water meter lid and delivery to City
 - d) Pavement removal
 - e) Excavation
 - f) Hauling
 - g) Disposal of excess materials
 - h) Furnishing, placement, and compaction of backfill
 - i) Clean-up
- f. Concrete Water Vault Removal
 - 1) Measurement
 - a) Measured per each junction structure to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Remove Concrete Water Vault”.
 - 3) The price bid shall include:
 - a) Coordination with City for City performed disconnection, removal, and salvage of water meter (if applicable)
 - b) Removal, salvage, and delivery of valves/meters to City (if applicable)
 - c) Removal and disposal of all piping, fittings, and other appurtenances (if applicable)
 - d) Removal and disposal of manhole
 - e) Removal and disposal of vault
 - f) Removal and disposal of hatches
 - g) Cutting and plugging of existing utility lines
 - h) Pavement removal
 - i) Excavation
 - j) Hauling
 - k) Disposal of excess materials
 - l) Furnishing, placement, and compaction of backfill
 - m) Surface restoration
 - n) Clean-up
- g. Cathodic Test Station Abandonment
 - 1) Measurement
 - a) Measured per each cathodic test station to be abandoned.
 - 2) Payment

- a) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Abandon Cathodic Test Station".
- 3) The price bid shall include:
 - a) Abandon cathodic test station
 - b) CLSM
 - c) Pavement removal
 - d) Excavation
 - e) Hauling
 - f) Disposal of excess materials
 - g) Furnishing, placement, and compaction of backfill
 - h) Clean-up
- 3. Stormwater Specific Items
 - a. Stormwater Inlet Removal
 - 1) Measurement
 - a) Measured per each stormwater inlet to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Storm Inlet".
 - 3) The price bid shall include:
 - a) Removal and disposal of inlet
 - b) Pavement removal
 - c) Excavation
 - d) Hauling
 - e) Disposal of excess materials
 - f) Furnishing, placement, and compaction of backfill
 - g) Clean-up
 - b. Headwall/SET Removal
 - 1) Measurement
 - a) Measured per each headwall or safety end treatment (SET) to be removed.
 - 2) Payment
 - a) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" shall be paid for at the unit price bid per each "Remove Headwall/SET".
 - 3) The price bid shall include:
 - a) Removal and disposal of Headwall/SET
 - b) Pavement removal
 - c) Excavation
 - d) Hauling
 - e) Disposal of excess materials
 - f) Furnishing, placement, and compaction of backfill
 - g) Clean-up
 - c. Trench Drain Removal
 - 1) Measurement
 - a) Measured horizontally along the ground surface of existing trench drain to be removed.
 - 2) Payment

- a) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” shall be paid for at the unit price bid per linear foot of “Remove Trench Drain”.
- 3) The price bid shall include:
 - a) Removal and disposal of trench drain
 - b) Pavement removal
 - c) Excavation
 - d) Hauling
 - e) Disposal of excess materials
 - f) Furnishing, placement, and compaction of backfill
 - g) Clean-up

1.3 REFERENCES

A. Abbreviations

- 1. CLSM – Controlled Low Strength Material

B. Definitions

- 1. Pressure Plug – Plugging of an existing pressurized pipeline to remain in service with fitting, blind flange, or welded plug, as applicable.
- 2. Abandonment Plug – Plugging of an existing gravity or pressurized pipeline to be abandoned with CLSM.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

- 1. Contact Project Manager and Water Utilities for coordination of salvaged material return.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Special Procedure Submittals

- 1. Utility Abandonment by Grout Fill Plan:
 - a. Grout fill narrative
 - b. Grout port locations
 - c. Calculations demonstrating proposed volume of grout

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

- 1. Protect and salvage all materials such that no damage occurs during delivery to City.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Coordinate with Water Utilities prior to abandonment of existing water or sanitary sewer lines to determine whether all existing services have been removed.

3.4 REMOVAL, SALVAGE, AND ABANDONMENT

A. General Utility Items

1. Utility Line Abandonment by Grout Fill
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Dewater existing line to be grouted.
 - c. Dispose of any sewage from existing line to be grouted for sanitary sewer lines.
 - d. Fill line with CLSM in accordance with Section 03 34 13 or Low-Density Cellular Grout in accordance with specification.
 - e. Dispose of any excess material.
2. Utility Line Removal, Separate Trench
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Dewater existing line to be removed.
 - c. Dispose of any sewage from existing line to be removed for sanitary sewer lines.
 - d. Cut any service, lateral, or main connections prior to removal.
 - e. Remove existing utility line and properly dispose of as approved by City.
3. Utility Manhole Abandonment
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of existing frame, cover, grade rings, and manhole cone section.
 - c. Cut and plug existing service, lateral, and main lines with 2000 psi concrete in accordance with Section 03 30 00.
 - d. Backfill manhole with utility sand in accordance with Section 33 05 06.
4. Utility Manhole Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of existing frame, cover, and grade rings.

- c. Dispose of any sewage from existing manhole for sanitary sewer manholes.
- d. Demolish and remove entire concrete manhole.
- e. Plug existing service, lateral, and main lines with abandonment plugs.
- 5. Plugging of Utility Lines
 - a. Water Line Pressure Plugs
 - 1) Ductile Iron and PVC C900 Water Lines
 - a) Excavate, embed, and backfill in accordance with Section 33 05 06.
 - b) Plug line with MJ Plug with mechanical restraint and blocking in accordance with Section 33 05 19.
 - 2) Buried Steel Water Lines
 - a) Excavate, embed, and backfill in accordance with Section 33 05 06.
 - b) Plug line using:
 - (1) Fabricated plug restrained by welding in accordance with Section 33 05 24;
or
 - (2) Blind flange in accordance with Section 33 05 24.
 - b. Utility Line Abandonment Plugs
 - 1) Excavate and backfill in accordance with Section 33 05 06.
 - 2) Dispose of any sewage for sanitary sewer lines.
 - 3) Install bulkhead sufficient to retain CLSM plug before it has cured.
 - 4) Backfill trench adjacent to pipe plug with CLSM to top of pipe.
 - 5) Plug minimum 2 feet of existing pipe with CLSM in accordance with Section 03 34 13.
 - a) Pressure plugs may be used for water line abandonment plugs as an acceptable alternative.
- 6. Utility Junction Structure Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of existing frame, cover, hatch, and grade rings.
 - c. Dispose of any sewage from existing manhole for sanitary sewer manholes.
 - d. Demolish and remove entire concrete structure.
 - e. Plug existing service, lateral, and main lines with abandonment plugs.

B. Water Items

- 1. Water Valve Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of valve box.
 - c. Remove and dispose of valve bonnet, wedge, and stem.
 - d. Fill valve body with CLSM in accordance with Section 03 34 13.
- 2. Water Valve Removal and Salvage
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of valve box.
 - c. Remove valve bonnet, wedge, and stem, and deliver to the City as directed by City Inspector.
 - d. Protect salvaged materials from damage.
 - e. Fill valve body with CLSM in accordance with Section 03 34 13.
- 3. Water Valve Abandonment
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove the top 2 feet of the valve stack and any valve extensions.
 - c. Fill the remaining valve stack with CLSM in accordance with Section 03 34 13.

4. Fire Hydrant Removal and Salvage
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove fire hydrant.
 - c. Install abandonment plug on fire hydrant lead line.
 - d. Deliver salvaged fire hydrant to the City as directed by City.
 - e. Protect salvaged materials from damage.
5. Water Meter Removal and Salvage
 - a. Coordinate with City to have City remove and salvage water meter.
 - 1) Contractor shall not remove water meter.
 - b. Remove and dispose of curb stop, and meter boxes.
 - c. Remove and salvage meter box lid and deliver to City as directed by City Inspector.
 - d. Crimp abandoned service lines.
 - e. Backfill in accordance with Section 33 05 06.
6. Concrete Water Vault Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Coordinate with City to have City remove and salvage water meter if applicable.
 - 1) Contractor shall not remove water meter.
 - c. Remove and salvage valve, if applicable.
 - d. Remove and salvage vault lid.
 - e. Remove and salvage test stations.
 - f. Protect salvaged materials from damage.
 - g. Remove and dispose of piping and other appurtenances.
 - h. Deliver salvaged material to City as directed by City Inspector.
 - i. Demolish and remove entire concrete water vault.
 - j. Plug existing service and main lines with abandonment plugs.
 - k. Dispose of excess materials.
7. Cathodic Test Station Abandonment
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove top 2 feet of the cathodic test station stack and contents.
 - c. Fill any remaining voids with CLSM in accordance with Section 03 34 13.

C. Stormwater Items

1. Stormwater Inlet Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Demolish and remove entire concrete inlet.
 - c. Plug existing lateral and main lines with abandonment plugs.
2. Headwall/SET Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Demolish and remove concrete headwall/SET.
 - c. Plug existing lateral and main lines with abandonment plugs.
3. Trench Drain Removal
 - a. Excavate and backfill in accordance with Section 33 05 06.
 - b. Remove and dispose of existing pipe.

- 3.5 REPAIR [NOT USED]**
- 3.6 RE-INSTALLATION [NOT USED]**
- 3.7 FIELD QUALITY CONTROL [NOT USED]**
- 3.8 SYSTEM STARTUP [NOT USED]**
- 3.9 ADJUSTING [NOT USED]**
- 3.10 CLEANING [NOT USED]**
- 3.11 CLOSEOUT ACTIVITIES [NOT USED]**
- 3.12 PROTECTION [NOT USED]**
- 3.13 MAINTENANCE [NOT USED]**
- 3.14 ATTACHMENTS [NOT USED]**

END OF SECTION

SECTION 02 41 15

PAVING REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Construction methods for
 - a. Remove Concrete Pavement
 - b. Remove Concrete Curb and Gutter
 - c. Remove Concrete Valley Gutter
 - d. Remove Sidewalk
 - e. Remove Curb Ramp
 - f. Remove Asphalt Pavement
 - g. Remove Driveway
 - h. Remove Brick Pavers
 - i. Remove Permeable Pavers
 - j. Wedge Milling
 - k. Surface Milling
 - l. Butt Joint Milling
 - m. Pavement Pulverization
 - n. Obliterate Abandoned Road
 - o. Pavement Removal for Utility Trenching

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Remove Concrete Pavement
 - a. Measurement
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Remove Concrete Pavement."
 - c. The price bid shall include:
 - 1) Sawing and breaking the material.
 - 2) Removal of monolithic concrete curb and concrete pavement
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Salvaging or disposing
 - 8) Repair adjacent pavement damaged by the removal of concrete.
2. Remove Concrete Curb and Gutter
 - a. Measurement

- 1) Measured per linear foot of “Remove Curb and Gutter.”
- b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Remove Curb and Gutter.”
- c. The price bid shall include:
 - 1) Sawing and breaking the material.
 - 2) Removal of concrete curb and gutter
 - 3) Cleaning
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Salvaging or disposing
 - 9) Repair adjacent pavement and curb and gutter damaged by the removal of curb and gutter.
3. Remove Concrete Valley Gutter
 - a. Measurement
 - 1) Measured per square yard of “Remove Concrete Gutter.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Remove Concrete Gutter.”
 - c. The price bid shall include:
 - 1) Sawing and breaking the material.
 - 2) Removal of concrete gutter
 - 3) Cleaning
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Salvaging or disposing
 - 9) Repair adjacent pavement damaged by the removal of concrete gutter.
4. Remove Sidewalk
 - a. Measurement
 - 1) Measured per square foot of “Remove Sidewalk.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot for “Remove Sidewalk.”
 - c. The price bid shall include:
 - 1) The removal of integral sidewalk walls
 - 2) The removal of landscape walls adjacent to sidewalk less than 3 feet in height
 - 3) Sawing and breaking the material.
 - 4) Cleaning
 - 5) Loading
 - 6) Unloading
 - 7) Storing

- 8) Hauling
 - 9) Salvaging or disposing
 - 10) Repair to adjacent curb or curb and gutter damaged by the removal of sidewalk
5. Remove Curb Ramp
- a. Measurement
 - 1) Measured per each of “Remove Curb Ramp.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for “Remove Curb Ramp” for:
 - a) Various types.
 - c. The price bid shall include:
 - 1) Removal of curb ramp, curb ramp curbs, flares, and detectable warning tiles
 - 2) Sawing and breaking the material.
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Salvaging or disposing
 - 8) Repair to adjacent curb, curb and gutter, or sidewalk damaged by the removal of curb ramp.
6. Remove Asphalt Pavement and base.
- a. Measurement
 - 1) Measured per square yard from gutter edge to gutter edge or edge to edge of existing asphalt pavement for all thicknesses.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Remove Asphalt Pavement.”
 - c. The price bid shall include:
 - 1) Sawing
 - 2) Breaking the material
 - 3) Removal of asphalt pavement
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Salvaging or disposing
 - 9) Repair adjacent pavement damaged by the removal of asphalt.
7. Remove Driveway
- a. Measurement
 - 1) Measured per square foot of “Remove Driveway.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot for “Remove Driveway” for:
 - a) Various pavement types (gravel, concrete, asphalt, pavers).
 - c. The price bid shall include:

- 1) Sawing
 - 2) Breaking the material
 - 3) Removal of driveway material
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Salvaging or disposing
 - 9) Repair adjacent pavement damaged by the removal of the driveway.
8. Remove Brick Pavers
- a. Measurement
 - 1) Measured per square foot of "Remove Brick Pavers."
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square foot for "Remove Brick Pavers."
 - c. The price bid shall include:
 - 1) Full-depth removal of bricks and any brick base material to existing subgrade.
 - 2) Sawing
 - 3) Breaking the material
 - 4) Removal of brick pavers
 - 5) Cleaning
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Disposal
 - 11) Salvage and delivery to City, if required
 - 12) Repair adjacent pavement damaged by the removal of bricks.
9. Remove Permeable Pavers
- a. Measurement
 - 1) Measured per square foot of "Remove Permeable Pavers."
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square foot for "Remove Permeable Pavers."
 - c. The price bid shall include:
 - 1) Full-depth removal of any permeable pavers and paver base material to existing subgrade or compacted soil.
 - 2) Sawing
 - 3) Breaking the material
 - 4) Removal of permeable pavers
 - 5) Cleaning
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Disposal

- 11) Salvage and delivery to City, if required
 - 12) Repair adjacent pavement damaged by the removal of permeable pavers.
10. Wedge Milling
- a. Measurement
 - 1) Measured per square yard of “Wedge Milling.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Wedge Milling.”
 - c. The price bid shall include:
 - 1) Milling
 - 2) Rolling
 - 3) Sweeping and cleaning remaining pavement
 - 4) Cleaning
 - 5) Surface treatments as specified in the Drawings.
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Repair to adjacent pavement damaged by wedge milling.
11. Asphalt Surface Milling
- a. Measurement
 - 1) Measured square yard of “Surface Milling.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Surface Milling.”
 - c. The price bid shall include:
 - 1) Milling
 - 2) Rolling
 - 3) Sweeping and cleaning remaining pavement
 - 4) Cleaning
 - 5) Surface treatments as specified in the Drawings.
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Salvaging or disposing
 - 11) Repair to adjacent pavement damaged by surface milling.
12. Butt Joint Milling
- a. Measurement
 - 1) Measured per linear foot of “Butt Milling.”
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear feet for “Butt Milling.”
 - c. The price bid shall include:
 - 1) Milling

- 2) Rolling
 - 3) Sweeping and cleaning remaining pavement
 - 4) Cleaning
 - 5) Surface treatments as specified in the Drawings.
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Salvaging or disposing
 - 11) Repair to adjacent pavement damaged by butt milling.
13. Pavement Pulverization (if specified)
- a. Measurement
 - 1) Measured per square yard of "Pavement Pulverization."
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Pavement Pulverization."
 - c. The price bid shall include:
 - 1) Pulverization
 - 2) Base undercutting
 - 3) Mixing and compaction
 - 4) Surface treatments as specified in the Drawings.
 - 5) Sweeping and cleaning remaining pavement
 - 6) Temporary removal and stockpiling of pulverized material
 - 7) Loading
 - 8) Unloading
 - 9) Storing
 - 10) Hauling
 - 11) Salvaging or disposing
 - 12) Repair to adjacent pavement damaged by pavement pulverization.
14. Obliterate Abandoned Road
- a. Measurement
 - 1) Measured per square yard of "Obliterate Abandoned Road."
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Obliterate Abandoned Road."
 - c. The price bid shall include:
 - 1) Salvaging and replacing topsoil.
 - 2) Furnishing and installing any new topsoil
 - 3) Removal of abandoned structures within the roadway
 - 4) Scarifying, mixing, and shaping abandoned roadway.
 - 5) Grading to maintain drainage.
 - 6) Sodding
 - 7) Removal of any material or items specified under Obliterate.
 - 8) Loading
 - 9) Unloading
 - 10) Storing

- 11) Hauling
- 12) Salvaging or disposing
- 13) Clean-up
- 15. Pavement Removal for Utility Trenching
 - a. Measurement
 - 1) This item is considered subsidiary to the installation of water, wastewater, or stormwater piping.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per linear foot of water, wastewater, or stormwater piping installed.

1.3 REFERENCES

A. Abbreviations

- 1. HMA – Hot-mix Asphalt

B. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
- 2. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing

- 1. Sidewalk Construction
 - a. Where existing sidewalks are to be closed during Paving Removal activities:
 - 1) Utilize pedestrian/sidewalk detour route specified in the Drawings.
 - a) If no detour route is provided, submit a pedestrian/sidewalk detour route that has been signed and sealed by a registered professional engineer to the City for review.
 - b. The pedestrian/sidewalk detour route will be subsidiary to pertinent Traffic Control items included with the project.
 - c. Install all sidewalk detours and closures in accordance with the TMUTCD, State, and local guidelines.
 - d. Provide any traffic control devices as required by the City.
- 2. Pavement Removal
 - a. Install traffic control devices prior to removal of pavement per the Drawings.
 - b. If no traffic control plan is provided, submit a traffic control plan that has been signed and sealed by a registered professional engineer to the City for review.

B. Pre-Construction Meeting

- 1. Hold a pre-construction meeting prior to performing any tasks included under Paving Removal. Invite the City and appropriate representatives. The following items will be reviewed and discussed at the meeting:
 - a. All removal limits for any pavement to be removed.
 - b. Concrete paving removal method

1.5 SUBMITTALS

A.Submittals shall be in accordance with Section 01 33 00.

B.All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A.Informational Submittal:

1. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.Site Preparation

1. Mark all pavement removal limits prior to construction.
2. City will review and provide direction to Contractor, regarding proposed limits prior to saw cutting, milling, or any other pavement removal activities.
3. For maintenance projects, the City will mark the limits of Paving Removal prior to construction unless otherwise shown in plans.

3.4 PAVEMENT REMOVAL

A.Sawing

1. Full depth saw cut all pavement to be removed.
2. Make a clean, smooth cut producing a groove 1/8 inch to 1/4 inch wide and full depth.
3. Any saw cut wider than 1/4 inch will not be accepted.
4. Re-saw pavement edge after pavement is removed as many times as necessary to provide a smooth, neat, straight pavement edge free from chips or gouges. Contractor to re-saw a minimum of one time.
5. If a saw cut falls within 5 feet of an existing joint, pavement edge, or edge of gutter, remove paving to the nearest joint, pavement edge, or gutter edge.
6. Minimize dust and residue from entering the atmosphere by using water, vacuums, or other approved dust reducing measures.
7. Utilize erosion control measures to prevent dust and residue from entering the storm drain system in accordance with Section 31 25 14.
8. Use care to prevent fracturing or spalling of adjacent existing pavement. Repair any damage done to the existing pavement due to saw cutting or pavement removal in accordance with Sections 32 01 17 or 32 01 29 at no cost to the City.

B. Remove Concrete Paving

1. Saw Cut
 - a. In accordance with this Section.
2. Minimum Limits of Removal
 - a. Parallel to the Centerline
 - 1) Minimum cut along street path is:
 - a) 10 feet in total length
 - b) 1 foot from the edge of the trench
 - b. Perpendicular to the Center Line
 - 1) Remove full panel of each lane width if trench or repairs are contained within the lane and panel. If trench or repairs are contained within a half panel (beginning at an existing joint), then half panel replacement is allowed.
 - 2) For locations where two or more lanes are affected, remove the full width of affected lanes.
 - 3) Maintain minimum gutter width of 2 feet from back of curb at all times.
 - c. Concrete alley or residential street less than 30 feet wide:
 - a) Remove pavement from centerline to back of curb. Curb will be considered subsidiary to removal of pavement.
 - d. Concrete alley or residential street greater than 30 feet wide:
 - a) Maintain a minimum of 10 feet from center line or gutter to trench edge or repair.
 - b) Remove pavement starting at the centerline if trench edge or repair is less than 10 feet from centerline.
 - c) If the trench edge or repair is within 10 feet of the back of curb, remove pavement from trench edge or repair to back of curb. Curb will be considered subsidiary to removal of pavement.
3. Construction
 - a. A drop hammer or guillotine-style concrete breaker is not allowed without prior approval by City.
 - b. Pavement removal method to be discussed and approved by City during the Pre-removal Meeting.

- c. Preferred method:
 - 1) Saw cut sections of the concrete pavement.
 - 2) Vertically lift concrete pavement section in whole pieces in a way that does not damage existing features.
- d. If pavement can't be removed utilizing the preferred method, utilize a jackhammer to break-up concrete and remove using a front-end loader or backhoe.

C.Remove Concrete Curb and Gutter

- 1. Saw Cut
 - a. In accordance with this Section
- 2. Minimum Limits of Removal
 - a. Minimum width of 2 feet from back of curb.
 - b. Minimum length of 5 feet.
 - c. If new joint is within 5 feet of existing joint, remove to existing joint limits.

D.Remove Sidewalk and Curb Ramp

- 1. Saw Cut
 - a. In accordance with Sawing
- 2. Minimum Limits of Sidewalk Removal
 - a. Minimum sidewalk removal of one full panel.
 - b. Sidewalk replacement shall comply with ADA criteria.
 - c. Remove curb ramp to the nearest joint. Do not saw cut and leave in place any portion of the existing curb ramp unless specified in the Drawings.

E. Remove Asphalt Paving

- 1. Saw Cut
 - a. In accordance with this Section
 - b. Protect asphalt edges to prevent spalling or damage.
 - c. If damage or spalling occurs, obtain direction from the City for repairs, if necessary.
- 2. Minimum Limits of Removal
 - a. Parallel to the Centerline
 - 1) Minimum cut along the street path is:
 - a) 10 feet in total length.
 - b) 1 foot from the edge of the trench if the trench width is wider than 5 feet.
 - b. Perpendicular to the Center Line – Multiple Lanes
 - 1) If the trench or repairs occur between the center line and the inside lane line, remove the full lane width.
 - 2) If the trench or repairs occur between the gutter edge and the outside lane, remove from the lane line to the gutter edge.
 - 3) If the trench or repairs occur between two lanes, remove half-lane-width to half-lane-width.
 - c. Perpendicular to the Center Line – Single Lane
 - 1) General:
 - a) 2 feet from the edge of the trench
 - b) Minimum width from repair to gutter edge is 10 feet.
 - c) Remove pavement to gutter edge if distance from trench or repair to gutter edge is less than 10 feet.
 - 2) Concrete alley or residential street less than 30 feet wide:
 - a) Remove pavement from centerline to gutter edge.

- 3) Concrete alley or residential street greater than 30 feet wide:
 - a) Maintain a minimum of 10 feet from center line or gutter edge to trench edge or repair.
 - b) Remove pavement starting at the center line if trench edge or repair is less than 10 feet from centerline.
 - c) Remove pavement from trench edge or repair to gutter if distance from trench edge or repair to the face of curb is less than 10 feet.
3. Construction
 - a. Utilize a milling machine to remove asphalt pavement where possible in accordance with this Section.
 - b. Obtain approval prior to construction to utilize alternative equipment for asphalt pavement removal.

F. Remove Driveway

1. Saw Cut
 - a. In accordance with this Section
2. Minimum Limits of Removal
 - a. If the driveway is concrete, remove to nearest driveway joint.

G. Remove Brick Pavers and Permeable Pavers

1. Saw Cut
 - a. In accordance with Sawing
 - b. Saw cut 2 feet beyond the limits of the pavers if the adjacent pavement is concrete or asphalt.
2. Remove pavers to the limits specified in the Drawings.
3. If salvaging pavers for re-use, remove, palletize and either deliver to specified location in Drawings or stockpile for re-use on the Project.

H. Milling

1. General
 - a. Mill surfaces to the depth specified in the Drawings.
 - b. Milled surface should be rough. If necessary, grind or mill the surface again to make the surface rough.
 - c. If the milled surface is going to be opened to traffic:
 - 1) Install a temporary transition section.
 - 2) An acceptable transition is 2 inches over 5 feet.
 - 3) A different transition may be approved by City prior to opening the milled surface to traffic.
 - d. Remove excess material and clean milled surfaces.
 - e. Stockpiling of milled material will not be permitted within the right of way unless otherwise approved by City.
2. Milling Equipment
 - a. Provide equipment that meets the following criteria.
 - 1) Power operated milling machine capable of removing the specified pavement thickness in maximum of two passes.
 - 2) Self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut and slope.
 - 3) Able to immediately remove material cut from the surface of the roadway and discharge the cuttings into a truck utilizing an integral loading and reclaiming system.

- 4) Equipped with a dust control system.
- 5) Equipped with a manual system that provides uniform varying depths of cut while the machine is in motion.
3. Wedge and Surface Milling
 - a. Only used for roadway maintenance. Only utilized with prior approval by City or as specified in Drawings.
 - b. Wedge Mill existing asphalt or concrete from the gutter edge at a minimum depth of 2 inches and transition to match the existing pavement within a 5-foot width.
 - c. Surface Mill existing asphalt to the depth specified on Drawings.
 - d. Provide a uniform milled surface free from gouges, ridges, oil film, and other irregularities.
 - e. Wedge milling includes the portion of HMA pavement that covers the existing concrete curb and gutter. This depth is estimated to vary from 2 inches to the full height of the curb. This additional depth would be milled prior to milling the minimum 2 inches previously specified.
 - f. Perform wedge or surface milling operations in a continuous manner for the length specified in the Drawings.
4. Butt Joint Milling
 - a. Butt joint will be full width of overlay operation.
 - b. Typical locations for butt joints are at the beginning and ending of streets where asphalt paving is removed or where a street is being overlaid. Butt joints may be required in other locations as specified in the Drawings.
 - c. Butt joints at a minimum of 20 feet wide (perpendicular to the center line) for the width specified in the Drawings.
 - d. Taper the butt joint from 2 inches to 0 inches adjacent to existing pavement at the start or end of the project limits or as specified in the Drawings.
 - e. Provide a temporary asphalt transition in accordance with this Section.
- I. Pavement Pulverization
 1. Pulverization
 - a. Pulverize the existing pavement to a depth of 8 inches. In accordance with Section 32 11 33.
 - b. Temporarily remove and stockpile pulverized material.
 - c. After temporary removal, cut subgrade or base material down 2 inches.
 2. Cement Application
 - a. Use 3.5 percent Portland cement.
 - b. In accordance with Section 32 11 33.
 3. Mixing
 - a. In accordance with Section 32 11 33
 4. Compaction
 - a. In accordance with Section 32 11 33
 5. Finishing
 - a. In accordance with Section 32 11 33
 6. Curing
 - a. In accordance with Section 32 11 33
 7. If the existing pavement has a combination of 10 inches of HMA pavement and crushed stone or gravel

- a. 2-inch cutting is not required
- b. Pulverize existing pavement 2 inches deep.
- c. Temporarily remove and stockpile pulverized material

J. Obliterating Abandoned Roadway

1. Strip and windrow existing topsoil before shaping operations.
2. Remove asphalt or concrete pavement in accordance with this Section.
3. Remove any abandoned structures within the roadway unless otherwise specified in the Drawings.
4. Scarify and mix the abandoned roadbed with soil and blade to produce a smooth, uniform appearance.
5. Fill, cut, and shape the abandoned road to blend into the surrounding terrain.
6. Grade to maintain drainage patterns.
7. Eliminate or re-align existing ditches as appropriate to maintain positive drainage.
8. Cover disturbed areas with topsoil after shaping operations.
9. Install sod or hydro-mulching within the limits of disturbance after topsoil is installed.

K. Disposal, Salvaging, and Recycling Removed Pavement

1. Contractor is responsible for any material removed during Paving Removal activities.
2. Dispose of all material in accordance with Federal, State, and local laws and regulations.
3. The disposal, salvaging, and recycling of any material removed as part of Paving Removal is considered subsidiary to the applicable items.
4. Contractor is encouraged, but not required, to salvage and recycle as much material as possible. Any recycled material used on a City project shall be in accordance with the requirements of the appropriate Section based on the intended use.

3.5 REPAIR

A. Repair the following items to remain if any damage is caused due to pavement removal activities at no cost to the City:

1. Adjacent concrete or asphalt pavement
2. Adjacent sidewalk
3. Adjacent curb or curb and gutter
4. Subgrade or base material
5. Utility piping, structures, and appurtenances
6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
7. Landscape beds or planters.
8. Sod
9. Decorative hardscape or landscape features
10. Retaining walls

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 03 00 00
CONCRETE AND CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material requirements for concrete and concrete reinforcing.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Concrete and concrete reinforcing materials, equipment, tools, testing, and incidentals are subsidiary to the installation of various items.
 - 2. Payment
 - a. The work performed and materials furnished in accordance with this item are subsidiary to the unit prices bid for various items which require the use of concrete and concrete reinforcing and will not be measured or paid for separately.

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. American Concrete Institute (ACI):
 - a. 211, Proportioning of Concrete Mixes
 - b. 301, Specifications for Structural Concrete
 - c. 318, Building Code Requirements for Structural Concrete
 - 3. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel
 - b. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - c. A675, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
 - d. A955, Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
 - e. A996, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
 - f. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 - g. C33, Standard Specification for Concrete Aggregates
 - h. C94, Standard Specification for Ready-Mixed Concrete

- i. C150, Standard Specification for Portland Cement
- j. C260, Standard Specification for Air-Entraining Admixtures for Concrete
- k. C494, Standard Specification for Chemical Admixtures for Concrete
- l. C1116, Standard Specification for Fiber-Reinforced Concrete
- m. C1399, Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete
- 4. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS)
 - a. DMS-4515, Multiple Piece Tie Bars for Concrete Pavements
 - b. DMS-4550, Fibers for Concrete
 - c. DMS-4600, Hydraulic Cement
 - d. DMS-4610, Fly Ash
 - e. DMS-4640, Chemical Admixtures for Concrete
 - f. DMS-4650, Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
 - g. DMS-6100, Epoxies and Adhesives
- 5. TxDOT Test Procedures:
 - a. Tex-401-A, Sieve Analysis of Fine and Coarse Aggregate
 - b. Tex-409-A, Free Moisture and Water Absorption in Aggregate for Concrete
 - c. Tex-470-A, Optimized Aggregate Gradation for Hydraulic Cement Concrete Mix Designs
 - d. Tex-425-A, Determining Moisture Content in Fine Aggregate by the “Speedy” Moisture Method

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Shop Drawing
 - 1. Concrete Mix Design – Submit a design of the concrete mix at for approval minimum 30 days prior to the start of construction activities requiring concrete unless approved otherwise by the City. Provide the mix design in accordance with the class of concrete or concrete mix design specified in the Drawings including:
 - a. Concrete Material Source Information
 - 1) Concrete supplier name
 - 2) Project name and address
 - 3) Contractor name
 - 4) Mixture Identification Number
 - b. Design Requirements and Design Summary Including:
 - 1) The combined aggregate gradation, source, and material testing results in accordance with Section 32 05 16.
 - 2) Maximum slump
 - 3) Concrete intended use (sidewalk, roadway, etc.)
 - 4) Design water to cement (w/c) ratio
 - 5) Design Target Strength
 - 6) 7-Day and 28-Day compressive strengths in accordance with ACI 301 and 318

- a) Two 7-Day and two 28-Day cylinders required. 3-Day and 14-Day cylinders are optional at the Contractor's expense.
 - 7) Batch weights, specific gravity, and type/class information for:
 - a) Cement
 - b) Supplementary cementing materials (if used)
 - c) Coarse Aggregate
 - d) Fine Aggregate
 - e) Water
 - 8) Chemical admixtures – Type and amount used
 - 9) Product Data for all chemical admixtures, cement, and fly ash used.
 - c. Statement from the concrete supplier verifying concrete has been tested and handled in accordance with ASTM C94.
2. Product Data
- a. Provide electronic product data from each manufacturer that is supplying curing compounds, evaporation retardant, joint fillers, or chemical additives to be used on the project.
 - b. Product data sheets for all products other than epoxy to include:
 - 1) Manufacturer name
 - 2) Date
 - 3) Material description
 - 4) Point of delivery
 - 5) Data and test results as required in this Section
 - 6) Material Safety Data Sheets (if applicable, required for Epoxy and Curing Compounds)
 - 7) Manufacturer Recommended Storing Data (if applicable)
 - 8) Application Recommendations (if applicable)
 - 9) Manufacturer's Recommended Storage and Handling instructions
 - c. Epoxy Product Data Sheet Additional Requirements:
 - 1) Resin or hardener components
 - 2) Brand name
 - 3) Name of manufacturer
 - 4) Lot or batch number
 - 5) Temperature range for storage
 - 6) Date of manufacture
 - 7) Expiration date
 - 8) Quantity contained

B. Informational Submittals

- 1. Source Locations
 - a. Provide the location of all material sources

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. Storage and Stockpiling
 1. Cement and Supplementary Cementitious Material (SCM)
 - a. Store all cement and SCM in weatherproof enclosures to protect them from dampness or absorption of moisture.
 2. Steel Reinforcement
 - a. Store reinforcement above ground surface on skids, platforms, or other support.
 - b. Protect reinforcement from mechanical damage and surface deterioration caused by exposure to conditions that could cause rust.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Concrete Production Materials
 1. Cementitious Material
 - a. Defined as the cement and supplementary cementing materials used in concrete.
 - b. Cement
 - 1) Furnish cement Type I or IA in accordance with ASTM C150 Portland Cement.
 - 2) Provide cement from sources that are in accordance with DMS-4600 and listed on TxDOT's Material Producer List (MPL) entitled "Hydraulic Cement".
 - c. Supplementary Cementing Materials (SCM)
 - 1) Fly Ash
 - a) Refer to DMS – 4610 for types of Fly Ash
 - b) Acceptable Fly Ash includes:
 - (1) Class F
 - (2) Modified Class F (MFFA)
 - c) Provide fly ash in accordance with DMS-4610 and from sources listed on TxDOT's MPL entitled "Fly Ash".
 - d) Refer to Table 2 (Page 11 of 17) for Concrete Classes and Mix Design Options.
 - 2) Other SCMs
 - a) No other SCM will be approved for use.
 2. Water
 - a. Provide mixing water and curing water free from oils, acids, organic matter, or other deleterious substances.
 - b. Provide water from municipal supplies approved by the TCEQ.
 - c. Obtain approval from the City if using water not approved by the TCEQ prior to construction.
 - 1) If approved to use water from a non-pre-approved source, water testing may be required.
 3. Aggregate
 - a. General

- 1) Recycled crushed concrete pavement may be used as coarse or fine aggregate in Class A, B, and E concrete.
- 2) A maximum of 20 percent of the fine aggregate may consist of recycled crushed concrete pavement.
- b. Fine aggregate
 - 1) In accordance with Section 32 05 16
- c. Coarse Aggregates
 - 1) Provide coarse aggregate consisting of clean, tough, durable fragments in accordance with Section 32 05 16.
 - 2) Provide coarse aggregates that meet the gradation shown in Table 1 when tested in accordance with Tex-401-A.
 - 3) Select aggregate gradation based on the allowable grade for the appropriate concrete class shown in shown in Table 1.

Table 1
Coarse Aggregate Gradation Chart

Aggregate Grade No. ¹	Maximum Nominal Size	Percent Passing on Each Sieve								
		2- 1/2"	2"	1- 1/2"	1"	3/4"	1/2"	3/8"	#4	#8
1	2"	100	80-100	50-85		20-40			0-5	
2(467)	1-1/2"		100	95-100		35-70		10-30	0-5	
3	1-1/2"		100	95-100		60-90	25-60		0-5	
4 (57)	1"			100	95-100		25-60		0-10	0-5
5 (67)	3/4"				100	90-100		20-55	0-10	0-5
6 (7)	1/2"					100	90-100	40-70	0-15	0-5
7	3/8"						100	70-95	0-25	
8	3/8"						100	95-100	20-65	0-10

1. Corresponding ASTM C33 gradation shown in parentheses

4. Chemical Admixtures

a. General

- 1) Only water reducing and air-entraining admixtures are allowed.
- 2) Provide admixtures in accordance with DMS-4640, Chemical Admixtures for concrete.
- 3) Do not use Type C, E, F, or G admixtures in Class S bridge deck concrete.
- 4) Do not use chemical admixtures containing calcium chloride in any concrete.

b. Water Reducing Admixture

- 1) Provide water-reducing admixtures in accordance with ASTM C494. Types D and G will be allowed.
 - a) ASTM C494, Types "D" and "G":
 - (1) Maintains workability during hot weather placement

c. Air-Entraining Admixture

- 1) Provide air-entraining admixtures in accordance with ASTM C260.
- 2) Maintain a total air content between 3 and 5 percent.
- 3) Do not exceed the manufacturer's recommended dosage.

B. Concrete Placement Materials

1. Reinforcing Steel

- a. Provide type, size, grade, and quantity of steel reinforcement as specified in the Drawings.
- b. Provide Grade 60 or above steel bar reinforcing unless otherwise indicated in the Drawings.
- c. Provide reinforcement free from dirt, loose rust, painting, oil, or other foreign material.
- d. Provide corrosion protection if specified in the Drawings.
- e. Provide deformed reinforcing steel in accordance with one of the following:
 - 1) New Billet Steel in accordance with ASTM A615, Grades 60, 75, or 80
 - 2) Axle Steel in accordance with ASTM A996, Type A, Grade 60
 - a) Provide as straight bars only and do not bend them.
 - 3) Rail Steel in accordance with ASTM A996 Type R, Grade 60.
 - a) Rail steel only allowed in concrete pavement. Provide as straight bars only and do not bend them.
- f. Provide bars in accordance with the size and weight requirements for reinforcing in ASTM A615.
- g. Twisted bars are not considered deformed and will not be accepted by the City.
- h. Steel Wire Reinforcement will not be accepted by the City.
- i. Spiral Reinforcement
 - 1) Provide smooth or deformed wire conforming to ASTM A1064.
 - 2) Provide bars in accordance with ASTM A615, ASTM A996 Type A, or ASTM A675 Grade 80 meeting dimensional requirements of ASTM A615.
- j. Bending
 - 1) Bend all bars cold in a shop true to the shapes specified in the Drawings.
 - 2) Bend all bars used for stirrups and ties around a pin having a diameter at least two times the minimum thickness of the bar.
 - 3) Perform all other bends in accordance with the latest code of Standard Practice of Reinforcing Steel Institute.
 - 4) Bend stainless reinforcing steel in accordance with ASTM A955.

2. Tie Bars

- a. Refer to pertinent Sections and City standard details for specific uses and installation requirements for Multiple Piece Tie Bars and Single Piece Tie Bars.
- b. Install bars in accordance with the size, type, and location specified in the Drawings.
- c. Provide straight deformed steel tie bars in accordance with ASTM A615.
- d. Install tie bars per the size and spacing specified in the Drawings.
- e. Do not bend or use bent tie bars. Tie bars should remain straight.
- f. Multiple Piece Tie Bars
 - 1) Provide multiple piece tie bars in accordance with DMS-4515, Multiple Piece Tie Bars for Concrete Pavements.

3. Dowel Bars

- a. General
 - 1) Install bars in accordance with the size, type, and location shown on the Drawings.
 - 2) Refer to pertinent Sections and City standard details for uses and installation requirements.

- b. Dowel Bars
 - 1) Provide smooth, straight dowel bars free of burrs with a yield strength of at least 60 kilo-pound per square inch (ksi) as specified in the Drawings.
 - 2) Provide steel in accordance with ASTM A615 or meet the physical requirements of ASTM A36 for smooth bars that are larger than 3/8 inch in diameter.
 - 3) Coat dowels with a thin film of grease, wax, silicone, or other approved de-bonding material.
 - 4) Designate smooth bars by diameter in inches.
- c. Dowel Caps
 - 1) Provide dowel caps on the lubricated end of each dowel bar used in an expansion joint.
 - 2) Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of expansion joint.
 - 3) Provide dowel caps to the length specified in the Drawings. The cap should have sufficient length to allow at least a 1.25-inch gap between the end of the bar and the edge of the cap.
 - 4) Provide caps for dowel bars with an internal diameter sufficient to permit the cap to freely slip over the bar, but do not have an internal diameter that exceeds the bar diameter by more 1/8 inch.
- 4. Reinforcement Supporting Devices
 - a. Use reinforcement supporting devices for construction of sidewalks, driveways, roadways, crosswalks, and any other concrete paving operation.
 - b. Provide positioning and supporting devices (baskets and chairs) capable of securing and holding the reinforcing steel in proper position before and during paving.
 - c. Do not allow construction personnel to walk on the reinforcement bars. Replace any broken chairs prior to concrete placement.
 - d. Provide supporting devices (baskets and chairs) made of plastic or non-rusting metal.
 - 1) Supporting devices to show no visible indications of deterioration after immersion in a 5-percent solution of sodium hydroxide for 120-hours.
 - 2) Provide the City with test results or product data sheets proving devices are in accordance with the requirements of this Section if requested.
- 5. Epoxy
 - a. Provide Type 3, Class C epoxy in accordance with DMS-6100.
 - b. City to approve all epoxy and adhesive products prior to use. Submit a Product Data Sheet in accordance with this Section.
 - c. Do not use damaged or previously opened containers.
 - d. Do not use any material showing evidence of crystallization, lumps, skinning, extreme thickening, or settling of pigments that cannot be readily dispersed with normal agitation.
 - e. Follow sound environmental practices when disposing of epoxy and adhesive wastes.
 - f. Dispose of all empty containers separately. Completely empty and mix the epoxy before disposal.
- 6. Evaporation Retardant
 - a. Provide evaporation retardant in accordance with DMS-4650.
- 7. Curing
 - a. The use of mats, plastic, or film to be approved by the City prior to use.
 - b. Provide membrane curing compounds in accordance with this specification and DMS-4650.

- 1) Provide curing material in accordance with the requirements of DMS-4650 unless otherwise specified in the Drawings or by the City.
- 2) Provide a curing compound that does not react deleteriously with concrete or its compounds.
- 3) Curing compound to produce a firm, continuous uniform moisture-impermeable film free from pinholes and adhere to surface of damp concrete.
- 4) The City may reject any concrete not cured properly due to improperly applied curing compound or faulty materials.
- 5) The City may reject the curing compound based on visual or odor defects.
- 6) Curing compound to be delivered to the job site in the manufacturer's original containers only, with original label containing the following:
 - a) Manufacturer's name
 - b) Trade name of the material
 - c) Batch number or symbol with which test samples may be correlated

C. Concrete Mix Design

1. General

- a. Furnish mix designs using ACI 211 or Tex-470-A.
- b. Maintain mix design and maximum water to cement ratio once mix design is approved by City.
- c. Do not place concrete until the mix design has been approved by the City. The City may require any concrete placed prior to approval to be removed and replaced at no cost to the City.
- d. Perform mix design proportioning by absolute volume method unless otherwise approved.
- e. Perform cement replacement using equivalent weight method unless otherwise approved.
- f. Do not exceed specified water to cement ratios listed in Table 2 for concrete classes when designing the mixture.
- g. Provide a mix design after the trial batch tests are complete in accordance with the requirements in this Section.

2. Cementitious Material

- a. Do not exceed 700 pounds of cementitious material per cubic yard of concrete unless otherwise specified or approved by the City.
- b. Use cement of the same type and from the same source for monolithic placements.

3. Concrete Classes

a. General

- 1) Provide concrete mix designs in accordance with the requirements shown in Table 2 for the class of concrete specified in the Drawings.
- 2) Refer to the Drawings and the General Usage column on Table 2 for concrete class information.

b. Class P Concrete

- 1) Use air entraining admixture.
- 2) Class P Concrete
 - a) Use Class P concrete for machine paved concrete roadways and alleyways unless otherwise specified in the Drawings or directed by City.
 - b) Provide Class P concrete for hand poured concrete roadways, driveways, alleyways, and all other hand poured, vehicular trafficked concrete pavement unless otherwise specified in the Drawings.

c. High Early Strength Concrete (HES)

- 1) Use air entraining admixture.
- 2) Provide HES concrete in accordance with the requirements of Table 2.
- 3) Use HES concrete only when specified in the Drawings or when directed by City.
- 4) HES may be approved for use when a roadway or driveway needs to be opened to traffic quickly.
- 5) Perform tests at 24 hours to verify compressive strength of HES concrete is minimum 3,500 psi.
- 6) Maximum coarse aggregate size is 1–1/2 inches.

Table 2
Concrete Classes

Class of Concrete	Design Strength¹, Min f'c (psi)	Maximum Water to Cementitious Material Ratio	Coarse Aggregate Grades^{2,3}	General Usage⁴
A	3,000	0.60	1 – 4, 8	Non-monolithic curb and curb & gutter, sidewalks, sidewalk walls, and driveways. Traffic signal controller foundations, small roadside signs, and anchors
F ⁵	Note 6	0.45	2 – 5	Drilled shafts, bridge substructure, bridge railing, railroad structures, retaining wall (cast-in-place), and concrete traffic barrier (cast-in-place)
H ⁵	Note 6	0.45	3 – 6	Precast concrete
S ⁵	4,000	0.45	2 – 5	Riprap, bridge slabs, top slabs of direct traffic culverts, approach slabs, headwalls, wingwalls, cast-in-place inlets and manholes
P ⁸	3,500	0.50	2 – 3	Concrete pavement and monolithic curbs, Culverts (except top slab of direct traffic culverts)
HES ^{8,9}	5,000	0.45	2 – 3	Concrete pavement and concrete pavement repair

1. Design strength must be attained within 28 days.
2. Do not use Grade 1 coarse aggregate except in foundations with 4 inch minimum clear spacing between reinforcing steel bars unless otherwise specified on the Drawings or approved by the City. Do not use Grade 1 aggregate in drilled shafts.
3. Use Grade 8 aggregate in extruded curbs unless otherwise approved by the City or specified on the Drawings.
4. For information only.
5. Structural concrete classes.
6. As shown on the Drawings.
7. Mix design options do not apply. 700 pounds of cementitious material per cubic yard limit does not apply.
8. For machine poured concrete, use a minimum cementitious material content of 517 pounds per cubic yard. For hand poured concrete, use a minimum cementitious material content of 564 pounds per cubic yard.
9. For HES, design strength must be attained within 7 days.

4. Slump

- a. Provide concrete with a slump between 3”-5” unless otherwise specified in the Drawings.
 - b. Request approval to exceed the noted slump limits with the mix design submittal as part of the Action Submittal.
 - c. Do not exceed maximum slump during production of the mix design or during concrete placement.
 - d. Any concrete placed with a slump exceeding the noted limits will be rejected and removed and replaced at no cost to the City.
5. Trial Batch Production and Testing
- a. Trial Batch
 - 1) Produce a trial batch of the mix design in accordance with the requirements of the concrete class specified in the Drawings, using the same materials proposed for the project.
 - 2) Perform testing and provide the results verifying the concrete mix design is in accordance with the requirements of this Section. Testing to include:
 - a) Fresh concrete tests for air content and slump
 - b) Strength testing at 7 days and 28 days
 - 3) Do not modify the mix design after the City has approved it.
 - 4) Submit a new mix design if a change is made to concrete supplier.

Table 3
Concrete Discharge Times

Fresh Concrete Temperature, Degrees Fahrenheit	Max Time After Batching for Concrete Not Containing Type B or D Admixtures, Minimum	Max Time After Batching for Concrete Containing Type B or D Admixtures², Minimum
90 and Above	45	75
Between 75 and 90	60	90
Below 75	90	120

1. Admixture Types are defined in DMS-4640
2. Concrete must contain at least the minimum manufacturer’s recommended dosage of Type B or D admixture.
3. Batching can occur at a commercial concrete site or at a batch plant.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

- A. Concrete Mix Design and Verification
 1. Any concrete installed using a non-conforming mix design is subject to removal and replacement at no cost to the City.
- B. Concrete Production Acceptance
 1. During production and placement of concrete, perform testing to verify the concrete is in accordance with the requirements in this Section for admixtures, mix design, slump, and compressive strength.
- C. Concrete Placement Acceptance
 1. General

- a. If concrete is suspected of having foreign material, City may reject at any time and the concrete may be removed and replaced at no cost to the City.
- b. Acceptance will be based on attaining the strength and the fresh concrete tests.
- 2. Placement Sampling
 - a. Perform all fresh and hardened concrete testing at the frequency shown on Table 4.
 - b. If any test comes back as non-conforming, stop production and placement of concrete until the reason has been determined and resolved.
 - c. Any concrete that was placed is subject to further testing and removal and replacement at no cost to the City.

Table 4
Testing Frequencies

Concrete Placements	Frequency
Bridge Deck Placements	Test the first 3 loads, then every 60 cubic yards or a fraction thereof specified by the City.
All Other Structural Class Concrete Placements	One test every 60 cubic yards or a fraction thereof per class per day as specified by the City
Non-Structural Class Concrete Placements	One test every 180 cubic yards or a fraction thereof as specified by the City

- 3. Testing of Fresh Concrete
 - a. Sample and test fresh concrete for properties listed in Table 5.
 - b. Take the sample at the time of discharge from the delivery truck.
 - c. Concrete that is exhibiting segregation, excessive bleeding, or has a slump lower than the minimum slump allowed per concrete type after addition of all water withheld will be rejected. Contractor will remove and replace at no cost to the City.

Table 5
Fresh Concrete Tests

Tests	Test Methods
Slump	Tex-415-A
Temperature	Tex-422-A
Air Content ¹	Tex-414-A, Tex-416-A, or ASTM C457

1. Only required when air-entraining admixtures are used.

- 1. Concrete Strength Test
 - a. General
 - 1) Perform strength testing for all projects containing more than 60 cubic yards of concrete.
 - 2) Provide trained technicians during concrete paving to cast test cylinders in accordance with ASTM C31.
 - 3) Refer to Table 2 for required strength for each concrete class.
 - b. Sampling
 - 1) Collect 4 test cylinders from a representative portion of concrete being placed for every 100-cubic yards
 - 2) After the cylinders have been cast by trained technicians, transport samples to the lab and test in accordance with ASTM C31 and ASTM C39. Provide test results to the City.
 - 3) Test the 4 cylinders per the following:

- a) 2 cylinders tested at 7 days, (24 hours for HES) and
 - b) 2 cylinders tested at 28 days (7 days for HES)
 - c) Re-test at 50-cubic yards.
 - 4) Optional Testing
 - a) 3-day and 14-day cylinder tests are optional and at the Contractor's expense.
 - c. Acceptance
 - 1) If the 28-day test results for the cylinders taken indicate deficient strength, the Contractor may, at their own expense, core the pavement in question and have the cores tested by another approved laboratory, in accordance with ASTM C42 and ACI 318 protocol.
 - 2) Average of the 28-day test results of all cores within a designated area must meet 100 percent of the minimum specified strength.
 - 3) If any individual cylinder or core results in less than 90 percent of design strength, additional cores will be taken to identify the limits of the non-compliant concrete at no cost to the City.
 - 4) All concrete considered non-compliant will be removed and replaced at no cost to the City.
 - 2. Cracked Concrete Acceptance Policy
 - a. If cracks greater than 0.025-inches exist in concrete pavement upon completion of the project and prior to the termination of the maintenance period, the City may require corrective action that could include removal and replacement at no cost to the City depending on the cause of the cracking.
 - b. Corrective Actions:
 - 1) The City will determine whether the following options are viable. The City will evaluate each crack greater than 0.025-inches during the final inspection and prior to the end of the maintenance period.
 - 2) Routing and Sealing:
 - a) Perform the routing and sealing work as directed by the Project Inspector, at no cost to the City, regardless of the cause of the cracking.
 - 3) If routing and sealing is not a viable solution due to the cause of the cracking, or the size, remove and replace the concrete.
 - 4) If the cause of the cracking is determined to be due to deficient subgrade, remove and replace the subgrade with flexible base or another approved subgrade within the limits of the deficient concrete.
 - 3. Aggregate Moisture Testing
 - a. Perform testing and provide results in accordance with 32 05 16.
 - b. City may request this test to be performed at any time during construction.
- D. Non-Conforming Work
- 1. Concrete Mix Design and Production Materials
 - a. The City may reject the mix design if not in accordance with the requirements of this Section.
 - 1) Any concrete installed using a non-conforming mix design will be subject to removal and replacement at no cost to the City.
 - b. If the trial batch fails to meet the requirements specified in this Section, the Contractor will produce test results for trial batches until the trial batch meets the requirements specified herein at no cost to the City.
 - c. The City may perform verification testing on all materials to verify the conformance of the mixture.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Batching Equipment

1. Batching equipment shall be in accordance with the requirements of Section 41 14 00.

B. Refer to the following Sections for all installation requirements:

1. Section 03 30 00 Cast-in-Place Concrete
2. Section 03 80 00 Modifications to Existing Concrete Structures
3. Section 31 37 00 for Riprap
4. Section 32 13 13 for Concrete Paving
5. Section 32 13 16 for Decorative Concrete Paving
6. Section 32 16 00 for Curbs, Gutters, Sidewalks, and Driveways
7. Section 32 32 00 for Retaining Walls
8. Section 33 05 60 for Pre-Cast Manholes and Bases
9. Section 33 42 11 for Stormwater Pipe and Boxes
10. Section 33 42 23 for Stormwater Headwalls, Wingwalls, and End Treatments
11. Section 33 42 30 for Stormwater Junction Boxes
12. Section 33 42 33 for Stormwater Curb Inlets

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, and placement procedures.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement
 - a. Cast-in-place concrete materials, equipment, tools, testing, and incidentals are subsidiary to the installation of structures or item being installed.
2. Payment
 - a. The work performed and materials furnished in accordance with this item are subsidiary to the unit prices bid for various items which require the use of cast-in-place concrete.

1.3 REFERENCES

A. Abbreviations and Acronyms

1. HPC – High Performance Concrete
2. PSI – Pounds per square inch

B. Definitions

1. Substructure
 - a. Structures that are below ground, partially below ground, or retain earth. Substructures could include footings, columns, caps, abutments, piers, culverts, retaining walls, headwalls, wingwalls, riprap, other bridge substructure elements, and other concrete structures as indicated, or not included as a superstructure.
2. Superstructure
 - a. Structures that are elevated above ground. Superstructures could include bridge slabs, decks, flat slabs, slab and girder units, approach slabs, or other bridge superstructure elements as indicated.

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Concrete Institute (ACI):
 - a. ACI 207 – Mass Concrete.

4. Texas Department of Transportation, Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (TxDOT):
 - a. Item 420 – Concrete Substructures.
 - b. Item 422 – Concrete Superstructures.
 - c. Item 426 – Post-Tensioning.
 - d. Item 441 – Steel Structures.
 - e. Item 448 – Structural Field Welding.
5. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. DMS-4650 – Hydraulic Cement Concrete Curing Materials and Evaporation Retardants.
 - b. DMS-4675 – Cementitious Grouts and Mortars for Miscellaneous Applications.
 - c. DMS-6100 – Epoxies and Adhesives.
 - d. DMS-6160 – Water Stops, Nylon-Reinforced Neoprene Sheet, and Elastometric Pads.
 - e. DMS-6310 – Joint Sealants and Fillers.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

A.Submittals shall be in accordance with Section 01 33 00.

B.All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A.Shop Drawings

1. Concrete Mix Design
 - a. In accordance with Section 03 00 00.
2. Product Data
 - a. Provide a product data sheet from each manufacturer supplying the following in accordance with Section 03 00 00:
 - 1) Curing compounds
 - 2) Evaporation retardant
 - 3) Joint fillers
 - 4) Chemical additives
 - 5) Epoxy
 - 6) Fiber reinforcing
 - 7) Bond breaker material
3. Curing Method, Equipment, and Materials
 - a. Provide the method of curing, list of materials, and list of equipment to be used for review. Obtain approval prior to placing concrete.
 - b. If different methods, equipment, or materials will be used in various locations, provide each method, equipment, and material used at each location using cast-in-place concrete.
4. Heat Control Plan
 - a. Provide a heat control plan for monolithic placements specified as mass concrete in the Drawings.
 - b. Develop using TxDOT's ConcreteWorks software, or another approved method in accordance with ACI 207.
 - 1) Use historical temperature ranges for the anticipated time of the mass placement.
 - 2) Re-create plan if the work schedule shifts by more than one month.

- c. Provide a heat control plan including the following applicable elements:
 - 1) Selection of concrete ingredients including aggregates, gradation, and cement types to minimize heat of hydration;
 - 2) Use of ice or other concrete cooling ingredients;
 - 3) Use of liquid nitrogen dosing systems;
 - 4) Controlling rate or time of concrete placement;
 - 5) Use of insulation or supplemental external heat to control heat loss;
 - 6) Use of supplementary cementing materials;
 - 7) Use of a cooling system to control the core temperature; or
 - 8) Variation of the duration formwork remains in place.
- B. Informational Submittals:
 - 1. Source Locations
 - a. Location of all material sources
 - 1. Testing Laboratory
 - a. Submit for review and approval the following information for each testing laboratory used on the project:
 - 1) Testing Laboratory Name
 - 2) Location
 - 3) Tests performed
 - a) Summary of each test performed at each lab, if multiple labs are used.
 - 4) ACI Certification
 - a) All labs and Contractor personnel performing concrete testing must be ACI certified.
 - 2. Falsework and Forms Drawings
 - a. Submit Drawings for falsework and forms for the following items:
 - 1) Vertical forms for piers and single column bents;
 - 2) Load supporting forms for caps and tie-beams;
 - 3) Form attachments for bridges to be widened; and
 - 4) Other items specified in the Drawings or by the city.
 - b. Design and construct falsework to safely carry the maximum anticipated loads and to provide the necessary rigidity.
 - c. Use AASHTO's Guide Design Specifications for Bridge Temporary Works and Construction Handbook for Bridge Temporary works for falsework and shoring information.
 - d. Provide design calculations when requested and show all essential details of proposed forms, falsework, and bracing signed and sealed by a licensed professional engineer in the state of Texas.
 - e. The Contractor is responsible for the design and safety of all falsework and forms.
 - f. Account for the weight of materials and live loading when designing forms.
 - 3. Equipment Information
 - a. Submittal for all major equipment including:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. Storage and Stockpiling
 - 1. Cement and Supplementary Cementitious Material
 - a. In accordance with Section 03 00 00.
 - 2. Steel Reinforcement
 - a. In accordance with Section 03 00 00.
 - 3. Chemical Admixture, Epoxy, Curing Compound, and Other Materials
 - a. Follow manufacturer's instructions regarding storage and application at temperatures of material.
 - 4. Epoxy
 - a. In accordance with Section 32 13 13.

1.11 FIELD CONDITIONS

- A. Weather Conditions
 - 1. In accordance with Sections 03 00 00 and 32 13 13.
 - 2. Do not place concrete in contact with any material coated with frost or with a temperature of 40 degrees Fahrenheit or lower.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Concrete Production Materials
 - 1. Concrete Class
 - a. As specified in the Drawings or in accordance with the usage stated in Section 03 00 00.
 - 2. Provide cementitious materials, water, aggregate, chemical admixtures, reinforcing materials, and evaporation retardant in accordance with Sections 03 00 00 and 32 13 13.
- B. Concrete in Water
 - 1. Design the mix in accordance with Section 03 00 00 with a minimum cement content of 650 pounds per cubic yard for concrete to be placed under water. Include an anti-washout admixture in the mix design as necessary.
- C. Grout, Mortar, and Epoxy
 - 1. Provide grout in accordance with DMS-4675.
 - 2. For use with Anchor Bolts or Dowels
 - a. Provide grout, epoxy, or epoxy mortar as the binding agent unless otherwise specified in the Drawings.
 - b. Neat Epoxy
 - 1) Provide a Type 3 epoxy in accordance with DMS-6100.

c. Epoxy Mortar

- 1) Provide a Type 8 epoxy in accordance with DMS-6100.

D. Jointing Materials

1. Joint Fillers

- a. Provide in accordance with Section 32 13 13 and DMS-6310.
- b. Superstructures

- 1) Provide joint materials in accordance with TxDOT Standard Specification Item 422

2. Joint Sealants

- a. Provide in accordance with Section 32 13 73.

E. Waterstops

1. Provide rubber or polyvinyl chloride (PVC) waterstops in accordance with DMS-6160 unless otherwise specified in the Drawings.

F. Curing

1. Provide membrane curing compounds in accordance with Section 03 00 00 and DMS-4650.
2. Burlap Mats
 - a. Provide burlap material which complies with AASHTO M 182, Class 3 (10 ounces per square yard) with the following additions:
 - 1) Do not use burlap fabricated from bags.
 - 2) Do not use burlap containing any water-soluble ingredient.
 - b. Provide burlap only previously used for curing concrete.
 - c. Provide burlap mats free from contamination with any substance foreign to the concrete curing process, such as grease or oil.
 - d. Concrete will be rejected if cured with contaminated burlap mats.
 - e. When using burlap mats, provide a layer of polyethylene sheeting on top of the burlap mats.
3. Polyethylene Sheeting
 - a. Provide polyethylene sheeting a minimum of 4 millimeters thick and free from visible defects.
 - b. Provide only clear or opaque white sheeting when the ambient temperature during curing exceeds 90 degrees Fahrenheit, or when applicable to control temperature during mass pours.
4. Burlap-Polyethylene Mats
 - a. Provide mats made from burlap impregnated on one side with a film of opaque white pigmented polyethylene.
 - b. Provide laminated mats with a minimum of one layer of an impervious material such as polyethylene, vinyl plastic, or other acceptable material (either as a solid sheet or impregnated into another fabric)
 - c. Provide mats free of visible defects.

G. Formwork Materials

1. Timber Forms

- a. Provide properly seasoned, good-quality lumber free from imperfections that compromise the material strength or impair the finished surface of the concrete.
- b. Provide timber or lumber in accordance with the requirements for species and grade in the submitted falsework and form drawings.
- c. Maintain forms or form lumber to maintain a good, clean condition.

- d. Do not use any split, warped, bulged, or marred lumber, or any lumber with defects that will produce inferior work.
 - e. Provide form lining for all formed surfaces except:
 - 1) The inside of culvert barrels, inlets, manholes, and box girders;
 - 2) Surfaces that are subsequently covered by backfill materials, or are completely enclosed; and
 - 3) Any surface formed by a single finished board or by plywood.
 - f. Provide form lining of an approved type, such as Masonite or plywood. Do not provide thin membrane sheeting, such as polyethylene sheets, for form lining.
 - g. Use plywood a minimum of 3/4 inch thick. Place the grain of the face plies on plywood forms parallel to the span between the supporting studs or joists unless otherwise indicated on the submitted falsework and form drawings.
 - h. Use plywood for forming exposed surfaces in accordance with the requirements for B-B Plyform Class 1 or Class 2 Exterior of the US Department of Commerce Voluntary Product Standard PS 1.
 - i. Space studs and joists so the facing form material remains in true alignment under the imposed loads.
 - j. Space wales close enough to hold forms securely to the designated lines and scabbed at least 4 feet on each side of joints to provide continuity. Place a row of wales near the bottom of each placement.
 - k. Place facing material with parallel and square joints, securely fastened to supporting studs.
 - l. Place forms with the form panels symmetrical (long dimensions set in the same direction) for surfaces exposed to view and receiving only an ordinary surface finish.
 - m. Make molding for chamfer strips or other materials that will not split when nailed and can be maintained to a true line without warping.
 - n. Fill forms at all sharp corners and edges with triangular chamfer strips measuring 3/4 inches on the sides unless otherwise specified in the Drawings.
 - o. Remove metal and wooden spreaders separating the forms as the concrete is being placed.
 - p. Provide adequate clean-out openings for narrow walls and other locations where access to the bottom of the forms is not readily available.
2. Metal Forms
- a. Requirements for timber forms also apply to metal forms. Metal forms do not require lining unless otherwise specified in the Drawings or by the City.
 - b. Use form metal thick enough to maintain the true shape without warping or bulging.
 - c. Countersink all bolt and rivet heads on the facing sides.
 - d. Design clamps, pins, or other connecting devices to hold the forms rigidly together and to allow removal without damage to the concrete.
 - e. Use metal forms that present a smooth surface and line up properly.

H.Repair Materials

- 1. In accordance with Section 32 01 29.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A.Tests and Inspections

- 1. Material Source Testing and Submittals

- a. Perform in accordance with Sections 03 00 00 and 32 13 13.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

EXAMINATION [NOT USED]

3.2 PREPARATION

A.Hauling

1. Deliver concrete to the Site in accordance with Sections 01 66 00 and 03 00 00.
2. Maintain concrete delivery and placement rates to prevent cold joints and in accordance with Section 03 00 00.
3. Any concrete not placed within the time limits specified under Section 03 00 00 will be rejected.
4. Protect concrete transported by conveyors from sun and wind to prevent loss of slump and workability. Shade or wrap the pipes the concrete is pumped through, if necessary.
 - a. Wrap pipes in wet burlap.
5. Adding Water or Chemical Admixtures
 - a. Water may be added to the truck until the slump test is conducted. Once the slump test is conducted, the addition of water or admixtures is not permitted unless the slump is too low or otherwise permitted.
 - b. When water or air entraining admixture is added, turn the drum or blades at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete.
 - c. When water is added, do not exceed the approved mix design water to cementitious material ratio.
 - d. Do not add water or chemical admixtures after any concrete has been discharged.

B.Transport and Discharging

1. Arrange discharging equipment, such as chutes, troughs, conveyors, pipes, and vertical downspouts, to prevent segregation of the concrete material.
2. Keep all transporting and discharging equipment clean and free from hardened concrete coatings.
3. Discharge water used for cleaning clear of the concrete.
4. Discharging Time
 - a. In accordance with Section 03 00 00.

C.Concrete Temperature

1. Do not place concrete in contact with any material coated with frost or with a temperature of 40 degrees Fahrenheit and rising

D.Surface Preparation

1. Thoroughly wet all forms and adjacent hardened concrete prior to placing concrete.
2. Remove any remaining puddles of excess water before placing concrete.
3. Provide surfaces in a moist, saturated surface-dry condition when concrete is placed on them.

4. Ensure the subgrade or foundation is moist before placing concrete on grade.

3.3 INSTALLATION

A. Superstructure Construction

1. Construct all superstructures in accordance with TxDOT Standard Specification Item 422.

B. Schedule Restrictions

1. Reducing Schedule Restrictions
 - a. The Contractor may request to perform additional testing to reduce the schedule restrictions required. At the time of request, the City will provide additional testing requirements based on the site conditions.
 - b. If the Contractor does not perform additional strength testing, the 7-day lab-cured tests will be used for strength determination unless otherwise specified in the Drawings.
2. Setting Forms
 - a. Attain at least 3,000 psi compressive strength before erecting forms on concrete footings supported by piling or drilled shafts, or on individual drilled shafts.
 - b. Erect forms on spread footings and culvert footings after the concrete has aged at least 2 curing days.
 - c. Place concrete only after the forms and reinforcing steel have been inspected.
 - d. Support tie beam or cap forms by falsework on previously placed tie beams only if the tie beam concrete has attained a compressive strength of 3,000 psi and the member is properly supported.
 - e. Maintain curing as required until completion of the curing period.
 - f. Place superstructure forms or falsework on the substructure only if the substructure concrete has attained a minimum compressive strength of 3,000 psi.
3. Placement of Superstructure Members
 - a. Place superstructure members or precast substructure members only after the substructure concrete has attained a compressive strength of 3,000 psi.
4. Opening to Traffic
 - a. Direct traffic culverts may be opened to traffic when the design strength specified in the Drawings or in Section 03 00 00 has been reached and after the curing period has ended.
 - b. Obtain approval before opening direct traffic culverts to the traveling public.
5. Post-Tensioned Construction
 - a. Ensure strength requirements specified in the Drawings for structural element designed to be post-tensioned are met for stressing and staged loading of structural elements.

C. Falsework and Forms

1. Falsework
 - a. Provide falsework design and materials in accordance with TxDOT Standard Specification Item 420.
2. Forms
 - a. Provide formwork design and materials in accordance with TxDOT Standard Specification Item 420.
 - b. Provide bond-breaking layer on timber and metal forms.

D. Drains

1. Install and construct weep holes and roadway drains as specified in the Drawings.

E. Placing Reinforcement and Post-Tensioning

1. Place reinforcement in accordance with Section 03 00 00.
2. Do not weld reinforcing steel supports to other reinforcing steel unless specified in the Drawings.
3. Place post-tensioning ducts, anchorages, and other hardware in accordance with the approved prestressing details and TxDOT Standard Specification Item 426. Keep ducts free of obstructions until all post-tensioning operations are complete.

F. Joints

1. Expansion Joints
 - a. Construct joints and devices in accordance with the Drawings.
 - b. Use light wire or nails to anchor any preformed fiber joint material to the concrete on 1 side of the joint.
 - c. Ensure finished joints are in accordance with the Drawings with the concrete sections completely separated by the specified opening or joint material.
 - d. Remove all concrete within the joint opening immediately after form removal and again where necessary after surface finishing.
2. Construction Joints
 - a. Make construction joints of the type and at the locations specified in the Drawings.
 - b. Additional joints in other members are not permitted without approval.
 - c. Place approved additional joints using details specified in the Drawings.
 - d. Make construction joints square and normal to the forms unless otherwise specified in the Drawings or by the City.
 - e. Use bulkheads in the forms for all vertical joints.
 - f. Thoroughly roughen the top surface of a concrete placement terminating at a horizontal construction joint as soon as possible after initial set is attained.
 - g. Thoroughly clean the hardened concrete surface of all loose material, laitance, dirt, and foreign matter, and saturate with water.
 - h. Remove all free water and moisten the surface before concrete or bonding grout is placed against it.
 - i. Ensure the surface of the existing concrete is in a saturated surface-dry condition immediately before placing subsequent concrete.
 - 1) A saturated surface-dry condition is achieved when the surface remains damp when exposed to sunlight for 15 minutes.
 - j. Wet the existing concrete by ponding water on the surface for 24 hours before placing subsequent concrete.
 - 1) Use high-pressure water blasting if ponding is not possible to achieve a saturated surface-dry condition 15 to 30 minutes before placing the concrete.
 - k. Draw forms tight against the existing concrete.
 - l. Bonding agents are not required unless otherwise specified in the Drawings or by the City.
 - m. Coat the joint surface with bonding mortar, grout, epoxy, or other material if a bonding agent is required.
 - n. Provide Type V epoxy in accordance with DMS-6100 for bonding fresh concrete to hardened concrete.
 - o. Place the bonding epoxy on a clean, dry surface, and place the fresh concrete while the epoxy is still tacky.

- p. Place bonding mortar or grout on a surface in a saturated surface-dry condition and place the concrete before the bonding mortar or grout dries.
- q. Place other bonding agents in accordance with the manufacturer's recommendations.

G.Placing Concrete

1. General

- a. Minimize segregation while placing concrete.
- b. Produce and place a uniform, dense compact mass of concrete.
- c. Ensure concrete free-falls no more than 5 feet.
- d. Fill the forms by depositing concrete as close to final position as possible. Do not deposit large quantities of concrete in one location and move the concrete to fill the forms.
- e. Remove any hardened concrete splatter ahead of the plastic concrete.
- f. Deposit concrete in layers no more than 36 inches deep unless otherwise permitted.
- g. Avoid cold joints in monolithic placement. Sequence successive layers or adjacent portions of concrete so they can be vibrated into a homogeneous mass with the previously placed concrete before it sets.
- h. Re-Vibration
 - 1) When re-vibrating between adjacent or successive placements of concrete, verify approved time lapse between adjacent or successive placements with the City.
 - 2) The timeframe between adjacent or successive placements will be subject to approval by the City.
 - 3) General accepted timeframes include:
 - a) No more than 1 hour to elapse
 - b) If the concrete contains at least the minimum recommended dosage of Type B or D admixture, the City may approve 1.5 hours to elapse.

2. In Cold Weather

- a. Provide and install recording thermometers, maturity meters, or other suitable temperature measuring devices capable of determining the temperature of the concrete to verify all concrete is in accordance with the following temperature limits:
 - 1) Maintain the temperature at all surfaces of concrete in bents, piers, culvert walls, retaining walls, parapets, wingwalls, top slabs of non-direct traffic culverts, and other similar formed concrete at or above 40 degrees Fahrenheit for 72 hours from the time of placement.
 - 2) Maintain the temperature of all other concrete, including the bottom slabs (footings) of culverts placed on or in the ground above 32 degrees Fahrenheit for 72 hours from the time of placement.
- b. Use coverings, insulated forms, artificial heating, or other means until all requirements for curing have been satisfied. Do not apply heat directly to concrete surfaces.
- c. Plan for cold weather and have all necessary heating and covering material ready for use. If any concrete is damaged due to poor planning, remove and replace concrete at no cost to the City.
- d. In accordance with ambient temperature requirements of this Section and Section 03 00 00.

3. In Hot Weather

- a. Keep the concrete at or below the maximum temperature at the time of placement.
- b. To control the concrete temperature, use ice, liquid nitrogen, shade, or water on aggregate stockpiles.

4. In Water
 - a. Deposit concrete in water only when specified in the Drawings or with approval from the City.
 - b. Make forms or cofferdams tight enough to prevent any water current passing through.
 - c. Do not pump water during or within 36 hours of concrete placement.
 - d. Place the concrete with a tremie, pump, or other approved method.
 - 1) Do not allow the concrete to fall freely through the water and do not disturb the concrete after it has been placed.
 - e. Keep the concrete surface level during placement.
 - f. Submerge the lower end of the tremie or pump hose in the concrete at all times.
 - g. Use continuous placing operations until the work is complete.
5. Mass Placements
 - a. Develop and obtain approval for a heat control plan for monolithic placements specified in the Drawings as mass concrete.
 - b. Place in accordance with the following temperature limits during the heat dissipation period for mass monolithic placements:
 - 1) The temperature differential between the central core of the placement and the exposed concrete surface does not exceed 35 degrees Fahrenheit
 - 2) The temperature at the central core of the placement does not exceed 160 degrees Fahrenheit
 - 3) Revise the heat control plan as necessary to maintain the temperature limitations.
 - 4) Repair any resulting cracking if the temperature differential between the central core of the placement and the nearest concrete surface exceeds 35 degrees Fahrenheit, at no cost to the City.
 - c. Furnish and install enough temperature recording devices, maturity meters, or other approved equivalent devices to monitor the heat dissipation.
 - d. Maintain temperature control methods for 4 days unless otherwise directed or approved based on the heat control plan.
 - e. Install devices using the following parameters:
 - 1) Measuring Surface Temperature
 - a) Install no more than 3 inches from the surface.
 - 2) Measuring Core Temperature
 - a) Install mid-way between the point of maximum predicted heat to the nearest surface.
 - f. Do not use maturity meters to predict strength.
 - g. If the core temperature exceeds 160 degrees Fahrenheit, the mass concrete will be subject to removal and replacement at no cost to the City.
 - 1) Do not move forward with subsequent construction until the City has evaluated the mass concrete.
6. In Foundation and Substructure
 - a. Perform any pumping or bailing from a suitable sump located outside the forms.
 - b. Construct or adjust all temporary wales or braces inside cofferdams as the work proceeds to prevent unauthorized construction joints.
 - c. Footings
 - 1) Do not place concrete in footings until the depth and formwork has been inspected.
 - 2) Place concrete footings upon seal concrete after the cofferdams are free from water and the seal concrete is cleaned.
 - d. Columns

- 1) Place concrete in columns monolithically between construction joints unless otherwise specified in the Drawings or by the City.
 - 2) Place the column concrete to the lower level of the cap or tie beam and delay placing the cap or tie beam on top of the column until the column concrete has reached a compressive strength of 3,000 psi.
7. In Box Culverts
- a. For locations where the culvert is more than 4 feet in clear height, delay placing the top slab until the wall concrete has reached a compressive strength of 3,000 psi.
 - b. Finishing
 - 1) Footing slab
 - a) Provide a smooth, uniform finish.
 - 2) Direct traffic top slabs
 - a) Finish in accordance with TxDOT Standard Specification Item 422.
 - 3) Other top slabs
 - a) Float finish

H. Extending Existing Substructures

1. Removal
 - a. Remove portions of the existing structure to the lines and dimensions specified in the Drawings or as directed by the City.
 - b. Repair any minor damage to the existing structure in accordance with Section 32 01 29.
 - c. Do not use explosives to remove portions of the existing structure.
 - d. Do not use a demolition ball, other swinging weight, or impact equipment unless directed to or approved by the City.
 - e. Use equipment that will not damage the remaining concrete.
2. Splicing Reinforcing Steel
 - a. Splice new reinforcing bars to exposed bars in the existing structure using lap splices in accordance with Section 03 00 00.
 - b. Welded splices are permitted, perform welds in accordance with TxDOT Standard Specification Item 448.
3. Concrete Preparation
 - a. Roughen and clean concrete surfaces in contact with new construction before placing forms.
 - b. Prepare joint surfaces in accordance with this Section.

I. Consolidation

1. Consolidate concrete and flush mortar to the form surfaces with immersion type vibrators. Do not use vibrators that operate by attachment to forms or reinforcement, unless otherwise approved.
2. Vibrate the concrete immediately after deposit. Space points of vibration to ensure complete consolidation and thorough working of the concrete around the reinforcement, embedded fixtures, and into the corners and angles of the forms.
3. Insert the vibrators vertically where possible.
4. Vibrate the entire depth of each lift and penetrate the previous lift 2 to 3 inches where applicable.
5. Do not use the vibrator to move the concrete to other locations in the forms.
6. Do not drag the vibrator through the concrete.

7. Thoroughly consolidate concrete along construction joints by operating the vibrator along and close to the joint surface. Do not vibrate against the joint surface.
8. Continue vibration until the concrete surrounding reinforcements and fixtures is completely consolidated.
9. Hand-space or rod the concrete if necessary to ensure flushing of mortar to the surface of all forms.

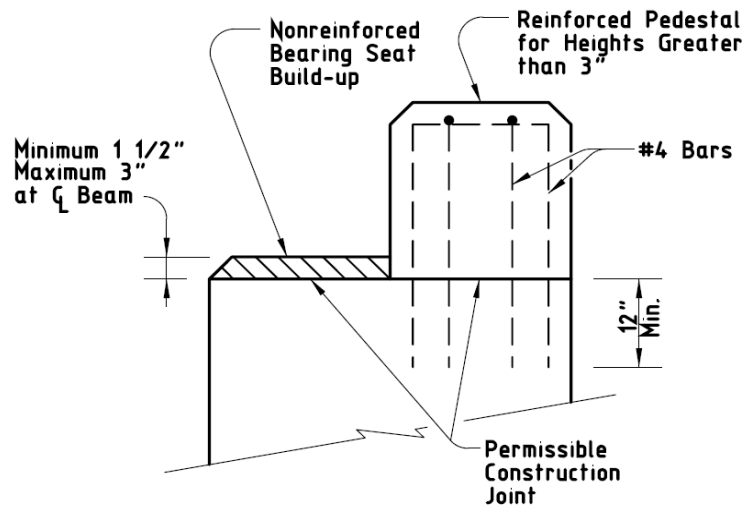
J. Dowels and Anchor Bolts

1. Install dowels and anchor bolts by casting them in-place or by grouting with grout, epoxy, or epoxy mortar, unless otherwise specified.
2. Form or drill holes for grouting.
3. Follow the manufacturer's recommended installation procedures for pre-packaged grout or epoxy anchor systems.
4. Test anchors if specified in the Drawings or required within applicable Sections.
5. Drill holes for anchor bolts to accommodate the bolt embedment specified in the Drawings.
6. Make holes for dowels at least 12 inches deep unless otherwise specified in the Drawings.
7. Hole Diameter Size
 - a. A minimum of twice the dowel or bolt diameter
 - b. When using cementitious grout or epoxy mortar, do not exceed the dowel or bolt diameter plus 1.5 inches.
 - c. When using neat epoxy, make the hole diameter 1/16 to 1/4 inch greater than the dowel or bolt diameter, unless otherwise specified by the epoxy manufacturer.
8. Thoroughly clean holes of all loose material, oil, grease, or other bond-breaking substance, and blow them clean with filtered compressed air.
9. Use a wire brush followed by oil-free compressed air to remove all loose material from the holes, repeating as necessary until no more material is removed.
10. Ensure holes are in a surface-dry condition when epoxy type materials are used and a surface-moist condition when cementitious grout is used.
11. Develop and demonstrate for approval a procedure for cleaning and preparing the holes for installation of the dowels and anchor bolts.
12. Completely fill the void between the hole and dowel or bolt with grouting material.
13. Follow all product recommendations for pre-packaged systems.

K. Finishing of Surfaces

1. Standard Surfaces
 - a. Provide a consistent and uniform surface for all visible concrete surfaces.
 - b. Apply an ordinary smooth surface finish to all concrete surfaces unless a flat, textured, broom, or trowel surface is specified in this Section, the Drawings, or as directed by the City.
 - c. Repair defects and surface irregularities in accordance with this Section. Remove and replace any visible surfaces with defects or irregularities that are unable to be repaired.
 - d. Apply an ordinary smooth surface finish as the final finish to the following exposed concrete surfaces, unless otherwise specified in the Drawings or by the City:
 - 1) Inside and top of inlets
 - 2) Inside and top of manholes
 - 3) Inside of sewer and appurtenances

- 4) Inside of culvert barrels
- e. Form marks and chamfer edges do not need to be smoothed for the inside of culvert barrels.
2. Horizontal Surfaces
 - a. Do not use mortar topping for surfaces, unless otherwise directed by the City.
 - b. Strike off to grade and finish all unformed upper surfaces and float the surface.
 - c. Slope the following to drain water from the surface
 - 1) Tops of caps and piers between bearing areas from the center slightly toward the edge
 - 2) The tops of abutment and transition bent caps from the backwall to the edge
 - d. Construct bearing areas for steel units in accordance with TxDOT Standard

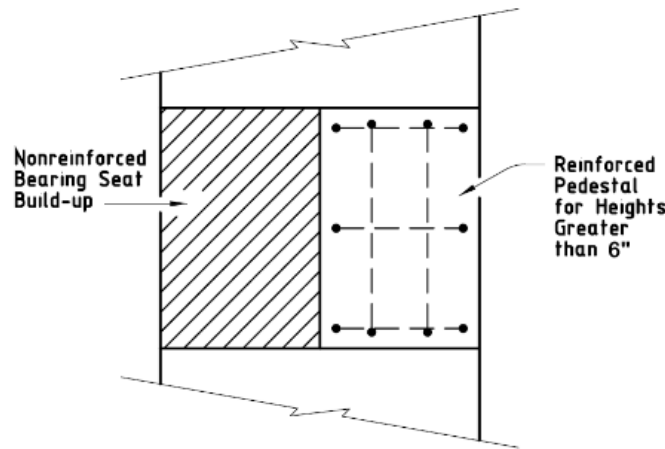


Specification Item 441.

- e. Finish
 - 1) Standard
 - a) Smooth trowel finish
 - 2) Bearing area under the expansion ends of concrete slabs and slab and girder spans
 - a) Steel-trowel finish to the grades specified
 - 3) Bearing areas under elastomeric bearing pads or nonreinforced bearing seat buildups
 - a) Textured, wood float finish
 - 4) Do not allow the bearing area to vary from a level plane by more than 1/16 inch in all directions.
- f. Cast bearing seat buildups or pedestals for concrete units integrally with the cap or a construction joint.
- g. Provide a latex-based mortar, an epoxy mortar, or an approved proprietary bearing mortar for bearing seat buildups cast with a construction joint.
- h. Construct pedestals of Class C concrete, reinforced as specified in the Drawings or, for pedestals less than 12 inches in height, as indicated in Figure 1 and 2

Figure 1
Section Through Bearing Seat Buildups

Figure 2



Section Through Bearing Seat Buildups

L. Curing

1. General
 - a. Perform curing in accordance with approved methods.
 - b. Curing Day
 - 1) Standard
 - a) The temperature, taken in the shade, is above 50 degrees Fahrenheit for at least 19 hours.
 - 2) Cold Day
 - a) The temperature of all surfaces of the concrete is maintained above 40 degrees Fahrenheit for the entire 24 hours.
 - c. The curing period begins when all concrete has attained its initial set in accordance with Tex-440-A, unless otherwise indicated in the Drawings.
 - d. Curing Locations
 - 1) For vertical surfaces, use form or membrane curing unless otherwise specified in the Drawings or by the City.
 - 2) For horizontal surfaces of HPC or mass concrete, use only water curing.
 - 3) For horizontal or unformed surfaces of all other concrete, use water or membrane curing.
 - 4) For the top surface of any concrete structure that additional concrete will be placed and bonded onto at a later date, use water curing. Examples include, but are not limited to stub walls, caps with backwalls, and risers.
 - 5) Cure all other concrete as specified in other applicable Sections.
 - e. Curing Timeframes:
 - 1) Standard

- a) Cure all concrete for 4 consecutive days
- 2) Vertical Surfaces
 - a) Form cure for 48 hours after placement followed by 4 days of form curing.
 - b) Form cure for 12 hours after placement followed by membrane cure in accordance with manufacturer recommendations, as specified by the Drawings, or as directed by the City.
 - c) HPC concrete
 - (1) Form cure for 48 hours after placement followed by membrane cure in accordance with manufacturer recommendations, as specified by the Drawings, or as directed by the City.
- 3) Mass Concrete
 - a) If forms are removed prior to 4 days of curing, form cure as required by the heat control plan and then membrane cure in accordance with manufacturer recommendations, as specified by the Drawings, or as directed by the City.
- f. If using membrane curing, apply within 2 hours of form removal.
- 2. Form Curing
 - a. When forms are left in contact with the concrete, other curing methods are not required except for exposed surfaces and for cold weather protection.
 - b. Use other approved curing methods if forms are removed prior to the 4-day curing period.
- 3. Water Curing
 - a. Keep all exposed surfaces of the concrete continuously wet for the required curing timeframe.
 - b. Use water in accordance with Section 03 00 00. Do not use water that stains or leaves a residue.
- 4. Blankets
 - a. Keep the concrete continuously wet by maintaining wet cotton or burlap mats in direct contact with the concrete for the required curing time.
 - b. Cover the cotton or burlap mats with a layer of polyethylene sheeting.
 - c. Weigh the mats adequately to provide continuous contact with all concrete.
 - d. Cover surfaces that cannot be cured by direct contact with mats by forming an enclosure well anchored to the forms or ground so outside air cannot enter the enclosure.
 - 1) Provide sufficient moisture inside the enclosure to keep all surfaces of the concrete wet.
- 5. Membrane Curing
 - a. Do not vary the type of curing compound throughout the project.
 - b. Apply membrane curing at a rate of approximately 180 square feet per gallon unless otherwise specified in accordance with manufacturer recommendations, as specified by the Drawings, or as directed by the City.
 - c. Do not spray curing compound on projecting reinforcing steel or concrete that will later form a construction joint.
 - d. Do not apply membrane curing to dry surfaces. Follow the manufacturer's recommendations for what level of surface moisture to apply curing compound.
 - e. Leave the film unbroken for the minimum curing period specified by the manufacturer.
 - f. Correct damaged membrane immediately by reapplication of membrane.

M. Removal of Falsework and Forms

- 1. Follow curing requirements when removing forms.

2. For mass placements, keep forms in place for 4 days following concrete placement unless otherwise specified by the heat control plan, in the Drawings, or by the City.
3. Do not remove weight-supporting forms and falsework spanning more than 1 foot for all bridge components and culvert slabs until the concrete has attained a compressive strength of 3,000 psi.
4. Remove inside forms (walls and top slabs) for box culverts and sewers after concrete has attained 75 percent of the design compressive strength.
5. If a form is not providing support, the form may be removed provided the removal does not disturb other forms that are providing support.
6. Metal Appliances:
 - a. Remove all metal appliances used inside forms to a depth of at least one-half inch from the concrete surface.
 - b. Remove appliances without chipping or spalling the concrete.
 - c. If the concrete is damaged, the City will decide if the concrete can be repaired, or if it will need to be replaced.
 - d. Replace any concrete that has been damaged due to the removal of metal appliances at no cost to the City.
7. Do not leave any forms or falsework in place unless otherwise specified in the Drawings or as directed by the City.

3.4 REPAIR

A. Repair Surface Defects and Irregularities

1. Chip away all loose or broken material to sound concrete where porous, spalled, or honeycombed areas are visible after form removal.
2. Repair spalls in accordance with Section 32 01 29.
3. Clean and fill holes or spalls caused by the removal of form and falsework with latex grout, cement grout, or epoxy grout. Fill only the holes. Do not blend the patch with the surrounding concrete.
4. Remove all fins, rust stains, runs, drips, or mortar from surfaces that will be exposed. Smooth all form marks and chamfer edges by grinding or dry rubbing.
5. Ensure all repairs are dense, well-bonded, and properly cured. Finish exposed large repairs to blend with the surrounding concrete where a higher class of finish is not specified.

3.5 RE-INSTALLATION [NOT USED]

3.6 SITE QUALITY CONTROL

A. Concrete Mix Design and Verification

1. Perform testing in accordance with Section 03 00 00.

B. Concrete Production and Placement Acceptance

1. Perform production and placement testing in accordance with Section 03 00 00.

C. Non-Conforming Work

1. General
 - a. The City may at any time reject a material if it fails to meet the requirements specified in this Section.

- b. The City may require the Contractor at any time to remove and replace installed concrete if any material is found to be non-conforming, at no additional cost to the City.
 - c. Any rejection of materials or source locations will be at no cost to the City.
- 2. Aggregates
 - a. If the aggregates fail to meet the requirements specified in Section 32 05 16, the City may reject the aggregates.
- 3. Concrete Mix Design and Production Materials
 - a. If the mix design fails to meet the requirements specified in this Section and Section 03 00 00, the City may reject the mix design.
 - b. Any concrete installed using a non-conforming mix design will be subject to removal and replacement at no cost to the City.
 - c. The City may perform verification testing on all materials to verify the conformance of the mixture.

3.7 SYSTEM STARTUP [NOT USED]

3.8 ADJUSTING [NOT USED]

3.9 CLEANING [NOT USED]

3.10 CLOSEOUT ACTIVITIES [NOT USED]

3.11 PROTECTION [NOT USED]

3.12 MAINTENANCE [NOT USED]

3.13 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 03 30 53
CONCRETE FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for cast-in-place concrete and steel reinforcement.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Where there is not a separate item listed on the Unit Price Schedule for Work in this Section, no separate measurement and payment is made. Include cost for Work under this Section in the related item listed on the Unit Price Schedule.
2. Measurement and payment are as noted on the Unit Price Schedule.

1.3 REFERENCES

A. Reference Standards

1. ACI 117 - Tolerances for Concrete Construction and Materials.
2. ACI 211.1 - Selecting Proportions for Normal, Heavyweight and Mass Concrete.
3. ACI 214.3R - Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete.
4. ACI 302.1R - Ready-Mixed Concrete. U. ASTM C 138 - Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
5. ASTM C 143 - Slump of Hydraulic-Cement Concrete. W. ASTM C 150 - Portland Cement.
6. ASTM C 172 - Sampling Freshly Mixed Concrete.
7. ASTM C 173 - Air Content of Freshly Mixed Concrete by Volumetric Method.
8. ASTM C 231 - Air Content of Freshly Mixed Concrete by Pressure Method.
9. ASTM C 260 - Air-Entraining Admixtures for Concrete.
10. ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete.

11. ASTM C 494 - Chemical Admixtures for Concrete.
12. ASTM C 595 - Blended Hydraulic Cements.
13. ASTM C 618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
14. ASTM C 685 - Concrete Made by Volumetric Batching and Continuous Mixing.
15. ASTM C 1077 - Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
16. CPMB-100 - Concrete Plant Standards, Part 2 Plant Control Systems. II. CRSI - Placing Reinforcing Bars.
17. CRSI MSP-1 - Manual of Standard Practice.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the EOR or Consultant prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 1. Concrete mix summary sheet.
- B. Shop Drawings
 1. Submit proposed mix design and strength test data for each type and strength of concrete used.
 2. Submit Shop Drawings in accordance with ACI 315 and ACI 318, when required, showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details and other pertinent information.
- C. Test and Evaluation Reports
 1. Provide laboratory reports prepared by an independent testing laboratory verifying that materials used comply with the requirements of this Section.

2. Provide mill certificates for reinforcing steel for inspection in the field. Steel not accompanied by mill certificates will not be approved. Provide specimens for testing when required by Engineer.
3. Provide batch tickets showing mix design number and the information required by ASTM C 94 for ready-mixed concrete delivered to the site. Provide batch tickets showing the information required by ASTM C 685 for concrete produced by continuous mixing.
4. For waterstops, submit product information, including description literature, installation instructions and specifications.
5. Submit curing procedures including materials and equipment to be used.

D. Quality Control Submittals

1. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Section.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Reinforcing Steel: Store reinforcing steel to protect it from damage and formation of excessive rust. Protect epoxy-coated steel from damage to the coating.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Cement

1. Standard White or Gray Portland Cement: ASTM C 150, Type I.

2. Fly Ash

- a. Pavement: Class F
- b. Sub-base and Base Stabilization: Class C or Class F

B. Water

- 1. Potable water from municipal supplies approved by the State.

C. Aggregate

- 1. Coarse Aggregate shall consist of durable particles of gravel and crushed stone conforming to ASTM C 33. When tested by ASTM C 131 procedures coarse aggregate shall have a percentage of wear of not more than forty percent.
- 2. Fine aggregate shall consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without mineral filler conforming to ASTM C 33.

D. Admixtures

- 1. Air entraining admixtures shall adhere to ASTM C 260.
- 2. Chemical Admixtures
 - a. Water Reducers: ASTM C 494, Type A.
 - b. Water Reducer and Retarder: ASTM C 494, Type D.
 - c. High Range Water Reducer (Superplasticizer): ASTM C 494, Types F and G.
- 3. Prohibited Admixtures
 - a. Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chlorine ions in excess of 0.1 percent by weight of cement.

E. Reinforcing Steel

- 1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 60 unless otherwise shown on Plans. Use deformed bars except where smooth bars are specified. When placed in Work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
- 2. Tie Wire
 - a. Adhere to ASTM A 82. Use 16-1/2 gauge minimum for tie wire unless otherwise shown on the Plans.

F. Curing Compounds

1. Liquid membrane-forming compounds conforming to ASTM C 309, with white or other heat reflecting pigment.

G. Formwork

1. Lumber and Plywood
 - a. Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections, which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing and sheathing.
2. Formwork
 - a. For exposed concrete indicated to receive rubbed finish, provide form or form- lining surfaces free of irregularities.
3. Form Ties
 - a. Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter.
4. Metal Forms
 - a. Clean and in good condition, free from dents and rust, grease or other foreign material that tend to mar or discolor concrete, in a gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

H. Performance / Design Criteria

1. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685. Measure water and liquid admixtures by volume. 2.5 DESIGN MIX Use design mixes prepared by a certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.
2. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this Section. Proportioning on the basis of field experience or trial mixtures in accordance with the requirements of Section 5.3 of ACI 318 may be used, if approved by Engineer.

Type	Minimum 28-day Compressive Strength (lbs./sq. in.)	Maximum W/C Ratio	Air Content (Percent)	Minimum Cementitious Content (lbs/cy)
Structural	4000	0.45	3-5	470
Thrust Blocking	2500	0.60	3-5	520
Pavement	3500	0.45	3-5	550
Sidewalks	2500	0.60	3-5	520

3. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231. Use of Concrete Types: Use types of concrete as indicated on the Plans. Unless indicated otherwise on the Plans or Specifications, use non- structural, unreinforced concrete for pipe plugs, seal slabs, thrust blocks, trench dams and concrete fill; use structural, reinforced concrete for all other applications.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Refer to Section 01 45 23 – Testing and Inspection Services.

B. Non-Conforming Work

1. Remove and repair defective Work at no cost to the City.
2. If concrete surface is bulged, uneven, or shows honeycombing or form marks, which cannot be repaired satisfactorily through patching, remove and replace the defective Work as directed by the Engineer. Replace or submit a repair plan for pitted or washed concrete to be approved by the Engineer.

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Formwork

1. Install forms in accordance with ACI 304R. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117.
2. Construction forms to permit removal without damage to concrete.
3. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides). Remove metal form ties to depth of at least 3/4 inch from surface of concrete.
4. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.
5. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

B. Embedded Items

1. Install conduit and piping as shown on the Plans. Locate and fasten conduit, piping and other embedded items in forms.

C. Steel Reinforcement

1. Where required, steel reinforcing shall conform to TxDOT current "Standard Specifications" for reinforcing steel.
2. Place reinforcing steel as shown on the Plans. Secure steel in position in forms to prevent misalignment. Welding of reinforcing steel is not permitted unless noted on the Plans.
3. Maintain reinforcing steel in place using approved concrete, hot-dip galvanized metal or plastic chairs and spacers. Place reinforcing steel in accordance with CRSI Publication NG Reinforcing.

4. Request inspection of reinforcing steel by Engineer before concrete is placed. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Plans: 2 inches.
5. Detail bars in accordance with ACI 315. Provide reinforcing steel fabricated in accordance with CRSI Publication MSP-1, of Standard Bend reinforcing steel to required shape while steel is cold. Do not over bend steel. Provide splice and development length of bars as shown on Plans. Stagger splices or locate at points of low tensile stress.

D. Consistency

1. The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface.
2. The concrete shall be workable, cohesive, possess satisfactory finishing qualities and be of the stiffest consistency that can be placed and vibrated into a homogenous mass.
3. If the strength required or consistency requirement cannot be maintained, the contractor may use an approved water reducing or retarding agent, or additional cement or aggregates, which will produce the required results.

E. Concrete Placement

1. The contractor shall give the Engineering Inspector sufficient advance notice before placing concrete to permit the inspection of forms, reinforcing steel and other preparations. Concrete shall not be placed prior to the approval of preparation.
2. Concrete mixing, placing and finishing shall be done in daylight hours and not before 7 AM or after 7 PM.
3. The placing shall be regulated so the pressures caused by the plastic concrete shall not exceed the loads used in the form design.
4. The method of handling, placing and consolidation of concrete shall minimize segregation and displacement of the reinforcement, and produce a uniformly dense and compact mass.
5. Concrete shall not have free-fall of more than three feet.
6. The method and equipment used to transport concrete to the forms shall be capable of maintaining the rate required for a continuous placement.
7. Concrete shall be placed with a termite, closed bottom-dump bucket, barrel trucks, or other approved method. Each part of the forms shall be filled by depositing concrete as near its final position as possible.

8. The coarse aggregate shall be worked back from the face and the concrete forced under and around the reinforcement bars without displacing them. Depositing large quantities at one point and running or working it along the forms will not be allowed.
9. Concrete shall be deposited in layers of suitable depth but not more than 36" in thickness.
10. The sequence of successive layers or adjacent portions of concrete shall be such that they can be vibrated into a homogeneous mass with the previously placed concrete without a cold joint. Unauthorized construction joints shall be avoided by placing all concrete between the authorized joints in one continuous operation.
11. All concrete shall be well consolidated by mechanical means and the mortar flushed to the form surfaces by continuous working with immersion type vibrators. The vibration shall continue until thorough consolidation and complete embedment of reinforcement and fixtures is produced but not long enough to cause segregation.
12. Footings, forms, trenches, etc., shall be free of standing or flowing water before any concrete is placed therein. Any necessary pumping or bailing during concreting operations shall be done from a suitable sump located outside the forms or excavations receiving concrete.

F. Concrete Protecting and Curing

1. Concrete shall be allowed to cure at 40 degrees F or above for at least seventy-two hours after placement before any backfill, load, or strain is placed on the concrete or any projecting reinforcing. While curing, the concrete shall be protected from drying by leaving the forms in place, or by covering with damp mats, blankets, or by complete coverage of the moist concrete with a sealing "membrane" curing compound.
2. The contractor shall inform the City of League City Engineering Department fully of the methods and procedures proposed for curing and shall provide the proper equipment and material in adequate amounts, and shall have the proposed method, equipment and materials approved by the City of League City Engineering Department prior to placing the concrete.

G. Miscellaneous Concrete Items

1. Weather Conditions
 - a. The contractor is responsible for the protection of concrete placed under any and all-weather conditions. In threatening weather, which may result in conditions that will adversely affect quality of the concrete to be placed, the contractor shall postpone the Work.

- b. Where Work has been started and changes in weather conditions require protective measures, the contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or from freezing temperatures.
- c. Concrete shall be protected, and its surface temperature maintained at 40 degrees F or above for at least seventy-two hours after placement.
- d. No concrete may be placed unless the atmosphere temperature is at least 40 degrees F and rising; concreting shall be discontinued if the temperature drops to 45 degrees F and is falling.
- e. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

H. Material Disposal

- 1. Refer to Section 02 41 13 - Material Disposal.

3.5 REPAIR

A. Defects

- 1. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one (1) part cement to two (2) parts fine aggregate. Repair defects by removing unsatisfactory material and replacing with new concrete, keyed and bonded to existing concrete. Finish to provide a uniform surface between patches and existing concrete.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Final Cleaning

- 1. Clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on the surface to re-set; then wash surface with clean water. Leave structure with a clean, neat and uniform finish.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION

A. Freshly Placed Concrete

1. Refer to **Section 31 23 34 - Structural Excavating and Backfilling**. *(Highlighted sections to be included at later time. EOR to provide section in interim period.)*
2. Provide for protection of freshly placed concrete against damage from precipitation by having sufficient material on-site to protect finished surface.

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 03 34 13
CONTROLLED LOW STRENGTH MATERIAL (CLSM)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Controlled low strength material (CLSM) for use as flowable backfill.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. This item is considered subsidiary to utility pipe installed.
 - 2. Payment
 - a. The work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per linear foot of utility pipe installed.

1.3 REFERENCES

- A. Acronyms
 - 1. CLSM – Controlled Low Strength Material.
- B. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. American Society of Testing and Materials (ASTM):
 - a. C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - b. C33 - Standard Specification for Concrete Aggregates.
 - c. C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - d. C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - e. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - f. C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - g. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Sieve analysis
 - 1. Analyses of fine and coarse aggregates proposed to be used.
 - a. Resubmit at any time there is a significant change in grading of materials.
 - 2. Mix
 - a. Full details, including mix design calculations for proposed mix.
- B. Trial batch test data
 - 1. Data for each test cylinder.
 - 2. Data identifying mix and slump for each test cylinder.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 SITE CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Materials
 - 1. Portland Cement:
 - a. Type I/IA Portland cement in accordance with Section 03 00 00.
 - 2. Fly Ash in accordance with ASTM C618.
 - 3. Water in accordance with Section 03 00 00.
 - 4. Admixtures:
 - a. Air entrainer in accordance with ASTM C260.
 - 5. Fine Aggregate:
 - a. Concrete sand (not required to be in accordance with ASTM C33).
 - b. No more than 12 percent of fine aggregate shall pass a No. 200 sieve.
 - c. No plastic fines shall be present.
 - 6. Coarse Aggregate:
 - a. Pea gravel no larger than 3/8-inch.
- B. Mixes
 - 1. Performance requirements
 - a. Total calculated air content
 - 1) Not less than 8.0 percent or greater than 12.0 percent.
 - b. Minimum unconfined compressive strength
 - 1) Not less than 50 psi measured at 28 days.

- c. Maximum unconfined compressive strength
 - 1) Not greater than 150 psi measured at 28 days.
 - 2) Limit the long-term strength (90 days) to 200 psi such that material could be re-excavated with conventional excavation equipment in the future if necessary.
 - d. Slump
 - 1) Greater than 8 inches and sufficient to allow the material to flow freely during placement.
 - e. Wet density
 - 1) No greater than 132 pounds per cubic foot.
 - f. Color
 - 1) No coloration required unless noted.
 - 2) Submit dye or other coloration means for approval.
2. Suggested mix design:

Material	Weight	Specific Gravity	Absolute Volume Cubic Foot
Cement	30 pounds	3.15	0.15
Fly Ash	300 pounds	2.30	2.09
Water	283 pounds	1.00	4.54
Coarse Aggregate	1,465 pounds	2.68	8.76
Fine Aggregate	1,465 pounds	2.68	8.76
Admixture	4-6 ounces	-	2.70
TOTAL	3,543 pounds	-	27.00

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Trial Batch

1. After mix design has been accepted by City, have trial batch of the accepted mix design prepared by testing laboratory acceptable to City.
2. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.
3. Prepare trial batch with sufficient quantity to determine slump, workability, consistency, and to provide sufficient test cylinders.

B. Test Cylinders

1. Prepare test cylinders in accordance with ASTM C31 with the following exceptions:
 - a. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
 - b. Do not rod the concrete mix.
 - c. Strike off the excess material.
2. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
3. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.

4. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - a. Perform the capping carefully to prevent premature fractures.
 - b. Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
 - c. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
- C. Compression test 8 test cylinders: Test 4 test cylinders at 3 days and 4 at 28 days in accordance with ASTM C39 with the following exceptions:
 1. The compression strength of the 4 test cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but not exceed maximum compression strength.
- D. If the trial batch tests do not meet the requirements for strength or density, revise and resubmit the mix design, and prepare additional trial batch and tests. Repeat until an acceptable trial batch is produced in accordance with the requirements of this Section.
 1. All the trial batches and acceptability of materials shall be paid by Contractor.
 2. After acceptance, do not change the mix design without submitting a new mix design, trial batches, and test information.
- E. Determine slump in accordance with ASTM C143 with the following exceptions:
 1. Do not rod the concrete material.
 2. Place material in slump cone in 1 semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Placement

1. Place CLSM by any method which preserves the quality of the material in terms of compressive strength and density:
 - a. Limit lift heights of CLSM placed against structures and other facilities that could be damaged due to the pressure from the CLSM to 4 feet or the lift height indicated on the Drawings, whichever is less.
 - 1) Do not place another lift of CLSM until the last lift of CLSM has set and gained sufficient strength to prevent lateral load due to the weight of the next lift of CLSM.
 - b. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.
 - c. Transport and place material so it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
 - d. Maintain slump developed for trial batch during construction at all times within 1-inch +/-.

- e. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity so compaction or mechanical vibration is not required.
- f. When using as embedment for pipe take appropriate measures to ensure line and grade of pipe.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Quality Control Testing

1. Perform testing to determine whether the CLSM, as being produced during the process of construction, is in accordance with the requirements of this Section.
 - a. Make and deliver test cylinders to testing laboratory at the Contractor's expense.
2. Test cylinders
 - a. Prepare test cylinders in accordance with ASTM C31 with the following exceptions:
 - 1) Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
 - 2) Do not rod the concrete mix.
 - 3) Strike off the excess material.
 - b. Place the cylinders in a safe location away from the construction activities. Keep the cylinders moist by covering with wet burlap, or equivalent. Do not sprinkle water directly on the cylinders.
 - c. After 2 days, place the cylinders in a protective container, such as a Styrofoam or similar lining that will limit the jarring and bumping of the cylinders, for transport to the laboratory for testing.
 - d. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
 - e. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
 - f. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - 1) Perform the capping carefully to prevent premature fractures.
 - 2) Use neoprene pads a minimum of 1/2 inch thick and 1/2 inch larger in diameter than the test cylinders.
 - 3) Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
3. The number of cylinder specimens taken each day shall be determined by the City.
 - a. Test 1 cylinder at 3 days and 2 at 28 days in accordance with ASTM C39 except as modified herein.
 - b. The compression strength of the cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but not exceed maximum compression strength.
4. Test the air content of the CLSM. Test will be made immediately after discharge from the mixer in accordance with ASTM C231.
5. Test the slump of CLSM using a slump cone in accordance with ASTM C143 with the following exceptions:
 - a. Do not rod the concrete material.

- b. Place material in slump cone in 1 semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.
6. If compressive strength of test cylinders does not meet requirements, make corrections to the mix design to be in accordance with the requirements of this Section.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 03 80 00
MODIFICATIONS TO EXISTING CONCRETE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modifications to existing concrete structures, including manholes, junction boxes, vaults, retaining walls, wingwalls, headwalls, and culverts.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-in-Place Concrete.
 - 3. Section 03 34 13 - Controlled Low Strength Material (CLSM).
 - 4. Section 32 32 00 – Retaining Walls.
 - 5. Section 33 05 05 - Utility Trench Excavation, Embedment, and Backfill.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Modifications to Existing Concrete Structures materials, equipment, tools, testing, and incidentals are subsidiary to the structure or item being installed.
 - 2. Payment
 - a. The work performed and materials furnished in accordance with this item are subsidiary to the unit prices bid for various items which require the use of Modifications to Existing Concrete Structures.

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. DMS-6100, Epoxies and Adhesives.
 - 3. TxDOT Concrete Repair Manual.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Provide electronic product data from each manufacturer supplying curing compounds, evaporation retardant, joint fillers, or chemical additives to be used on the project.
2. Product data sheets for all products other than epoxy including:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Point of delivery
 - e. Data and test results as required in this Section
 - f. Material Safety Data Sheets, if applicable, required for Epoxy and Curing Compounds
 - g. Manufacturer Recommended Storing Data, if applicable
 - h. Application Recommendations, if applicable
 - i. Manufacturer's Recommended Storage and Handling instructions
3. Epoxy Product Data Sheet Additional Requirements:
 - a. Resin or hardener components
 - b. Brand name
 - c. Name of manufacturer
 - d. Lot or batch number
 - e. Temperature range for storage
 - f. Date of manufacture
 - g. Expiration date
 - h. Quantity contained

B. Information Submittals

1. Equipment Information
 - a. Submittal for all major equipment including:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Cast-in-Place Concrete
 - 1. In accordance with Sections 03 00 00 and 03 30 00.
- B. Controlled Low Strength Material
 - 1. In accordance with Section 03 34 13.
- C. Steel Reinforcement
 - 1. In accordance with Section 03 00 00.
- D. Epoxy Bonding Agent
 - 1. Provide a two component, solvent-free, asbestos-free, moisture-insensitive epoxy resin material used to bond plastic concrete to hardened concrete in accordance with DMS-6100, Type V.
- E. Backfill material
 - 1. Trenches
 - a. In accordance with Section 33 05 06.
 - 2. Retaining walls
 - a. In accordance with Section 32 32 00.
- F. Repair Mortars
 - 1. Provide an asbestos free, moisture insensitive, polymer-modified, Portland cement-based cementitious trowel grade mortar for repairs on horizontal or vertical surfaces.
- G. Pipe Penetration Sealants
 - 1. Provide one component polyurethane, bentonite-free, extrudable swelling waterstop that is chemically resistant, not soluble in water, and capable of withstanding wet/dry cycling.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

- A. Verification of Conditions
 - 1. Examine existing structure to be modified for damage or defects that may affect modification.

- a. Report issue to City for review before beginning modification.

3.3 PREPARATION

A. Connection Surface Preparation

1. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means such as sanding or grinding.
 - a. Irregular voids or surface stones do not need to be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the City's final inspection.

B. Reinforcing Steel Preparation

1. Clean reinforcing steel shown to be incorporated in new concrete of existing demolished concrete by wire brush or other similar means to remove all loose material and products of corrosion before proceeding with the repair.
2. If reinforcing steel is exposed, clean by wire brush or other similar means to remove all contaminants.
3. If half of the diameter or more of the reinforcing steel is exposed, chip out a minimum of 1 inch behind the steel.
4. Cut, bend, or lap to new reinforcing as specified in the Drawings and provide with 1-inch minimum cover all around.

3.4 INSTALLATION

A. General

1. When drilling holes for dowels or bolts at new or existing concrete, stop drilling if rebar is encountered and relocate the hole to avoid rebar as approved by the City and Engineer.
2. Do not cut rebar without prior approval from the City Engineer.

B. Concrete Removal

1. Remove concrete designated to be removed to specific limits as shown on the Drawings by chipping, jack-hammering, or saw-cutting as appropriate in areas where concrete is to be taken out.
 - a. Do not jackhammer sanitary sewer manhole penetrations.
2. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged.
3. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, apply a coating or surface treatment of epoxy to the entire cut surface to a thickness of 1/4 inch.
4. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, provide a 1-inch deep saw cut on each exposed surface of the existing concrete at the edge of concrete removal.

C. Modification

1. When doweling in new concrete to existing structure, drill a hole 1/4 inch larger than the diameter of the dowel.
 - a. Thoroughly clean the hole of all loose particles and dust and blow clean with filtered compressed air prior to installing epoxy.

2. Roughen the existing concrete surface by dry mechanical means such as sanding or grinding prior to placing grout, epoxy, or new concrete.
3. Place concrete as specified in the Drawings and in accordance with Section 03 30 00.

3.5 REPAIR

- A. Repair damaged concrete specified to be left in place in accordance with the TxDOT Concrete Repair Manual.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 10 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site Preparation

- a. Preparing the right-of-way and designated easements for construction operations by the removal and disposal of obstructions within the project limits.
- b. Removing trees and shrubs.
- c. Pruning trees and shrubs.
- d. Tree protection fence
- e. Trunk protection
- f. Erosion and sediment control

B. Deviations from this City of League City Standard Specification:

1. None.

C. Related Specification Sections include but are not limited to:

1. Section 02 41 13 – Selective Site Demolition.
2. Section 02 41 15 – Paving Removal.
3. Section 31 23 16 – Unclassified Excavation.
4. Section 34 71 13 – Traffic Control

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Site Preparation

a. Measurement

- 1) Measured per lump sum of Site Preparation within the project limits, when specifically required by the Contract Documents. Otherwise, this item is considered subsidiary to the various items bid.

b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid for lump sum for “Site Preparation.”

c. The price bid shall include:

- 1) Full compensation for Site Preparation, including installation and removal of Best Management Practices as specified by the Drawings
- 2) Tools, equipment, and labor and incidentals needed to execute work
- 3) Sawing
- 4) Grading and backfilling of holes
- 5) Excavation
- 6) Topsoil and sod limits of tree removal disturbance unless quantified separately under another bid item
- 7) Tree and shrub protection for trees and shrubs to remain

- 8) Replace any tree designated to remain that is damaged during tree removal
- 9) Tree wound treatment material
- 10) Tree and shrub pruning
- 11) Disposal of debris, tree clippings, limbs, leaves, and pine needles removed as part of pruning
- 12) Trunk Protection
 - a) Closed cell foam pad
 - b) Wood planks
 - c) Steel straps
- 13) Tree protection fence
 - a) Woven wire fence
 - b) T-Bar posts
 - c) One strand barbed wire fence
 - d) Tundra weight orange flagging
- 14) Remove, haul-off, and dispose of:
 - a) Trees, shrubbery, grass and all other vegetation not designated to remain
 - b) Stumps, roots, brush, and logs
 - c) Abandoned utility pipes or conduits
 - d) Fence and fence posts if Fence Removal bid item is not used
 - e) Gravel, stone, or boulders, not including removal of gravel or stone driveways, roads, or other driving surfaces.
 - f) Scrap metal
 - g) All rubbish or debris
 - h) All obstructions and objectionable material not specifically included in another bid item

1.3 REFERENCES

A. Abbreviations and Acronyms

1. SWPPP – Storm Water Pollution Prevention Plan
2. SWQMP – Storm Water Quality Management Plan
3. MUTCD – Manual on Uniform Traffic Control Devices
4. TCEQ – Texas Commission on Environmental Quality
5. pH – Potential of Hydrogen

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. Tree Care Industry Association (TCIA) / American National Standards Institute (ANSI):
 - a. A300, Tree, Shrub, and Other Woody Plant Management – Standard Practices (Pruning).
3. National Arborist Association Pruning Standards
4. Texas Manual on Uniform Traffic Control Devices (TMUTCD).
5. City of League City Development Code

1.4 ADMINISTRATIVE REQUIREMENTS

A. Disposal Letter

1. Provide the City with a Disposal Letter in accordance with Division 01.

B. Permits

1. TCEQ Permit, TXR15000, Notice of Intent (NOI) and Construction Site Notice (CSN).
2. Follow the City Policy and Procedure for Stormwater Activities
3. For commercial and residential construction, a Clear and Grade Permit is required to be obtained from City.
 - a. No excavation or embankment activities will be allowed without an executed construction contract and an assigned City inspector.
 - b. Remove and replace any embanked soils if excavation and/or embankment activities are performed prior to an executed construction contract and an assigned City inspector at no cost to the City.
4. Tree Removal Permit in accordance with the City of League City Development Code is required.
5. Tree Inventory Plan prepared in accordance with the City of League City Development Code or as specified in the Drawings.
 - a. Provide Tree Inventory Plan sufficient for the purposes of obtaining a Tree Removal Permit.
 - 1) If insufficient, provide a Tree Inventory Plan that has been prepared by an arborist or a registered landscape architect.
 - b. Provide the City with the correct documents for obtaining the Tree Removal Permit.
6. SWPPP – Provide a SWPPP in accordance with Section 01 57 13.

C. Pre-Construction Meeting

1. Hold a pre-construction meeting prior to performing any tasks included under Site Clearing with City and appropriate representatives.
2. Clearly mark all:
 - a. Trees and shrubs to remain
 - b. Trees and shrubs to remove
 - c. Trees and shrubs to be pruned pre and post construction as specified in the Drawings.
3. Have the SWPPP in place and inspected by Stormwater Coordinator prior to Site Clearing activities.
4. Review Tree Inventory Plan as prepared for Tree Removal Permit or in the Drawings.
5. Confirm approval of the Tree Removal Permit.
6. Confirm trees and shrubs to be removed during pre-construction meeting
7. Confirm limits for Site Preparation during pre-construction meeting.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data:
 1. Tree wound treatment material product data
- B. Informational Submittal

1. SWPPP Manual, NOI, CSN and TCEQ Permit
2. Wetlands Delineation Report
3. Threatened Endangered Species Report
4. Certificates
 - a. Certified Arborist
 - 1) A company with a certified arborist is required when performing Tree and Shrub Pruning. Provide the certificate of the employee(s) from the company performing the pruning.
5. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Certifications
 1. Conduct weekly inspection by the General Contractor and/or Developer.
 2. Tree and Shrub Pruning
 - a. Comply with requirements of League City Tree Disposition Permit.
 3. Tree Inventory Plan or Tree Disposition Permit
 - a. Apply for and obtain a Tree Disposition permit as required by the City Arborist.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS

- A. Maintenance of BMPs.
- B. An ISA Certified Arborist is required to be on site during all pruning activities.
- C. Avoid pruning between February and July.
 1. When pruning activities need to occur between February and July, use an approved wound treatment material.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 PRODUCTS

- A. Tree Wound Treatment
 1. Provide in accordance with Standard Product List or approved equal.
- B. Root Barrier

1. Provide in accordance with Standard Product List or approved equal.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 EXECUTION

A. General

1. Removal
 - a. Notify the City in writing when items required to be removed are:
 - 1) Buried and not easily detected from the surface
 - 2) Not specified in the Drawings.
2. Accept ownership and dispose of all materials removed within project limits.
3. Plug remaining ends of abandoned underground utilities over 3 inches in diameter with concrete to form a tight closure.
4. Backfill, compact, and restore areas where items have been removed unless otherwise specified in the Drawings.
5. Do not remove any trees unless directed by City or as specified in the Drawings.
6. Dispose of all trees within 24 hours of removal. Longer durations may be allowed if prior written approval from the City engineer.
7. Dispose of all material in accordance with Federal, State, and local laws and regulations.

B. Hazardous Material

1. This item does not include the removal and disposal of hazardous material.
2. Notify the City immediately if any hazardous or questionable materials not shown in the Drawings are encountered.
3. Test, remove, and dispose of hazardous material in accordance with City requirements.

C. Tree and Shrub Protection

1. General
 - a. Perform all excavation and earthwork within the drip line of trees by hand.
 - b. Do not park or service equipment, store materials, or disturb the root area under the branches of trees designated to remain.
 - c. Protect trees designated to remain during construction activity from:
 - 1) Compaction of root area by material storage
 - 2) Compaction by driving or parking within the dripline
 - 3) Trunk damage by moving equipment, material storage, nailing, or bolting
 - 4) Girding by tying constrictive material to trees
 - 5) Poisoning by pouring solvents, gas, paint, etc. on or around trees and roots
 - 6) Cutting of roots 1.5 inch in diameter or more.

- 7) Changes of soil pH factor by disposal of lime-based material such as concrete within the drip line.
- 8) Deformation or permanent damage to the trunk or limbs
- d. Treatment of Damaged Limbs
 - 1) Saw clean all damaged areas and damaged limbs over 1 inch in diameter and treat with an approved wound treatment material.
 - 2) Treat with an approved wound treatment within 20 minutes of damaging the tree.
- 2. Tree Protection Fence
 - a. Install tree protection fence at the drip line around trees designated to be protected in Drawings.
 - b. If field conditions do not allow fencing to be installed at the drip line, obtain City approval to install tree protection fencing at a minimum of 8 feet from the trunk.
 - c. Provide “Keep Out. Tree Preservation” signs for protected trees.
 - d. Use the following to construct the Tree Protection Fence unless otherwise specified in Drawings
 - 1) Woven wire fence installed with T-Bar posts
 - 2) Space T-Bar posts at 10 feet on center
 - 3) Place one strand barbed wire along the top of poses.
 - 4) Tie tundra weight orange flagging that is 2 feet in length at 3 feet on center along the woven wire.
 - e. Do not install mulch within 12 inches of tree trunk.
 - f. Maintain existing grade within the tree protection fence unless otherwise specified in Drawings.
- 3. Trunk Protection
 - a. Install Trunk Protection as specified in Drawings.
 - b. Use the following to construct the Trunk Protection unless otherwise specified in Drawings
 - 1) Closed cell foam pad around trunk
 - a) Extend the foam pad 6 inches above and 6 inches below the wood planks.
 - 2) 4-foot-long planks that are 4 inches wide and 2 inches thick. Staple planks together using steel straps on top of the foam pad and around the trunk.
 - c. Mulch:
 - 1) Provide a 2-foot-wide mulch barrier around the tree trunk.
 - d. Provide “Caution. Tree Protection Area” orange tape around protected tree trunks.
- D. Tree and Shrub Removal
 - 1. Remove tree stumps:
 - a. To 12 inches or more below the finished grade.
 - b. To natural ground when area will be covered by 3 feet or more of embankment
 - c. Completely remove all stumps and roots when the area will be used as borrow or embankment within the project limits.
 - 2. Backfill holes with acceptable material and compact flush with surrounding area.
 - 3. Install topsoil and sod, or hydromulch, within limits of tree and shrub removal unless topsoil and sod will be installed as part of the project.
- E. Tree and Shrub Pruning
 - 1. Equipment:
 - a. Use a Vermeer V-1550 RC root pruner or equal to perform all root pruning operations.

2. Use tree wound treatment when pruning trees or shrubs during the months of February to July.
 3. Perform all tree, shrub, and root pruning under the supervision of a certified arborist.
 4. Prune lower limbs to prevent breakage and to permit access by construction machinery during grading, field/site preparation, and clearing and grubbing operations.
 5. Prune limbs in accordance with ANSI A300 and National Arborist Association Pruning Standards.
 6. Prune shade trees in accordance with Class IV National Arborist Association Pruning Standards
 7. Make cuts as close as possible to the trunk or parent limb without cutting into the limb collar or leaving a protruding stub.
 8. Remove branch shoots to the height of the lowest main branch.
 9. Disinfect tools with 70 percent methyl alcohol, benzalkonium chloride, choline solution, or other approved disinfectant prior to:
 - a. Pruning oak trees
 - b. Cutting any tree of different type than previous tree pruned
 10. Tree pruning on 2-inch diameter or larger trees:
 - a. Undercut one-third through the limb 8 to 12 inches from the main stem
 - b. Remove limb 4 to 6 inches outside the first cut.
 - c. Remove stub with an even flush cut so that the limb collar protrudes approximately 0.5 inch
 - d. Do not allow limb to fall free if it could damage any other limbs or items
 - e. Treat exposed cuts with wound treatment within 20 minutes of the cut
- F. Debris Removal and Ponding
1. All stump roots and debris in areas required for roadways, channels, or structural excavation, shall be removed to a minimum depth of 2 feet below the lowest elevation of excavation
 2. Grade right of way to prevent ponding of water and to provide proper drainage.

3.5 REPAIR

- A. Repair the following at no cost to the City if any damaged due to Site Clearing activities:
1. Adjacent concrete or asphalt pavement
 2. Adjacent sidewalk
 3. Adjacent curb or curb and gutter
 4. Subgrade or base material
 5. Utility piping, structures, and appurtenances
 6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
 7. Landscape beds or planters
 8. Decorative hardscape or landscape features
 9. Retaining walls
 10. Trees, shrubs, sodding, and topsoil
- B. Tree Replacement

1. Replace any existing tree permanently damaged by construction activities at no cost to the City. Replace tree with an equal or larger caliper tree.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 23 16

UNCLASSIFIED EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation for general site grading, street grading, and channel excavation.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 02 41 13 – Selective Site Demolition.
 - 2. Section 02 41 15 – Paving Removal.
 - 3. Section 31 00 00 – Site Clearing.
 - 4. Section 31 24 00 – Embankments.
 - 5. Section 31 25 14 – Erosion and Sedimentation Controls.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Unclassified Excavation
 - a. Measurement
 - 1) Measured per cubic yard in its final position using the average end area method of Excavation performed. Limits of measurement shown in the Drawings.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per cubic yard for “Unclassified Excavation.”
 - c. The price bid shall include:
 - 1) Shrinkage and/or swelling factors. Contractor is responsible for determining factors and will not be compensated separately.
 - 2) Excavation of all materials within excavation limits
 - 3) Finishing parkways and medians
 - 4) Excavation
 - 5) Safety
 - 6) Dewatering
 - 7) Temporary drainage
 - 8) Drying
 - 9) Dust control
 - 10) Reworking or replacing over excavated material in rock cuts
 - 11) Placement
 - 12) Compaction
 - 13) Loading, hauling, and unloading
 - 14) Disposal of unsuitable and excess materials not used elsewhere on the job site

- 15) Finishing slopes, ditches, and channels
- 16) Maintenance blading or scarifying the ground surface
- 17) Equipment
- 18) Tools, equipment, and labor and incidentals needed to execute work

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. ROW: Right-of-Way
- 2. SWPPP: Storm Water Pollution Prevention Plan

B. Classification:

- 1. All authorized excavation is considered unclassified and involves removal of all materials necessary to complete excavation of the site. Any reference to rock, limestone, or other material on the Drawings and/or this specification is solely for the City and the Contractor's information and is not to be taken as an indication or guarantee of classification of excavation. Payment will not be separated based on classification of excavation unless expressly noted in the Drawings.

C. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - a. Occupational Safety and Health Administration (OSHA):
 - 1) Technical Manual Section 5.
 - 2) Laws and Regulations Standard 1926, Occupational Safety and Health Regulations for Construction.
 - b. City of League City Unified Development Code

1.4 ADMINISTRATIVE REQUIREMENTS

A. Permits

- 1. For commercial and residential construction, a Clear and Grade Permit is required, if work is not already included in other City Engineer approved documents.
 - a. No excavation or embankment activities will be allowed without an executed construction contract and an assigned City inspector.
 - b. If the City determines or suspects excavation and/or embankment activities have occurred prior to an executed contract and a City inspector assigned, all construction activities could be suspended for at least 30 days pending the results of the Pre-Construction meeting.
 - c. Any damages caused by early clearing and grading activities will be repaired at no cost to the City.

B. Sequencing

- 1. Sidewalk Construction
 - a. Where existing sidewalks are to be closed during Paving Removal activities:
 - 1) Utilize pedestrian/sidewalk detour route specified in the Drawings
 - a) If no detour route is provided, submit a pedestrian/sidewalk detour route to City for review.
 - b. The pedestrian/sidewalk detour route will be subsidiary to pertinent Traffic Control items included with the project.

- c. Install all sidewalk detours and closures in accordance with the TMUTCD, State, and local guidelines.
- d. Provide any traffic control devices as required by the City.

C. Pre-Construction Meeting

- 1. Hold a Pre-Construction meeting. Invite the City and appropriate representatives.
- 2. Clearly mark all the following items prior to the meeting:
 - a. All requirements for pre-construction meeting in accordance with 31 10 00.
 - b. Excavation limits
 - c. Cut/fill stakes
- 3. Submit means and methods for any rock cutting for review prior to the Pre-Earthwork Meeting.
- 4. Have the SWPPP in place and inspected by Stormwater Coordinator in accordance with Section 01 57 13 prior to excavation activities.
- 5. Determine any site-specific constraints or concerns prior to meeting for review.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Informational Submittal

- 1. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use
- 2. Explosives, Blasting, and Rock Ripping
 - a. Submit storage locations and guidelines for using explosives.
 - b. For rock ripping and blasting, submit means and methods prior to Pre-Earthwork meeting for review.
 - c. Provide a list of personnel and employer who will be handling and using explosives. Provide reference information including previous projects and certifications proving explosive qualifications.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Excavation Safety

- 1. Perform all excavations in a safe manner.
- 2. Comply with the requirements of OSHA 29 CFR part 1926 and state requirements when performing excavation, sheeting, and bracing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material prior to any excavation activities beginning in accordance with Section 01 66 00.
2. Store excavated material to be used in other areas within the right-of-way (ROW) or property boundary or easement limits unless specifically disallowed in the Contract Documents.
 - a. No material shall be delivered to a city resident lot(s) without approval of Grading/fill permit
 - b. Storage of excavated material shall follow City's Stockpiled Material Policy.
3. Store material and equipment in approved areas that are at least 30 feet from edge of construction limits. Install erosion control fencing around staging areas.
4. For urban areas with limited staging areas, designate offsite location for storing and staging of materials and equipment. If this is not feasible, obtain approval from the City to stage and store materials within project site.
5. All offsite staging areas to be in accordance with SWPPP and Erosion Control requirements. Offsite staging areas are considered part of the project site and will need to be included with the SWPPP and Stormwater review.
6. If excavated material is stored off-site:
 - a. Provide an authorized letter from property owner approving the storage of excavated materials.
 - b. Contractor is responsible for negotiating and coordinating with the property owner.
 - c. The City is not responsible for establishing an off-site location.
 - d. The City is not liable for any damage resulting in off-site storage of excavated materials.
7. Remove any excavated material not used in other areas within 48 hours of excavation activities.
8. Do not block drainage ways, inlets, or driveways with excavation activities or materials.
9. Provide erosion control in accordance with Section 31 25 14.
10. Store materials only in areas barricaded as provided in the traffic control plans or as approved by the City if excavation is performed during active traffic. During the night, no materials are allowed to be stored on the roadways.
11. Do not store material within the drip line of any tree or in landscaped areas.
12. Install tree protection in accordance with Section 31 10 00.

1.11 FIELD CONDITIONS

A. Existing Conditions

1. Any data provided regarding subsurface conditions of excavated material is not intended as a representation or warranty of accuracy or continuity of proposed excavated material.
2. The City is not responsible for interpretations or conclusions made by the Contractor regarding the existing material to be excavated.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-FURNISHED [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Surface Preparation

1. If needed, provide temporary drainage to maintain positive drainage throughout excavation activities. Any temporary drainage construction will be considered subsidiary to excavation.
2. Dewatering and temporary storm drain activities will be considered part of the SWPPP and Stormwater review and are required to be in accordance with all requirements listed therein.

B. Demolition / Removal

1. Remove any existing pavement in accordance with Section 02 41 13 and 02 41 15.

3.4 EXCAVATION

A. General

1. Accept ownership of unsuitable or excess material and dispose of material off-site in accordance with Federal, State, and local regulations. City is not responsible for any disposed material or disposal activities.
2. Perform excavation only when the material is dry. Material that has been sprayed with water for dust control is acceptable.
3. Contractor is responsible for the condition of the subgrade until the pavement is in place.
4. Over-excavate and replace any portion of subgrade that becomes damaged or unstable due to weather or construction activities prior to stabilizing the subgrade, installing base material, or placing the pavement. This will be at no cost to the City.
5. Separate, remove, and dispose of unacceptable fill material as defined in Section 31 24 00 in accordance with Federal, State, and local regulations.
6. Maintain positive drainage in the excavated area to avoid damage to any existing structures, proposed structures, and the roadway.
7. Shape slopes to avoid loosening material below or outside the proposed grade.

B. Earth Cut

1. Excavate to finish grade or subgrade within acceptable subgrade tolerances.
2. Use approved embankment material compacted in accordance with 31 24 00 to replace over-excavated material at no cost to City. Anticipated reasons for over excavation can include, but are not limited to:
 - a. Excavation below an acceptable subgrade tolerance
 - b. Soils damaged due to weather or construction activities
 - c. Root removal, stump removal, and abandoned utility removal

3. Shape and compact subgrade in accordance with Section 31 24 00.
4. Subgrade Tolerances
 - a. Excavate to within 0.1 foot in all directions.
 - b. In areas of over excavation, provide fill material approved by the City at no cost to City.

C. Rock Cut

1. Do not use dynamite or rock ripping within 500 feet of residences or commercial development.
2. Blasting
 - a. Obtain City approval prior to any blasting.
 - b. Send notification at least 15 days in advance to all property owners within 1,000 feet of the blasting site.
 - c. Follow all OSHA regulations for explosives and blasting agents, including but not limited to requirements in the OSHA Technical Manual Section 5, and OSHA Laws and Regulations Standard 1926, Safety and Health Regulations for Constructions.
 - d. Use only authorized workers with training, knowledge, or experience in the field of transporting, storing, handling, and use of explosives.
 - 1) Authorized workers also need to have working knowledge of State and local laws and regulations pertaining to explosives.
 - e. If there are concerns that seismic vibrations may cause damage to adjacent structures, provide:
 - 1) A structural engineer to determine safe limits to prevent any damage.
 - 2) All equipment, monitors, tools, and engineering design necessary at no cost to the City.
 - f. Use blasting mats or other approved containment equipment to ensure that no rocks or debris will be thrown into the air.
 - g. Comply with all City of League City noise ordinances when blasting.
3. Excavate to finish grade or subgrade within acceptable subgrade tolerances.
4. For small pockets or thin layers, remove rock to at least 12-inches below subgrade.
5. Use approved embankment material compacted in accordance with 31 24 00 to replace over excavated material at no cost to City.

D. Water for Construction

1. Provide water as needed for site preparation, compaction, dust control, and other incidental activities in accordance with local requirements in accordance with Section 01 35 13.

E. Dewatering

1. Dewatering is subsidiary to excavation and includes the installation and operation of all pumping, bailing, well-pointing, sumps, and draining necessary to keep the excavation free from groundwater, seepage water, water from storm drains, wastewater collection systems, ditches, creeks, ponds, and other sources.
2. Keep channels, trenches, pits, and other low point excavations drained as much as practical during construction at no cost to the City.
3. Construction will not be permitted in standing water.
4. Conform all discharge from dewatering activities to Federal, State, and local requirements in a manner approved by the City.
5. Control outlet velocities from dewatering discharges to prevent erosion. Desilting bag is an allowable method.

F. Excavated Material

1. Maintain safe and convenient access to private and public properties adjacent to excavation activities unless specified in the Drawings. Obtain approval from the City for maintenance of access methods.
2. Acceptable fill material may be used for embankment in accordance with 31 24 00.
3. Stockpile acceptable excavated materials on-site in accordance with Sections 31 10 00 and 31 24 00. Proper erosion control and BMPs to be utilized in accordance with the drawings approved by City, TCEQ regulations, and Section 31 25 14.

G. Methods of Excavation

1. Submit means and methods for review by the City prior for any method of excavation that is not using traditional excavation methods.
2. Comply with all Federal, State, and local regulations when developing and submitting for approval any alternative method.
3. If an alternative method is requested and approved after contract execution, perform excavation at no additional cost to the City beyond the stated excavation unit price in the bid form.

3.5 REPAIR

A. Repair the following at no cost to the City if any damage is caused due to excavation activities:

1. Adjacent concrete or asphalt pavement to remain
2. Adjacent sidewalk to remain
3. Adjacent curb or curb and gutter to remain
4. Adjacent subgrade or base material to remain
5. Utility piping, structures, and appurtenances
6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
7. Landscape beds or planters
8. Decorative hardscape or landscape features
9. Retaining walls
10. Mail boxes
11. Fences
12. Light poles

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 23 22
CEMENT STABILIZED SAND

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Includes requirements for furnishing cement stabilized sand.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES

A. Reference Standards

1. ASTM C 123 - Lightweight Pieces in Aggregate.
2. ASTM C 142 - Clay Lumps and Friable Particles in Aggregates.
3. ASTM C 150 - Portland Cement.
4. ASTM D 558 - Moisture-Density Relations of Soil-Cement-Mixtures.
5. ASTM D698 - Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lb/ft³ (600kN-m/m³)).
6. ASTM D 1633 - Compressive Strength of Molded Soil-Cement Cylinders.
7. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
8. ASTM D 4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Refer to Section 01 33 00 - Submittal Procedures.
- B. Submit proposed design mix, test data for sand/cement mixture and sample batch ticket for City Engineer review and approval. or per ton of product, batch date and time and weight of load to City Engineer at time of delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Materials

1. Cement - ASTM C 150, Type I.
2. Sand - Clean, durable sand: ASTM D 2487, classified as SW, SP, SC or SM by the Unified Soils Classification System.
3. Deleterious materials: Clay lumps - ASTM C 142, less than 0.5 percent.
4. Lightweight pieces - ASTM C 123, less than 5.0 percent.
5. Organic impurities - ASTM C 40, color no darker than the standard color.
6. Plasticity index - ASTM D 4318, of 4 or less.
7. Water - ASTM C 94.

B. Design

1. Design sand/cement mixture to produce a minimum unconfined compressive strength of 200 psi in 48 hours when compacted to 95 percent maximum standard dry density in accordance with ASTM D 558.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Refer to Section 01 45 23 – Testing and Inspection Services.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Installation

1. Perform molding, curing and compression testing in accordance with ASTM D 1633 - Method A.
2. Add required amount of water and mix it thoroughly in pugmill-type mixer.

B. Placement

1. Place sand/cement mixture for free formed structures in 8-inch-thick loose layers and compact to not less than 95 percent maximum standard dry density (ASTM D 698) unless otherwise specified.
2. The moisture content during compaction shall be on the dry side of optimum but sufficient for hydration.
3. Perform and complete compaction of sand/cement mixture within 4 hours after addition of water to mix at the plant.
4. Do not place or compact sand/cement mixture in standing or free water.

3.5 [REPAIR] / [RESTORATION] [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Non-Conforming Work

1. Material not placed and compacted within 4 hours after mixing will be considered nonconforming.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING

A. Adjustment for Deficient Strength

1. When mixture produces 7-day compressive strength greater than or equal to 200 psi, then material will be considered satisfactory and bid price will be paid in full.
2. When mixture produces 7-day compressive strength less than 200 psi and greater than or equal to 140 psi, material shall be accepted contingent on credit in payment.
3. Compute credit by the following formula: $\text{Credit per Pay Item} = \$(\text{Bid Amount}) \times [(2 (200 \text{ psi} - \text{actual psi at 48 hours})) / 200]$ To use this formula, Bid Amount refers to the unit price of the related Pay Item (CMP, RCP, RCB, etc.) Credit per Pay Item refer to the amount to be deducted, per unit from the unit price of the related Pay Item.
4. When mixture produces 2-day compressive strength less than 140 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary Work at no cost to the City.

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES

A. Acceptance

1. Strength level of material will be considered satisfactory if: The average 48-hour strength is greater than 200 psi with no individual strength test below 140 psi.
2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 200 psi.
3. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 200 psi but greater than 140 psi.
4. See Paragraph 3.5 Adjustment for Deficient Strength.
5. The material will be considered unacceptable and subject to removal and replacement tests (average of two specimens) have 7-day strength less than 140 psi.
6. When moving average of three daily 48-hour averages falls below 200 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 200 psi at 48 hours.

7. At no cost to the City, five 48-hour strength tests shall be made in this determination with no individual strength tests less than 200 psi.
8. Testing laboratory shall notify Contractor, Project Manager, and material supplier of tests indicating results falling below specified strength requirements within 24 hours.
9. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense and with Engineer approval, request test of cores drilled from the area in question in accordance with ASTM C42.
10. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.4.A.
11. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 200 psi and if no single core is less than 140 psi.
12. Additional testing of cores extracted from locations represented by erratic core strength results will not be permitted.

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 24 00

EMBANKMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing, placing, and compacting approved soils for construction.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Embankment

- a. Measurement

- 1) Measured per cubic yard in its final position using the average end area method of Embankment performed. Limits of measurement shown in the Drawings.

- b. Payment

- 1) The work performed in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per cubic yard for “Embankment.”

- c. The price bid shall include:

- 1) Transporting or hauling material
 - 2) Placing, compacting, and finishing Embankment
 - 3) Construction Water
 - 4) Dust Control
 - 5) Proof Rolling
 - 6) Disposal of excess materials
 - 7) Reworking or replacement of undercut material
 - 8) Erosion Control
 - 9) Clean-up

2. Select Fill Embankment

- a. Measurement

- 1) Measured cubic yard in its final position using the average end area method of Select Fill Embankment performed. Limits of measurement shown in the Drawings.

- b. Payment

- 1) The work performed in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per cubic yard for “Select Fill Embankment”.

- c. The price bid shall include:

- 1) Transporting or hauling material
 - 2) Placing, compacting, and finishing Embankment
 - 3) Construction Water
 - 4) Dust Control
 - 5) Clean-up

- 6) Proof Rolling
- 7) Disposal of excess materials
- 8) Reworking or replacement of undercut material

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. ASTM Standards:
 - a. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - b. D4318, Test Procedure for Determining Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - c. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - d. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Permits

1. For commercial and residential construction, a Clear and Grade Permit is required, if work is not already included in other City Engineer approved documents.
 - a. No excavation or embankment activities will be allowed without an executed construction contract and an assigned City inspector.
 - b. Any excavation or embankment activities performed prior to an executed construction contract and an assigned City inspector is subject to additional testing, compaction, and site requirements at no cost to the City.

B. Sequencing

1. Install all erosion control measures in accordance with Section 31 25 14 prior to commencing any earthwork activities.
2. Complete all site clearing in accordance with Section 31 10 00 prior to commencing any earthwork activities.

C. Pre-Construction Meeting

1. A Pre-Construction Meeting is required for Capital Improvement projects.
2. Hold a Pre-Construction meeting. Invite the City and appropriate representatives.
3. Clearly mark all the following items prior to the meeting
 - a. All requirements for pre-construction meeting in accordance with 31 10 00.
 - b. Excavation limits
 - c. Cut/fill stakes
4. Have the SWPPP in place and inspected by Stormwater Coordinator in accordance with Section 01 57 13 prior to Excavation activities.
5. Determine any site-specific constraints or concerns prior to meeting for review.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to commencement of any lime treating activities.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Information Submittal
 - 1. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS

- A. Test and Evaluation Reports
 - 1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
 - 2. Within Existing Rights-of-Way (ROW)
 - a. Store soil within existing ROW, easements, or temporary construction easements, unless specifically disallowed in the Contract Documents.
 - b. Do not block drainage ways, inlets, or driveways.
 - c. When the Work is performed in active traffic areas, store materials only in areas barricaded as provided in the traffic control plans.
 - d. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.
 - 3. Designated Storage Areas
 - a. If the Contract Documents do not allow the storage within the ROW, easement or temporary construction easement, secure and maintain an adequate storage location.
 - b. Provide an affidavit verifying rights have been secured to store the materials on private property.
 - c. Do not block drainage ways.
 - d. Follow all requirements outlined in the City's Stockpiling Policy.

1.11 FIELD CONDITIONS

- A. Ambient Conditions
 - 1. Surface temperature must be at least 40°F and the ambient temperature must be 45°F and rising.
 - 2. Do not install embankment during or shortly after rain events which prevent proper work placement of the material and compaction.

- a. Prior to resuming compaction operations:
 - 1) Let soil dry to optimal density.
 - 2) Remove muddy material off the surface to expose firm and compacted materials.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. General

1. Furnish material capable of forming a stable embankment.
2. Furnish material free from trees, stumps, roots, vegetation, or other deleterious materials.

B. Acceptable Fill Material

1. In-situ or imported soils classified as CL, CH, SC, or GC in accordance with ASTM D2487.
2. Free from deleterious materials, boulders over 6 inches in size, and organics.
3. Can be placed free from voids.
4. Has 20 percent passing the number 200 sieve.
5. Meets the requirements of Table 1.

Table 1 – Acceptable Fill Material Requirements

Property	Test Method	Specification Limit
Liquid Limit (LL)	Tex-104-E	≤ 50
Plasticity Index (PI)	Tex-106-E	≤ 35
Sulfate Limit	Tex-145-E	≤ 3000 ppm
Bar Linear Shrinkage	Tex-107-E	≥ 2

C. Blended Fill Material

1. In-situ soils classified as SP, SM, GP, or GM in accordance with ASTM D2487.
2. Blended with in-situ or imported Acceptable Fill material in accordance with the requirements of this Section.
3. Free from deleterious materials, boulders over 6 inches in size, and organics.
4. Has 20 percent passing the number 200 sieve.
5. Final blended product meets the requirements of Table 1.

D. Unacceptable Fill Material

1. In-situ soils classified as ML, MH, PT, OL, or OH in accordance with ASTM D2487

E. Select Fill Material

1. Classified as SC or CL in accordance with ASTM D2487
2. Free from deleterious materials, boulders over 6 inches in size, and organics.
3. Can be placed free from voids.

4. Has 20 percent passing the number 200 sieve.
5. Meets the requirements of Table 2.

Table 2 – Select Fill Material Requirements

Property	Test Method	Specification Limit
Liquid Limit (LL)	Tex-104-E	≤ 35
Plasticity Index (PI)	Tex-106-E	≤ 20
Sulfate Limit	Tex-145-E	≤ 2000 ppm
Bar Linear Shrinkage	Tex-107-E	≥ 2

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

- A. Borrow material shall be tested prior to delivery to the Site.
 1. Provide Proctor Test results, Gradation, and Atterberg Limits for Borrow material from each source.
 - a. All testing listed above shall be performed in accordance with ASTM D698, D6913, and D4318 respectively.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Protection of In-Place Conditions
 1. Pavement
 - a. Conduct activities in such a way that does not damage existing pavement designated to remain.
 - b. Repair or replace any pavement damaged due to the negligence of the contractor outside the limits designated for pavement removal at no additional cost.
 2. Trees
 - a. Flag and protect all trees designated to remain in accordance with Section 31 10 00.
 - b. Conduct embankments in a manner such that there is no damage to the tree canopy.
 - c. Prune or trim tree limbs as specified in the Drawings or as directed by City.
 - 1) Pruning or trimming may only be accomplished with equipment specifically designed for tree pruning or trimming.
 3. Above ground Structures
 - a. Protect all above ground structures adjacent to the construction.

B. Surface Preparation

1. Backfill stump holes or other small incidental excavations due to site clearing with material of same properties as in-situ material.
2. Scarify base soil surface on which the embankment will be constructed to a minimum depth of 6 inches.
3. Bench slopes before placing new material.

3.4 EMBANKMENT

A. General

1. Provide material type as specified in the Drawings.
2. Begin filling in the lowest section or the toe of the work area.
3. When fill is placed directly or upon older fill, remove debris and any loose material and proof roll existing surface.
4. After spreading the loose lifts to required thickness and adjusting its moisture content as necessary, simultaneously recompact scarified material with the placed embankment material.
5. Compact material in loose lifts no greater than 8 inches.
6. Roll with enough passes to achieve the minimum required compaction.
7. Provide water sprinkled as necessary to achieve required moisture levels for specified compaction.
8. Do not add additional lifts until the entire previous lift is properly compacted.

B. Surface Water Control

1. Grade surface horizontally but provide with sufficient longitudinal and transverse slope to allow for runoff of surface water from every point.
2. Conduct fills so no obstruction to drainage from any other sections of fill is created.
3. Install temporary dewatering sumps in low areas during filling where excess amounts of runoff collect.
4. Compact uniformly throughout. Keep surfaces of fill reasonably smooth and free from humps and hollows that would prevent proper uniform compaction.

C. Earth Embankments

1. Construct embankments in successive layers, evenly distributing materials in lengths suited for sprinkling and rolling.
2. Move the material dumped in piles or windrows by blading or by similar methods and incorporate it into uniform layers.
3. Construct embankments in layers approximately parallel to the finished grade of the street.
4. Featheredge or mix abutting layers of dissimilar material for at least 100 feet to ensure no abrupt changes in the material.
5. Break down clods or lumps of material and mix embankment until a uniform material is attained.
6. Establish grade and shape to the typical sections specified in the Drawings.
7. Maintain finished sections of embankment to the grade and compaction requirements until the project is accepted.

D. Rock Embankments

1. Rock Embankments for roadways are only allowed when specified in the Drawings.
2. Construct rock embankments in successive layers for the full width of the roadway cross-section with a depth of 18 inches or less.
3. The layer depth for large rock sizes shall not exceed a depth of 18 inches in any case.
4. Fill voids created by the large stone matrix with smaller stones during the placement and filling operations.
5. Ensure the depth of the embankment layer is greater than the maximum dimension of any rock.
6. Do not place rock greater than 18 inches in its maximum dimension.
7. Do not place rock embankments in any location where future utilities are anticipated.
8. Construct the final layer with graded material so the density and uniformity is in accordance with compaction requirements.

E. Density Control

1. Determine maximum dry density and moisture content using ASTM D698 and submit moisture-density curves to City for review.
2. Compact each lift to meet the following requirements:
 - a. For soils with a PI less than 35, compact to 98% of maximum dry density, plus or minus 2%.
 - b. For soils with a PI greater than 35, compact to at least 98% of maximum dry density.

F. Maintenance of Moisture and Reworking

1. Maintain the density and moisture content once all requirements are met.
2. For soils with a PI greater than 15, maintain the moisture content no lower than 4 percentage points below optimum.
3. Rework the material to obtain specified compaction when the material loses the required stability, density, moisture, or finish.
4. Alter the compaction methods and procedures on subsequent work to obtain specified density as directed by City.

3.5 REPAIR

A. Repair the following at no cost to the City if any damage is caused due to Embankment activities:

1. Adjacent concrete or asphalt pavement to remain
2. Adjacent sidewalk to remain
3. Adjacent curb or curb and gutter to remain
4. Adjacent subgrade or base material to remain
5. Utility pipes
6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
7. Landscape beds or planters
8. Decorative hardscape or landscape features
9. Retaining walls

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Proctors
 - a. Perform Proctor Tests in accordance with ASTM D698.
 - b. Notify the City if the characteristic of the soil changes.
 - c. Perform new Proctors for varying soils:
 - 1) When indicated in the geotechnical investigation in the Appendix
 - 2) If notified by the Engineer
 - 3) At the convenience of the City
 - d. For Embankments where different soil types are present and are blended, the Proctors shall be based on the mixture of those soils.
2. Proof Rolling
 - a. City must be on-site during proof rolling operations.
 - b. Make at least two passes with the proof roller, offsetting each trip by at most one tire width.
 - c. Correct areas of rutting or pumping and unstable or non-uniform areas in accordance with this Section.
3. Density Testing of Embankments
 - a. Density Testing shall be in accordance with ASTM D6938.
 - b. City must be on site during density testing.
 - c. For Embankments under future pavement:
 - 1) Perform density testing twice per working day when compaction operations are being conducted.
 - 2) Measure density every 100' along corridor.
 - 3) City to determine density testing locations.
 - d. For Embankments not under future pavement or structures:
 - 1) The City will perform density testing once per working day when compaction operations are being conducted.
 - 2) Measure density every 250' along embankment.
 - 3) City to determine density testing locations.
 - e. Test reports shall include:
 - 1) Location of test by station number
 - 2) Time and date of test
 - 3) Depth of testing
 - 4) Field moisture
 - 5) Dry density
 - 6) Proctor identifier
 - 7) Percent Proctor Density

B. Non-Conforming Work

1. All non-conforming work shall be removed and replaced at no additional cost to the City.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 25 14
EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation and maintenance of temporary control measures necessary to prevent and control soil erosion, sedimentation, and water pollution.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Reinforced Silt Fence

a. Measurement

- 1) Measured per linear foot of Reinforced Silt Fence installed.

b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Reinforced Silt Fence" installed.

c. The price bid shall include:

- 1) Furnishing and installing Reinforced Silt Fence as specified by the Drawings
- 2) T-Posts
- 3) Filter fabric
- 4) Wire mesh
- 5) Fasteners
- 6) Stone overflows
- 7) Safety caps
- 8) Cleaning
- 9) Disposal of silt
- 10) Repair of damaged Silt Fence

2. Rock Filter Dam

a. Measurement

- 1) Measured per linear foot of Rock Filter Dam installed.

b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Rock Filter Dam" installed.

c. The price bid shall include:

- 1) Furnishing and installing Rock Filter Dam
- 2) Aggregate, wire reinforcement, and filter fabric
- 3) Excavation
- 4) Loading, unloading, hauling, and storing
- 5) Maintenance

- a) Disposal of silt
 - b) Repair of damaged Rock Filter Dam
- 3. Sediment Erosion Control Log
 - a. Measurement
 - 1) Measured per linear foot of Sediment Erosion Control Log installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Sediment Erosion Control Log” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Sediment Erosion Control Log
 - 2) Containment mesh
 - 3) Core material
 - 4) Post 1½” x 1½” x 18” minimum of wooden stake or metal T-post
 - 5) Rock bags
 - 6) Maintenance
 - a) Disposal of silt
 - b) Repair of damaged Organic Filter Tube
- 4. Inlet Protection
 - a. Measurement
 - 1) Measured per each of Inlet Protection installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for “Inlet Protection” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Inlet Protection as specified by the Drawings
 - 2) All items pertaining to Organic Filter Tubes or rock bags for erosion control as needed
 - 3) Loading, unloading, hauling, and storing
 - 4) Maintenance
 - a) Disposal of silt
 - b) Repair of damaged Inlet Protection items
- 5. Erosion Control Blanket
 - a. Measurement
 - 1) Measured per square yard of Erosion Control Blanket installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Erosion Control Blanket” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Erosion Control Blanket as specified by the Drawings
 - 2) Blanket and staples
 - 3) Loading, unloading, hauling, and storing
 - 4) Maintenance
 - a) Disposal of silt
 - b) Repair of damaged Erosion Control Blanket
- 6. Stabilized Construction Entrance/Exit

- a. Measurement
 - 1) This item is considered subsidiary to the various items bid, unless included as a specific pay item.
- b. Payment
 - 1) The work performed and the materials furnished in accordance with this item are subsidiary to the various items bid and no other compensation will be allowed.
- 7. Mulching
 - a. Measurement
 - 1) Measured square yard of Mulching installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Mulching" installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Mulching as specified by the Drawings
 - 2) Loading, unloading, hauling, and storing
- 8. Pipe Inlet Sediment Trap
 - a. Measurement
 - 1) Measured per each Pipe Inlet Sediment Trap installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each for "Pipe Inlet Sediment Trap" installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Pipe Inlet Sediment Trap as specified by the Drawings
 - 2) Filter stone
 - 3) Loading, unloading, hauling, and storing
 - 4) Maintenance
 - a) Disposal of silt
 - b) Repair of damaged Pipe Inlet Sediment Traps
- 9. Stone Outlet Sediment Trap
 - a. Measurement
 - 1) Measured per each Stone Outlet Sediment Trap installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each for "Stone Outlet Sediment Trap" installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Stone Outlet Sediment Trap as specified by the Drawings
 - 2) Filter stone
 - 3) Loading, unloading, hauling, and storing
 - 4) Cleaning
 - 5) Disposal of silt
 - 6) Repair of damaged Stone Outlet Sediment Traps
- 10. Turf Reinforcement Mat
 - a. Measurement
 - 1) Measured square yard of Turf Reinforcement Mat installed.
 - b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Turf Reinforcement Mat” installed.
- c. The price bid shall include:
 - 1) Furnishing and installing Turf Reinforcement Mat as specified by the Drawings
 - 2) Loading, unloading, hauling, and storing
 - 3) Cleaning
 - 4) Disposal of silt
 - 5) Repair of damaged Pipe Inlet Sediment Traps items
11. Dewatering Controls
 - a. Measurement
 - 1) This item is considered subsidiary to the various items bid.
 - b. Payment
 - 1) The work performed and the materials furnished in accordance with this item are subsidiary to the various items bid and no other compensation will be allowed.
12. Storm Water Pollution Prevention Device Installation
 - a. Measurement
 - 1) Measurement for this item shall be by lump sum.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item shall be paid for at the lump sum price bid for all “Storm Water Pollution Prevention Device Installation”.
 - c. The price bid shall include:
 - 1) Furnishing and installing all items and Best Management Practices (BMPs) under Storm Water Pollution Prevention Device Installation as specified by the Drawings
 - 2) Excavation
 - 3) Loading, unloading, hauling, and storing
 - 4) Cleaning
 - 5) Disposal of silt
 - 6) Repair of damaged Storm Water Pollution Prevention Devices
13. Remove Storm Water Pollution Prevention Devices
 - a. Measurement
 - 1) This item is considered subsidiary to the various items bid, unless included as a specific pay item.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item shall be paid for at the lump sum price bid for all “Remove Storm Water Pollution Prevention Devices.”
 - c. The price bid shall include:
 - 1) Removing all items previously installed as part of the Storm Water Pollution Prevention Plan as specified by the Drawings
 - 2) Loading, unloading, and hauling
 - 3) Cleaning
 - 4) Disposal of silt

1.3 REFERENCES

A.Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. Texas Department of Transportation, Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (TxDOT):
 - a. Item 169, Soil Retention Blankets.
3. Texas Department of Transportation (TxDOT), Departmental Material Specifications (DMS):
 - a. DMS-6200, Filter Fabric.
 - b. DMS-6230, Temporary Sediment Control Fence Fabric.
 - c. DMS-6370, Erosion Control Blankets.
4. NPDES and EPA

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing

1. Ensure erosion control measures are fully installed prior to any earth disturbing activities begin.
2. Contact Stormwater Coordinator for initial inspection prior to any earth disturbing activities.
3. On phased projects, final stabilization shall be completed and Erosion and Sediment Control devices removed from each phase as construction is completed.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Storm Water Pollution Prevention Plan (SWPPP) submittals in accordance with Section 01 57 13.

B. Storm Water Quality Management Plan (SWQMP)

C. Product Data

1. Provide product data from each manufacturer supplying Erosion and Sediment Control devices and accessories.
2. Product data sheets for all products to include:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Point of delivery
 - e. Data and test results as specified in this Section
 - f. Manufacturer Recommended Storing Data, if applicable
 - g. Application Recommendations, if applicable

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A.Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Store all storm water pollution prevention materials in accordance with manufacturer's recommendations.

1.11 SITE CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A.Reinforced Silt Fence

1. Fabric
 - a. Minimum 36-inches tall.
 - b. Provide fabric in accordance with the following criteria:

Property	Test Method	Specification Limit
Tensile Strength	ASTM D4632	90-lbs
Puncture Rating	ASTM D4833	60-lbs
Mullen Burst Rating	ASTM D3796	280-psi
Apparent Opening Size	ASTM D4751	Sieve No. 30 to No. 100
Ultraviolet Resistance	ASTM D4355	70 percent min

2. Posts
 - a. Provide steel T-section or L-section posts, 1.3 pounds per linear foot, and 4 feet in length minimum.
 - b. Provide plastic caps on all steel posts in areas exposed to pedestrian traffic.
 - c. Wood posts may be approved by City if project duration is expected to be less than 90 days.
3. Net Reinforcement
 - a. Provide net reinforcement of at least 12 gauge galvanized welded wire mesh, with a maximum opening size of 2x2 inches.
4. Stone Overflows
 - a. Provide 1 1/2 inch washed stone aggregate in accordance with Section 32 05 16.

B.Rock Filter Dam

1. Aggregate
 - a. Provide 3-to-6-inch aggregate in accordance with Section 32 05 16 for rock filter dam heights of 24 inches or less.
 - b. Provide 4-to-8-inch aggregate in accordance with Section 32 05 16 for rock filter dam heights greater than 24 inches in height.

2. Wire
 - a. If required, provide mesh consisting of minimum 20-gauge galvanized wire.
3. Fabric
 - a. For rock filter dams greater than 18 inches in height, provide filter fabric in accordance with the following criteria:

Property	Test Method	Specification Limit
Tensile Strength	ASTM D4632	250-lbs
Puncture Rating	ASTM D4833	135-lbs
Mullen Burst Rating	ASTM D3796	420-psi
Apparent Opening Size	ASTM D4751	Sieve No. 20 max
Ultraviolet Resistance	ASTM D4355	20 percent min

C.Organic Filter Tube

1. Containment Mesh
 - a. Provide biodegradable, photodegradable, or recyclable containment mesh with a minimum rated life of one year under normal site conditions, such as burlap, twine, UV photodegradable plastic, or polyester.
 - 1) Obtain approval from the City for use of any other material.
 - b. Provide recyclable containment mesh for temporary organic filter tube installation.
 - c. Provide biodegradable or photodegradable containment mesh when organic filter tube will remain in place as part of vegetative system.
2. Core Material
 - a. Provide biodegradable or recyclable core material such as compost, mulch, or coir.
 - 1) Obtain approval from the City for use of any other material.
3. Posts
 - a. Provide steel T-section or L-section posts, 1.3 pounds per linear foot or 2 inches by 2 inches wooden posts.
 - b. Provide posts at least 6 inches longer than the outside diameter of the Organic Filter Tube.

D.Inlet Protection

1. Provide Inlet Protection comprised of Organic Filter Tubes or rock bags for erosion control in accordance with this Section.

E.Erosion Control Blanket

1. Blanket
 - a. In accordance with DMS 6370.
2. Staples
 - a. In accordance with the Erosion Control Blanket manufacturer recommendations.

F. Stabilized Construction Exit

1. Aggregate
 - a. Provide 3-to-6-inch aggregate in accordance with Section 32 05 16.

G.Mulching

1. Provide type of organic mulching as specified in the Drawings.

H.Pipe Inlet Sediment Trap

1. Riprap
 - a. Provide 6-to-12-inch Dry Stone Riprap in accordance with Section 31 37 00.
2. Filter Stone
 - a. Provide 1 1/2 inch washed stone aggregate in accordance with Section 32 05 16.
3. Wire
 - a. Provide mesh consisting of minimum 20-gauge galvanized wire with 1/2 inch by 1/2 inch openings.
4. Fabric
 - a. Provide Filter Fabric meeting the following criteria:

Property	Test Method	Specification Limit
Tensile Strength	ASTM D4632	250-lbs
Puncture Rating	ASTM D4833	135-lbs
Mullen Burst Rating	ASTM D3796	420-psi
Apparent Opening Size	ASTM D4751	Sieve No. 20 max
Ultraviolet Resistance	ASTM D4355	20 percent min

5. Concrete Block
 - a. Provide standard 8-inch x 8-inch x 16-inch concrete masonry units in accordance with ASTM C139.

I. Stone Outlet Sediment Trap

1. Riprap
 - a. Provide 6-to-12-inch Dry Stone Riprap in accordance with Section 31 37 00.
2. Filter Stone
 - a. Provide 1 1/2 inch washed stone aggregate in accordance with Section 32 05 16.
3. Fabric
 - a. Provide Filter Fabric in accordance with the following criteria:

Property	Test Method	Specification Limit
Tensile Strength	ASTM D4632	250-lbs
Puncture Rating	ASTM D4833	135-lbs
Mullen Burst Rating	ASTM D3796	420-psi
Apparent Opening Size	ASTM D4751	Sieve No. 20 max
Ultraviolet Resistance	ASTM D4355	20 percent min

J. Turf Reinforcement Mat

1. Provide Turf Reinforcement Mats in accordance with TxDOT Item 169 Approved Products List, *Erosion Control Approved Products* and in accordance with the following criteria:

Property	Test Method	Specification Limit
Minimum Thickness	ASTM D6525	0.25 in
Ultraviolet Resistance	ASTM D4355	80 percent
Tensile Strength	ASTM D6818	175 lbs/ft

K. Dewatering Controls

1. Sediment Filter Bag

- a. Provide sediment filter bags made of non-woven, needle-punched, geotextile that meets the following criteria:

Property	Test Method	Specification Limit
Tensile Strength	ASTM D4632	250-lbs
Puncture Rating	ASTM D4833	135-lbs
Mullen Burst Rating	ASTM D3796	420-psi
Ultraviolet Resistance	ASTM D4355	20 percent min
Water Flow Rate	ASTM D4491	85 to 110 gpm/ft ²

2. Temporary Sediment Tank
 - a. Provide compartmented container with a storage volume equal to 1 cubic foot for each gallon per minute of pump discharge capacity.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.General

1. Remove trees, brush, stumps, and other objectionable material that will interfere with the construction of the erosion control measure.

B.Erosion Control Blanket

1. Remove rocks, dirt clods, stumps, and other objectionable material that will prevent the mat from lying in direct contact with the soil.

C.Mulching

1. Fertilize and treat soil prior to mulching installation when used with final vegetation.
 - a. Fertilization and soil treatment are not required when using mulching with hydroseeding or when seed is spread during winter months.

D.Turf Reinforcement Mat

1. Remove rocks, dirt clods, stumps, and other objectionable material that will prevent the mat from lying in direct contact with the soil.

3.4 INSTALLATION

A.Reinforced Silt Fence

1. Provide silt fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow.
2. Install posts 18 inches deep, maximum 6 feet on center.

3. Dig 6-inch x 6-inch trench on uphill side of fence and embed fabric and wire mesh. Backfill the trench.
4. Attach wire mesh reinforcement to posts with clips for metal T-posts or staples for wood posts in at least four equally spaced locations per post.
5. Fasten fabric to top of net reinforcement at a maximum spacing of 15 inches.
6. Locate splices in fabric at a post and provide a 6-foot overlap ensuring no leakage or bypass.
7. Install stone overflow structures at low points or spaced at approximately 300 feet if there is no apparent low point.
8. Turn last 10 feet of Reinforced Silt Fence slightly uphill to prevent bypass.
9. Repair or replace any posts, net reinforcement, or fabric that are bent, torn, or otherwise unable to function as intended in accordance with this Section.

B. Rock Filter Dam

1. Place the aggregate to the lines, height, and slopes specified in the Drawings.
2. Place Rock Filter Dams perpendicular to the direction of flow.

C. Sediment Erosion Control Log

1. Install Sediment Erosion Control Log near the downstream perimeter of a disturbed area to intercept sediment from sheet flow.
2. When placed on soil, excavate a 1-inch to 2-inch deep bedding trench along the length of the Sediment Erosion Control Log.
3. Secure Sediment Erosion Control Log using 1½" x 1½" x 18" wooden stakes or 18" metal T-posts to prevent displacement as a result of normal rain events, damage to the logs, and flow from penetrating under the logs.
 - a. Rock bags may be used in place of posts on paved surfaces.
4. Overlap ends of Organic Filter Tubes by at least 18 inches and secure ends together preventing gaps from forming.
5. Turn last 10 feet of Organic Filter Tubes slightly uphill to prevent bypass.

D. Inlet Protection

1. Install prefabricated inlet protection systems in accordance with manufacturer's instructions.
2. Install Organic Filter Tubes, rock bags, and filter fabric as specified in the Drawings and in accordance with this Section.
3. Install inlet protection systems to provide 2-inch overflow capability to allow storm water overflow during extreme storm events or when filter media on protection device clogs.

E. Erosion Control Blanket

1. Use an Erosion Control Blanket anywhere seeding is to be used, and the slope is steeper than a 6:1 slope.
2. Use Turf Reinforcement Mat when stabilizing slopes of 3:1 or steeper.
3. Provide blanket on sod locations only when specified in the Drawings.
4. Dig 6-inch trench along the entire perimeter of the installation area.
5. Lay Erosion Control Blanket into trench and backfill with compacted soil.
6. Fasten Erosion Control Blanket in accordance with manufacturer's instructions.

7. Ensure staples are installed parallel to the direction of flow.
8. Overlap ends of Erosion Control Blanket by a minimum of 3 feet, and longitudinal edges by 6 inches.
9. Staple Erosion Control Blanket at all critical channel points and all overlaps.

F. Stabilized Construction Entrance/Exit

1. Install stabilized construction exit as specified in the Drawings.
2. Install stabilized construction exits at any point where traffic will be leaving a construction site to or from a street, alley, sidewalk, or parking area.
3. Slope stabilized construction exit away from offsite paved surfaces or incorporate a drainage swale to prevent runoff from leaving the construction site.
4. Do not place stabilized construction exits at the lowest point on the construction site or on top of utility lines.
5. Minimum width of 20 feet for residential and 30 feet for commercial.

G. Mulching

1. Spread organic mulch by hand or mechanical means providing complete, uniform coverage of the specified area.
2. Install mulching to a thickness between 1 to 2 inches.
3. Anchor mulching by application of fiber mulch binder, synthetic mulch binder, using a tractor-drawn crimper to punch into the soil, or by placing netting above the mulch and stapled into the ground when placed on slopes of 3:1 or steeper.
4. Do not use mulching on slopes of 1.5:1 or steeper.

H. Pipe Inlet Sediment Trap

1. Install pipe inlet sediment trap as specified in the Drawings.
2. Provide a stormwater and sediment storage area upslope of the pipe inlet sediment trap to a minimum volume equal to the runoff calculated from the temporary control design storm.
3. Provide side slopes surrounding the storage area at 3:1 or flatter.
4. Install the pipe inlet sediment trap to a maximum height of half the inlet pipe diameter.
5. Install pipe inlet sediment trap to provide 2-inch overflow capability to allow storm water overflow during extreme storm events or when filter media on protection device clogs.

I. Stone Outlet Sediment Trap

1. Install stone outlet sediment trap as specified in the Drawings.
2. Provide a stormwater and sediment storage area upslope of the pipe inlet sediment trap to a minimum volume equal to the runoff calculated from the temporary control design storm.
3. Install the pipe inlet sediment trap to a maximum height of half the inlet pipe diameter.
4. Grade side slopes surrounding the storage area at 3:1 or flatter.
5. Install pipe inlet sediment trap to provide 2-inch overflow capability to allow storm water overflow during extreme storm events or when filter media on protection device clogs.

J. Turf Reinforcement Mat

1. Install turf reinforcement mats as specified in the Drawings and manufacturer's recommendations.

2. Install turf reinforcement mats immediately after completing grading of the slope or channel, and at most within 7 days after completing the grading.
3. Install turf reinforcement mats vertically down slope on steep cut/fill slopes, embankments, and steep channel slopes above the water surface level.
4. Install turf reinforcement mats horizontally (parallel to flow) for channel slopes below the water surface level.
5. Dig 6-inch trench along the entire perimeter of the installation area.
6. Lay turf reinforcement mat into trench and backfill with compacted soil.
7. Fasten turf reinforcement mat in accordance with manufacturer's instructions.
8. Ensure staples are installed parallel to the direction of flow.
9. Overlap ends of turf reinforcement mat by a minimum of 3 feet, and longitudinal edges by 6 inches.
10. Staple turf reinforcement mat at all critical channel points and all overlaps.

3.5 REPAIR

1. Repair any controls determined to no longer be functioning as intended in accordance with this Section.
2. Repair devices as soon as exposed ground has dried sufficiently to prevent further damage from equipment operations needed for repairs.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Inspections

1. Inspect all best management practices at least once every 7 calendar days with Stormwater Coordinator.
2. Inspect dewatering pumps and sediment controls hourly while pumps are in operation.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE

A. General

1. If a storm water pollution prevention control ceases to function as intended, repair and replace the device or any portions necessary. Repeated failure indicates a device is insufficient and additional or different Erosion and Sediment Control devices must be selected.
2. Remove sediment, debris, and litter from all devices as necessary to maintain intended operation.

3. Continue maintenance of all erosion and sediment control devices until vegetative cover reaches 70 percent density, as determined by the City.

B. Rock Filter Dam

1. Remove silt when it reaches a depth equal to one-third the height of the dam or one foot, whichever is less.

C. Dewatering Controls

1. Repair areas eroded due to dewatering pumping and install erosion control devices to prevent further erosion.
2. Clean sediment tanks when they become half full of sediment.

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 34 19

GEOSYNTHETIC SOIL REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Geosynthetic Soil Reinforcements.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Geosynthetic Soil Reinforcement
 - a. Measurement
 - 1) Measured per the square yard of Geosynthetic Soil Reinforcement installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Geosynthetic Soil Reinforcement” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Geosynthetic Soil Reinforcement
 - 2) Loading
 - 3) Unloading
 - 4) Hauling
 - 5) Disposal of excess materials
 - 6) Clean-up

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. American Society for Testing and Materials (ASTM):
 - a. D4632, Grab Breaking Load and Elongation of Geotextiles
 - b. D276, Identification of Fibers in Textiles
 - c. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus
 - 3. TXDOT Test Procedures:
 - a. Tex-616-J, Construction Fabrics

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Name
 - 2. Manufacturer
 - 3. Chemical composition
 - 4. Material Properties

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS

- A. Ambient Conditions
 - 1. Install Geosynthetic Soil Reinforcement under appropriate ambient and soil conditions in accordance with manufacturer's recommendations.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Geosynthetic Soil Reinforcement
 - 1. Manufactured from a punched polypropylene sheet
 - 2. Delivered to the job site in roll form with each roll individually identified

B. Material Requirements

1. Provide Geosynthetic Soil Reinforcement meeting the following requirements:

Characteristic	Test Method	Average Roll Minimum Value
Grab Strength	ASTM D4632	80-lbs @ 12-in per minute
Elongation at Break	ASTM D4632	50% @ 12-in per minute
Asphalt Retention	Tex-616-J	0.5-oz per square foot
Melting Point	ASTM D276	300° F
Resistance to UV Light	ASTM D4355	70%

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. Install Geosynthetic Soil Reinforcement in accordance with manufacturer’s guidelines.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 36 00

GABIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing and installing gabions and gabion mattresses.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Gabions
 - a. Measurement
 - 1) Measured per cubic yard of Gabion installed.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard for "Gabions" installed for:
 - a) Various Types
 - c. The price bid shall include:
 - 1) Furnishing and installing Gabions as specified by the Drawings
 - 2) Wire baskets, lacing, fasteners, reinforced filter fabric, and filter material
 - 3) Excavation, grading, and backfill
2. Gabion Mattresses
 - a. Measurement
 - 1) Measured per cubic yard of Gabion Mattress installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard for "Gabion Mattresses" installed for:
 - a) Various Types.
 - c. The price bid shall include:
 - 1) Furnishing and installing Gabion Mattresses as specified by the Drawings
 - 2) Wire baskets, lacing, fasteners, reinforced filter fabric, and filter material
 - 3) Excavation, grading, and backfill

1.3 REFERENCES

A. Definitions

1. Gabion: A wire fabric or mesh container, filled with stone, with a height of 1 foot or greater.
2. Gabion Mattress: A wire fabric or mesh container filled with stone and with a height less than 1 foot.

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. ASTM Standards
 - a. ASTM A975, Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel Wire With Poly (Vinyl Chloride) (PVC) Coating).
3. TxDOT Test Procedures
 - a. Tex-411-A, Test Procedure for Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate.
4. TxDOT Departmental Materials Specifications
 - a. DMS-6200, Filter Fabric.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS

A. Product Data

1. Provide product data from each manufacturer that is supplying gabion baskets and accessories.
2. Product data sheets for all products to include:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Point of delivery
 - e. Data and test results as required in this Section
 - f. Manufacturer Recommended Storing Data, if applicable
 - g. Application Recommendations, if applicable

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Reinforced Filter Fabric
 - a. Store reinforced filter fabric out of direct sunlight.

1.11 FIELD CONDITIONS

A.Ambient Conditions

1. Ambient temperature must be 15°F and rising above the manufacturer's listed brittleness temperature of the PVC coating.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A.Gabions

1. Provide twisted wire gabions and gabion mattresses, stiffeners, lacing wire, and spiral connectors with Style 3 PVC wire coating in accordance with ASTM A 975.
2. Alternate wire fasteners may be allowed if they meet the following minimum connection strength requirements:

Application	Strength (lb/ft)
Gabions, galvanized	1,400
Gabions, PVC-coated	1,200
Gabion mattresses	700

B.Filler Stone

1. Provide stone consisting of clean, hard, durable stone not containing shale, caliche, or other soft particles.
2. Provide stones between 3 and 8 inches in their smallest dimension for gabions and between 3 and 6 inches for gabion mattresses.
3. Provide stones with a 5-cycle magnesium sulfate soundness below 18 percent when tested in accordance with Tex-411-A.

C.Reinforced Filter Fabric

1. Provide Type 2 reinforced filter fabric in accordance with DMS-6200, if required.

D.Filter Material

1. Provide filter material consisting of hard, durable, clean sand or gravel with a maximum particle size of 3/8 inch, if required.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.Foundation

1. Excavate the foundation to the extent shown on the plans or as directed in accordance with Section 31 23 16.
2. Remove all loose or otherwise unsuitable material and any debris protruding from the foundation within the limits of the proposed gabion or gabion mattress.
3. Backfill and compact voids to a density matching the adjacent foundation.
4. A City Stormwater Coordinator is required to inspect the prepared surface immediately before gabion or gabion mattress placement.

3.4 INSTALLATION

A.Reinforced Filter Fabric

1. Install reinforced filter fabric in accordance with manufacturer's instructions and Section 31 25 14.
2. Install reinforced filter fabric with the long axis parallel to the centerline of the structure, highway, or dam.
3. Keep the fabric material free of tension, stress, folds, wrinkles, or creases.
4. Lap the material at least 18 inches along the longitudinal joint of material.
5. Lap the ends of rolls at joints by at least 3 feet.
6. Securing pins:
 - a. Place securing pins through both strips of material at lapped joints at approximately the midpoint of the overlap.
 - b. Place securing pins in lapped longitudinal joints on approximately 10-foot centers.
 - c. Place additional securing pins as necessary to hold fabric in position.
7. Repair torn or punctured fabric by placing a layer of fabric over the damaged area, overlapping at least 3 feet beyond the damaged area in all directions.
8. Any defects, rips, holes, flaws, or damage to the material may be cause for rejection.
9. Cover filter fabric as soon as possible, but no later than 3 days after placing.

B.Assembly

1. Gabion baskets shall be assembled in accordance with the manufacturer's instructions.
2. Ensure all sides, ends, and diaphragms erected are level and in the correct position.

C.Basket Placement

1. Place gabion baskets into final position while empty.
2. Place the front row of gabion or gabion mattress units first, and successively construct units toward the top of the slope or the back of the structure.
3. Bind baskets together along all contacting edges in order to form one continuous, connecting unit.
4. Partially fill initial row of gabion or gabion mattress units to provide anchorage against deformation and displacement.
5. Stretch and hold empty baskets to remove kinks and provide a uniform alignment.

D.Stone Placement

1. Place stones by hand in layers no greater than 12 inches ensuring maximum density and minimum voids.
2. For gabions 2 feet or greater in height, install looped inner tie wires connecting front to back faces after each 12-inch layer.
3. Do not fill any cell more than 12 inches above any adjacent cell unless looped inner tie wires run in both directions.
4. Place vertical outside faces with select stone to achieve the best appearance and to ensure stones are larger than wire openings.
5. Overfill final layer of stone uniformly by 1 inch.

E. Basket Closing

1. Close the lid tightly along all edges, ends, and internal diaphragms.
2. Do not use crowbars or other single-point leverage bars for lid closing.
3. Tie lid to the edges, ends, and internal diaphragms in same manner basket units were tied together.
4. Tie adjacent lids together in same manner basket units were tied together.
5. Ensure all protruding wires are bent in toward basket.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 31 37 00

RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Provide and place concrete, stone, cement-stabilized, or special riprap.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Riprap
 - a. Measurement
 - 1) Measured per square yard of Riprap installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Riprap" installed for:
 - a) Various depths.
 - b) Various types.
 - c. The price bid shall include:
 - 1) Furnishing and installing Riprap as specified by the Drawings
 - 2) Aggregate, reinforced filter fabric, expansion joint material, concrete, grout, mortar, and reinforcing steel
 - 3) Excavation for wingwalls and toe wall trenches
 - 4) Excavation below natural ground or bottom of excavated channel, as applicable
 - 5) Loading, unloading, hauling, and storing
 - 6) Shaping of slopes, as applicable
 - 7) Bedding
 - 8) Maintenance

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM)
 - a. D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials.
3. TxDOT Departmental Material Specifications (DMS):
 - a. DMS 6200, Filter Fabric.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A.Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS

A.Ambient Conditions

1. Place mortar or grout only when the air temperature is above 40° F and rising.
2. For concrete riprap, follow all field condition requirements for concrete in accordance with Sections 03 00 00 and 32 13 13.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A.Reinforced Filter Fabric

1. Provide Type 2 reinforced filter fabric in accordance with DMS-6200, if required.

B.Concrete Riprap

1. Use concrete with a compressive strength of 4,000 psi at 28-days in accordance with Section 03 30 00.

C.Stone Riprap

1. Use durable natural stone with a bulk specific gravity of at least 2.50 and a maximum weight loss of 18 percent after 5 cycles of magnesium sulfate solution.
2. Common
 - a. Use stones between 50 and 250 pounds.
 - b. Use stones at least 3 inches in their least dimension.
 - c. Use stones at least twice as wide as they are thick.
3. Protection
 - a. Use boulders or quarried rock that meets the gradation requirements of Table 1.
 - b. Both the width and the thickness of each piece of riprap must be a least 1/3 of the length.
 - c. Provide bedding stone that in-place meets the gradation requirements shown in Table 2 or as otherwise shown on the Drawings.

- d. Determine the gradation of the finished, in-place, riprap stone under the direct supervision of the City in accordance with ASTM D5519.

Table 1
Riprap Gradation Requirements

Thickness	Maximum Size (lb.)	90 percent Size ¹ (lb.)	50 percent Size ² (lb.)	8 percent Size ³ , Minimum (lb.)
12 in.	200	80-180	30-75	3
15 in.	320	170-300	60-165	20
18 in.	530	290-475	105-220	22
21 in.	800	460-720	175-300	25
24 in.	1,000	550-850	200-325	30
30 in.	2,600	1,150-2.50	400-900	40

1. Defined such that 10% of the total riprap stone by weight is larger and 90% is smaller.
2. Defined such that 50% of the total riprap stone by weight is larger and 50% is smaller.
3. Defined such that 92% of the total riprap stone by weight is larger and 8% is smaller.

Table 2
Bedding Stone Gradation

Sieve Size (Square Mesh)	Percent by Weight Passing
3 inches	100
1-1/2 inches	50-80
3/4 inches	20-60
No. 4	0-15
No. 10	0-5

D.Grout

1. Provide grout with a ratio of 1-part portland cement to 3-parts sand and mixed with water until it achieves a consistency that will flow into and completely fill all voids.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.Grading

1. Grade and compact the slopes and other areas to be protected with riprap to match the line and grade shown on the plans.

3.4 INSTALLATION

A.Reinforced Filter Fabric

1. Place reinforced filter fabric with the length running up and down the slope, if required.

2. Ensure fabric has a minimum overlap of 2 feet.
3. Secure fabric with nails at least 2 inches long or U-shaped pins with legs at least 9 inches long.
4. Space nails or pins at a maximum 10 feet in each direction and 5 feet along seams.

B. Concrete Riprap

1. Reinforcement
 - a. Reinforce concrete riprap with No. 3 reinforcing bars spaced at a maximum of 18 inches in each direction unless otherwise specified in the Drawings.
 - b. Provide a minimum 6-inch lap at all splices.
 - c. Place the first parallel bar no more than 6 inches from the edge of concrete and ensure between 1 and 3 inches of horizontal cover at the edge of riprap.
 - d. Use approved supports to hold the reinforcement approximately equidistant from the top and bottom surface of the slab.
 - e. Adjust reinforcement during concrete placement to maintain correct position.
 - f. Provide 2-inch weep holes on 10-foot centers located 2 feet above finished grade backed by 1 cubic foot of gravel and galvanized hardware cloth.
 - g. Provide additional rows of 2-inch weep holes for each 20 feet of riprap height, offset by 5 feet from the first row.
2. Subgrade
 - a. Sprinkle and consolidate the subgrade before the concrete is placed ensuring all surfaces are moist.
 - b. Compact each layer to a minimum of 98 percent standard proctor density with a moisture content not to exceed plus or minus 2 percent of optimum.
3. Compact and shape the concrete once it has been placed in accordance with the dimensions shown on the plans.
4. Finish the surface with a wood float after it has set sufficiently.
5. Provide a smooth surface or broom finish, as approved.
6. Cure the riprap immediately after the finishing operation in accordance with Section 32 13 13.

C. Stone Riprap

1. Provide the following types of stone riprap as specified in the Drawings:
 - a. Dry Riprap
 - 1) Stone riprap with voids filled entirely with only spalls or small stones.
 - 2) Use spalls and small stones lighter than 25 pounds to fill open joints and voids in stone riprap, and place to a tight fit.
 - 3) Do not exceed a 6-inch variation between the tops of adjacent stones.
 - 4) Replace, embed deeper, or chip away stones that project more than the allowable amount above the finished surface.
 - b. Grouted Riprap
 - 1) Common stone riprap with voids grouted after all stones are in place.
 - 2) Prevent earth, sand, or foreign material from filling the spaces between the stones.
 - 3) Wet the stones thoroughly after they are in place, fill the spaces between the stones with grout, and pack.
 - 4) Sweep the surface of the riprap with a stiff broom after grouting.
 - 5) Protect work from rapid drying for at least 3 days after placement.

2. Common
 - a. Construct riprap as shown in Figure 1.
 - b. Place stones on a bed excavated for the base course.
 - c. Bed the base course of stone well into the ground with the edges in contact.
 - d. Bed and place each succeeding course in even contact with the preceding course.
3. Protection
 - a. Construct riprap as shown in Figure 2.
 - b. Place riprap stone on the slopes within the limits specified in the Drawings.
 - c. Place stone for riprap on the bedding material to produce a reasonably well-graded mass of riprap with the minimum practicable percentage of voids.
 - d. Place riprap to its full thickness in a single operation.
 - e. Avoid displacing the bedding material.
 - f. Ensure the entire mass of stones in their final position is free from objectionable pockets of small stones and clusters of larger stones.
 - g. Do not place riprap in layers, and do not place by dumping into chutes, dumping from the top of the slope, pushing from the top of the slope, or any method likely to cause segregation of the various sizes.
 - h. Obtain the desired distribution of the various sizes of stones throughout the mass by selective loading of material at the quarry or other source or by other methods of placement that will produce the specified results.
 - i. Rearrange individual stones by mechanical equipment or by hand if necessary to obtain a reasonably well-graded distribution of stone sizes.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Perform a size verification test in accordance with ASTM D5519 at least once per 5,000 square yards of finished riprap for all types of stone.
2. For installations greater than 5,000 square yards, do not place additional riprap until the initial size verification test has been approved.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS

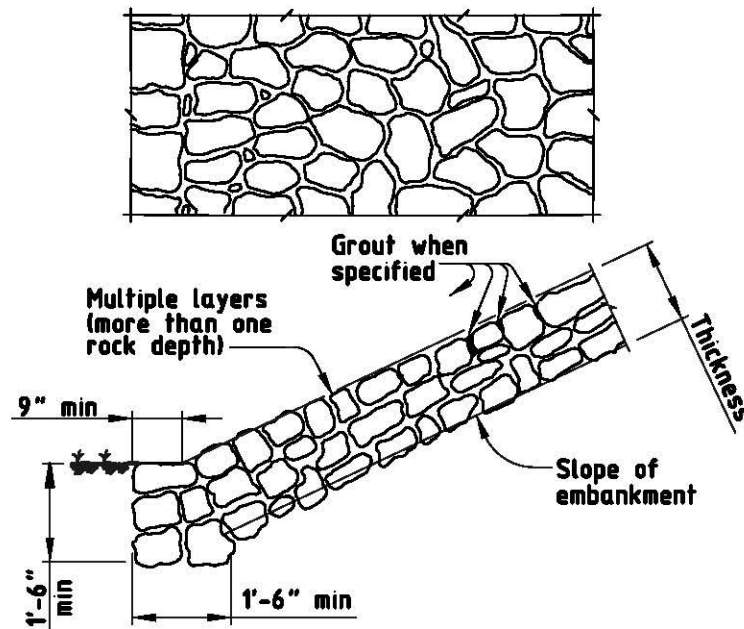


Figure 1 – Common Stone Riprap, dry or grouted

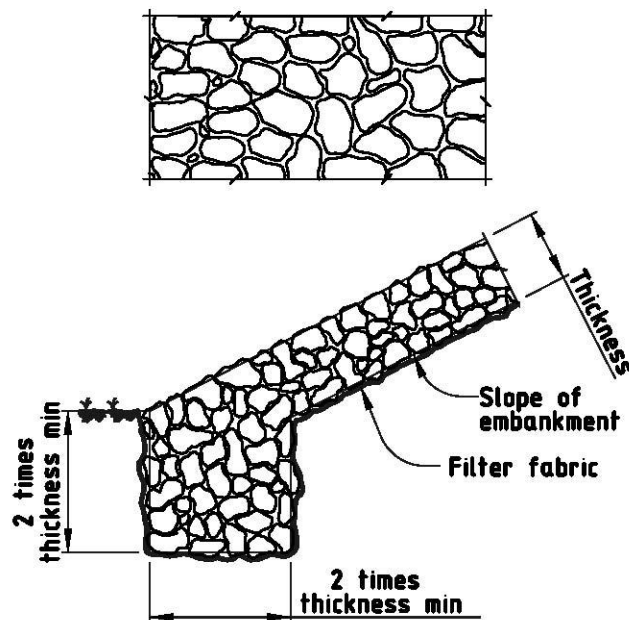


Figure 2 – Protection Stone Riprap

END OF SECTION

SECTION 32 01 17
FLEXIBLE PAVING REPAIR

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flexible Paving Repair including:
 - a. Flexible Paving Repair
 - b. Pothole Repair (Flexible Paving)
 - c. Cleaning and Sealing Cracks
 - d. Flexible Paving Repair for Utility Trench
 - e. Temporary Flexible Paving Repair for Utility Trench
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Flexible Paving Repair
 - a. Measurement
 - 1) Measured per square yard of Flexible Paving Repair installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Flexible Paving Repair” installed for:
 - a) Various street classifications.
 - c. The price bid shall include:
 - 1) Furnishing and installing Flexible Paving Repair as specified by the Drawings
 - 2) Removal of existing asphalt pavement and base material.
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Trial batches (as needed)
 - 10) All costs associated with obtaining and submitting the required action and informational submittals
 - 11) Asphalt, aggregate, and additives
 - 12) Materials and work needed for any corrective action
 - 13) Tack coat, PCE, Fog Seal, Crack sealant
 - 14) Removal and/or sweeping excess material
 - 2. Pothole Repair (Flexible Paving)
 - a. Measurement
 - 1) Measured per square yard of Pothole Repair (Flexible Paving) installed.

- b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Pothole Repair (Flexible Paving)” installed.
- c. The price bid shall include:
 - 1) Furnishing and installing Pothole Repair (Flexible Paving) as specified by the Drawings
 - 2) Loading
 - 3) Unloading
 - 4) Storing
 - 5) Hauling
 - 6) Handling of materials
 - 7) Traffic control for all testing
 - 8) Trial batches (as needed)
 - 9) All costs associated with obtaining and submitting the required action and informational submittals
 - 10) Asphalt, aggregate, and additives
 - 11) Materials and work needed for any corrective action
 - 12) Tack coat, PCE, Fog Seal, Crack sealant
 - 13) Removal and/or sweeping excess material
- 3. Cleaning and Sealing Cracks
 - a. Measurement
 - 1) Measured by the pound of “Cleaning and Sealing Joints and Cracks” installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per pound for “Cleaning and Sealing Joints and Cracks (Flexible Paving)” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Cleaning and Sealing Cracks as specified by the Drawings
 - 2) Loading
 - 3) Unloading
 - 4) Storing
 - 5) Hauling
 - 6) Handling of materials
 - 7) Traffic control for all testing
 - 8) Trial batches (as needed)
 - 9) All costs associated with obtaining and submitting the required action and informational submittals
 - 10) Asphalt, aggregate, and additives
 - 11) Materials and work needed for any corrective action
 - 12) Tack coat, PCE, Fog Seal, Crack sealant
 - 13) Removal and/or sweeping excess material
- 4. Flexible Paving Repair for Utility Trench
 - a. Measurement
 - 1) Measured per square yard of Flexible Paving Repair for Utility installed.
 - b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Flexible Paving Repair for Utility Trench” installed for:
 - a) Various street classifications.
- c. The price bid shall include:
 - 1) Furnishing and installing Flexible Paving Repair for Utility Trench as specified by the Drawings
 - 2) Removal of temporary material
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Trial batches (as needed)
 - 10) All costs associated with obtaining and submitting the required action and informational submittals
 - 11) Asphalt, aggregate, and additives
 - 12) Materials and work needed for any corrective action
 - 13) Tack coat, PCE, Fog Seal, Crack sealant
 - 14) Removal and/or sweeping excess material
5. Temporary Flexible Paving Repair for Utility Trench
 - a. Measurement
 - 1) Measured per square yard of Temporary Flexible Paving Repair for Utility Trench installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Temporary Flexible Paving Repair for Utility Trench” installed for:
 - a) Various street classifications.
 - c. The price bid shall include:
 - 1) Furnishing and installing Temporary Flexible Paving Repair for Utility Trench as specified by the Drawings
 - 2) Loading
 - 3) Unloading
 - 4) Storing
 - 5) Hauling
 - 6) Handling of materials
 - 7) Traffic control for all testing
 - 8) Trial batches (as needed)
 - 9) All costs associated with obtaining and submitting the required action and informational submittals
 - 10) Asphalt, aggregate, and additives
 - 11) Materials and work needed for any corrective action
 - 12) Tack coat, PCE, Fog Seal, Crack sealant
 - 13) Removal and/or sweeping excess material

1.3 REFERENCES

A. Abbreviations and Acronyms

1. TxDOT – Texas Department of Transportation

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM):
 - a. ASTM C457 – Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete
3. TxDOT Standards:
 - a. Tex-414-A – Air Content of Freshly Mixed Concrete by the Volumetric Method
 - b. Tex-415-A – Slump of Hydraulic Cement Concrete
 - c. Tex-416-A – Air Content of Freshly-Mixed Concrete by the Pressure Method
 - d. Tex-422-A – Measuring Temperature of Freshly Mixed Portland Cement Concrete

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Product Data
 - a. Submit product data for all products used for Pothole Repair and Cleaning and Sealing Joints and Cracks. Provide product data in accordance with Section 32 12 73 and this Section.
2. Asphalt Mix Design
 - a. Provide an asphalt mix design for TY C, TY D, and TY B asphalt in accordance with Section 32 12 16.
3. Rolling Pattern
 - a. Provide the proposed rolling pattern in accordance with Section 32 12 16.

B. Information Submittals

1. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. Follow all delivery, storage, and handling requirements for asphalt and concrete in Sections 32 12 16, 32 13 13, and 03 00 00.
- C. Follow all manufacturer recommendations for delivery, storage, and handling requirements specified in the product data.

1.11 FIELD CONDITIONS

- A. Follow all field condition requirements for asphalt and concrete in Sections 32 05 16, 32 11 23, 32 12 16, 32 13 13, and 03 00 00.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Refer to City Standard Details and Section 33 05 06 for requirements for excavation, embedment, and backfill.
- B. Asphalt Paving:
 - 1. Refer to Section 31 23 16 and Section 31 24 00 for material requirements.
 - 2. Use TY C or TY D for the 2-inch surface course. Refer to street classification in this Section and the City Standard Detail.
 - 3. Use TY B for the intermediate and/or base courses.
- C. Concrete Base Material for Trench Repair
 - 1. Acceptable with prior written approval from City Engineer.
 - 2. Production Materials:
 - a. Cement
 - 1) ASTM C150 Type I
 - b. Fly Ash
 - 1) Class F Fly Ash F in accordance with Section 03 00 00.
 - c. Water
 - 1) In accordance with Section 03 00 00.
 - d. Chemical Admixtures
 - 1) Air entraining admixture in accordance with Section 03 00 00.
 - e. Aggregate:
 - 1) Provide aggregate in accordance with Section 03 00 00 and 32 05 16.
 - 2) Fine Aggregate:
 - a) Provide fine aggregate with maximum of 12 percent of fine aggregate passing the number 200 sieve.
 - 3) Coarse Aggregate:
 - a) Use pea gravel that is no larger than 3/8 inch.

D. Cleaning and Sealing Joints and Cracks

1. Provide sealants in accordance with Section 32 12 73.

E. Subgrade or Subbase Course

1. Provide a Flexible Base, TY A, GR 1-2 in accordance with Section 32 11 23 for all base course installation and repair unless otherwise specified in the Drawings or directed by the City.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Perform all tests and inspections required for asphalt, concrete, and flexible base in accordance with Sections 03 00 00, 32 11 23, 32 12 16, and 32 13 13.

B. Non-Conforming Work

1. If the materials do not meet the requirements of Sections 03 00 00, 32 11 23, 32 12 16, and 32 13 13, or the product data sheet, the material will be considered non-conforming and will be rejected or removed and replaced at Contractor's expense.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Surface Preparation for Pothole Repair

1. Square the edges of the pothole by saw-cutting 1' from the edge of the pothole to the depth of the pothole around the entire pothole.
2. Remove any loose and foreign material.
3. Clean and dry the repair area thoroughly.

B. Surface Preparation for Asphalt Pavement Repair

1. Full depth sawcut and remove asphalt pavement and base material within the limits shown on the Drawings in accordance with Section 02 41 15.

3.4 PAVEMENT REPAIR

A. Disposal, Salvaging, and Recycling Removed Pavement

1. In accordance with the requirements in Section 02 41 15.

B. Concrete Base for Trench Repair

1. Concrete base material is acceptable only with prior written approval from the City Engineer.
2. Install concrete base material in accordance with the requirements for concrete in Section 03 00 00.
3. Install to the depth and width specified in the Drawings and the City Standard Details.

C. Asphalt Pavement Repair

1. General

- a. Refer to City Standard Details for flexible pavement sections and subgrade depth based on street classifications. Standard street classifications are: Residential, Neighborhood Collector, City Collector, Minor Arterial and Major Arterial.

2. Pavement Section for Standard Pavement Repair:

a. Subgrade:

- 1) After the asphalt and base material is removed, replace the subgrade to the depth specified on the City Standard Detail based on the street classification.
- 2) Install subgrade material Flexible Base TY A, GR 1-2 in accordance with Section 32 11 23.
- 3) Install the full-depth of asphalt courses and subgrade specified on the City Standard Detail. Use flexible base for the subgrade at the depth specified.
- 4) Installation of base and full-depth asphalt material is considered subsidiary to Asphalt Pavement Repair.

b. Pavement Section

- 1) Compare the existing flexible pavement section with the City Standard Details for Asphalt Paving based on the street classification specified on the Drawings.
 - a) If the existing flexible pavement section matches the Detail or is thicker, match the existing pavement section.
 - b) If the existing flexible pavement section is thinner than the Detail, install asphalt pavement to the thickness specified on the City Standard Detail.
- 2) Full-depth installation of all courses of asphalt pavement is considered subsidiary to Asphalt Pavement Repair.

3. Pavement Section for Utility Trench:

- a. If a street classification is specified in Drawings:
 - 1) Follow the same process for selecting a pavement section as for standard pavement repair.
 - 2) Full-depth installation of all courses of asphalt pavement is considered subsidiary to Asphalt Pavement Repair for Utility Service Trench.
- b. If no street classification is specified in Drawings:
 - 1) Pavement Section:
 - a) Surface Course: 3 inches TY C
 - (1) Unless approved by City Engineer in writing, surface course shall not be less than 2 inches.
 - b) Base Asphalt Course: 9 inches TY B
 - c) Subgrade Depth: 12 inches of flexible base or Class D Concrete

D. Pothole Repair

1. After the surface is prepared, apply a tack coat to the exposed asphalt surface.
2. Hot-Mix Asphalt
 - a. Use TY D asphalt for hot-mix asphalt.
3. Cold-Mix Asphalt
 - a. Provide a high-performance polymer-modified cold asphalt. Submit a product data submittal for material approval.
4. After material is placed, finish to grade and compact to conform to the existing roadway surface. Compact with a hand tamp, mechanical tamps, or rollers as directed or approved. Compact until full consolidation is achieved.

5. Clean roadway surface after repair operations and remove and dispose of any excess material.
6. Maximum pothole size:
 - a. The maximum allowable size of a pothole is roughly 3 feet by 3 feet or larger and 3 inches deep.
 - b. If the pothole measures larger than 3 feet by 3 feet, or if the depth of the pothole is greater than 3 inches, perform a full depth removal of asphalt and base material. Refer to Section 02 41 15 for paving removal limits.
 - c. Any base repair will be considered subsidiary to the square yards of asphalt for pothole repair.
 - d. Use a flexible base course in accordance with Section 32 11 23 for repair of any base material.
 - e. If a full depth repair is needed, coordinate with the City prior to performing repair activities on that pothole. The City may choose to allow a temporary patch of the pothole. Obtain written permission from the City Engineer if a temporary patch is allowed and follow all requirements provided by the City.
- E. Cleaning and Sealing Joints and Cracks
 1. Prepare the site and install sealants in accordance with Section 32 12 73.
- F. Temporary Paving Repair for Utility Trenches
 1. Refer to City Standard Details for additional information.
 2. Refer to Section 02 41 15 for paving removal.
 3. Pavement thickness
 - a. Match existing pavement thickness.
 - b. If street classification is specified in Drawings:
 - 1) Provide pavement section as shown on City Standard Details for full depth of asphalt. The depth should include the surface and both base depths.
 - c. If no street classification is specified in Drawings:
 - 1) Minimum thickness: 2 inches TY C or TY D
 - 2) If existing asphalt is rutting:
 - a) Surface Course: 3 inches TY C or TY D
 - b) Base Course: 6 inches TY B

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Crack Sealant, Polymer-Modified Cold Mix Asphalt, and other Products
 1. Perform placement testing in accordance with this Section.
- B. Asphalt Paving
 1. Perform all testing requirements for asphalt pavement in accordance with Section 32 12 16.
- C. Concrete Base Material for Trench Repair
 1. Testing Frequency:
 - a. Test concrete each day for a concrete mixture of up to 25 cubic yards. For each additional 50 cubic yards, perform an additional test.

2. Testing of Fresh Concrete:
 - a. Perform in accordance with Sections 03 00 00 and 32 13 13.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 01 29

CONCRETE REPAIR

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete Repair Including:
 - a. Concrete Paving Repair
 - b. Concrete Paving Repair for Utility Trench
 - c. Concrete Pavement Spalling Repair
 - d. Concrete Structure Repair, Concrete Crack Repair
 - e. Cleaning and Sealing Joints and Cracks
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Concrete Paving Repair
 - a. Measurement
 - 1) Measured per square yard of Concrete Paving Repair installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Concrete Paving Repair" installed for:
 - a) Various Street Classifications.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Paving Repair as specified by the Drawings
 - 2) Subgrade removal and replacement as specified on the Drawings
 - 3) Sawing and removal of existing pavement
 - 4) Removal of base material as needed
 - 5) Water
 - 6) Loading
 - 7) Unloading
 - 8) Storing
 - 9) Hauling
 - 10) Handling of materials
 - 11) Traffic control for all testing
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing

- 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Joint sealant
 - 23) Reinforcing steel and reinforcement chairs
 - 24) Disposal of excess material
 - 25) Clean-up
2. Concrete Paving Repair for Utility Trench
- a. Measurement
 - 1) Measured per square yard of Concrete Paving Repair for Utility Trench installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Concrete Paving Repair for Utility Trench” installed for:
 - a) Various Street Classifications.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Paving Repair for Utility Trench as specified by the Drawings
 - 2) Sawing
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Joint sealant
 - 21) Reinforcing steel and reinforcement chairs
 - 22) Disposal of excess material
 - 23) Clean-up
3. Concrete Structure Repair
- a. Measurement
 - 1) Measured per square foot of Concrete Structure Repair installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot for “Concrete Structure Repair” installed.
 - c. The price bid shall include:

- 1) Furnishing and installing Concrete Structure Repair as specified by the Drawings
 - 2) Sawing and removal of existing pavement
 - 3) Removal of base material as needed
 - 4) Water
 - 5) Loading
 - 6) Unloading
 - 7) Storing
 - 8) Hauling
 - 9) Handling of materials
 - 10) Traffic control for all testing
 - 11) Trial batches (as needed)
 - 12) Materials and work needed for any corrective action
 - 13) Concrete
 - 14) Aggregate
 - 15) Supplementary cementing materials
 - 16) Concrete additives
 - 17) Mixing
 - 18) Placement of concrete
 - 19) Finishing of concrete
 - 20) Curing and curing compounds
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
4. Concrete Pavement Spalling Repair
- a. Measurement
 - 1) Measured per square foot of Concrete Pavement Spalling Repair installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square foot for Concrete Pavement Spalling Repair installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Pavement Spalling Repair as specified by the Drawings
 - 2) Sawing and removal of existing pavement
 - 3) Removal of base material as needed
 - 4) Water
 - 5) Loading
 - 6) Unloading
 - 7) Storing
 - 8) Hauling
 - 9) Handling of materials
 - 10) Traffic control for all testing
 - 11) Trial batches (as needed)
 - 12) Materials and work needed for any corrective action
 - 13) Concrete
 - 14) Aggregate
 - 15) Supplementary cementing materials
 - 16) Concrete additives

- 17) Mixing
 - 18) Placement of concrete
 - 19) Finishing of concrete
 - 20) Curing and curing compounds
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
5. Concrete Crack Repair
- a. Measurement
 - 1) Measured per linear foot of Concrete Crack Repair installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Concrete Crack Repair installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Crack Repair as specified by the Drawings
 - 2) Sawing
 - 3) Concrete
 - 4) Aggregate
 - 5) Supplementary cementing materials
 - 6) Concrete additives
 - 7) Mixing
 - 8) Placement of concrete
 - 9) Finishing of concrete
 - 10) Curing and curing compounds
 - 11) Joint sealant
 - 12) Loading
 - 13) Unloading
 - 14) Storing
 - 15) Hauling
 - 16) Handling of materials
 - 17) All costs associated with obtaining and submitting the required action and informational submittals.
 - 18) Removal and/or sweeping excess material
 - 19) Tools
 - 20) Equipment
6. Cleaning and Sealing Joints
- a. Measurement
 - 1) Measured per linear foot of Cleaning and Sealing Joints installed.
 - 2) This item is considered subsidiary to other pertinent items when used, which can include, but is not limited to, Concrete Paving and Concrete Paving Repair.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Cleaning and Sealing Joints installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Cleaning and Sealing Joints as specified by the Drawings

- 2) Cleaning and joint sealant materials
- 3) Loading
- 4) Unloading
- 5) Storing
- 6) Hauling
- 7) Handling of materials
- 8) Traffic control for all testing
- 9) Trial batches (as needed)
- 10) Materials and work needed for any corrective action
- 11) Joint sealant
- 12) Clean-up

1.3 REFERENCES

A. Abbreviations and Acronyms

1. TxDOT – Texas Department of Transportation

B. Definitions

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM) Standards:
 - a. ASTM C928 – Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
3. TxDOT Concrete Repair Manual.
4. TxDOT Standards:
 - a. Tex-418-A – Compressive Strength of Cylindrical Concrete Specimens.
 - b. Tex-448-A – Flexural Strength of Concrete Using Simple Beam Third-Point Loading.
 - c. DMS-4655, Concrete Repair Materials.
 - d. DMS-6100 – Epoxies and Adhesives.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Product Data
 - a. Submit product data for all products used for Cleaning and Sealing Joints. Provide product data in accordance with Section 32 13 73 and this Section.
2. Concrete Mix Design
 - a. Provide a mix design for each class or type of concrete used in accordance with Section 03 00 00 and DMS-4655.
3. Structural Repair

- a. Submit all materials and application methods for approval at least 3 weeks prior to performing any structural repair work.
- 4. Crack Repair
 - a. Submit all materials and application methods for approval prior to performing any crack repair work.
- B. Information Submittals
 - 1. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. Follow all delivery, storage, and handling requirements for concrete in Section 32 05 16, 32 11 23, 32 13 13, 32 13 73, and 03 00 00.
- C. Follow all manufacturer recommendations for delivery, storage, and handling requirements specified in the product data.

1.11 FIELD CONDITIONS

- A. Follow all field condition requirements in Section 32 05 16, 32 11 23, 32 13 13, 32 13 73, and 03 00 00.
- B. Follow all manufacturer recommendations for field conditions specified in the product data.
- C. Concrete Pavement Spalling Repair
 - 1. Place concrete if the air temperature is 40 degrees Fahrenheit and rising.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Refer to City Standard Details and Section 31 23 16 and Section 31 24 00 for requirements for excavation, embedment, and backfill.
- B. Concrete Paving Repair:
 - 1. Refer to Section 03 00 00 and 32 13 13 for material requirements.
 - 2. Concrete Class:

- a. Standard Concrete Pavement: Concrete Class P or HES
 - 1) Provide HES concrete designed to attain a minimum compressive strength in accordance with Section 03 00 00. Use HES when concrete needs to be open to traffic within 72 hours.
 - 2) Provide Class P concrete when possible.
 - 3) Use standard concrete pavement unless otherwise approved by the City or specified in the Drawings.
 - b. Alternate Concrete Material: Type A concrete listed on TxDOT's DMS-4655 Concrete Repair Materials.
 - 1) The Contractor may request to use Type A concrete. The Contractor must obtain approval in writing unless otherwise specified in the Drawings.
 - 3. Reinforcing Steel, Dowel Bars, and Tie Bars
 - a. Provide reinforcing steel, dowel bars, and tie bars in accordance with Section 03 00 00 and 32 13 13.
- C. Concrete Structure Repair
- 1. Concrete Repair Materials:
 - a. Provide repair materials suitable for the appropriate horizontal, vertical, or overhead application in accordance with the requirements in DMS-4655.
 - b. Trowel-Applied:
 - 1) Use Type P in vertical and overhead applications that are less than 3 inches unless otherwise shown on the Drawings.
 - c. Horizontal or Form-and-Pour Applications:
 - 1) Use neat Type A materials for applications that are equal to or less than 3 inches thick.
 - 2) Use extended Type A for repairs exceeding 3 inches in depth.
 - d. The City may reject any product based on structural compatibility.
 - 2. Pneumatically Applied Materials:
 - a. Provide concrete conforming to TxDOT Item 431 – Pneumatically Placed Concrete.
 - b. Only use pneumatically applied materials when specified in Drawings or approved by the City.
 - c. Prepare trial batches of any proposed repair material and application method as specified by Item 431, this Section, the Drawings, and/or directed by the City Engineer.
 - 3. Epoxy Mortars
 - a. Use Type 8 neat epoxy or epoxy mortar per DMS-6100 – Epoxies and Adhesives for repairs less than 1 inch thick unless otherwise noted on the plans.
 - 4. Concrete:
 - a. Concrete Class: Class F for substructures, Class S for decks, or concrete designed to the strength specified in the Drawings unless the following conditions apply:
 - 1) An option for vertical/overhead repairs greater than 6 inches thick,
 - 2) For full or partial depth slab repairs,
 - 3) For replacement of entire members or elements, or
 - 4) As an option for horizontal repairs greater than 4 inches thick.
 - 5) If the previous conditions apply, stop work until the City provides written direction on how to proceed.
 - b. Do not use corrosion-inhibiting admixtures unless specified in the Drawings or approved by the City.

5. Steel
 - a. Provide reinforcing in accordance with the Drawings and Section 03 00 00.
- D. Concrete Pavement Spalling Repair:
 1. Refer to Section 03 00 00 and 32 13 13 for material requirements.
 2. Concrete Type:
 - a. Provide Type A concrete in accordance with DMS-4655 unless otherwise specified in the Drawings.
 - b. Use a packed blend of cement, sand, and gravel (maximum size 3/8 inch) which requires the addition of water and has a maximum shrinkage of 0.15 percent in accordance with ASTM C928.
 3. Do not use chlorides, magnesium, or gypsum to accelerate setting time.
 4. Demonstrate the mixture meets a minimum compressive strength of 5,100 psi in 7 days and 6,300 psi in 28 days before spall repair operations. Test in accordance with Tex-418-A and Tex-448-A. Provide test results as part of concrete submittal.
 5. Do not use polymeric patching material unless otherwise specified in the Drawings or approved by the City.
- E. Concrete Crack Repair
 1. Use epoxy injection, gravity filling, routing and sealing, or surface sealing.
 2. Provide materials in accordance with TxDOT's Concrete Repair Manual. Select a pre-approved material meeting the requirements of the applicable DMS when available.
 3. Provide materials and application methods for approval prior to crack repair.
- F. Cleaning and Sealing Joints
 1. Provide joint and crack sealants in accordance with Section 32 13 73.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. Provide equipment necessary to complete the specified concrete repair in accordance with Section 03 00 00, 32 05 16, 32 11 23, 32 13 13, and 32 13 73.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Concrete Paving Repair (Non-Structural)
 1. Remove the existing concrete pavement.
- B. Cleaning and Sealing Joints
 1. Prepare the site in accordance with Section 32 13 73.

3.4 CONCRETE REPAIR

A. Concrete Paving Repair

1. General
 - a. Half-depth repairs will not be allowed. Perform only full-depth concrete pavement repairs.
 - b. Refer to City Standard Details for concrete pavement sections and subgrade depth based on street classifications. Standard street classifications are: Residential/Local, Neighborhood Collector, City Collector, Minor Arterial and Major Arterial.
2. Pavement Section for Standard Pavement Repair:
 - a. Subgrade Repairs:
 - 1) Once the pavement has been removed, repair any damaged subgrade using Flexible Base, TY A, GR 1-2 in accordance with Section 32 11 23 or as specified in the Drawings.
 - 2) Remove and replace subgrade under paving repair section with Flexible Base TY A, GR 1-2 if specified in the Drawings. This will be considered subsidiary to the Concrete Paving Repair item.
 - 3) After removing the pavement, if the existing subgrade is found to be deficient by the City, stop work and obtain approval from the City indicating how to proceed.
 - b. Pavement Section
 - 1) Compare the existing concrete pavement section with the City Standard Details for Concrete Paving based on the street classification specified on the Drawings.
 - 2) If the existing concrete pavement section matches or is thicker than the Standard Detail, match the existing pavement section.
 - 3) If the existing concrete pavement section is thinner than the detail, install concrete pavement to the thickness specified on the City Standard Detail.
 - 4) Full-depth installation of concrete pavement is considered subsidiary to Concrete Paving Repair.
3. Pavement Section for Utility Service Trench
 - a. If a street classification is specified in the Drawings:
 - 1) Follow the same process for selecting a pavement section for standard pavement repair.
 - 2) Full-depth installation of concrete pavement is considered subsidiary to Concrete Paving Repair for Utility Service Trench.
 - b. If no street classification is specified in Drawings:
 - 1) Match thickness specified on the City Standard Detail for Existing Pavement Trench.
4. Concrete Installation:
 - a. Reinforcing:
 - 1) Use tie bars and epoxy in accordance with Section 03 00 00 and 32 13 13.
 - 2) Place tie bars as shown on the Drawings or in the City Standard Details.
 - 3) Drill holes in accordance with Section 03 00 00 and 32 13 13 into the existing concrete at least 10 inches deep unless otherwise directed. Inject the holes with Type 3, Class C epoxy in accordance with Section 03 00 00 before inserting tie bars.

- 4) Place reinforcing steel and dowel bars of the size and spacing shown on the Drawings or in the City Standard Details. Lap all longitudinal steel at least 25 inches. Provide and place steel supports in accordance with Section 03 00 00 and 32 13 13 as needed.
- b. Concrete Placement and Joints:
 - 1) Mix, place, cure, and test concrete in accordance with Section 03 00 00 and 32 13 13.
 - 2) Install and restore joints in accordance with Section 03 00 00 and 32 13 13.
- B. Concrete Structure Repair
 1. Follow procedures outlined in the TxDOT Concrete Repair Manual unless otherwise specified in the Drawings.
- C. Concrete Pavement Spalling Repair
 1. General:
 - a. Saw at least 1.5 inches deep around the repair area before concrete removal unless otherwise directed. Provide a vertical face around the perimeter of the repair area.
 - b. Protect and maintain existing reinforcing if encountered, unless it is damaged or otherwise directed by the City.
 - c. If the City determines that the existing reinforcing is damaged, full-depth remove and replace concrete. Perform full-depth paving repair in accordance with this Section.
 2. Removal of Concrete:
 - a. Remove deteriorated concrete to a depth of at least 1.5 inches or the maximum depth of the deteriorated concrete, whichever is greater.
 - b. If deteriorated concrete is deeper than 1.5 inches in depth, use chipping hammers not heavier than the nominal 15-pound class or hydro-demolition equipment.
 3. Concrete Placement:
 - a. Clean the surface so it is free of loose particles.
 - b. Mix, place, and cure the concrete in accordance with Section 03 00 00 and 32 13 13.
 - c. Screed concrete to the existing roadway surface.
 4. Texture: Match existing pavement.
- D. Concrete Crack Repair
 1. Follow procedures outlined in the TxDOT Concrete Repair Manual unless otherwise specified in the Drawings.
 2. Submit application methods for review and approval prior to performing any crack repair.
- E. Cleaning and Sealing Joints
 1. Install joint sealants in accordance with Section 32 13 73.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Concrete Testing
 1. Perform testing in accordance with this specification and Sections 03 00 00, 03 30 00, and 32 13 13.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 05 16 AGGREGATES FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coarse and fine aggregate requirements for asphalt and concrete.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Aggregate materials, equipment, tools, and incidentals will not be measured or paid for separately. All items required for the testing and furnishing of aggregates is subsidiary to other pertinent items.

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. AQMP – Texas Department of Transportation’s Aggregate Quality Monitoring Program (Tex-499-A)
 - 2. BRSQC – Texas Department of Transportation’s *Bituminous Rated Source Quality Catalog*
 - 3. CRSQC – Texas Department of Transportation’s *Concrete Rated Source Quality Catalog*
 - 4. HMA – Hot-Mix Asphalt
 - 5. RAP – Reclaimed Asphalt Pavement
 - 6. RAS – Recycled Asphalt Shingles
 - 7. SAC – Surface Aggregate Classification
 - 8. TxDOT – Texas Department of Transportation
 - 9. WWARP – Wet Weather Accident Reduction Program
- B. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS)
 - a. DMS-9210, Limestone Rock Asphalt (LRA).
 - 3. TxDOT Test Procedures:
 - a. Tex-100-E, Surveying and Sampling Soils for Highways.
 - b. Tex-107-E, Determining the Bar Linear Shrinkage of Soils.
 - c. Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates.
 - d. Tex-203-F, Sand Equivalent Test.
 - e. Tex-217-F, Determining Deleterious Material and Decantation Test for Coarse Aggregates (Bituminous Mixtures).

- f. Tex-221-F, Sampling Aggregate for Bituminous Mixtures, Surface Treatments, and Limestone Rock Asphalt.
- g. Tex-280-F, Determining Flat and Elongated Particles.
- h. Tex-402-A, Fineness Modulus of Fine Aggregate.
- i. Tex-406-A, Material finer than No. 200 Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
- j. Tex-408-A, Organic Impurities in Fine Aggregate for Concrete.
- k. Tex-410-A, Abrasion of Coarse Aggregate Using the Los Angeles Machine.
- l. Tex-411-A, Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate.
- m. Tex-413-A, Determining Deleterious Material in Mineral Aggregate.
- n. Tex-460-A, Determining Crushed Face Particle Count.
- o. Tex-499-A, Aggregate Quality Monitoring Program.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

- 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

B. Storage and Stockpiling of Aggregates

- 1. General
 - a. Selected stockpiling location should be relatively flat. Clean the area of trash, weeds, and grass.
 - b. Stockpile aggregates for each source and type separately.
 - c. Do not add materials to approved stockpiles.
 - d. Prevent segregation of the aggregates and maintain the stockpiles.
- 2. Coarse Aggregates
 - a. Separate the stockpiles into different gradations.
 - b. The stockpiles should be separated so that the grading requirements of final product are met when the piles are combined.
 - c. No more than 20 percent by weight of material that passes a number 8 sieve will be allowed in the coarse aggregate stockpile unless specified in the Drawings.
- 3. Fine Aggregates
 - a. Stockpiles may contain coarse aggregate of up to 20-percent by weight.
 - b. The coarse aggregate included in the fine aggregate stockpile is required to meet the quality tests specified in Table 2.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. General

1. Provide aggregates free from loam, clay balls, or other injurious foreign matter occurring either free or as a coating.
2. Provide aggregates in accordance with the definitions in Tex-100-E.
3. Perform, document, and provide all test results for aggregate testing.
4. Provide aggregates from sources that stockpile each type of aggregate separately.
5. Furnish LRA in accordance with DMS-9210, "Limestone Rock Asphalt (LRA)" when used.
6. Provide aggregates for asphalt production from TxDOT's *Bituminous Rated Source Quality Catalog* (BRSQC).
7. Provide aggregates for concrete production from TxDOT's *Concrete Rated Source Quality Catalog* (CRSQC).
8. Submit material tests from source locations to verify the aggregates are in accordance with this Section.
9. Conform aggregate sampling to Tex-221-F.

Table 1
Aggregate Types

Type	Material
A	Gravel, crushed slag, crushed stone, or LRA
B	Crushed gravel, crushed slag, crushed stone, or LRA
C	Gravel, crushed slag, or crushed stone
D	Crushed gravel, crushed slag, or crushed stone

B. Coarse Aggregate

1. The portion of the total aggregates retained on the number 10 sieve.
2. Provide coarse aggregate of uniform quality throughout.
3. Asphalt Requirements
 - a. General
 - 1) Provide aggregates from stockpiles that have no more than 20% material passing the number 8 sieve.
 - 2) Provide aggregates that meet the definitions of crushed gravel or crushed stone in accordance with Tex-100-E.
 - 3) Use only the rated values on the BRSQC for hot mix. Rated values for surface treatment do not apply to coarse aggregate sources used in hot-mix asphalt.
 - 4) Maximum aggregate size should not be over half of the proposed lift depth to prevent particle on particle contact issues.
 - b. RAP
 - 1) Aggregate from RAP is not required to meet the requirements of Table 2 unless otherwise specified in the Drawings or directed by the City Engineer.
 - c. SAC Requirements

- 1) Furnish aggregate with a minimum SAC of A for all surface course asphalt lifts used on travel lanes. The BRSQC lists the SAC for sources on the AQMP.
- 2) Do not blend aggregate to meet the SAC unless otherwise approved.
- 3) If blending is approved by the City:
 - a) Class A and Class B aggregates are defined in TxDOT WWARP.
 - b) Class B aggregate meeting all other requirements in Table 2 may be blended with a Class A aggregate to meet requirements for Class A materials.
 - (1) Ensure that at least 50 percent by weight, or volume if required, of the material retained on the Number 4 sieve comes from the Class A aggregate source.
 - c) Blend by volume if the bulk specific gravities of Class A and B aggregates differ by more than 0.300.
 - d) Coarse aggregate from RAP and RAS will be considered as Class B aggregate for blending purposes.
4. Concrete Requirements
 - a. General
 - 1) Provide coarse aggregate consisting of durable particles of gravel, crushed blast furnace slag in accordance with the requirements of ASTM C989 Grade 100 or 120, recycled crushed hydraulic cement concrete, crushed stone, or combinations which are free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material.
 - 2) Provide coarse aggregate of uniform quality throughout.

Table 2
Coarse Aggregate Requirements

Property	Test Method	Requirement
Sampling	Tex-221-F	—
SAC	Tex-499-A (AQMP)	Note 1
Deleterious material, percent maximum	Tex-217-F, Part 1	1.5
Decantation, percent maximum	Tex-406-A, Part 2	1.5
Los Angeles Abrasion, percent maximum	Tex-410-A	40
Magnesium sulfate soundness, ^{2,3} 5 cycles, percent maximum (non-air-entrained concrete and asphalt)	Tex-411-A	25
Coarse aggregate angularity, 2 crushed faces, percent minimum	Tex-460-A, Part 1	85
Additional Requirements for Asphalt		
Flat and elongated particles at 5:1, percent maximum	Tex-280-F	10
Additional Requirements for Concrete		
Magnesium sulfate soundness, ^{2,4} 5 cycles, percent maximum (air-entrained concrete)	Tex-411-A	18
Weight of Clay Lumps, percent maximum	Tex-413-A	0.25
Weight of Shale, percent maximum		1.0
Weight of Laminate and Friable Particle, percent maximum		5.0

1. SAC A for All Surface Courses Unless Otherwise Noted on Drawings.
2. Recycled crushed hydraulic cement concrete is not subject to 5-cycle magnesium sulfate soundness requirements.
3. Only when air-entrained concrete is required by the plans.
4. FOR CONCRETE ONLY: If the material finer than the number 200 sieve is determined to be at least 85% calcium carbonate in accordance with Tex-406-A:
 - Increase the decantation limit to 3.0 percent for all classes of concrete.
 - Increase the decantation limit to 5.0 percent for Class A, B, and P concrete.
 - Provide test results with concrete action submittals.

C. Fine Aggregate

1. Consists of crushed stone, crushed gravel, sand, and/or limestone or steel slag screenings
2. Provide fine aggregate, except for field sand, from coarse aggregate sources that meet the requirements of this specification.
3. Asphalt Requirements
 - a. Provide sand, limestone, or steel slag screenings passing the number 40 sieve that conform to the requirements shown in Table 3.
 - b. Provide aggregates free from impurities.
 - c. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that conform to requirements in Table 3.
 - d. Sand
 - 1) No more than 15 percent of the total aggregate may be field sand or other uncrushed fine aggregate.
 - 2) Gradation – The gradation of the sand is the portion of the total aggregate that passes the No. 10 sieve. Provide sand that is well graded and composed of sound, durable sand particles.
4. Concrete Requirements
 - a. Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of the two, that is clean, hard, durable, uncoated, and free from clay lumps.
 - b. Provide fine aggregate free from frozen material and injurious amounts of salt, alkali, vegetable matter, or other objectionable material.

**Table 3
Fine Aggregate Requirements**

Property	Test Method	Requirement
Requirements for Asphalt		
Linear Shrinkage, Percent, Maximum	Tex-107-E	3
Organic Impurities	Tex-408-A	None allowed
Additional Requirements for Concrete		
Weight of clay lumps, percent maximum	Tex-413-A	0.50
Sand Equivalent, percent maximum	Tex-203-F	80
Fineness Modulus	Tex-402-A	2.3 to 3.1
Organic Impurities*	Tex-408-A	None allowed

* - Only when air-entrained concrete is required by the plans.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Aggregate Quality Requirements

1. Submit material tests from source location to verify the aggregates are in accordance with the applicable requirements in Tables 2 and 3.
 - a. Test and Evaluation Reports
 - a) Provide testing and evaluation reports to the City for each material being used to prepare concrete pavement. Test samples or provide product data verifying source material complies with all requirements in this Section. Materials to be tested include, but are not limited to:
 - (1) Coarse and Fine Aggregate Testing

- (a) Provide verification that the material source location is listed on TxDOT's CRSQC. If listed, source quality testing may be waived.
 - (b) If the source location is not listed on TxDOT's CRSQC, provide all testing and evaluation reports to verify the source material complies with all requirements in Section 32 05 16.
 - (2) Cement and Supplementary Cementing materials
 - (3) Manufacturer supplied testing and product data
 - 2. Submit new material tests from any new source location.
- B. Non-Conforming Work
- 1. General
 - a. The City may at any time reject a material if it is found to be non-conforming to this Section.
 - b. The City may require the Contractor at any time to remove and replace installed Concrete Pavement if any material used is found to be non-conforming at no cost to the City.
 - 2. Aggregates
 - a. Test in accordance with specified ASTM and TxDOT Test Methods in this Section.
 - b. Aggregates that fail to meet the requirements of this Section will be rejected.
 - c. Aggregate source locations may be rejected if supplied aggregates do not meet the requirements of this Section.
 - d. Any rejection of materials or source locations will be at no cost to the City.

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION [NOT USED]

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 11 23

FLEXIBLE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foundation course for surface course or other base course composed of flexible base constructed in one or more courses in accordance with the typical section specified in the Drawings.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Flexible Base
 - a. Measurement
 - 1) Measured by the square yard of Flexible Base Course installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for Flexible Base Course installed for:
 - a) Various depths.
 - b) Various grades.
 - c) Various types.
 - c. The price bid shall include:
 - 1) Furnishing and installing Flexible Base Course as specified by the Drawings
 - 2) Loading
 - 3) Unloading
 - 4) Hauling
 - 5) Storing
 - 6) Disposal of excess materials
2. Rework
 - a. Payment
 - 1) Material used and work performed for reworking will not be paid for directly but will be subsidiary to original item bid.

1.3 REFERENCES

A. Definitions

1. RAP – Recycled Asphalt Pavement.

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.

2. ASTM International (ASTM):
 - a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
 - b. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
3. Texas Department of Transportation (TxDOT) Test Procedures:
 - a. Tex-104-E, Determining Liquid Limits of Soils
 - b. Tex-106-E, Calculating the Plasticity Index of Soils
 - c. Tex-107-E, Determining the Bar Linear Shrinkage of Soils
 - d. Tex-110-E, Particle Size Analysis of Soils
 - e. Tex-116-E, Ball Mill Method for Determining the Disintegration of Flexible Base Material
 - f. Tex-117-E, Triaxial Compression for Disturbed Soils and Base Materials
 - g. Tex-140-E, Measuring Thickness of Pavement Layer
 - h. Tex-411-A, Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate
 - i. Tex-413-A, Determining Deleterious Material in Mineral Aggregate

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery of materials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Informational Submittals

1. Proposed source and supplier of flexible base material.
2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports

1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. Deposit material directly on subgrade and spread and shape same day.

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Stockpiling

- a. When required, stockpile base material at a location approved by City.
- b. Create stockpiles in layers no greater than 2 feet thick.
- c. Stockpile must have a total height between 6 feet and 12 feet.
- d. Do not load material from stockpile until City has approved stockpile construction.
- e. Load by making successive vertical cuts through the entire depth of the stockpile.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS

A. Existing Products

1. Recycled Concrete
 - a. Recycled concrete may only be used in Type D Flexible Base when obtained from the City.
 - 1) Coordinate with City regarding quantity available for use in the Work.
 - a) Contractor will not be entitled to additional payment or to submit a Contract Claim if recycled concrete is not available for their use.
 - b. City-furnished recycled concrete is not subject to the requirements of Table 1.
 - c. The final blended product will be subject to the requirements of Table 1.

2.2 MATERIALS

A.General

1. Furnish uncontaminated materials of uniform quality in accordance with this Section and as specified in the Drawings.
2. Notify City of changes to material sources.
3. The City may sample and test project materials at any time before compaction throughout the duration of the project to assure materials accordance with this Section.

B.Aggregates

1. Furnish aggregate of the type and grade specified in the Drawings and in accordance with the requirements of Table 1.
2. If blending of sources is approved by the City, ensure each source is in accordance with the requirements of Table 1.
3. Do not use additives, such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1 unless approved by the City.
 - a. Additives may be used during final placing as directed by the geotechnical report.

Table 1
Material Requirements

Property	Test Method	Grade 1	Grade 2
Master gradation sieve size (% retained)	Tex-110-E		
2-1/2 in.		—	0
1-3/4 in.		0	0–10
7/8 in.		10–35	—
3/8 in.		30–50	—
No. 4		45–65	45–75
No. 40		70–85	60–85
Liquid limit, % max. ¹	Tex-104-E	35	40
Plasticity index, max. ¹	Tex-106-E	10	12
Wet ball mill, % max. ²	Tex-116-E	40	45
Wet ball mill, % max. increase passing the No. 40 sieve		20	20
Classification ³	Tex-117-E	1.0	1.1–2.3
Min. compressive strength ³ , psi			
lateral pressure 0 psi		45	35
lateral pressure 15 psi		175	175

- Determine plastic index in accordance with Tex 107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex 104-E.
- When a soundness value is required by the Drawings, test material in accordance with Tex 411-A.
- Meet both the classification and the minimum compressive strength, unless otherwise shown on the Drawings.

C. Flexible Base Types

- Type A
 - Flexible Base Course consisting of limestone aggregate obtained from single, naturally occurring source in accordance with Section 32 05 16.
 - Do not use gravel or recycled materials in Type A Flexible Base Course.
- Type B
 - Flexible Base Course consisting of limestone aggregate obtained from two or more naturally occurring sources in accordance with Section 32 05 16.
 - Do not use gravel or recycled materials in Type B Flexible Base Course.
- Type D
 - Flexible Base Course consisting of Type A material in addition to up to 30% recycled material.
 - Ensure final blended material is in accordance with the requirements of Table 1.

D. Recycled Materials

- General
 - Obtain City approval prior to using any recycled materials.
 - Furnish recycled materials free from reinforcing steel and other objectional material.
 - Furnish recycled materials with at most 1.5 percent deleterious material when tested in accordance with TEX-413-A.
- Recycled Asphalt Pavement (RAP)
 - Up to 30% of Flexible Base Course material may be RAP when approved by the City.
 - Crush RAP such that 100% passes the 2-inch sieve.

E. Water

1. Furnish water free of industrial wastes and other objectionable material.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.Surface Preparation

1. Shape subgrade or existing base to within 0.2 feet of finished grade according to the typical sections specified in the Drawings or as directed by City.
2. Proof roll subgrade material and correct soft spots as directed.
3. Remove unsuitable soil or material and replace with acceptable soil.
4. When material is imported from a borrow source, manipulate and thoroughly mix new base with existing material to provide uniform mixture before shaping.

B.Demolition / Removal

1. Remove existing pavement in accordance with Section 02 41 15 as specified in the Drawings.

3.4 INSTALLATION

A.General

1. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content.
2. Maximum layer depth of flexible base course in single layer not to exceed 6 inches.
3. Minimum layer depth of flexible base course is 2 inches.
4. Where subbase or base course exceeds 6 inches in thickness, construct in 2 or more courses of equal thickness not exceeding 4 inches.
5. Provide a smooth surface in accordance with the typical sections, lines, and grades specified in the Drawings or as directed by City.

B.Equipment

1. Provide machinery, tools, and equipment necessary for proper execution of the work.
2. Compaction
 - a. Sheepfoot roller required for all compaction operations.
 - 1) Alternate Equipment
 - a) Contractor may use alternative compaction equipment that produces equivalent results if approved by City prior to use.
 - b) Discontinue use of the alternate equipment and furnish the specified equipment if the desired results are not achieved.

- 2) City may require Contractor to substitute equipment if production rate and quality requirements of the Contract Documents are not met.

C.Placement

1. Spread and shape flexible base into a uniform layer by approved means the same day as delivered unless otherwise approved by City.
2. Move all material from the location in which it is deposited no more than once.
3. Place material such that it is mixed to minimize segregation.
4. Construct layers to the thickness specified in the Drawings while maintaining the shape of the course.
5. Control dust by sprinkling.
6. Correct or replace segregated areas as directed.
7. Place successive base courses and finish courses using the same construction methods required for the first course.
8. When required to use multiple lifts, ensure successive base courses and finish courses are placed such that section breaks do not align.

D.Compaction

1. Compact using density control unless otherwise specified in the Contract Documents.
2. Bring each layer to the moisture content directed. When necessary, sprinkle the material to the extent necessary to provide not less than the required density as specified in this Section.
3. Compact the full depth of the subbase or base to the extent necessary to remain firm and stable under construction equipment.
4. Density Control
 - a. Compact until the entire depth of the mixture has achieved a uniform density not less than 98 percent of the maximum density as determined by ASTM D698.
 - b. Final moisture content shall be plus or minus 2 percent of optimum.

E. Finishing

1. After completing compaction, clip, skin, or tight-blade surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
2. Remove loosened material and dispose of it at an approved location.
3. Seal the clipped surface immediately by rolling with an appropriate size pneumatic tire roller until a smooth surface is attained.
4. Add small increments of water as needed during rolling.
5. Shape and maintain the course and surface in accordance with the typical sections, lines, and grades as specified in the Drawings or as directed by the City.
6. In areas where surfacing is to be placed, correct grade deviations greater than 1/4 inch in 16 feet measured longitudinally or greater than 1/4 inch over the entire width of the cross-section.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION

A.Reworking a Flexible Base Section

1. Rework any constructed course which fails to meet the requirements of this Section.
2. Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing.

3.7 FIELD QUALITY CONTROL

A.Field Test and Inspections

1. Test in accordance with Section 01 45 23.
2. Density Test
 - a. City must be on site during density testing
 - b. Measure density of flexible base course in accordance with ASTM D6938.
 - c. Measure density every 100' along corridor or as directed by City.
 - d. City to determine density testing locations.
3. Depth Test
 - a. City must be on site during density testing
 - b. Measure depth of flexible base course in accordance with Tex-140-E in hand excavated holes.
 - c. Measure depth every 300' along corridor or as directed by City.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE

- #### **A.Maintain the completed flexible base in good condition, satisfactory to the City as to grade, crown, and cross section until the overlaying or next course is constructed.**

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 11 29

LIME TREATED BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Treating subgrade, subbase, and base courses by pulverization and addition of lime.
 - 2. Mixing and compacting the mix material to the required density.
- B. Deviations from City of League City Standards:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 02 41 15 – Paving Removal.
 - 2. Section 31 23 16 – Unclassified Excavation.
 - 3. Section 31 24 00 – Embankments.
 - 4. Section 32 11 23 – Flexible Base Courses.
 - 5. Section 32 12 16 – Asphalt Paving.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Commercial Lime Slurry
 - a. Measurement
 - 1) Measured by ton (dry weight) as calculated from minimum percent dry solids content of slurry multiplied by weight of Commercial Lime Slurry installed.
 - b. Payment
 - 1) The materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per ton for “Commercial Lime Slurry.”
 - c. The price bid shall include:
 - 1) Furnishing Commercial Lime Slurry as specified by the Drawings
 - 2) Hauling
 - 3) Unloading
 - 4) Storing
 - 5) Handling
 - 2. Lime Treatment
 - a. Measurement
 - 1) Measured by square yard of base course treated.
 - b. Payment
 - 1) The work performed in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard of “Lime Treatment” for:
 - a) Various depths.
 - c. The price bid shall include:

- 1) Treating base course as specified in the Drawings
- 2) Subgrade preparation
- 3) Excavation
- 4) Loading
- 5) Unloading
- 6) Hauling
- 7) Disposal of excess material
- 8) Compaction
- 9) Clean-up

1.3 REFERENCES

A. Definitions

1. Commercial Lime Slurry: liquid mixture of hydrated lime solids and water delivered to a project in slurry form.

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section, unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. C977, Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
 - c. D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
3. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS)
 - a. DMS-6350, Lime and Lime Slurry.
4. TxDOT Test Procedures:
 - a. Tex-101-E, Preparing Soil and Flexible Base Materials for Testing.
 - b. Tex-140-E, Measuring Thickness of Pavement Layer.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to commencement of any lime treating activities.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Informational Submittals

1. Proposed source and supplier of lime treatment material.
2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports

1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. List the weight of lime measured on certified scales on each truck ticket.
2. Submit delivery tickets, certified by supplier, that include weight with each bulk delivery of lime to the site.
3. When using slurry, spread lime across treatment area when delivered in accordance with this Section.

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS

A. Ambient Conditions

1. Surface temperature must be at least 60°F and the ambient temperature must be 45°F and rising.

B. Suspend Lime Treatment if:

1. Ambient Condition requirements are not met
2. City determines weather conditions are unsuitable

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. General

1. Furnish uncontaminated materials of uniform quality in accordance with the Drawings and this Section.
2. Notify the City of the proposed material sources and changes to material sources.
3. Obtain City approval for material sources.
4. The City may sample and test project materials at any time before compaction.
5. Furnish lime in accordance with the requirements of ASTM C977.
6. Furnish lime in slurry.

B. Slurry Grades

1. Prior to treating the base select a grade to be used and notify the City.

2. Furnish Commercial Lime Slurry in accordance with DMS-6350 and the applicable grade requirements below:

	Minimum Dry Solids Contents by Percentage of the Slurry
Grade 2	35
Grade 3	46

C. Flexible Base Courses

1. Furnish base material in accordance with Section 32 11 23, for the type and grade specified in the Drawings, before the addition of lime.

D. Embankment

1. Furnish Embankments in accordance with Section 31 24 00 before the addition of lime.

E. Water

1. Furnish water free of industrial wastes and other objectionable material.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Surface Preparation

1. Shape the subgrade or existing base to within 0.2 feet of finished grade in accordance with typical sections specified in the Drawings or as directed.
2. Proof roll the subgrade and correct any rutting.
3. Remove unsuitable soil or material and replace with acceptable soil.
4. When material is imported from a borrow source, manipulate and thoroughly mix new base with existing material to provide uniform mixture before shaping.

B. Demolition / Removal

1. Remove existing pavement in accordance with Section 02 41 15 as shown in the Drawings.
2. Remove existing soil in accordance with Section 31 23 16 as shown in the Drawings.

3.4 INSTALLATION

A. General

1. Produce a completed course of treated material containing:
 - a. Uniform lime mixture, free from loose or segregated areas
 - b. Uniform density and moisture content

- c. Well bound for full depth
 - d. A smooth surface suitable for placing subsequent courses
 - 2. Maximum layer depth of 6 inches of lime treatment in single layer.
 - 3. Minimum layer depth of 2 inches of lime treatment.
 - 4. For treated subgrades exceeding 6 inches deep, pulverize, apply lime, mix, compact, and finish in equal layers not exceeding 4 inches deep.
- B. Equipment
- 1. Provide machinery, tools, and equipment necessary for proper execution of the work.
 - 2. Pulverization Equipment
 - a. Provide pulverization equipment that:
 - 1) Cuts and pulverizes material uniformly to the proper depth with cutters plane to a uniform surface over the entire width of the cut.
 - 2) Provides a visible indication of the depth of cut at all times
 - 3) Uniformly mixes the materials.
 - 3. Compaction
 - a. Sheepfoot roller required for all compaction operations.
 - 4. Proof Rolling
 - a. Use equipment that will apply sufficient load to identify soft spots that rut or pump.
 - 1) Acceptable equipment includes fully loaded single-axle water truck with minimum 1,500-gallon capacity.
 - 5. Slurry Equipment
 - a. Provide a distributor truck equipped with an agitator, or
 - b. Provide a pump for agitating the slurry.
 - 6. Substitution requests for equipment not indicated above shall be processed in accordance with Section 01 25 00.
 - a. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract Documents are not met.
- C. Pulverization
- 1. Pulverize or scarify existing material after shaping so 100 percent passes a 2 1/2 inch sieve.
 - 2. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to depth as specified in the Drawings.
- D. Application of Lime
- 1. General
 - a. Uniformly apply lime in accordance with the Drawings or as directed by the City.
 - b. Add lime in accordance with percentage specified in Geotechnical report or as directed by the City.
 - c. Apply lime slurry only on an area where mixing can be completed during the same working day.
 - 2. Slurry Placement
 - a. Apply Commercial Lime Slurry with a percentage not less applicable for grade used.
 - b. Make successive passes over a measured surface of roadway until the proper moisture and lime content have been achieved.

E. Mixing

1. Begin mixing within 6 hours of application of lime.
2. Thoroughly mix the material and lime using approved equipment.
3. Mix until a homogeneous, friable mixture of material and lime is obtained, free from all clods and lumps.
4. Do not mix greater than 1 inch deeper than specified stabilization depth.
5. Mix materials containing plastic clay or other materials not readily mixed with lime as thoroughly as possible at the time of lime application. Bring mixture to the proper moisture content and seal with a pneumatic roller.
6. Allow the mixture to cure for 72 hours.
7. Sprinkle the treated materials during the mixing and curing operation to achieve adequate hydration and proper moisture content.
8. After curing, resume mixing until a homogeneous, friable mixture is obtained.
9. After mixing, City may sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the following gradation requirements:

Sieve Size	Minimum % Passing
1-3/4 in.	100
3/4 in.	85
No. 4	60

F. Compaction

1. General
 - a. Begin compaction immediately after final mixing.
 - b. Aerate and sprinkle as necessary to provide optimum moisture content.
 - c. When multiple lifts are required bring each layer to moisture content as directed by the City.
2. Proof Rolling
 - a. City must be on-site during proof rolling operations.
 - b. Minimum of 2 passes made with the proof roller, offsetting each trip by at most one tire width.
 - c. Correct areas of rutting or pumping greater than 3/4 in and unstable or non-uniform areas in accordance with this Section.
3. Density Control
 - a. Compact until entire depth of mixture has achieved a uniform density of not less than 98 percent of the maximum density in accordance with ASTM D698.
 - b. Final moisture content shall be plus or minus 2 percent of optimum.

G. Finishing

1. Complete after compaction of the final course.
2. Clip, skin, or tight-blade surface of lime-treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
3. Remove loosened material and dispose of at an approved location.
4. Roll the clipped surface immediately with pneumatic tire roller until a smooth surface is attained.

5. Maintain density control by adding small amounts of water as needed during rolling.
6. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades shown in the Drawings or as directed.

H. Curing

1. Allow lime treatment to cure in accordance with finished pavement type.
 - a. Concrete pavement
 - 1) Sprinkle with water
 - 2) Maintain moisture during curing
 - 3) Do not allow equipment on the finished course during curing except as required for sprinkling.
 - b. Asphalt Pavement
 - 1) Apply an asphalt material in accordance with 32 12 16 at a rate of 0.10 to 0.20 gallon per square yard.
 - 2) Do not allow equipment on the finished course during curing.
2. Allow lime treatment to cure for minimum number of days in accordance with requirements for PI of untreated material:

Untreated Material	Curing (Days)
PI $\leq$ 35	2
PI > 35	5

3. Begin paving operations or add other courses within 14 calendar days of final compaction.
4. Keep treated subgrade moist preventing cracking until pavement or other courses are placed.
5. If the pavement or other courses are not to be placed within 14 days of final compaction apply a seal coat to the treated subgrade surface in accordance with Section 32 12 16.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION

A. Reworking

1. Reworking includes loosening, adding material, or removing unacceptable material, if necessary, mixing as directed, compacting, and finishing.
2. Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted.
 - a. Continue until material is in accordance with the requirements of this Section.
 - b. Rework in accordance with this Section.
3. A minimum of 72 hours of curing time after the initial mixing of the subgrade will be required before remixing is allowed and the placement of base courses or other construction activities are permitted.
4. When a section is reworked more than 72 hours after completion of compaction, add additional lime at 25 percent of the percentage specified.

3.7 FIELD QUALITY CONTROL

A. Field Test and Inspections

1. Perform tests in accordance with Section 01 45 23.

2. Density Test
 - a. City must be on site during density testing
 - b. Measure density of lime treated subgrade in accordance with ASTM D6938.
 - c. Measure density every 100' along corridor.
 - d. City determines density testing locations.
3. Depth Test
 - a. City must be on site during density testing.
 - b. Measure depth of lime treated subgrade in accordance with Tex-140-E in hand excavated holes.
 - c. Measure depth every 250' along corridor or once per street, whichever is shorter.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE

- A. Maintain the completed soil lime base in good condition and satisfactory to the City as to grade, crown, and cross section until the overlaying or next course is constructed.
- B. Keep treated subgrade moist preventing cracking until pavement or other courses are placed.

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 11 33

CEMENT TREATED BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Treating subgrade, subbase, and base courses by pulverization and addition of cement.
2. Mixing and compacting the mix material to the required density.

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include but are not necessarily limited to

1. Section 02 41 15 – Paving Removal.
2. Section 31 24 00 - Embankment.
3. Section 32 11 23 – Flexible Base Courses.
4. Section 32 12 16 – Asphalt Paving.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Cement
 - a. Measurement
 - 1) Measured by the ton of Cement installed.
 - b. Payment
 - 1) The materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per ton of Cement installed.
 - c. The price bid shall include:
 - 1) Furnishing Cement as specified in the Drawings
 - 2) Hauling
 - 3) Unloading
 - 4) Storing
 - 5) Handling
2. Cement Treatment
 - a. Measurement
 - 1) Measured by the square yard of base course treated.
 - b. Payment
 - 1) The work performed in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard of “Cement Treatment” for:
 - 2) Various depths.
 - c. The price bid shall include:
 - 1) Treating base course as specified in the Drawings
 - 2) Subgrade preparation

- 3) Excavation
- 4) Loading
- 5) Unloading
- 6) Hauling
- 7) Disposal of excess material
- 8) Compaction
- 9) Clean-up

1.3 REFERENCES

A.Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. C150, Standard Specification for Portland Cement.
 - b. D558, Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
 - c. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
3. TxDOT Test Procedures:
 - a. Tex-101-E, Preparing Soil and Flexible Base Materials for Testing.
 - b. Tex-120-E, Soil-Cement Testing
 - c. Tex-140-E, Measuring Thickness of Pavement Layer

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

A.Submittals shall be in accordance with Section 01 33 00.

B.All submittals shall be approved by the City prior to commencement of any cement treatment activities.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A.Informational Submittals

1. Proposed source and supplier of cement treatment material.
2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use
3. Cement Mix Design
 - a. Submit mix design detailing target cement content and optimum moisture content in accordance with Tex-120-E.

1.7 CLOSEOUT SUBMITTALS

A.Test and Evaluation Reports

1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A.Delivery and Acceptance Requirements

1. List the weight of cement measured on certified scales on each truck ticket.
2. Submit delivery tickets, certified by supplier, that include weight with each bulk delivery of cement to the site.

B.Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Store cement in closed, weatherproof containers.

1.11 FIELD CONDITIONS

A.Ambient Conditions

1. Surface temperature must be at least 60°F and the ambient temperature must be 45°F and rising.

B.Suspend cement treatment if:

1. Ambient Condition requirements are not met
2. City determines weather conditions are unsuitable

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A.General

1. Furnish uncontaminated materials of uniform quality in accordance with the Drawings and this Section.
2. Notify the City of the proposed material sources and of changes to material sources.
3. Obtain City approval for material sources.
4. The City may sample and test project materials at any time before compaction.

B.Cement

1. Furnish cement in accordance with ASTM C150 Type I or IA.

C. Flexible Base Courses

1. Furnish base material in accordance with the requirements of Section 32 11 23 for the type and grade specified in the Drawings, before the addition of cement.

D.Embankment

1. Furnish embankment in accordance with the requirements of Section 31 24 00 before the addition of cement.

E. Water

1. Furnish water free of industrial wastes and other objectionable material.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A.Surface Preparation

1. Shape the subgrade or existing base to within 0.1 feet of finished grade in accordance with the typical sections shown in the Drawings or as directed.
2. Proof roll roadbed in accordance with Paragraph 3.4 unless specified otherwise.
3. Remove unsuitable soil or material and replace with acceptable soil.
4. When material is imported from a borrow source manipulate and thoroughly mix new base with existing material to provide a uniform mixture before shaping.

B.Demolition / Removal

1. Remove existing pavement in accordance with Section 02 41 15 as shown on the Drawings.

3.4 INSTALLATION

A.General

1. Produce a completed course of treated material containing:
 - a. Uniform Portland cement mixture, free from loose or segregated areas
 - b. Uniform density and moisture content
 - c. Well bound for full depth
 - d. With smooth surface and suitable for placing subsequent courses
2. Maximum layer depth of 6 inches of cement treatment in single layer.
3. Minimum layer depth of 3 inches of cement treatment.
4. For treated subgrade exceeding 6 inches deep, pulverize, apply cement, mix, compact, and finish in equal layers not exceeding 4 inches deep.

B. Equipment

1. Provide machinery, tools, and equipment necessary for proper execution of the work.
2. Pulverization Equipment
 - a. Provide pulverization equipment that:
 - 1) Cuts and pulverizes material uniformly to the proper depth with cutters plane to a uniform surface over the entire width of the cut
 - 2) Provides a visible indication of the depth of cut at all times
 - 3) Uniformly mixes the materials
3. Compaction
 - a. Sheepfoot roller required for all compaction purposes.

4. Proof rolling
 - a. Use equipment that will apply sufficient load to identify soft spots that rut or pump.
 - 1) Acceptable equipment includes fully loaded single-axle water truck with minimum 1,500-gallon capacity.
5. Slurry Equipment
 - a. Provide a distributor truck equipped with an agitator, or
 - b. Provide a pump for agitating the slurry.
6. Substitution requests for equipment not indicated above shall be processed in accordance with Section 01 25 00.
 - a. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract Documents are not met.

C. Pulverization

1. Pulverize or scarify existing material after shaping so that 100 percent by dry weight passes a 2 1/2 inch sieve, and 80 percent by dry weight passes a No. 4 sieve exclusive of gravel or stone retained in sieves.
2. No gravel or stone should be greater than 4 inches in maximum dimension.
3. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to depth as specified in the Drawings.

D. Application of Cement

1. General
 - a. Uniformly apply cement as specified in the Drawings or as directed by the City.
 - b. Spread by an approved dry or slurry method uniformly on the soil at the rate specified in the Drawings.
 - c. All the operations are to be continuous and completed in daylight within 6-hours of initial application.
 - d. Do not exceed the quantity of cement that permits uniform and intimate mixture of soil and cement during dry-mixing operations
 - e. No equipment, except that used in the spreading and mixing, allowed to pass over the freshly spread cement until it is mixed with the soil.
2. Dry Placement
 - a. Before applying cement, bring the prepared roadbed to approximately 2 percentage points above optimum moisture content.
 - b. If a bulk cement spreader is used, position by string lines or other approved method during spreading to insure a uniform distribution of cement.
 - c. Minimize dust and scattering of lime by wind. Do not apply lime when wind conditions, in the opinion of the City, cause blowing lime to become dangerous to traffic or objectionable to adjacent property owners.
3. Slurry Placement
 - a. Apply slurry within 2 hours of adding water and when the roadbed is at a moisture content drier than optimum.
 - b. Make successive passes over a measured surface of roadway until the proper moisture and cement content have been achieved.

E. Mixing

1. Thoroughly mix the material and cement using approved equipment.

2. Mix until a homogeneous, friable mixture of material and cement is obtained, free from all clods and lumps.
3. Keep mixture within moisture tolerances throughout the operation.
4. Spread and shape the completed mixture in a uniform layer.
5. After mixing City may sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements:

Sieve Size	Minimum % Passing
1-3/4 in.	100
3/4 in.	85
No. 4	60

F. Compaction

1. General
 - a. Begin compaction after mixing, and after gradation and moisture requirements have been met.
 - b. Begin compaction at the bottom and continue until the entire depth of the mixture is uniformly compacted.
 - c. At start of compaction, percentage of moisture in the mixture and in un-pulverized soil lumps shall be less than the quantity which shall cause the soil-cement mixture to become unstable during compaction and finishing.
 - d. Reconstruct entire section in accordance with this Section at the sole expense of the Contractor if average moisture content exceeds the tolerance given at the time of final compaction.
 - e. Uniformly compact the mixture to specified density within 2-hours.
 - f. After the soil and cement mixture is compacted uniformly apply water as needed and thoroughly mix in.
 - g. Reshape the surface to the required lines, grades, and cross sections.
 - h. Lightly scarify surface to loosen any imprint left by the compacting or shaping equipment.
2. Rolling
 - a. Begin rolling longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least one-half the width of the roller unit.
 - b. On superelevated curves, begin rolling at the low side and progress toward the high side.
 - c. Offset alternate trips of the roller.
 - d. Operate rollers at a speed between 2 and 6 MPH or as directed.
 - e. Proof roll the cement treated base course in accordance with the following:
 - 1) Proof Rolling
 - a) City must be on-site during proof rolling operations.
 - b) Make at least 2 passes with the proof roller (down and back = 1 pass).
 - c) Offset each trip by at most 1 tire width.
 - f. Correct areas of rutting or pumping greater than 3/4 in and unstable or non-uniform areas in accordance with Article 3.6.
3. Density Control
 - a. Compact until the entire depth of the mixture has achieved a uniform density of not less than 95 percent of the maximum density as determined by ASTM D558.
 - b. Final moisture content shall be minus 2 percent to plus 4 percent of optimum.

G.Finishing

1. Complete after compaction of the final course.
2. Clip, skin, or tight-blade surface of lime-treated material with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
3. Remove loosened material and dispose of at an approved location.
4. Roll the clipped surface immediately with a pneumatic tire roller adding small increments of moisture as needed and until a smooth surface is attained.
5. Add small amounts of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades shown in the Drawings or as directed.
6. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2-hours, a smooth, closely knit surface, free of cracks, ridges or loose material, conforming to the drawn grade and line shown in the Drawings.
7. After the final layer or course of the cement modified soil has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections.
8. The completed section shall then be finished by rolling with a pneumatic tire or other suitable roller sufficiently to create micro-fractures.

H.Micro-fracturing

1. Maintain moisture content of the finished cement treated base for a period of 24 to 48 hours.
2. During this time, but not sooner than 24 hours, roll the finished course with a vibratory roller to induce micro-fracturing.
3. Rolling
 - a. Vibratory roller must have a static weight equal to or greater than 12 tons.
 - b. Vibratory roller must be at least 20 inches wide.
 - c. Make 2 to 4 passes vibrating at maximum amplitude traveling at a speed of 2 mph.
 - d. Additional passes may be required to achieve the desired cracking pattern, as directed by the City.
 - e. Notify the City 24 hours before the micro-fracturing begins.

I. Curing

1. General
 - a. Cure for 72 hours after micro-fracturing is complete.
 - b. Maintain the moisture content during curing at no lower than 2 percentage points below optimum.
2. Curing method depends on finished pavement type:
 - a. Concrete pavement:
 - 1) Sprinkle with water
 - 2) Maintain moisture during curing
 - 3) Do not allow equipment on finished course during curing except as required for sprinkling, unless otherwise approved.
 - b. Asphalt Pavement:
 - 1) Apply an asphalt material in accordance with 32 12 16 at a rate of 0.10 gallon per square yard.
 - 2) Do not allow equipment on the finished course during curing
3. Continue curing until paving operations begin.

3.5 RESTORATION [NOT USED]

3.6 RE-INSTALLATION

- A. Remedy any low area of treated subgrade by scarifying the surface to a depth of at least 2 inches, filling the area with treated material and compacting.
- B. Remedy any low area of subbase or base by replacing the material for the full depth of subbase or base treatment rather than adding a thin layer of stabilized material to the completed work.
- C. Reworking a Section
 - 1. Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing.
 - 2. Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted.
 - a. Continue until material is in accordance with the requirements of this Section.
 - b. Rework in accordance with this Section.

3.7 FIELD QUALITY CONTROL

- A. Field Test and Inspections
 - 1. Perform tests in accordance with Section 01 45 23.
 - 2. Density Test
 - a. City must be on site during density testing
 - b. Measure density of cement treated subgrade in accordance with ASTM D6938.
 - c. Measure density every 100' along corridor or per street, whichever is shorter.
 - d. City determines density testing locations.
 - 3. Depth Test
 - a. City must be on site during density testing.
 - b. Measure depth of cement treated subgrade in accordance with Tex-140-E in hand excavated holes.
 - c. Measure depth every 250' along corridor or per street, whichever is shorter.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE

- A. Maintenance
 - 1. Maintain the soil-cement treatment in good condition from the time it first starts work until all work shall is completed.
 - 2. Maintenance includes immediate repairs of any defect that may occur after the cement is applied.
 - 3. Maintenance work shall be done by the Contractor at the Contractor's expense and repeated as often as necessary to keep the area continuously intact.

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material requirements and construction methods for:
 - a. Asphalt Pavement
 - b. Asphalt Level-Up
 - c. Temporary Asphalt Pavement
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 32 01 17 – Flexible Paving Repair.
 - 2. Section 32 11 29 – Lime Treated Base Courses.
 - 3. Section 32 12 73 – Asphalt Paving Joint Sealants.
 - 4. Section 32 05 16 – Aggregates for Exterior Improvements.
 - 5. Section 41 14 00 – Batching Equipment.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Asphalt Pavement (SY)
 - a. Measurement
 - 1) Measured per square yard of Asphalt Pavement installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Asphalt Pavement (SY)” for:
 - a) Various types.
 - b) Various depths.
 - c) Various performance grade binders.
 - d) Various SAC requirements.
 - c. The price bid shall include:
 - 1) Furnishing and installing Asphalt Pavement as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Testing and trial batches
 - 4) All costs associated with obtaining and submitting the required action and informational submittals
 - 5) Asphalt, aggregate, and additives
 - 6) Materials and work needed for any corrective action
 - 7) Tack coat, PCE, Fog Seal, Crack sealant
 - 8) Removal and/or sweeping excess material

2. Asphalt Pavement (TON)
 - a. Measurement
 - 1) Measured tons of Asphalt Pavement (TON) installed
 - a) Tonnage is based on the rate of 110 lb/SY/in (pounds/square yard/pavement inch)
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per ton for “Asphalt Pavement (TON)” for:
 - a) Various types.
 - b) Various depths.
 - c) Various performance grade binders.
 - d) SAC requirements.
 - c. The price bid shall include:
 - 1) Furnishing and installing Asphalt Pavement as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Testing and trial batches
 - 4) All costs associated with obtaining and submitting the required action and informational submittals
 - 5) Asphalt, aggregate, and additives
 - 6) Materials and work needed for any corrective action
 - 7) Tack coat, PCE, Fog Seal, Crack sealant
 - 8) Removal and/or sweeping excess material
3. Asphalt Level-Up
 - a. Measurement
 - 1) Measured ton of Asphalt Level-Up installed
 - a) Tonnage is based on the rate of 110 lb/SY/in (pounds/square yard/pavement inch)
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per ton for “Asphalt Level-Up”.

The price bid shall include:

 - 2) Furnishing and installing Asphalt Level-Up as specified by the Drawings
 - 3) Shaping and fine grading the roadbed (as needed)
 - 4) Testing and trial batches
 - 5) All costs associated with obtaining and submitting the required action and informational submittals
 - 6) Asphalt, aggregate, and additives
 - 7) Materials and work needed for any corrective action
 - 8) Tack coat, PCE, Fog Seal, Crack sealant
 - 9) Removal and/or sweeping excess material
4. Temporary Hot-Mix Asphalt Pavement
 - a. Measurement
 - 1) Measured per square yard of Temporary Asphalt Pavement installed.
 - b. Payment

- 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for Temporary Hot-Mix Asphalt Pavement for:
 - a) Various depths of TY B asphalt pavement.
 - b) Various types of subgrade.
 - c) Examples:
 - (1) Temporary Hot-Mix Asphalt Pavement, 4” of TY B on 6” of Flexbase Subgrade
 - (2) Temporary Hot-Mix Asphalt Pavement, 6” of TY B on 8” of Cement Stabilized Subgrade
 - (3) Temporary Hot-Mix Asphalt Pavement, 8” of TY B on 10” of Lime Stabilized Subgrade
- c. The price bid shall include:
 - 1) Furnishing and installing Temporary Hot-Mix Asphalt Pavement as specified by the Drawings
 - 2) Installation and of temporary asphalt
 - 3) Any subgrade required per the drawings or requested by the Contractor due to site conditions. Subgrade could consist of compacted subgrade, treated subgrade, or flexible base.
 - 4) Maintaining temporary asphalt for the duration of the traffic control phase it is used for.
 - 5) Removal of the temporary asphalt is considered subsidiary to the installation.
 - 6) Shaping and fine grading the roadbed (as needed)
 - 7) Testing and trial batches (as needed)
 - 8) All costs associated with obtaining and submitting the required action and informational submittals
 - 9) Asphalt, aggregate, and additives
 - 10) Materials and work needed for any corrective action
 - 11) Tack coat, PCE, Fog Seal, Crack sealant
 - 12) Removal and/or sweeping excess material

1.3 REFERENCES

A. Abbreviations and Acronyms

1. AQMP – Texas Department of Transportation’s Aggregate Quality Monitoring Program (Tex-499-A)
2. BRSQC – Texas Department of Transportation’s *Bituminous Rated Source Quality Catalog*
3. HMA – Hot-Mix Asphalt
4. MPL – Texas Department of Transportation’s Material Producer List
5. MTD – Material Transfer Device
6. PCE – Prime, Cure, and Erosion Control
7. RAP – Reclaimed Asphalt Pavement
8. RAS – Recycled Asphalt Shingles
9. SAC – Surface Aggregate Classification
10. TCEQ – Texas Commission on Environmental Quality
11. TGC – Texas Gyratory Compactor

12. TxDOT – Texas Department of Transportation

13. VMA – Voids in Mineral Aggregate

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. National Institute of Standards and Technology (NIST)
 - a. Handbook 44 – Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices.
3. American Association of State Highway and Transportation Officials (AASHTO) Standards:
 - a. M323, Standard Specification for Superpave Volumetric Mix Design
 - b. R35, Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt
 - c. T48, Standard Method of Test for Flash and Fire Points by Cleveland Open Cup
 - d. T201, Kinematic Viscosity of Asphalts (Bitumens)
 - e. T202, Standard Method of Test for Viscosity of Asphalts by Vacuum Capillary Viscometer
 - f. T315, Standard Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
 - g. T316, Standard Method of Test for Viscosity Determination of Asphalt Binder Using Rotational Viscometer
 - h. T313, Test Method for Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
4. TxDOT Test Procedures:
 - a. Tex-106-E, Calculating the Plasticity Index of Soils
 - b. Tex-107-E, Determining the Bar Linear Shrinkage of Soils
 - c. Tex-200-F, Sieve Analysis of Fine and Coarse Aggregates
 - d. Tex-204-F, Design of Bituminous Mixtures
 - e. Tex-205-F, Laboratory Method of Mixing Bituminous Mixtures
 - f. Tex-206-F, Compacting Specimens Using the Texas Gyratory Compactor (TGC)
 - g. Tex-207-F, Determining Density of Compacted Bituminous Mixtures
 - h. Tex-211-F, Recovery of Asphalt from Bituminous Mixtures by the Abson Process
 - i. Tex-212-F, Determining Moisture Content of Bituminous Materials
 - j. Tex-217-F, Determining Deleterious Material and Decantation Test for Coarse Aggregates
 - k. Tex-222-F, Sampling Bituminous Mixtures
 - l. Tex-226-F, Indirect Tensile Strength Test
 - m. Tex-227-F, Theoretical Maximum Specific Gravity of Bituminous Mixtures
 - n. Tex-236-F, Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method
 - o. Tex-242-F, Hamburg Wheel-Tracking Test
 - p. Tex-243-F, Tack Coat Adhesion
 - q. Tex-244-F, Thermal Profile of Hot Mix Asphalt
 - r. Tex-406-A, Material Finer than 75 μm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
 - s. Tex-499-A, Texas Department of Transportation's Aggregate Quality Monitoring Program (AQMP)

- t. Tex-530-C, Effect of Water on Bituminous Paving Mixtures
- u. Tex-540-C, Measurement of Polymer Separation on Heating in Modified Asphalt Systems
- v. Tex-541-C, Rolling Thin Film Oven Test for Asphalt Binders
- w. Tex-923-K, Verifying the Accuracy of Liquid Additive Metering Systems

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meeting

- 1. Hold meeting 1 week prior to performing any tasks included under Asphalt Paving.
- 2. Invite the City and appropriate representatives.
- 3. Prior to pre-construction meeting, prepare the following:
 - a. Paving Plan including:
 - 1) Paving widths
 - 2) Joint offsets
 - 3) Lift thicknesses for each paving course
 - b. Paving Process including:
 - 1) Process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality.
 - 2) Procedures to construct quality longitudinal and transverse joints
 - 3) Proposed rolling pattern in accordance with Asphalt Placement.
 - c. Action and Information Submittals to be reviewed and approved:
 - 1) Product Data
 - 2) Hot-Mix Asphalt Mix Design
 - 3) Trial Batch Testing
 - 4) Certifications
 - 5) Testing and Evaluation Reports
 - 6) Equipment Submittal
 - 7) Location of all Material Sources
 - 8) Testing Laboratory

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to commencement of any Asphalt Paving activities.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

- 1. Product Data
 - a. Provide electronic product data from each manufacturer that is supplying asphalt binder, tack coat, Fog Seal, PCE, mineral filler, or additives to be used on the project.
 - b. Product data sheets will include:
 - 1) Manufacturer name
 - 2) Date
 - 3) Material description
 - 4) Point of delivery
 - 5) Produce data and test results as required in this specification

- 6) Material Safety Data Sheets (if applicable, required for PCE and all additives)
- 7) Manufacturer Recommended Storing Data (if applicable)
- 8) Application Recommendations (if applicable)
- 9) Liquid Antistripping Agent Specific Data:
 - a) Specific gravity of the agent at the manufacturer's recommended addition temperature
 - b) Manufacturer's recommended dosage range
 - c) Manufacturer's Recommended Storage and Handling instructions
2. Hot-Mix Asphalt Mix Design – Provide the project mix design using the template provided in Tex-204-F. The submittal will include:
 - a. The combined aggregate gradation, source, specific gravity, and percent of each material used.
 - b. Asphalt binder content and aggregate gradation of Reclaimed Asphalt Paving (RAP) and Recycled Asphalt Shingles (RAS) stockpiles.
 - c. The target laboratory-molded density.
 - d. Results of all applicable tests in accordance with Delivery, Storage, and Handling, Materials, and Source Quality Control.
 - e. Additive information including type, quantity, addition rate, and moisture resistance requirements
 - f. The mixing and molding temperatures.
 - g. The signature of the person or persons performing the design.
 - h. The date the mixture design was performed.
 - i. The unique identification number for the mixture design.

B. Informational Submittals

1. Source Locations
 - a. Provide the location of all material sources
2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use
3. Certificates
 - a. Provide material certifications for all asphalt paving materials certifying the material complies with this Section.
 - b. Additional PCE Certifications
 - 1) Provide a certification letter from an approved analytical lab per TxDOT's MPL with the product data sheet for PCE that has been signed by a lab official indicating the PCE formulation does not:
 - a) Meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste.
 - b) Contain any or Polychlorinated Biphenyls (PCBs) in the product.
4. Test and Evaluation Reports
 - a. Provide testing and evaluation reports to the City for each material being used to prepare asphalt pavement. Test samples to verify source material complies with all requirements in this specification. Materials to be tested include, but are not limited to:
 - 1) Coarse and Fine Aggregate Testing

- a) Provide verification material source location is listed on TxDOT's BRSQC. If it is listed, source quality testing may be waived.
 - b) If the source location is not listed on TxDOT's BRSQC, provide all testing and evaluation reports to verify the source material complies with all requirements of Section 32 05 16.
- 2) Asphalt Binder
 - a) Manufacturer Supplied Testing Reports for Performance Grade Asphalt Binder
 - b) Daily records of asphalt binder temperatures in accordance with section Placement Operations.
- b. Gyratory Compactor
 - 1) Supply the City with the gyratory compactor correlation factor determined as part of Source Quality Control.
- c. Trial Batch
 - 1) Provide a testing and evaluation report to the City for the trial batch prepared in accordance with Source Quality Control. The trial batch will be a representative sample verifying that the mix design meets the requirements of this specification.
 - 2) Provide the mix design that was used to produce the trial batch with the trial batch test and evaluation reports.
- 5. Testing Laboratory
 - a. Submit for review and approval the following information for each testing laboratory used on the project:
 - 1) Testing Laboratory Name
 - 2) Location
 - 3) What tests will be performed at the lab if multiple labs are used.

1.7 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports

- 1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. If asphalt is paid for by the ton, provide electronic copies of asphalt pavement delivery tickets that include:
 - 1. Asphalt Plant Name
 - 2. Date
 - 3. Project Identification Number
 - 4. Purchase order number
 - 5. Delivery ticket number
 - 6. Plant Identification
 - 7. Mix Identification
 - 8. Vehicle Identification

9. Point of delivery
 10. Total Weight of the Load
 11. Tare Weight of the Vehicle
 12. Quantity delivered
 13. Weight of Mixture in each Load
 14. Load Number or Sequential Ticket Number for the Day
- C. Storage, Heating, and Application Temperatures of Bituminous Materials
1. Store and apply materials at the lowest temperature yielding satisfactory results.
 2. Use storage and application temperatures in accordance with Table 1.
 3. No material will be heated above the maximum temperature shown.
 4. Follow manufacturer's instructions for agitation requirements in storage.
 5. Manufacturer's instructions regarding application and storage temperatures supersede those in Table 1.

Table 1
Storage and Application Temperatures

Type – Grade	Application		Storage Maximum Degrees Fahrenheit
	Recommended Range Degrees Fahrenheit	Maximum Allowable Degrees Fahrenheit	
CSS-1h	50 – 130	140	140
PCE	50 – 130	140	140
PG Binders	275 – 350	350	350

- D. Storage and Stockpiling of Recycled Materials
1. Reclaimed Asphalt Pavement (RAP)
 - a. Test any RAP stockpiles (coarse and fine) for decantation in accordance with Tex-406-A, Part 1.
 - b. Determine the plasticity index for RAP stockpiles (coarse and fine) in accordance with Tex-106-E if the decantation value exceeds 5 percent.
 - c. Decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.
 2. Recycled Asphalt Shingles
 - a. Stockpile to contain less than 0.5 percent deleterious materials.
 - b. Test stockpile in accordance with Tex-217-F, Part 3 to determine deleterious material content.
- E. Storage of Hot-Mix Asphalt
1. Do not store mixture long enough to affect the quality of the mixture.
 2. Do not store mixture at the plant for longer than 12 hours unless otherwise approved by City.
 3. Provide asphalt storage sufficient to meet the plant requirements.
 4. Heat asphalt by steam coils. Steam coils to be tight enough to prevent leakage of moisture into the asphalt.
 5. Store asphalt in accordance to the temperature requirements in Table 1.
 6. Direct fire heating will not be permitted.

7. Agitating asphalt with steam or air will not be permitted.
 8. Steam heating in accordance with the requirements of this Section.
- F. Storage of Temporary Hot-Mix Asphalt Paving
1. Store temporary asphalt paving using the same storage requirements as Hot-Mix Asphalt Paving.

1.11 SITE CONDITIONS

A. Weather Conditions

1. Hot-Mix Asphalt Paving
 - a. Place mixture when the roadway surface temperature is at or above the temperatures listed in Table 2 unless otherwise approved or as specified in the Drawings.
 - b. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer.
 - c. If roadway temperatures will reach the required temperature within 2 hours, the City may allow placement before the roadway surface reaches the required temperature.
 - d. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the City.
 - e. The City may restrict the Contractor from paving if the ambient temperature is likely to drop below 32 degrees Fahrenheit within 12 hours of paving.

Table 2
Pavement Surface Temperatures

High Temperature Binder Grade	Minimum Pavement Surface Temperatures (degrees Fahrenheit)	
	Subsurface Layers or Night Paving Operations	Surface Layers Placed in Daylight Operations
PG 64-22, PG 70-22, And Prime Coat	60	50

1. Temporary Asphalt Paving
 - a. Install temporary asphalt paving using the same temperature requirements as Hot-Mix Asphalt Paving.
2. Prime Coat
 - a. Apply the mixture in accordance with Table 2.
 - b. Measure the air temperature in the shade away from artificial heat.
 - c. The City will determine when weather conditions are suitable for application.
 - d. Do not permit traffic, hauling, or placement of subsequent courses over freshly constructed prime coats.
 - e. Maintain the primed surface until placement of subsequent courses or acceptance of the work.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Use materials shown in Table 3, unless otherwise approved by City or specified in the Drawings.

Table 3
Typical Material Use

Material Application	Allowable Material
Hot-Mixed, Hot-Laid Asphalt Mixtures	PG 64-22 ¹ and PG 70-22 ¹
Tack Coat and Fog Seal	Type CSS-1h
Prime Coat	PCE
Erosion Control	PCE

1. Refer to Asphalt Binder for information on when each performance grade binder is allowed.

B. Aggregate

1. Provide aggregates in accordance with Section 32 05 16.
2. Provide aggregates from sources in accordance with this Section and 32 05 16.
3. Notify the City of all source locations and any changes to material source or mix design.
4. Aggregates for Asphalt Pavement to be approved by the City prior to use in accordance with this Section.
5. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part 2.
6. The Surface Aggregate Classification (SAC) will be SAC-A unless otherwise specified in the Drawings for all surface courses. The SAC will only apply to the aggregate used on the travel lanes unless otherwise specified in the Drawings. Provide aggregates in accordance with all SAC requirements in Section 32 05 16.
7. Coarse Aggregate
 - a. Provide aggregates in accordance with the requirements of Section 32 05 16.
8. Fine Aggregate
 - a. Provide fine aggregates that consists of crushed stone, crushed gravel, sand, and/or limestone or steel slag screenings in accordance with Section 32 05 16.
 - b. Provide fine aggregate in accordance with the gradation requirements shown in Table 4.
 - c. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate.
 - d. Limestone or Steel Slag Screenings
 - 1) Limestone or steel slag screenings may constitute part of or all of the fine aggregate.
 - 2) Provide screenings that conform to the requirements for Fine Aggregate in Section 32 05 16.

Table 4
Gradation Requirements for Fine Aggregate

Sieve Size	percent Passing by Weight or Volume
3/8-inch	100
No. 8	70–100
No. 200	0–30

C. Mineral Filler

1. Mineral filler is allowed unless otherwise specified in the Drawings and should consist finely divided material such as:
 - a. Stone dust
 - b. Crushed fines
 - c. Hydrated lime
 - 1) Use no more than 2 percent unless otherwise specified in the Drawings
 - 2) Use no more than 1 percent if a substitute binder is used (refer to Table 10) unless otherwise specified in the Drawings
 - d. Portland cement
 - 1) Use no more than 2 percent unless otherwise specified in the Drawings
 - e. Fly ash
2. Provide mineral fillers that:
 - a. Are sufficiently dry, free flowing, and free from clumps and foreign matter
 - b. Meet the gradation requirements shown in Table 5 when performing Tex-200-F Part 1 (based on weight) or Part 3 (based on volume).
 - c. In accordance with the requirements listed in Source Quality Control.

Table 5
Gradation Requirements for Mineral Filler

Sieve Size	Percent Passing by Weight
No. 8	100
No. 200	55–100

D. Asphalt Binder

1. Asphalt binder will be PG64-22 for TY B mix designs unless otherwise approved by the City or specified in the Drawings.
2. Asphalt binder will be PG70-22 for TY D and TY C mix designs unless otherwise approved by the City or specified in the Drawings.
3. Provide material that:
 - a. Is produced from crude petroleum.
 - b. Is homogenous and free from water and residue from distillation of coal, coal tar, or paraffin oil.
 - c. Will not foam when heated to 347 degrees Fahrenheit
 - d. In accordance with the requirements shown in Table 6 for performance grade asphalt binder.
 - e. Shows no separation when tested in accordance with Tex-540-C

Table 6
Performance Grade Asphalt Binder

Property and Test Method	Performance Grade	
	PG 64	PG 70
	-22	-22
Average 7-Day Max Pavement Design Temperature, Degrees Celsius ¹	< 64	<70
Min Pavement Design Temperature, Degrees Celsius ¹ (i.e. design temperature shall be greater than shown)	>-22	>-22
Original Binder		
Flash Point Temperature, AASHTO T48: Minimum, degrees Celsius	230	
Viscosity, AASHTO T48 ^{2,3} or T316 ^{2,3} Maximum, 3.0 Pa*s, Test Temperature, Degrees Celsius	135	
Dynamic Shear, AASHTO T315: ⁴ G*/sin(δ), Minimum, 2.00-kPa ⁷ Test Temperature at 10-rad/s, Degrees Celsius	64	70
Elastic Recovery, D 6084, 50 Degrees Fahrenheit, percent minimum	-	30
Rolling Thin Film Oven (Tex-541-C)		
Maximum Loss, maximum percent	1.0	
Dynamic Shear, AASHTO T315: G*/sin(δ), Minimum, 2.20-kPa, Maximum, 5.0-kPa Test Temperature at 10-rad/s, Degrees Celsius	64	70
Pressure Aging Vessel (PAV) Residue (R28)		
PAV Aging Temperature, degrees Celsius	100	
Dynamic Shear, AASHTO T315: G*/sin(δ), Maximum, 5,000-kPa Test Temperature at 10-rad/s, Degrees Celsius	25	25
Creep Stiffness, AASHTO T313: ^{5,6} S, Maximum, 300-MPa m-value, Minimum 0.300 Text Temperature at 60 s, Degrees Celsius	-12	-12
Direct Tension, AASHTO T314: ⁶ Failure Strain, Minimum, 1.0 percent Test Temperature at 1.0-mm/min, Degrees Celsius	-12	-12

1. Pavement temperatures are estimated from air temperatures using an algorithm contained in the TxDOT PGEXCEL3.XLS software program, may be provided by the City, or by following the procedures as outlined in AASHTO MP2 and PP28.
2. This requirement may be waived at the discretion of the City if the supplier warrants that the asphalt binder can be adequately pumped, mixed and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T201 or T202) or rotational viscometry (AASHTO T48 or T316). A waiver will need to be submitted to the City for approval prior to asphalt paving.
3. Viscosity at 135 degrees Celsius is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Be aware that variation could significantly impact mixing and compaction operations. Contractor is responsible for addressing any constructability issues which may arise.
4. For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T201 or T202) or rotational viscometry (AASHTO TP48 or T316).
5. Silicone beam molds as described in AASHTO TP 1-93 are acceptable for use.
6. If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

E. Emulsified Asphalt for Tack Coat and Fog Seal (CSS-1h)

1. Use cationic emulsion CSS-1h in accordance with the requirements shown in Table 7 unless approved by the City or specified in the Drawings.
2. The material will be composed of a paving asphalt base uniformly emulsified with water.
3. The material will be homogenous throughout and when stored will show no signs of separation within 3-days after delivery.
4. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.
5. Temperature
 - a. Never raise the temperature of the emulsion above 160 degrees Fahrenheit after it is loaded for transportation from refinery to the purchaser.
 - b. Tack coat and prime coat may be reheated
 - c. Prevent localized overheating when reheating the material.
 - d. Do not allow the material to cool to a temperature of less than 40 degrees Fahrenheit.
 - e. Apply the material at the manufacturer's recommended temperature.
 - f. Provide a thermometer capable of testing the temperature of the asphalt binder on site at all times.

Table 7
Tests and Properties of Cationic Emulsions

Property	Test Procedure	Slow Setting	
		Type – Grade	
		CSS-1h	
		Min	Max
Viscosity, Saybolt Furol at 77 degrees Fahrenheit, second at 122 degrees Fahrenheit, second	T 72	20 –	100 –
Sieve Test, percent	T 59	–	0.1
Cement Mixing, percent	T 59	–	2.0
Coating Ability and Water Resistance: Coating, Dry Aggregate, After Spraying Coating, Wet Aggregate, After Spraying	T 59	– –	– –
Demulsibility, 35 ml 0.8 percent Sodium dioctyl sulfosuccinate, percent	T 59	–	–
Storage Stability, 1 day, percent	T 59	–	1
Particle Charge Test	T 59	Positive	
Distillation Test: Residue by Distillation, percent by weight Oil Distillate, percent by volume of Emulsion	T 59	60 –	– 0.5
Tests on Residue from Distillation: Penetration at 77 degrees Fahrenheit, 100-g, 5-seconds Solubility in Trichloroethylene, percent Ductility at 77 degrees Fahrenheit, 5 cm/min, cm	T 49 T 44 T 51	70 97.5 80	110 – –

F. Emulsified Asphalt for Prime Coat, Curing, and Erosion Control (PCE)

1. Use slow setting PCE in accordance with the requirements shown in Table 8 unless approved by the City or specified in the Drawings.
2. PCE may be used as a prime coat for base materials, curing seal for stabilized base materials, and erosion control applications such as dust control, soil surface stabilization, or mulch binder.
3. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

Table 8
Tests and Properties of PCE Emulsions

Property	Test Procedure	Type – Grade	
		Slow Setting	
		PCE ¹	
		Min	Max
Viscosity, Saybolt Furol at 77 degrees Fahrenheit, second at 122 degrees Fahrenheit, second	T 72	10 –	100 –
Sieve Test, percent	T 59	–	0.1
Miscibility	T 59 ²	Pass	–
Demulsibility, 35 mL of 0.10 N CaCl ₂ , percent	T 59	–	–
Storage Stability, 1 day, percent	T 59	–	–
Particle Size ⁵ , percent by volume < 2.5 µm	Tex-238-F ³	90	–
Asphalt Emulsion Distillation to 500 degree Fahrenheit Followed by Cutback Asphalt Distillation of Residue to 680 degrees Fahrenheit Residue after both distillations, percent by weight Total oil distillate from both distillations, percent by volume of emulsion	T 59 & T 78	– –	– –
Residue by Distillation, percent by weight	T59	–	–
Residue by Evaporation, percent by weight	T 59 ⁴	60	–
Tests on Residue after all Distillation(s): Viscosity, 140 degrees Fahrenheit, poise Kinematic Viscosity ⁵ , 140 degrees Fahrenheit, cSt Flash Point C.O.C, degrees Fahrenheit Solubility in Trichloroethylene, percent Float Test, 122 degrees Fahrenheit, seconds	T 202 T 201 T 48 T 44 T 50	– 100 400 – –	– 350 – – –

1. Each PCE shipment will include the information indicated under Source Quality Control
2. Except the dilution shall use 350-mL distilled or deionized water and a 100-mL beaker.
3. Use Tex-238-F, beginning at "Particle Size Analysis by Laser Diffraction", with distilled or deionized water as a medium and no dispersant, or use another approved method.
4. Except the sample shall remain in the oven until foaming ceases, then cooled and weighed.
5. PCE must meet either the kinematic viscosity requirement or the particle size requirement

G. Additives

1. General:

- a. Only use additives when they are specified in the Drawings unless otherwise approved by the City.
- b. If additives are used, additive information to be provided as part of the HMA Mix Design Action Submittal.
- c. Stop production if the production mixture does not meet moisture resistance requirements and correct the problem.
- d. Verify when antistripping agents are added at the plant (batch or source location) that:
 - 1) The measuring device for the addition of the agent is connected into the automatic plant controls to automatically adjust the supply to the plant production and provide consistent percentage in the mixture.
 - 2) Set automatic plant controls so that an interruption of asphalt antistripping agent's flow causes plant shutdown.

2. Lime Antistripping Agent:

- a. Do not allow lime to be added directly into the mixing drum at any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.
- b. If lime is used, provide only commercial lime slurry in accordance with Section 32 11 29.
- c. Add between 0.5 and 2.0 percent commercial lime slurry by weight of the individual aggregate treated.
- d. Mix the lime slurry in a suitable pug mill mixer with the aggregate.
- e. Mix with aggregate between the plant cold feeds and the dryer or mixing drum during mixture production.

3. Liquid Antistripping Agent

- a. Add to the binder in accordance with the manufacturer's instructions. Do not exceed the manufacturer's maximum recommended dosage rate.
- b. Provide a liquid antistripping agent uniform and shows no evidence of crystallization, settling, or separation.
- c. Ensure all liquid antistripping agents arrive in:
 - 1) Properly labeled and unopened containers shipped directly from the manufacturer
 - 2) Sealed tank trucks with an invoice to show contents and quantities
- d. Handle in accordance with the manufacturer's recommendations.
- e. Add at the manufacturer's recommended addition temperature.
- f. Add into the asphalt line by means of an in-line-metering device and a blending device to disperse the agent.
- g. Furnish a meter that reads in increments of 0.1 gallons or less.

4. Antistripping Additive Meters

- a. Provide a means to check the accuracy of meter output for liquid and lime additives.
- b. For liquid additive meters, verify accuracy of the meter in accordance with Tex-923-K.
- c. Ensure the accuracy of the meter is within 5.0 percent.

H. Recycled Materials

1. General

- a. Use of RAP and RAS is permitted unless otherwise specified in the Drawings.
- b. Do not exceed the maximum allowable percentages of RAP and RAS shown in Table 9 unless specified in the Drawings.

- c. Determine asphalt binder content and gradation of the RAP and RAS stockpiles for mixture design purposes in accordance with Tex-236-F.
 - d. The City may verify the asphalt binder content of the stockpiles at any time during production.
 - e. Perform all tests specified in the Drawings and listed under Source Quality Control.
 - f. Asphalt binder from RAP and RAS is designated as recycled asphalt binder.
 - g. Calculate and ensure that the ratio of the recycled asphalt binder to total binder does not exceed percentages shown in Table 10 during mixture design and HMA production when RAP or RAS is used.
 - h. Use a separate cold feed bin for each stockpile of RAP and RAS during HMA production.
 - i. Surface, intermediate, and base mixes referenced in Table 9 and 10 are defined as follows:
 - 1) Surface – This is the pavement course placed at the top of the pavement structure. RAP or RAS will not be permitted for use in the surface course.
 - 2) Intermediate – TY B asphalt courses placed directly under the surface course and above the base course.
 - 3) Base – TY B asphalt course placed directly under the intermediate course in the HMA pavement structure.
2. Reclaimed Asphalt Pavement (RAP)
- a. Consists of salvaged, milled, pulverized, broken, or crushed asphalt pavement.
 - b. Use of RAP is permitted for TY B asphalt courses unless otherwise specified in the Drawings.
 - c. Crush or break RAP so that 100 percent of the particles pass the No. 2 sieve.
 - d. Fractionated RAP is defined as 2 or more RAP stockpiles that are divided into coarse and fine fractions.
 - e. Ensure that the coarse RAP stockpile contains only material retained on a 3/8 inch or 1/2 inch sieve unless otherwise approved.
 - f. Ensure that the fine RAP stockpile contains only material passing the 3/8 inch or 1/2 inch sieve unless otherwise approved.
 - g. The maximum percentages of fractionated RAP may be comprised of coarse or fine fractionated RAP.
 - h. The maximum percentages of fractionated RAP may also be a combination of both coarse and fine fractionated RAP.
 - i. Provide RAP material free from dirt or other objectionable materials.
 - j. Do not use any RAP material if the decantation value exceeds 5 percent and the plasticity index is greater than 8.
 - k. Conform storing and stockpiling RAP to the requirements under Delivery, Storage, and Handling.

Table 9
Maximum Allowable Amounts of RAP¹

Maximum Allowable Fractionated RAP² (percent)			Maximum Allowable Unfractionated RAP³, (percent)		
Surface	Intermediate	Base	Surface	Intermediate	Base
0.0	25.0	30.0	0.0	10.0	10.0

1. Must also meet the recycled binder to total binder ratio shown in Table 10.
 2. Up to 5 percent RAS may be used separately or as a replacement for fractionated RAP
 3. Unfractionated RAP may not be combined with fractionated RAP or RAS.
3. Recycled Asphalt Shingles (RAS)
- a. RAS is processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures.
 - b. Post-manufactured RAS is processed manufacturer's shingle scrap by-product.
 - c. Post-consumer RAS is processed shingle scrap removed from residential structures.
 - d. Comply with all regulatory requirements stipulated for RAS by the TCEQ.
 - e. Use of post-manufactured RAS or post-consumer RAS (tear-offs) is permitted for TY B asphalt courses unless otherwise specified in the Drawings.
 - f. RAS may be used separately or in conjunction with RAP.
 - g. Up to 5 percent RAS may be used separately or as a replacement for fractionated RAP in accordance with Table 9 and 10.
 - h. Process RAP by ambient grinding or granulating such that 100 percent of the particles pass the 3/8 inch sieve when tested in accordance with Tex-200-F, Part 1.
 - i. Perform a sieve analysis on processed RAS material before extraction (or ignition) of the asphalt binder.
 - j. Add sand meeting the requirements of fine aggregate in Section 32 05 16 and fine aggregate gradation to RAS stockpiles if needed to keep the processed material workable.
 - k. Fine RAP may also be added to RAS stockpiles if needed to keep the processed material workable.
 - l. Any stockpile that contains RAS will be considered a RAS stockpile.
 - m. RAS is limited to no more than 5.0 percent of the HMA mixture in accordance with Table 9.
 - n. Certify compliance of the RAS with DMS-11000, "Evaluating Using Nonhazardous Recyclable Materials Guidelines."
 - o. Treat RAS as an established nonhazardous recyclable material if it has not encountered any hazardous materials.
 - p. Use RAS from shingle sources on the TxDOT MPL or approved by City.
 - q. Substantially remove all materials before use that are not part of the shingle such as wood, paper, metal, plastic, and felt paper.
 - r. Do not use RAS if the deleterious materials content is more than 0.5 percent of the stockpiled RAS unless otherwise approved.

Table 10
Allowable Substitute PG Binders and Maximum Recycled Binder Ratios

Originally Specified PG Binder	Allowable Substitute PG Binder	Maximum Ratio of Recycled Binder to Total Binder ¹ , (percent)		
		Surface	Intermediate	Base
PG 64-22 ²	None	0.0	30.0	30.0
PG 70-22 ²	64-22	0.0	20.0	20.0

1. Combined recycled binder from RAP and RAS
2. Use no more than 20.0 percent recycled binder when using this originally specified PG binder.

I. Hot-Mix Asphalt Paving Mix Design

1. Prepare a mix design for each asphalt type specified in the Drawings (TY B, C, or D) in accordance with the requirements listed in Table 11.
2. Design the mixture using a Texas Gyratory Compactor (TGC).
3. Provide a mix design after the trial batch tests are complete in accordance with the requirements in this Section.
 - a. Superpave Mix Design: Prepare in accordance with M323 and R35.

Table 11
Dense Graded Hot-Mix Master Gradation Limits (% Passing by Weight of Volume)
and VMA Requirements

Sieve Size	B Fine Base	C Coarse Surface	D Fine Surface
2 inch	—	—	—
1-1/2 inch	100.0 ¹	—	—
1 inch	98.0 – 100.0	100.0 ¹	—
3/4 inch	84.0 – 98.0	95.0 – 100.0	100.0 ¹
1/2 inch	—	—	98.0 – 100.0
3/8 inch	60.0 – 80.0	70.0 – 85.0	85.0 – 100.0
No. 4	40.0 – 60.0	43.0 – 63.0	50.0 – 70.0
No. 8	29.0 – 43.0	32.0 – 44.0	35.0 – 46.0
No. 30	13.0 – 28.0	14.0 – 28.0	15.0 – 29.0
No. 50	6.0 – 20.0	7.0 – 21.0	7.0 – 20.0
No. 200	2.0 – 7.0	2.0 – 7.0	2.0 – 7.0
Design VMA, Percent Minimum			
—	13.0	14.0	15.0
Production (Plant-Produced) VMA, Percent Minimum			
—	12.5	13.5	14.5
Allowable PG Binder			
-	PG64-22	PG 70-22	PG70-22

1. Defined as maximum sieve size. No tolerances allowed.

J. Temporary Hot-Mix Asphalt Pavement

1. Temporary HMA Pavement in accordance with all the requirements of TY B asphalt.
2. Submit a mix design if TY B Asphalt Paving is not being used as a pavement course other than for temporary hot-mix asphalt.
3. No trial batches will be required to verify mix design for temporary HMA pavement.

K. Trial Batch Production and Testing

1. Trial Batch
 - a. Produce a trial batch of the mix design based on the requirements of the specified asphalt mix (TY B, C, or D) in a large enough quantity to ensure the mixture meets the Section requirements. Perform testing on the trial batch to verify the mixture produced using the submitted mix design in accordance with the requirements in Table 11, 12, 13, and 14.
 - b. Provide the necessary quantity of each material to the laboratory for testing and production of the trial batch.
 - c. Perform testing on the trial batch to verify the mix design is in conformance with the requirements of this specification.
 - d. If the trial batch does not meet the requirements of this Section, prepare a revised mix design. Produce and test trial batches until a trial batch is produced that meets all of the requirements in this Section.
 - e. Use only equipment and materials proposed for use on the project to produce the trial batch.

- f. Use materials to produce the trial batch in accordance with all requirements in this Section.
 - g. Use a TxDOT MPL laboratory to perform the Hamburg Wheel test. Refer to Table 18 for requirements.
 - h. Provide a new trial batch when the plant or plant location is changed.
- 2. Gyratory Compactor
 - a. Use a TGC calibrated in accordance with Tex-914-K, Part 2 when designing the mixture in accordance with Tex-204-F, Part 2 for molding production samples.
 - b. Use the dense-graded design procedure provided in Tex-204-F.
 - c. Use Tex-206-F, Part 2 to perform a gyratory compactor correlation when the City uses a different gyratory compactor during verification testing. Apply the correlation factor to all subsequent production test results when applicable.
- 3. Target laboratory-molded density when the TGC is used
 - a. Design the mixture at a 96.5 percent target laboratory-molded density. Increase the target laboratory-molded density to 97.0 percent or 97.5 percent at the Contractor's discretion or when specified in the Drawings.
 - b. Use an approved laboratory from the TxDOT MPL to perform the Hamburg Wheel test and provide the results with the mix design. Refer to Table 18 for requirements.
 - c. The mix design in accordance with the requirements under section Materials and Source Quality Control.
- 4. Ignition Oven Correction Factor
 - a. Determine the aggregate and asphalt correction factors from the ignition oven in accordance with Tex-236-F.
 - b. Provide the City with split samples of the mixtures including all additives (except water) and blank samples used to determine the correction factors for the ignition oven used for QA testing during production.
- 5. Boil Test
 - a. Perform Tex-530-C and retain the tested sample until completion of the project or as directed.
 - b. Use this sample for comparison purposes during production.

Table 12
Laboratory Mixture Design Properties

Mixture Property	Test Method	Requirement
Target Laboratory-Molded Density (TGC), percent	Tex-207-F	96.5 ¹
Indirect Tensile Strength (dry), psi	Tex-226-F	85-200 ²
Boil test ³	Tex-530-C	—

- Increase to 97.0 percent or 97.5 percent at the Contractor's discretion or when specified in the Drawings.
- The City may allow the IDT strength to exceed 200 psi if the corresponding Hamburg Wheel rut depth is greater than 3.0 mm and less than 12.5 mm.
- Used to establish baseline for comparison to production results. May be waived when approved.

Table 13
Operational Tolerances for Mix Design and Trial Batch Testing

Description	Test Method	Allowable Difference Between Trial Batch and Mix Design
Individual percent retained for No. 8 sieve and larger	Tex-200-F Or Tex-236-F	Must be Within Master Grading Limits in Table 11
Individual percent retained for sieves smaller than No. 8 and larger than No. 200		
Percent passing the No. 200 sieve		
Asphalt binder content, percent	Tex-236-F	+/- 0.5
Laboratory-molded density, percent	Tex-207-F	+/- 1.0
In-place air voids, percent		N/A
Laboratory-molded bulk specific gravity		N/A
VMA, percent, minimum	Tex-204-F	Note 1
Theoretical maximum specific (Rice)gravity	Tex-227-F	N/A

- Test and verify Table 11 requirements are met.

L. Production Operations

1. General

- Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.
- Submit a new mix design and perform a new trial batch when the asphalt binder content of:
 - Any RAP stockpile used in the mix more than 0.5 percent higher than the value shown on the mixture design report.
 - Any RAS stockpile used in the mix more than 2.0 percent higher than the value shown on the mixture design report.

2. Mixture and Discharge of Materials

- Notify the City of the target discharge temperature and produce the mixture within 25 degrees Fahrenheit of the target.
- Monitor the temperature of the material in the truck before shipping to ensure temperature does not exceed 350 degrees Fahrenheit and does not fall lower than 215 degree Fahrenheit.
- The City will not pay for or allow placement of any mixture produced above 350 degree Fahrenheit.
- Control the mixing time and temperature so that all moisture is substantially removed from the mixture before discharging from the plant.

- e. Production Testing – Obtain the sample immediately after discharging the mixture into the truck and perform the production testing in accordance with Source Quality Control promptly.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Verification Testing
 - a. Verification testing will be performed in accordance with Tex-500-C, Part 3
2. Material Source Testing and Submittals
 - a. Perform testing on all materials that have changed source locations to verify the material conforms to all requirements in this specification.
 - b. Provide new submittals for all materials produced from a new source location.
 - c. Perform all Source Quality Control tests required. Use the test results from the Source Quality Control tests as a comparison during construction.
 - d. Aggregate Quality Requirements
 - 1) Perform all aggregate testing in accordance with Section 32 05 16.
 - e. Mineral Filler
 - 1) Refer to Table 14 for testing requirements.
 - f. Asphalt Binder Quality Requirements
 - 1) Provide manufacturer testing reports in accordance with Action Submittals.
 - 2) Refer to Table 14 and Materials for testing requirements.
 - g. Emulsified Asphalt for Tack Coat and Fog Seal (CSS-1h)
 - 1) Provide manufacturer testing reports in accordance with Action Submittals.
 - 2) Testing will be done in accordance with Tex-500-C, Part 3
 - 3) Refer to Table 14 and Materials for testing requirements.
 - h. Emulsified Asphalt for Prime Coat, Curing, and Erosion Control (PCE)
 - 1) Provide manufacturer testing reports in accordance with Action Submittals.
 - 2) Refer to Table 14 and Materials for testing requirements.

Table 14
Material Source Quality Testing

Material	Characteristic	Test Method	Requirement
Aggregate	Perform all aggregate testing in accordance with Section 32 05 16		
Mineral Filler	Linear Shrinkage	Tex-107-E	3 percent maximum
Asphalt Binder	Perform all tests specified under Materials and Source Quality Control. Provide testing and evaluation reports in accordance with Action Submittals		
Tack Coat and Fog Seal (CSS-1h)			
Prime Coat, Curing, and Erosion Control (PCE)			

3. HMA Mix Design and Trial Batch
 - a. Perform the required tests specified under Materials and provide testing and evaluation reports in accordance with Action Submittals.
4. Temporary Asphalt Pavement
 - a. Source Quality Control testing and inspections is not required for temporary HMA pavement.

5. Asphalt Production Acceptance

a. General

- 1) Perform Tex-226-F on the first day of production to confirm the indirect tensile strength does not exceed 200 psi.
- 2) Take corrective action to bring the mixture within specification compliance if the indirect tensile strength exceeds 200 psi unless otherwise directed.

b. Production Lot

- 1) A production lot consists of 4 equal sublots.
- 2) The default quantity of a lot is:
 - a) 1,000 tons
 - b) 9,000 SY for 2" pavement course thickness
 - c) 4,500 SY for 4" pavement course thickness
 - d) 3,000 SY for 6" pavement course thickness
 - e) 2,500 SY for 8" pavement course thickness
 - f) 1,500 SY for 12" pavement course thickness
- 3) The City may change the standard lot size based on the anticipated daily production to ensure there are 3 or 4 sublots produced each day.

c. Production Sampling

1) Mixture Sampling

- a) Obtain hot-mix samples from trucks at the plant in accordance with Tex-222-F.
- b) Blind Samples
 - (1) The City may select "blind" samples throughout the project for verification testing.
 - (2) Test the blind sample in accordance with asphalt production testing and provide testing and evaluation reports to the City in accordance with Action Submittals.

2) Asphalt Binder Sampling

- a) Obtain a 1 quart sample of the asphalt binder at approximately the same time the mixture sample is obtained for regular samples and blind samples.
- b) Sample from a port located immediately upstream from the mixing drum or pug mill in accordance with Tex-500-C, Part 2.
- c) Label the can with the date and sequential testing number that corresponds with the mixture sample obtained at the same time.

d. Production Testing

1) General

- a) Control the production process and perform production tests to verify the asphalt produced is within the operational tolerances listed in Table 15.
- b) The City may sample and test at any time during production to verify compliance.
- c) Take immediate corrective action if the laboratory-molded density on any test is less than 95 percent or greater than 98 percent to bring the mixture within these tolerances.
- d) The City may suspend work at any time if a sample does not conform to the requirements in this specification.
- e) The City may suspend operations if the Contractor's corrective actions do not produce acceptable results.
- f) The City will allow production to resume when test results or other information indicates that the next mixture produced will be within operational tolerances.

- e. Operational Tolerances
 - 1) Gradation
 - a) Suspend operation and take corrective action if any aggregate is retained on the maximum sieve size shown for Dense Graded Hot-Mix Master Gradation Limits.
 - b) Production will be suspended when test results for gradation exceed the operational tolerances for:
 - (1) 3 consecutive tests on the same sieve
 - (2) 4 consecutive tests on any sieve unless otherwise directed
 - 2) Asphalt Binder Content
 - a) Suspend production and shipment of the mixture if the test results deviate from the mix design by more than the operational tolerance shown in Table 15 for any asphalt binder content test.
 - 3) Voids in Mineral Aggregate (VMA)
 - a) Take immediate action if the VMA for any test is less than the minimum VMA requirement shown for Dense Graded Hot-Mix Master Gradation Limits.
 - b) Suspend production and shipment of the mixture if the City's VMA results:
 - (1) On 2 consecutive tests are below the minimum VMA requirement.
 - (2) Is more than 0.5 percent below the minimum VMA requirement
 - c) For asphalt installed with non-conforming VMA, the City may:
 - (1) Require removal and replacement of any asphalt installed
 - (2) Allow the asphalt to remain in place without payment.
- f. Moisture Content
 - 1) Determine the moisture content, if requested, by oven-drying in accordance with Tex-212-F, Part 2 and verify that the mixture conforms to the requirements in Table 15.
- g. Individual Loads of Hot-Mix
 - 1) The City may reject individual truckloads of hot mix at any time if the City suspects the load does not conform to the requirements of this specification.
 - 2) When a load of hot mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested within 4 hours of rejection.
 - 3) Sample and test the mixture. If the test results are within the operational tolerances in Table 15, payment will be made for the load. If the test results are not within operational tolerances, no payment will be made.

Table 15
Production Testing

Description	Test Method	Operational Tolerances	Contractor Testing Frequency	City Verification Testing Frequency	
Individual percent retained for No. 8 sieve and larger	Tex-200-F Or Tex-236-F	+/- 5.0 ¹	1 per subplot	The City may request the Contractor to perform additional verification testing throughout the project. No more than an additional 10 percent of each test performed will be requested	
Individual percent retained for sieves smaller than No. 8 and larger than No. 200		+/- 3.0 ¹			
Percent passing the No. 200 sieve		+/- 2.0 ¹			
Asphalt binder content, percent	Tex-236-F	0.5	1 per subplot		
VMA, percent, minimum	Tex-204-F	Note 2	1 per subplot		
Laboratory-molded density, percent	Tex-207-F	+/- 1.0	1 per subplot		
Laboratory-molded bulk specific gravity		N/A	1 per subplot		
Theoretical maximum specific (Rice) gravity	Tex-227-F	N/A	1 per subplot		
Recycled asphalt shingles (RAS)	Tex-217-F, Part 3	N/A	As requested		The City may perform verification testing utilizing a third party testing laboratory.
Moisture content, maximum percent	Tex-212-F	0.2			
Boil test ⁴	Tex-530-C	—			
Hamburg wheel test	Tex-242-F	See Table 18			

- When within these tolerances, mixture production gradations may fall outside the master grading limits. The percent passing the No. 200 will be considered out of tolerance when outside the master grading limits.
- Test and verify that mix design requirements are met.
- For all tests that have N/A for tolerances, material must conform to requirements provided within this specification. No tolerances are allowed.
- The City may wave the sampling and testing requirements.

B. Non-Conforming Work

- General
 - The City may at any time reject a material if it is found to be non-conforming to this specification.
 - The City may require the Contractor at any time to remove and replace installed Asphalt Pavement if any material it was made with is found to be non-conforming. This would be at no cost to the City.
- Aggregates
 - Aggregates that fail to meet the requirements of Section 32 05 16 will be rejected by the City.
 - Any rejection of materials or source locations will be at no cost to the City. It is the responsibility of the Contractor to provide materials that comply with the requirements of this specification.
- Asphalt Binder
 - Material may be rejected at any time based on the following:
 - If the certified letters provided by the manufacturer indicate the supplied asphalt binder is not in conformance with the Products section of this specification.
 - For failure to meet requirements of this specification.

- 3) For any defect causing it to be unsuitable for the intended use.
- b. If during verification testing, the material does not conform to the requirement of this specification, the City may stop work until the Contractor can determine the source of the problem at no cost to the City. The City may require that the area installed using the non-conforming asphalt binder be removed and replaced at no cost to the City.
4. HMA Mix Design and Verification
 - a. The City may reject the mix design if it does not conform to the requirements of this specification. Any asphalt installed using a non-conforming mix design will be subject to removal and replacement at no cost to the City.
 - b. If the trial batch does not conform to the requirements specified in this specification, the Contractor will produce trial batches at no cost to the City until the trial batch meets the requirements specified.
 - c. The City may perform verification testing on all trial batches to verify the conformance of the mixture.
5. Temporary Hot-Mix Asphalt Paving
 - a. If the temporary HMA pavement fails due to materials non-conforming to the requirements of TY B asphalt, the City may require the Contractor to remove and replace the temporary asphalt pavement.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Hauling

1. Equipment for Lay-Down Operations
 - a. Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture.
 - b. Except for miscellaneous areas, end dump trucks are only allowed when used in conjunction with a Material Transfer Device (MTD) with remixing capability unless otherwise allowed.
 - c. When end dump trucks are used, ensure the bed does not contact the paver when raised.
2. Operations
 - a. Clean all truck beds before use to ensure the mixture is not contaminated.
 - b. Provide trucks with enclosed sides to prevent asphalt mixture loss.
 - c. Cover each load of mixture with waterproof tarpaulins.
 - d. Coat the inside truck beds, when necessary, with a City approved release agent.
 - e. Petroleum based products, such as diesel fuel will not be allowed.

B. Surface Preparation

1. Asphalt Placement
 - a. Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand leaves, and other loose impediments from the surface before placing.
 - b. Remove vegetation from pavement edges.

2. Prime Coat
 - a. Prepare the surface by sweeping or other approved methods.
 - b. When directed lightly sprinkle the surface with water before applying prime coat to control dust and ensure application.

3.4 INSTALLATION

A. Equipment

1. General
 - a. Provide equipment that does not damage underlying pavement.
 - b. Comply with laws and regulations concerning overweight vehicles
 - c. Use other equipment that will consistently produce satisfactorily results when approved.
2. Batching Equipment
 - a. Batching equipment shall be in accordance with the City's requirements.
3. Asphalt Paver
 - a. General
 - 1) Furnish a paver that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements
 - 2) Ensure the paver does not support the weight of any portion of hauling equipment other than the connection.
 - 3) Provide loading equipment that does not transmit vibrations or other motions to the paver that adversely affect the finished pavement quality.
 - 4) Equip the paver with an automatic, dual, longitudinal-grade control system and an automatic, transverse-grade control system.
 - b. Tractor Unit
 - 1) The tractor unit will be able to push or propel vehicles dumping directly into the finishing machine to obtain the desired lines and grades to eliminate any hand finishing.
 - 2) Equip the unit with a hitch that is able to maintain contact between the hauling equipment's rear wheels and the finishing machine's pusher rollers while mixture is loaded.
 - c. Screed
 - 1) Provide a heated compacting screed that will produce a finished surface that meets the longitudinal and transverse profile, typical section, and placement requirements.
 - 2) Screed extensions must provide the same compacting action and heating as the main unit unless otherwise approved.
 - d. Grade Reference
 - 1) Provide a grade reference with enough support that the maximum deflection does not exceed 1/16 inch between supports.
 - 2) Ensure that the longitudinal controls operate from any longitudinal grade reference including a string line, ski, mobile reference, or joint matching shoes.
4. Material Transfer Devices (MTD)
 - a. Provide the specified type of device if showed on drawings.
 - b. Ensure the devices provide a continuous, uniform mixture flow to the paver.
5. Remixing Equipment
 - a. Provide equipment that includes a pug mill, variable pitch augers, or variable diameter augers operating under a storage unit with a minimum capacity of 8 tons.

6. Motor Grader
 - a. Provide a self-propelled grader with a blade length of at least 12 feet and a wheelbase of at least 16 feet.
7. Hand-Held Thermal Camera or Thermal Imaging System
 - a. Provide a hand-held thermal camera or thermal imaging system meeting the requirements of Tex-244-F.
 - b. A thermal imaging system is the preferred method for obtaining temperatures.
8. Rollers
 - a. Provide rolling equipment required to achieve adequate compaction based on site conditions. If compaction is not achieved based on Site Quality Testing due to inadequate rollers, provide new rolling equipment. Any rolled utilizing inadequate rollers is subject to removal and replacement at no cost to the City.
 - b. Use a pneumatic-tire roller to seal the surface unless excessive pickup of fines occurs.
 - c. Provide rollers meeting the requirements in Table 16 for each type of roller required for compaction.

Table 16
Roller Requirements¹

Roller Type	Materials to be Compacted	Load (Tons)	Contact Pressure	Roller Speed (MPH)
Steel Wheel	Asphalt	Greater than or equal to 10	Greater than or equal to 325 pounds per inch of wheel width	2 – 3
Vibratory	Asphalt	Type A < 6 Type B > 6 Type C as specified in the Drawings	Per equipment specification and as approved	As approved
Light Pneumatic	Asphalt, Prime Coat, Tack Coat, Fog Seal	4.5 – 90	Greater than or equal to 45 psi	4 – 12
Medium Pneumatic	Asphalt	12 – 25	Greater than or equal to 80 psi, as directed	4 – 12

1. Unless otherwise specified by the City or the drawings.

9. Straightedges and Templates
 - a. Furnish 10-foot straightedges and other templates as required or approved.
10. Distributor Vehicles
 - a. Furnish vehicles that can achieve a uniform placement
 - b. The nozzle patterns, spray bar height, and distribution pressure must work together to produce uniform application.
 - c. The vehicle should be set to provide a “double lap” or “triple lap” coverage.
 - d. Nozzle spray patterns should be identical to one another along the distributor spray bar.
 - e. Spray bar height should remain constant.
 - f. Pressure within the distributor must be able to force the tack coat, fog seal, and/or PCE material out of spray nozzles at a constant rate.

B. Coring Equipment

1. Provide equipment suitable to obtain a pavement specimen meeting the dimensions for testing when coring is required.

C. Ride Quality Equipment

1. Surface Test Type A
 - a. Provide a 10-foot straightedge
 - b. A high-speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute may be used when approved by the City.
2. Surface Test Type B
 - a. Provide a high-speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute.
 - b. Provide equipment certification documentation.
 - c. Display a current decal on the equipment indicating the certification expiration date.
 - d. Use a certified profiler operator from TxDOT's MPL or as approved by the City. When requested, furnish documentation for the person certified to operate the profiler.
3. Diamond Grinding Equipment
 - a. Provide self-propelled powered grinding equipment specifically designed to smooth and texture pavements using circular diamond blades when grinding is required.
 - b. Provide equipment with automatic grade control capable of grinding at least 3 feet of width longitudinally in each pass without damaging the pavement.

D. Placement Operations

1. General
 - a. Collect haul tickets from each load of mixture delivered to the project and provide to the City as directed.
 - b. Measure and record the internal temperature of the asphalt mixture using a hand-held thermal camera or an infrared thermometer when a thermal imaging system is not used. A thermal imaging system is the City's preferred method for measuring temperatures.
 - c. Measure the temperature as it is discharged from the truck or Material Transfer Device (MTD) to the paver. Do not measure the temperature after the mix has already entered the paver.
 - d. Record an approximate station number or GPS coordinate on each ticket.
 - e. Calculate the daily yield and cumulative yield for the specified lift and provide to the City at the end of paving operations for each day unless otherwise directed.
 - f. The City may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.
 - g. Place the mixture to meet the typical section requirements and produce a smooth finished surface with a uniform appearance and texture.
 - h. Offset longitudinal joints of successive courses of hot-mix asphalt between 3 and 5 feet. The City may require any successive course that is not placed with an offset to be removed and replaced at no cost to the City.
 - i. Place mixture so that longitudinal joints on the surface course coincide with lane lines or as directed.
 - j. Ensure that all finished surfaces will drain properly.
 - k. Placement can be performed by hand in situations where the paver cannot place it adequately due to space restrictions.
 - l. Receive approval from the City prior to placing any asphalt pavement by hand.

- m. Hand-placing should be minimized to prevent aggregate segregation and surface texture issues.
- n. All hand placements will be checked with a straightedge or template before rolling to ensure uniformity.
- o. Place the mixture at the rate or thickness specified in the Drawings.
- p. The specified layer thickness is based on the rate of 110 pounds per square yard per inch of pavement unless another rate is specified in the Drawings.
- q. Install asphalt lifts in accordance with the recommended thicknesses shown on Table 17.

Table 17
Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness Guidelines			Minimum Untrimmed Core Height (inch) Eligible for Testing
	Minimum (inch)	Maximum (inch)	Recommended (inch)	
B (Intermediate and Base Course)	2.50	5.0	3.0	1.75
C (Surface Course)	2.0	4.0	3.0	1.50
D (Residential Only Surface Course)	1.50	3.0	2.0	1.25

- 1. Testing
 - a. Perform coring and testing in accordance with Site Quality Control.
- 2. Tack Coat
 - a. Tack coat is required when the current lift is not paved the same day as the previous lift, during overlay procedures, or any time an asphalt layer is added on top of cold asphalt.
 - b. Clean the surface before placing the tack coat.
 - c. Tack coat is subsidiary to the appropriate corresponding asphalt bid item when used.
 - d. Distribute the material smoothly at a rate of 0.10 gallons of residual asphalt per square yard of surface area unless otherwise approved by the City or specified in the Drawings.
 - e. Apply a uniform tack coat at the specified rate unless otherwise directed.
 - f. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns.
 - g. Apply a thin, uniform tack coat to curbs, gutters, vertical faces of existing pavements, and all structures in actual contact with asphaltic mixes.
 - h. Allow adequate time for emulsion to break completely before placing any material.
 - i. Prevent splattering of tack coat onto adjacent features or structures.
 - j. The City may use Tex-243-F to verify that the tack coat has adequate adhesive properties and may suspend paving operations if the tack coat is considered non-conforming.
 - k. Place the tack coat in advance of paving to allow enough time to break or set before applying hot-mix asphalt layers.
 - l. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed.
 - m. Do not allow traffic on tack coat unless covered with blotter material.
 - n. Blotter Material
 - 1) Blotter material is subsidiary to tack coat when used.

- 2) Provide blotter material consisting of either base course sweepings obtained from cleaning the base or native sand unless otherwise specified in the Drawings or directed by the City.
 - 3) A typical application rate for blotter material is 4 to 8 pounds per square yard.
3. Prime Coat
- a. Prime coat is required to be placed on any subgrade that is not paved immediately.
 - b. Prime coat is subsidiary to the appropriate corresponding asphalt bid item when used.
 - c. Apply material within 15 degrees Fahrenheit of the approved temperature in accordance with Deliver, Storage, and Handling.
 - d. Do not exceed maximum temperatures in accordance with Delivery, Storage, and Handling.
 - e. Distribute the material smoothly at a rate of 0.10 gallons per square yard of surface area unless otherwise approved by the City or specified in the Drawings.
 - f. Roll the freshly applied prime coat with a pneumatic-tire roller to ensure penetration when directed.
 - g. Before allowing traffic to use a primed surface, apply asphalt base course or blotter material.
 - h. Provide blotter material in accordance with Tack Coat.
4. Lay-Down Operations
- a. Thermal Profile
 - 1) General
 - a) Use a hand-held thermal camera or thermal imaging system to obtain a continuous thermal profile in accordance with Tex-244-F.
 - b) Use a thermal imaging system where possible. The use of a hand-held thermal camera is only permitted when it is not feasible to use a thermal imaging system. Receive approval from the City before using a hand-held thermal camera.
 - 2) Thermal Segregation
 - a) Moderate
 - (1) Any areas that have a temperature differential greater than 25 degrees Fahrenheit, but not exceeding 50 degrees Fahrenheit are deemed as having moderate thermal segregation.
 - b) Severe
 - (1) Any areas that have a temperature differential greater than 50 degrees Fahrenheit are deemed as having severe thermal segregation.
 - 3) Thermal Imaging System
 - a) This is the preferred method by the City to prepare thermal profiles and measure thermal segregation.
 - b) Review the output results when a thermal imaging system is used.
 - c) Provide the automated report described in Tex-244-F to the City daily unless otherwise directed.
 - d) Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system.
 - e) The City may suspend paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe thermal segregation.
 - f) Density profiles are not required when using a thermal imaging system.

- g) Provide the City with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots upon completion of the project or as requested.
- 4) Thermal Camera
 - a) Refer to Asphalt Production Acceptance for size of lots and sublots.
 - b) Take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used.
 - c) Provide the City with the thermal profile produced in accordance with Tex-244-F of every subplot within one working day of the completion of each lot in accordance with Site Quality Control.
 - d) Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed.
 - e) Resume operations when the City determines that subsequent production will meet the requirements of this specification.
 - f) Evaluate areas with severe thermal segregation by performing density profiles in accordance with Site Quality Control.
 - g) Remove and replace the material in any areas that have both severe thermal segregation and a failing result for Segregation (Density Profile) unless otherwise directed.
 - h) Any asphalt removed and replaced due to non-conformance with the requirements of this specification will be at no cost to the City.
- b. Screed Heaters
 - 1) Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 minutes.
 - 2) The City may evaluate the suspect area in accordance with Site Quality Control if the screed heater remains on for more than 5 minutes while the paver is stopped.

E. Compaction

- 1. General
 - a. Compact the pavement uniformly to contain between 3.8 percent and 8.5 percent in-place air voids.
 - b. Take immediate corrective action to bring the operation within 3.8 percent and 8.5 percent when the in-place air voids exceed the range of these tolerances.
 - c. The City will allow paving to resume when the proposed corrective action is likely to yield between 3.8 percent and 8.5 percent in-place air voids.
- 2. Rollers
 - a. Provide rollers that meet the Equipment requirements of this specification.
 - b. Use additional rollers as required to remove any roller marks.
 - c. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.
 - d. Use the control strip method shown in Tex-207-F, Part 4 on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.
 - e. Use the approved rolling pattern for the remainder of the project unless otherwise directed.
- 3. Tamps
 - a. Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures.

- b. Use tamps only in locations that will not allow thorough compaction with rollers.
- c. The City may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.
- 4. Temperature
 - a. Complete all compaction operations before the pavement temperature drops below 160 degrees Fahrenheit unless otherwise allowed.
 - b. The City may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160 degrees Fahrenheit.
 - c. Allow the compacted pavement to cool to 160 degrees Fahrenheit or lower before opening to traffic unless otherwise directed.
 - d. When directed, sprinkle the finished mat with water or limewater to expedite opening the roadway to traffic.

3.5 REPAIR

- A. Repair flexible pavement in accordance with Section 32 01 17.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Placement Acceptance

- 1. General
 - a. Shoulders, Ramps, Etc.
 - 1) Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are subject to in-place air void determination unless otherwise specified in the Drawings.
 - 2) Intersections may be considered miscellaneous areas when determined by the City.
 - 3) Production Lot – Refer to Production Acceptance
 - b. Miscellaneous Areas
 - 1) Areas that typically involve significant handwork or discontinuous paving operations. These would include:
 - a) Temporary detours
 - b) Driveways
 - c) Mailbox turnouts
 - d) Crossovers
 - e) Gores
 - f) Spot level-up areas
 - g) Other similar areas
 - 2) Miscellaneous areas also include level-ups and thin overlays when the layer thickness specified on the plans is less than the minimum untrimmed core height eligible for testing shown in Table 17.
 - 3) Miscellaneous areas are not eligible for random placement sampling locations.
 - 4) Compact miscellaneous areas in accordance with Compaction.
 - 5) Miscellaneous areas are not subject to in-place air void determination, thermal profiles testing, segregation (density profiles), or longitudinal joint density evaluations.

2. Placement Sampling

a. General

- 1) Provide the equipment and means to obtain and trim roadway cores on-site.
- 2) Obtain the cores within 1 working day of the time the placement area is completed unless otherwise approved.
- 3) Random coring locations may be requested by the City based on visual irregularities in the pavement.
- 4) Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are always eligible for selection as a random sample location.

b. Coring Location, Sizes, and Identification

1) Coring Set:

- a) Is defined as all of the pavement cores across the full width of the roadway for the station location determined at the beginning of each day.
- b) Provide one core on the inside an outside edge of each travel lane across the full width of the roadway.
- c) Provide a 2-foot clearance from a longitudinal joint or edge of pavement.

2) Location

- a) Mark station locations where core sampling is to be taken at the beginning of each day.
- b) For projects placing more than 1,000 tons of asphalt per day:
 - (1) Perform tests in accordance with Table 19 and Site Quality Control.
- c) For projects placing less than 1,000 tons of asphalt per day:
 - (1) Provide a Coring Set at only one location per day unless additional cores are requested by the City based on irregularities or suspicion that the pavement is non-conforming.
 - (2) Request approval from the City for the core location prior to coring.
- d) For projects placing less than 100 tons of asphalt per day:
 - (1) City may exempt the Contractor from collecting pavement cores each day.
 - (2) Coordinate with the City to determine how many pavement core sets will be required for testing.
 - (3) The City may request pavement cores at any time for verification testing.

3) Sizes

- a) For TY D pavement, cores will be 4 inch in diameter
- b) For TY B and TY C pavement, cores will be 6 inch in diameter.

4) Identification:

- a) Identification number
- b) Station location
- c) The untrimmed core height

c. Pavement Cores

- 1) The City inspector will witness the coring operation and measurement of the core thickness.
- 2) The inspector should visually inspect each core to verify current paving layer is bonded to the underlying layer.
- 3) Take corrective action if an adequate bond does not exist between the current and underlying layer to ensure an adequate bond will be achieved during subsequent placement operations.
- 4) The untrimmed core height must be in accordance with the requirements in Table 17.

- 5) If the cores are an acceptable height, trim the cores immediately after obtaining the cores in accordance with Tex-207-F.
- 6) Any core that does not meet the requirements in Table 17 will be rejected.
- 7) The City may request additional cores to be taken within the area. If more than 2 cores are non-conforming, the pavement area may be subject to removal and replacement at no cost to the City.
- 8) Trim the cores on-site in the presence of the inspector. The cores may be trimmed by the testing lab if approved by the City.
- 9) Blind Coring Locations
 - a) The City may select “blind” coring locations throughout the project for verification testing.
 - b) Test the blind pavement cores in accordance with asphalt placement testing and provide testing and evaluation reports to the City in accordance with Action Submittals.
- d. Core Hole repair
 - 1) Dry the core holes and tack the sides and bottom immediately after obtaining the cores.
 - 2) Fill the hole with the same type of mixture and properly compact the mixture.
 - 3) Holes may be repaired with other methods approved by the City.
3. Placement Testing
 - a. General
 - 1) Perform placement tests in accordance with Table 19 and 20.
 - 2) The City may suspend work at any time if any of the test results are non-conforming with the requirements of this specification.
 - 3) Verification Testing
 - a) The City may request the Contractor to perform additional testing to verify compliance, or the City may perform verification testing utilizing a third-party testing laboratory.
 - b) The City may request verification testing at any time if production is suspected to be non-conforming.
 - b. In-Place Air Voids
 - 1) Measure in-place air voids in accordance with Tex-207-F and Tex-227-F.
 - 2) Before drying to a constant weight, cores may be pre-dried using a Corelok or similar vacuum device to remove excess moisture.
 - 3) Average the values obtained for all cores taken during each production day to determine the theoretical maximum specific gravity.
 - 4) Use the average air void content for in-place air voids.
 - 5) Use the vacuum method to seal the core if required by Tex-207-F.
 - 6) Remove and replace any area with in-place air voids less than 2.8 percent or greater than 9.5 percent.
 - c. Segregation (Density Profile)
 - 1) Test for segregation using density profiles in accordance with Tex-207-F, Part 5. Density profiles are not required if a thermal imaging system is used.
 - 2) Perform a density profile every time the paver stops for more than 60 seconds on areas that are identified by either the Contractor or the City as having thermal segregation. Perform density profiles on any visibly segregated areas unless otherwise approved.

- 3) Perform a minimum of one profile per subplot if the paver does not stop for more than 60 seconds and there are no visibly segregated areas or areas that are identified as having thermal segregation.
 - 4) Provide the City with the density profiles of every subplot in the lot within one working day of the completion of each lot.
 - 5) The density profile is considered failing if it exceeds the tolerances in Table 20.
 - 6) The City may require the Contractor to remove and replace the area in question if the area fails the density profile and has surface irregularities as defined in Irregularities. Remove and replace the failing area at no cost to the City.
 - 7) Investigate density profile failures and take corrective actions during production and placement to eliminate the segregation.
 - 8) Suspend production if 2 consecutive density profiles fail unless otherwise approved.
 - 9) Resume production after the City approves changes to production or placement methods.
- d. Longitudinal Joint Density
- 1) Informational Tests
 - a) Perform joint density evaluations while establishing the rolling pattern and verify that the joint density is no more than 3.0 pounds per cubic foot below the density taken at or near the center of the mat.
 - b) Adjust the rolling pattern, if needed, to achieve the desired joint density.
 - c) Perform additional joint density evaluations as directed by the City.
 - 2) Record Tests
 - a) Perform a joint density test 2 to 4 times a day or as directed by the City along all joints that will become a longitudinal joint.
 - b) Joint density evaluations are not applicable in areas described as Miscellaneous Areas.
 - c) Determine the joint density in accordance with Tex-207-F, Part 7.
 - d) Record the joint density information and submit results to the City.
 - e) The evaluation is considered failing if the joint density is more than 3.0 pounds per cubic foot below the density taken at the nearest core sample location and the correlated joint density is less than 90 percent.
 - f) Provide the City with the density profile of every test within 1 working day of the completion of each working day.
 - g) Investigate joint density failures and take corrective actions during production and placement to improve joint density. Suspend production if the evaluations on 2 consecutive tests fail unless otherwise approved.
 - h) Resume production after Engineer approves changes to production or placement methods.
- e. Hamburg Wheel Test
- 1) The City may perform a Hamburg Wheel test at any time during production or placement including when the boil test indicates a change in quality from the materials submitted for the trial batch.
 - 2) The City may request additional cores to be taken and the Hamburg Wheel test to be performed where rutting is observed.
 - 3) Suspend production until further Hamburg Wheel tests meet the specified values when the production or core samples fail the Hamburg Wheel test criteria in Table 18.

- 4) Obtain core samples from the center of the finished mat or other areas excluding the vehicle when path.
- 5) The City may require up to the entire area of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.
- 6) If the City determines the material to be removed and replaced, the Contractor may request the City re-test the failing material.

Table 18
Hamburg Wheel Test Requirements

High-Temperature Binder Grade	Test Method	Minimum Number of Passes at 12.5 mm¹ Rut Depth, Tested at 50 degrees Celsius
PG 64	Tex-242-F	10,000 ²
PG 70		15,000 ³

1. When the rut depth at the required minimum number of passes is less than 3 mm, the City may require the Contractor to increase the target laboratory-molded density (TGC) by 0.5 percent to no more than 97.5 percent.
2. May be decreased to no less than 5,000 passes when specified in the Drawings.
3. May be decreased to no less than 10,000 passes when specified in the Drawings

- f. Recovered Asphalt Dynamic Shear Rheometer (DSR) and Aging Ratio
 - 1) The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder.
 - 2) The City may request an aging ratio test be performed on production samples or cores from suspect areas of the project to determine recovered asphalt properties.
 - 3) Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective.
 - 4) Obtain DSR values in accordance with AASTO T 315 at the specified high temperature performance grade of the asphalt.
 - 5) Recover the asphalt binder for testing from production samples or cores in accordance with Tex-211-F.
 - 6) The City may require removal and replacement of the defective material at the Contractor's expense.
- g. Irregularities
 - 1) Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles.
 - 2) If the City determines that the irregularity will adversely affect pavement performance, the City may require the Contractor remove and replace the non-conforming area at no cost to the City.
 - 3) If irregularities are detected, the City may require the Contractor to immediately suspend operations. The City may allow the Contractor to continue operations for more than one day while the Contractor is taking appropriate corrective action.

Table 19
Placement Testing

Description	Test Method	Allowable Tolerances	Contractor Testing Frequency ¹	City Verification Testing Frequency
In-place air voids, percent	Tex-207-F and Tex-227-F	+/- 1.0	1 per subplot	The City may request the Contractor to perform additional verification testing throughout the project. No more than an additional 10 percent of each test performed will be requested
Segregation (density profile)	Tex-207-F, Part 4	N/A	1 per subplot	
Longitudinal joint density	Tex-207-F, Part 7	N/A	1 per subplot	
Recycled asphalt shingles (RAS)	Tex-217-F, Part 3	N/A	As requested	
Thermal profile ²	Tex-244-F	N/A	1 per subplot	
Asphalt binder sampling and testing	Tex-500-C	N/A	1 per subplot	
Tack coat sampling and testing	Tex-500-C, Part 3	N/A	As requested	The City may perform verification testing utilizing a third party testing laboratory.
Aging ratio, maximum ratio	AASHTO T315	3.5	As requested	
Establish a Rolling Pattern	Tex-207-F	See Compaction		
Ride quality	Tex-1001-S	See Ride Quality		

- For projects placing less than 700 tons of asphalt pavement per day, refer to Placement Sampling.
- If using a thermal imaging system, provide the automated report daily unless otherwise directed. If using a thermal camera, provide a thermal profile per subplot daily unless otherwise directed.
- For all tests that have N/A for tolerances, material must conform to requirements provided within this specification. No tolerances are allowed.

Table 20
Segregation (Density Profile) Acceptance Criteria

Mixture Type	Maximum Allowable Density Range (Highest to Lowest)	Maximum Allowable Density Average (Average to Lowest)
Type B	8.0 pounds per cubic foot	5.0 pounds per cubic foot
Type C and Type D	6.0 pounds per cubic foot	3.0 pounds per cubic foot

B. Ride Quality

- General
 - Provide pavement to have a finished grade that is smooth and true to the established line, grade, and cross-section.
 - Ride quality will be measured parallel (longitudinal) and perpendicular (transverse) to the centerline of the roadway for pavement surfaces.
- Transverse Profile Measurements
 - Use a 10-foot straightedge to perform ride quality tests or a high-speed or lightweight inertial profiler that has been certified at the Texas A&M Transportation Institute.
 - If using an inertial profiler, provide equipment certification documentation, display a current decal on the equipment indicating the certification expiration date, and use a certified profiler operator from TxDOT's Material Producer List.
 - Use an inertial profiler when requested by the City.

- 3) Provide documentation of profiles when requested by the City.
 - b. Perform tests daily throughout the duration of the project.
 - c. Perform tests on the finished surface of the completed project or at the completion of a major stage of construction as approved.
 - d. Perform testing during off-peak traffic flow. Operate the inertial profiler in a manner that does not disrupt traffic flow as directed.
 - e. When measuring the ride quality on a surface open to traffic, use a moving traffic control plan in accordance with Part 6 of the TMUTCD and the drawings.
3. Acceptance Plan
- a. General
 - 1) Evaluate longitudinal and transverse profiles to verify there is not more than 1/8-inch variation between any 2 contacts. Perform corrective action on surface areas that have more than 1/8-inch variation between any 2 contacts
 - 2) Fog seal the aggregate exposed by diamond grinding or other approved work methods.
 - 3) When a fog seal is required, use a fog seal that conforms to the requirements for cationic emulsified asphalt, CSS-1h, within this specification.
 - b. Localized Roughness
 - 1) Determine areas of localized roughness using the individual profile from each wheel path.
 - 2) Use a 10-foot straightedge to locate areas that have more than 1/8-inch variation between any 2 contacts on the straightedge.
 - 3) The City may waive localized roughness requirements for deficiencies resulting from manholes or other similar appurtenances near the wheel paths.
 - c. Corrective Action
 - 1) Use diamond grinding to correct variations in the pavement surface or localized roughness.
 - 2) After making corrections, reprofile the pavement section to verify that corrections have produced the required improvements.
 - 3) If corrective action does not produce the required improvement, the City may require:
 - a) Continued corrective action
 - b) Removal and replacement of area at no cost to the City. The City may negotiate a reduced payment amount for the defective area to remain in place.
- C. Temporary Hot-Mix Asphalt Paving
- 1. Does not require any placement sampling or testing.
 - 2. Acceptance Plan
 - a. Acceptable ride quality includes:
 - 1) A maximum depth of potholes to be 0.25 inches.
 - 2) Maintain temporary hot-mix asphalt in accordance with 32 01 17.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 12 73

ASPHALT PAVING CRACK SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sealant for cracks in asphalt paving.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 32 12 16 – Asphalt Paving
 - 2. Section 32 01 17 – Flexible Paving Repair

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Crack sealant materials, equipment, tools, testing, and incidentals are subsidiary to the installation of asphalt paving and paving repair in accordance with Section 32 12 16 and 32 01 17.
 - 2. Payment
 - a. The work performed and materials furnished in accordance with this item are subsidiary to the unit prices bid for various items which require the use of crack sealant and will not be measured or paid for separately.

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically sited.
 - 2. American Society for Testing and Materials (ASTM):
 - a. D4-86, Standard Test Method for Bitumen Content.
 - b. D113, Standard Test Method for Ductility of Asphalt Materials.
 - c. D5329, Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Provide electronic product data from each manufacturer supplying asphalt crack sealant.
2. Product data sheets including:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Point of delivery
 - e. Provide data and test results in accordance with this Section
 - f. Material Safety Data Sheets (if applicable, required for PCE and all additives)
 - g. Manufacturer Recommended Storing Data (if applicable)
 - h. Application Recommendations (if applicable)
 - i. Liquid Antistripping Agent Specific Data:
 - 1) Specific gravity of the agent at manufacturer's recommended addition temperature
 - 2) Manufacturer's recommended dosage range
 - 3) Manufacturer's recommended storage and handling instructions

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

B. Keep material stored in a clean condition at all times to prevent contamination with foreign matter.

C. Follow any manufacturer recommendations for delivery, storage, and handling.

1.11 FIELD CONDITIONS

A. Ambient Conditions

1. Ambient temperature must be between 40 degrees Fahrenheit and 105 degrees Fahrenheit.

B. Suspend sealing activities if:

1. Ambient condition requirements are not met, or
2. City determines that weather conditions are unsuitable.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Manufacturer List
 - a. Rubberized Crack Seal
 - 1) Provide in accordance with Standard Products List or approved equal
 - b. Provide rubber used to make sealant free from fabric, wire, core, or other contaminating material. Recycled rubber is not allowed.
2. Substitution requests for manufacturers or models not indicated above shall be processed in accordance with Section 01 25 00.

B. Material Requirements

1. Provide rubberized crack seal meeting the following requirements:

Table 1

Criteria		ASTM Specification
Softening Point	210°F (99°C)	N/A
Ductility at 77°F (25°C)	30 cm min.	ASTM D113
Cone Penetration	15-45 mm	ASTM D5329
Resilience	30% min.	ASTM D5329
Bitumen Content	60% min.	ASTM D4-86
Tensile Adhesion	400% min.	ASTM D5329

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Use crack cleaning equipment to clean and prepare the cracks for sealing.

3.4 INSTALLATION

A. General

1. Clean and seal cracks greater than 1/16 inch in width.
2. Clean cracks to a minimum depth of at least twice the crack width using an air compressor with an air lance to remove debris and moisture from the crack.
3. Cracks must be free of moisture before sealing.
4. Apply sealant to cleaned cracks as directed by the manufacturer.

5. Level sealant with a squeegee in a narrow band not to exceed 2 inches wide and 1/8 inch above the pavement surface.
6. Prevent tracking material offsite using an application of fine aggregate as specified in the Drawings and directed by the City.
7. Do not apply sealant over existing sealant in good condition.
8. Disposal of Materials:
 - a. Dispose of any excess material produced from cleaning of cracks.

B. Equipment

1. Hot Pour Sealing Equipment
 - a. Heat in a double-jacketed heater using a heat transfer oil so no direct flame meets shell of the vessel containing the sealing compound.
 - b. Provide a heater capable of circulating and agitating the sealant during heating process to achieve a uniform temperature rise and maintain desired temperature.
 - c. Provide gauges to monitor temperature of the vessel contents and avoid overheating the material.
 - d. Provide a heater equipped with a gear-driven asphalt pump with adequate pressure to dispense sealant.
2. Crack Cleaning Equipment
 - a. Provide equipment capable of delivering dry compressed air at 185 cubic feet per minute to remove all loose debris from cracks in accordance with depth specified in Article 3.4 of this Section.
 - b. Provide at least one handheld pressure wand per crew to clean cracks.
3. Condition of Equipment
 - a. Provide equipment in good repair and operating condition.
 - b. Subject to the approval of City.
 - c. If equipment is found to be insufficient, the Contractor is responsible for replacing non-conforming equipment at no cost to City.
 - d. Any sealant installed using non-conforming equipment is subject to removal and replacement at no cost to City.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material requirements and construction methods for:
 - a. Concrete pavement classes
 - b. Concrete pavement
 - c. Concrete street header

B. Deviations from this City of League City Standard Specification:

1. None.

C. Related Specification Sections include but are not limited to:

1. Section 03 00 00 – Concrete and Concrete Reinforcing.
2. Section 32 01 29 – Concrete Paving Repair.
3. Section 32 05 16 – Aggregates for Exterior Improvements.
4. Section 32 13 73 – Concrete Paving Joint Sealants.
5. Section 41 14 00 – Batching Equipment.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Concrete Pavement
 - a. Measurement
 - 1) Measured per square yard from back of curb to back of curb or edge of concrete to edge of concrete for Concrete Pavement installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for Concrete Pavement installed for:
 - a) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Pavement as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action

- 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
2. Concrete Pavement (HES)
- a. Measurement
 - 1) Measured per square yard from back of curb to back of curb or edge of concrete to edge of concrete for Concrete Pavement (HES) installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for Concrete Pavement (HES) installed for:
 - a) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Pavement (HES) as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
3. Concrete Street Header

- a. Measurement
 - 1) Measured per linear foot of Concrete Street Header installed.
- b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Concrete Street Header installed.
- c. The price bid shall include:
 - 1) Furnishing and installing Concrete Street Header as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. ACI – American Concrete Institute
- 2. AASHTO – American Association of State Highway and Transportation Officials
- 3. ASTM – American Society for Testing and Materials
- 4. HES – High Early Strength
- 5. TxDOT – Texas Department of Transportation
- 6. W/C – Water to cement ratio
- 7. SCM – Supplementary Cementing Materials
- 8. UFFA – Ultra-Fine Fly Ash
- 9. MFFA – Modified Class F Fly Ash
- 10. PSI – Pounds per Square Inch
- 11. KSI – Kilopound per Square Inch

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO)
 - a. AASHTO T26, Standard Method of Test for Quality of Water to be Used in Concrete
3. American Society for Testing and Materials (ASTM):
 - a. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field
 - b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - c. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 - d. C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
4. American Concrete Institute (ACI):
 - a. ACI 305.1-14, Standard Specification for Hot Weathering Concreting
 - b. ACI 306.1-90, Standard Specification for Cold Weathering Concreting
 - c. ACI 301-16, Specifications for Structural Concrete
 - d. ACI 318, Building Code Requirements for Structural Concrete
5. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS)
 - a. DMS-4515, Multiple-Piece Tie Bars for Concrete Pavement
 - b. DMS-4600, Hydraulic Cement
 - c. DMS-4640, Chemical Admixtures for Concrete
 - d. DMS-4650, Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
 - e. DMS-6100, Epoxies and Adhesives
 - f. DMS-6310, Joint Sealants and Fillers
6. TxDOT Test Procedures:
 - a. Tex-422-A, Measuring Temperature of Freshly Mixed Portland Cement
 - b. Tex-423-A, Determining Concrete Thickness by Direct Measurement
 - c. Tex-424-A, Obtaining and Testing Drilled Cores of Concrete
 - d. Tex-470-A, Optimized Aggregate Gradation for Hydraulic Cement Concrete Mix Designs
 - e. Tex-472-A, Uniformity of Concrete
 - f. Tex-612-J, Acid Insoluble Residue for Fine Aggregate

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meeting

1. Hold meeting 1 week prior to performing any tasks included under Concrete Paving.
2. Invite the City and appropriate representatives.
3. Prior to pre-construction meeting, prepare the following:
 - a. Paving Plan
 - 1) Paving widths
 - 2) Jointing plan:
 - a) Locations and labels for all joint types including longitudinal and transverse construction joint locations
 - 3) Confirm rebar sizes for pavement reinforcing.

- 4) Confirm hand-pour location and equipment to be used for forming, pouring, compacting, and finishing concrete.
- 5) Texturizing method (broom or tining) and direction (longitudinal or transverse)
- 6) Consolidation methods at joints
- b. Paving Process
 - 1) Process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality.
- c. All Action and Information Submittals to be reviewed and approved prior to Pre-Construction Meeting.
4. During the Pre-Construction Meeting, determine whether tining or a broom finish is preferred by the City unless otherwise specified in the Drawings.

B. Night Work and Noise

1. Comply with all City Noise Ordinance in accordance with the General Conditions.
2. Night work will require prior City approval in accordance with the General Conditions.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to commencement of any Concrete Paving activities.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings:

1. Concrete Mix Design
 - a. In accordance with Section 03 00 00.
 - b. Statement from the concrete supplier verifying concrete has been tested and handled in accordance with ASTM C94.
2. Jointing Layout
 - a. Provide a jointing layout if one is not provided in the Drawings.
3. Product Data
 - a. Provide the following from each manufacturer supplying the following in accordance with Section 03 00 00:
 - 1) Curing compounds
 - 2) Evaporation retardant
 - 3) Joint fillers
 - 4) Chemical additives
 - 5) Epoxy

B. Informational Submittals:

1. Source Locations
 - a. Location of all material sources
2. Testing Laboratory
 - a. Submit for review and approval the following information for each testing laboratory used on the project:
 - 1) Testing Laboratory Name
 - 2) Location
 - 3) What tests will be performed at the lab if multiple labs are used.

- 4) ACI Certification – All labs and Contractor personnel performing concrete testing must be ACI certified.
3. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports

1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Secure and maintain a location to store the material in accordance with Section 01 66 00.

B. Storage and Stockpiling

1. Cement and Supplementary Cementitious Material
 - a. In accordance with Section 03 00 00.
 2. Steel Reinforcement
 - a. Store reinforcement above ground surface on skids, platforms, or other support.
 - b. Protect reinforcement from mechanical damage and surface deterioration caused by exposure to conditions that could cause rust.
 3. Chemical Admixture, Epoxy, Curing Compound, and Other Materials
 - a. Follow manufacturer's instructions regarding storage and application at temperatures of material.
 4. Epoxy
 - a. Package components in airtight containers and protect from light and moisture.
 - b. Include detailed instructions for the application of the material and all safety information and warnings regarding contact with the components.
- C. Store epoxy and adhesive components at temperatures recommended by the manufacturer.**

1.11 FIELD CONDITIONS

A. Weather Conditions

1. Do not place concrete when the ambient temperature exceeds 95 degrees Fahrenheit.
2. Do not place concrete when the ambient temperature in the shade is below 40 degrees Fahrenheit and falling unless approved in writing by the City.
3. Protect the pavement with an approved insulating material capable of protecting the concrete for the specified curing period when temperatures warrant protection against freezing.
4. Submit proposed measure to protect the concrete from anticipated freezing weather for the first 72 hours after a concrete pour to the City for review.
5. Repair or replace all concrete damaged by freezing at no cost to the City.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1. CITY-SUPPLIED PRODUCTS [NOT USED]

2.2. MATERIALS

A. Concrete Production Materials

1. Produce Class P or HES concrete for concrete paving in accordance with 03 00 00.
 - a. Temperature
 - 1) Pour concrete that is between 40 degrees and 95 degrees Fahrenheit when measured in accordance with Tex-422-A at the time of discharge.
 - 2) Take immediate corrective action or cease concrete placement when the concrete temperature exceeds 95 degrees Fahrenheit.
2. Provide Cementitious Material and Water in accordance with Section 03 00 00.
3. Aggregate
 - a. General
 - 1) Recycled crushed concrete may be used as coarse or fine aggregate in Class A and P concrete.
 - 2) A maximum of 20 percent of the fine aggregate may consist of recycled crushed concrete.
 - b. Coarse Aggregates
 - 1) Provide coarse aggregate in accordance with Tex-470-A and Section 03 00 00 for P or HES concrete based on the concrete classes specified on the Drawings.
 - c. Fine Aggregates
 - 1) Fine aggregate will consist of clean, hard, durable fragments in accordance with Section 32 05 16.
 - 2) Use fine aggregate with an acid insoluble residue of at least 60 percent by weight when tested in accordance with Tex-612-J in all concrete subject to direct traffic.
 - 3) Use the following equation to determine if aggregate combination meets the acid insoluble residue requirement when blending fine aggregate:

$$\frac{(A_1 \times P_1) + (A_2 \times P_2)}{100} \geq 60 \text{ percent}$$

Where:

A₁ = acid insoluble (percent) of fine aggregate 1

A₂ = acid insoluble (percent) of fine aggregate 2

P₁ = percent by weight of fine aggregate 1 of the fine aggregate blend

P₂ = percent by weight of the fine aggregate 2 of the fine aggregate blend

- a) Instead of using the above equation, the following blending may be done.
 - (1) Blend fine aggregate with a micro-deval loss of less than 12 percent when tested in accordance with Tex-461-A with at least 40 percent of a fine aggregate that has an acid insoluble residue of at least 60 percent.

- 4) Provide fine aggregates in accordance with gradation shown in Table 1.

Table 1
Fine Aggregate Gradation Chart

Sieve Size	Percent Passing by Weight
3/8"	100
#4	95– 100
#8	80– 100
#16	50– 85
#30	25– 65
#50	10– 35 ¹
#100	0– 10
#200	0– 3 ²

1. 6 – 35 when sand equivalent value is greater than 85 when tested in accordance with Tex-203-F.
2. 0 – 6 for manufactured sand.

4. Chemical Admixtures

a. General

- 1) Provide chemical admixtures in accordance with Section 03 00 00.

b. Water Reducing Admixture

- 1) Provide water-reducing admixtures in accordance with Section 03 00 00.

c. Air-Entraining Admixture

- 1) Provide air-entraining admixtures in accordance with Section 03 00 00.

B. Concrete Placement Materials

1. Reinforcing Steel

- a. Provide in accordance with Section 03 00 00.

2. Tie Bars

a. General

- 1) Provide in accordance with Section 03 00 00.
- 2) Use tie bars in longitudinal contraction and longitudinal construction joints.
- 3) Use support baskets to support the tie bars during concrete placement. Do not use chairs or other support devices without prior approval from the City.
- 4) Refer to this Section for installation requirements.

b. Multiple Piece Tie Bars

- 1) Use multiple piece tie bars along all longitudinal construction joints unless otherwise approved by the City.
- 2) Do not use multiple piece tie bars for contraction joints or any transverse joints.
- 3) Provide multiple piece tie-bars conforming to DMS-4515.

c. Single Piece Tie Bars

- 1) Use single piece tie bars for contraction joints only.
- 2) Single piece tie bars will only be accepted for longitudinal construction joints when the existing concrete is already hardened in widening projects or when performing maintenance work such as panel replacement or concrete repair.

3. Dowel Bars

a. General

- 1) Provide dowel bars and dowel caps in accordance with Section 03 00 00.
- 2) Use dowel bars in transverse contraction joints and expansion joints.
- 3) Refer to this Section for installation requirements.

4. Reinforcement Supporting Devices

- a. Provide in accordance with Section 03 00 00.

5. Epoxy
 - a. Provide in accordance with Section 03 00 00.
6. Evaporation Retardant
 - a. Provide in accordance with Section 03 00 00.
7. Curing
 - a. Provide in accordance with Section 03 00 00.
8. Joint Fillers (Expansion Joints)
 - a. Provide boards at the size, shape, and type specified in the Drawings. Use redwood if the type of board is not specified in the Drawings.
 - 1) Provide redwood timber boards for expansion joints in accordance with DMS-6310.
 - b. Provide wood boards free of deformities and are smooth, flat, straight throughout, and sufficiently rigid to allow for easy installation.
9. Joint Sealants
 - a. Provide joint sealants in accordance with Section 32 13 73.

2.3. ACCESSORIES [NOT USED]

2.4. SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Material Source Testing and Submittals
 - a. Resubmit Action Submittals affected if any material source locations or concrete supplier is changed.
 - b. Cementitious Materials
 - 1) Provide manufacturer testing reports in accordance with this Section.
 - 2) Perform testing in accordance with DMS-4600
 - 3) Furnish in accordance with Section 03 00 00.
 - c. Water
 - 1) Perform testing to verify the water is in accordance with the requirements of AASHTO T26.
 - 2) Mix water in accordance with ASTM C1602.
 - d. Aggregate Quality Requirements
 - 1) Provide aggregates in accordance with all requirements in Section 32 05 16 and this Section.
 - e. Chemical Admixtures
 - 1) Provide manufacturer testing reports in accordance with this Section.
 - 2) Perform testing in accordance with DMS-4640
 - f. Epoxy, Evaporation Retardants, Curing Compounds, Joint Fillers, and Joint Sealants
 - 1) Provide manufacturer testing reports and product data in accordance with this Section.
 - 2) Perform testing in accordance with DMS-4650, DMS-6100, and DMS-6310.

PART 3 - EXECUTION

3.1. INSTALLERS [NOT USED]

3.2. EXAMINATION [NOT USED]

3.3. PREPARATION

A. Class P and HES Preparation

1. Hauling
 - a. Clean delivery equipment as necessary to prevent accumulation of old concrete before loading fresh concrete.
 - b. Deliver concrete to the site in accordance with Section 41 14 00.
 - c. Maintain concrete delivery and placement rates to prevent cold joints and in accordance with Section 03 00 00.
 - d. Any concrete not placed within the time limits specified under Section 03 00 00 will be rejected.
 - e. Adding Water or Chemical Admixtures
 - 1) Adding chemical admixtures is not permitted at the jobsite.
 - 2) Water may be added to the truck until the slump test is conducted. Once the slump test is conducted, the addition of water or admixtures is not permitted unless the slump is too low or otherwise permitted.
 - 3) When water or an admixture is added, turn the drum or blades at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete.
 - 4) When water is added, do not exceed the approved mix design water to cementitious material ratio.
 - 5) Do not add water or chemical admixtures after any concrete has been discharged.
 - f. Provide the delivery ticket for the concrete in accordance with Section 41 14 00.
2. Subgrade
 - a. Hot-Mix Asphalt Base
 - 1) Prepare surface by removing, sweeping, or other approved methods.
 - b. Lime, Cement or Flexible Base Subgrade:
 - 1) Correct all irregularities in the subgrade of more than 1/2 inch., as shown by straightedge or template.
 - 2) Verify subgrade meets all requirements for the applicable subgrade type.
 - 3) Spray prepared subgrade with water, if needed, in advance of placing the pavement to ensure it is in a firm and moist condition.
 - 4) Take density tests no more than 72-hours prior to placement of concrete.
 - c. If rain or other conditions may have adversely affected the condition of the subgrade or base, additional tests may be required as directed by the City.

3.4. INSTALLATION

A. Class P and HES Equipment

1. General
 - a. Furnish and maintain all equipment necessary for the construction of concrete pavement in good working condition.
 - b. The equipment to include spreading devices (augers), internal vibration, tamping, and surface floating necessary to finish the freshly placed concrete shall provide a dense and homogeneous pavement.

2. Forming Equipment

a. Pavement Forms

- 1) Pavement forms shall only be used when hand-pouring concrete. Unless otherwise approved by the City, use a slip-form paver for all machine-poured concrete on roadways projected to carry 10,000 vehicles per day or more.
- 2) Provide metal or wood side forms unless otherwise approved by the City.
- 3) Provide side forms of sufficient cross-section, strength, and rigidity to support paving equipment and resist the impact and vibration of the operation without visible springing, settling, or deflection.
- 4) Use forms that extend the full depth of concrete and shall be:
 - a) a minimum of 1.5 inches in thickness when wooden forms are used
 - b) of a gauge that provides equivalent rigidity and strength when metal forms are used.
- 5) Use forms that are clean, oiled, and free from detrimental kinks, bends, or warps that could affect ride quality or alignment.
- 6) Provide flexible or curved forms made of metal or wood for curves that have a radius of 250 feet or less.
- 7) Secure forms on a base or firm subgrade accurately graded and that provides stable support without deflection and movement.
- 8) Pin every form at a minimum in the middle and near each end. Tightly join and key form sections together to prevent displacement.
- 9) Forms to be reset using heavy stakes or other additional supports if subgrade becomes unstable.
- 10) Obtain approval of formwork from the City prior to placement of concrete.
- 11) Forms are to be placed to provide pavement at final grade as specified in the Drawings.
- 12) Check conformity of the grade, alignment, and stability of forms immediately before pouring concrete and make necessary corrections.
- 13) Use a straight edge or other approved method to test the top of forms to ensure ride quality requirements for the completed pavement will be met.
- 14) Submit a request to the City for any alternative pavement form equipment for review.

b. Curb Forms

- 1) Provide curb forms for separately placed curbs not slip-formed in accordance with the requirements of Section 32 16 00.

c. Settling

- 1) Stop paving operations if forms settle or deflect more than 1/8 inch under finishing operations.
- 2) Reset the forms and refinish concrete surface to correct grade.

3. Paving, Consolidating, and Finishing Equipment

- a. Do not add water to concrete after discharged from delivery equipment unless approved by the City.

- b. Misting/fogging only allowed during Finishing. Refer to this Section for additional information.

c. Machine-Poured Concrete Pavement

- 1) Use a slip-form paver with a stringline that uniformly distributes the concrete with minimal segregation and provides a smooth finish in accordance with the plan line and grade for machine-poured concrete.

- 2) The Contractor is responsible for establishing the location and elevation of the stringline to ensure pavement will be at the correct final grade specified in the Drawings.
- 3) Provide mechanically operated finishing floats capable of producing a uniformly smooth pavement surface.
- 4) Provide watering equipment capable of providing a fine, light, water fog mist.
- 5) Provide a stake line for the stringline every 25 feet and at every horizontal and vertical geometry point as specified in the Drawings.
- d. Hand-Poured Concrete Pavement
 - 1) Receive approval of all equipment used for hand-pouring concrete during Pre-Construction Meeting.
 - 2) Refer to this Section for additional requirements.
- e. Consolidating
 - 1) Provide mechanically operated vibratory equipment capable of adequately consolidating the concrete.
 - 2) Provide immersion vibrators on paving equipment at sufficiently close intervals to provide uniform vibration and consolidation of the concrete over the entire width and depth of the pavement and in accordance with the manufacturer's recommendations.
 - 3) Provide immersion vibrator units that operate at a frequency in air of at least 8,000 cycles per minute on the paving equipment.
 - 4) Provide enough hand-operated immersion vibrators for timely and proper consolidation of the concrete along forms, at all joints, and in areas not covered by other vibratory equipment.
 - 5) Surface vibrators may be used to supplement equipment-mounted immersion vibrators.
 - 6) Provide tachometers to verify the proper operation of all vibrators.
- f. Finishing
 - 1) Floats
 - a) Use a float attached to the slip-form paver or as a separate machine where possible.
 - b) When using a hand float or trowel, take care to not distort the surface. The City may require any concrete that has a non-uniform surface due to the improper use of a float to be removed and replaced at no cost to the City.
 - 2) Straightedge
 - a) Use a 10- or 15-foot-long square tube straightedge made of magnesium or steel.
 - b) The City may require any concrete that has a non-uniform surface due to the improper use of a straightedge to be removed and replaced at no cost to the City.
4. Texturing Equipment
 - a. A baker broom or tining are the approved methods for texturizing concrete.
 - b. Provide a baker broom of sufficient transverse length to span the full width of pavement being placed.
 - c. Request approval to use an evaporation retardant if there is concern the concrete surface will dry too quickly before texturing and curing can occur.
 - d. Tining Equipment
 - 1) Provide a self-propelled metal tine device equipped with steel tines to obtain groves that are 1/12-inch-wide and a depth of 1/8 inch to 3/16 inch.
 - 2) Tine Spacing:
 - a) Transverse tining spaced at approximately 1-inch center-to-center.
 - b) Longitudinal tining spaced at approximately 3/4-inch center-to-center.

- 3) Manual methods may be used that produce an equivalent texture when it is impractical to use self-propelled equipment. However, manual methods should be minimized. Obtain approval before using manual tining methods.
 5. Curing Equipment
 - a. Provide a self-propelled machine for applying membrane curing compound using mechanically pressurized spraying equipment with atomizing nozzles where possible.
 - b. If manually applying a curing compound, use equipment with a nozzle capable of producing the desired coverage based on the requirements of this specification.
 - c. Provide equipment and controls that maintain the required uniform rate of application over the entire paving area.
 - d. When reinforcing is exposed, provide plastic covers to prevent the bars from being coated in curing compound. Remove any curing compound on exposed reinforcing with a steel brush or by sand blasting.
 6. Sawing Equipment
 - a. Provide power-driven concrete saws to saw joints specified in the Drawings.
 7. Grinding Equipment
 - a. Provide grinding equipment specifically designed to smooth and texture concrete pavement using circular diamond blades when required.
 - b. Provide equipment with an automatic grade control capable of grinding at least a 3-foot width longitudinally in each pass without damaging the concrete.
 8. Coring Equipment
 - a. Provide coring equipment capable of extracting cores in accordance with Tex-424-A.
 9. Miscellaneous Equipment
 - a. Provide both a 5-foot and a 10-foot steel or magnesium long-handled, standard straightedge.
 - b. Provide enough work bridges long enough to span the pavement for finishing and inspection operations.
 10. The City may reject equipment and stop operation if equipment does not meet requirements.
- B. Class P and HES Concrete Placement
1. General
 - a. This section outlines the requirements for the placement of Class P and HES concrete. Refer to other specifications for the placement requirement of other concrete items.
 - b. Contractor to notify the City at least two working days in advance of installation of concrete pavement.
 - c. Take care when placing concrete to keep all foreign material out.
 - d. Remove any foreign material from concrete pavement without damaging the concrete.
 - e. Concrete may be poured by hand in situations where a slip-form paver cannot be used due to space restrictions.
 - f. Receive approval from the City prior to hand pouring concrete. Hand pouring should be minimized.
 - g. Do not allow pavement edge to deviate from the established paving line by more than 1/2 inches at any point.
 - h. Place the concrete as near as possible to its final location and minimize segregation and re-handling.
 - i. Distribute concrete using shovels where hand spreading is necessary. Do not use rakes or vibrators to distribute concrete.
 2. Removing Forms

- a. Cleaning
 - 1) Clean forms thoroughly after each use.
- b. Removal
 - 1) Forms to remain in place until the concrete is set and the removal will not cause damage to the concrete. Leave the forms in place for 12 hours after concrete has been poured unless approved by the City.
 - 2) If forms are removed before 72 hours after concrete placement, promptly apply membrane curing compound to the edge of the concrete pavement.
 - 3) Avoid damage to the edge of the pavement when removing forms.
 - 4) Repair damage resulting from form removal and honeycombed areas with a mortar mix within 24 hours after form removal unless otherwise approved.
 - 5) Remove and replace any damaged concrete that was not repaired within 24 hours at no cost to the City.
- 3. Reinforcing Steel and Joint Assemblies
 - a. General
 - 1) Place reinforcing steel, dowels, and tie bars in position specified in the Drawings.
 - 2) Provide reinforcing in accordance with the requirements of this Section.
 - 3) Secure reinforcing bars at alternate intersections with wire ties or locking support chairs.
 - 4) Tie all splices with wire.
 - 5) Install all bars in their required position as specified in the Drawings.
 - b. Splicing
 - 1) Provide standard reinforcement splices by lapping and tying ends.
 - 2) In accordance with ACI 318 for minimum lap of spliced bars where not specified in the Drawings.
 - c. Installing and Supporting Reinforcing Steel
 - 1) Layout reinforcing steel in accordance with Drawings. Support reinforcing steel using approved chairs or baskets.
 - 2) Do not allow construction personnel to walk on the reinforcement bars. Replace any chair that is broken prior to concrete placement.
 - 3) Steel pins may also be used to hold the reinforcement in place.
 - 4) If reinforcing steel is found to be at incorrect depth:
 - a) Prior to concrete being poured, Contractor to adjust steel to correct depth as specified in the Drawings.
 - b) If concrete has been poured, Contractor to remove and replace at no cost to the City.
- 4. Joints
 - a. General
 - 1) Place joints shown on the Drawings. If jointing layout is not provided on the Drawings, submit a jointing layout for review and approval to the City.
 - 2) Maintain a right angle with the surface of the pavement for all joints.
 - 3) Maintain an angle of greater than 75 degrees between all joints if 90 degrees is not achievable unless otherwise shown on the Drawings.
 - 4) If uncontrolled cracking occurs during sawing, the City may require the panel with the crack to be removed and replaced at no cost to the City.
 - 5) Use dowel baskets to support dowels and tie bars in the location shown on the Drawings. Do not manually or mechanically insert tie bars or dowels into wet or hardened concrete unless otherwise approved by the City.

- 6) Secure the dowel baskets into the subgrade or hot-mix asphalt base so that the baskets do not tip or move during concrete placement. Set up rebar and support baskets at least 12 hours prior to concrete placement for inspection.
- 7) Use the appropriate bar based on the Drawings and the requirements under Materials.
- 8) Clean and seal all joints before opening the pavement to traffic.
- 9) Joint Dimensions and Spacing
 - a) Match width and depth of the joint shown on the Drawings.
 - b) Dimensions of the sealant reservoir to match manufacturer's recommendations.
 - c) Ensure the joint depth after curing is 1/8 inch to 1/4 inch below the pavement surface at the center of the joint. If joint depth exceeds 1/4 inch, The City may request corrective action to be taken that may include remove and replace at no cost to the City.
 - d) Maintain a maximum 15 foot longitudinal joint spacing.
 - e) Ensure longitudinal joints follow the proposed lane lines where possible.
- b. Contraction Joints
 - 1) Transverse Contraction Joints
 - a) Only used in plain-jointed concrete pavement.
 - b) Maintain joint spacing as shown on the Drawings.
 - c) Do not install transverse contraction joints in continuously reinforced concrete pavement.
 - d) Use dowel bars that are coated with a thin film of grease or other approved debonding material to prevent concrete from bonding to the bar. See Materials.
 - e) Use the appropriate bar size, length, and spacing shown on the Drawings.
 - f) Maintain a sawcut depth of 1/3 of the slab thickness.
 - 2) Longitudinal Contraction Joints
 - a) Used in plain-jointed and continuously reinforced concrete.
 - b) Maintain joint spacing as specified in the Drawings.
 - c) Use single piece tie bars. See Materials.
 - d) Use the appropriate bar size, length, and spacing specified in the Drawings.
 - e) Maintain a sawcut depth of 1/3 of the slab thickness.
- c. Construction Joints
 - 1) General
 - a) Use reinforcing support chairs to hold reinforcing bars that extend through the bulkhead in place.
 - b) Splicing is not allowed within 10 feet of a transverse construction joint.
 - c) Use the appropriate bar size, length, and spacing specified in the Drawings.
 - 2) Transverse Construction Joints
 - a) A transverse construction joint shall be formed at the close of each day's work or when the placing of concrete has been stopped for 30-minutes or longer.
 - b) Provide a bulkhead (header) of sufficient cross-sectional area to prevent deflection and accurately notched to allow longitudinal rebar to continue through the bulkhead.
 - c) Provide bulkheads cut true to the section of the finished pavement and cleaned.
 - d) Plain-Jointed Concrete
 - (1) Select the construction joint location to be either at planned transverse contraction joint or halfway between two planned transverse contraction joints.
 - e) Continuously Reinforced Concrete

- (1) Additional steel may be required. See Drawings for additional information.
- (2) Ensure longitudinal steel is supported and protected to prevent damage, vibration, and impact.
- 3) Longitudinal Construction Joints
 - a) Use multiple piece tie bars where possible. See Materials.
 - b) Bent tie bars are not permitted.
 - c) Drill and epoxy single piece tie bars only for widening or maintenance projects where new concrete is being poured adjacent to existing concrete.
 - d) Inserting Tie Bars
 - (1) When approved, insert tie bars per this Section.
 - (2) Fresh Concrete Installation:
 - (a) Mechanically insert the tie bars using the paving machine when possible.
 - (b) If the tie bar is inserted manually, check the insertion depth and location to ensure proper placement and evaluate if there has been any surface drop down.
 - (c) If any surface drop down has occurred, repair concrete to the City's satisfaction.
 - (d) Take care to avoid moving the reinforcing mat or any other reinforcing in the concrete when inserting the tie bar.
 - (3) Hardened Concrete Installation:
 - (a) Mark tie bar location and drill holes into the hardened concrete at least 10-inches deep with a drill bit that is 1/8-inch greater in diameter than the tie bar diameter.
 - (b) Clean the hole with a wire brush and compressed air to remove all the dust and moisture.
 - (c) Follow the epoxy manufacturer's instruction to apply the epoxy. Fill the entire hole with Type 3, Class C epoxy before inserting the tie bars.
 - (d) When installing tie bars into hardened concrete, perform a pullout test.
 - (4) Pullout Test:
 - (a) Perform pullout tests on tie bars designated by the City.
 - (b) Install the tie bar in accordance with this Section and the Drawings.
 - (c) Perform a pullout test in accordance with ASTM E488 within the epoxy manufacturer's recommended curing time.
 - (d) Verify the tie bar meets a pullout strength of at least 3/4 of the yield strength of the tie bar.
 - (5) Corrective Measures
 - (a) Perform corrective measures to provide adequate pullout resistance if any of the tests do not meet the required minimum pullout strength.
 - (b) Repair any damage caused by testing at no cost to the City.
 - (c) Acceptable corrective measures include, but are not limited to, installation of additional or longer tie bars.
- d. Expansion Joints
 - 1) Install expansion joints perpendicularly to the surface at the locations shown on the Drawings, or as approved by the City.
 - 2) Use dowels for expansion joints with a thin film of grease or other approved de-bonding material with dowel caps on the lubricated end of each dowel bar.
 - 3) Use the appropriate bar size, length, and spacing shown on the Drawings.

- 4) When the proposed pavement is adjacent to or around existing structures, install expansion joints along the entire length of an existing structure.
- 5) Joint Filler
 - a) Provide joint fillers that conform to the requirements under Materials and Source Quality Control.
 - b) Provide timber boards that are accurately notched to allow rebar to continue through the expansion joint as needed.
 - c) Extend joint filler past or slightly below the bottom of concrete slab.
 - d) Use timber boards that span the length of the pavement width. Take care to ensure the timber board does not break, crack, or shift during concrete placement.
 - e) If the timber boards cracks, breaks, or shifts, remove and replace the adjacent pavement panels and reconstruct the pavement with a compliant timber board at no cost to the City.
- e. Curb Joints
 - 1) Provide joints in the curb of the same type and location as the adjacent pavement.
 - 2) Extend expansion joints through the curb.
 - 3) Extend sawed joints through the curb.
 - 4) Construct curb joints at all transverse pavement joints.
 - 5) For non-monolithic curbs, drill and epoxy tie bars as specified in the Drawings.
- f. Sawing Joints
 - 1) Joints to be sawed into concrete as soon as can be accomplished without damage to the pavement within 24 hours of concrete pavement placement as shown on Drawings.
 - 2) Saw joints to the depth and spacing shown on the Drawings.
 - 3) Use a chalk line, stringline, saw template, or other approved method to provide a true joint alignment.
- g. Joint Sealing
 - 1) See Section 32 13 73.
5. Concrete Placement
 - a. Traffic Volumes
 - 1) For roadways that will carry a minimum of 10,000 vehicles per day at ultimate build-out (per City's Master Mobility Plan), concrete shall be placed using a slip-form paving machine. Hand paving is only permitted in areas such as intersections or other areas where use of paving machine is not practical or as outlined in the City's Slip Form Paving Waiver Policy.
 - 2) For roadways that will carry less than 10,000 vehicles per day at ultimate build-out, concrete may be placed by hand pouring or using a slip-form paving machine.
 - b. General
 - 1) If hand-pouring does not produce the required consolidation and finishing results, take immediate action. The City may require corrective action that may include removal and replacement of concrete at no cost to the City.
 - a) Do not use rakes or vibrators to move concrete. Only use shovels or the augers on the spreader and paver to move the concrete.
 - 2) Do not allow the pavement edge to deviate from the established paving line by more than 1/2 inch at any point.
 - a) Consistency
 - 3) Provide concrete with following consistency qualities:
 - a) Mortar clings to coarse aggregate
 - b) Aggregate does not segregate in concrete when transported to the place of deposit

- c) Concrete should flatten out at the center of the pile with edges standing and not flowing when dropped directly from the discharge chute of the mixer.
 - d) Concrete and mortar show no free water when removed from the mixer
 - e) Concrete to slide and not flow into place when transported in metal chutes at an angle of 30 degrees with the horizontal
 - f) Surface of the finished concrete to be free from a surface film or laitance
- c. Honeycombing
 - 1) Prevent honeycombing by taking special care placing and spading the concrete against forms and joints.
 - 2) The City may reject concrete with excessive voids and honeycombing on the edge of the pavement. The City may request corrective action to be taken that may include removal and replacement at no cost to the City
- 6. Consolidation
 - a. Consolidate all concrete by approved mechanical vibrators in accordance with the requirements of this Section.
 - b. Ensure the vibrators don't dislodge or disturb the reinforcement.
 - c. Use hand-operated vibrators to consolidate concrete along forms, at all joints, and in areas not accessible to the machine-mounted vibrators.
 - d. Do not operate machine-mounted vibrators while the paving equipment is stationary.
- 7. Curb
 - a. Construct concrete curb in accordance with Section 32 16 00.
- 8. Spreading and Finishing
 - a. General
 - 1) Finish concrete using approved finishing equipment per this specification.
 - 2) If excessive surface slurry or bleeding occurs:
 - a) Do not finish concrete
 - b) Contact concrete supplier and review on-site conditions to verify too much water is not being added to the concrete mix by the Contractor or at the plant.
 - c) A fine mist of water may be used during dry conditions when approved by the City and only when under City supervision.
 - 3) Use minimal amount of water to maintain a moist surface.
 - 4) Reduce misting if float or straightedge finishing operations result in an excess amount of surface slurry.
 - 5) Do not apply water from a nozzle or a garden-type hose.
 - 6) Do not finish the concrete if there is free standing water on the surface of the concrete. Wait until the water evaporates before finishing.
 - 7) Hand finishing permitted only in intersections and areas inaccessible to a finishing machine.
 - b. Quality Checks
 - 1) Perform sufficient checks with a long-handled 10-foot or 15-foot straightedge on fresh concrete to ensure the final surface is within the tolerances specified in Ride Quality.
 - a) Verify there is not more than 1/16-inch variation between the straightedge and the surface of the pavement.
 - b) Rework and refinish any surface not within the tolerance limits.
 - 2) Edging
 - a) Tool all edges of slabs and all joints with an edger of the radius specified in the Drawings.

- b) All concrete work to be left smooth and true to lines.
9. Texturing
- a. Complete final texturing using approved texturing equipment in accordance with this Section.
10. Curing
- a. Surface Moisture
 - 1) Prevent surface drying of pavement before application of the curing compound by means that may include water fogging/misting, wind screens, and evaporation retardants. Obtain approval from the City before using any of these methods.
 - 2) If an evaporation retardant is approved, reapply as needed to maintain the concrete surface in a moist condition until the curing compound is applied.
 - 3) Do not use evaporation retardant as a finishing aid.
 - 4) If there is pavement failure due to poor surface moisture, City may require corrective action that could include removal and replacement at no cost to the City.
 - b. A curing day is defined as a 24-hour period when either the temperature taken in the shade away from artificial heat is above 50 degrees Fahrenheit for at least 19 hours or the surface temperature of the concrete is maintained above 40 degrees Fahrenheit for 24 hours.
 - c. Curing begins when the concrete curing compound or system has been applied.
 - d. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days.
 - e. Ensure curing compound does not disintegrate, peel, or crack.
 - f. The City may reject the curing compound based on visual and odor inspection.
 - g. Application
 - 1) Apply the curing compound in accordance with DMS-4650.
 - 2) Manage finishing and texturing operations to ensure placement of curing compound on a moist concrete surface relatively free of water.
 - 3) Maintain curing compounds in a uniformly agitated condition free of settlement before and during application.
 - 4) Do not thin or dilute the curing compound.
 - 5) Apply two coats of the curing compound.
 - 6) Apply to damp concrete as a fine mist through atomizing nozzles, at a rate of no more than 180 square feet per gallon, that covers entire surfaces thoroughly and completely with a uniform film.
 - 7) Coat sides of concrete slab after side forms are removed and earth is banked against them.
 - h. Alternative Curing Methods
 - 1) If an alternative curing method is preferred, submit a request to City with all product data needed at least 72 hours prior to a concrete pour.
 - 2) If the alternative method for curing does not produce desired results, cease concrete paving activities and implement another method of curing.
11. Protection of Pavement and Opening to Traffic
- a. Protection of Pavement
 - 1) Erect and maintain barricades and other standard and approved devices, excluding all vehicles and equipment from the newly placed pavement for the periods specified.
 - 2) Maintain an adequate supply of sheeting or other material to cover and protect fresh concrete surface from weather damage. Apply as needed to protect the pavement surface from weather.

- b. Opening to Traffic
 - 1) All traffic to be excluded from new concrete pavement for a minimum of 14 days.
 - 2) Early Opening to Traffic
 - a) If traffic needs to be open earlier than 14 days post pavement activities, use HES concrete.
 - b) Perform concrete cylinder breaks at 24 hours. If the compressive strength is 3,200 psi or higher, pavement may be opened to traffic after 72 hours.
 - 3) Emergency Opening to Traffic
 - a) Open the pavement to traffic under emergency conditions when directed in writing by the City and the pavement is at least 72 hours old.
 - b) Remove all obstructing materials, place stable material against the pavement edges, and perform other work involved in providing for the safety of traffic as required for emergency opening.
 - c. Clean and fill all joints prior to opening pavement to traffic.
12. Pavement Leave outs
- a. Provide pavement leave outs as necessary for local traffic at locations specified in the Drawings or as directed by the City.
 - b. Provide a suitable crossover connection for traffic movements based on a location that is determined in the field by the City.

C. Batching Equipment

- 1. Batching equipment shall be in accordance with the requirements of Section 41 14 00.

3.5. REPAIR

A. Repair concrete pavement in accordance with 32 01 29.

B. Repair the following items to remain at no cost to the City if any damage is caused due to concrete paving activities:

- 1. Adjacent concrete or asphalt pavement to remain
- 2. Adjacent sidewalk to remain
- 3. Adjacent curb or curb and gutter to remain
- 4. Subgrade or base material
- 5. Utility pipe
- 6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
- 7. Landscape beds or planters
- 8. Sod
- 9. Decorative hardscape or landscape features
- 10. Retaining walls

3.6. RE-INSTALLATION [NOT USED]

3.7. SITE QUALITY CONTROL

A. Verification Testing

- 1. General:
 - a. At the request of the City, the Contractor is to perform additional testing to verify compliance, or the City may perform verification testing utilizing a third-party testing laboratory.

- b. The City may request verification testing at any time if production is suspected to be non-conforming.
 - c. Verification testing will be performed in accordance with ASTM C42.
 - d. Verification testing will be performed by the Contractor at no cost to the City.
- 2. Concrete Mix Design and Verification
 - a. Perform required tests specified under Section 03 00 00 and provide testing and evaluation reports.
 - b. Any concrete installed using a non-conforming mix design will be subject to removal and replacement at no cost to the City.
- 3. Concrete Production Acceptance
 - a. During production and placement of concrete, perform testing to verify the concrete is in conformance with the requirements in Section 03 00 00 for the admixtures, mix design, slump, and compressive strength.
 - b. Aggregate Moisture Testing
 - 1) In accordance with Section 32 05 16.
- 4. Concrete Placement Acceptance
 - a. Perform required tests specified under Section 03 00 00 and provide testing and evaluation reports.
 - b. If concrete is suspected of having foreign material, City may reject at any time and the concrete may be removed and replaced at no cost to the City.
 - c. Acceptance will be based on attaining the strength and the fresh concrete tests in accordance with Section 03 00 00.

B. Class P and HES Pavement Thickness Test

- 1. Sampling
 - a. Perform strength testing for all projects containing more than 60 cubic yards of concrete.
 - b. Obtain pavement cores in accordance with Tex-424-A. Check the pavement thickness in accordance with Tex-423-A.
 - c. Collect pavement cores every 500 feet at the center of each concrete paving run. If lanes are paved separately, collect a pavement core at the center of each set of paved lanes.
 - d. For hand poured concrete collect pavement cores every 250 feet.
 - e. Fill core holes using an approved concrete mixture and method.
- 2. Acceptance
 - a. The Contractor will not be paid over the contract unit price for any pavement that is thicker than what is specified in the Drawings.
 - b. For pavement thickness deficiencies greater than 0.2 inches but less than 0.5-inches less than the thickness designated on the Drawings:
 - 1) Obtain additional cores every 150 feet at locations designated by the City.
 - 2) Additional cores may be requested by the City if the pavement is suspected to be deficient.
 - 3) Obtain cores until the variation between the thickness designated on the Drawings is less than 0.2-inches.
 - 4) For deficit concrete limit:
 - a) Remove limits of deficient concrete and replace at no cost to the City, or
 - b) Concrete to remain and City will pay the Contractor 50 percent of the unit price of concrete specified in the bid documents.
 - c. For pavement thickness deficiencies greater than 0.5 inches less than the thickness designated on the Drawings:

- 1) Remove and replace deficient concrete at no cost to the City.

C. Class P and HES Concrete Ride Quality

1. General
 - a. Provide a pavement to have a finished grade smooth and true to the established line, grade, and cross-section.
 - b. Ride quality will be measured parallel (longitudinal) and perpendicular (transverse) to the centerline of the roadway for pavement surfaces.
2. Profile Measurements
 - a. Use a 10-foot straightedge to perform ride quality tests or a high-speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute.
 - 1) If using an inertial profiler, provide equipment certification documentation, display a current decal on the equipment indicating the certification expiration date, and use a certified profiler operator from TxDOT's Material Producer List.
 - 2) Use an inertial profiler when requested by the City.
 - 3) Provide documentation of the profiles when requested by the City.
 - b. Perform tests daily throughout the duration of the project.
 - c. Perform tests on the finished surface of the completed project or at the completion of a major stage of construction as approved.
 - d. Perform testing during off-peak traffic flow. Operate the inertial profiler in a manner that does not disrupt traffic flow as directed.
 - e. When measuring the ride quality on a surface open to traffic, use a moving traffic control plan in accordance with Part 6 of the TMUTCD and the Drawings.
3. Acceptance Plan
 - a. General
 - 1) Evaluate longitudinal and transverse profiles to verify not more than 1/8-inch variation between any 2 contacts.
 - 2) Perform corrective action on surface areas that have more than 1/8-inch variation between any 2 contacts.
 - b. Localized Roughness
 - 1) Determine areas of localized roughness using the individual profile from each wheel path.
 - 2) Use a 10-foot straightedge to locate areas that have more than 1/8-inch variation between any 2 contacts on the straightedge.
 - 3) The City may waive localized roughness requirements for deficiencies resulting from manholes or other similar appurtenances near the wheel paths.
 - c. Corrective Action
 - 1) Use diamond grinding to correct variations in the pavement surface or localized roughness.
 - 2) Reprofile the corrected area and provide results indicating the corrective action was successful.
 - 3) After making corrections, reprofile the pavement section to verify corrections have produced the required improvements.
 - 4) If corrective action does not produce the required improvement, the City may require:
 - a) Continued corrective action, or
 - b) Removal and replacement of area at no cost to the City. The City may negotiate a reduced payment amount for the defective area to remain in place.

D.Non-Conforming Work

1. General
 - a. The City may at any time reject a material if it is found to be non-conforming to this specification.
 - b. The City may require the Contractor at any time to remove and replace installed Concrete Pavement if any material it was made with is found to be non-conforming. This would be at no cost to the City.
 - c. Any rejection of materials or source locations will be at no cost to the City.
2. Aggregates
 - a. Aggregates that fail to meet the requirements of Section 32 05 16 will be rejected by the City.
3. Concrete Mix Design and Production Materials
 - a. The City may reject the mix design if it does not conform to the requirements of this specification and section 03 00 00.
 - b. Any concrete installed using a non-conforming mix design will be subject to removal and replacement at no cost to the City.
 - c. The City may perform verification testing on all materials verify the conformance of the mixture.

3.8. SYSTEM STARTUP [NOT USED]

3.9. ADJUSTING [NOT USED]

3.10. CLEANING [NOT USED]

3.11. CLOSEOUT ACTIVITIES [NOT USED]

3.12. PROTECTION [NOT USED]

3.13. MAINTENANCE [NOT USED]

3.14. ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 13 16

DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material requirements and construction methods for Decorative Concrete Pavement
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 32 13 13 – Concrete Paving.
 - 3. Section 32 16 00 – Curbs, Gutters, Sidewalks, and Driveways.
 - 4. Section 32 84 00 – Irrigation Installation and Repair.
 - 5. Section 32 93 00 – Plantings.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Decorative Concrete
 - a. Measurement
 - 1) Measured per square yard of Decorative Concrete installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for Decorative Concrete Pavement installed for:
 - a) Various depths
 - c. The price bid shall include:
 - 1) Furnishing and installing Decorative Concrete as specified by the Drawings
 - 1) Shaping and fine grading the placement area
 - 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Disposal of excess materials
 - 8) Testing and trial batches
 - 9) Materials and work needed for any corrective action
 - 10) All costs associated with obtaining and submitting the required action and informational submittals.
 - 11) Concrete, aggregate, supplementary cementing materials, and additives
 - 12) Stamps and color
 - 13) Mixing, placing, and finishing

- 14) Curing and curing compounds
- 15) Reinforcing steel and chairs
- 16) All reinforcing and materials required for joints
- 17) Joint sealant
- 18) Removal and/or sweeping excess material
- 19) Tools, equipment, and labor and incidentals needed to execute work

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM):
 - a. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - b. C979, Standard Specification for Pigments for Integrally Colored Concrete.
 - c. C1315 Type 1, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Construction Meeting

1. Prior to installing decorative concrete (hardscape) and landscape, conduct a meeting. Invite the City and their appropriate representatives. Prior to the meeting, the following need to be prepared or approved:
 - a. Product Data and Concrete Mix Design in accordance with this Section
 - b. Mock sample in accordance with this Section
 - c. Paving Plan
 - 1) Jointing locations
 - 2) Paving Schedule

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawing

1. Concrete Mix Design
 - a. In accordance with Section 03 00 00
2. Product Data
 - a. Provide electronic product data from each manufacturer supplying stamps, color, antiquing releases, and curing compounds. Provide the following data for all product data sheets:
 - 1) Manufacturer name
 - 2) Date
 - 3) Material description
 - b. Data and test results as specified in this Section

- 1) Material Safety Data Sheets (if applicable, required for Epoxy and Curing Compounds)
 - 2) Stamp pattern and size
 - 3) Integral color shade name and number
 - 4) Dosage recommendations
 - 5) Manufacturer recommended storing data (if applicable)
 - 6) Application recommendations (if applicable)
 - 7) Manufacturer's recommended storage and handling instructions
 - 8) Manufacturer's curing and sealing recommendations.
3. Integral Color Concrete Mix Design
 - a. Provide concrete mix design that in accordance with the requirements of Section 03 00 00.

B. Samples

1. Provide 3-foot by 3-foot square mock-up 4-inches thick of the integral stamped and stained concrete of selected color and stamp pattern with specified releasing agents at the site for review by City.
 - a. If the sample is not satisfactory, City may request up to 3 additional samples to be prepared.
 - b. Leave sample on-site until decorative concrete has been completed.
 - c. Remove sample within 72 hours after decorative concrete activities have been completed.

C. Information Submittals:

1. Source Locations
 - a. Location of all material sources
2. Testing and Evaluation Reports
 - a. Provide test results required in accordance with this Section and any other related Sections.
3. Equipment Submittals
 - a. Submittal for all major equipment to include:
 - 1) Equipment name
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS

A. Test and Evaluation Reports

1. All test reports generated during testing.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS

- A. Refer to Section 32 13 13 for field condition requirements.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Concrete Production and Placement Materials

1. Refer to the following Sections based on uses:
 - a. Roadway Paving and Crosswalks - Section 32 13 13
 - b. Sidewalks or Driveways – Section 32 16 00
 - c. General Concrete and Concrete Reinforcing – Section 03 00 00

B. Integral Color

1. Provide integrally colored concrete. Do not use surface stains or dyes to color the concrete unless otherwise approved by the City or specified in the Drawings.
2. Use non-fading synthetic iron oxide pigments with resistance to ultraviolet radiation.
3. Provide pigments for colored concrete in accordance with ASTM C979.
4. Add integral concrete colorant according to manufacturer's instructions. Provide a copy of manufacturer instructions to City in accordance with this Section.
5. Provide in accordance with Standard Product List or approved equal.
 - a. Provide the following approved colors in the designated locations unless otherwise specified in the Drawings or by the City:
 - 1) Median Areas:
 - a) SCOFIELD Integral Color SG: Red Brick or approved equal
 - b) SCOFIELD LITHOTEX Antiquing Release Pro: A-24, Russet
 - 2) Other locations:
 - a) Integral color and antiquing release in accordance with the Drawings

C. Curing Compound

1. Provide in accordance with Standard Product List or approved equal.
 - a. Any approved equal needs to be clear with a low-gloss finish that complies with ASTM C309 and ASTM C1315 Type 1 requirements for liquid membrane forming compounds.
 - b. Provide product data in accordance with this Section.
2. No other curing methods will be allowed.

D. Admixtures

1. Furnish admixtures designed for use with and compatible with colored concrete pigments.
2. Do not use calcium chloride or other admixtures containing chlorides.

E. Decorative Concrete Mix Design

1. Concrete Classes
 - a. Provide concrete in accordance with the requirements of Section 03 00 00 for the designated concrete class specified in the Drawings.
 - b. If no class is specified, provide decorative concrete based on the following uses:
 - 1) Roadway Paving and Crosswalks - Class P or HES, or as specified in the Drawings.
 - 2) Sidewalks or Driveways – Use Class A or the concrete specified in the Drawings.
 - c. Mix Design Options: No variations or substitutions will be approved for cementitious material, slump, additives, or mix design options. Conform to all requirements in Section 03 00 00 unless otherwise specified in this Section or in the Drawings.
2. Decorative Concrete Mix Design
 - a. Provide the amount of color to be added to the concrete during production with the concrete mix design. Provide a concrete mix design that conforms to the requirements of Section 03 00 00.
 - b. Obtain City approval for colored concrete mixes before placing decorative concrete.
 - c. Maintain mix characteristics for colored concrete requiring a matching finish.
 - d. Use the same source, brand, type, and color of Portland cement, supplementary cementitious materials, aggregates, and admixtures for colored concrete throughout the project.
 - e. Use constant cement content, supplementary cementitious material content, and water/cementitious materials ratio to maintain consistent color.
3. Trail Batches
 - a. The contractor may use preliminary laboratory or field trial batching to establish the mix proportions necessary to conform to the contract-required color.
 - b. Provide samples in accordance with Action Submittals and discuss during the Pre-Hardscape and Landscape Meeting
 - 1) Produce samples using the same workers and materials designated to perform the contract work.
 - c. Produce at least 2 cubic yards of the colored concrete to make the sample.
 - d. Submit the final mix design including color after the City has approved the decorative concrete sample.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. In accordance with preparation requirements in Section 32 13 13.

3.4 DECORATIVE CONCRETE PLACEMENT

A. Imprinting Tools

1. Stamped Concrete
 - a. Use SCOFIELD stamp tools or approved equal to install the stamp pattern designated on the Drawings or by the City.
 - b. Any approved equal tool needs to provide the texture, stamp, and finish that is specified in the Drawings. If the required affect is not produced by the tools provided, as determined by City, stop work immediately, identify the problem, and supply different tools capable of producing the texture, stamp, and finish specified.
 - c. Provide the following approved patterns in the designated locations:
 - 1) Median Areas:
 - a) Pattern: New Brick – Running Bond (SCOFIELD LITHOTEX Pavecrafters)
2. If specified texture is baker's broom or tining, provide tools and equipment
 - a. in accordance with requirements for P and HES concrete in Section 32 13 13 for any decorative concrete that will be used by vehicular traffic.
 - b. in accordance with requirements for sidewalks and driveways in Section 32 16 00 for any decorative concrete that will be used in medians, sidewalks, or driveways.

B. Concrete Placement

1. In accordance with the requirements for P and HES concrete in Section 32 13 13 for any decorative concrete used by vehicular traffic.
2. In accordance with the requirements for sidewalks and driveways in Section 32 16 00 for any decorative concrete used in medians, sidewalks, or driveways.
3. The following additions to Section 32 13 13 apply:
 - a. Schedule placement to minimize exposure to rapid drying conditions, wind, and full sun, before applying curing compound.
 - b. Do not place colored concrete if rain, snow, or freezing temperatures are forecast within 24-hours.
 - c. Cover or otherwise protect adjacent concrete work from discoloration and spillage while placing and curing colored concrete.
 - d. Remove and replace discolored concrete as directed by the City.

C. Spreading and Finishing

1. In accordance with the requirements for P and HES concrete in Section 32 13 13 for any decorative concrete that will be used by vehicular traffic.
2. In accordance with the requirements for sidewalks and driveways in Section 32 16 00 for any decorative concrete that will be used in medians, sidewalks, or driveways.
3. The following additions to Section 32 13 13 apply:
 - a. Perform finishing operations consistently to avoid color variation.
 - b. Do not begin finishing while bleed water is present.
 - c. City will order removal and replacement of colored concrete if the contractor adds water to the surface to aid in finishing.
 - d. Apply strokes in the same direction during final finishing and texturing.

D. Texturing

1. Reference Drawings for location of texturing and stamping used for decorative concrete.

2. If the decorative concrete requires a baker's broom or tining:
 - a. In accordance with the requirements for P and HES concrete in Section 32 13 13 for any decorative concrete that will be used by vehicular traffic.
 - b. In accordance with the requirements for sidewalks and driveways in Section 32 16 00 for any decorative concrete that will be used in medians, sidewalks, or driveways.
3. If the decorative concrete requires a stamp pattern:
 - a. Apply the stamp pattern using approved tools that produce the texture, stamp, and finish specified in the Drawings.
 - b. If the required affect is not produced by the tools provided, stop work immediately, identify the problem, and supply different tools capable of producing the texture, stamp, and finish specified.
 - c. Use the manufacturer's recommendation for:
 - 1) Using release agents
 - a) Approved release agents include:
 - (1) Designated antiquing release: Follow the manufacturer's instructions when using an antiquing release and stamping.
 - (2) LITHOTEX Liquid Release
 - (3) SCOFIELD Liquid Release SG
 - (4) Or approved equal
 - 2) Antiquing agents
 - 3) Aligning, placing, and removing the tools
 - 4) Any other manufacturer requirements or recommendations not listed.

E. Curing

1. Apply approved curing compound in accordance with manufacturer's recommendations.
2. Protect colored concrete from premature drying and excessive cold or hot temperatures by promptly applying curing compound.
 - a. Do not allow plastic sheeting to come in contact with colored concrete.

F. Protection of Pavement and Opening to Traffic

1. In accordance with the requirements in Section 32 13 13.
2. Follow manufacturer's recommendations for allowing traffic onto decorative concrete.
3. If traffic is allowed onto decorative concrete prior to sealing, patch and touch-up any chips in the decorative concrete.
4. Where possible, finish placing, stamping, and sealing large sections of decorative concrete before opening to traffic.

3.5 REPAIR

- A. In accordance with Section 32 01 29.
- B. Repair the following items to remain at no cost to the City if any damage is caused due to decorative concrete paving activities:
 1. Adjacent concrete or asphalt pavement
 2. Adjacent sidewalk
 3. Adjacent curb or curb and gutter
 4. Subgrade or base material
 5. Utility pipe

6. Irrigation systems including but not limited to sprinkler heads, conduit, and pipe.
7. Landscape beds or planters
8. Sod
9. Decorative hardscape or landscape features
10. Retaining walls

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Tests and Inspections

1. Perform all testing in accordance with Sections 01 45 23, 03 00 00, and 32 13 13.

B. Non-Conforming Work

1. Decorative Concrete Production Acceptance
 - a. Produce consistently colored concrete.
 - b. Any concrete that has visible variations in color, texture, or stamp pattern will be subject to removal and replacement at no cost to the City

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealants for Concrete Joints.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Joint sealant materials, equipment, tools, and incidentals will not be measured or paid for directly. All items included with the testing and furnishing of joint sealants are subsidiary to other pertinent items.

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM):
 - a. ASTM D5249 – Standard Specification for Backer Material for Use with Cold and Hot Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
3. TxDOT Standards:
 - a. DMS-6310 – Joint Sealants and Seals.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.5 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Provide electronic product data from each manufacturer that is supplying concrete joint sealants to be used on the project.
2. Product data sheets will include:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Point of delivery
 - e. Produce data and test results in accordance with this Section
 - f. Material Safety Data Sheets, if applicable, required for PCE and all additives
 - g. Manufacturer Recommended Storing Data, if applicable

- h. Application Recommendations, if applicable
- i. Liquid Antistripping Agent Specific Data:
 - 1) Specific gravity of the agent at the manufacturer's recommended addition temperature
 - 2) Manufacturer's recommended dosage range
 - 3) Manufacturer's Recommended Storage and Handling instructions

1.6 CLOSEOUT SUBMITTALS [NOT USED]

1.7 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.8 QUALITY ASSURANCE [NOT USED]

1.9 DELIVERY, STORAGE, AND HANDLING

A.Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

B. Keep the material stored in a clean condition at all times to prevent contamination with foreign matter.

C. Follow any manufacturer recommendations for delivery, storage, and handling.

1.10 FIELD CONDITIONS

A.Ambient Conditions

1. In accordance with manufacturer's recommendations.

1.11 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A.Joint Sealant

1. Provide joint sealants in accordance with DMS-6310 types 4, 5, 7, or 8 unless otherwise specified in the Drawings or as directed by the City.

B.Backer Rod

1. Provide in accordance with Standard Product List or approved equal.
2. The Contractor may request to use an alternative backer rod product in writing. If requesting an alternative material, the alternative backer rod must comply with the following:
 - a. The backer rod must not react with or bond to the sealant and must meet the requirements of the sealant manufacturer.
 - b. Provide a backer rod with a diameter of at least 25 percent larger than the joint reservoir width.

- c. Backer rod materials must include closed-cell resilient foam; sponge rubber stock of vinyl, butyl, or neoprene; and polyethylene or polyurethane. Backer rods must also be flexible, lightweight, non-staining, heat-resistant, chemical-resistant, ultraviolet-stable, non-absorbent, low density, and compressible foam.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Condition of Equipment

1. Provide equipment in good repair and operating condition.
2. The condition is subject to the approval of the City.
3. If the equipment is found to be insufficient, the Contractor is responsible for replacing the non-conforming equipment with conforming equipment at no cost to the City.
4. Any sealant installed using non-conforming equipment is subject to removal and replacement at no cost to the City.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Make a groove along the cracks to be sealed and rout the groove approximately 1/2-inch-deep and 5/8-inch-wide, unless otherwise specified in the Drawings or directed by the City.
- B. Remove all foreign material from the joint or groove reservoir.
- C. Clean the joint by sandblasting or other approved methods. If directed, saw joint sides to remove embedded foreign material in the concrete not removed by sandblasting.
- D. Do not place sealant in a wet or damp joint or groove. Use approved drying method if joints or grooves are sealed within 24 hours of rain.
- E. Apply primer when required by the sealant manufacturer. Blow out joint or groove with high pressure air or other approved methods before placing sealant.

3.4 INSTALLATION

- A. After the joint is prepped, install sealant material. See Table 1 for different types of joints and sealants to be used.
- B. Install joint sealant per manufacturer's recommendations. If backer rods are required, install backer rods and sealant in accordance with the manufacturer's recommendations and this Section.
- C. Backer Rods:
 1. Install backer rod with a single-wheeled or three-wheeled roller, depending on application.
 2. Avoid stretching or puncturing the material.
 3. Hold the backer rod in compression.

4. Provide a backer rod with a diameter 1/8 inch larger than the width of the joint for joint widths up to 3/4 inch. For joints 3/4 inch and larger, add 1/4 inch to diameter rod selection.
 5. After backer rods are installed, apply sealants as necessary.
- D. Remove and replace sealant when placed flush with or above the pavement surface.

Table 1
Types of Joints Requirements

Joint Type	Requirement
Transverse Contraction Joints	Backer Rods and Sealant
Longitudinal Contraction Joint	Sealant
Longitudinal Construction Joints	Sealant
Expansion Joints	Backer Rods and Sealant

E. Disposal of Materials:

1. Dispose of any excess material produced from cleaning of cracks.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 16 00
CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Curbs
 - 2. Gutters
 - 3. Sidewalks
 - 4. Curb Ramps
 - 5. Driveways
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 - Concrete and Concrete Reinforcing.
 - 2. Section 32 12 16 – Asphalt Paving.
 - 3. Section 32 13 13 – Concrete Paving.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Concrete Curb
 - a. Measurement
 - 1) Measured per linear foot of Concrete Curb installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Concrete Curb” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Curb as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials

- 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
2. Concrete Curb and Gutter
- a. Measurement
 - 1) Measured per linear foot of Concrete Curb and Gutter installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Concrete Curb and Gutter” installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Curb and Gutter as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
3. Concrete Ribbon Curb
- a. Measurement
 - 1) Measured per linear foot of Concrete Ribbon Curb installed.
 - b. Payment

- 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Concrete Ribbon Curb” installed.
- c. The price bid shall include:
 - 1) Furnishing and installing Concrete Ribbon Curb as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
4. Concrete Sidewalk
 - a. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard or square foot as indicated in bid proposal, for “Concrete Sidewalk” installed for:
 - a) Various depths.
 - b. The price bid shall include:
 - 1) Furnishing and installing Concrete Sidewalk as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate

- 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
5. Concrete Sidewalk with Curb
- a. Measurement
 - 1) Measured per square yard or square foot as indicated in bid proposal, of Concrete Sidewalk with Curb installed to the back of curb.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard or square foot, as indicated in bid proposal, for “Concrete Sidewalk with Curb” installed for:
 - a) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Sidewalk with Curb as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
6. Concrete Sidewalk with Retaining Wall

- a. Measurement
 - 1) Measured per square yard or square foot, as indicated in bid proposal, of Concrete Sidewalk installed to the face of Retaining Wall.
 - 2) Retaining Wall portion will be measured and paid for under Section 32 32 00.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard or square foot, as indicated in bid proposal, for “Concrete Sidewalk” installed for:
 - a) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Concrete Sidewalk with Retaining Wall as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
7. Curb Ramp
- a. Measurement
 - 1) Measured by Each of Curb Ramp installed.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for “Curb Ramp” installed for:
 - a) Type specified.
 - c. The price bid shall include:
 - 1) Furnishing and installing Curb Ramp as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading

- 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
 - 25) Landing and detectable warning surface as shown on the Drawings
 - 26) Adjacent flares or side curb
8. Driveway Approach
- a. Measurement
 - 1) Measured per square yard of Driveway Approach installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per square yard for "Driveway Approach" installed for:
 - a) Various types.
 - b) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Driveway Approach as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete

- 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up
9. Driveway
- a. Measurement
 - 1) Measured per square yard of Driveway installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard for “Driveway” installed for:
 - a) Various types.
 - b) Various depths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Driveway as specified by the Drawings
 - 2) Shaping and fine grading the placement area
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Trial batches (as needed)
 - 11) Materials and work needed for any corrective action
 - 12) Concrete
 - 13) Aggregate
 - 14) Supplementary cementing materials
 - 15) Concrete additives
 - 16) Mixing
 - 17) Placement of concrete
 - 18) Finishing of concrete
 - 19) Curing and curing compounds
 - 20) Sawing
 - 21) Joint sealant
 - 22) Reinforcing steel and reinforcement chairs
 - 23) Disposal of excess material
 - 24) Clean-up

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. TAS – Texas Accessibility Standards
 - 2. TDLR – Texas Department of Licensing and Regulation
- B. Definitions

1. Curb: concrete edging or barrier measuring 18” or less in maximum height.
- C. Reference Standards
 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 2. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Construction Meeting
 - a. Hold a pre-construction meeting in accordance with Sections 32 12 16 and 32 13 13.
- B. Sequencing
 1. Sidewalk Construction
 - a. Where existing sidewalks are to be closed during Curb, Gutter, Sidewalk, and Driveway activities:
 - 1) Utilize pedestrian/sidewalk detour route specified in the Drawings
 - a) If no detour route is provided, submit a pedestrian/sidewalk detour route to City for review.
 - 2) The pedestrian/sidewalk detour route will be subsidiary to pertinent Traffic Control items included with the project.
 - b. Install all sidewalk detours and closures in accordance with the TMUTCD, State, and local guidelines.
 - c. Provide any traffic control devices as required by the City.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Concrete Mix Design in accordance with Section 03 00 00.
- B. Asphalt Mix Design in accordance with Section 32 12 16.
- C. Product Data
 1. Provide the following from each manufacturer supplying the following in accordance with Sections 03 00 00 and 32 12 16:
 - a. Curing compounds
 - b. Evaporation retardant
 - c. Joint fillers
 - d. Chemical additives
 - e. Epoxy
 - f. Fiber reinforcing
- D. Equipment Submittals
 1. Submit an equipment list of all major equipment in accordance with Sections 32 12 16 and 32 13 13.
- E. Test and Evaluation Reports

1. Provide testing and evaluation reports in accordance with Sections 01 45 23, 03 00 00, 32 12 16, and 32 13 13.

1.7 CLOSEOUT SUBMITTALS

- A. Test and Evaluation Reports
 1. All test reports generated during testing.
- B. TDLR Inspection
 1. Submit TDLR Proof of Inspection. Remove and replace any portions found to be failing in accordance with Article 3.7.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. Follow all delivery, storage, and handling requirements for asphalt and concrete in Sections 03 00 00, 32 12 16, and 32 13 13.

1.11 FIELD CONDITIONS

- A. Follow all field condition requirements for asphalt and concrete in accordance with Sections 03 00 00, 32 12 16, and 32 13 13.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Refer to City standard details and Section 31 23 16 and 31 24 00 for requirements for excavation and backfill.
- B. Concrete
 1. Provide Class A in accordance with Section 03 00 00.
 2. Production Materials
 - a. Provide cementitious materials, admixtures, water, forms, joint filler, joint sealant, and reinforcing chairs in accordance with Section 32 13 13.
 3. Aggregate:
 - a. Provide aggregate in accordance with Section 03 00 00 and 32 05 16.
 - b. Use coarse aggregate that is no larger than 1-1/2 inch.
 4. Reinforcement:
 - a. Curb

- 1) When constructing Concrete Curb, Concrete Curb and Gutter, Concrete Valley Gutter, or Concrete Ribbon Curb use fiber reinforcing in accordance with Section 03 00 00.
 - 2) When constructing Concrete Curb (Monolithic) use reinforcing steel in accordance with Section 03 00 00.
 - b. Sidewalk and Curb Ramps
 - 1) When constructing sidewalk less than 6" in thickness use steel reinforcement in accordance with Section 03 00 00.
 - 2) When constructing sidewalk 6" in thickness or greater use steel reinforcement in accordance with Section 03 00 00.
 - c. Driveway and Driveway Approaches
 - 1) Provide reinforcing steel in accordance with Section 03 00 00.
- C. Asphalt
1. Refer to Section 32 12 16 for material requirements.
 2. Use Type D for Asphalt Driveway surface courses.
 3. Use Type B for Asphalt Driveway intermediate and/or base courses.
- D. Curb Ramps
1. Provide detectable warning surface in accordance with TAS.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

- A. Follow all source quality control requirements for asphalt and concrete in Sections 03 00 00, 32 12 16, and 32 13 13.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Surface Preparation
1. Excavate and remove materials as required for the construction of curbs, gutters, sidewalks, and driveways in accordance with Sections 02 41 15, 31 10 00, and 31 23 16.
 2. Shape and compact subgrade or foundation surface to the line, grade, and cross-section specified in the Drawings.
 3. If required, treat subgrade in accordance with Sections 32 11 29 and 32 11 33.
 4. Lightly sprinkle subgrade or foundation surface immediately before final concrete or asphalt placement.

3.4 INSTALLATION

- A. General
1. Provide finished work with a well-compacted mass and a surface free from voids meeting the required shape, line, and grade as specified in the Drawings.

2. Place concrete and asphalt in accordance with Sections 32 12 16 and 32 13 13.
3. All pedestrian facilities shall comply with provisions of TAS including location, slope, width, shapes, texture and coloring. Pedestrian facilities installed by the Contractor and not meeting TAS must be removed and replaced to meet TAS at no cost to the City.

B. Equipment

1. Use equipment in accordance with Section 32 12 16 and 32 13 13.
2. Smart level:
 - a. Use approved Smart Level to verify all sidewalk, curb ramp, and driveway grades.
 - b. Calibrate Smart Level with City inspector prior to performing tests.

C. Curbs

1. Integral
 - a. Place integral curb while the pavement is still plastic.
 - b. Spade and consolidate concrete material with pavement in order to obtain a thorough bond.
2. Formed
 - a. Extend forms to full depth of concrete.
 - b. Pour concrete into forms and strike off with a template 1/4 to 3/8 in. less than the dimensions of the finished curb.
 - c. When removing forms, take caution to prevent marring or spalling of concrete.
 - d. After initial set, plaster surface with mortar consisting of 1 part hydraulic cement and 2 parts fine aggregate.
 - e. Brush exposed surfaces to a uniform texture.
3. Slip-formed
 - a. Hand-tamp and sprinkle subgrade material before concrete placement.
 - b. Provide clean surfaces for concrete placement.
 - c. Place the concrete with approved self-propelled equipment.
 - 1) The forming tube of the extrusion machine or the form of the slip form machine must easily be adjustable vertically during the forward motion of the machine to provide variable heights required to maintain established grade line.
 - d. Attach a pointer or gauge to the machine so a continual comparison can be made between the extruded or slip form work and grade guideline.
 - e. Brush finish surfaces immediately after extrusion or slip forming.
4. Joints
 - a. Place expansion joints in the curb and gutter at 200-foot intervals and at intersection returns and other rigid structures.
 - b. Place tooled joints at 15-foot intervals or matching abutting sidewalk joints and pavement joints to a depth of 1-1/2 inches.
 - c. Place expansion joints at all intersections with concrete driveways, curbs, buildings, and other curb and gutters.
 - d. Make expansion joints no less than 1/2 inch in thickness, extending the full depth of the concrete.
 - e. Make expansion joints perpendicular and at right angles to the face of the curb.
 - f. Neatly trim any expansion material extending above the finished work down to finished grade.
 - g. Make expansion joints in the curb and gutter coincide with concrete expansion joints.
 - h. Longitudinal dowels across the expansion joints in the curb and gutter are required.

- i. Install 3 No. 4 round, smooth bars, 24 inches in length, for dowels at each expansion joint.
- j. Coat 1/2 of the dowel with a bond breaker and terminate with dowel cap.
 - 1) Dowel cap required to provide a minimum of 1 inch free expansion.
- k. Support dowels by an approved method.

D. Sidewalk

- 1. Sidewalks constructed in driveway approach sections shall have a minimum thickness equal to that of driveway approach or as specified in the Drawings.
- 2. Terminate workday production at an expansion joint.
- 3. Formed
 - a. Provide pre-molded or board expansion joints of the thickness specified in the Drawings for sidewalk section lengths greater than 8 feet but less than 40 feet.
- 4. Slip-formed
 - a. Provide any additional surface finishing immediately after extrusion of slip-forming.
 - b. Construct joints at locations as specified in the Drawings.
- 5. Joints
 - a. Place expansion joints at 40 foot intervals.
 - b. Place expansion joints at sidewalks with concrete driveways, intersections with other sidewalks, and at other adjacent old concrete work.
 - c. All expansion joints shall be 1/2 inch in thickness.
 - d. Edges of all construction and expansion joints and outer edges of all sidewalks shall be finished to approximately a 1/2 inch radius with a suitable finishing tool.
 - e. Sidewalks shall be marked at intervals equal to the width of the walk with a marking tool.
 - f. When sidewalk is against the curb, expansion joints shall match those in the curb.

E. Curb Ramps

- 1. Install detectable warning surface according to manufacturer's instructions.

F. Driveways

- 1. Provide concrete driveways and driveway approaches unless specified otherwise.
- 2. Provide uninterrupted access to adjacent property unless otherwise directed.
- 3. When curb is required, construct monolithically with the driveway pavement.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Concrete Placement Acceptance

- 1. Follow all acceptance requirements in accordance with Sections 03 00 00 and 32 13 13.

B. Asphalt Placement Acceptance

- 1. Follow all acceptance requirements in accordance with Sections 03 00 00 and 32 12 16.

C. Non-conforming work

- 1. Any work found to be non-conforming to the Contract Documents will be removed and replaced at Contractor's expense.

2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pavement Markings:
 - a. Thermoplastic, hot-applied, spray (HAS) pavement markings
 - b. Thermoplastic, hot-applied, extruded (HAE) pavement markings
 - c. Preformed retroreflective polymer pavement markings tape
 - d. Reflectorized multipolymer, spray pavement markings
 - e. Preformed heat-activated thermoplastic tape
 - f. Pavement markings, paint
2. Pavement Marking Legends.
3. Raised Pavement Markers.
4. Work Zone Markings.
5. Removal of Pavement Markings and Markers.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Pavement Markings
 - a. Measurement
 - 1) Measured per linear foot of pavement markings installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of pavement markings installed for:
 - a) Various Widths.
 - b) Various Types.
 - c) Various Materials.
 - d) Various Colors.
 - c. The price bid shall include:
 - 1) Furnishing and installing pavement markings as specified by the Drawings
 - 2) Glass beads, if required
 - 3) Surface preparation
 - 4) Clean-up
 - 5) Testing, if required
2. Pavement Marking Legends
 - a. Measurement
 - 1) Measured per each pavement marking legend installed.
 - b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each pavement marking legend installed for:
 - a) Various Types.
 - b) Various Materials.
 - c) Various Applications.
- c. The price bid shall include:
 - 1) Furnishing and installing pavement marking legend as specified by the Drawings
 - 2) Glass beads, if required
 - 3) Surface preparation
 - 4) Clean-up
 - 5) Testing, if required)
3. Raised Pavement Markers
 - a. Measurement
 - 1) Measured per each raised pavement marker installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each raised pavement marker installed for:
 - a) Various Types.
 - c. The price bid shall include:
 - 1) Furnishing and installing raised pavement markers as specified by the Drawings
 - 2) Surface preparation
 - 3) Clean-up
 - 4) Testing, if required
4. Work Zone Tab Markers
 - a. Measurement
 - 1) Measured per each tab marker installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each tab marker installed.
 - c. The price bid shall include:
 - 1) Furnishing and installing tab markers as specified by the Drawings
 - 2) Surface preparation
 - 3) Clean-up
5. Pavement Marking Removal
 - a. Measurement
 - 1) Measured per linear foot of pavement markings removed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of pavement markings removed for:
 - a) Various Widths.
 - b) Various Types.
 - c) Various Materials.
 - d) Various Colors.
 - c. The price bid shall include:

- 1) Removing pavement markings as specified by the Drawings
 - 2) Hauling
 - 3) Disposal of excess materials
 - 4) Clean-up
6. Pavement Marking Legend Removal
 - a. Measurement
 - 1) Measured per each pavement marking legend removed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each pavement marking legend removed for:
 - a) Various Types.
 - c. The price bid shall include:
 - 1) Removing pavement marking legend as specified by the Drawings
 - 2) Hauling
 - 3) Disposal of excess materials
 - 4) Clean-up
7. Raised Pavement Markers Removal
 - a. Measurement
 - 1) Measured per each raised pavement marker removed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each raised pavement markers removed for:
 - a) Various Widths.
 - b) Various Types.
 - c) Various Materials.
 - d) Various Colors.
 - c. The price bid shall include:
 - 1) Removing and disposing raised pavement markers as specified by the Drawings
 - 2) Hauling
 - 3) Disposal of excess materials
 - 4) Clean-up
8. Pavement Marking, Legend, and Raised Pavement Markers Removal for Utility Trenching
 - a. Measurement
 - 1) This item is considered subsidiary to the installation of water, wastewater, or stormwater piping.
 - b. Payment
 - 1) The work performed and materials in accordance with this item are subsidiary to the unit price bid per linear foot of water, wastewater, or stormwater piping installed.
9. Pavement Marking, Legend, and Raised Pavement Markers Replacement for Utility Trenching
 - a. Measurement
 - 1) Measurement for this item shall be by lump sum.
 - b. Payment

- 1) The work performed and materials in accordance with this item shall be paid for at the lump sum price bid for “Pavement Marking, Legend, and Raised Pavement Markers Replacement for Utility Trenching”.
- c. The price bid shall include:
 - 1) Furnishing and installing pavement markings, legends, and raised pavement markers to match pre-construction conditions
 - 2) Hauling
 - 3) Disposal of excess materials
 - 4) Clean-up

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. Texas Manual on Uniform Traffic Control Devices (TMUTCD), 2011 Edition:
 - a. Part 3, Markings.
3. Federal Highway Administration (FHWA):
 - a. 23 CFR Part 655, FHWA Docket No. FHWA-2009-0139.
4. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. 4200, Pavement Markers (Reflectorized).
 - b. 4300, Traffic Buttons.
 - c. 8200, Traffic Paint.
 - d. 8220, Hot Applied Thermoplastic.
 - e. 8240, Permanent Prefabricated Pavement Markings.
 - f. 8241, Removable Prefabricated Pavement Markings.
 - g. 8242, Temporary Flexible-Reflective Road Marker Tabs.
 - h. 8290, Glass Traffic Beads.
5. Texas Department of Transportation (TxDOT) Pavement Marking Handbook:
 - a. Special Specification 1513 – Reflectorized Multipolymer Pavement Markings- Houston District.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and /or fabrication for special.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Pavement Markings
 - a. Preformed Retroreflective Polymer Pavement Markings Tape
 - 1) Provide in accordance with Standard Product List or approved equal.
2. Substitution requests for manufacturers or models not indicated above shall be processed in accordance with Section 01 25 00.

B. Materials

1. Pavement Markings
 - a. Thermoplastic, hot applied, spray
 - 1) Width of longitudinal lines as specified in Drawings.
 - 2) Supply products especially compounded for traffic markings.
 - 3) When placed on driving surfaces, markings shall not be slippery when wet, lift from pavement under normal weather conditions, nor exhibit a tacky exposed surface.
 - 4) Cold ductility of the material shall permit normal road surface expansion and contraction without chipping or cracking.
 - 5) Retain original color, dimensions, and placement under normal traffic conditions at road surface temperatures of 158 degrees Fahrenheit and below.
 - 6) Uniform cross-section, clean edges, square ends, and no evidence of tracking.
 - 7) Density, quality, and thickness of the material shall be uniform throughout the length and width of the markings.
 - 8) 95 percent free of holes and voids, and free of blisters for a minimum of 60 days after application.
 - 9) Material shall not deteriorate by contact with sodium chloride, calcium chloride or other chemicals used to prevent roadway ice, because of the oil content of pavement markings, from oil droppings, or other effects of traffic.
 - 10) Material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing material.
 - a) New material shall bond itself to the old marking in such a manner that no splitting or separation takes place.
 - 11) Markings placed on driving surfaces shall be completely retroreflective both internally and externally with traffic beads and shall exhibit uniform retro-directive reflectance.
 - b. Thermoplastic, hot applied, extruded
 - 1) Supply products especially compounded for traffic markings

- 2) When placed on driving surfaces, markings shall not be slippery when wet, lift from pavement under normal weather conditions nor exhibit a tacky exposed surface.
 - 3) Cold ductility of the material shall permit normal road surface expansion and contraction without chipping or cracking.
 - 4) Markings shall retain their original color, dimensions, and placement under normal traffic conditions at road surface temperatures of 158 degrees Fahrenheit and below.
 - 5) Markings shall have uniform cross-section, clean edges, square ends, and no evidence of tracking.
 - 6) Density, quality, and thickness of the material shall be uniform throughout the length and width of the markings.
 - 7) 95 percent free of holes and voids, and free of blisters for a minimum of 60 days after application
 - 8) Minimum thickness of the marking, as measured above the plane formed by the pavement surface, shall not be less than 1/8 inch in the center of the marking and 3/32 inch at a distance of 1/2 inch from the edge.
 - 9) Maximum thickness shall be 3/16 inch.
 - 10) Material shall not deteriorate by contact with sodium chloride, calcium chloride, or other chemicals used to prevent roadway ice or because of the oil content of pavement markings or from oil droppings or other effects of traffic.
 - 11) Material shall not prohibit adhesion of other thermoplastic markings if, at some future time, new markings are placed over existing material.
 - a) New material shall bond itself to the old marking in such a manner that no splitting or separation takes place.
 - 12) Markings placed on the roadway shall be completely retroreflective both internally and externally with traffic beads and shall exhibit uniform retro-directive reflectance.
- c. Glass traffic beads
- 1) Manufactured from glass
 - 2) Spherical in shape
 - 3) Essentially free of sharp angular particles
 - 4) Essentially free of particles showing cloudiness, surface scoring or surface scratching
 - 5) Water white in color
 - 6) Applied at a uniform rate
 - 7) In accordance with requirements of DMS-8290
- d. Reflectorized Multipolymer, spray Pavement Markings Tape
- 1) Material in accordance with TxDOT Special Specification 1513.

- e. Preformed Heat-Activated Thermoplastic Tape
 - 1) HotTape preformed thermoplastic
 - a) 0.125 mil thickness
- f. Pavement Markings, Paint
 - 1) In accordance with DMS-8200.
- 2. Raised Pavement Markers
 - a. In accordance with the requirements of the TMUTCD.
 - b. Non-reflective markers:
 - 1) Round Ceramic Marker Types
 - a) Type Y (yellow body)
 - b) Type W (white body)
 - 2) In accordance with DMS-4300
 - c. Reflective markers:
 - 1) Manufactured of plastic
 - 2) In accordance with DMS-4200
 - 3) Marker Types:
 - a) Type I-C, white body, 1 face reflects white
 - b) Type II-A-A, yellow body, 2 faces reflect amber
 - c) Type II-C-R, white body, 1 face reflects white, the other red
- 3. Work Zone Markings
 - a. Temporary Flexible-Reflective Roadway Marker Tabs
 - 1) In accordance with DMS-8242
 - 2) Do not use to simulate edge lines.
 - 3) No segment of roadway open to traffic shall remain without permanent pavement markings for a period greater than 14 calendar days.
 - b. Raised Pavement Markers
 - 1) In accordance with DMS-4200
 - c. Striping
 - 1) In accordance with DMS-8200

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Performance

- 1. Maintain minimum retro reflectivity level for longitudinal markings as detailed below for a minimum of 30 calendar days.

	Posted Speed (mph)		
	≤ 30	35 – 50	≥ 55
2-lane roads with centerline markings only ⁽¹⁾	n/a	100	250
All other roads ⁽²⁾	n/a	50	100

⁽¹⁾ Measured at standard 30-m geometry in units of mcd/m²/lux.

⁽²⁾ Exceptions:

A. When raised reflective pavement markings (RRPMs) supplement or substitute for a longitudinal line, minimum pavement marking retroreflectivity levels are not applicable as long as the RRPMs are maintained so that at least 3 are visible from any position along that line during nighttime conditions.

B. When continuous roadway lighting assures that the markings are visible, minimum pavement marking retro reflectivity levels are not applicable.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Surface Preparation

1. Remove dirt, grease, loose and/or flaking existing markings, and other forms of contamination from existing roadway surface.
2. Remove curing membrane from new concrete surfaces.
3. Apply material after pavement surface is completely dry.
 - a. The pavement is considered dry if there is no condensation after 15 minutes of observation on the underside of 1 square foot piece of clear plastic placed on pavement surface and weighted on the edges on a sunny day.
4. Equipment and methods used for surface preparation shall not damage existing pavement or create a hazard to motorists or pedestrians.

3.4 INSTALLATION

A. General

1. Apply materials in accordance with the manufacturer's recommendations.
2. Apply markings and markers on clean, dry pavement with a surface temperature above 50 degrees Fahrenheit and/or within temperature limits recommended by the material manufacturer.
3. Ensure proper safety precautions and traffic control when markings are applied on roadways open to traffic. Provide traffic control in accordance with TMUTCD.
4. Protect freshly applied markings from traffic damage and disfigurement.
5. Temperature of the material must be equal to the temperature of the road surface prior to restoring traffic.

B. Pavement Markings

1. Thermoplastic, hot applied, spray
 - a. For installation and replacement of long lines – centerlines, lane lines, edge lines, turn lanes, and dots.
 - b. Application Thickness:
 - 1) 100 mils
 - a) For applications over existing markings, install 90 mils.
 - c. Use sealer on concrete or asphalt pavement older than three (3) years.
 - d. Provide a typical setting time between 4 minutes and 10 minutes depending upon the roadway surface temperature and the humidity factor.
 - e. Supplement roadway centerlines, lane lines, and turn lanes with retroreflective raised pavement markers. Place markers as specified in the Drawings.
2. Thermoplastic, hot applied, extruded

- a. For installation and replacement of crosswalks and stop-lines.
 - b. Apply markings at a 125 mil thickness.
3. Preformed Polymer Tape
 - a. For installation and replacement of crosswalks, stop-lines, and legends.
 - b. Apply markings to adhere to the pavement surface with no slippage or lifting and have square ends, straight lines, and clean edges.
4. Preformed Heat-Activated Thermoplastic Tape
 - a. For installation and replacement of crosswalks, stop-lines, and legends.
 - b. Apply marking to adhere to the pavement surface with no slippage or lifting and have square ends, straight lines, and clean edges.
- C. Raised Pavement Markers
 1. Install on concrete roadways with epoxy adhesive.
 - a. Bituminous adhesive is not permitted.
 2. Install on new asphalt roadways with epoxy or bituminous adhesive.
 3. Ensure proper alignment of individual marker using a chalk line, chain, or equivalent. Place markers uniformly along the line to achieve a smooth continuous appearance.
- D. Work Zone Markings
 1. Minimize disruption to traffic.
 2. Install longitudinal markings on pavement surfaces before opening to traffic.
 3. Maintain lane alignment traffic control devices and operations until markings are installed.
 4. Install markings in proper alignment in accordance with the TMUTCD and as specified in the Drawings.
 5. Place standard longitudinal lines no sooner than 3 calendar days after the placement of a surface treatment, unless otherwise specified in the Drawings.
 6. Place in proper alignment with the location of the final pavement markings.
 7. Do not use raised pavement markers for words, symbols, shapes, or diagonal or transverse lines.
 8. Marking visibility is required for at least a distance of 300 feet in daylight conditions and 160 feet in nighttime conditions on a low-beam automobile headlight illumination.
 9. The daytime and nighttime reflected color of the markings must be distinctly white or yellow.
 10. The markings must exhibit uniform retroreflective characteristics.
 11. Epoxy adhesives are not permitted for work zone markings
- E. Removals
 1. Pavement Marking and Pavement Marker Removal
 - a. Use best practices to remove existing pavement markings and markers.
 - b. If the roadway is damaged during marker removal, coordinate with the City prior to continuing removal operations.
 - c. Minimize color and texture contrast of the pavement surface as a result of removals.
 - d. Repair damages greater than ¼ inch in depth resulting from the removal of pavement markings and markers from asphaltic surfaces.
 - 1) Driveway patch asphalt emulsion may be broom applied to reseal damage to asphaltic surfaces.

- e. Dispose of markers in accordance with Federal, State, and local regulations.
- f. Use any of the following methods unless otherwise specified in the Drawings.
 - 1) Surface Treatment Method
 - a) Apply surface treatment at rates specified in the Drawings.
 - b) Place a surface treatment a minimum of 2 feet wide to cover the existing marking.
 - c) Place a surface treatment, thin overlay, or microsurfacing a minimum of 1 lane in width in areas where directional changes of traffic are involved or in other areas as directed by the City.
 - 2) Burn Method
 - a) Use burning method approved by City.
 - b) For thermoplastic pavement markings or prefabricated pavement markings, heat may be applied to remove the bulk of the marking material prior to blast cleaning.
 - c) When using heat, avoid spalling pavement surfaces.
 - d) Sweeping or light blast cleaning may be used to remove minor residue.
 - 3) Blasting Method
 - a) Use a blasting method such as water blasting, abrasive blasting, water abrasive blasting, shot blasting, slurry blasting, water-injected abrasive blasting, or brush blasting as approved by City.
 - b) Remove pavement markings on concrete surfaces by blasting method only.
 - 4) Mechanical Method
 - a) Use any mechanical method except grinding.
 - b) Flail milling is acceptable in the removal of markings on asphalt and concrete surfaces.
- 2. No additional compensation will be allowed for removing markings and markers at the location to be paved over or where pavement is to be removed.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION

- A. Remove and replace markings placed by faulty application methods or in the wrong position or alignment by the Contractor at the Contractor's expense.
- B. Replace or remedy faulty markings on the same day of notification if markings create motorist confusion or hazard, as determined by City. Replace and remedy all other faulty markings within 5 days of notification.

3.7 FIELD QUALITY CONTROL

- A. Maintain uniform cross-section with clean edge and square ends for all markings.
- B. Maintain uniform density and quality of markings throughout its thickness.
- C. More than 5 percent, by area, of holes or voids on the applied markings is not acceptable. Applied markings shall be free of blisters.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 31 00
FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing and installing, removing, or replacing wooden, metal, chain link, or wire fences and gates.

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Fence

a. Measurement

- 1) Measured per linear foot of Fence installed.

b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "Fence" installed for:
 - a) Various Types.
 - b) Various Heights.

c. The price bid shall include:

- 1) Furnishing and installing Fence as specified by the Drawings
- 2) Posts, fencing material, and all accessories
- 3) Excavation and embankment
- 4) Loading
- 5) Unloading
- 6) Hauling
- 7) Storing
- 8) Mow strip, if required

2. Gate

a. Measurement

- 1) Measured per each Gate installed.

b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Gate" installed for:
 - a) Various Types.
 - b) Various Heights.
 - c) Various Widths.

c. The price bid shall include:

- 1) Furnishing and installing Gates as specified by the Drawings
- 2) Posts, fencing material, and all accessories

- 3) Excavation and embankment
 - 4) Loading
 - 5) Unloading
 - 6) Hauling
 - 7) Storing
 - 8) Mow strip, if required.
3. Cattle Guard
 - a. Measurement
 - 1) Measured per each Cattle Guard installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Cattle Guard” installed for:
 - a) Various Widths.
 - c. The price bid shall include:
 - 1) Furnishing and installing Cattle Guards as specified by the Drawings
 - 2) Excavation and embankment
 - 3) Loading
 - 4) Unloading
 - 5) Hauling
 - 6) Storing

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. A116, Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric
 - b. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
 - c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
 - d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
 - e. A702, Standard Specification for Steel Fence Posts, Hot Wrought
 - f. F626, Standard Specification for Fence Fittings
 - g. F668, Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric
 - h. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
 - i. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
3. American Wood-Preservers’ Association (APWA).

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS

A. Product Data

1. Provide product data from each manufacturer that is supplying fence, gate, or cattle guard materials and accessories.
2. Product data sheets for all products to include:
 - a. Manufacturer name
 - b. Date
 - c. Material description
 - d. Data and test results as required in this Section
 - e. Manufacturer Recommended Storing Data, if applicable
 - f. Installation Recommendations, if applicable

B. Shop Drawings

1. Provide shop drawings for all fence, gates, and cattle guards showing:
 - a. Installation layout with details and dimensions
 - b. Material type
 - c. Material finish

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 SITE CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. General

1. Provide only new materials of the size, weight, and material specified in the Drawings.
2. Provide materials of good commercial quality and design.

B. Posts

1. Metal
 - a. Do not use rerolled or open-seam material.
 - b. Provide steel pipe in accordance with ASTM F1083.
 - c. Provide T-posts in accordance with ASTM A702.
 - d. Paint all non-galvanized posts with an anti-corrosive paint approved by the City.

2. Wood
 - a. Provide posts free of all decay, shakes, splits, or other defects that would weaken or otherwise make the posts unsuitable for the purposes intended.
 - b. Ensure all knots are sound, tight, trimmed flush, and not exceeding 1/3 the small dimension of the post.
 - c. Ensure posts are straight, such that a line drawn between the center of each end does not fall outside the center of the post at any point by more than 2 inches.
 - d. For untreated posts use cedar, redwood, cypress, or live oak.
 - e. For treated posts use pine, spruce, or fir preservative treated in accordance with all applicable AWP standards.

3. Concrete
 - a. Provide concrete with a minimum 28 day compressive strength of 3,000 psi in accordance with Section 03 00 00.
 - b. Bagged concrete is allowed.

C. Chain Link Fabric

1. Provide PVC vinyl coated fabric in accordance with ASTM F668 and colored in accordance with ASTM F934.
2. Provide chain link fabric made of at least 9 gauge steel wire in accordance with ASTM A392 or ASTM A491.
3. Provide knuckled selvages at the top and bottom edge of fabric.
4. Provide 7 gauge steel tension wire with a minimum breaking strength of 1,950 pounds for the bottom edge, and top edge when railing is not used, of all chain link fence.

D. Wire Mesh Fabric

1. Provide wire mesh fabric made of at least 10 gauge wire for the top and bottom wires and at least 12-1/2 gauge wire for the intermediate wire and vertical stays in accordance with ASTM A116.

E. Barbed Wire

1. Provide barbed wire made of 2 strands 12-1/2 gauge wire, twisted with 2-point 14 gauge barbs spaced no more than 5 inches apart in accordance with ASTM A121, Class 1.

F. Privacy Slats

1. Provide PVC coated PVC slats free from all decay, shakes, splits, or other defects that would weaken or otherwise make the slats unsuitable for the purposes intended.
2. Provide redwood or cedar slats free from all decay, shakes, splits, or other defects that would weaken or otherwise make the slats unsuitable for the purposes intended.

G. Gates

1. Provide gates of the same material used in the adjacent fence, unless otherwise specified in the Drawings.
2. Provide all gate materials in accordance with the Section.

H. Cattle Guards

1. Provide cattle guards of the dimensions and materials specified in the Drawings.

2.3 ACCESSORIES

A. Miscellaneous

1. Provide galvanized bolts, nuts, washers, staples, screws, braces, straps, and other suitable devices needed to erect fence.
 2. For metal posts, provide fittings from pressed or rolled steel, forged steel, malleable iron, or wrought iron.
 3. Paint all non-galvanized metal accessories with anti-corrosive paint approved by the City.
- B. Post Caps
1. Provide malleable iron post caps designed to exclude all moisture.
- C. Chain Link Accessories
1. Provide fittings and other appurtenances in accordance with ASTM F626.

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Clearing
1. Remove all stumps, brush, rocks, trees, or other obstructions that would interfere with construction of the fence to a minimum width of 2 feet on each side of the centerline of the fence.
 2. Grub or excavate any stumps in fence clearing area.
 3. Remove any existing fence in a position to interfere with the new fence location in accordance with Section 02 41 13.
 4. Backfill and compact all holes remaining after post and stump removal with suitable soil.

3.4 INSTALLATION

- A. General
1. Stake the locations for corner, pull, gate, and end posts as specified in the Drawings, for City approval.
 2. Follow the finished ground elevations for fencing panels between corner, pull, gate, and end posts.
 3. Level off minor ground elevation irregularities in the path of the fencing.
- B. Post Installation
1. Space fence posts as specified in the Drawings, to match existing, or to meet the minimum requirements below.

Post Type	Required Spacing or Placement
Line posts	Max 8 feet on centers
Pull posts	Max 500 feet on centers; Each horizontal change between 15° and 30°; Each vertical change greater than 20°
Corner posts	Each horizontal change greater than 30°

2. Post Holes

- T-posts for wire fence may be hand driven. For all other posts, drill holes for concrete footings.
- Set posts at a minimum depth of 2 feet for line posts, and 4 feet or 1/3 the length of the post, whichever is greater, for corner and pull posts under tension.
- Drill holes to provide a minimum 3 inches of space between the post and drilled hole on all sides, including the bottom.
- Place concrete to fill all voids around post in a continuous pour. Maintain plumbness and post position as concrete is poured.
- Trowel finish around post sloping to direct water away from post.
- Allow concrete footing to cure for 3 days prior to hanging gates or tensioning cables.
- If bagged concrete is used pull emptied bags from post holes before curing.

3. Plumb and permanently position posts with anchorages firmly set.

4. Brace corner and pull posts in two directions.

5. Brace end and gate posts in one direction.

6. Set end, corner, pull, and gate posts prior to stretching wire or wire mesh fabric between posts.

7. Gate Posts

- Set gate posts such that the line between both tops is level, regardless of the grade at the groundline.
- When the grade at the groundline is not level, set posts such that the minimum height requirement is met for the downgrade post.

C. Chain Link Fence

- Fasten fabric to corner, pull, end, and gate posts using steel stretcher bars.
- Fasten one end of fabric and apply tension to the other end to remove all slack before making attachments.
- Place bottom of fabric approximately 2 inches above the finished grade.
- Grade uneven areas so the maximum distance between the bottom of the fabric and ground is 6 inches.
- Fasten fabric to the tension wires, top rail, and intermediate line posts at 16-inch intervals using 9 gauge galvanized steel ties.
- Connect existing fence to new fence at existing or newly installed corner post.

D. Wire Mesh Fabric and Wire Fence

- Fasten wire mesh fabric or wire fence to posts using galvanized ties or staples while drawing the fencing taut.
- Guy Wire

- a. Secure fencing with guy wire at the critical point of grade depressions where tension tends to pull posts out of the ground with a double 9 gauge galvanized wire.
 - b. Connect the guy wire to the top and bottom wire of wire mesh fabric or each strand of wire fence and to a deadman brace weighing at least 100 pounds, buried in the ground.
 - c. Stretch the wire fence prior to guying.
3. Connect existing cross fences to new fences and corner posts at junction with existing fences.

E. Wood Fence

1. Place wood fence slats approximately 2 inch above the finished grade and on a straight grade between posts.
2. Grade uneven areas so the maximum distance between the bottom of the slats and ground is 6 inches.
3. Attach slats to rails using galvanized screws.

F. Gates

1. Install horizontal stiffeners on gates 7 feet or taller, and vertical stiffeners on maximum 8-foot centers.
2. Install swing gates to open 180 degrees from the closed position.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 32 32 00 RETAINING WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation and construction of retaining walls.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Retaining Wall
 - a. Measurement
 - 1) Measured per *[each, square foot of wall face, or cubic yard]* of Retaining Wall installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per *[each, square foot of wall face, or cubic yard]* for Retaining Wall installed for:
 - a) Various Types.
 - c. The price bid shall include:
 - 1) Furnishing and installing Retaining Wall as specified by the Drawings
 - 2) Excavation for Retaining Wall footings
 - 3) Backfill
 - 4) Cement stabilization
 - 5) Proof rolling
 - 6) Waterproofing material
 - 7) Filter fabric
 - 8) Loading
 - 9) Unloading
 - 10) Storing
 - 11) Hauling
 - 12) Handling of Materials
 - 13) Clean up
 - d. The price bid shall not include the following:
 - 1) Furnishing, placing, and compacting backfill in embankment areas
 - 2) Drilled shaft foundations
 - 2. Temporary Retaining Wall
 - a. Measurement
 - 1) Measured per *[each, square foot of retaining wall face, or cubic yard]* of Temporary Retaining Wall installed.
 - b. Payment

- 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per *[each, square foot of retaining wall face, or cubic yard]* for Temporary Retaining Wall installed for:
 - a) Various Types.
- c. The price bid shall include:
 - 1) Furnishing and installing Retaining Wall as specified by the Drawings
 - 2) Excavation for Retaining Wall footings
 - 3) Furnishing, placing, and compacting backfill in excavation areas
 - 4) Leveling pads
 - 5) Copings
 - 6) Traffic rail foundations
 - 7) Fabricating wall blocks or panels
 - 8) Anchorage systems
 - 9) Loading
 - 10) Unloading
 - 11) Storing
 - 12) Hauling
 - 13) Handling of Materials
 - 14) Clean up
- d. The price bid shall not include the following:
 - 1) Furnishing, placing, and compacting backfill in embankment areas
 - 2) Drilled shaft foundations

1.3 REFERENCES

A. Abbreviations and Acronyms

1. MSE – Mechanically Stabilized Earth
2. CIP – Cast-in-Place
3. RAP – Recycled Asphalt Pavement
4. LRA – Limestone Rock Asphalt

B. Definitions

1. Permanent Wall
 - a. A retaining wall with a design service life of 75 years. All walls are presumed to be permanent walls unless otherwise specified in the Drawings.
2. Temporary Wall
 - a. A retaining wall with a design service life of 3 years or less.
3. MSE Wall
 - a. A wall consisting of a volume of select backfill with tensile earth reinforcement elements distributed throughout.
4. Concrete Block Wall
 - a. A retaining wall that uses machine-made, precast concrete block units as facing elements.

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.

2. ASTM International (ASTM):
 - a. C90, Standard Specification for Loadbearing Concrete Masonry Units.
3. Texas Department of Transportation (TxDOT) Test Procedures:
 - a. Tex-128-E, Determining Soil pH.
 - b. Tex-129-E, Measuring the Resistivity of Soil Materials.
 - c. Tex-411-A, Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate.
 - d. Tex-460-A, Determining Crushed Face Particle Count.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Working Drawings
 1. When proprietary wall systems are used submit casting drawings, construction drawings, and design calculations signed and sealed by a professional engineer licensed in the State of Texas.
 2. For any retaining wall with a maximum height of 4 feet or greater provide casting drawings, construction drawings, and design calculations signed and sealed by a professional engineer licensed in the State of Texas.
- B. Casting Drawings
 1. Provide all information necessary for casting wall elements, including:
 - a. Railing and coping when prefabricated
 - b. Shape and dimensions of panels
 - c. Size, quantity, and details of the reinforcing steel
 - d. Size, quantity, type, and details of connection and lifting hardware
- C. Construction Drawings
 1. Provide a numbered panel layout showing horizontal and vertical alignment of the walls as well as the existing and proposed groundlines.
 2. Provide all information necessary to erect walls including:
 - a. Proposed leveling pad elevations
 - b. The type and details of the soil reinforcing system
 - c. The details and manufacturer of all pads, fillers, and filter fabric
 - d. Limits, dimensions, and type of structural backfill
 - e. Details necessary to incorporate coping, railing, inlets, drainage, and electrical conduit
- D. Design Calculations
 1. Provide calculations covering the range of heights and loading conditions on the project.
 2. Provide calculations for both internal and external stability as described on the plans.
 3. Provide summary of all design parameters used, including:
 - a. Material types, strength values, and assumptions
 - b. Loads and loading combinations
 - c. Factor of safety parameters

1.7 CLOSEOUT SUBMITTALS

A. Record Documentation

1. Upon completion of construction, submit a set of reproducible as-built drawings.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Cement and Supplementary Cementitious Material
 - a. In accordance with Section 03 00 00.
3. Steel Reinforcement
 - a. In accordance with Section 03 00 00.
4. Chemical Admixture, Epoxy, Curing Compound, and Other Materials
 - a. Follow manufacturer's instructions regarding storage and application at temperatures of material.
5. Epoxy
 - a. In accordance with Section 32 13 13.

1.11 FIELD CONDITIONS

A. Ambient Conditions

1. Surface temperature must be at least 40° F and the ambient temperature must be 45° F and rising.
2. Do not install retaining walls during or shortly after rain events which prevent proper placement of wall elements, backfill, or embankments.
 - a. Do not resume retaining wall construction until area within wall limits dries to optimal density.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Concrete

1. Provide concrete for retaining walls in accordance with Section 03 00 00, Section 03 30 00, and in accordance with the criteria below:

Application	Concrete

Cast-in-place	Class F, 4,000 psi
Precast	Class H, 4,000 psi

B. Reinforcing Steel

1. Provide reinforcing steel in accordance with Section 03 00 00.
2. Epoxy coat all steel used in concrete panels and coping including connectors, dowels, stirrups, and reinforcing steel when the Drawings specify epoxy coating of steel earth reinforcements.

C. Concrete Blocks

1. Provide machine-made concrete block units in accordance with ASTM C90, Class 1, Type II, with a minimum 28-day compressive strength of 4,000 psi and a maximum moisture absorption of 7 percent.
2. Provide units with molded dimensions within 1/8 inch of specified dimension horizontally and 1/16 inch vertically.
3. Provide sample block units displaying the color, texture, and finish prior to delivery.

D. Backfill

1. General
 - a. Provide backfill free from organic or otherwise deleterious materials.
 - b. Provide backfill free from shale, caliche, or other soft, poor-durability coarse aggregate particles.
 - c. RAP is not allowed.
 - d. Crushed concrete is not allowed.
 - e. Manufactured sand is allowed for temporary walls only.
2. Non-Select
 - a. Furnish non-select backfill in accordance with Section 31 24 00.
 - b. Use non-select backfill for walls other than temporary and permanent MSE and concrete block walls as specified in the Drawings.
3. Select
 - a. Use select backfill for permanent and temporary MSE and concrete block walls as specified in the Drawings.
 - b. Provide backfill in accordance with the gradation requirements of the table below for the type specified in the Drawings.

Type	Material	Recommended Use	Sieve Size	Percent Retained
AS	Gravel, crushed slag, crushed stone, or LRA	As directed in Drawings	3"	0
			1/2"	50-100
			#4	See Note*
			#200	95-100
BS	Crushed gravel, crushed slag, crushed stone, or LRA	Permanent Walls	3"	0
			#4	See Note*
			#40	40-100
			#200	85-100
CS		Temporary Walls	3"	0
			#4	See Note*

Type	Material	Recommended Use	Sieve Size	Percent Retained
	Gravel, crushed slag, or crushed stone		#200	75-100
DS	Crushed gravel, crushed slag, or crushed stone	Walls subject to inundation; wall below the 100-year flood elevation	3"	0
			3/8"	85-100
			#200	95-100

* - When the backfill gradation results in 85 percent or more material retained on the #4 sieve, the backfill will be considered rock backfill.

- c. Furnish gravel with a minimum 95 percent of aggregates with two or more mechanically induced crushed faces in accordance with Tex-460-A.
 - d. All select backfill particles larger than 1/4 inch must be angular or completely crushed.
 - e. Rounded rock or rounded gravel is not allowed.
 - f. Natural sand in accordance with the requirements of this Section is allowed.
 - g. When nonmetallic or epoxy coated earth reinforcements are used furnish rock backfill with a maximum backfill particle size of 3/4 inch.
4. Drainage Aggregate
- a. When specified in the Drawings provide drainage aggregate in accordance with the gradation limits below.

Sieve Size	Percent Retained
1"	0
3/4"	25-50
1/2"	50-100
#4	75-100

- 5. Cement Stabilized Backfill
 - a. Stabilize Type CS backfill with 5% hydraulic cement by dry weight of the backfill material when specified in the Drawings.
 - 6. Electrochemical Requirements
 - a. When using permanent retaining wall systems with galvanized metallic earth reinforcements provide backfill with the following additional criteria:
 - 1) The pH is between 5.5 and 10.0 in accordance with Tex-128-E.
 - 2) Resistivity is more than 3,000 ohm-cm in accordance with Tex-129-E.
- E. Filter Fabric
- 1. Provide Type 1 filter fabric in accordance with DMS-6200.
 - 2. Provide UV-resistant filter fabric when used as part of the exposed facing for a temporary wall.
- F. Earth Reinforcements
- 1. Furnish earth reinforcements as specified in the Drawings.
 - 2. Galvanize or epoxy coat all steel elements for permanent walls in contact with soil.
 - 3. Furnish nonmetallic, galvanized, or epoxy coated connection hardware to match the earth reinforcement.

G. Subdrainage

1. In accordance with Section 33 46 00.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Backfill Material Quality

1. Submit material tests from each backfill source location to verify they are in accordance with this Section.
 - a. Test each source of backfill for durability and soundness in accordance with Tex-411-A.
 - b. Backfill material with a maximum 5-cycle soundness loss exceeding 25 percent will be rejected.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. General

1. Grade the foundation for the wall to a width equal or exceeding the length of the reinforcing system.
2. Proof rolling
 - a. Use equipment that will apply sufficient load to identify soft spots that rut or pump.
 - 1) Acceptable equipment includes fully loaded single-axle water truck with minimum 1,500-gallon capacity.
 - b. City must be on-site during proof rolling operations.
 - c. Make at least two passes with the proof roller, offsetting each trip by at most one tire width.
 - d. Correct areas of rutting or pumping greater than 3/4 inch and unstable or non-uniform areas in accordance with this Section.
3. Place drilled shaft foundations in accordance with City requirements.
4. Place subdrainage in accordance with Section 33 46 00.

3.4 INSTALLATION

A. General

1. Construct walls to a horizontal tolerance of 3/4 inch when measured along a 10-foot straightedge.
2. Construct walls to an overall vertical tolerance of 1/2 inch per 10 feet of wall height.
3. Prevent surface water from damaging the retaining wall during construction.
 - a. Shape the backfill form to prevent water from ponding or flowing on the backfill or against the wall face.
 - b. Remove and replace all portions of the retaining wall damaged or moved out of tolerance.

B. Cast-in-Place Concrete Walls

1. Construct cast-in-place concrete walls in accordance with Section 03 30 00.

C. Permanent MSE Walls

1. Concrete Leveling Pad
 - a. Place concrete leveling pad as specified in the Drawings.
 - b. Wait a minimum of 24 hours before beginning panel erection.
 - c. Shim the first row of panels as necessary to achieve correct alignment.
 - 1) Use plastic shims or other material that will not deteriorate.
 - 2) If the required shim height exceeds 1 inch remove and replace the leveling pad or provide grout level-up as directed.
2. Place filter fabric behind the wall along the joint between the leveling pad and the panels. Grout areas where filter fabric spans more than 6 inches at leveling pad steps.
3. Place and compact fill material over the leveling pad to an elevation even with or above the surrounding ground after backfilling the first row of panels. Do not allow water to accumulate and stand at the base of the wall.
4. Place filter fabric behind all wall joints and at the intersection of retaining walls with other structures. Cover joints at least 6 inches on each side and use adhesive to hold the fabric in place.
5. Place panels with care to prevent damage.
 - a. Stop any operation that results in chipping, spalling, or cracking of panels.
 - b. Remove and replace damaged panels.
6. Provide external bracing for the initial row of panels.
 - a. Use wooden wedges, clamps, or other means necessary to maintain position and stability of panels during placement and compaction of backfill.
 - b. Remove wooden wedges as soon as the panel or coping above the wedged element is erected and backfilled.
 - c. Remove all wedges after completing the wall.
7. Construct walls so the maximum offset at any panel joint is 3/4 inch and no joint is open to the extent the filter fabric is visible from the front of the wall.
8. Check each row of panels for plumbness and position before placing the subsequent row. Remove and rebuild any portion of the wall out of tolerance.
9. Place backfill and embankment material in accordance with Section 31 24 00.
 - a. Place backfill to closely follow the erection of each row of panels.
 - b. Place the select and embankment backfill to the same elevation where possible and operate the compaction equipment over the interface.
 - c. Do not create a continuous, distinct, vertical joint between the select and embankment backfill.
 - d. When using cement stabilized backfill place and compact the backfill within 2 hours of mixing.
 - e. Replace any panels or earth reinforcements damaged or displaced during backfill and embankment placement or compaction.
10. Maintain the stability of the interface area between the existing ground and the select fill when building a wall against existing ground. Remove and recompact any material that loosens, caves, or falls.
11. Earth Reinforcements
 - a. Place and compact backfill to each reinforcement level prior to placing reinforcement.

- b. Place earth reinforcements perpendicular to the face of the wall.
 - c. Remove slack in connections prior to placing backfill.
 - d. Pre-tension each layer of reinforcement to remove slack prior to placing backfill for systems using nonmetallic earth reinforcements.
 - e. Do not operate tracked equipment directly on any reinforcement.
12. Place filter fabric over rock backfill any time backfill type transitions to finer gradation within the wall volume.
- a. Overlap fabric at least 18 inches at splices, and extend it past the edge of the rock backfill at least 18 inches.
13. Complete embankment and compaction after wall is fully constructed.

D. Temporary MSE Walls

- 1. Provide a facing system rigid enough to maintain a smooth and straight wall face both during and after construction.
- 2. Place facing elements and filter fabric with no gaps in the facing or fabric.
- 3. Place earth reinforcements and compact backfill in accordance with this Section.

E. Concrete Block Walls

- 1. Place concrete block facing units in accordance with the approved working drawings.
- 2. Fill voids within the units and fill the 1-foot zone immediately behind the facing with drainage aggregate as specified in the Drawings.
- 3. Place facing elements with maximum 1/4 inch gaps between block units.
- 4. Place earth reinforcements and compact backfill in accordance with this Section.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Field Tests and Inspections

- 1. Perform testing in accordance with Sections 03 00 00, 03 30 00, and 31 24 00.

B. Non-Conforming Work

- 1. The City may at any time reject a material if it is found to not be in accordance with this Section.
- 2. Any rejection of materials or source locations will be at no cost to the City.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 01 12

HYDROSTATIC TESTING & DISINFECTION

PART 1 - GENERAL

1.1 SUMMARY

A. General

1. Before any newly constructed potable water mains will be permitted to be placed into service in the League City Public Works Department's Water Distribution System, it shall be cleaned (purged) and tested, or cleaned, disinfected, and tested until the bacteria count within the water main meets the standards established by the League City Public Works Department and the requirements of Chapter 290 of the Texas Administrative Code (TAC) established by the Texas Commission on Environmental Quality (TCEQ).

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement
 - a. This Item is considered subsidiary to the water main being Cleaned and Tested.
2. Payment
 - a. The Work performed and the materials furnished in accordance with this Item are subsidiary to cleaning, disinfection, hydrostatic testing, and bacteriological testing and shall be subsidiary to the unit price bid per linear foot of water pipe complete in place, and no other compensation will be allowed.

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Water Works Association/American (AWWA):
 - a. C301, Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
 - b. C303, Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
 - c. C651, Disinfecting Water Mains.

- d. C655, Field De-Chlorination.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.
- C. For 12-inch and larger water mains, provide the following:
 - 1. Cleaning Plan – Prior to the start of construction, submit a water main cleaning plan detailing the methods and schedule, including:
 - a. A detailed description of cleaning procedures
 - b. Pigging entry and exit ports
 - c. Flushing procedures
 - d. Plans and hydraulic calculations to demonstrate adequate flushing velocities
 - e. Control of water
 - f. Disposal
 - 2. Disinfection Plan – prior to the start of construction submit a disinfection plan including:
 - a. The method mixing and introducing chlorine
 - b. Flushing
 - c. De-chlorination
 - d. Sampling (Consult with City Water Dept. for Sampling)

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 PRODUCT TYPES

- A. Pigs

1. Open cell polyurethane foam body
2. Densities between 2 pounds per cubic foot up to 8 pounds per cubic foot
3. May be wrapped with polyurethane spiral bands
4. Abrasives are not permitted, unless expressly approved by the City in writing for the particular application.
5. Must pass through a reduction up to 65 percent of the cross sectional area of the nominal pipe diameter
6. Pigs shall be able to traverse standard piping arrangements such as 90 degree bends, tees, crosses, wyes, and gate valves.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 APPLICATION [NOT USED]

3.5 [REPAIR] / [RESTORATION] [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. General

1. All water mains shall be cleaned prior to bacteriological testing.
 - a. Flushing is only permitted when specially designated in the Drawings, or if pigging is not practical and approved by the City.
 - b. If bacteria test fails twice, pigging will be required on 16-inch and large water mains.

B. Pigging Method

1. If the method of pigging is to be used, prepare the main for the installation and removal of a pig, including:

- a. Furnish all equipment, material and labor to satisfactorily expose cleaning wye, remove cleaning wye covers, etc.
- b. Where expulsion of the pig is required through a dead-ended conduit:
 - 1) Prevent backflow of purged water into the main after passage of the pig.
 - 2) Install a mechanical joint to provide a riser out of the trench on 12-inch and smaller mains to prevent backwater re-entry into the main.
 - 3) Additional excavation of the trench may be performed on mains over 12 inches, to prevent backwater re-entry into the main.
 - 4) Flush any backflow water that inadvertently enters the main.
- c. Flush short dead-end pipe sections not swabbed by a pig.
- d. Once pigging is complete:
 - 1) Pigging wyes shall remain in place unless otherwise specified in the Contract Documents.
 - 2) Install cleaning wye, blind flanges or mechanical joint plugs.
 - 3) Plug and place blocking at other openings.
 - 4) Backfill
 - 5) Complete all appurtenant Work necessary to secure the system and proceed with disinfection.

C. Flushing Method

- 1. Prepare the main by installing blow-offs at appropriate locations, of sufficient sizes and numbers, and with adequate flushing to achieve a minimum velocity in the main of 2.5 feet per second.
 - a. A fire hydrant shall be used as blow off for all water mains.
 - b. Flushing shall be subject to the following limitations:
 - 1) Limit the volume of water for flushing to 3 times the volume of the water main.
 - 2) Do not unlawfully discharge chlorinated water.
 - 3) Do not damage private property.
 - 4) Do not create a traffic hazard.
 - c. Once Flushing is complete:
 - 1) Corporations stops used for flushing shall be plugged.

D. Daily main cleaning

- 1. Wipe joints and then inspect for proper installation.
- 2. Sweep each joint and keep clean during construction.
- 3. Install a temporary plug on all exposed mains at the end of each working day or an extended period of Work stoppage.

E. Hydrostatic Testing

- 1. All water mains and force mains that are under pressure, shall be hydrostatically tested to meet the following criteria:

- a. Furnish and install appurtenances for proper testing of the main.
 - 1) All pipe has been installed and backfilled.
 - 2) All service connections, fire hydrants and other appurtenances have been installed, connected and adjusted. No water service lines are to be installed during Development unless approved by City Engineer.
 - 3) All surface pavement, lot grading and other related construction activities are complete within the area of line to be accepted.
- b. A pressure and leakage test will be conducted by the contractor and monitored by the city inspector.
 - 1) The contractor shall furnish the pump, meter, and gauges for the tests.
 - 2) If permanent air vents are not located at all dead ends and high points, the contractor shall install corporation stops at such points. Location of test pump may require additional corporation stops. At the conclusion of the pressure test, the corporation stops shall be properly plugged and secured to prevent leakage.
 - 3) All potable water provided for water test shall be through a City provided contractors' meter assembly and backflow preventer. No direct connection will be allowed for filing of lines.
 - 4) All valve connections between a system that is presently serviced and an unaccepted system shall be operated only by City personnel.
 - 5) Pressurization and flush of the line will be coordinated by the City, with ample notification.
 - 6) Charges for water usage will be consistent with current City policy.
- c. Expel air from the pipe before applying the required test pressure.
- d. Test Pressure
 - 1) The specified test pressures will be based on the elevation of the lowest point on the line under test.
 - 2) The leakage test shall be at 150 psi for 4 hours or 125 psi for 8 hours.
 - 3) Leakage shall be defined as the quantity of water that must be supplied into any test section of pipe, to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- e. Test Conditions
 - 1) Must be at least 4-hour duration
 - 2) Add water as necessary to sustain the required test pressure.
 - 3) Test fire hydrants to the fire hydrant valve.
 - a) Leave the isolation valve on the fire hydrant lead line open during the hydrostatic testing.
 - 4) Test service lines to curb stop
 - a) Leave the corporation stop on the service line open during the hydrostatic testing. (When Applicable)
 - 5) Close isolation valves for air release valves.

- f. Measure all water used in the pressure test through an approved meter, or measure the difference in volume within a 55-gallon container.
 - 1) Do not test against existing water distribution valves unless expressly provided for in the Drawings or approved by the City.
 - 2) If the City denies approval to test against existing water distribution system valve, then make arrangements to plug and test the pipe at no additional cost.
- 2. Allowable Leakage
 - a. No pipe installation should be accepted if the leakage is greater than that determined by the current AWWA Standards "Allowable Leakage" for the applicable pipe material. All visible leaks are to be repaired regardless of the amount of leakage.
 - b. For any pipeline that fails to pass hydrostatic test:
 - 1) Identify the cause
 - 2) Repair the leak
 - 3) Restore the trench and surface
 - 4) Retest
 - c. All costs associated with repairing the pipeline to pass the hydrostatic test is the sole responsibility of the Contractor and included in the price per linear foot of pipe.
 - d. If the City determines that an existing system valve is responsible for the hydrostatic test to fail, the Contractor shall make provisions to test the pipeline without the use of the system valve.
 - e. There shall be no additional payment to the Contractor if the existing valve is unable to sustain the hydrostatic test and shall be included in the price per linear foot of pipe.

F. Disinfection

- a. General Sanitary precautions, flushing, and disinfections procedures and bacteriological sampling, as prescribed in AWWA Standard C 601 for disinfecting water-mains, shall be followed in laying waterlines.
- b. Pipe shall not be laid in water or placed where it can be flooded with water or sewage during storage or installation. The effectiveness of disinfections depends in large measure on maintaining clean pipes and avoiding major contamination during construction.
- c. All newly installed mains shall be disinfected in accordance with ANSI/AWWA C 601 and flushed and sampled before being placed in service.
- d. After satisfactory completion of the hydrostatic testing, League City personnel will flush and collect samples for bacteriological analysis to check the efficiency of the disinfections procedure, which shall be repeated if contamination persists.
 - 1) A minimum of one sample for each 1,000 feet of completed main will be required.

- 2) Charges for water usage will be consistent with current City policy.
- e. Following the chlorination period, all treated water flushed from the lines shall be disposed of by discharging to the nearest sanitary sewer or other approved means.
 - 1) No discharge to any storm sewer or natural water course will be allowed.
 - 2) Calcium hypochlorite granules shall be used as the source of chlorine.
2. Contractor Requirements
 - a. Furnish all equipment, material and labor to satisfactorily prepare the main for the disinfection method approved by the City with adequate provisions for sampling.
 - b. Make all necessary taps into the main to accomplish chlorination of a new line, unless otherwise specified in the Contract Documents.
 - c. After satisfactory completion of the disinfection operation, as determined by the City, remove surplus pipe at the chlorination and sampling points, plug the remaining pipe, backfill and complete all appurtenant Work necessary to secure the main.

G. Dechlorination

1. General. All chlorinated water shall be de-chlorinated before discharge to the environment. Chemical amounts, as listed in ANSI/AWWA C651: "Disinfecting Water Mains", shall be used to neutralize the residual chlorine concentrations using de-chlorination procedures listed in ANSI/AWWA C655: "Field De-Chlorination". De-Chlorination shall continue until chlorine residual is below 4.0 mg/L.
2. Testing. Contractor shall continuously test for the chlorine residual level immediately downstream of the de-chlorination process, during the entire discharge of the chlorinated water. Contractor shall periodically conduct chlorine residual testing and check for possible fish kills at locations where discharged water enters the existing watershed.
3. Fish Kill. If a fish kill occurs associated with the discharge of water from the distribution system or any other construction activities:
 - a. The Contract shall immediately alter activities to prevent further fish kills.
 - b. The Contractor shall immediately notify Public Works.
 - c. The Contractor shall coordinate with City to properly notify TCEQ.
 - d. Any fines assessed by the TCEQ (or local, state or federal agencies) for fish kills shall be the responsibility of the Contractor.

H. Bacteriological Testing (Water Sampling)

1. General
 - a. Notify the City when the main is suitable for sampling.
 - b. The City shall then take water samples from a suitable tap for analysis by the City's laboratory, unless otherwise specified in the Contract Documents.
2. Water Sampling

- a. Contractor will make sure all valves including isolation valves are 100% open.
 - 1) If all valves are not open, we will inform the City inspector.
- b. Contractor will introduce a dose of chlorine fed at a constant rate such that the water will have no less than 25 mg/L free chlorine. Chlorine application shall not cease until the entire main is filled with chlorinated water.
- c. The chlorinated water shall be retained in the main for at least 24 hr.
- d. At the end of the 24 hr period, Water Production will check that the treated water in all portions of the main shall have a residual of no less than 10 mg/L of free chlorine.
 - 1) If WQ checks the main and it is less than 10 mg/L after 24 hr period, we will stop the Work and let the City Inspector know that the new main failed chlorination and it will be up to the contractor to re-chlorinate.
- e. Once Water Production has a satisfactory residual of at least 10 mg/L in the new water main we will schedule a bacteriological test with the City Inspector.
- f. We will flush every hydrant at maximum flow for a minimum of 10 minutes each. Then we will sample 1 time every 1,000 ft of pipe.
 - 1) If there is a defected hydrant or an issue arises that warrants us to stop our test, we will let the City Inspector know what needs to be done to correct the problem.
 - 2) The City Inspector will let Water Production know when the problem has been corrected.
 - 3) Once Water Production has the green light from the City Inspector, we will continue sampling. Depending on the severity of the problem, the contractor may be responsible to re-chlorinate the line.
- g. After sampling we will have our laboratory pick up the samples at the next scheduled time.
 - 1) If a sample has failed, we will flush again and resample 1 time.
 - 2) The second time the sample has failed, we will start over from the beginning and the contractor will be responsible to chlorinate the line again and pig in accordance with 3.10 B.
- h. When we get notified that all samples have passed, we will inform the City Inspector and we will activate the new water main.

I. Site Cleaning

- 1. Keep the construction site cleaned as indicated in Section 01 74 23.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 01 13

SANITARY AND STORM SEWER CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. General

1. Before any television inspection, any sewer main shall be cleaned to remove all debris, solids, sand, grease, grit, etc. from the sewer and manholes.

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

- a. This Item is considered subsidiary to the sewer main being cleaned.

2. Payment

- a. The Work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of sewer pipe complete in place, and no other compensation will be allowed.

1.3 REFERENCES [NOT USED]

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 OWNER-SUPPLIED PRODUCTS [NOT USED]

2.2 PRODUCT TYPES

- A. Use only the type of cleaning material which will not create hazards to health or property or affect treatment plant processes.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 ERECTION/INSTALLATION/APPLICATION [NOT USED]

3.5 REPAIR/RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. General

1. All materials, equipment, and personnel necessary to complete the cleaning of the sanitary sewer main and manholes must be present on the jobsite prior to

isolating the sewer manhole or line segment and beginning the cleaning process.

2. Maintain clean Work and surrounding premises within the Work limits so as to comply with Federal, State, and local environmental and anti-pollution laws, ordinances, codes, and regulations when cleaning and disposing of waste materials, debris, and rubbish.
3. Keep the Work and surrounding premises within Work limits free of accumulations of dirt, dust, waste materials, debris, and rubbish.
4. Suitable containers for storage of waste materials, debris, and rubbish shall be provided until time of disposal. Contractor to coordinate with City Solid Waste Coordinator.
 - a. It is the sole responsibility of the Contractor to secure a licensed legal dump site for the disposal of this material.
 - b. Under no circumstances shall sewage or solids removed from the main or manhole be dumped onto streets or into ditches, catch basins, storm drains, or sanitary sewers.
5. The cleaning process shall remove all grease, sand, silts, solids, rags, debris, etc. from each sewer segment, including the manhole(s).
6. Selection of cleaning equipment and the method for cleaning shall be based on the condition of the sanitary sewer mains at the time Work commences and will be subject to approval by Public Works.
7. All cleaning equipment and devices shall be operated by experienced personnel.
8. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted by the improper use of the cleaning process or equipment.
9. Any damages done to a sewer main and/or structure by the Contractor shall be repaired by the Contractor at no additional cost and to the satisfaction of the City.
10. Cleaning shall also include the manhole wall washing by high pressure water jet. Washing pressure shall be per coating manufacturer recommendation.
11. The Contractor may be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the project.

- a. If the results obtained by the proposed sanitary sewer cleaning equipment are not satisfactory, the Contractor shall use different equipment and/or attachments, as required, to meet City satisfaction.
 - b. More than 1 type of equipment/attachments may be required at a location.
12. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.
13. Whenever hydraulically-propelled cleaning tools which depend upon water pressure to provide their cleaning force, or any tool which retard the flow of water in the sanitary sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved.
14. Any damage of property, as a result of flooding, shall be the liability and responsibility of the Contractor.
15. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.
16. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily.
- a. No fire hydrant shall be obstructed or used when there is a fire in the area.
 - b. It is the responsibility of the Contractor to obtain the fire hydrant, water meter and all related charges for the set-up, including the water usage bills from the City.
 - c. All expenses shall be considered incidental to the cleaning of the existing sanitary sewer mains.

B. Methods

1. High-Velocity Cleaning

- a. Cleaning equipment that uses a high velocity water jet for removing debris shall be capable of producing a minimum volume of 50 gpm, with a pressure of 1,500 psi, for the sanitary sewer line and 3,500 psi for the (manhole) structure at the pump. Cleaning pressures shall be in accordance with coating manufacturers recommendations.
- 1) Any variations to this pumping rate must be approved, in advance, by the City.

- 2) To prevent damage to older sewer mains and property, a pressure less than 1500 psi can be used.
- 3) A working pressure gauge shall be used on the discharge of all high pressure water pumps.
- 4) For sewers 18 inches and larger in diameter, in addition to conventional nozzles, use a nozzle which directs the cleaning force to the bottom of the pipe.
- 5) Operate the equipment so that the pressurized nozzle continues to move at all times.
- 6) The pressurized nozzle shall be turned off or reduced anytime the hose is on hold or delayed in order to prevent damage to the line.

2. Mechanical Cleaning

- a. Mechanical cleaning, in addition to normal cleaning when required, shall be with approved equipment and accessories driven by power winching devices.
- b. Submit the equipment manufacturer's operational manual and guidelines to the City, which shall be followed strictly unless modified by the City.
- c. All equipment and devices shall be operated by experienced operators so that they do not damage the pipe in the process of cleaning.
- d. Buckets, scrapers, scooters, porcupines, kites, heavy duty brushes, and other debris-removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machines.
- e. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites, and other approved equipment, in conjunction with hand winching device, and/or gas, electric rod propelled devices, shall be considered normal cleaning equipment.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 01 14

SEWER AND MANHOLE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing for sanitary sewer pipe and manholes prior to placing in service
 - a. Low Pressure Air Test and Deflection (Mandrel) Test
 - 1) Excludes pipe with flow
 - 2) Hydrostatic Testing is not allowed.
 - b. Vacuum Testing for sanitary sewer manholes
2. Before any newly constructed sanitary sewer pipe and manholes are placed into service it shall be cleaned and tested.
3. Pipe testing will include low pressure air test and deflection (mandrel) test for 36-inch pipe and smaller.
4. Hydrostatic testing is not allowed.
5. Manhole testing will include vacuum test. According to TCEQ rules.

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 01 13 – Sewer Main Cleaning

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Pipe Testing
 - a. Measurement
 - 1) This Item is considered subsidiary to the sanitary sewer main (pipe) completed in place.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of sanitary sewer main (pipe) complete in place, and no other compensation will be allowed.
2. Manhole Testing
 - a. Measurement
 - 1) This item is considered subsidiary to manhole complete in place.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each manhole complete in place.

1.3 REFERENCES

- A. Uni-Bell PVC Pipe Association**

1. UNI-B-6, Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS

- A. Test and Evaluation Reports
 - 1. All test reports generated during testing (pass and fail)

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Certifications
 - 1. Mandrel Equipment
 - a. Submit mandrel testing equipment to City for approval prior to testing.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Materials
 - 1. Mandrel used for deflection test. (Mandrel testing is also incidental to sewer pipe.)
 - a. Use of an uncertified mandrel or a mandrel altered or modified after certification will invalidate the deflection test.
 - b. Mandrel requirements
 - 1) Odd number of legs with 9 legs minimum
 - 2) Effective length not less than its nominal diameter
 - 3) Fabricated of rigid and nonadjustable steel
 - 4) Fitted with pulling rings at each end
 - 5) Stamped or engraved on some segment other than a runner indicating the following:
 - a) Pipe material specification
 - b) Nominal size
 - c) Mandrel outside diameter (OD)
 - 6) Mandrel diameter must be 95 percent of inside diameter (ID) of pipe.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Low Pressure Air Test (Pipe)
 - 1. Clean the sewer main before testing, as outlined in Section 33 01 13.
 - 2. Plug ends of all branches, laterals, tees, wyes, and stubs to be included in test.
- B. Deflection (mandrel) test (Pipe)
 - 1. Perform as last Work item before final inspection.
 - 2. Clean the sewer main and inspect for offset and obstruction prior to testing.
- C. Vacuum test (Manhole)
 - 1. Plug lifting holes and exterior joints.
 - 2. Plug pipes and stubouts entering the manhole.
 - 3. Secure stubouts, manhole boots, and pipe plugs to prevent movement while vacuum is drawn.
 - 4. Plug pipes with drop connections beyond drop.
 - 5. Place test head inside the frame at the top of the manhole.

3.4 INSTALLATION

- A. Low pressure air test (Pipe)
 - 1. Install plug with inlet tap.
 - 2. Connect air hose to inlet tap and a portable air control source.
 - 3. After the stabilization period (3.5 psig minimum pressure) start the stopwatch.
 - 4. Determine time in seconds that is required for the internal air pressure to reach 2.5 psig. Minimum permissible pressure holding time per diameter per length of pipe is computed from the following equation:

$$T = \frac{(0.0850 \cdot D \cdot K)}{Q}$$

Where:

T = shortest time, seconds, allowed for air pressure to drop to 1.0 psig

K = $0.000419 \cdot D \cdot L$, but not less than 1.0

D = nominal pipe diameter, inches

L = length of pipe being tested (by pipe size), feet

Q = 0.0015, cubic feet per minute per square foot of internal surface

- 5. UNI-B-6, Table 1 provides required time for given lengths of pipe for sizes 4-inch through 60-inch based on the equation above.

6. Stop test if no pressure loss has occurred during the first 25 percent of the calculated testing time.

B. Deflection (mandrel) test (Pipe)

1. Deflection testing of the gravity sewer line shall be conducted after the final backfill and pavement has been in place at least 30 days.
2. For pipe 36 inches and smaller, the mandrel is pulled through the pipe by hand to ensure that maximum allowable deflection is not exceeded.
3. The test shall be performed without mechanical pulling devices.
4. Maximum percent deflection by pipe size is as follows:

Nominal Pipe Size Inches	Percent Deflection Allowed
12 and smaller	5.0
15 through 30	4.0
Greater than 30	3.0

C. Vacuum test (Manhole)

1. Vacuum testing of manholes shall be provided in accordance with TCEQ Rule 217.58.
2. Draw a vacuum of 10 inches of mercury and turn off the pump.
3. With the valve closed, read the level vacuum level after the required test time of 2 minutes.
4. Minimum time required for vacuum drop of 1 inch of mercury is as follows:

Depth of Manhole, feet	4-foot Dia Seconds	5-foot Dia Seconds	6-foot Dia Seconds
8	20	26	33
10	25	33	41
12	30	39	49
14	35	45	57
16	40	52	67
18	40	59	73
**	T=5	T=6.5	T=8

** For manholes over 18 feet deep, add “T” seconds as shown for each respective diameter for each 2 feet of additional depth of manhole to the time shown for 18 foot depth. (Example: A 30 foot deep, 4-foot diameter. Total test time would be 70 seconds. 40+6(5)=70 seconds)

5. Manhole vacuum levels observed to drop greater than 1 inch of mercury will have failed the test.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Non-Conforming Work

1. Low pressure air test
 - a. Should the air test fail, find and repair leak(s) and retest.
2. Deflection (mandrel) test (Pipe)
 - a. Should the mandrel fail to pass, the pipe is considered overdeflected.
 - b. Uncover overdeflected pipe. Reinstall if not damaged.
 - c. If damaged, remove and replace.
3. Vacuum test (Manhole)
 - a. Should the vacuum test fail, repair suspect area and retest.
 - 1) External repairs required for leaks at pipe connection to manhole.
 - 2) Leaks within the manhole structure may be repaired internally or externally.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 01 15
CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements and procedures for Closed Circuit Television (CCTV) Inspection of sanitary sewer or storm sewer mains
 - 2. For sanitary sewer projects (existing main: Pre-CCTV) shall be inspected.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 01 13 – Sanitary and Storm Sewer Cleaning
 - 2. Section 33 01 16 – Bypass Pumping of Existing Sewer Systems

1.2 PRICE AND PAYMENT PROCEDURES

- A. Pre-CCTV Inspection
 - 1. Measurement
 - a. Measurement for this Item will be by the linear foot of line televised for CCTV Inspection performed prior to any line modification or replacement determined from the distance recorded on the video log.
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Pre-CCTV Inspection”.
 - 1) Contractor will not be paid for unaccepted video.
 - 3. The price bid shall include:
 - a. Mobilization
 - b. Cleaning
 - c. Digital file

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. Pipeline Assessment and Certification Program (PACP)
 - 3. National Association of Sewer Service Companies (NASSCO)

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Requirements

1. All sanitary sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstruction.
 2. The total footage of all sewer lines shall be inspected with television equipment.
 3. Any pipe settlement which causes excess ponding of water in pipeline, any miss-aligned joints, or other defects shall be cause for rejection.
 4. The developer is responsible for the TV inspection of newly constructed sanitary sewer lines.
 5. The TV inspection shall take place after the low-pressure testing has been completed, but before the final walk-through inspection is performed.
 6. Personnel from the City's Line Repair Department or the City's Engineering Department shall witness the TV inspection, which shall be performed during the City's normal working hours.
- B. Scheduling:
1. CCTV cannot be performed until final surface repair and manhole adjustments are completed.
 2. CCTV cannot be performed until all items listed in Paragraph 3.3 A have been completed.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.
- C. Log sheet report must utilize PACP reporting standards.
- D. Video submittal shall be a digital mpeg file unless otherwise directed by the City and must be compatible with the City's equipment.
- E. All information gathered must be legible, easily read or viewed, and of high definition color in accordance with NASSCO.
- F. Inspection Report shall include:
1. Asset
 - a. Date
 - b. City
 - c. Address and/or Project Name
 - d. Main Number – GIS ID (If Available) or Station
 - e. Upstream Manhole GIS ID (If Available) or Station
 - f. Downstream Manhole GIS ID (If Available) or Station
 - g. Pipe Diameter
 - h. Material
 - i. Pipe Length
 - j. Mapsco Location Number
 - k. Date Constructed
 - l. Pipe Wall Thickness
 2. Inspection
 - a. Inspection Number (i.e. 1st, 2nd, etc...)
 - b. Crew Number
 - c. Operator Name
 - d. Operator Comments

- e. Reason for Inspection
- f. Equipment Number
- g. Camera Travel Direction (Upstream/Downstream)
- h. Inspected Length (feet)
- i. Work Order Number (if required)
- j. City Project Number (if required)
- k. City Contract Name and Number
- l. Contractor Company Name
- m. Contractor Contact Name
- n. Contractor Contact Phone Number

1.6 INFORMATIONAL SUBMITTALS

- A. Pre-CCTV submittals
 - 1. 2 copies of CCTV video results on USB drive
 - 2. 1 hard copies of Inspection Report and one pdf copy on USB drive
- B. Additional information that may be requested by the City
 - 1. Listing of cleaning equipment and procedures
 - 2. Listing of flow diversion procedures if required
 - 3. Listing of CCTV equipment
 - 4. Listing of backup and standby equipment
 - 5. Listing of safety precautions and traffic control measures

1.7 CLOSEOUT SUBMITTALS

- A. Post-CCTV submittals
 - 1. Provide PDF copies of CCTV video and Inspection Reports on 2 USB drives.
 - 2. Provide 1 hard copies of CCTV Inspection Report.
 - 3. Submit to the City for review prior to scheduling a project final walk through.
 - 4. For each segment the video and corresponding written report shall clearly identify:
 - a. Each line segment being inspected
 - b. The size and type of pipe being inspected
 - c. Accurate footage of the line segment inspected
 - d. Deficiencies in materials, alignment, pipe shape, grade, or any other apparent deficiencies
 - e. Locations of all service connections
 - 5. The City maintains the right to reject CCTV submittals if the submittals fail to conform to the quality or administrative requirements as specified in this Section (e.g., obstructions on lens, foggy lens, insufficient data, etc.).
 - a. Any additional CCTV inspections performed by the Contractor due to a rejected submittal will be the responsibility of the Contractor.

1.8 QUALITY ASSURANCE [NOT USED]

1.9 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.10 FIELD [SITE] CONDITIONS [NOT USED]

1.11 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Equipment

1. Closed Circuit Television Camera

- a. The television camera used shall be one specifically designed and constructed for sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity/submerged conditions. The equipment will provide a view of the pipe ahead of the equipment and of features to the side of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe. The lights on the camera shall also be capable of panning 90-degrees to the axis of the pipe.
- b. The radial view camera must be solid state color and have remote control of the rotational lens. The camera shall be capable of viewing the complete circumference of the pipe and manhole structure, including the cone-section or corbel. The camera lens shall be an auto-iris type with remote controlled manual override.

2. Video Capture System

- a. The video and audio recordings of the sewer inspections shall be made using digital video equipment. A video enhancer may be used in conjunction with, but not in lieu of, the required equipment. The digital recording equipment shall capture sewer inspection on USB drive, with each sewer segment (from upstream manhole to downstream manhole) inspection recorded as an individual file in Windows Media Audio/Video (.wmv) format. City has a right to change the format from .WMV media to .MP4
- b. The system shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
- c. The system shall store digitized color picture images and be saved in digital format on a USB drive.
- d. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes outlined in the City's CCTV manual.
- e. Camera footage, date & manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.

2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. General

1. Prior to inspection obtain pipe and manhole asset identification numbers from the plans or City to be used during inspections. Inspections performed using identification numbers other than the plans or from assigned numbers from the City will be rejected.
2. Inspection shall not commence until the sewer section to be televised has been completely cleaned in conformance with Section 33 01 13. (Sewer system should be connected to existing sewer system and should be active)
3. Inspection of newly installed sewers (not yet in service) shall not begin prior to completion of the following:
 - a. Pipe testing
 - b. All manhole Work is complete
 - c. Installation of all lateral services
 - d. Vacuum test of manholes
4. Temporary Bypass Pumping (if required) shall conform to Section 33 01 16.

3.4 INSPECTION (CCTV)

A. General

1. Begin inspection immediately after cleaning of the main.
2. Move camera through line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the main's condition.
3. Do not move camera at a speed greater than 30 feet per minute.
4. Use manual winches, power winches, TV cable, and power rewinds that do not obstruct camera view, allowing for proper evaluation.
5. During investigation, stop camera at each defect along the main.
 - a. Record the nature, location, and orientation of the defect or infiltration location.
6. Pan and tilt the camera to provide additional detail at:
 - a. Manholes
 - 1) Pan camera around to see condition of manhole including installation of epoxy liner, if applicable.
 - a) Visual confirmation does not relieve the Contractor from performing Quality Control on epoxy liners in accordance with Section 33 01 14.
 - b. Service connections

- 1) Pan camera to get a complete overview of service connection including zooming into service connection, include location (i.e. 3 o'clock, 9 o'clock, etc.)
- c. Joints
 - 1) Include comment on condition, signs of damage, etc.
- d. Visible pipe defects
 - 1) Including but not limited to cracks, broken or deformed pipe, holes, offset joints, obstructions or debris (show as % of pipe diameter).
 - a) If debris has been found in the pipe during the post-CCTV inspection, additional cleaning is required and pipe shall be re-televised.
- e. Infiltration/Inflow locations
- f. Pipe material transitions
- g. Other locations that do not appear to be typical for normal pipe conditions
- h. Note locations where camera is underwater and level as a % of pipe diameter.
7. Provide accurate distance measurement.
 - a. The meter device is to be accurate to the nearest 1/10 foot.
8. CCTV inspections are to be continuous.
 - a. Do not provide a single segment of main on more than 1 USB drive.
 - b. A single segment is defined from manhole to manhole.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. See Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 01 16
BYPASS PUMPING OF EXISTING SEWER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bypass pumping of lift stations and the existing sewer system mains, unless otherwise specified in the Contract Documents.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Measurement for this item will be by lump sum.
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this item will be paid for at the lump sum price bid for "Bypass Pumping".
 - 3. The price bid shall include:
 - a. Mobilization
 - b. Development of bypass plans
 - c. Transportation and storage
 - d. Setup
 - e. Confined space entry
 - f. Plugging
 - g. Pumping
 - h. Clean up
 - i. Manhole restoration
 - j. Surface restoration

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. Occupational Safety and Health Organization (OSHA).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Schedule meeting with City to review sewer shutdown prior to replacing or rehabilitating any facilities.
2. City reserves the right to delay schedule due to weather conditions or other unexpected emergency within the sewer system.
3. Review bypass pumping arrangement or layout in the field with City prior to beginning operations. Facilitate preliminary bypass pumping run with City staff present to affirm the operation is satisfactory to the City.
4. After replacement or rehabilitation of facilities, coordinate the reestablishment of sewer flow with City.
5. Provide onsite continuous monitoring during all bypass pumping operations using one of the following methods:
 - a. Personnel on site, or
 - b. Portable SCADA equipment.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. For lift stations and sewer mains, submit a detailed plan and description outlining all provisions and precautions taken with regard to the handling of sewer flows.
1. Submit the plan to the City for approval a minimum of 14 days prior to commencing Work. Include the following details:
 - a. Schedule for installation and maintenance of the bypass pumping system
 - b. Staging areas for pumps
 - c. Pump sizes, capacity, number of each size, and power requirements
 - d. Calculations for static lift, friction losses, and velocity
 - e. Pump curves showing operating range and system head curves
 - f. Sewer plugging methods
 - g. Size, length, material, joint type, and method for installation of suction and discharge piping
 - h. Method of noise control for each pump and/or generator, if required
 - i. Standby power generator size and location
 - j. Suction and discharge piping plan
 - k. Emergency action plan identifying the measures taken in the event of a pump failure or sewer spill
 - l. Staffing plan for responding to alarm conditions identifying multiple contacts by name and phone numbers (office, mobile)
 - m. A contingency plan to implement in the event the replacement or rehabilitation has unexpected delays or problems

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 EQUIPMENT

A. Pumping

1. Provide equipment that will convey the following:
 - a. City-provided flow data.
 - 1) Full flow capacity of the sewer main, if data is not available
 - a) Calculate using Manning's equation assuming the following:
 - (1) Roughness coefficient, $n = 0.013$
2. Provide fully automatic self-priming pumps.
 - a. Foot-valves or vacuum pumps are not permitted for priming the system.
3. Pumps must be constructed to allow dry running for periods of time to account for the cyclical nature of sewer flow.
4. Provide 1 stand-by pump for each size to be maintained on site. Place backup pumps on line, isolated from the primary system by valve.
5. If multiple pumps are required to meet the flow requirements, provide the necessary fittings and connections to incorporate multiple discharges.
6. Noise levels of the pumping system must follow the more stringent of the requirements below:
 - a. City noise ordinance
 - b. No more than 65dB when measured at a distance of 300-ft from the source.
 - 1) The noise level will be the average of sound level meter readings taken consecutively at any given time from 4 or more diametrically opposite positions measured at a distance of 300-ft from the source.
 - c. May be subject to special noise mitigation as required by the City.

B. Piping

1. Install pipes with joints which prevent the incident of flow spillage.

C. Plugs or Stop Logs

1. Plugs
 - a. Select a plug made for the size and potential pressure head that will be experienced.
 - b. Provide an additional anchor, support, or bracing to secure plug when back pressure is present.
 - c. Use accurately calibrated air pressure gauges for monitoring the inflation pressure.
 - d. Place inflation gauge at location outside of confined space area. Keep the inflation gauge and valve a safe distance from the plugs.
 - e. Never over inflate the plug beyond pressure rating.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Locate the bypass pipelines in the area to minimize disturbance to existing utilities. Obtain approval from the City for use of locations.
- B. Make preparations to comply with OSHA requirements when working in the presence of sewer gases, oxygen-deficient atmospheres, and confined spaces.
- C. Do not begin bypass preparation and operation until City approval of the submittals requested in accordance with the requirements of this Section.

3.4 INSTALLATION

- A. Install and operate pumping and piping equipment in accordance to the submittals provided in accordance with the requirements of this Section.
- B. Sewer flow stoppage
 - 1. Plugging
 - a. Use confined space procedures and equipment during installation when necessary.
 - b. Thoroughly clean the pipe before insertion of the plug.
 - c. Insert the plug seal surface completely so it is fully supported by the pipe.
 - d. Position the plug where there are not sharp edges or protrusions that may damage the plug.
 - e. Use pressure gauges for measuring inflation pressures.
 - f. Minimize upstream pressure head before deflating and removing.
- C. Sewer flow control and monitoring
 - 1. Take precautions to ensure sewer flow operations do not cause flooding or damage to public or private property.
 - a. The Contractor is responsible for any damage resulting from bypass pumping operations.
 - 2. Begin continual monitoring of the sewer system as soon as the sewer is plugged or blocked. Be prepared to immediately start bypass pumping if needed due to surcharge conditions.
 - 3. Sewer discharge may be into another sewer manhole, appropriate vehicle, or container only. Do not discharge sewer into an open environment such as an open channel or earthen holding facility.
 - 4. Do not construct bypass facilities where vehicular traffic may travel over the piping.
 - a. Provide details in the suction and discharge piping plan that accommodate both the bypass facilities and traffic without disrupting either service.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Perform leakage and pressure tests of the bypass pumping pipe and equipment before actual operation begins. Have City on Site during tests.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES

- A. Once plugging or blocking is no longer necessary, remove in such a way that permits the sewer flow to slowly return to normal – preventing surge, surcharging, and major downstream disturbance.

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

- A. Contractor shall have a responsible person available for maintenance and repairs within a 2-hour notification for the entire duration of the bypass pumping activity.

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 04 10
JOINT BONDING AND ELECTRICAL ISOLATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joint bonding requirements for electrical continuity of:
 - a. Concrete cylinder pipe
 - b. Mortar coated steel pipe
 - c. Dielectrically coated steel pipe
 - d. Ductile iron pipe, as required on Drawings
 - 2. Electrical isolation devices for installation at:
 - a. Connections to existing piping
 - b. Laterals
 - c. Cased crossings
 - d. Tunnels
 - e. Selected below grade to above ground piping transitions
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 05 54 – Installation of Carrier Pipe in Casing or Metal Liner Plate

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. When a pay item for Cathodic Protection exists:
 - a. Measurement
 - 1) This Item is subsidiary to Cathodic Protection construction.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this Item are subsidiary to the lump sum price bid for “Cathodic Protection” for each material of utility pipe bid, and no other compensation will be allowed.
 - 2. When a pay item for Cathodic Protection does not exist:
 - a. Measurement
 - 1) Measurement for this Item is by lump sum.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the lump sum price bid for “Joint Bonding and Electrical Isolation”.
 - 3. The price bid shall include:
 - a. Furnishing and installing Joint Bonding and Electrical Isolation as specified by the Drawings
 - b. Mobilization
 - c. Excavation

- d. Furnishing, placement, and compaction of backfill
- e. Field welding
- f. Connections
- g. Adjustments
- h. Testing
- i. Clean-up
- j. Start-up/Commissioning

1.3 REFERENCES

A. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. ASTM International (ASTM).
- 3. American Water Works Association (AWWA):
 - a. C207, Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
- 4. NACE International (NACE).

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

- 1. Manufacturer's catalog cut sheets shall be submitted for each item.
 - a. Include the manufacturer's name and provide sufficient information to show that the materials meet the requirements of the Contract Documents for:
 - 1) Flange Isolation
 - 2) Bonding Clips for Concrete Cylinder Pipe
 - 3) Petrolatum tape
- 2. Where more than 1 item or catalog number appears on a catalog cut sheet, clearly identify the item proposed.

B. Test and Evaluation Reports

- 1. Record results for the Post-Installation Thermite Weld Inspection and submit to the City for approval prior to backfilling.
- 2. Record results for bonded joint testing and submit to City for approval prior to backfilling.
- 3. Record results for the continuity test for casing to carrier pipe and submit to the City for approval prior to backfilling.

1.7 CLOSEOUT SUBMITTALS

- A. Test results for electrical continuity, flange isolation and casing to carrier pipe isolation shall be submitted to the City.
- B. Results of all testing are to be submitted to City for inclusion in the O&M manual.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Joint Bonding and Electrical Isolation Materials to be incorporated into the project include, but are not limited to, the following:
 - 1. Electrical continuity bonds
 - 2. Flange isolation assemblies
 - 3. Casing spacers
 - 4. Casing end seals
- B. Electrical Continuity Bonds
 - 1. Applications for Electrical Continuity Bonding include the following:
 - a. Bonding across bolted joint assemblies
 - b. Bonding across gasketed joint assemblies
- C. Flange Isolation
 - 1. Required applications of dielectric flange isolation assemblies include, but are not limited to, selected locations where new piping is mechanically connected to existing piping.
 - 2. Gasket
 - a. Isolating and seal gasket
 - b. G-10 Epoxy Glass material
 - c. Full face
 - d. 1/8-inch thickness
 - e. Use with a minimum of 1 EDPM sealing element placed in a tapered groove.
 - f. NSF 61 certified
 - g. A minimum of 800 volts/mil dielectric strength is required.
 - h. Flange shall seal for the test pressure without leaking.
 - 3. Sleeves
 - a. Provide full length mylar sleeves.
 - 4. Washers
 - a. Provide double G-10 washer sets.
- D. Casing Spacers
 - 1. For piping installed in tunnels or cased crossings, install casing spacers between the piping and the casing or tunnel liner to provide electrical isolation in accordance with Section 33 05 54.

E. Casing End Seals

1. See Section 33 05 54 for casing end seals.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Preparation of Concrete Pipe for Bonding

1. General
 - a. Fabrication
 - 1) Use concrete pipe for this project that has been fabricated in such a manner as to establish electrical continuity between metallic components of pipe and joints.
 - b. Acceptable Methods
 - 1) Establish electrical continuity as indicated in the Contract Documents.
2. Criteria for Electric Continuity
 - a. Tensile Wire
 - 1) Pipe manufacturer is to obtain a resistance no greater than 0.03 ohms between any wire and steel joint ring at end of pipe farthest from that wire.
 - 2) Manufacturer is to report values obtained and method of measurement.
 - b. Internal Pipe Joint Components
 - 1) Pipe manufacturer is to obtain resistance of less than 0.03 ohms between any component and steel pipe cylinder.
3. Tensile Wire Continuity
 - a. Establish continuity between tensile wire coils and steel cylinder on embedded cylinder type pre-stressed pipe by tightly wrapping tensile wire over longitudinal mild steel straps during pipe manufacture.
 - b. Use and install 2 continuous straps 180 degrees apart longitudinally along the pipe.
 - 1) These straps must maintain electrical continuity between metallic components.
 - c. Use steel straps made of mild steel and free of grease, mill scale or other high resistance deposits.
 - d. Make longitudinal straps electrically continuous with pipe cylinder by steel fasteners of suitable dimensions placed between steel cylinder and longitudinal straps.
 - 1) Connect fasteners so as to remain intact during pipe fabrication process.
4. Steel Cylinder Continuity
 - a. Establish continuity of all joint components and steel cylinder.
 - 1) These components include anchor socket brackets, anchor socket, spigot ring and bell ring.
 - b. If mechanical contact does not provide a resistance of less than 0.03 ohms between components, tack weld component to provide electrical continuity.

B. Preparation of Steel Pipe for Bonding

1. Bonding wires are not required for welded steel pipe.
 2. Mechanical jointed steel pipe requires the installation of bond wires across the joint as shown on the Drawings.
- C. Preparation of Ductile Iron Pipe for Bonding
1. Install insulated bond wires as shown on the Drawings.
- D. Electrical Bond Wires
1. Electrical bond wires are to be a minimum No. 4 AWG, 7 stranded, copper cable with THHN insulation.
 2. Remove 1 inch of THHN insulation from each end of the bond wire.
 3. Thermite weld the bond wires to the pipeline.
 4. Provide the minimum number of bond wires as shown on Drawings for steel or ductile iron pipe.
- E. Electrical Bond Clip
1. Weld 3 ASTM 366 steel bonding clips, each approximately 0.13 inches thick, 2.5 inches long, and 1.25 inches wide, with 1/8-inch fillet welds to the bell and spigot of adjacent pre-stressed concrete cylinder pipe or steel pipe with rubber gasketed joints.
 2. Manufacture clips to maintain continuity regardless of small deflections of finished joints.

3.4 INSTALLATION

- A. Installation of Electrical Continuity Bonds by Thermite Welding
1. Inspection
 - a. Use continuous bond wires with no cuts or tears in the insulation covering the conductor.
 2. General
 - a. Attach bond wires at required locations by thermite welding process.
 3. Thermite Welding Methods
 - a. Perform thermite welding of bond wires to piping in the following manner:
 - 1) Clean and dry pipe to which the wires are to be attached.
 - 2) Use grinding wheel to remove all coating, mill scale, oxide, grease and dirt from an area approximately 3 inches square.
 - a) Grind surface to bright metal.
 - 3) Remove approximately 1 inch of insulation from each end of wire to be thermite welded to pipe exposing clean, oxide-free copper for welding.
 - 4) Select proper size thermite weld mold as recommended by manufacturer. Place wire or strap between graphite mold and the prepared metal surface.
 - 5) Place metal disk in bottom of mold.
 - 6) Pour thermite weld charge into the mold. Squeeze bottom of cartridge to spread ignition powder over charge.
 - 7) Close mold cover and ignite starting powder with flint gun.
 - 8) After exothermic reaction, remove thermite weld mold and gently strike weld with a hammer to remove weld slag.
 - 9) Pull on wire or strap to assure a secure connection.
 - 10) If weld is not secure or the bond breaks, repeat procedure with new wire.
 - 11) If the weld is secure, coat all bare metal and weld metal with Stopaq CZ tape.

4. Post-Installation Thermite Weld Inspection
 - a. Contractor is responsible for all testing.
 - b. All testing is to be performed by or under the supervision of certified NACE personnel.
 - c. Visually examine each thermite weld connection for strength and suitable coating prior to backfilling.
 - d. Measure resistance through selected bonded joints with a digital low resistance ohmmeter (DLRO).
 - 1) Resistance of 0.001 ohms or less is acceptable.
 - 2) If the above procedure indicates a poor quality bond connection, reinstall the bond.
 - 3) Record results and submit to the City for approval prior to backfilling.
 5. Backfilling of Bonded Joints
 - a. Perform backfilling of bonded piping in manner that prevents damage to the bonds and all connections to the metallic structures.
 - b. Use appropriate backfill material to completely cover the electrical bond.
 - c. Provide protection so that future construction activities in the area will not destroy the bonded connections.
 - d. If construction activity damages a bonded connection, install new bond wire.
- B. Installation of Pipeline Flange Isolation Devices
1. Placement
 - a. Install isolation joints at the locations shown on the Drawings.
 2. Assembly
 - a. Place gasket, sleeves and washers as recommended by the manufacturer.
 - b. Follow manufacturer's recommendations for even tightening to proper torque.
 3. Testing
 - a. Immediately after an electrical isolation fitting has been installed, contact the City to perform testing for electrical isolation effectiveness.
 4. Painting
 - a. Do not use metal base paints on electrical isolation devices.
 5. Encapsulation
 - a. Encapsulate below-grade isolation joints with the Denso Densyl Tape system after the isolation joint has been tested for effectiveness.
- C. Installation of Casing Spacers
1. Casing spacers shall be installed in accordance with Section 33 05 54.
- D. Installation of End Seals
1. End seals shall be installed in accordance with Section 33 05 54.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

- A. Testing of Joint Continuity Bonds and Isolation Joints
1. After the completion of the continuity bonding of individual joints, but before the pipe is backfilled, each bonded joint shall be tested for electrical continuity.

2. A DC current shall be impressed on the pipe on 1 side of the joint under test using a portable 12-volt battery and a driven ground rod. The battery shall be connected such that the positive terminal is connected to the ground rod and the negative terminal is connected to the pipe section under test. The magnitude of test current is not important as long as it causes a change in pipe-to-soil potential on the section of pipe that is in the test current circuit.
 3. The pipe-to-soil potential shall be measured on each side of the isolation joint using a high impedance voltmeter and portable copper/copper sulfate reference electrode with the test current “on” and “off”.
 4. A joint is considered electrically continuous if the “on” and “off” potentials are the same on either side of the joint under test.
 5. This same procedure shall be used to test individual isolation joints except that the joint is considered effective if the pipe-to-soil potential is not the same when measured on each side of the joint when the test current is “on”.
 6. Record results and submit in accordance with this Specification.
- B. Casing to Carrier Pipe Isolation Tests
1. Immediately after the pipe has been installed in the casing, but prior to connecting the line, make pipe available for testing and contact the City to perform an electrical continuity test to determine that the casing is electrically isolated from the pipeline.
 2. The continuity test shall be fully documented and approved by the City prior to backfilling.
 3. Record results and submit in accordance with this Specification.
 4. If the electrical isolation between carrier pipe and casing is not effective, the cause shall be immediately investigated and the situation remedied.
 5. Under no circumstances shall a shorted casing be backfilled.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 01

LOCATION OF EXISTING UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Locating and verifying the location and elevation of existing underground utilities at proposed connection points or that may conflict with proposed facilities, by use of:
 - a. Exploratory Excavation
 - b. Vacuum Excavation
 - c. Call Texas 811 (Must follow Texas One Call Laws)

B. Deviations from this City of League City Standard Specification:

1. None.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES

A. Definitions

1. Exploratory Excavation: Commonly referred to as “potholing”, a method used to locate existing 10” and smaller underground utilities through the use of standard excavation equipment.
2. Vacuum Excavation: Method used to locate existing underground utilities of all sizes, but which must be used for utilities 12 inches and larger, through the use of geophysical prospecting equipment such as vacuum excavation.

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society of Civil Engineers (ASCE)
 - a. ASCE Publication CI/ASCE 38 (Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data)

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Stake areas for location at least 72 hours prior to commencement of location.
2. Coordinate location of all utilities within vicinity of excavation prior to commencing location.
3. Coordinate with City at least 48 hours prior to commencing on site for location of utilities.
4. Call Texas 811

B. Sequencing

1. Location of utilities shall be performed prior to construction of the entire Work. (Must Follow Texas One Call Laws)

C. Scheduling

1. For critical utility locations, City may choose to be present during excavation.
2. Alter schedule for location of existing utilities to accommodate City personnel.

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS

A. Report of Utility Location

1. Locations of identified utilities shall be reflected in the record plans.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

A. Verification of Conditions

1. Verify location of existing utilities in accordance with Division 1 and the Drawings.

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Exploratory Excavation

1. **Do not perform Exploratory Excavation on 12 inch and larger utilities.**

2. Verify location of **all** existing 10 inch and smaller utilities which cross or connect to proposed facilities for construction.
 - a. Acquire record documentation from and coordinate with utility companies as necessary to locate utility.
 - b. Expose to utility spring line.
 - c. Excavate and backfill trench for the Exploratory Excavation in accordance with Section 33 05 06.

B. Vacuum Excavation

1. Verify location of **all** existing 12 inch and larger utilities which cross or connect to proposed facilities for construction.
 - a. Designate the horizontal position of the existing underground utilities using geophysical prospecting equipment.
 - b. Acquire record documentation from and coordinate with utility companies as necessary to locate utility.
 - c. Perform excavation in general accordance with the recommended practices and procedures described in ASCE Publication CI/ASCE 38.
- C. Submit a report of the findings upon completion of location of existing utilities.
- D. Notify City for appropriate design modifications if location of utility is in conflict with the proposed facilities indicated in the Drawings.
- E. Place embedment and backfill in accordance with Section 33 05 06.
- F. Once necessary data is obtained, immediately restore surface to existing conditions to:
 1. Obtain a safe driving surface, if applicable
 2. Ensure the safety of the general public
 3. The satisfaction of the City
 4. Repair yards if in easement

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 06
PIPE BEDDING AND BACKFILL MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, Embedment and Backfill for:
 - a. Pressure Applications
 - 1) Water Distribution or Transmission Main
 - 2) Wastewater Force Main
 - 3) Reclaimed Water Main
 - b. Gravity Applications
 - 1) Wastewater Gravity Mains
 - 2) Storm Sewer Pipe and Culverts
 - 3) Storm Sewer Precast Box and Culverts
2. Including:
 - a. Excavation of all material encountered, including rock and unsuitable materials
 - b. Disposal of excess unsuitable material
 - c. Site specific trench safety
 - d. Pumping and dewatering
 - e. Embedment
 - f. Concrete encasement for utility lines
 - g. Backfill
 - h. Compaction

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 05 91 – Utility Marker Locators and Tracer Wire

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Trench Excavation, Embedment and Backfill associated with the installation of an underground utility or excavation

- a. Measurement

- 1) This Item is considered subsidiary to the installation of the utility pipe line as designated in the Drawings.

- b. Payment

- 1) The Work performed and the materials furnished in accordance with this Item are considered subsidiary to the installation of the utility pipe for the type of embedment and backfill as indicated on the plans. No other compensation will be allowed.

2. Imported Embedment or Backfill

- a. Measurement

- 1) Measured by the cubic yard as delivered to the site and recorded by truck ticket provided to the City Engineer.

- b. Payment

- 1) Imported embedment and backfill is considered incidental.
 - a) Various embedment/backfill materials.

3. Concrete Encasement for Utility Lines

- a. Measurement

- 1) Measured by the cubic yard per plan quantity.

- b. Payment

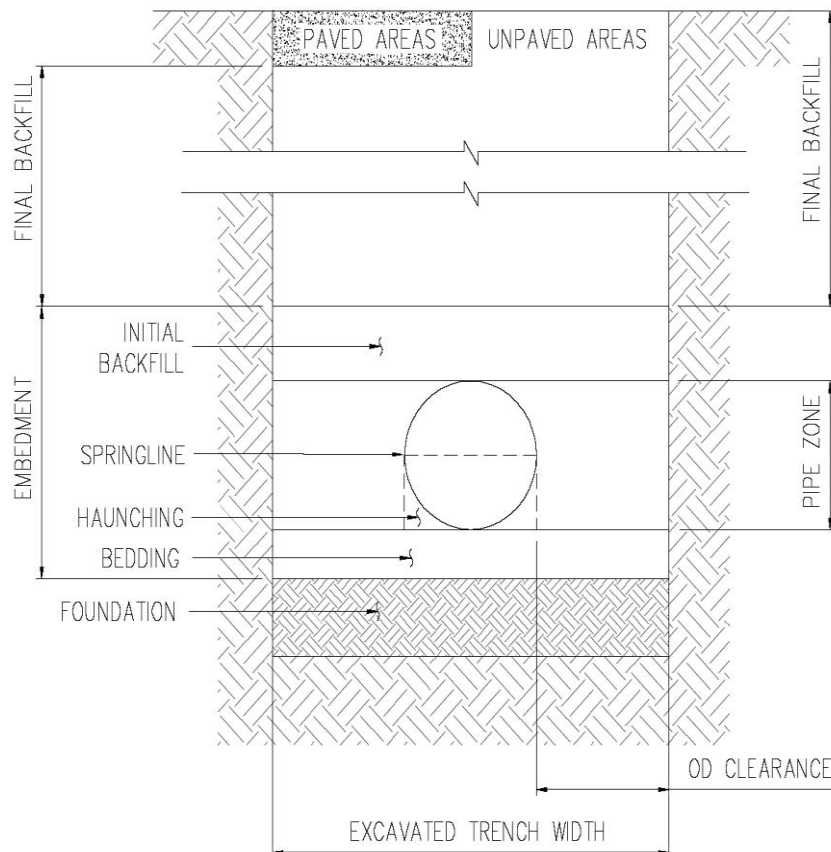
- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per cubic yard of "Concrete Encasement for Utility Lines" per plan quantity.
- c. The price bid shall include:
 - 1) Furnishing, hauling, placing and finishing concrete in accordance with Section 03 30 53.
 - 2) Clean-up
4. Ground Water Control
 - a. Measurement
 - 1) Measurement shall be lump sum when a ground water control plan is specifically required by the Contract Documents.
 - b. Payment
 - 1) Payment shall be per the lump sum price bid for "Ground Water Control" including:
 - a) Submittals
 - b) Additional Testing
 - c) Ground water control system installation
 - d) Ground water control system operations and maintenance
 - e) Disposal of water
 - f) Removal of ground water control system
5. Trench Safety
 - a. Measurement
 - 1) Measured per linear foot of excavation for all trenches that require trench safety in accordance with OSHA excavation safety standards (29 CFR Part 1926 Subpart P Safety and Health regulations for Construction)
 - b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of excavation to comply with OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), including, but not limited to, all submittals, labor and equipment.

1.3 REFERENCES

A. Definitions

1. General – Definitions used in this section are in accordance with Terminologies ASTM F412 and ASTM D8 and Terminology ASTM D653, unless otherwise noted.
2. Definitions for trench width, backfill, embedment, initial backfill, pipe zone, haunching bedding, springline, pipe zone and foundation are defined as shown in the following schematic:



3. Deleterious materials – Harmful materials such as clay lumps, silts and organic material
4. Excavated Trench Depth – Distance from the surface to the bottom of the bedding or the trench foundation
5. Final Backfill Depth
 - a. Unpaved Areas – The depth of the final backfill measured from the top of the initial backfill to the surface
 - b. Paved Areas – The depth of the final backfill measured from the top of the initial backfill to bottom of permanent or temporary pavement repair

B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM Standards:
 - a. ASTM C33-08 Standard Specifications for Concrete Aggregates
 - b. ASTM C88-05 Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
 - c. ASTM C136-01 Test Method for Sieve Analysis of Fine and Coarse Aggregate
 - d. ASTM D448-08 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - e. ASTM C535-09 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - f. ASTM D588 – Standard Test method for Moisture-Density Relations of Soil-Cement Mixture
 - g. ASTM D698-07 Test Method for Laboratory Compaction Characteristics of Soil Using Stand Efforts (12,400 ft-lb/ft³ 600 Kn-m/M³)).
 - h. ASTM D 1140 - Amount of Material in Soil Finer Than the No. 200 (75µm) Sieve.

- i. ASTM 1556 Standard Test Methods for Density and Unit Weight of Soils in Place by Sand Cone Method.
- j. ASTM 2487 – 10 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- k. ASTM 2321-09 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
- l. ASTM D2922 – Standard Test Methods for Density of Soils and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
- m. ASTM 3017 - Standard Test Method for Water Content of Soil and Rock in place by Nuclear Methods (Shallow Depth)
- n. ASTM D4254 - Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density
- o. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- p. ASTM D 4647 - Identification and Classification of Dispersive Clay Soils by the Pinhole Test.

3. OSHA

- a. Occupational Safety and Health Administration CFR 29, Part 1926-Safety Regulations for Construction, Subpart P - Excavations

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Utility Company Notification

- a. Notify area utility companies at least 48 hours in advance, excluding weekends and holidays, before starting excavation.
- b. Request the location of buried lines and cables in the vicinity of the proposed Work.

B. Sequencing

1. Sequence Work for each section of the pipe installed to complete the embedment and backfill placement on the day the pipe foundation is complete.
2. Sequence Work such that proctors are complete in accordance with ASTM D698 prior to commencement of construction activities.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the EOR prior to construction.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Shop Drawings
 1. Provide detailed drawings and explanation for ground water and surface water control, if required.
 2. Trench Safety Plan in accordance with Occupational Safety and Health Administration CFR 29, Part 1926-Safety Regulations for Construction, Subpart P - Excavations
 3. Stockpiled excavation and/or backfill material
 - a. Provide a description of the storage of the excavated material only if the Contract Documents do not allow storage of materials in the right-of-way of the easement.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage
 1. Within Existing Rights-of-Way (ROW)

- a. Spoil, imported embedment and backfill materials may be stored within existing ROW, easements or temporary construction easements, unless specifically disallowed in the Contract Documents.
- b. Do not block drainage ways, inlets or driveways.
- c. Store materials only in areas barricaded as provided in the traffic control plans.
- d. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.

2. Designated Storage Areas

- a. If the Contract Documents do not allow the storage of spoils, embedment or backfill materials within the ROW, easement or temporary construction easement, then secure and maintain an adequate storage location.
- b. Provide an affidavit that rights have been secured to store the materials on private property.
- c. Do not block drainage ways.
- d. Only materials used for 1 working day will be allowed to be stored in the Work zone.

B. Deliveries and haul-off - Coordinate all deliveries and haul-off.

1.11 FIELD [SITE] CONDITIONS

A. Existing Conditions

- 1. Any data which has been or may be provided on subsurface conditions is not intended as a representation or warranty of accuracy or continuity between soils. It is expressly understood that neither the City nor the Engineer will be responsible for interpretations or conclusions drawn there from by the Contractor.
- 2. Data is made available for the convenience of the Contractor.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Materials

1. Utility Sand

- a. Clean, Granular, and free flowing
- b. Reasonably free of mud, silt, clay lumps, clods, vegetation, or debris
- c. The material removed by decantation (Tex 406A) plus the weight of any clay lumps, shall not exceed 4.5% by weight.
- d. Gradation: sand material consisting of durable particles, free of thin or elongated pieces, lumps of clay, loam or vegetable matter and meets the following gradation may be used for utility sand embedment/backfill, and graded with following limits when tested in accordance with ASTM C136.

<u>Sieve Size</u>	<u>Percent Retained</u>
½"	0
¼"	0-5
#4	0-10
#16	0-20
#50	20-70
#100	60-90
#200	90-100

2. Crushed Rock

- a. Durable crushed rock or recycled concrete
- b. Meets the gradation of ASTM D448 size numbers 56, 57 or 67

- c. May be unwashed
 - d. Free from significant silt clay or unsuitable materials
 - e. Percentage of wear not more than 40 percent per ASTM C131 or C535
 - f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88
3. Fine Crushed Rock
- a. Durable crushed rock
 - b. Meets the gradation of ASTM D448 size numbers 8 or 89
 - c. May be unwashed
 - d. Free from significant silt clay or unsuitable materials.
 - e. Have a percentage of wear not more than 40 percent per ASTM C131 or C535
 - f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88
4. Ballast Stone
- a. Stone ranging from 3 inches to 6 inches in greatest dimension.
 - b. May be unwashed
 - c. Free from significant silt clay or unsuitable materials
 - d. Percentage of wear not more than 40 percent per ASTM C131 or C535
 - e. Not more than a 12 percent maximum loss when subjected to 5 cycles of sodium sulfate soundness per ASTM C88
5. Acceptable Backfill Material
- a. In-situ or imported soils classified as CL, CH, SC or GC in accordance with ASTM D2487
 - b. Free from deleterious materials, boulders over 6 inches in size and organics
 - c. Can be placed free from voids
 - d. Must have 20 percent passing the number 200 sieve

6. Blended Backfill Material

- a. In-situ soils classified as SP, SM, GP or GM in accordance with ASTM D2487
- b. Blended with in-situ or imported acceptable backfill material to meet the requirements of an Acceptable Backfill Material
- c. Free from deleterious materials, boulders over 6 inches in size and organics
- d. Must have 20 percent passing the number 200 sieve

7. Unacceptable Backfill Material

- a. In-situ soils classified as ML, MH, PT, OL or OH in accordance with ASTM D2487

8. Select Fill

- a. Classified as SC or CL in accordance with ASTM D2487
- b. Liquid limit less than 35
- c. Plasticity index between 8 and 20

9. Cement Stabilized Sand (CSS)

- a. Sand

- 1) Shall be clean and free of all foreign matter, and meeting the following gradation requirements:

Sieve Size	% Retained
1-1/4"	0-10
1/2"	10-20
3/8"	15-30
No. 4	30-65
No. 40	50-75

- a) Do not use material passing the No. 40 sieve with a plasticity index greater than 10 to a liquid limit greater than 35.

- b. Cement shall adhere to Section 03 30 53.
- c. Water
- d. Potable water, free of soils, acids, alkalis, organic matter or other deleterious substances. Water of doubtful quality shall be tested by briquette test to determine if it is equal to water of known satisfactory quality.
 - 1) Unless otherwise specified, use no less than 1.5 sacks of cement per ton of mixture.
 - 2) Use amount of water necessary to obtain optimum moisture content for mechanical tamping.
 - 3) Mix cement, and, and water in a mill type mixer.
- e. Cement stabilized sand shall not be used after it loses its moisture content, or after it has obtained an initial set. Material not in place within 4 hours shall be rejected.

10. Controlled Low Strength Material (CLSM)

- a. Conform to Section 03 34 13

11. Trench Geotextile Fabric

- a. Soils other than ML or OH in accordance with ASTM D2487
 - 1) Needle punch, nonwoven geotextile composed of polypropylene fibers
 - 2) Fibers shall retain their relative position
 - 3) Inert to biological degradation
 - 4) Resist naturally occurring chemicals
 - 5) UV Resistant
 - 6) Mirafi 140N by Tencate, or approved equal
- b. Soils Classified as ML or OH in accordance with ASTM D2487
 - 1) High-tenacity monofilament polypropylene woven yarn

- 2) Percent open area of 8 percent to 10 percent
- 3) Fibers shall retain their relative position
- 4) Inert to biological degradation
- 5) Resist naturally occurring chemicals
- 6) UV Resistant
- 7) Mirafi FW402 by Tencate, or approved equal

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

A. Verification of Conditions

1. Review all known, identified or marked utilities, whether public or private, prior to excavation.
2. Locate and protect all known, identified and marked utilities or underground facilities as excavation progresses.
3. Notify all utility owners within the project limits 48 hours prior to beginning excavation.
4. The information and data shown in the Drawings with respect to utilities is approximate and based on record information or on physical appurtenances observed within the project limits.
5. Coordinate with the Owner(s) of underground facilities.
6. Immediately notify any utility owner of damages to underground facilities resulting from construction activities.
7. Repair any damages resulting from the construction activities.

- B. Notify the City immediately of any changed condition that impacts excavation and installation of the proposed utility.

3.3 PREPARATION

A. Protection of In-Place Conditions

1. Pavement

- a. Conduct activities in such a way that does not damage existing pavement that is designated to remain.
 - 1) Where desired to move equipment not licensed for operation on public roads or across pavement, provide means to protect the pavement from all damage.
- b. Repair or replace any pavement damaged due to the negligence of the contractor outside the limits designated for pavement removal at no additional cost to the City.

2. Drainage

- a. Maintain positive drainage during construction and re-establish drainage for all swales and culverts affected by construction.

3. Trees

- a. When operating outside of existing ROW, stake permanent and temporary construction easements.
- b. Restrict all construction activities to the designated easements and ROW.
- c. Flag and protect all trees designated to remain.
- d. Conduct excavation, embedment and backfill in a manner such that there is no damage to the tree canopy.
- e. Prune or trim tree limbs as specifically allowed by the Drawings or as specifically allowed by the City.
 - 1) Pruning or trimming may only be accomplished with equipments specifically designed for tree pruning or trimming.
- f. Remove trees specifically designated to be removed in the Drawings.

4. Above ground Structures

- a. Protect all above ground structures adjacent to the construction.
- b. Remove above ground structures designated for removal in the Drawings.

5. Traffic

- a. Maintain existing traffic, except as modified by the traffic control plan.
- b. Do not block access to driveways or alleys for extended periods of time unless:
 - 1) Alternative access has been provided
 - 2) Proper notification has been provided to the property owner or resident
 - 3) It is specifically allowed in the traffic control plan
- c. Use traffic rated plates to maintain access until access is restored.

6. Traffic Signal – Poles, Mast Arms, Pull boxes, Detector loops

- a. Notify Streets and Traffic a minimum of 48 hours prior to any excavation that could impact the operations of an existing traffic signal.
- b. Protect all traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops.
- c. Immediately notify Streets and Traffic if any damage occurs to any component of the traffic signal due to the contractors activities.
- d. Repair any damage to the traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops as a result of the construction activities.

7. Fences

- a. Protect all fences designated to remain.
- b. Leave fence in the equal or better condition as prior to construction.

3.4 INSTALLATION

A. Excavation

- 1. Excavate to a depth indicated on the Drawings.

2. Trench excavations are defined as unclassified. No additional payment shall be granted for rock or other in-situ materials encountered in the trench.
3. Excavate to a width sufficient for laying the pipe in accordance with the Drawings and bracing in accordance with the Excavation Safety Plan.
4. The bottom of the excavation shall be firm and free from standing water.
 - a. Notify the City immediately if the water and/or the in-situ soils do not provide for a firm trench bottom.
 - b. The City will determine if any changes are required in the pipe foundation or bedding.
5. Unless otherwise permitted by the Drawings or by the City, the limits of the excavation shall not advance beyond the pipe placement so that the trench may be backfilled in the same day.
6. Over Excavation
 - a. Fill over excavated areas with the specified bedding material as specified for the specific pipe to be installed.
 - b. No additional payment will be made for over excavation or additional bedding material.
7. Unacceptable Backfill Materials
 - a. In-situ soils classified as unacceptable backfill material shall be separated from acceptable backfill materials.
 - b. If the unacceptable backfill material is to be blended in accordance with this Specification, then store material in a suitable location until the material is blended.
 - c. Remove all unacceptable material from the project site that is not intended to be blended or modified.
8. Rock – No additional compensation will be paid for rock excavation or other changed field conditions.

B. Shoring, Sheet piling and Bracing

1. Engage a Licensed Professional Engineer in the State of Texas to design a site specific excavation safety system in accordance with Federal and State requirements. System shall be accepted by the City prior to start of excavation.
2. Excavation protection systems shall be designed according to the space limitations as indicated in the Drawings.
3. Furnish, put in place and maintain a trench safety system in accordance with the Excavation Safety Plan and required by Federal, State or local safety requirements.
4. If soil or water conditions are encountered that are not addressed by the current Excavation Safety Plan, engage a Licensed Professional Engineer in the State of Texas to modify the Excavation Safety Plan and provide a revised submittal to the City.
5. Do not allow soil, or water containing soil, to migrate through the Excavation Safety System in sufficient quantities to adversely affect the suitability of the Excavation Protection System. Movable bracing, shoring plates or trench boxes used to support the sides of the trench excavation shall not:
 - a. Disturb the embedment located in the pipe zone or lower
 - b. Alter the pipe's line and grade after the Excavation Protection System is removed
 - c. Compromise the compaction of the embedment located below the spring line of the pipe and in the haunching

C. Water Control

1. Surface Water
 - a. Furnish all materials and equipment and perform all incidental Work required to direct surface water away from the excavation.
2. Ground Water
 - a. Furnish all materials and equipment to dewater ground water by a method which preserves the undisturbed state of the subgrade soils.
 - b. Do not allow the pipe to be submerged within 24 hours after placement.

- c. Do not allow water to flow over concrete until it has sufficiently cured.
- d. Engage a Licensed Engineer in the State of Texas to prepare a Ground Water Control Plan if any of the following conditions are encountered:
 - 1) A Ground Water Control Plan is specifically required by the Contract Documents
 - 2) If in the sole judgment of the City, ground water is so severe that an Engineered Ground Water Control Plan is required to protect the trench or the installation of the pipe which may include:
 - a) Ground water levels in the trench are unable to be maintained below the top of the bedding
 - b) A firm trench bottom cannot be maintained due to ground water
 - c) Ground water entering the excavation undermines the stability of the excavation.
 - d) Ground water entering the excavation is transporting unacceptable quantities of soils through the Excavation Safety System.
- e. In the event that there is no bid item for a Ground Water Control and the City requires an Engineered Ground Water Control Plan due to conditions discovered at the site, the contractor will be eligible to submit a change order.
- f. Control of ground water shall be considered subsidiary to the excavation when:
 - 1) No Ground Water Control Plan is specifically identified and required in the Contract Documents
- g. Ground Water Control Plan installation, operation and maintenance
 - 1) Furnish all materials and equipment necessary to implement, operate and maintain the Ground Water Control Plan.
 - 2) Once the excavation is complete, remove all ground water control equipment not called to be incorporated into the Work.
- h. Water Disposal
 - 1) Dispose of ground water in accordance with City policy or Ordinance.

- 2) Do not discharge ground water onto or across private property without written permission.
- 3) Permission from the City is required prior to disposal into the Sanitary Sewer.
- 4) Dispose of water in accordance with NPDES permit and SWPPP.
- 5) Disposal shall not violate any Federal, State or local regulations.

D. Embedment and Pipe Placement

1. Water Lines less than, or equal to, 12 inches in diameter:
 - a. The entire embedment zone shall be of uniform material.
 - b. Utility sand shall be generally used for embedment.
 - c. If ground water is in sufficient quantity to cause sand to pump, then use crushed rock as embedment.
 - 1) If crushed rock is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
 - d. Place evenly spread bedding material on a firm trench bottom.
 - e. Provide firm, uniform bedding.
 - f. Place pipe on the bedding in accordance with the alignment of the Drawings.
 - g. In no case shall the top of the pipe be less than 36 inches from the surface of the proposed grade, unless specifically called for in the Drawings.
 - h. Place embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
 - i. Where gate valves are present, the initial backfill shall extend to 6 inches above the elevation of the valve nut.
 - j. Form all blocking against undisturbed trench wall to the dimensions in the Drawings.
 - k. Compact embedment and initial backfill.

- l. Place marker tape on top of the initial trench backfill in accordance with Section 33 05 91.
2. Water Lines 16-inches through 24-inches in diameter:
 - a. The entire embedment zone shall be of uniform material.
 - b. Utility sand may be used for embedment when the excavated trench depth is less than 15 feet deep.
 - c. Crushed rock or fine crushed rock shall be used for embedment for excavated trench depths 15 feet, or greater.
 - d. Crushed rock shall be used for embedment for steel pipe.
 - e. Provide trench geotextile fabric at any location where crushed rock or fine crushed rock come into contact with utility sand
 - f. Place evenly spread bedding material on a firm trench bottom.
 - g. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
 - h. Place pipe on the bedding according to the alignment shown on the Drawings.
 - i. The pipe line shall be within:
 - 1) ± 3 inches of the elevation on the Drawings for 16-inch and 24-inch water lines
 - j. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
 - k. Place remaining embedment including initial backfill to a minimum of 6 inches, but not more than 12 inches, above the pipe.
 - l. Where gate valves are present, the initial backfill shall extend to up to the valve nut.

- m. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
 - n. Density test may be performed by City to verify that the compaction of embedment meets requirements.
 - o. Place trench geotextile fabric on top of the initial backfill.
3. Water Lines 30-inches and greater in diameter
- a. The entire embedment zone shall be of uniform material.
 - b. Crushed rock shall be used for embedment.
 - c. Provide trench geotextile fabric at any location where crushed rock or fine crushed rock come into contact with utility sand.
 - d. Place evenly spread bedding material on a firm trench bottom.
 - e. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
 - f. Place pipe on the bedding according to the alignment shown on the Drawings.
 - g. The pipe line shall be within:
 - 1) ± 1 inch of the elevation on the Drawings for 30-inch and larger water lines
 - h. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
 - i. For steel pipe greater than 30 inches in diameter, the initial embedment lift shall not exceed the spring line prior to compaction.
 - j. Place remaining embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
 - k. Where gate valves are present, the initial backfill shall extend to up to the valve nut.

- l. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
 - m. Density test may be performed by City to verify that the compaction of embedment meets requirements.
 - n. Place trench geotextile fabric on top of the initial backfill.
 - o. Place marker tape on top of the trench geotextile fabric in accordance with Section 33 05 91.
4. Sanitary Sewer Lines and Storm Sewer Lines (HDPE)
- a. The entire embedment zone shall be of uniform material.
 - b. Crushed rock shall be used for embedment.
 - c. Place evenly spread bedding material on a firm trench bottom.
 - d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipe line.
 - e. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
 - f. Place pipe on the bedding according to the alignment shown in the Drawings.
 - g. The pipe line shall be within ± 0.1 inches of the elevation, and be consistent with the grade shown on the Drawings.
 - h. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
 - i. For sewer lines greater than 30 inches in diameter, the embedment lift shall not exceed the spring line prior to compaction.
 - j. Place remaining embedment including initial backfill to a minimum of 6 inches, but not more than 12 inches, above the pipe.

- k. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
 - l. Density test may be performed by City to verify that the compaction of embedment meets requirements.
 - m. Place trench geotextile fabric on top of the initial backfill.
 - n. Place marker tape on top of the trench geotextile fabric in accordance with Section 33 05 91.
5. Storm Sewer (RCP)
- a. The bedding and the pipe zone up to the spring line shall be of uniform material.
 - b. Crushed rock shall be used for embedment up to the spring line.
 - c. The specified backfill material may be used above the spring line.
 - d. Place evenly spread bedding material on a firm trench bottom.
 - e. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipe line.
 - f. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
 - g. Place pipe on the bedding according to the alignment of the Drawings.
 - h. The pipe line shall be within ± 0.1 inches of the elevation, and be consistent with the grade, shown on the Drawings.
 - i. Place embedment material up to the spring line.
 - 1) Place embedment to ensure that adequate support is obtained in the haunch.

- j. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
- k. Density test may be performed by City to verify that the compaction of embedment meets requirements.
- l. Place trench geotextile fabric on top of pipe and crushed rock.

6. Storm Sewer Reinforced Concrete Box

- a. Crushed rock shall be used for bedding.
- b. The pipe zone and the initial backfill shall be:
 - 1) Crushed rock, or
 - 2) Acceptable backfill material compacted to 95 percent Standard Proctor density
- c. Place evenly spread compacted bedding material on a firm trench bottom.
- d. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipe line.
- e. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
- f. Fill the annular space between multiple boxes with crushed rock, CLSM.
- g. Place pipe on the bedding according to the alignment of the Drawings.
- h. The pipe shall be within ± 0.1 inches of the elevation, and be consistent with the grade, shown on the Drawings.
- i. Compact the embedment initial backfill to 95 percent Standard Proctor ASTM D698.

7. Water Services (Less than 2 Inches in Diameter)

- a. The entire embedment zone shall be of uniform material.
- b. Utility sand shall be generally used for embedment.
- c. Place evenly spread bedding material on a firm trench bottom.
- d. Provide firm, uniform bedding.
- e. Place pipe on the bedding according to the alignment of the Plans.
- f. Compact the initial backfill to 95 percent Standard Proctor ASTM D698.

8. Sanitary Sewer Services

- a. The entire embedment zone shall be of uniform material.
- b. Crushed rock shall be used for embedment.
- c. Place evenly spread bedding material on a firm trench bottom.
- d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipe line.
- e. Provide firm, uniform bedding.
 - 1) Additional bedding may be required if ground water is present in the trench.
 - 2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
- f. Place pipe on the bedding according to the alignment of the Drawings.
- g. Place remaining embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
- h. Compact the initial backfill to 95 percent Standard Proctor ASTM D698.
- i. Density test may be required to verify that the compaction meets the density requirements.

E. Trench Backfill

1. At a minimum, place backfill in such a manner that the required in-place density and moisture content is obtained, and so that there will be no damage to the surface, pavement or structures due to any trench settlement or trench movement.
 - a. Meeting the requirement herein does not relieve the responsibility to damages associated with the Work.
2. Backfill Material
 - a. Final backfill depth less than 15 feet
 - 1) Backfill with:
 - a) Acceptable backfill material
 - b) Blended backfill material, or
 - c) Select backfill material, CSS, or CLSM when specifically required
 - b. Final backfill depth 15 feet or greater: (under pavement or future pavement)
 - 1) Backfill depth from 0 to 15 feet deep
 - a) Backfill with:
 - (1) Acceptable backfill material
 - (2) Blended backfill material, or
 - (3) Select backfill material, CSS, or CLSM when specifically required
 - 2) Backfill depth from 15 feet and greater
 - a) Backfill with:
 - (1) Select Fill
 - (2) CSS, or
 - (3) CLSM when specifically required
 - c. Final backfill depth 15 feet or greater: (not under pavement or future pavement)
 - 1) Backfill with:
 - a) Acceptable backfill material, or

b) Blended backfill material

d. Backfill for service lines:

- 1) Backfill for water or sewer service lines shall be the same as the requirement of the main that the service is connected to.

3. Required Compaction and Density

a. Final backfill (depths less than 15 feet)

- 1) Compact acceptable backfill material, blended backfill material or select backfill to a minimum of 95 percent Standard Proctor per ASTM D698 at moisture content within -2 to +5 percent of the optimum moisture.
- 2) CSS or CLSM requires no compaction.

b. Final backfill (depths 15 feet and greater/under existing or future pavement)

- 1) Compact select backfill to a minimum of 98 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.
- 2) CSS or CLSM requires no compaction.

c. Final backfill (depths 15 feet and greater/not under existing or future pavement)

- 1) Compact acceptable backfill material blended backfill material, or select backfill to a minimum of 95 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.

4. Saturated Soils

- a. If in-situ soils consistently demonstrate that they are greater than 5 percent over optimum moisture content, the soils are considered saturated.
- b. Flooding the trench or water jetting is strictly prohibited.
- c. If saturated soils are identified in the Drawings or Geotechnical Report in the Appendix, Contractor shall proceed with Work following all backfill procedures outlined in the Drawings for areas of soil saturation greater than 5 percent.

d. If saturated soils are encountered during Work but not identified in Drawings or Geotechnical Report in the Appendix:

1) The Contractor shall:

- a) Immediately notify the City.
- b) Submit a Contract Claim for Extra Work associated with direction from City.

2) The City shall:

- a) Investigate soils and determine if Work can proceed in the identified location.
- b) Direct the Contractor of changed backfill procedures associated with the saturated soils that may include:
 - (1) Imported backfill
 - (2) A site specific backfill design

5. Placement of Backfill

- a. Use only compaction equipment specifically designed for compaction of a particular soil type and within the space and depth limitation experienced in the trench.
- b. Flooding the trench or water setting is strictly prohibited.
- c. Place in loose lifts not to exceed 12 inches.
- d. Compact to specified densities.
- e. Compact only on top of initial backfill, undisturbed trench or previously compacted backfill.
- f. Remove any loose materials due to the movement of any trench box or shoring or due to sloughing of the trench wall.
- g. Install appropriate tracking balls for water and sanitary sewer trenches in accordance with Section 33 05 91.

6. Backfill Means and Methods Demonstration

- a. Notify the City in writing with sufficient time for the City to obtain samples and perform standard proctor test in accordance with ASTM D698.
 - b. The results of the standard proctor test must be received prior to beginning excavation.
 - c. Upon commencing of backfill placement for the project the Contractor shall demonstrate means and methods to obtain the required densities.
 - d. Demonstrate Means and Methods for compaction including:
 - 1) Depth of lifts for backfill which shall not exceed 12 inches
 - 2) Method of moisture control for excessively dry or wet backfill
 - 3) Placement and moving trench box, if used
 - 4) Compaction techniques in an open trench
 - 5) Compaction techniques around structure
 - e. Provide a testing trench box to provide access to the recently backfilled material.
 - f. The City will provide a qualified testing lab full time during this period to randomly test density and moisture content.
 - 1) The testing lab will provide results as available on the job site.
7. Varying Ground Conditions
- a. Notify the City of varying ground conditions and the need for additional proctors.
 - b. Request additional proctors when soil conditions change.
 - c. The City may acquire additional proctors at its discretion.
 - d. Significant changes in soil conditions will require an additional Means and Methods demonstration.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Proctors

- a. The City will perform Proctors in accordance with ASTM D698.
- b. Test results will generally be available to within 4 calendar days and distributed to:
 - 1) Contractor
 - 2) City Project Manager
 - 3) City Inspector
 - 4) Engineer
- c. Notify the City if the characteristic of the soil changes.
- d. City will perform new proctors for varying soils:
 - 1) When indicated in the geotechnical investigation in the Appendix
 - 2) If notified by the Contractor
 - 3) At the convenience of the City
- e. Trenches where different soil types are present at different depths, the proctors shall be based on the mixture of those soils.

2. Density Testing of Backfill

- a. Density Tests shall be in conformance with ASTM D2922.
- b. Provide a testing trench protection for trench depths in excess of 5 feet.
- c. Place, move and remove testing trench protection as necessary to facilitate all test conducted by the City.
- d. Make the excavation available for testing.

- e. The City will determine the location of the test.
- f. The City hires a third-party for testing and will provide results to Contractor and the City's Inspector upon completion of the testing.
- g. Test reports shall include:
 - 1) Location of test by station number
 - 2) Time and date of test
 - 3) Depth of testing
 - 4) Field moisture
 - 5) Dry density
 - 6) Proctor identifier
 - 7) Percent Proctor Density

3. Density of Embedment

- a. Storm sewer boxes that are embedded with acceptable backfill material, blended backfill material, cement modified backfill material or select material will follow the same testing procedure as backfill.
- b. The City may test fine crushed rock or crushed rock embedment in accordance with ASTM D2922 or ASTM 1556.

B. Non-Conforming Work

- 1. All non-conforming Work shall be removed and replaced.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 19
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ductile Iron Pipe 3-inch through 64-inch for potable water, wastewater, and reuse applications.
 - 2. Ductile Iron Fittings 3-inch through 64-inch for potable water, wastewater, and reuse applications for use with Ductile Iron Pipe (all sizes) and C900 Polyvinyl Chloride (PVC) Pipe (4-inch through 12-inch).
 - 3. Mechanical wedge type retainer glands.
 - 4. Ductile Iron external joint restraint harness for 4-inch through 12-inch C900 PVC Pipe.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 13 – Sanitary and Storm Sewer Cleaning
 - 2. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection
 - 3. Section 33 05 06 – Pipe Bedding and Backfill Material
 - 4. Section 33 05 22 – Nuts, Bolts, and Gaskets

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Ductile Iron Pipe
 - a. Measurement
 - 1) Measured horizontally along the ground surface from center line to center line of fitting, manhole, or appurtenance of Ductile Iron Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Ductile Iron Pipe” installed for:
 - a) Various sizes.
 - b) Various types of backfill.
 - c) Various linings.
 - c. The price bid shall include:
 - 1) Furnishing and installing Ductile Iron Pipe as specified by the Drawings
 - 2) Polyethylene encasement
 - 3) Lining
 - 4) Coating
 - 5) Pavement Removal
 - 6) Excavation
 - 7) Hauling

- 8) Disposal of excess material
 - 9) Furnishing, placement and compaction of embedment
 - 10) Furnishing, placement and compaction of backfill
 - 11) Clay Dams
 - 12) Thrust restraint
 - 13) Ductile Iron Fittings with Restraint
 - 14) Bolts and nuts
 - 15) Gaskets
 - 16) Clean-up
 - 17) Cleaning
 - 18) Disinfection
 - 19) Testing
2. Ductile Iron Fittings with Restraint
 - a. Measurement
 - 1) This item is considered subsidiary to Ductile Iron Pipe, HDPE pipe, Polyvinyl Chloride (PVC) or any other water Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per linear foot of Ductile Iron Pipe, HDPE pipe, Polyvinyl Chloride (PVC) or any other water pipe installed.

1.3 REFERENCES

A. Abbreviations

1. DFT – Dry Film Thickness

B. Definitions

1. Gland or Follower Gland
 - a. Non-restrained, mechanical joint fitting
2. Retainer Gland
 - a. Mechanically restrained mechanical joint fitting, consisting of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
3. ASTM International (ASTM):
 - a. A536, Standard Specification for Ductile Iron Castings.
 - b. A674, Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
4. American Water Works Association (AWWA):
 - a. M41, Ductile-Iron Pipe and Fittings.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C104/A21.4, Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.

- b. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - c. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
 - d. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - e. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - f. C150/A21.50, Thickness Design of Ductile-Iron Pipe.
 - g. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - h. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
 - i. C600, Installation of Ductile-Iron Water Mains and their Appurtenances.
6. International Organization for Standardization (ISO):
- a. 8179-1, Ductile Iron Pipes, Fittings, Accessories and their Joints – External Zinc-Based Coating – Part 1: Metallic Zinc with Finishing Layer.
7. NSF International (NSF):
- a. 61, Drinking Water System Components - Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.
8. Society for Protective Coatings (SSPC):
- a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to fabrication and delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Ductile Iron Pipe
 - a. Pressure or special thickness class
 - b. Interior lining
 - c. Exterior coating
 - d. Joint type
 - 2. Ductile Iron Fittings
 - a. Pressure class
 - b. Interior lining
 - c. Exterior coating
 - d. Joint type
 - 3. Polyethylene encasement and tape
 - a. Planned method of installation
 - b. Polyethylene type
 - c. Polyethylene thickness
 - 4. Interior Lining
 - a. If other than cement mortar lining in accordance with AWWA/ANSI C104/A21.4, provide:
 - 1) Material.
 - 2) Application Recommendations.
 - 3) Field touch-up procedures.

5. Thrust Restraint
 - a. Retainer glands
 - b. PVC joint harnesses
 - c. Other means
6. Gaskets
 - a. In accordance with Section 33 05 22.
7. Bolts and Nuts
 - a. Mechanical Joints
 - 1) Provide bolts and nuts in accordance with Section 33 05 22.
 - b. Flanged Joints
 - 1) In accordance with AWWA/ANSI C115/A21.15.
 - 2) Provide bolts and nuts in accordance with Section 33 05 22.
1. Flange Coatings
 - a. Connections to Steel Flanges
 - 1) Coat buried connections with steel flanges with a Petrolatum Tape System.

B. Shop Drawings

1. For 16-inch and 20-inch diameter Ductile Iron Pipe used in the water distribution system or wastewater force mains, provide:
 - a. Thrust restraint calculations for all fittings, valves and deflections sealed by a Professional Engineer Licensed in Texas.
 - b. Lay schedule sealed by a Professional Engineer Licensed in Texas including:
 - 1) Pipe class
 - 2) Joint type
 - 3) Fittings
 - 4) Stationing
 - 5) Transitions
 - 6) Joint deflection
2. For 24-inch and greater diameter Ductile Iron Pipe used in the water distribution system or wastewater force mains, provide:
 - a. Wall thickness design calculations sealed by a Professional Engineer Licensed in Texas including:
 - 1) Working Pressure
 - 2) Surge Pressure
 - 3) Deflection
 - b. Thrust restraint calculations for all fittings, valves, and deflections sealed by a Professional Engineer Licensed in Texas.
 - c. Lay drawings (with schedule) sealed by a Professional Engineer Licensed in Texas including:
 - 1) Pipe class
 - 2) Joint type
 - 3) Fittings
 - 4) Stationing
 - 5) Transitions
 - 6) Joint deflection

C. Certificates

1. Furnish an affidavit certifying the Ductile Iron Pipe meets the provisions of this Section, all inspections have been made, and that all tests have been performed in accordance with AWWA/ANSI C151/A21.51.
2. Furnish an affidavit certifying the Ductile Iron Fittings meet the provisions of this Section and meet the requirements of AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
 - a. Finished pipe shall be the product of 1 manufacturer.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
 - b. Pipe manufacturing operations (pipe, lining, and coatings) shall be performed under the control of the manufacturer.
 - c. Fittings manufacturing operations (fittings, lining, and coatings) shall be performed under the control of the manufacturer.
 - d. Ductile Iron Pipe
 - 1) Manufactured in accordance with AWWA/ANSI C151/A21.51
 - a) Perform quality control tests and maintain results as outlined within standard to assure compliance.
 - b) Hydrostatically test each pipe segment to 500 psi for a minimum duration of 10 seconds.
 - e. Ductile Iron Fittings
 - 1) Manufactured in accordance with AWWA/ANSI C110/A21.10 or AWWA/ANSI C153/A21.53.
 - a) Perform quality control tests and maintain results as outlined within standards to assure compliance.

B. Preconstruction Testing

1. The City may, at its own cost, subject random lengths of pipe and random fittings for testing by an independent laboratory for compliance with this Section.
 - a. The compliance test will be performed in the United States.
 - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Store and handle in accordance with the guidelines as stated in AWWA M41.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Standard Product List
 - a. See “League City Standard Product List” for approved manufacturers.

B. Ductile Iron Pipe

1. In accordance with AWWA/ANSI C111/A21.11, AWWA/ANSI C150/A21.15 and AWWA/ANSI C151/A21.51.
2. All pipe shall meet the requirements of NSF 61 and 372.
3. Pipe shall have a lay length of 18 feet or 20 feet except for special fittings or closure pieces and as necessary to comply with the Drawings.
4. As a minimum the following pipe classes apply. The Drawings or the pressure and deflection design criteria may require a higher wall thickness, but in no case should the pipe classes be less than the following:

Nominal Diameter (inches)	Min Pipe Class
3 through 24	Special Thickness Class 52
30 through 64	Pressure Class 350

5. Pipe markings shall meet the minimum requirements of AWWA/ANSI C151/A21.51. Minimum pipe markings shall be as follows:
 - a. “DI” or “Ductile” shall be clearly labeled on each pipe
 - b. Weight, pressure, or special thickness class, and nominal thickness of each pipe
 - c. Year and country pipe was cast
 - d. Manufacturer’s mark
 - e. Blue striping for water applications and green striping for wastewater applications
6. Pressure and Deflection Design
 - a. Pipe design shall be based on trench conditions, design pressure and as specified in the Drawings.
 - b. Pipe shall be designed according to the methods indicated in AWWA/ANSI C150/A21.50, AWWA/ANSI C151/A21.51, and AWWA M41 for trench construction, using the following parameters:
 - 1) Unit Weight of Fill (w) = 130 pcf
 - 2) Live Load
 - a) Cooper E-80 for railroad crossings
 - b) AASHTO HS-20 for all other installations
 - 3) Trench Depth = 12 feet minimum or as indicated in Drawings

- 4) Bedding Conditions = Type 4
- 5) Working Pressure (P_w) = 150 psi
- 6) Surge Allowance (P_s) = 100 psi
- 7) Design Internal Pressure (P_i) = $P_w + P_s$ or 2:1 safety factor of the actual working pressure plus the actual surge pressure, whichever is greater.
 - a) Test Pressure
 - (1) No less than 1.25 minimum times the stated working pressure (187.5 psi minimum) of the pipeline measured at the highest elevation along the test section.
 - (2) No less than 1.5 times the stated working pressure (225 psi minimum) at the lowest elevation of the test section.
 - 8) Maximum Calculated Deflection (D_x) = 3 percent
- c. Trench depths shall be verified after existing utilities are located.
 - 1) Vertical alignment changes required because of existing utility or other conflicts shall be accommodated by an appropriate change in pipe design depth.
 - 2) In no case shall pipe be installed deeper than its design allows.
7. Provisions for Thrust
 - a. Mechanically restrain all bends, tees, plugs, or other fittings with retainer glands in accordance with this Section.
 - b. Restrain all joints within casing pipe.
 - c. No thrust restraint contribution allowed for the restrained length of pipe within the casing.
 - d. Utilize restrained joints for a sufficient distance from each side of the bend, tee, plug, valve, or other fitting to resist thrust developed at the design pressure of the pipe. For the purpose of thrust, the following shall apply:
 - 1) Calculate valves as dead ends.
 - 2) Restrained Joint Safety Factor (S_f) = 1.5
 - 3) Design Internal Pressure (P_i) = $P_w + P_s$
 - a) P_w = 150 psi and P_s = 100 psi, or
 - b) 2:1 safety factor of the actual working pressure plus the actual surge pressure, whichever is greater.
 - 4) Restrained joints consist of approved mechanical restrained or push-on restrained joints as listed in this Section.
 - 5) The distance for thrust restraint shown on the Drawings is the minimum restraint and does not relieve the manufacturer from calculating the restraint needs as specified herein.
 - a) In no case shall the restrained distance be less than indicated on the Drawings.
 - e. Thrust restraint design
 - 1) The length of pipe with restrained joints to resist thrust forces shall be the complete responsibility of the pipe manufacturer in accordance with AWWA M41 and the following:
 - a) Calculate the weight of earth (W_e) as the weight of the projected soil prism above the pipe.
 - (1) Soil Density
 - (a) Unsaturated soil conditions = 110 pounds per cubic foot (maximum value to be used)
 - (b) Locations with groundwater = buoyant weight for the backfill below the water table

8. Joints
 - a. In accordance with AWWA/ANSI C111/A21.11.
 - b. Push-On Joints
 - c. Mechanical Joints
 - d. Push-On Restrained Joints
 - 1) Restraining Push-on joints by means of a special gasket is not permitted
 - 2) Push-on Restrained Joint bell and spigot
 - a) Only those products listed in this Section.
 - b) Pressure rating shall exceed the working and test pressure of the pipe line.
 - e. Flanged Joints
 - 1) In accordance with AWWA/ANSI C115/A21.15 and ASME B16.1, Class 125.
 - f. Flange bolt circles and bolt holes in accordance with ASME B16.1, Class 125.
 - g. Field fabricated flanges are prohibited.
9. Exterior Coatings
 - a. 12-inch and smaller Ductile Iron Pipe:
 - 1) Minimum 1-mil thick asphaltic coating.
 - b. 16-inch and larger Ductile Iron Pipe:
 - 1) Minimum 200 grams per square meter application of metallic zinc in accordance with ISO 8179-1.
 - 2) Minimum 1-mil thick asphaltic finishing layer.
10. Interior Lining
 - a. Cement Mortar Lining
 - 1) Line all Ductile Iron Pipe for potable water with a cement mortar lining.
 - a) In accordance with AWWA/ANSI C104/A21.04, NSF 61, and 372.
 - b. Ceramic Epoxy or Epoxy Linings
 - 1) Line all Ductile Iron Pipe for use in wastewater applications with a ceramic epoxy or epoxy lining.
 - 2) Apply lining at minimum of 40 mils DFT.
 - 3) Due to the tolerances involved, the gasket area, and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum, using a joint compound as supplied by the manufacturer.
 - a) Apply the joint compound by brush to ensure coverage.
 - b) Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends.
 - c) Coat the gasket seat and spigot ends after the application of the lining.
 - 4) Surface preparation shall be in accordance with the manufacturer's recommendations.
 - 5) Check thickness using a magnetic film thickness gauge in accordance with the method outlined in SSPC PA 2.
 - 6) Test the interior lining of all pipe barrels for pinholes with a non-destructive 2,500-volt test.
 - a) Repair any defects prior to shipment.
 - 7) Mark each fitting with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his Work.
 - 8) For all Ductile Iron Pipe in wastewater service where the pipe has been cut, coat the exposed surface with the touch-up material as recommended by the manufacturer
 - a) The touch-up material and the lining shall be of the same manufacturer.

C. Ductile Iron Fittings

1. In accordance with AWWA/ANSI C110/A21.10 and AWWA/ANSI C153/A21.53.
2. All fittings for potable water service shall be in accordance with NSF 61 and 372.
3. Ductile Iron Fittings, at a minimum, shall meet or exceed the pressures rating of the pipe which the fitting is connected, unless specifically indicated in the Drawings.
4. Fitting body types shall be as indicated below:

Nominal Diameter (inches)	Allowable Fitting Body Type
12" and Smaller	AWWA C153 (Compact Body) AWWA C110 (Full Body)
16" and Larger	AWWA C110 (Full Body)

5. Fittings Markings
 - a. Meet the minimum requirements of AWWA/ANSI C151/A21.51.
 - b. Minimum markings shall include:
 - 1) "DI" or "Ductile" cast or metal stamped on each fitting
 - 2) Applicable AWWA/ANSI standard for that the fitting
 - 3) Pressure rating
 - 4) Number of degrees for all bends
 - 5) Nominal diameter of the openings
 - 6) Year and country fitting was cast
 - 7) Manufacturer's mark
6. Joints
 - a. Mechanical Joints with mechanical restraint
 - 1) In accordance with AWWA/ANSI C111/A21.11 and applicable parts of ANSI/AWWA C110/A21.10.
 - 2) Minimum retainer gland rated working pressure:
 - a) Ductile Iron Pipe
 - (1) 3-inch – 16-inch, 350 psi
 - (2) 18-inch – 48-inch, 250 psi
 - b) PVC C900
 - (1) 3-inch – 12-inch, 350psi
 - c) Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes.
 - 3) Retainer glands shall have specific designs for Ductile Iron and PVC and be easily differentiated.
 - 4) Gland body, wedges and wedge actuating components shall be cast from Grade 65-45-12 ductile iron material in accordance with ASTM A536.
 - 5) Mechanical joint restraint shall require conventional tools and installation procedures as outlined in AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
 - 6) Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
 - 7) A minimum of 6 wedges shall be required for 8-inch diameter PVC pipe.
 - b. Flanged Joints
 - 1) AWWA/ANSI C115/A21.15, ASME B16.1, Class 125

- 2) Flange bolt circles and bolt holes in accordance with ASME B16.1, Class 125.
- 3) Field fabricated flanges are prohibited.
- c. PVC Joint Harness
 - 1) Restrainer
 - a) Manufactured for use with C900 PVC pipe bells.
 - b) Grade 65-45-12 ductile iron material in accordance with ASTM A536.
 - 2) Restraining rods and bolts in accordance with Section 33 14 05.
 - 3) Clamping bolts and nuts in accordance with flange bolt and nut requirements as indicated in Section 33 14 05.
- d. Restrained Flange Adapters
 - 1) ASTM A536 and ANSI/AWWA C110/A21.10
 - 2) Flange bolt circles and bolt holes in accordance with ASME B16.1, Class 125.
 - 3) Field fabricated flanges are prohibited.
 - 4) Minimum 2 to 1 Safety Factor
7. Exterior Coatings
 - a. All ductile iron fittings shall have an asphaltic coating, minimum of 1 mil thick, on the exterior.
8. Interior Lining
 - a. Cement Mortar Lining
 - 1) Line all Ductile Iron Fittings for potable water shall with a cement mortar lining.
 - 2) In accordance with AWWA/ANSI C104/A21.4, NSF 61, and 372.
 - b. Ceramic Epoxy or Epoxy Linings
 - 1) Line all Ductile Iron Fittings for use in wastewater applications with a ceramic epoxy or epoxy lining.
 - 2) Apply lining at a minimum of 40 mils DFT.
 - 3) Due to the tolerances involved, the gasket area and spigot end up to 6 inches back from the end of the spigot end must be coated with 6 mils nominal, 10 mils maximum, using a Joint Compound as supplied by the manufacturer.
 - a) Apply the joint compound by brush to ensure coverage.
 - b) Care should be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends.
 - c) Coat the gasket seat and spigot ends after the application of the lining.
 - 4) Prepare surface in accordance with the manufacturer's recommendations.
 - 5) Check thickness using a magnetic film thickness gauge in accordance with the method outlined in SSPC PA 2.
 - 6) Test the interior lining of all fittings for pinholes with a non-destructive 2,500-volt test.
 - a) Repair any defects prior to shipment.
 - 7) Mark each fitting with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his Work.
 - 8) For all Ductile Iron Fittings in wastewater service where the fitting has been cut, coat the exposed surface with the touch-up material as recommended by the manufacturer.
 - 9) The touch-up material and the lining shall be of the same manufacturer.

D. Gaskets

1. Provide Gaskets in accordance with Section 33 05 22.

E. Bolts and Nuts

1. Mechanical Joints
 - a. Provide bolts and nuts in accordance with Section 33 05 22.
2. Flanged Joints
 - a. In accordance with AWWA/ANSI C115/A21.15
 - b. Provide bolts and nuts in accordance with Section 33 05 22.

F. Flange Coatings for buried Flange Connections

1. Provide Petrolatum Tape System.

G. Polyethylene Encasement

1. Polyethylene encase all buried Ductile Iron Pipe and Fittings as follows:
 - a. 12-inch and smaller
 - 1) Inner Layer - 8 mil V-Bio polyethylene in accordance with AWWA/ANSI C105/A21.5
 - 2) Outer Layer - 4 mil high density cross-laminated (HDCL) polyethylene encasement in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.
 - b. 16-inch and larger
 - 1) 8 mil V-Bio polyethylene conforming to AWWA/ANSI C105/A21.5
2. Use only virgin polyethylene material.
3. Marking: At a minimum of every 2 feet along its length, the mark the polyethylene film with the following information:
 - a. Manufacturer's name or trademark
 - b. Year of manufacturer
 - c. AWWA/ANSI C105/A21.5
 - d. Minimum film thickness and material type
 - e. Applicable range of nominal diameter sizes
 - f. Warning – Corrosion Protection – Repair Any Damage
4. Special Markings/Colors
 - a. Reclaimed water, perform one of the following:
 - 1) Provide purple polyethylene in accordance with the American Public Works Association Uniform Color Code; or
 - 2) Place purple marker tape in trench backfill.
 - b. Wastewater, perform one of the following:
 - 1) Label polyethylene encasement with "WASTEWATER";
 - 2) Provide green polyethylene in accordance with the American Public Works Association Uniform Color Code; or
 - 3) Attach green sanitary sewer marker tape to the polyethylene wrap.
5. Minimum widths

Polyethylene Tube and Sheet Sizes for Push-On Joint Pipe and Fittings

Nominal Pipe Diameter (inches)	Min. Width – Flat Tube (inches)	Min. Width – Sheet (inches)
3	14	28
4	14	28
6	16	32
8	20	40
10	24	48

12	27	54
14	30	60
16	34	68
18	37	74
20	41	82
24	54	108
30	67	134
36	81	162
42	81	162
48	95	190
54	108	216
60	108	216
64	121	242

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install pipe, fittings, specials, and appurtenances in accordance with this Section, AWWA C600, AWWA M41, and the pipe manufacturer's recommendations.
2. Lay pipe and fittings to the lines and grades indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 33 05 06.
4. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals, and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.
5. Embed Ductile Iron Pipe and Fittings in accordance with Section 33 05 06.
6. For installation of carrier pipe within casing, see Section 33 05 54.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
 - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Do not handle the pipe in such a way that will damage the interior lining.

- c. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe for handling the pipe.

C. Pipe Jointing

1. Mechanical Joints

- a. Bolt the follower ring into compression against the gasket with the bolts tightened down evenly then cross torqued in accordance with AWWA C600.
- b. Overstressing of bolts to compensate for poor installation practice will not be permitted.

2. Push-on Joints

- a. Install Push-on joints in accordance with AWWA/ANSI C111/A21.11.
- b. Wipe gasket seat inside the bell clean of all extraneous matter.
- c. Place the gasket in the bell in the position specified by the manufacturer.
- d. Apply a thin film of non-toxic vegetable soap lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell.
 - 1) Do not apply lubricant to the bell socket or the surface of the gasket in contact with the bell socket.
- e. When using a field cut plain end piece of pipe, refinish the field cut and scarf in accordance with AWWA C600.

3. Flanged Joints

- a. Use erection bolts and drift pins to make flanged connections.
 - 1) Do not use undue force or restraint on the ends of the fittings.
 - 2) Apply even and uniform pressure to the gasket.
- b. The fitting must be free to move in any direction while bolting.
 - 1) Install flange bolts with all bolt heads faced in one direction.

4. PVC Joint Harness

- a. Install joint harness in accordance with manufacturer requirements.
- b. Provide full 360-degree contact with restrainer and pipe.
- c. Do not distort the pipe when installing the restrainer.

5. Joint Deflection

- a. Deflect the pipe only with written pre-approval from City Engineer and when necessary to avoid obstructions or to meet the lines and grades and shown in the Drawings.
- b. In accordance with AWWA C600 Table 3.
- c. The maximum deflection allowed is 80 percent of that indicated in AWWA C600.

D. Polyethylene Encasement Installation

1. Preparation

- a. Remove all lumps of clay, mud, cinders, etc., on pipe surface prior to installation of polyethylene encasement.
 - 1) Prevent soil or embedment material from becoming trapped between pipe and polyethylene.
- b. Fit polyethylene film to contour of pipe to ensure a snug, but not tight, encasement with minimum space between polyethylene and pipe.
 - 1) Provide sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces and bolted joints or fittings, and to prevent damage to polyethylene due to backfilling operations.
 - 2) Secure overlaps and ends with adhesive tape and hold.
- c. For installations below water table and/or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

2. Tubular Type (Method A)
 - a. Cut polyethylene tube to length approximately 2 feet longer than pipe section.
 - b. Slip tube around pipe, centering it to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.
 - c. Lower pipe into trench and make up pipe joint with preceding section of pipe.
 - d. Make shallow bell hole at joints to facilitate installation of polyethylene tube.
 - e. After assembling pipe joint, overlap polyethylene tube, pull bunched polyethylene from preceding length of pipe, slip it over end of the new length of pipe and wrap until it overlaps joint at end of preceding length of pipe.
 - f. Secure overlap in place.
 - g. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points.
 - h. Repair cuts, tears, punctures, or other damage to polyethylene.
 - i. Proceed with installation of next pipe in same manner.
3. Tubular Type (Method B)
 - a. Cut polyethylene tube to length approximately 1 foot shorter than pipe section.
 - b. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end.
 - c. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.
 - d. Before making up joint, slip 3-foot length of polyethylene tube over end of proceeding pipe section, bunching it accordion-fashion lengthwise.
 - e. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.
4. Sheet Type
 - a. Cut polyethylene sheet to a length approximately 2 feet longer than piece section.
 - b. Center length to provide 1-foot overlap on each adjacent pipe section, bunching it until it clears the pipe ends.
 - c. Wrap polyethylene around pipe so that it circumferentially overlaps top quadrant of pipe.
 - d. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.
 - e. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe.
 - f. Make shallow bell hole at joints to facilitate installation of polyethylene.
 - g. After completing joint, overlap and secure ends.
 - h. Repair cuts, tears, punctures, or other damage to polyethylene.
 - i. Proceed with installation of next section of pipe in same manner.
5. Pipe-Shaped Appurtenances
 - a. Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe and fittings.
6. Odd-Shaped Appurtenances
 - a. When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length polyethylene tube by passing sheet under appurtenances and bringing it up around body.
 - b. Make seams by bringing edges together, folding over twice and taping down.
 - c. Tape polyethylene securely in place at the valve stem and at any other penetrations.
7. Repairs

- a. Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around fitting to cover damaged area and secured in place.
- 8. Openings in Encasement
 - a. Provide openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film.
 - b. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene with tape.
 - c. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as described above.
- 9. Junctions between Wrapped and Unwrapped Pipe:
 - a. Where polyethylene-wrapped pipe joints with an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet.
 - b. Secure end with circumferential turns of tape.
 - c. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from Cast or Ductile Iron Pipe.
- E. Blocking
 - 1. Install concrete blocking for all 24-inch and smaller fittings, at all bends, tees, crosses, and plugs as indicated in the Drawings.
 - a. Blocking is not permitted for fittings 30-inch and larger.
 - 2. Provide and install concrete in accordance with Sections 03 00 00 and 03 30 00.
 - 3. Place the concrete blocking so as to rest against firm undisturbed trench walls, normal to the thrust.
 - 4. In no instance should the supporting area for each block be smaller than those specified in Drawings. Each block shall be sufficient to withstand the thrust, including water hammer, which may develop.
 - 5. Each block shall rest on a firm, undisturbed foundation or trench bottom. If the Contractor encounters soil that appears to be different than that which was used to calculate the blocking according to the Drawings, the Contractor shall notify the Engineer prior to the installation of the blocking.

3.5 REPAIR

- A. Patching
 - 1. Excessive field-patching is not permitted of lining or coating.
 - 2. Patching of lining or coating will be allowed where area to be repaired does not exceed 100 square inches and has no dimensions greater than 12 inches.
 - 3. In general, there shall not be more than 1 patch on either the lining or the coating of any 1 joint of pipe or any 1 fitting.
 - 4. Wherever necessary to patch the pipe or fittings:
 - a. Make patch with cement mortar as previously specified for interior joints.
 - b. Do not install patched pipe until the patch has been properly and adequately cured and approved for laying by the City.
 - 5. Promptly remove rejected pipe or fittings from the site.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Potable Water Mains

1. Hydrostatic testing of water mains:
 - a. Hydrostatically test the mains in accordance with Section 33 01 12.

B. Sewer Force Mains

1. Hydrostatic testing of sewer force mains:
 - a. Hydrostatically test the mains in accordance with Section 33 01 12.

C. Gravity Sewer Mains

1. Closed Circuit Television (CCTV) Inspection
 - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 15.
2. Sewer Pipe Testing
 - a. Test pipe in accordance with Section 33 01 14.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Potable Water Mains

1. Cleaning, disinfection, and bacteriological testing of water mains:
 - a. Clean, disinfect, and bacteriological test the mains in accordance with Section 33 01 12.

B. Sewer Force Mains

1. Cleaning of sewer force mains:
 - a. Clean the mains in accordance with Section 33 01 13.

C. Gravity Sewer Mains

1. Cleaning of sewer mains
 - a. Clean the mains in accordance with Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 22

NUTS, BOLTS, AND GASKETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All nuts, bolts and gaskets associated with pressurized water utility lines including:
 - a. T-Bolts and Nuts
 - b. Flange Bolts and Nuts
 - c. Threaded Rods
 - d. Push-on Gaskets
 - e. Mechanical Joint Gaskets
 - f. Flange Gaskets
 - g. Flange Isolation Kits
 - h. Petrolatum Tape Systems

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Hydrocarbon Resistant Gaskets
 - a. Measurement
 - 1) Measurement for this Item shall be by lump sum.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the lump sum price bid for all "Hydrocarbon Resistant Gaskets".
2. All Other Items
 - a. Measurement
 - 1) The Items in this Section are considered subsidiary to the Item being installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this Item are subsidiary to the unit price bid for the Item being installed and no other compensation will be allowed.

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.
2. American Iron and Steel Institute (AISI).
3. American Society of Mechanical Engineers (ASME):
 - a. PCC-1-2012 Guidelines for Pressure Boundary Bolted Flange Joint Assembly.
4. American Society of Testing and Materials (ASTM):

- a. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- b. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
- c. A242, Standard Specification for High-Strength Low-Alloy Carbon Structural Steel
- d. B117, Salt Spray Testing
- e. F436, Standard Specification for Hardened Steel Washers
- 5. American Water Works Association (AWWA):
 - a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - b. C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
 - c. C600, Installation of Ductile-Iron Mains and Their Appurtenances.
 - d. M11, Steel Pipe.
 - e. M41, Ductile-Iron Pipe and Fittings.
- 6. Fastener Quality Act (FQA)
 - a. Public Law 106-34 (P.L. 106-34)
- 7. NSF International (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.
- 8. Society for Protective Coating (SSPC) Surface Preparation Standards (SP):
 - a. SP2, Hand Tool Cleaning
 - b. SP3, Power Tool Cleaning

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Bolts and nuts for mechanical and or flange joints
 - 2. Gaskets
- B. Certificates
 - 1. Furnish an affidavit certifying that all fasteners, excluding T-Bolts, shall conform to the Fastener Quality Act (FQA) (P.L. 106-34).
 - 2. Furnish an affidavit certifying that the Xylan Coating is manufactured by Whitford Corporation, or a Whitford Corporation certified Applicator.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturers

- a. Fastener manufacturing operations (bolts, nuts, gaskets and coatings) shall be performed under the control of the manufacturer.
- b. All gaskets shall meet or exceed the latest revisions NSF 61 and shall meet or exceed the requirements of this Specification.

B. Preconstruction Testing

1. The City may, at its own cost, subject random fittings for destructive testing by an independent laboratory for compliance with this Specification.
 - a. The compliance test shall be performed in the United States.
 - b. Any visible defects or failure to meet the quality standards herein will be grounds for rejecting the entire order.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Regulatory Requirements

1. All fasteners, excluding T-Bolts, shall conform to the Fastener Quality Act (FQA) (P.L. 106-34). All fasteners shall meet the marking requirements set forth by this Act.

C. T-Bolts and Nuts

1. Standard Xylan Coated T-bolt and Nut
 - a. High strength, corrosion-resistant, low-carbon weathering steel in accordance with AWWA/ANSI C111/A21.11 and ASTM A242
 - b. Xylan Coating in accordance with this Section
2. Stainless Steel T-bolt with Xylan Coated Stainless Steel Nut
 - a. Stainless Steel T-bolt and Nut in accordance with AISI 304.
 - b. Coat nut with Xylan in accordance with this Section.

D. Flange Bolts and Nuts

1. Bolts shall be corrosion-resistant, low alloy, high strength steel bolts equal to "cor-ten."
 - a. In sizes for which "cor-ten" bolts are unavailable. Bolts may be used coated as follows:
 - 1) Bolts and nuts shall be immersed in Koppers super tank solution or approved equal

- 2) Inserted and tightened in the joint while still wet
- 3) All exposed parts touched up with a brush coat immediately after tightening
- 4) After an interval of at least one hour, the entire joint shall be coated with Bitumastic #50, as specified under protective coatings.

E. Threaded Rods

1. Meet requirements of AWWA C207
2. Rods: ASTM A193, Grade B8, Class 1(AISI 304 Stainless Steel, carbide solution treated)
3. Nuts and Washers: ASTM A194, Grade 8 Nuts with AISI 304 Stainless Steel Washers
 - a. Coat nut with Xylan in accordance with this Section.

F. Push-on Gaskets

1. Shall be of natural or synthetic rubber conforming to the physical and marking requirements specified in ANSI/AWWA C111/A21.11.
2. Gaskets shall be provided by the manufacturer of that particular pipe being used.
3. A joint lubricant shall be used, and applicable recommendations of the manufacturer shall be followed.
4. All gaskets shall meet or exceed the latest revisions NSF 61.
5. Rubber gaskets shall be made of vulcanized styrene butadiene rubber SBR, unless otherwise specified in drawings.
6. Gaskets shall be free from porous areas, foreign material and other defects that make them unfit for intended use.
7. Gaskets shall be the size and shape required to provide an adequate compressive force against the plain end and socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances.

G. Mechanical Joint Gaskets

1. Conforming to the physical and marking requirements specified in ANSI/AWWA C111/A21.11.
2. All gaskets shall meet or exceed the latest revisions NSF 61.
3. Rubber gaskets shall be made of vulcanized styrene butadiene rubber SBR, unless otherwise specified in Drawings.
4. Gaskets shall be free from porous areas, foreign material and other defects that make them unfit for intended use.

H. Flange Gaskets

1. Class E Flanges
 - a. Full face
 - b. Manufactured true to shape from minimum 80 durometer SBR rubber stock of a thickness not less than 1/8 inch
 - c. Virgin stock
 - d. Conforming to the physical and test requirements specified in AWWA/ANSI C111/A21.11
 - e. All gaskets shall meet or exceed the latest revisions NSF 61.
 - f. Finished gaskets shall have holes punched by the manufacturer and shall match the flange pattern in every respect.
 - g. Frayed cut edges are not acceptable.

- h. Field cut sheet gaskets are not acceptable.
- I. Hydrocarbon Resistant Gaskets
 - 1. Furnish Viton® (Fluorocarbon) Rubber, hydrocarbon resistant gaskets, when required.
- J. Flange Isolation Kits
 - 1. Flanges which are required by the Drawings to be Isolation Flanges shall conform to Section 33 04 10.
 - 2. For bolts used with isolation sleeves per Section 33 04 10, threading must extend to bolt head with no grip to ensure sleeves fit properly.
- K. Petrolatum Tape System
 - 1. Petrolatum Tape Primer: Denso Paste, or approved equal
 - 2. Molding and Filler mastic: Densyl Mastic, or approved equal
 - 3. All Purpose Petrolatum Tape: Densyl Tape, or approved equal
- L. Coating
 - a. Coat nuts and bolts with a ceramic-filled, baked on fluorocarbon resin, when required.
 - b. Coated nuts and bolts shall be prepared “near white” or “white” when coated to the coating manufacturer’s recommended thickness by a certified applicator.
 - c. Coating shall be per City’s Standard Product List and applied per manufacturers recommendations.
 - d. Coating shall be free from holidays and defects.
 - e. Coating thickness shall between 0.0007-inches and 0.0012-inches and shall be such that the nut turns freely on the bolt.
 - f. Coating shall conform to the performance requirements of ASTM B117, “Salt Spray Test” and shall include, if required, a certificate of conformance.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Mechanical Joints

- 1. Assemble mechanical joints in accordance with ANSI/AWWA C111/A21.11 Appendix A, AWWA C600 and AWWA Manual M41.
- 2. Use Standard Xylan Coated T-bolts and Nuts.
 - a. Stainless Steel T-bolts with Coated Stainless Steel Nuts shall only be used when specifically required in the Drawings.

B. Flanged Joints

- 1. Install in accordance with ASME PCC-1-2012.

2. Use Stainless Steel Bolts and Coated Nuts.
 3. Wrap all buried steel flanges for AWWA C200, C301 or C303 pipe with Petrolatum Tape System.
 - a. If only 1 flange in a joint is steel (AWWA C200, C301, or C303), petrolatum tape wrapping will be required.
 - b. If a joint is made between two ductile iron flanges, the joint should be polyethylene encased in accordance with Section 33 05 19.
 4. Flange bolts are normally spaced evenly around the flange.
 5. During assembly, tighten nuts gradually and equally using a three-pass method in accordance with ASME PCC-1-2012.
 - a. For the first pass, tighten the nuts to 50 percent at diametrically opposite sides to prevent misalignment and to ensure that all bolts carry equal loads.
 - b. For the second pass, tighten the nuts to 100 percent again in a diametrically opposite pattern.
 - c. Allow a minimum of 1 hour to pass to provide time for settlement between bolts and nuts and gasket relaxation.
 - d. Complete the third pass by checking each bolt in a clockwise pattern. Each nut should be tightened until it will no longer turn. This step compensates for elastic interaction and brings all bolts into parity.
 6. The threads of the bolts should protrude a minimum of ½-inch from the nuts.
- C. Flanged Joints with Isolation Kit
1. Flange Isolation Kits shall be installed in accordance with Section 33 04 10.
 2. City will verify Isolation in accordance with Section 33 04 10.
- D. Threaded Rod
1. Install as part of joint harness assembly in accordance with AWWA Manual M11.
 2. Space rods evenly around the pipe.
 3. During assembly, tighten nuts gradually and equally using a three-pass method in accordance with ASME PCC-1-2012.
 - a. For the first pass, tighten the nuts to 50 percent at diametrically opposite sides to prevent misalignment and to ensure that all bolts carry equal loads.
 - b. For the second pass, tighten the nuts to 100 percent again in a diametrically opposite pattern.
 4. The threads of the bolts should protrude a minimum of ½-inch from the nuts.
 5. Wrap joint harness assembly with Petrolatum Tape System.
- E. Petrolatum Tape System
1. Surfaces should be free from dirt, loose rust, scale or flaking coatings.
 - a. Clean surfaces in accordance with SSPC SP2 or SSPC SP3.
 - 1) High pressure wash of 3,000 to 7,000 psi is also suitable.
 - b. Surfaces may be damp but shall not have droplets or continuous film of water.
 2. Apply a uniform, thin coat of Petrolatum Tape Primer to the entire surface by stiff brush, gloved hand or rag at normal ambient temperatures.
 3. By hand application, apply Molding and Filler Mastic to a rounded configuration to fill irregular shapes and reduce sharp-edged surfaces.
 4. Spirally wrap All Purpose Petrolatum Tape with a minimum overlap of 1 inch.

- a. For severely corrosive environments, an overlap of 55 percent is recommended.
 - b. Press air pockets out and smooth all lap seams.
5. For additional mechanical protection, overwrap may be applied to increase impact strength and electrical resistance.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [or] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 24
STEEL PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Buried Steel Pipe 24-inches and larger for potable water applications

B. Deviations from this City of League City Standard Specification

1. None.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Buried Steel Pipe

a. Measurement

- 1) Measured horizontally along the surface from center line to center line of the fitting or appurtenance

b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Steel AWWA C200 Pipe" installed for:
 - a) Various sizes
 - b) Various type of backfill

c. The price bid shall include:

- 1) Furnishing and installing Buried Steel Pipe with joints as specified by the Drawings
- 2) Mobilization
- 3) Coating
- 4) Lining
- 5) Pavement removal
- 6) Excavation
- 7) Hauling

- 8) Disposal of excess material
 - 9) Furnishing, placement and compaction of embedment
 - 10) Thrust restraint
 - 11) Bolts and nuts
 - 12) Welding
 - 13) Gaskets
 - 14) Furnishing, placement and compaction of backfill
 - 15) Trench water stops
 - 16) Clean-up
 - 17) Cleaning
 - 18) Disinfection
 - 19) Testing
2. Buried Steel Pipe Fittings
- a. Measurement
 - 1) Measurement for this Item shall be by lump sum.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the lump sum price bid for "Steel Fittings".
 - c. The price bid shall include:
 - 1) Furnishing and installing Buried Steel Pipe with joints as specified by the Drawings
 - 2) Mobilization
 - 3) Coating
 - 4) Lining
 - 5) Pavement removal
 - 6) Excavation
 - 7) Hauling
 - 8) Disposal of excess material
 - 9) Furnishing, placement and compaction of embedment
 - 10) Thrust restraint
 - 11) Bolts and nuts
 - 12) Welding
 - 13) Gaskets

- 14) Furnishing, placement and compaction of backfill
- 15) Trench water stops
- 16) Clean-up
- 17) Cleaning
- 18) Disinfection
- 19) Testing

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Architectural Manufacturers Association (AASHTO).
3. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250).
4. ANSI International (ASTM):
 - a. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PDI Tensile Strength.
 - b. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - c. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - d. C33, Standard Specifications for Concrete Aggregates.
 - e. C144, Standard Specification for Aggregate for Masonry Mortar.
 - f. C150, Standard Specification for Portland Cement.
 - g. C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
 - h. D16, Standard Terminology for Paint, Related Coatings, Materials, and Applications.
 - i. D242, Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
 - j. DD522, Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - k. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
 - l. D4541, Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
 - m. E165, Standard Practice for Liquid Penetrant Examination for General Industry.

5. American Welding Society (AWS)
6. D1.1, Structure Welding Code - Steel.
7. American Water Works Association (AWWA):
 - a. C200, Steel Water Pipe - 6 Inches and Larger.
 - b. C205, Cement Mortar Protective Lining and Coating for Steel Water Pipe 4 Ins and Larger Shop-Applied.
 - c. C206, Field Welding of Steel Water Pipe.
 - d. C207, Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN
 - e. C208, Dimensions for Fabricated Steel Water Pipe Fittings.
 - f. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
 - g. C216, Heat Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
 - h. C222, Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings
 - i. M11, Steel Pipe - A Guide for Design and Installation.
8. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
9. International Organization for Standardization (ISO).
10. NACE International (NACE):
 - a. SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
11. NSF International (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
12. Spray Polyurethane Foam Alliance (SPFA).
13. Society for Protective Coatings (SSPC)/National Associate of Corrosion Engineers (NACE)
 - a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
 - b. SP 1, Solvent Cleaning.
 - c. SP 2, Hand Tool Cleaning.
 - d. SP 3, Power Tool Cleaning.
14. Society for Protective Coatings/National Associate of Corrosion Engineers (SSPC/NACE)
 - a. SP 10/NACE No. 2, Near-White Blast Cleaning.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. Provide proof of AWS certification for welders to conduct Work.
- C. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Exterior Coating
 - a. Material data
 - b. Application recommendations
 - c. Field touch-up procedures
 - 2. Heat Shrink Sleeves, if applicable
 - a. Material data
 - b. Installation recommendations
 - 3. Joint Wrappers, if applicable
 - a. Material data
 - b. Installation recommendations
 - 4. Mixes
 - a. Mortar for interior joints and patches
 - b. Bonding agents for patches
 - 5. Gaskets
- B. Shop Drawings
 - 1. Wall thickness design calculations sealed by a Licensed Professional Engineer in Texas including:
 - a. Internal pressure
 - 1) Maximum design pressure
 - 2) Surge pressure
 - b. External pressure
 - 1) Deflection

- 2) Buckling
 - 3) Extreme loading conditions
 - c. Special physical loading such as supports or joint design
 - d. Thermal expansion and/or contraction
 - 2. Thrust restraint calculations for all fittings and valves including the restraint length sealed by a Licensed Professional Engineer in Texas to verify the restraint lengths shown in the Drawings.
 - 3. Fabrication and lay drawings showing a schematic location with profile and a tabulated layout schedule that is sealed by a Licensed Professional Engineer in Texas and includes:
 - a. Pipe class
 - b. Joint types
 - c. Fittings
 - d. Outlets
 - e. Thrust Restraint
 - f. Stationing (in accordance with the Drawings)
 - g. Transitions
 - h. Joint deflection
 - i. Interior lining
 - j. Outlet locations for welding, ventilation, and access
 - k. Welding requirements and provisions for thermal stress control
- C. Certificates and Test Reports
- 1. Prior to shipment of the pipe, the pipe manufacturer shall submit the following:
 - a. A Certificate of Adequacy of Design stating that the pipe to be furnished complies with AWWA C200, AWWA C205, AWWA C210, AWWA C222 and these Specifications.
 - b. Copies of results of factory hydrostatic tests shall be provided to the Engineer.
 - c. Mill certificates, including chemical and physical test results for each heat of steel.
 - d. A Certified Test Report from the polyurethane coating manufacturer indicating that the coatings were applied in accordance with manufacturer's requirements and in accordance with this Specification.
 - e. Certified test reports for welder certification for factory and field welds in accordance with AWWA C200, Section 4.11.
 - f. Certified test reports for cement mortar tests.

- g. Certified test reports for steel cylinder tests.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

- a. Shall be certified under S.P.F.A. or I.S.O. quality certification program for steel pipe and accessory manufacturing
- b. Finished pipe shall be the product of 1 manufacturer.
- c. Pipe manufacturing operations (pipe, lining and coatings) shall be performed under the control of the manufacturer.
- d. The pipe manufacturer shall not have less than 5 years successful experience manufacturing pipe of the particular type and size indicated or demonstrate an experience record that is satisfactory to the Engineer and City.
 - 1) This experience record will be thoroughly investigated by the Engineer, and acceptance will be at the sole discretion of the Engineer and City.
 - 2) Pipe manufacturing operations (pipe, fittings, lining, coating) shall be performed at 1 location, unless otherwise approved by the Engineer.
- e. Manufacture pipe in accordance with the latest revisions of AWWA C200, AWWA C205, AWWA C210 and AWWA C222.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packing

- 1. Prepare pipe for shipment to:
 - a. Afford maximum protection from normal hazard of transportation
 - b. Allow pipe to reach project site in an undamaged condition
- 2. Pipe damaged in shipment shall not be delivered to the project site unless such damaged pipe is properly repaired.
- 3. After the completed pipe and fittings have been removed from the final cure at the manufacturing plant:
 - a. Protect pipe lining from drying by means of plastic end covers banded to the pipe ends.
 - b. Maintain covers over the pipe ends at all times until ready to be installed.

- c. Moisture shall be maintained inside the pipe by periodic addition of water, as necessary.
- 4. Pipes shall be carefully supported during shipment and storage.
 - a. Pipe, fittings and specials shall be separated so that they do not bear against each other and the whole load shall be securely fastened to prevent movement in transit.
 - b. Ship pipe on padded bunks with tie-down straps approximately over stulling.
 - c. Store pipe on padded skids, sand or dirt berms, tires or other suitable means to protect the pipe from damage.
 - d. Each end of each length of pipe, fitting or special and the middle of each pipe joint shall be internally supported and braced with stulls to maintain a true circular shape.
 - 1) Internal stulls shall consist of timber or steel firmly wedged and secured so that stulls remain in place during storage, shipment and installation.
 - 2) Pipe shall be rotated so that 1 stull remains vertical during storage, shipment and installation.
 - 3) At a minimum, stulls shall be placed at each end and center.
 - a) Additional stulls may be required depending upon the length of the joints and pipe design.
 - 4) Stulls shall not be removed until backfill operations are complete (excluding final clean up), unless it can be demonstrated to the City's satisfaction that removal of stulls will not adversely affect pipe installation.

B. Delivery, Handling, and Storage

- 1. Once the first shipment of pipe has been delivered to the site, the Engineer and the Contractor shall inspect the pipe's interior coating for excessive cracking.
- 2. If excessive cracking is found, the Contractor shall modify shipping procedures to reduce or eliminate cracking.
- 3. Deliver, handle and store pipe in accordance with the manufacturer's recommendations to protect coating systems.
- 4. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed by the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Materials

1. General
 - a. Pipe shall be manufactured in accordance with the latest revisions of AWWA C200, AWWA C205, AWWA C210 and AWWA C222.
 - b. All pipe lining material in contact with potable water shall meet the requirements of NSF 61.
2. Exterior Polyurethane Coating
 - a. For Pipe:
 - 1) Polyurethane Coating shall be factory applied and meet the requirements of AWWA C222. Use a Coating Standard ASTM D16, Type V system which is a 100 percent solids, 2-component polyurethane (or 2-package polyisocyanate, polyol-cured urethane) coating.
 - a) Components shall have balanced viscosities in their liquid state and shall not require agitation during use.
 - b) Conversion to Solids by Volume: 97 percent $\pm$ 3 percent
 - c) Temperature Resistance: Minus 40 degrees F and plus 150 degrees F
 - d) Minimum Adhesion: 1500 psi, when applied to steel pipe which has been blasted to comply with SSPC SP 10/NACE No. 2
 - (1) Cure Time: For handling in 2-3 minutes at 120 degrees F and full cure within 7 days at 70 degrees F

- e) Maximum Specific Gravities
 - (1) Polyisocyanate resin, 1.20
 - (2) Polyol resin, 1.15
- f) Minimum Impact Resistance: 80 inch-pounds using 1-inch diameter steel ball
- g) Minimum Tensile Strength: 2000 psi
- h) Hardness: Minimum Durometer hardness of 65 on the Shore D scale in accordance with ASTM D2240
- i) Flexibility Resistance
 - (1) ASTM D522 using 1-inch mandrel
 - (2) Allow coating to cure for 7 days.
 - (3) Perform testing on test coupons held for 15 minutes at temperature extremes specified above.
- j) Dry Film Thickness: 35 mils
- k) Coating shall be a self priming, plural component, 100 percent solids, non-extended polyurethane, suitable for burial or immersion and shall be:
 - (1) Corropipe II Omni as manufactured by Madison Chemical Industries Inc.
 - (2) Durashield 210 as manufactured by LifeLast, Inc., or
 - (3) Protec II, as manufactured by ITW – Futura Coatings, Inc.
- 2) The coating manufacturer shall have a minimum of 5 years experience in the production of this type coating.
- b. For Specials, Fittings, Repair and Connections
 - 1) Provide shop-applied and field-applied coating as follows:
 - a) Corropipe II Omni, and GP II (E) Touch-Up, respectively, as manufactured by Madison Chemical Industries, or
 - b) Durashield 210, Durashield 310, or Durashield 310 JARS as manufactured by LifeLast, Inc., or
 - c) Protec II, or as recommended by the coating manufacturer.
 - d) Properties specified above.

- e) Mix and apply polyurethane coatings in accordance with the coating manufacturer's recommendations.
- 3. Cement Mortar Linings
 - a. Cement mortar linings shall be shop-applied.
 - b. Shop-applied cement mortar linings shall conform to the requirements of AWWA C205 with the following modifications:
 - 1) Sand used for cement mortar shall be silica sand ASTM C33.
 - 2) Curing of the linings shall conform to the requirements of AWWA C205.
- 4. Gaskets
 - 1) Flange in accordance with AWWA C207.
 - 2) Provide Gaskets in accordance with Section 33 05 22.
- 5. Bolts and Nuts
 - a. Flanged Ends
 - 1) Flange in accordance with AWWA C207.
 - 2) Provide bolts and nuts in accordance with Section 33 05 22.
- 6. Flange Coatings
 - a. Flange Coatings in accordance with Section 33 05 22.
- 7. Steel shall:
 - a. Meet the requirements of AWWA C200
 - b. Be of continuous casting
 - c. Be homogeneous
 - d. Be suitable for field welding
 - e. Be fully kilned
 - f. Be fine austenitic grain size
- 8. Bend Fittings
 - a. Fabricate all fittings from hydrostatically tested pipe.
 - b. All bend fittings shall be long radius to permit easy passage of pipeline pigs.
- 9. Threaded Outlets
 - a. Where outlets or taps are threaded, Threaded with CC Threads and furnish and install brass bushings for the outlet size indicated.
- 10. Weld Lead Outlets
 - a. Use of threaded outlets for access for weld leads is permitted.
 - b. Additional outlet configurations shall be approved by the Engineer.
 - c. Outlets shall be welded after use.
- 11. Mixes

- a. Mortar for Joints
 - 1) Mortar shall be 1 part cement to 2 parts sand.
 - 2) Cement shall be ASTM C150, Type I or II.
 - 3) Sand shall be of sharp silica base.
 - a) Sand shall conform to ASTM C144.
 - 4) Interior joint mortar shall be mixed with as little water as possible so that the mortar is very stiff, but workable.
 - 5) Water for cement mortar shall be from a potable water source.
 - 6) Mortar for patching shall be as per interior joints.
- b. Bonding Agent
 - 1) Bonding Agent for Cement Mortar Lining must meet NSF 61, if cement lining is in contact with potable water.
 - 2) Bonding agent for cement mortar lining patching shall be:
 - a) Probond Epoxy Bonding Agent ET-150, parts A and B
 - b) Sikadur 32 Hi-Mod, or
 - c) Approved equal

12. Heat Shrink Sleeves for Polyurethane Coated Steel Pipe

- a. Primer: Provide as recommended by the sleeve manufacturer.
- b. Filler Mastic: Provide mastic filler as recommended by the heat shrink sleeve manufacturer.
 - 1) Size and type shall be as recommended by the sleeve manufacturer for type of pipe and joint.
- c. Joint Coating: Cross-linked polyolefin wrap or sleeve with a mastic sealant, 85 mils total thickness, suitable for pipeline operating temperature, sleeve material recovery as recommended by the manufacturer.
 - 1) High recovery sleeves shall be provided for bell and spigot and coupling style joints with a minimum of 50 percent recovery.
 - 2) Sleeve length shall provide a minimum of 3 inches overlap onto intact pipe coating on each side of the joint.
 - 3) Width to take into consideration shrinkage of the sleeve due to installation and joint profile
- d. Heat shrink sleeves shall meet AWWA C216, as manufactured by:
 - 1) Canusa
 - 2) Raychem, or
 - 3) Approved equal

- e. Provide heat shrink sleeve suitable to interior joint welding without damage to heat shrink sleeve.

C. Performance / Design Criteria

1. Pipe Design

- a. Steel pipe shall be designed, manufactured and tested in conformance with AWWA C200, AWWA M11 and these Specifications.
- b. Sizes and pressure classes (working pressure) shall be as shown below.
- c. For the purpose of pipe design, the transient pressure plus working pressure shall be as indicated below.
- d. Fittings, specials and connections shall be designed for the same pressures as the adjacent pipe.
- e. Pipe design shall be based on trench conditions and the design pressure in accordance with AWWA M11; using the following parameters:
 - 1) Unit Weight of Fill (W) = 130 pounds per cubic foot
 - 2) Live Load
 - a) = AASHTO HS 20, at all locations except at railroads
 - b) = Cooper E80, at Railroads
 - 3) Trench Depth = As indicated in the Drawings
 - 4) Deflection Lag Factor (D_l) = 1.0
 - 5) Coefficient (K) = 0.10
 - 6) Maximum Calculated Deflection:
 - a) D_x = 3 percent (for polyurethane coated pipe)
 - b) D_x = 2 percent (for cement mortar coated pipe)
 - 7) Soil Reaction Modulus (E') < 1,000
 - 8) Working Pressure = 150 psi
 - a) Test Pressure =
 - (1) No less than 1.25 minimum times the stated working pressure (187 psi minimum) of the pipeline measured at the highest elevation along the test section.
 - (2) No less than 1.5 times the stated working pressure (225 psi minimum) at the lowest elevation of the test section.
 - 9) Surge Allowance = 100 psi, minimum
 - a) Where Total Pressure (including surge) = 150 psi + 100 psi = 250 psi

- f. Fittings and specials shall be:
 - 1) Designed in accordance with AWWA C208 and AWWA M11 except that crotch plates shall be used for outlet reinforcement for all Pressure Diameter Values, PDV, greater than 6,000.
 - g. Where the pipe requires additional external support to achieve the specified maximum deflection, the Contractor and pipe supplier will be required to furnish alternate methods for pipe embedment.
 - 1) No additional compensation will be made to the Contractor by the City where this method is required.
 - h. Trench depths indicated shall be verified after existing utilities are located.
 - 1) Vertical alignment changes required because of existing utility or other conflicts shall be accommodated by an appropriate change in pipe design depth.
 - 2) In no case shall pipe be installed deeper than its design allows.
 - i. Field fabrication or cutting is not allowed, unless otherwise approved by the City.
2. Provisions for Thrust
- a. Thrust at bends, tees or other fittings shall be resisted by restrained joints.
 - 1) Thrust at bends adjacent to casing shall be restrained by welding joints through the casing and a sufficient distance each side of the casing.
 - 2) The distance for thrust restraint shown on the Drawings is the minimum restraint and does not relieve the manufacturer from calculating the restraint needs as specified herein.
 - a) In no case shall the restrained distance be less than indicated on the Drawings.
 - b. Restrained joints shall be used a sufficient distance from each side of the bend, tee, plug or other fitting to resist thrust which develops at the design pressure of the pipe.
 - c. Restrained joints shall consist of welded joints.
 - d. The length of pipe designed with restrained joints to resist thrust shall be verified by the pipe manufacturer in accordance with AWWA M11 and the following:
 - 1) The weight of the earth (W_e) shall be calculated as the weight of the projected soil prism above the pipe, for unsaturated soil conditions
 - 2) Soil Density = 110 pounds per cubic foot (maximum value to be used), for unsaturated soil conditions

- 3) Coefficient of Friction = 0.25 (maximum value to be used for polyurethane coated steel pipe).
- 4) If indicated on the Drawings and the Geotechnical Borings that ground water is expected, account for reduced soil density.
- 5) For horizontal bends, the length of pipe to be restrained shall be calculated as follows:

$$L = \frac{P A (1 - \cos \Delta)}{f (2W_e + W_p + W_w)}$$

Where:

Δ = Deflection angle

L = Length of pipe to be restrained on each side

P = internal pressure

A = Cross sectional area of pipe steel cylinder I.D.

W_e = Weight of prism of soil over the pipe

W_p = Weight of pipe

W_w = Weight of water

f = Coefficient of friction between pipe and soil

3. Inside Diameter

- a. The inside diameter, including the cement-mortar lining, shall be a minimum of the nominal diameter of the pipe specified, unless otherwise indicated on the Drawings.

4. Wall Thickness

- a. The minimum pipe wall steel thickness shall be as designed, but not less than 0.25 inches or pipe D/240, whichever is greater for pipe and fittings, with no minus tolerance, where D is the nominal inside pipe diameter.
- b. Where indicated on the Drawings, pipe and fittings shall have thicker steel pipe wall.

- c. The minimum steel wall thickness shall also be such that the fiber stress shall not exceed:
- 1) 50 percent of the minimum yield strength of the steel for working pressure and
 - 2) 75 percent of the minimum yield strength of the steel at the maximum pressure (including transient pressure), nor the following, at the specified working pressure:

Pipe Type	Maximum Stress at Working Pressure
Polyurethane Coated Steel	23,000 psi
Mortar Coated Steel	NOT USED

- d. Pipe which is placed in casing or tunnel shall have a minimum pipe wall steel thickness of 0.375 inches or pipe D/144, whichever is greater, where D is the nominal pipe diameter.
 - e. Pipe, fittings and specials shall be designed such that the maximum stresses in the pipe due to thrust loading will not exceed 18,000 psi.
5. Seams
- a. Except for mill-type pipe, the piping shall be made from steel plates rolled into cylinders or sections thereof with the longitudinal and girth seams butt welded or shall be spirally formed and butt welded.
 - 1) There shall be not more than 2 longitudinal seams.
 - 2) Girth seams shall be butt welded and shall not be spaced closer than 6 feet except in specials and fittings.
6. Joint Length
- a. Maximum joint length shall not exceed 50 feet.
 - b. Maximum joint length of steel pipe installed in casing shall meet the project requirements.
 - c. Manufactured random segments of pipe will not be permitted for straight runs of pipe.
 - 1) Closing piece segments, however, shall be acceptable.
7. Joint Bonds, Insulated Connections and Flange Gaskets
- a. Joint Bonds, Insulated Connection, and Flange Gaskets shall be in accordance with Section 33 04 10.
8. Bend Fittings
- a. All bend fittings shall be long radius to permit passage of pipeline pigs.
9. Pipe Ends
- a. Pipe ends shall be:
 - 1) Lap welded slip joints
 - 2) Butt strap joint
 - 3) Flanged joint

- 4) Flexible coupled joint
- 5) Roll groove gasket joint
- b. Pipe ends shall be welded or harnessed where indicated and as necessary to resist thrust forces.
 - 1) Thrust at bends adjacent to casing shall be restrained by welding joints through the casing and a sufficient distance each side of the casing.
- c. Rubber Gasket Joint
 - 1) Rubber gasketed joints (O-ring or Carnegie Joints) will only be allowed for pipe sizes 54-inch diameter and smaller.
 - 2) Joints shall conform to AWWA C200 standard.
 - 3) The joints shall consist of:
 - a) Bell
 - (1) Flared bell end formed and sized by forcing the pipe or a plug die or by expanding on segmental dies.
 - b) Spigot
 - (1) Rolled spigot or carnegie shaped steel joint ring in accordance with AWWA C200 and as shown as Item F or H in Figure 8-1 of the AWWA M11.
 - 4) The welded area of bell and spigot pipe ends shall be checked after forming by the dye penetrant or magnetic particle method.
 - 5) The difference in diameter between the interior diameter (I.D.) of the bell and the outer diameter (O.D.) of the spigot shoulder at point of full engagement with an allowable deflection shall be no more than 0.04 inches as measured on the circumference with a diameter tape.
 - 6) The gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200.
 - 7) The joint shall be suitable for the specified test and/or surge pressure and deflection.
 - 8) Joints shall be of clearances such that water tightness shall be provided under all operating and test conditions with a pipe diameter deflection based upon the supplied pipe coating.
 - 9) Joints shall be electrically continuous.
- d. Lap Welded Slip Joint

- 1) Lap welded slip joint shall be provided in all locations for pipe larger than 24-inches and where joints are welded for thrust restraint.
 - 2) Lap welded slip joints may be welded from the inside or outside.
 - 3) Ends of pipe, fittings and specials for field welded joints shall be prepared with 1 end expanded in order to receive a plain end making a bell and plain end type of joint.
 - a) Clearance between the surfaces of lap joints shall not exceed 1/8 inch at any point around the periphery.
 - 4) In addition to the provisions for a minimum lap of 1½ inches as specified in AWWA C200, the depth of bell shall be such as to provide for a minimum distance of 1 inch between the weld and the nearest tangent of the bell radius when welds are to be located on the inside of the pipe.
- e. Fittings with Flanges
- 1) Flanged joints shall be provided at connections to valves and where indicated on the Drawings.
 - 2) Ends to be fitted with slip-on flanges shall have the longitudinal or spiral welds ground flush to accommodate the type of flanges provided.
 - 3) Pipe flanges and welding of flanges to steel pipe shall conform to the requirements of AWWA C207 and AWWA C206.
 - 4) Pipe flanges shall be of rated pressure equal to or greater than the adjacent pipe class.
 - 5) Flanges shall match the fittings or appurtenances which are to be attached.
 - 6) Flanges shall be Class E with 275 psi working pressure in accordance with AWWA C207 and drilled in accordance with ASME B16.1 Class 125 for areas designated with a 225 test pressure.
 - 7) When Isolation Flanges are required by the Drawings, Drillings shall accommodate the required spacing for mylar sleeves according to Section 33 04 10.
- f. Flexible Couplings
- 1) Flexible couplings shall be provided where specified on the Drawings.
 - 2) Ends to be joined by flexible couplings shall be:
 - a) Plain end type, prepared as stipulated in AWWA C200.
 - b) Welds on ends to be joined by couplings shall be ground flush to permit slipping the coupling in at least 1 direction to clear the pipe joint.
 - c) Harness bolts and lugs shall comply with AWWA M11.

g. Butt Strap Closure Joints

- 1) Where necessary to make closure to pipe previously laid, closure joints shall be installed using butt strap joints in accordance with AWWA C206 and applicable provisions of this Specification.

10. Polyurethane Coating

a. Applicator Qualifications

- 1) Equipment shall be certified by the coating manufacturer to meet the requirements for:
 - a) Material mixing
 - b) Temperature control
 - c) Application rate
 - d) Ratio control for multi-part coatings
- 2) Equipment not meeting the written requirements of the coating manufacturer shall be rejected for coating application until repairs or replacement of the equipment is made to the satisfaction of the City.
- 3) Personnel responsible for the application of the coating system shall:
 - a) Provide certification of attendance at the coating manufacturer's training class within the last 3 years
 - b) Be present during all coating application Work and shall have responsibility for controlling all aspects of the coating application

b. Surface Preparation

- 1) Remove visible oil, grease, dirt and contamination in accordance with SSPC SP 1.
- 2) Remove surface imperfections such as metal slivers, burrs, weld splatter, gouges or delaminations in the metal by filing or grinding prior to abrasive surface preparation.
- 3) In cold weather or when moisture collects on the pipe and the temperature of the pipe is less than 45 degrees F, preheat pipe to a temperature between 45 and 90 degrees F and 5 degrees F above dew point.
- 4) Clean pipe by abrasive blasting with a mixture of steel grit and shot to produce the surface preparation cleanliness as required by coating manufacturer and as specified.
 - a) Recycled abrasive shall be cleaned of debris and spent abrasive in an air wash separator.

- 5) Blast media mixture and gradation shall be adequate to achieve a sharp angular surface profile as required by coating manufacturer and to the minimum depth specified.
- 6) Protect prepared pipe from humidity, moisture and rain.
- 7) Keep pipe clean, dry and free of flash rust.
 - a) Remove all flash rust, imperfections or contamination on cleaned pipe surface by reblasting prior to primer application.
- 8) Complete priming and coating of pipe in a continuous operation the same day as surface preparation.
- 9) Abrasive blast exterior surfaces in accordance with SSPC SP 10/NACE No. 2; to a near-white blast cleaning with a minimum 3.0 mil angular profile in bare steel.
- c. Equipment
 - 1) 2-component, heated airless spray unit in accordance with coating manufacturer's recommendation
- d. Temperature
 - 1) Minimum 5 degrees F above dew point temperature
 - a) The temperature of the surface shall not be less than 60 degrees F during application.
- e. Humidity
 - 1) Heating of pipe surfaces may be required to meet requirements of this Section if relative humidity exceeds 80 percent.
- f. Resin
 - 1) Do not thin or mix resins; use as received.
 - 2) Store resins at a temperature recommended by the coating manufacturer.
- g. Application
 - 1) Applicator shall be certified by the coating manufacturer and conform to coating manufacturer's recommendations.
 - a) Thinning is not permitted.
 - 2) Apply directly to pipe to achieve a total dry film thickness (DFT) of 35 mils.
 - 3) Multiple-pass, 1 coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.
 - 4) Provide cutbacks in accordance with coating manufacturer's recommendations as appropriate for the type of joint and heat shrink sleeve to be used.

- h. Recoating
 - 1) Recoat only when coating has cured less than maximum time specified by coating manufacturer.
 - 2) When coating has cured for more than recoat time, brush-blast or thoroughly sand the surface.
 - 3) Blow-off cleaning using clean, dry, high pressure compressed air.
- i. Curing
 - 1) Do not handle pipe until coating has been allowed to cure, per manufacturer's recommendations.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Marking for Identification

- 1. For each joint of pipe and each fitting, plainly mark on 1 end:
 - a. Class for which it is designated
 - b. Date of manufacturer
 - c. Identification number
 - d. Top centerlines shall be marked on all specials

B. Factory Testing

- 1. Cement Mortar Lining - Shop-applied cement mortar linings shall be tested in accordance with AWWA C205.
- 2. Polyurethane Coating - The polyurethane coating shall be tested in accordance with AWWA C222.
 - a. Thickness: Test thickness of coating in accordance with SSPC PA 2.
 - 1) Test coating system applied to the pipe for holidays according to the procedures outlined in NACE SP0188 using a high voltage spark tester (operating at 100 volts per mil), for the dry film thickness (DFT) specified of 35 mil.
 - b. Adhesion Testing
 - 1) Polyurethane coatings or linings shall have an adhesion to steel of 1,500 pounds per square inch, minimum.
 - 2) Test polyurethane coating adhesion to steel substrates using pneumatic pull off equipment, such as HATE Model 108 or Delfesko Positest, in accordance with ASTM D4541 and AWWA C222, except as modified in this Section.

- 3) Adhesion testing records shall include:
 - a) Pipe identification
 - b) Surface tested (interior or exterior)
 - c) Surface temperature
 - d) Coating thickness
 - e) Tensile force applied
 - f) Mode of failure
 - g) Percentage of substrate failure relative of dolly surface
- 4) Glue dollies for adhesion testing to the coating surface and allowed to cure for a minimum of 12 hours.
 - a) Because of high cohesive strength, score polyurethane coatings around the dolly prior to conducting the adhesion test.
- 5) Failure shall be by adhesive and cohesive failure only.
 - a) Adhesive failure is defined as separation of the coating from the steel substrate.
 - b) Cohesive failure is defined as failure within the coating, resulting in coating remaining both on the steel substrate and dolly.
- 6) Retest partial adhesion and glue failure if the substrate failure is less than 50 percent relative of the dolly surface area and the applied tension was less than the specified adhesion.
- 7) Glue failures in excess of the minimum required tensile adhesion are accepted as meeting the specified adhesion requirements.
- 8) Conduct, accept and reject adhesion tests on polyurethane pipe coating and lining independently (where applicable).
- 9) Frequency of adhesion testing in accordance with AWWA C222.
- 10) Randomly select repair patches on the polyurethane coating for adhesion testing in a manner as described herein and at the discretion of the coating inspector conducting the adhesion tests.
 - a) Adhesion of repairs shall be as specified by the coating manufacturer for the type of repair.

C. Manufacturer's Technician for Pipe Installation

1. Pipe Manufacturer's Representative

- a. If required by the Engineer or requested by the Contractor during construction, the pipe manufacturer shall furnish the services of a factory trained, qualified,

job experienced technician to advise and instruct as necessary in pipe laying and pipe jointing.

- 1) The technician shall assist and advise the Contractor in his pipe laying operations and shall instruct construction personnel in proper joint assembly and joint inspection procedures.
- 2) The technician is not required to be on-site full time; however, the technician shall be regularly on-site during the first 2 weeks of pipe laying and thereafter as requested by the Engineer, City or Contractor.

2. Polyurethane Coating Manufacturer's Representative

- a. The pipe manufacturer shall provide services of polyurethane coating manufacturer's representative and a representative from the heat shrink joint manufacturer for a period of not less than 3 days at beginning of actual pipe laying operations to advise Contractor and City regarding installation, including but not limited to:
 - 1) Handling and storage
 - 2) Cleaning and inspecting
 - 3) Coating repairs
 - 4) Field applied coating
 - 5) Heat shrink installation procedures
 - 6) General construction methods and how they may affect pipe coating
- b. Representative shall be required to return if, in the opinion of the Engineer, the polyurethane coating or the Contractor's construction methods do not comply with Contract Specifications.
 - 1) Cost for the manufacturer's representatives to return to the site shall be at no additional cost to the City.

D. Hydrostatic Pressure Testing

1. Perform hydrostatic pressure testing in accordance with AWWA C200.
2. Hydrostatically test each joint of pipe prior to application of lining or coating.
 - a. The internal test pressure shall be that which results in a fiber stress equal to 75 percent of the minimum yield strength of the steel used.
 - b. Each joint of pipe tested shall be completely watertight under maximum test pressure.
 - c. Test pressure shall be held for sufficient time to observe the weld seams.
 - d. Maintain a recording pressure gauge, reference number of pipe tested, etc.
 - 1) The pipe shall be numbered in order that this information can be recorded.

3. Test fittings by:
 - a. Hydrostatic test
 - b. Magnetic particle test
 - c. Ultrasonic
 - d. Radiography
 - e. Dye penetrant test

E. City Testing and Inspection

1. Pipe may be subject to inspection at the manufacturer's facility by an independent testing laboratory, which laboratory shall be selected and retained by the City.
 - a. The City Engineer and EOR shall have access to the Work whenever it is in preparation or progress.
 - b. Pipe manufacturer shall provide proper facilities for access and for inspection.
 - c. Pipe manufacturer shall notify the City Inspector in writing, a minimum of 2 weeks prior to the pipe fabrication so that the City may advise the manufacturer as to the City's decision regarding tests to be performed by an independent testing laboratory.
 - d. Material, fabricated parts and pipe, which are discovered to be defective, or which do not conform to the requirements of this Specification shall be subject to rejection at any time prior to City's final acceptance of the product.
2. The inspection and testing by the independent testing laboratory anticipates that production of pipe shall be done over a normal period of time and without "slow downs" or other abnormal delays.
 - a. The pipe manufacturer shall coordinate their manufacturing schedule with the Contractor and advise the Contractor of any changes in the schedule.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install steel pipe, fittings, specials and appurtenances as specified herein, as specified in AWWA M11, in accordance with the pipe manufacturer's recommendations and as required for the proper functioning of the completed pipe line.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate, embed and backfill trenches in accordance with Section 33 05 06.
4. For installation of carrier pipe within casing, see Section 33 05 54.
5. Inspect and test each joint for holidays just prior to pipe being lowered into the ditch.
 - a. All damaged areas and holidays are to be repaired before the pipe is lowered into the trench.
6. Place and consolidate embedment and backfill prior to removing pipe stulls.
7. Maximum allowable pipe deflection is limited to:
 - a. 2 percent for mortar coated steel pipe
 - b. 3 percent for polyurethane coated steel pipe
8. Install bonds at all pipe joints, except for welded joints or insulated joints.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle pipe with care to avoid damage.
 - a. Pipe shall be handled at all times with sufficient non-abrasive slings, belts or other equipment designed to prevent damage to the coating or lining.
 - b. The spacing of pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the lining or coating.
 - c. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - d. The equipment shall be kept in such repair that its continued use is not injurious to the coating.
 - e. Do not lay pipe in wet conditions.
3. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Line Up at Bends

1. Line up pipe for joining so as to prevent damage thereto.

- a. Thoroughly clean the bell and spigot ends of each joint of pipe of foreign matter, rust and scale before placing spigot into bell.
2. Where abrupt changes in grade and direction occur, employ special shop fabricated fittings for the purpose.
 - a. Field cutting the ends of the steel pipe to accomplish angular changes in grade or direction of the line shall not be permitted.

D. Pipe Laying

1. Rubber Gasket Joints

- a. Join rubber gasket joints in accordance with the manufacturer's recommendations.
- b. Clean bell and spigot of foreign material.
- c. Lubricate gaskets and bell and relieve gasket tension around the perimeter of the pipe.
- d. Engage spigot as far as possible in bell.
- e. Joint deflection or pull shall not exceed the manufacturer's recommendation.
- f. Check gasket with feeler gauge all around the pipe.
- g. In areas of petroleum hydrocarbon soil contamination, install special Neoprene gaskets or approved equal.

2. Welded Joints

- a. Weld joints in accordance with AWWA C206.
 - 1) Contractor shall provide adequate ventilation for welders and for City's representative to observe welds.
 - 2) Welds shall be full circle fillet welds, unless otherwise specified.
 - 3) Welding shall be completed after application of field applied joint coating.
- b. Adequate provisions for reducing temperature stresses shall be the responsibility of the Contractor.
- c. After the pipe has been joined and properly aligned and prior to the start of the welding procedure:
 - 1) The spigot and bell shall be made essentially concentric by shimming or tacking to obtain clearance tolerance around the periphery of the joint.
 - 2) In no case shall the clearance tolerance be permitted to accumulate.
- d. Before welding:
 - 1) Thoroughly clean pipe ends.
 - 2) Weld pipe by machine or by the manual shielded electric arc process.
 - 3) Welding shall be performed so as not to damage lining or coating.

- 4) Cover the polyurethane coating as necessary to protect from weld splatter.
- e. Furnish labor, equipment, tools and supplies, including shielded type welding rod.
 - 1) Protect welding rod from any deterioration prior to its use.
 - 2) If any portion of a box or carton is damaged, reject the entire box or carton.
- f. Hand Welding
 - 1) The metal shall be deposited in successive layers.
 - 2) Not more than 1/8 inch of metal shall be deposited in each pass.
 - 3) Each pass except the final 1, whether in butt or fillet welds, shall be thoroughly bobbed or peened to relieve shrinkage stresses and to remove dirt, slag or flux before the succeeding bead is applied.
 - 4) Each pass shall be thoroughly fused into the plates at each side of the welding groove or fillet and shall not be permitted to pile up in the center of the weld.
 - 5) Undercutting along the side shall not be permitted.
- g. Welds shall be free from pin holes, non-metallic inclusions, air pockets, undercutting and/or any other defects.
- h. If the ends of the pipe are laminated, split or damaged to the extent that satisfactory welding contact cannot be obtained, remove the pipe from the line.
- i. Furnish each welder employed with a steel stencil for marking the welds, so that the Work of each welder may be identified.
- j. Have each welder stencil the pipe adjacent to the weld with the stencil assigned to him.
 - 1) In the event any welder leaves the job, his stencil shall be voided and not duplicated if another welder is employed.
- k. Welders
 - 1) Use only AWS certified, competent, skilled and qualified workmen.
 - a) Each welder employed by the Contractor shall be required to satisfactorily pass a welding test in accordance with AWWA C206 before being allowed to weld on the line.
 - b) After each welder has qualified in the preliminary tests referred to above, inspections shall be made of joints in the line.
 - c) Any welder making defective welds shall not be allowed to continue to weld.

E. Interior Joint Grouting

1. Upon completion of backfilling of the pipe trench, clean out dirt or trash which has collected in the joint and moisten the concrete surfaces of the joint space by spraying or brushing with a wet brush.
2. Fill the inside of the joint recess with a stiff cement mortar.
3. Where the mortar joint opening is 1 inch or wider, such as where trimmed spigots are required, apply a bonding agent to mortar and steel surface prior to placing joint mortar.
4. Ram or pack the stiff mortar into the joint space and take extreme care to ensure that no voids remain in the joint space.
5. After the joint has been filled, level the surfaces of the joint mortar with the interior surfaces of the pipe with a steel trowel so that the surface is smooth.
6. Interior joints of pipe 24-inch and smaller shall have the bell buttered with mortar, prior to inserting the spigot, such that when the spigot is pushed into position it will extrude surplus mortar from the joint.
 - a. The surplus mortar shall be struck off flush with the inside of the pipe by pulling a filled burlap bag or inflated ball through the pipe with a rope.

F. Exterior Joint Protection

1. Heat Shrink Sleeves

a. General

- 1) Buried pipe joints shall be field coated after pipe assembly in accordance with AWWA C216, using Heat Shrink Sleeves.
- 2) Width of heat shrink sleeve shall be sufficient to overlap the polyurethane coating by a minimum of 3 inches.
- 3) Overlapping of 2 or more heat shrink sleeves to achieve the necessary width will not be permitted.

b. Installation

- 1) Clean pipe surface and adjacent coating of all mud, oil, grease, rust and other foreign contaminants with a wire brush in accordance with SSPC SP 2, or SSPC SP 3. Remove oil or grease contamination by solvent wiping the pipe and adjacent coating in accordance with SSPC SP 1.
 - a) Clean the full circumference of the pipe and a minimum of 6 inches onto the existing coating.
- 2) Remove all loose or damaged pipe coating at joint and either repair the coating as specified herein or increase the length of the joint coating, where reasonable and practical.

- 3) Complete joint bonding of non-welded pipe joints before application of joint coating.
- 4) Joint bonds shall be low profile bonds and all gaps and crevices around the bonds shall be filled with mastic sealant.
- 5) Store sleeves in shipping box until use is required.
 - a) Keep dry and sheltered from exposure to direct sunlight.
 - b) Store off the ground or concrete floors and maintain at a temperature between 60 degrees F and 100 degrees F as recommended by the sleeve manufacturer.
- 6) Metal surface shall be free of all dirt, dust and flash rusting prior to sleeve application.
- 7) Preheat pipe uniformly to 140 degrees F to 160 degrees F or as recommended by the sleeve manufacturer.
 - a) Monitor pipe temperature using a surface temperature gauge, infrared thermometer or color changing crayons.
 - b) Protect preheated pipe from rain, snow, frost or moisture with tenting or shields and do not permit the joint to cool.
- 8) Prime joint with specified primer and fill all cracks, crevices and gaps with mastic filler in accordance with the manufacturer's recommendations for the full circumference of the pipe.
- 9) Apply heat shrink sleeve when it is at a minimum temperature of 60 degrees F and while maintaining the pipe temperature above the preheat temperature specified.
- 10) Apply sleeve in accordance with the manufacturer's instructions and center the sleeve over the joint to provide a minimum of 3-inch overlay onto the existing pipe coating.
- 11) Apply heat to the sleeve using either propane fire infrared heaters or wrap around heaters.
 - a) Hold flame a minimum of 6 inches from the sleeve surface.
 - b) Periodically roll the coating on the pipe surface.
 - c) Heat from the center of the sleeve to the outer edge until properly seated, then begin in the opposite direction.
 - d) Monitor sleeve for color change, where appropriate, or with appropriate temperature gauges.
 - e) Take care not to excessively heat the parent coating.

- 12) Completed joint sleeve shall be fully bonded to the pipe and existing coating surface, without voids, mastic beading shall be visible along the full circumference of the sleeve, and there shall be no wrinkling or excessive burns on the sleeves.
 - a) Sleeves which do not meet these requirements shall be removed and the joint recoated as directed by the Engineer.
 - b) Minor repairs may be repaired using heat shrink sleeve repair kits.
- 13) Allow the sleeve to cool before moving, handling or backfilling. In hot climates, provide shading from direct sunlight.
 - a) Water quenching will be allowed only when permitted by the sleeve manufacturer.

G. Protective Welded Joints Coating System – Weld After Backfill

1. General

- a. Application of protective coating at the pipe joints will be as follows:
 - 1) Apply a 3 layer joint coating system consisting of a factory applied 35 mil polyurethane coating
 - 2) A field applied 60 mil by 6 inch wide strip of CANUSA HCO Wrapid Tape heat resistant tape at the location of the welding
 - 3) A field applied 110 mil (full recovered thickness) by 18 inch wide CANUSA AquaWrap high shrink heat shrinkable joint sleeve
 - 4) After the heat shrinkable joint sleeve is installed, backfill the trench and then weld the joint.
- b. The Contractor is responsible for his operations so that they do not damage the factory applied coating system.
- c. When applying the 3 layer joint coating system for post welding the joints, the Contractor must show that his operation will not damage the joint coating system to the Engineer's satisfaction.
- d. The Contractor will be required to fully uncover a maximum of 10 joints, selected at random by the Engineer or City to visually inspect and test the joint after welding. Any damage must be repaired.
 - 1) If the Contractor's welding procedure damages the 3 layer joint coating system, the Contractor, at the direction of the Engineer, will be required to modify his welding procedure.

2. Joint Coating (3 Layer)

- a. Apply 3 Layer Joint Coating System before Welding the Joint

- b. Pipe Manufacturing and Heat Tape
 - 1) A 35 mil thickness polyurethane coating shall be applied over entire length of pipe.
 - 2) The Contractor shall field apply 60 mil thick by 6 inch wide strip of CANUSA HCO Wrapid Tape heat resistant tape to the exterior bell end of the pipe, centered on the location of the welding, over a 35 mil factory applied polyurethane coating.
- c. Surface Preparation and Installation for Heat Shrinkable Joint Sleeve
 - 1) Clean pipe surface and adjacent coating of all mud, oil, grease, rust and other foreign contaminants with a wire brush in accordance with SSPC SP 2, or SSPC SP 3. Remove oil or grease contamination by solvent wiping the pipe and adjacent coating in accordance with SSPC SP 1.
 - a) Clean the full circumference of the pipe and a minimum of 6 inches onto the existing coating.
 - 2) Remove all loose or damaged pipe coating at joint and either repair the coating as specified herein or increase the length of the joint coating, where reasonable and practical.
 - 3) Complete joint bonding of pipe joints before application of joint coating.
 - a) Joint bonds shall be low profile bonds and all gaps and crevices around the bonds shall be filled with mastic sealant.
 - 4) Store sleeves in shipping box until use is required.
 - a) Keep dry and sheltered from exposure to direct sunlight.
 - b) Store off the ground or concrete floors and maintain at a temperature between 60 degrees F and 100 degrees F as recommended by the sleeve manufacturer.
 - 5) Metal surface shall be free of all dirt, dust and flash rusting prior to sleeve application.
 - 6) Preheat pipe uniformly to 140 degrees F to 160 degrees F or as recommended by the sleeve manufacturer.
 - a) Monitor pipe temperature using a surface temperature gauge, infrared thermometer or color changing crayons.
 - b) Protect preheated pipe from rain, snow, frost or moisture with tenting or shields and do not permit the joint to cool.

- 7) Prime joint with specified primer and fill all cracks, crevices, and gaps with mastic filler in accordance with the manufacturer's recommendations for the full circumference of the pipe.
- 8) Apply heat shrink sleeve when it is at a minimum temperature of 60 degrees F and while maintaining the pipe temperature above the preheat temperature specified.
 - a) Apply sleeve in accordance with the manufacturer's instructions and center the sleeve over the joint to provide a minimum of 3-inch overlay onto the existing pipe coating.
- 9) Apply heat to the sleeve using either propane fire infrared heaters or wrap around heaters.
 - a) Hold flame a minimum of 6 inches from the sleeve surface.
 - b) Periodically roll the coating on the pipe surface.
 - c) Heat from the center of the sleeve to the outer edge until properly seated, then begin in the opposite direction.
 - d) Take care not to excessively heat the parent coating.
 - e) Monitor sleeve for color change, where appropriate, or with appropriate temperature gauges.
- 10) Completed joint sleeve shall be fully bonded to the pipe and existing coating surface, without voids, mastic beading shall be visible along the full circumference of the sleeve, and there shall be no wrinkling or excessive burns on the sleeves.
 - a) Sleeves which do not meet these requirements shall be removed and the joint recoated as directed by the Engineer.
 - b) Minor repairs may be repaired using heat shrink sleeve repair kits.
- 11) Allow the sleeve to cool before moving, handling or backfilling.
 - a) In hot climates, provide shading from direct sunlight.
 - b) Water quenching will be allowed only when permitted by the sleeve manufacturer.
- 12) Holiday testing shall be performed using a high voltage holiday tester (operating at 100 volts per mil) at each joint after field application of heat shrinkable joint sleeve per SP0188.
 - a) If any holidays or cuts are detected, the sleeve shall be repaired using the heat shrink sleeve manufacturer's recommendation.

- b) The damaged area shall be covered with a minimum of 50-mm overlap around the damaged area.

H. Protection of Buried Metal

1. Coat buried ferrous metal such as bolts and flanges, which cannot be protected with factory or field-applied polyurethane coatings or heat shrink sleeves, with 2 wraps of wax tape and encase in flowable fill.

3.5 REPAIR

A. Repair and Field Touchup of Polyurethane Coating

1. For repair and field touch-up of polyurethane coating, apply:
 - a. Coating manufacturer's recommendation
2. Holidays
 - a. Remove all traces of oil, grease, dust, dirt and other debris.
 - b. Roughen area to be patched by sanding with rough grade sandpaper (40 grit).
 - c. Apply a 35 mil coat of repair material described above.
 - d. Work repair material into scratched surface by brushing or rolling in accordance with manufacturer's recommendations.
 - e. Retest for Holiday.
3. Field Cuts or Large Damage
 - a. If in the opinion of the City the polyurethane coating is excessively damaged, the pipe segment will be rejected until the coating system is removed and replaced so that the system is in a like-new condition.
 - b. Remove burrs from field cut ends or handling damage and smooth out edge of polyurethane coating.
 - c. Remove all traces of oil, grease, dust, dirt and other debris.
 - d. Roughen area to be patched with rough grade sandpaper (40 grit).
 - e. Feather edges and include overlap of 2 inches of roughened polyurethane in area to be patched.
 - f. Apply a 35 mil coat of repair material described above, in accordance with manufacturer's recommendations.
 - g. Work repair material into scratched surface by brushing.
 - h. Feather edges of repair material into prepared surface.
 - i. Cover at least 1 inch of roughed area surrounding damage or adjacent to field cut.
 - j. Test repairs for holidays.

B. Patch of Cement Mortar Lining

1. Repair cracks larger than 1/16 inch.
2. Pipes with disbonded linings will be rejected.
3. Excessive patching of lining shall not be permitted.
4. Repair in accordance with AWWA C205 and as follows:
 - a. Apply bonding agent to patch area.
 - b. Patching of lining shall be allowed where area to be repaired does not exceed 100 square inches and has no dimension greater than 12 inches.
 - c. In general, there shall be not more than 1 patch in the lining of any joint of pipe.
5. Wherever necessary to patch the pipe, make the patch with the mortar indicated.
6. Do not install patched pipe until the patch has been properly and adequately cured, unless approved by the City.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Quality Control of Field Applied Polyurethane Coating
 - a. Surface Preparation
 - 1) Visually inspect surface preparation to ensure cleanliness and dryness requirements have been met.
 - 2) Use Testex tape on at least 1 joint per day to ensure that adequate profile is being achieved.
 - b. Visual
 - 1) Visually inspect cured coating to ensure that the coating is completely cured with no blisters, cracks, pinholes, missed areas, excessive roughness, "sticky" or "goosey" areas.
 - 2) Check to ensure that the coating completely covers the steel and existing coating.
 - c. Thickness
 - 1) Use a magnetic dry film thickness (DFT) gauge on cured coating to ensure adequate thickness has been achieved according to SSPC PA 2.

- a) If the thickness of the coating is below the minimum specified millage anywhere along the length of the pipe, then adjustments must be made to the spray system to correct the problem.
 - 2) At a minimum, the thickness shall be measured for every 50 square feet of sprayed area.
- d. Adhesion
 - 1) Perform the following procedure on a minimum of 1 joint per day:
 - a) Select area to test that has cured for at least 1 hour for fast setting coatings.
 - b) Test and repair in accordance with AWWA C222 Dolly Pull-off Test.
- e. Holiday Testing
 - 1) Holiday testing shall be performed using a high voltage holiday tester at each joint no sooner than 1 hour after field application of polyurethane coating.
- f. Inspection at Welding Joints
 - 1) When applying the 3 layer joint coating system for post welding the joints, the Contractor must show that his operation will not damage the joint coating system to the Engineer's satisfaction.
 - 2) The Contractor will be required to fully uncover a maximum of 10 joints, selected at random by the Engineer or City to visually inspect and test the joint after welding.
 - 3) Any damage must be repaired.
 - 4) If the Contractor's welding procedure damages the 3 layer joint coating system, the Contractor, at the direction of the Engineer, will be required to modify his welding procedure.
- 2. Weld Testing
 - a. Dye penetrant tests in accordance with ASTM E165, or magnetic particle test in accordance with AWWA C206 and set forth in AWS D.1.1. shall be performed by the Contractor under the supervision and inspection of the City's Representative or an independent testing laboratory, on all full welded joints.
 - 1) Welds that are defective will be replaced or repaired, whichever is deemed necessary by the Engineer, at the Contractor's expense.
 - 2) If the Contractor disagrees with the Engineer's interpretation of welding tests, test sections may be cut from the joint for physical testing. The

Contractor shall bear the expense of repairing the joint, regardless of the results of physical testing.

- 3) The procedure for repairing the joint shall be approved by the Engineer before proceeding.

3. Deflection Testing

- a. Prior to hydrostatic testing, contractor shall perform deflection testing at a minimum rate of 1 measurement for every 2,500 linear feet of water line and submit proof to City.
- b. City may reject any areas not meeting the deflection requirements of this Specification.

4. Cleaning and Testing

- a. Cleaning, disinfection, hydrostatic testing, and bacteriological testing of water mains:
 - 1) Clean, flush, pig, disinfect, hydrostatic test, and bacteriological test the water main as specified in Section 33 01 12.

5. Closed Circuit Television (CCTV) Inspection

- a. Provide a Post-CCTV Inspection for water lines 24-inch and larger in accordance with Section 33 01 15.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 31
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyvinyl Chloride (PVC) Pressure Pipe 4-inch through 36-inch for potable water, wastewater and reuse applications
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 13 – Cleaning and Approval
 - 2. Section 33 01 12 – Hydrostatic Testing and Disinfection
 - 3. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection
 - 4. Section 33 05 06 – Pipe Bedding and Backfill Material
 - 5. Section 33 05 19 – Ductile Iron Pipe and Fittings
 - 6. Section 33 05 91 – Utility Markers, Locators, and Tracer Wire

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Measured horizontally along the surface from center line to center line of the fitting, manhole, or appurtenance
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “PVC Water Pipe” installed for:
 - 1) Various sizes
 - 2) Various types of backfill

- b. The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot installed for:
 - 1) Various sizes
- 3. The price bid shall include:
 - a. Furnishing and installing PVC Pressure Pipe with joints as specified by the Drawings
 - b. Mobilization
 - c. Pavement removal
 - d. Excavation
 - e. Hauling
 - f. Disposal of excess material
 - g. Furnishing, placement and compaction of embedment
 - h. Furnishing, placement and compaction of backfill
 - i. Trench water stops
 - j. Thrust restraint, if required by Contract Documents
 - k. Gaskets
 - l. Clean-up
 - m. Cleaning
 - n. Disinfection
 - o. Testing

1.3 REFERENCES

A. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. American Association of State Highway and Transportation Officials (AASHTO).
- 3. ASTM International (ASTM):
 - a. D1598, Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
 - b. D1599, Standard Test method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

- c. D1784, Standard Specification for Rigid Poly(Vinyl-Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- d. D1869, Standard Specification for Rubber Rings for Fiber-Reinforced Cement Pipe
- e. D2152, Standard Test Method for Adequacy of fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
- f. D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- g. D2412, Standard Test method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- h. D2444, Standard Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
- 4. American Water Works Association (AWWA):
 - a. C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 IN through 12 IN, for Water Transmission and Distribution.
- 5. NSF International (NSF):
 - a. 61, Drinking Water System Components – Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. For PVC Pressure Pipe that is used for water distribution or wastewater force mains including:
 - a. PVC Pressure Pipe
 - b. Manufacturer
 - c. Dimension Ratio
 - d. Joint Types

2. Restraint, if required in Contract Documents
 - a. Retainer glands
 - b. Thrust harnesses
 - c. Any other means of restraint
 3. Gaskets
- B. Shop Drawings: When restrained joints are required, furnish for PVC Pressure Pipe used in the water distribution system or for a wastewater force main for 16-inch and greater diameters, including:
1. Wall thickness design calculations sealed by a Licensed Professional Engineer in Texas including:
 - a. Working pressure
 - b. Surge pressure
 - c. Deflection
 2. Provide thrust restraint calculations for all fittings and valves, sealed by a Licensed Professional Engineer in Texas, to verify the restraint lengths shown on the Drawings.
 3. Lay schedule / drawing for 24-inch and greater diameters sealed by a Licensed Professional Engineer in Texas including:
 - a. Pipe class
 - b. Joints type
 - c. Fittings
 - d. Stationing
 - e. Transitions
 - f. Joint deflection
- C. Certificates
1. Furnish an affidavit certifying that all PVC Pressure Pipe meets the provisions of this Section, each run of pipe furnished has met Specifications, all inspections have been made and that all tests have been performed in accordance with AWWA C900.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

- a. Finished pipe shall be the product of 1 manufacturer for each size, unless otherwise approved by the City.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
- b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
- c. All pipe furnished shall be in conformance with AWWA C900.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Store and handle in accordance with the guidelines as stated in AWWA M23.
2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.

2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Pipe

1. Pipe shall be of the rigid (unplasticized) type pressure rated at 150 or 200 psi. conforming to AWWA C900 (DR18).
 2. PVC Pressure Pipe for potable water shall meet the requirements of NSF 61 and NSF 372.
 3. Pipe must bear the National Sanitation Foundation seal of approval for potable water pipe and shall be blue in color.
 4. Pipe shall have a lay length of 20 feet except for special fittings or closure pieces necessary to comply with the Drawings.
 5. The pipe material shall be PVC, meeting the requirements of ASTM D1784, with a cell classification of 12454. Outside diameters must be equal to those of cast iron and ductile iron pipes.
6. Pipe Markings
- a. Meet the minimum requirements of AWWA C900 or AWWA C905. Minimum pipe markings shall be as follows:
 - 1) Manufacturer's Name or Trademark and production record
 - 2) Nominal pipe size
 - 3) Dimension Ratio
 - 4) AWWA C900 or AWWA C905
 - 5) Seal of testing agency that verified the suitability of the pipe

C. Pressure and Deflection Design

1. Pipe design shall be based on trench conditions and design pressure class specified in the Drawings. Pipe shall be designed according to the methods indicated in AWWA M23 for trench construction, using the following parameters:
 - a. Unit Weight of Fill (w) = 130 pcf
 - b. Live Load = AASHTO HS 20
 - c. Trench Depth = 12 feet minimum, or as indicated in Drawings
 - d. Maximum E' = 1,000 max
 - e. Deflection Lag Factor = 1.0

- f. Working Pressure (P_w) = 150 psi
 - g. Surge Allowance (P_s) = 100 psi minimum
 - h. Test Pressure =
 - 1) No less than 1.25 times the stated working pressure (187 psi minimum) of the pipeline measured at the highest elevation along the test section.
 - 2) No less than 1.5 times the stated working pressure (225 psi minimum) at the lowest elevation of the test section.
 - i. Maximum Calculated Deflection = 3 percent
 - j. Restrained Joint Safety Factor (SF) = 1.5
 - k. Maximum Joint Deflection = 50 percent of the manufacturer's recommendations.
2. Verify trench depths after existing utilities are located.
- a. Accommodate vertical alignment changes required because of existing utility or other conflicts by an appropriate change in pipe design depth.
 - b. In no case shall pipe be installed deeper than its design allows.
3. Provisions for Thrust
- a. Thrusts at bends, tees, plugs or other fittings shall be mechanically restrained joints when required by the Drawings.
 - b. No thrust restraint contribution shall be allowed for the restrained length of pipe within the casing.
 - c. Restrained joints, where required, shall be used for a sufficient distance from each side of the bend, tee, plug, valve, or other fitting to resist thrust which will be developed at the design pressure of the pipe. For the purpose of thrust the following shall apply:
 - 1) Calculate valves as dead ends.
 - 2) Design pressure shall be greater than the pressure class of the pipe or the internal pressure (P_i), whichever is greater.
 - 3) Restrained joints shall consist of approved mechanical restrained or push-on restrained joints as listed in the City's Standard Products List as shown in Section 01 60 00.
 - 4) Restrained PVC pipe is not allowed for pipe greater than 12 inches.
 - d. The Pipe Manufacturer shall verify the length of pipe with restrained joints to resist thrust in accordance with the Drawings and the following:

- 1) Calculate the weight of the earth (W_e) as the weight of the projected soil prism above the pipe, for unsaturated soil conditions.
- 2) Soil density = 115 pcf (maximum value to be used), for unsaturated soil conditions
- 3) In locations where ground water is encountered, reduce the soil density to its buoyant weight for the backfill below the water table.
 - a) Reduce the coefficient of friction to 0.25.

4. Joints

- a. Each joint of pipe shall consist of a single continuous extrusion. Bells or other components attached by solvent welding are not acceptable.
- b. Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells, or of the double spigot type with thickened coupling sleeves with rubber gasket joints. Joints shall be gasket, bell and spigot and push on type conforming to ASTM D3139.
- c. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness.
- d. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction.
- e. Rubber gaskets shall be of such a cross section that compression of the gasket within the pipe joint and water pressure within the pipe will cause a reaction by the gasket which tends to seal the joint.
- f. Gaskets shall conform to retaining grooves in the bell or coupling, shaped to position the gasket and aid in sealing the joint.
- g. Lubricant must be nontoxic and NSF approved for potable water applications.

5. Detectable Markers

- a. Provide detectable markers in accordance with Section 33 05 91.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install pipe, fittings, specials and appurtenances as specified herein, as specified in AWWA C600, AWWA C605, AWWA M23 and in accordance with the pipe manufacturer's recommendations.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 33 05 06.
4. Embed PVC Pressure Pipe in accordance with Section 33 05 06.
5. For installation of carrier pipe within casing, see Section 33 05 54.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
 - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Joint Making

1. Push-on Joints
 - a. Install Push-On joints as defined in AWWA C900 and AWWA C905.
 - b. Wipe clean the gasket seat inside the bell of all extraneous matter.
 - c. Place the gasket in the bell in the position prescribed by the manufacturer.

- d. Apply a thin film of non-toxic vegetable soap lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell.
- e. When using a field cut plain end piece of pipe, refinish the field cut to conform to AWWA C605.

2. Joint Deflection

- a. Deflect the pipe only with written pre-approval from City Engineer and when necessary to avoid obstructions, or to meet the lines and grades shown in the Drawings.
- b. Joint deflection shall not exceed 50 percent of the manufacturer's recommendation.

D. Detectable Metallic Tape Installation

1. See Section 33 05 91.

3.5 REPAIR/RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL

A. Potable Water Mains

1. Cleaning, disinfection, hydrostatic testing, and bacteriological testing of water mains:
 - a. Clean, flush, pig, disinfect, hydrostatic test and bacteriological test the water main as specified in Section 33 01 12.

B. Wastewater Lines

1. Closed Circuit Television (CCTV) Inspection
 - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 15.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 32
POLYVINYL CHLORIDE (PVC) GRAVITY SANITARY SEWER PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Polyvinyl Chloride (PVC) pipe 4-inch through 6-inch for gravity sanitary sewer services.
 - 2. Polyvinyl Chloride (PVC) pipe 8-inch through 24-inch for gravity sanitary sewer main applications.
 - 3. Polyvinyl Chloride (PVC) pipe 8-inch through 12-inch for pressure rated gravity sanitary sewer main applications.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection
 - 2. Section 33 05 06 – Pipe Bedding and Backfill Material
 - 3. Section 33 05 91 – Utility Markers, Locators, and Tracer Wire
 - 4. Section 33 31 16 – Sanitary Sewer Service Connections and Service Line

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. PVC Gravity Sewer Pipe
 - a. Measurement
 - 1) Measured horizontally along the surface from center line to center line of the manhole, or appurtenance.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “PVC Gravity Sewer Pipe” installed for:
 - a) Various sizes.
 - b) Various backfills.
 - c. The price bid shall include:
 - 1) Furnishing and installing PVC Gravity Sewer Pipe with joints as specified by the Drawings
 - 2) Pavement removal
 - 3) Excavation
 - 4) Hauling
 - 5) Disposal of excess material
 - 6) Furnishing, placement, and compaction of embedment
 - 7) Furnishing, placement, and compaction of backfill
 - 8) Clay Dams
 - 9) Gaskets

- 10) Clean-up
- 11) Cleaning
- 12) Testing
- 2. PVC Gravity Sewer Pressure Pipe
 - a. Measurement
 - 1) Measured horizontally along the surface from center line to center line of the manhole, or appurtenance.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “PVC Gravity Sewer Pressure Pipe” installed for:
 - a) Various sizes.
 - b) Various backfills.
 - c. The price bid shall include:
 - 1) Furnishing and installing PVC Gravity Sewer Pressure Pipe with joints as specified by the Drawings
 - 2) Pavement removal
 - 3) Excavation
 - 4) Hauling
 - 5) Disposal of excess material
 - 6) Furnishing, placement, and compaction of embedment
 - 7) Furnishing, placement, and compaction of backfill
 - 8) Clay Dams
 - 9) Clean-up
 - 10) Cleaning
 - 11) Testing

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. PVC – Polyvinyl Chloride

B. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section, unless a date is specifically cited.
- 2. American Association of State Highway and Transportation (AASHTO).
- 3. ASTM International (ASTM):
 - a. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - b. D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - c. D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - d. D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - e. D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

- f. F679, Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- 4. Texas Administration Code:
 - a. Chapter 217, (30 TAC §217), Design Criteria for Sewerage System.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Product data sheet
 - 2. Manufacturer
 - 3. Nominal pipe diameter
 - 4. Standard dimension ratio (SDR)
 - 5. Cell classification
 - 6. Laying lengths
- B. Certificates
 - 1. Furnish an affidavit certifying the PVC Gravity and Pressure Rated Gravity Sewer Pipe has been air and deflection tested and is in accordance with this Section and ASTM D3034, ASTM F679, or ASTM D2241.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturers
 - a. Finished pipe shall be the product of 1 manufacturer for each size per project, unless otherwise approved by the City.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
 - b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
 - c. Furnish Gravity Sewer Pipe in accordance with ASTM D3034 (4-inch through 15-inch), ASTM F679 (18-inch through 30-inch) and ASTM F949 (larger than 30-inch).
 - d. Furnish Pressure Rated Gravity Sewer Pipe in accordance with ASTM D2241 (8-inch through 12-inch).

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements
 - 1. Pipe manufactured more than 1 years prior to installation date will not be accepted by the City.

B. Storage and Handling Requirements

1. Gravity pipe shall be stored and handled in accordance with the manufacturer's guidelines.
2. Protect pipe from UV exposure.
 - a. When long-term storage (more than 1-months) with exposure to direct sunlight is unavoidable, cover PVC pipe with an opaque material and provide adequate air circulation above and around the pipe as required to prevent excessive heat accumulation.
3. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
- 3.

B. Performance / Design Criteria

1. Pipe
 - a. Designed in accordance with 30 TAC §217.
 - b. Design in accordance with ASTM D3034 for 4-inch through 15-inch gravity pipe, ASTM F679 for 18-inch through 24-inch gravity pipe, and ASTM D2241 for 8-inch through 12-inch pressure rated gravity pipe.
 - c. PVC Gravity Sanitary Sewer Pipe shall be approved by the Underwriters Laboratories, Inc.
 - d. Assume a standard lay length of 14 feet and 20 feet except for special fittings or closure pieces necessary to comply with the Drawings.
 - e. PVC in accordance with ASTM D1784, with a cell classification of 12454 or 12364.
 - f. The following Standard Dimension Ratio's apply:

Application	Diameter (inch)	Min Performance Designation
Sewer Service	4 through 6	Schedule 40
Gravity Sewer Main (< 15-ft bury depth)	8 through 30	SDR 26/PS46
Gravity Sewer Main (≥ 15-ft bury depth)	8 through 30	SDR 26/PS115

Pressure Rated Gravity Sewer Main (All depths)	8 through 12	SDR 26/PR160

- g. Deflection Design
- 1) Base pipe design on pipe stiffness, soil stiffness, and load on the pipe.
 - 2) Design pipe according to the Modified Iowa Formula as detailed by the Uni-Bell PVC Pipe Association in the Handbook of PVC Pipe, using the following parameters:
 - a) Unit Weight of Fill (w) = 130 pounds per cubic foot
 - b) Live Load = AASHTO HS 20
 - c) Trench Depth = 12 feet minimum, or as indicated in Drawings
 - d) Maximum (E') = 1,000 max
 - e) Deflection Lag Factor (DL) = 1.0
 - f) Bedding Factor constant (K) = 0.1
 - g) Mean radius of the pipe (r), inches, as indicated in Drawings
 - h) Marston's load per unit length (W), pounds per inch, calculate per Drawings
 - i) PVC modulus of elasticity (E) = 400,000 psi
 - j) Moment of inertia of pipe wall per unit length, (I) = $t^3/12$, (in^4/in), per pipe type and size
 - (1) Where (t) = pipe thickness, inches
 - k) Maximum Calculated Deflection = 5 percent
 - h. Pipe Flotation: If the pipe is buried in common saturated soil (about 120 pounds per cubic foot) with at least $1\frac{1}{2}$ pipe diameters of cover, pipe is generally not subject to flotation. If shallower, check groundwater flotation potential. Flotation will occur if:

$$F_b > W_p + W_f + W_d$$

Where:

- F_b = buoyant force, pound per foot
- W_p = empty pipe weight, pound per foot
- W_f = weight of flooded soil, pound per foot
- W_d = weight of dry soil, pound per foot

Values and formulas for the above variables can be obtained from the pipe manufacturer and site-specific soil conditions.

- i. Verify trench depths after existing utilities are located.
 - j. If vertical alignment changes due to an existing utility or other conflict, verify whether change in required pipe design stiffness is required.
 - k. In no case shall pipe be installed deeper than its design allows.
2. Pipe markings
- a. In accordance with ASTM D3034 and ASTM F679.
 - b. Minimum pipe markings shall be as follows:
 - 1) Manufacturer's Name or Trademark and production record
 - 2) Nominal pipe size
 - 3) PVC cell classification
 - 4) ASTM or Standard Dimension Ratio (SDR) designation or pipe stiffness
 - 5) Seal of testing agency that verified the suitability of the pipe
3. Color
- a. Pipe shall be green in color.

- 1) Any discoloration in the pipe shall be sufficient cause for rejection.
- b. Fittings shall be green or white in color.
4. Joints
 - a. Each joint shall consist of a single continuous extrusion with push-on, rubber gasket joints of the integral bell and spigot type.
 - b. Elastomeric Gaskets shall comply in all respects with the physical requirements specified in ASTM F 477.
 - c. PVC fittings shall meet the requirements of ASTM D 3034 (SDR 26) for sizes 6" through 15" and ASTM F 679 (wall thickness T-1) for sizes 18" through 30".
 - d. Fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13343-C as defined in ASTM D 1784.
 - e. Fittings shall be suitable for use with PVC gravity sewer pipe and shall not deflect more than the pipe when loaded similar.
 - f. All PVC fitting shall be solid molded (no glue and heat fabrication) for sizes up to 15", for sizes over 15" product specifications shall be submitted for approval.
 - g. Since each pipe manufacturer has a different design for push-on joints; gaskets shall be part of a complete pipe section and purchased as such.
5. Connections
 - a. Only use manufactured fittings.
 - b. In accordance with Section 33 31 16
6. Detectable Metallic Tape
 - a. In accordance with Section 33 05 91

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

- A. Test pipe in accordance with ASTM D2412 assuming minimum pipe stiffness of 46 psi at 5 percent deflection.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. General
 1. Install pipe, specials, and appurtenances in accordance with this Section, Section 33 05 06, and the pipe manufacturer's recommendations.
 2. Lay pipe to the lines and grades as indicated in the Drawings.
 3. Excavate and backfill trenches in accordance with Section 33 05 06.
 4. Embed PVC pipe in accordance with Section 33 05 06.
 5. PVC gravity pipe and fittings shall be installed in accordance with UNI-B-5-86 and as specified herein.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
 - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals, and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Pipe Joint Installation

1. Clean dirt and foreign material from the gasketed socket and the spigot end.
2. Assemble pipe joint by sliding the lubricated spigot end into the gasketed bell end to the reference mark.
3. Install such that identification marking on each joint are oriented upward toward the trench opening.
4. When making connection to manhole, use a link seal or flexible boot to facilitate a seal.

D. Connection Installation

1. In accordance with Section 33 31 16.

E. Detectable Metallic Tape Installation

1. In accordance with Section 33 05 91.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Gravity Sewer Mains

1. Closed Circuit Television (CCTV) Inspection
 - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 15.
2. Sewer Pipe Testing
 - a. Test pipe in accordance with Section 33 01 14.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Gravity Sewer Mains

1. Cleaning of sewer mains
 - a. Clean the mains in accordance with Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 53
HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. High Density Polyethylene (HDPE) pipe and fittings from 4-inch through 32inch for potable water and reuse applications including distribution piping and horizontal directional drill (HDD).
- B. Deviations from this City of League City Standard Specification:
1. None.

1.2 PRICE AND PAYMENT PROCEDURES [NOT USED]

1.3 REFERENCES

- A. Reference Standards
1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
- B. ANSI/AWWA www.awwa.org
1. AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation
 2. ANSI/AWWA C111/A21.11-12 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 3. AWWA C207-13 Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
 4. ANSI/AWWA C651 Standard for Disinfecting Water Mains
 5. ANSI/AWWA C800 Underground Service Line Valves and Fittings
 6. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service
 7. ANSI/AWWA C906-15 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm to 1,650 mm), for Waterworks
- C. Plastics Pipe Institute, PPI www.plasticpipe.org
1. PPI Handbook of Polyethylene Pipe – 2009 (2nd Edition)
 2. PPI TR-33 Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe
 3. PPI TR-34 Disinfection of Newly Constructed Polyethylene Water Mains
 4. PPI TR-41 Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping
 5. PPI TN-34 Installation Guidelines for Electrofusion Couplings 14-inch and Larger
 6. PPI TN-42 Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects (2009)
 7. Municipal Advisory Board Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE) Pipe

D. NSF www.nsf.org

1. NSF 61, Drinking Water System Components–Health Effects
2. NSF 372, Drinking Water System Components–Lead Content

E. ASTM www.astm.org

1. ASTM B 62 Standard Specification for Composition Bronze or Ounce Metal Castings
2. ASTM D 698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
3. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR- PR) Based on Controlled Inside Diameter
4. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
5. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
6. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing
7. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
8. ASTM D 3035 Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
9. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
10. ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
11. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR- PR) Based on Outside Diameter
12. ASTM F 905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints
13. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
14. ASTM F 1290 Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
15. ASTM F 1412 Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
16. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
17. ASTM F 1668 Standard Guide for Construction Procedures for Buried Plastic Pipe
18. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
19. ASTM F 2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene
20. (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock
21. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F. F. AASHTO (www.transportation.org)

1. AASHTO T-99 Standard Method of Test for Moisture-Density Relations of Soils Using a
2. 5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

G. G. International Organization for Standardization (www.iso.org)

1. ISO 12176-2 Plastics pipes and fittings -- Equipment for fusion jointing polyethylene systems
- ISO/TR 13950 Plastics pipes and fittings -- Automatic recognition systems for electrofusion joints

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.
- C. Requirements
 1. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications. This certification shall be in the form of a written document from the manufacturer attesting to the manufacturing process meeting the standards.
 2. The Contractor shall submit shop drawings showing installation method and the proposed method and specialized equipment to be used.
 3. Manufacturers recommended fusion procedures for the products.
- D. Provide Product Data
 1. Manufacturer
 2. Dimension Ratio
 3. Joint Types
 4. Restraint, if required in Contract Documents
 - a. Retainer glands
 - b. Thrust harnesses
 - c. Any other means of restraint
- E. Lay schedule/drawing
 1. Lay schedule is required for 24-inch and greater diameters
 2. Schedule must be sealed by a Professional Engineer licensed in North Carolina and must include:
 - a. Pipe class
 - b. Fittings – bends, tees, services, connections, MJ adapters
 - c. Stationing
 - d. Transitions
 - e. Joint deflection
 3. Note that lay schedule does not need to indicate location of butt fusion joints, as these will be determined in the field based on available pipe lengths and field conditions
 4. Provide Internal Stiffeners Data
 5. Provide Mechanical Joint Adapters Data
 6. Installer Qualifications
 - a. Provide certifications meeting requirements of section 3.1 for each installer. Keep certifications on project site available to City, Engineer, and Inspector.
- F. Data Logger Records
 1. Provide electronic data logger record to the inspector daily or on request of inspector.

2. Fusion Reports shall report manufacturer, component, component fusion-jointing parameters, assembly operation and joint identification, per ISO 12176-4, and the following fusion-jointing operation data:
 - a. Temp-Compensated Fusion Time & Actual Fusion Time
 - b. Resistance before & after fusion
 - c. Hi and Low output voltage & output current during fusion
 - d. Total Amp-Hours applied to fitting
 - e. Input voltage and frequency before fusion
 - f. High and Low input voltage and frequency during fusion
 - g. Input waveform
 - h. GPS position and quality
 - i. Ambient temperature
 - j. Heating iron face temperatures
 - k. Fusion pressure
 - l. Graphic representation of the fusion cycle.
3. Report shall comply with ISO 12176-2 requirements for traceability databases.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

A. Shipping Requirement

1. Ship and deliver pipe and fittings from manufacturer with dust plugs on pipe ends and fitting ends.

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Handle the pipe in accordance with the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 2 using approved strapping and equipment rated for the loads encountered. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe or endanger persons or property. Field storage is to be in compliance with AWWA Manual of Practice M55 Chapter 7.
3. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use. Damages resulting from improper delivery, storage, or handling are the responsibility of the Contractor, and no additional payment shall be allowed by the City.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Standard Product List
 - a. See League City Standard Product List for approved manufacturers.

B. HDPE Pipe

1. Material
 - a. Polyethylene pipe shall be made from HDPE material having a material designation code of PE4710 or higher.
 - b. The material shall meet the requirements of ASTM D 3350 and shall have a minimum cell classification of PE445474C.
 - c. In addition, the material shall be listed as meeting NSF-61.
2. The pipe and fittings shall meet the requirements of AWWA C906.
3. The outside diameter of the pipe shall be based on the **Ductile Iron Pipe Size (IPS)** sizing system.
4. HDPE pipe shall be rated for use at a pressure class of 200 psi.
5. Pressure Pipe shall be approved by the Underwriter's Laboratory (UL) or Factory Mutual (FM).
6. Pipe Markings
 - a. Meet the minimum requirements of AWWA C906 as appropriate. Minimum pipe markings shall be as follows:
 - 1) Manufacturer's Name or Trademark and production record
 - 2) Nominal pipe size
 - 3) IPS
 - 4) Dimension Ratio (DR9)
 - 5) AWWA C906
 - 6) Seal of testing agency that verified the suitability of the pipe
 - 7) Resin type (PE4710)
 - b. Color identification to identify pipe service is required.
 - 1) Stripes or colored exterior pipe product shall be blue for potable water, or purple (lavender) for reclaimed water.
 - 2) Permanent identification of piping shall be provided by co-extruding multiple equally spaced color stripes into the pipe outside surface or by solid colored pipe shell.
 - 3) The striping material shall be the same material as the pipe material except for the color.
7. K. Socket fusion is not allowed for pipes with diameter greater than 2-inch diameter.

C. HDPE Butt Fusion Fittings

1. Butt Fusion Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of PE445474C.
2. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to or greater than the pipe unless otherwise specified on the plans.
 - a. Pipe stock used to manufacture fabricated fittings shall meet requirements of AWWA C906 and meet the material designation code of PE4710.
 - b. Fabricated Fittings typically require a lower DR rating than the pipe to meet or exceed the pipe pressure rating. Calculate the difference for a fabricated fitting based on a published rerating percentage.
 - c. Fabricated bend and tee fittings shall have a minimum of 3 segments.

- d. Fabricated bend fittings over 45 degrees through 90 degrees shall have a minimum of four segments.
- e. Field fabricated fittings are not allowed.
- 3. All fittings shall meet the requirements of AWWA C906.
- 4. Markings for molded fittings shall comply with the requirements of ASTM D 3261.
 - a. Standard Designation (ASTM D 3261)
 - b. Manufacturer's name or trademark
 - c. Material designation (PE4710)
 - d. Date of manufacture or manufacturing code
 - e. Size
 - f. Dimension Ratio (example: DR11)
- 5. Fabricated fittings shall be marked in accordance with ASTM F 2206.
 - a. Standard Designation (ASTM F 2206)
 - b. Manufacturer's name or trademark
 - c. Material designation (PE4710)
 - d. Date of manufacture or manufacturing code
 - e. Size
- 6. Equivalent Dimension Ratio

D. HDPE Electrofusion Fittings

- 1. Electrofusion Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of PE445474C.
- 2. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- 3. All electrofusion fittings shall be suitable for use as pressure conduits, and have nominal burst values of four times the Working Pressure Rating (WPR) of the fitting. D. Markings shall be according to ASTM F 1055.
 - a. Standard Designation (ASTM F 2206)
 - b. Manufacturer's name or trademark
 - c. Material designation (PE4710)
 - d. Date of manufacture or manufacturing code
 - e. Size
 - f. Equivalent Dimension Ratio

E. Flanges and Mechanical Joint Adapters

- 1. Flanges and Mechanical Joint Adapters shall have a material designation code of PE4710 or higher and a minimum Cell Classification of PE445474C..
- 2. Flanged and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206.
- 3. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- 4. Markings for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261.
 - a. Manufacturer's name or trademark
 - b. Material designation (PE4710)
 - c. Date of manufacture or manufacturing code
 - d. Size

- e. Where recessed marking is used, take care not to reduce the wall thickness below the minimum specified.
- 5. Fabricated (including machined) flange adapters shall be per ASTM F 2206.
- 6. Metal gland for MJ Adapter may be either AWWA C110 (heavyweight) or AWWA C153
- 7. (lightweight).
- 8. Low alloy steel bolts shall comply with AWWA C 111.4. Bolts, rods and hex nuts shall be manufactured from SAE Type 316 stainless steel.
- 9. Van-Stone style, ductile iron, convoluted or flat-plate, back-up rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt-holes and bolt-circles conforming to one of these standards: ASME B-16.5 Class 150, ASME B-16.47 Series A Class 150, ASME B-16.1 Class 125, or AWWA C 207 Class 150 Series B, D, or E.
- 10. The back-up ring shall provide a long-term pressure rating equal to or greater than the pressure class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the back-up ring. The back-up ring, bolts, and nuts shall be SAE Type 316 stainless steel. An internal stainless steel stiffener sleeve that is expanded hydraulically to create an interference fit with the pipe must also be used.

F. Mechanical Joint Wedge Action Restraint

- 1. Mechanical Joint wedge action restraint shall only be allowed with specific permission of the Engineer in cases where an MJ Adapter is not feasible.
- 2. Mechanical Joint wedge action restraint shall be designed specifically for use on HDPE pipe.
- 3. The grip of the serrations shall increase as the hydrostatic pressure increases.
- 4. There shall be no additional tool required for installation other than the tools required to install standard sizes of hex nuts from 5/8"-1 1/8". The hex heads, bolts and rods shall be designed to tighten clockwise. The hex heads, bolts and rods shall be manufactured to allow for disassembly and re-installation of the restraint.
- 5. The gland halves shall be manufactured of high strength ductile iron in accordance with the ASTM A536 Standard, Grade 65-45-12.
- 6. Rods are manufactured from 304 stainless steel and hex nuts are manufactured from 316 stainless steel as per ANSI/ AWWA C111/A21.11.
- 7. The restraining gland shall comply with all applicable dimensions of ANSI/AWWA C111/A21.11 and shall be compatible with all bell and spigot (push-on) joint sockets of the standard.
- 8. Stiffening insert required.

G. Service Connections

- 1. Service connections shall be electrofusion saddles with sidewall fusion branch saddles, or tapping tees.
- 2. Electrofusion saddles shall be made from materials required in 2.5.

3. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D 3261 or ASTM F 2206. After installation, approximately ¼-inch of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼-inch of area beyond the saddle are not acceptable.
4. Tapping tees shall be made to ASTM D 3261 or D 2683.
5. Electrofusion saddles are the preferred method of service connections. Mechanical strap-on saddles can only be used where approved by the Engineer. The body of the mechanical saddle shall be stainless steel. The gasket material and design must be acceptable for PE pipe. Install mechanical strap-on saddles per the manufacturer's instructions.

H. Pipeline Markers

1. Provide markers in accordance with Project Manual.
2. Detectable Warning Tape - 6-inch wide detectable warning tape - All force mains shall be clearly identified with colored plastic locator tape made specifically for that purpose. Color shall be blue for water, green for sanitary sewer, or purple (lavender) for reclaimed water. If sewer, the tape shall be marked with black lettering clearly identifying the pipeline as sanitary sewer. The tape shall be Detectable Marking Tape.
3. Tracer wire - continuous AWG no. 12 gauge solid copper tracer wire with 30 mil thick colored HDPE insulation. Color shall be blue for water, green for sanitary sewer, or purple (lavender) for reclaimed water. Perform conductivity test on the tracer wire at final inspection.
4. Marker post material shall be high-performance fiberglass composite. Minimum 3-foot above ground. Manufactured by Carsonite or accepted equal.

I. Stiffening Insert (Stiffener)

1. Provide Stiffeners at each MJ adapter and coupling per Standard Details.
2. Stiffening inserts shall be specially designed for use on the inside of HDPE pipe in conjunction with AWWA C111 mechanical joints.
3. Provide stainless steel per ASTM 240, type 304 or 316.
4. Stiffener shall be manufactured within the pipe or MJ adapter by the factory.
5. Field installed stiffeners may be allowed upon approval of League City Public Works inspector. Wedge style stiffeners are allowed.
6. Stiffener length must be sufficient to fully encompass the area of the pipe being restrained.
7. Inserts must be designed for underground pressurized fluid service and are pressure rated to match the pipe DR pressure rating, derated as appropriate for service temperature. Maximum test pressure limited to pipe rated pressure.
8. Stiffener design shall prevent movement causing fitting to slide or rotate on the pipe.

J. Flex Coupling Restraint Device

1. HDPE flex coupling restraint devices will be rated for minimum of 8,000 pounds of force.
2. Resin used to manufacture device shall meet requirements of ASTM 3350 with minimum cell classification of 445474C.
3. Device will include bar code and product label tag.
4. Device will install by electrofusion.

K. Wall Anchor

1. Butt fusion wall anchors, or force restraint collars, shall comply with requirements of DR9, Iron Pipe Size (IPS), minimum cell class 445474C, and meeting this specification's requirements for PE pipe except for striping.

L. Polyethylene Tubing

1. All polyethylene (PE) plastic tubing shall be high density, high molecular weight plastic tubing.
2. PE tubing shall be pressure rated at 200 psi working pressure..
3. PE tubing shall be standard copper tube size outside diameter with standard dimension ration (SDR) of nine (9).
4. PE tubing shall be homogenous throughout and free of cracks, holes, foreign inclusions or other injurious defects.
5. HDPE Pressure tubing for potable water shall meet the requirements of NSF 61 and bear the NSF seal of approval.
6. Pressure tubing shall be approved by the Underwriter's Laboratory (UL) or Factory Mutual (FM).
 - a. Applicable SpecificationsASTM Specification D 2737
 - b. ASTM Specification D 1599
 - c. ASTM Specification D 1598
 - d. AWWA Specification C 901

M. Copper Fittings

1. Fittings for copper tubing and polyethylene tubing shall be red brass containing 85% copper, 5% lead, 5% tin, and 5% zinc in conformance with ASTM B 62.
2. Fittings may be flared or compression as applicable, in accordance with AWWA C 800.
3. Compression fittings shall utilize a compression nut and/or split clamp with tightening screw.
4. Stab type fittings are not approved.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS

A. Installers

1. Only formally trained and certified fusion technicians may conduct fusions. Qualification of the fusion technician shall be demonstrated by certification in fusion training within the past year for the type of fusion, and size of the pipe, and on the specific equipment to be used on this project. Provide documentation showing current and up-to-date qualification of training obtained to fuse PE pipe in the appropriate sizes and equipment types for the job.
 - B. Training in accordance with ASTM F 6220 for butt fusion.
2. Training in accordance with ASTM F 1055 for electrofusion.
3. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
4. Qualified technician has documented prior experience in performing HDPE pipe installations, head fusion procedures, and testing methods.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. GENERAL

1. Install pipe, fittings, specials, and appurtenances as specified herein, as specified in AWWA M55, and in accordance with the pipe manufacturer's recommendations with the intention of providing a leak-free system to the City.
2. Excavate and backfill trenches in accordance with the Project Manual.

B. PIPE HANDLING

1. At the close of each operating day, when Work is stopped for more than 30 minutes, or when the trench is unsupervised:
 - a. Keep the pipe clean and free of debris, dirt, animals, and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. JOINING METHODS

1. Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33. All fusion joints shall be made in compliance with the pipe or fitting manufacturer's recommendations. Fusion joints shall be made by qualified fusion technicians per PPI TN-42.
2. Saddle fusion: Saddle fusion shall be done in accordance with ASTM F 2620 or PPI TR-41 or the fitting manufacturer's recommendations and PPI TR-41.
3. Socket Fusion: Molded socket fusion fittings are only to be used for joining of HDPE pipe from 1/2 inch to 2" in size. Socket fusion shall be done in accordance with ASTM F 2620 or the fitting manufacturer's recommendations. Socket fusion is the process of fusing pipe to pipe, or pipe to fitting by the use of a male and female end that are heated simultaneously, and pressed together so the outside wall of the male end is fused to the inside wall of the female end.
4. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure. Other sources of electrofusion joining information are ASTM F
5. 1290 and PPI TN 34. The process of electrofusion requires an electric source , a transformer, commonly called an electrofusion box that has wire leads, a method to read electronically (by laser) or otherwise input the barcode of the fitting, and a fitting that is compatible with the type of electrofusion box used.

D. MECHANICAL

1. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and ductile iron fittings shall use flange or mechanical joint adapters and other devices in conformance with AWWA Manual of Practice M55, Chapter 6.
2. Unless specified by the fitting manufacturer, a restraint harness or concrete anchor is recommended with mechanical couplings to prevent pullout.
3. Mechanical coupling shall be made by qualified technicians.

E. JOINT RECORDING

1. Butt Fusion: The butt fusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.

2. Electrofusion: The electrofusion equipment must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
3. The critical parameters of each fusion joint, as required by the manufacturer and these specifications, shall be recorded by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report.

F. INSTALLATION

1. Buried HDPE pipe and fittings shall be installed in accordance with ASTM D2321 or ASTM D2774 for pressure systems and AWWA Manual of Practice M55 Chapter 7.
2. Lay pipe with colored stripe within 45-degrees either side of crown, if pipe has colored stripe. Color shall be blue for water, green for sanitary sewer, or purple (lavender) for reclaimed water.
3. Pipe embedment - Embedment material shall be fine aggregate defined as:
 - a. Granular and free flowing
 - b. Generally meets or exceeds the limits on deleterious substances per Table 1 for fine aggregate according to ASTM C 33 c. Reasonably free of organic material
 - c. Gradation:

<u>Sieve Size</u>	<u>Percent Retained</u>
1 inch	0
3/8 inch	0-10
#30	25-60
#100	95

4. Compact backfill per ASTM D 698 and AASHTO T-99 as modified by NCDOT to 85% of maximum density or 95% maximum density within a road right-of-way. Compact the top 12-inches below the road sub-grade to 100% of maximum density within a road right-of-way.

G. MARKER INSTALLATION

1. See Standard Detail for placement requirements for detectable tape and tracer wire.

3.5 [REPAIR] / [RESTORATION] [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Leak Testing

1. Hydrostatic leakage testing is recommended and shall comply with AWWA C651, ASTM F 2164, ASTM F 1412, AWWA Manual of Practice M55 Chapter 9, and PPI Handbook of Polyethylene Pipe Chapter 2 (2nd Edition). If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the City.
3. Prior to scheduling a test with the inspector, preform a pre-test to confirm compliance.
4. Contractor shall perform hydrostatic and leakage tests in accordance with North Carolina state requirements.
5. Installed main shall be adequately anchored with a covering of at least 6-inches of initial backfill, if installed by an open trench method. The joints and fittings, particularly flange connections shall be left uncovered for visual leak inspection.

6. Leak tests of HDPE water system shall be conducted in accordance with ASTM F2164. The pipeline should be slowly filled with potable water and all trapped air bled off. The main should undergo a hydrostatic pressure test using pressure at the lowest elevation in the system at 150 psi. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, the pressure shall remain steady within 5% (7.5 psi) of a target 150 psi test pressure for one hour.
7. The total test time should not exceed 8 hours. If the pipeline has to be retested – the pipe must be depressurized and allowed to “relax” for at least 8 hours before the next testing sequence.
8. The pressure shall be maintained constant for 4-hour period by adding makeup water. After 4-hour period is completed, test the pressure at the lowest point.
9. Test pressure for one hour. Pressure should remain steady at 1.5 times the working pressure, but not more than the design pressure of the pipe (e.g. 200 psi for DR 11). Pressure must remain within 5% of a target test pressure for one hour.
10. In fused polyethylene water piping system no leakage shall be present. If leakage is observed at a fusion joint, complete rupture may be imminent. The Contractor shall move all personnel away from the joint and depressurize the main. Leaks, failure, or defective construction shall be promptly repaired by the Contractor at the Contractor’s sole expense.
11. Payment for pressure and leakage testing shall be considered included in the price paid per linear foot for water main installation.
12. Pneumatic (compressed air) leakage testing of HDPE pressure piping is prohibited for safety reasons.

B. Cleaning and Disinfection

1. After installation and pressure testing, disinfect water line according to AWWA C651.
2. The disinfection chemicals should be limited to less than 12% active chlorine. The duration of the disinfection shall be a minimum of 12 hours and should not exceed 24 hours.
3. Dechlorinate with sodium bisulfate prior to release. Any water discharged to the ground surface shall not exceed 0.2 ppm of free chlorine.
4. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water tubing and branch lateral pipes.

C. Disinfection and Bacteriological Testing

1. Newly installed potable water pipelines require disinfection in accordance with
2. ANSI/AWWA C651/B301. The disinfection should take place after the initial flushing and after the completion of the pressure testing.
3. Air is to be exhausted from each high point, dead end, branch run, and hydrant run. The chlorinated water shall be removed prior to samples being collected for bacteriological testing.
4. After flushing to remove sediment and other foreign matter, and after testing for leaks,
5. Contractor shall disinfect the main by the addition and thorough dispersion of a chlorine
6. solution in concentrations sufficient to produce a chlorine residual of at least 50 milligrams per liter (or ppm) in the water throughout the distribution system.

7. Injection of liquid chlorine solution shall be used to disinfect HDPE water mains. The disinfecting solution should not contain more than 12 percent of active chlorine. Prolonged exposure to highly concentrated disinfection chemicals may damage the inside surface of HDPE pipe and is to be avoided.
8. The chlorine solution shall remain in contact with interior surfaces of the water system for a period of 24-hours. Then the water system shall be flushed with fresh water from an approved water source until the chlorine solution is dispelled.
9. Before bacteriological testing samples are taken, each hydrant run, branch run, and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one part per million.
10. The Contractor shall measure residual chlorine concentrations by using a color comparator test that is witnessed and approved by the Inspector. After the chlorine concentration is less than 1 ppm, samples shall be gathered and tests conducted according to the provisions of AWWA C651-92, at the expense of the Contractor, by a laboratory approved by the Engineer.
11. Samples shall be taken at representative points as required to thoroughly test the installed main.
12. The Contractor will be required to perform two consecutive 24-hour apart Coliform tests. Testing laboratory used by the Contractor shall be State Certified and provide QA/QC report. If unsatisfactory or doubtful results are obtained from the initial sampling, the chlorination process shall be repeated until acceptable test results are obtained. The bacteriological test takes at least 48 hours for results to be conclusive.
13. Individual new water services will be flushed thru the angle meter stop after connection to the new water main.
14. Payment for disinfecting water mains shall be considered included in the price paid per linear foot for water main installation.
15. Disposal of chlorinated water shall comply with all federal, state, and local regulatory requirements. Disposal directly to the storm drain system without removal of chlorine is strictly prohibited. No discharge into the storm drain system shall be allowed during rain. Upon termination of the flushing, any standing water in the gutter shall be removed by sweeping it to the nearest storm drain catch basin. Flushing of chlorinated water directly into the sanitary sewer system will only be allowed with the written approval of League City Public Works.
16. New water mains must be tied-in into water distribution system within 24 hours following the Engineer's acceptance of the bacteriological tests' results or the Contractor will be required to repeat flushing, disinfection, and bacteriological testing procedures at the Contractor's expense. The new pipe, connections, and fittings must be kept clean and swabbed with a 5% solution of hypochlorite before installation.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 36
FIBERGLASS REINFORCED PIPE FOR GRAVITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass Reinforced pipe 30-inch and larger for gravity sanitary sewer applications
- B. Deviations from this City of League City Standard Specification
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Measured horizontally along the surface from center line to center line of the manhole, or appurtenance
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Fiberglass Reinforced Pipe” installed for:
 - 1) Various sizes
 - 2) Various backfills
 - 3. The price bid shall include:
 - a. Furnishing and installing Fiberglass Reinforced Pipe with joints as specified by the Drawings
 - b. Mobilization
 - c. Pavement removal
 - d. Excavation
 - e. Hauling
 - f. Disposal of excess material
 - g. Gaskets
 - h. Furnishing, placement and compaction of embedment
 - i. Furnishing, placement and compaction of backfill
 - j. Trench water stops
 - k. Clean-up
 - l. Cleaning
 - m. Testing

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. FRP – Fiberglass Reinforced Pipe
- B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. D3236, Standard Test Method for Apparent Viscosity of Hot Melt Adhesives and Coating Materials.
 - b. D3262, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
 - c. D3681, Standard Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition.
 - d. D4161, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
 - e. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
3. American Water Works Association (AWWA):
 - a. M45, Fiberglass Pipe Design

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 1. Manufacturer
 2. Manufacturer Number (identifies factory, location, and date manufactured.)
 3. Nominal Diameter
 4. Beam load
 5. Laying lengths
 6. ASTM designation
- B. Shop Drawings
 1. Pipe details
 2. Joint details
 3. Miscellaneous items to be furnished and fabricated for the pipe
 4. Dimensions
 5. Tolerances
 6. Wall thickness
 7. Properties and strengths
 8. Pipe calculations
 - a. Calculations confirming the pipe will handle anticipated loading signed and sealed by a Professional Engineer licensed in Texas
- C. Certificates

1. Furnish an affidavit certifying that all Fiberglass Reinforced Pipe meets the provisions of this Section and has been tested and meets the requirements of ASTM D3262.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
 - a. Finished pipe shall be the product of 1 manufacturer for each size per project.
 - b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
 - c. All pipe furnished shall be in conformance with this specification and ASTM D3262.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Provide adequate strutting during transport to prevent damage to the pipe, fittings and appurtenances.

B. Storage and Handling Requirements

1. Gravity pipe shall be stored and handled in accordance with the manufacturer's guidelines.
2. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Performance / Design Criteria

1. Pipe
 - a. Design in accordance with ASTM D3262
 - b. Design pipe for service loads that include:
 - 1) External groundwater and earth loads
 - 2) Jacking/pushing loads

- a) The allowable jacking/pushing capacity shall not exceed 40 percent of the ultimate compressive strength or the maximum allowable compressive strength recommended by the manufacturer, whichever is less.
 - 3) Traffic loads
 - 4) Practical considerations for handling, shipping and other construction operations
 - c. Pipe design shall be based on trench conditions in accordance with AWWA M45 using the following parameters:
 - 1) Unit Weight of Fill (W) = 130 pounds per cubic foot
 - 2) Live Load:
 - a) Cooper E-80 for railroad crossings
 - b) AASHTO HS-20 for all other installations
 - 3) Trench Depth = As indicated on the Drawings
 - 4) Deflection Lag Factor (D_1) = 1.0
 - 5) Bedding Coefficient (K_x) = 0.10
 - 6) Maximum Calculated Deflection:
 - a) $\Delta x = 3$ Percent
 - 7) Soil Reaction Modulus (E'): less than or equal to 1,000 psi
 - d. Design is to be conducted under the supervision of a Professional Engineer licensed in the State of Texas, who shall seal and sign the design.
 - e. Standard lay length of 20 feet, except for special fittings or closure pieces necessary to comply with the Drawings.
 - f. Stiffness class that satisfies design requirement on the Drawings, but not less than 72 psi when used in direct bury operations.
 - g. Accommodate vertical alignment changes required because of existing utility or other conflicts by an appropriate change in pipe design depth.
 - h. In no case shall pipe be installed deeper than its design allows.
2. Dimensional Tolerances
- a. Inside diameter
 - 1) Pipe shall not vary more than 1/8 inch from the nominal inside diameter.
 - b. Roundness
 - 1) The difference between the major and minor outside diameters shall not exceed 0.1 percent of the nominal outside or 1/4 inch, whichever is less.
 - c. Wall thickness
 - 1) Provide minimum single point thickness no less than 98 percent of stated design thickness.
 - d. End Squareness
 - 1) Provide pipe ends square to pipe axis with maximum tolerance of 1/8 inch.
 - e. Fittings
 - 1) Provide tolerance of angle of elbow and angle between main and leg of wye or tee to ± 2 degrees or as recommended by manufacturer, whichever is lower.
 - 2) Provide tolerance of laying length of fitting to ± 2 inches.
- C. Materials
- 1. Resin Systems
 - a. Only use polyester resin system with proven history of performance in this particular application.
 - 2. Glass Reinforcements
 - a. Use reinforcing glass fibers of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnated resins to manufacture components.

3. Fillers
 - a. Silica sand or other suitable materials may be used.
 - b. Use 98 percent silica with maximum moisture content of 0.2 percent.
4. Additives
 - a. Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally affect the performance of the product.
5. Internal liner resin
 - a. Suitable for service as sewer pipe
 - b. Highly resistant to exposure to sulfuric acid
 - c. Produced by biological activity from hydrogen sulfide gases
 - d. Meet or exceed requirements of ASTM D3681
6. Gaskets
 - a. Supply from approved gasket manufacturer in accordance with ASTM F477 and suitable for service intended.
 - b. Affix gaskets to pipe by means of suitable adhesive or install in a manner so as to prevent gasket from rolling out of pre-cut groove in pipe or sleeve coupling.
 - c. Provide the following gaskets in potentially contaminated areas.
 - 1) Petroleum (diesel, gasoline) – Viton
 - 2) Other contaminants – Manufacturer recommendation
7. Couplings
 - a. Field connect pipe with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as sole means to maintain joint water tightness.
8. Joints
 - a. Joints must meet requirements of ASTM D4161.
9. Pipe markings shall meet the minimum requirements of ASTM D3236. Minimum pipe markings shall be as follows:
 - a. Manufacturer
 - b. Manufacturer Number (identifies factory, location, date manufactured, shift and sequence)
 - c. Nominal diameter
 - d. Beam load
 - e. Laying length
 - f. ASTM designation
10. Connections
 - a. Use only manufactured fittings.
 - b. See Section 33 31 16.
11. Tracer Wire
 - a. See Section 33 05 91.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install pipe, fittings, specials, and appurtenances in accordance with this Section, AWWA M45, ASTM D3839, and with the pipe manufacturer's recommendations.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 33 05 06.
4. Embed pipe in accordance with Section 33 05 06.
5. Installation of carrier pipe within casing in accordance with Section 33 05 24.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
 - a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling pipe.
3. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Pipe Joint Installation

- a. Clean dirt and foreign material from the gasketed socket and the spigot end.
- b. Assemble pipe joint by sliding the lubricated spigot end into the gasketed bell end to the reference mark.
- c. Install such that identification marking on each joint are oriented upward toward the trench opening.
- d. When making connection to manhole, use an elastomeric seal or flexible boot to facilitate a seal.

D. Connection Installation

1. See Section 33 31 16.

E. Tracer Wire Installation

1. See Section 33 05 91.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Gravity Sewer Mains

1. Closed Circuit Television (CCTV) Inspection
 - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 15.

2. Sewer Pipe Testing

- a. Test pipe in accordance with Section 33 01 13.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Gravity Sewer Mains

1. Cleaning of sewer mains

- a. Clean the mains in accordance with Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 38
HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. HDPE pipe will be allowed for water services and water distribution for crossings of creeks, ditches, and railroads.
- B. Section Includes:
 - 1. HDPE Pipe 1-inch and 2-inch for potable water services.
 - 2. HDPE Pipe 4-inch through 60-inch for water distribution.
 - 3. HDPE Pipe 4-inch through 12-inch for gravity sanitary sewer.
 - 4. HDPE Pipe 4-inch through 60-inch for sanitary sewer force mains and reuse applications.
- C. Deviations from this City of League City Standard Specification:
 - 1. None.
- D. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 12 – Hydrostatic Testing and Disinfection.
 - 2. Section 33 01 13 – Cleaning and Approval.
 - 3. Section 33 01 14 – Sewer and Manhole Testing.
 - 4. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection.
 - 5. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 6. Section 33 05 22 –Nuts, Bolts, and Gaskets.
 - 7. Section 33 05 91 – Utility Markers, Locators, and Tracer Wire.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. HDPE Water Service Line
 - a. Measurement
 - 1) This item is considered subsidiary to New Water Service installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per each water service installed.
 - 2. HDPE Pressure Pipe
 - a. Measurement
 - 1) Measured horizontally along the ground surface from center line to center line of fitting, manhole, or appurtenance of HDPE Pressure Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “HDPE Pressure Pipe” installed for:
 - a) Various sizes.

- b) Various types of backfill.
- c. The price bid shall include:
 - 1) Furnishing and installing HDPE Pipe as specified by the Drawings
 - 2) Pavement Removal
 - 3) Excavation
 - 4) Hauling
 - 5) Disposal of excess material
 - 6) Furnishing, placement, and compaction of embedment
 - 7) Furnishing, placement, and compaction of backfill
 - 8) Clay Dams
 - 9) Fusion of joints
 - 10) HDPE fittings
 - 11) Ductile Iron Fittings with Restraint (if required)
 - 12) Bolts and nuts
 - 13) Clean-up
 - 14) Cleaning
 - 15) Disinfection (for potable)
 - 16) Testing
- 3. HDPE Gravity Pipe
 - a. Measurement
 - 1) Measured horizontally along the ground surface from center line to center line of fitting, manhole, or appurtenance of HDPE Gravity Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for "HDPE Gravity Pipe" installed for:
 - a) Various sizes.
 - b) Various types of backfill.
 - c. The price bid shall include:
 - 1) Furnishing and installing HDPE Pipe as specified by the Drawings
 - 2) Pavement Removal
 - 3) Excavation
 - 4) Hauling
 - 5) Disposal of excess material
 - 6) Furnishing, placement, and compaction of embedment
 - 7) Furnishing, placement, and compaction of backfill
 - 8) Clay Dams
 - 9) Fusion of joints
 - 10) HDPE fittings
 - 11) Clean-up
 - 12) Cleaning
 - 13) Testing

1.3 REFERENCES

A. Abbreviations and Acronyms

1. HDPE – High Density Polyethylene

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - b. D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials.
 - c. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
 - d. F1290, Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.
 - e. D3261, Standard Specifications for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
 - f. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
 - g. F2164: Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Pipeline Systems Using Hydrostatic Pressure.
3. American Water Works Association (AWWA):
 - a. C901, Polyethylene (PE) Pressure Pipe and Tubing, 3/4-inch through 3-inch, for Water Service.
 - b. C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution.
 - c. M55, PE Pipe Design and Installation.
4. NSF International (NSF) (for use in potable applications):
 - a. 61, Drinking Water System Components – Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Qualifications

1. Submit manufacturer and butt fusion welder qualifications in accordance with Article 1.9 and the following:
 - a. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.
 - b. Documentation of conformance with this Section and applicable standards, including written documentation regarding any intended variance from this Section and applicable standards. This will include fusion joint warranty information and recommended project specific fusion parameters, including criteria logged and recorded by data logger.

2. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:
 - a. Fusion reports for each fusion joint performed on the project, including joints that were rejected. Submittals of the Fusion Technician's joint reports are required as requested by the City or Engineer. Specific requirements of the Fusion Technician's joint report shall include:
 - 1) Pipe or fitting size and DR or pressure class rating
 - 2) Fusion equipment size and identification
 - 3) Fusion Technician Identification
 - 4) Job Identification Number
 - 5) Fusion Number
 - 6) Fusion joining parameters
 - 7) Ambient Temperature

B. Product Data

1. Manufacturer
2. Nominal pipe diameter
3. Pressure Rating
4. Standard Dimension ratio (DR)
5. Cell classification
6. Laying lengths

C. Shop Drawings

1. HDPE Pipe for water distribution or sanitary sewer force mains for 24-inch and greater diameters:
 - a. Wall thickness design calculations sealed by a Professional Engineer Licensed in Texas including:
 - 1) Working Pressure
 - 2) Surge Pressure
 - 3) Deflection

D. Certificates

1. Furnish an affidavit certifying all HDPE pipe has been tested and is in accordance with this Section and all ASTM and AWWA standards as listed herein.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
 - a. Finished pipe shall be the product of 1 manufacturer for each size, unless otherwise specified by the City.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
 - b. Pipe manufacturing operations shall be performed under the control of the manufacturer.

- c. Certified copies of test reports required with each delivery, stating all pipe is in accordance with ASTM F714, ASTM D3350, ASTM D3035 as applicable.
2. Butt-Fusion Welding
 - a. Butt-fusion welding of pipe sections shall be performed by a fusion technician certified by the pipe manufacturer. Manufacturer's recommended practices shall be followed.
 - b. Each Fusion Technician performing butt fusion, saddle fusion, or electrofusion joints shall be qualified to make butt fusion joints in accordance with ASTM F2620/1290. Qualification shall have occurred not more than 12 months before performing fusion joining on site in accordance with this Section. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620/1290 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620/1290.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
 2. Store and handle in accordance with the guidelines as stated in AWWA M55.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Manufacturers
 1. Only the manufacturers as listed in the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
 2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
- B. HDPE Pipe
 1. Pipe and Fittings
 - a. As a minimum the following pipe classes apply. The Drawings or the pressure and deflection design criteria may require a higher wall thickness, but in no case should the pipe classes be less than the following:

Type of Use	Min Pipe Class
Potable Service Lines	DR-9
Potable Distribution	DR-11
Force Main	DR-13.5
Gravity Sewer	DR-17
Pipe Bursting Method	DR-11

- b. Material
 - 1) Extra High Molecular Weight, High Density Polyethylene PE 4710, Cell Class PE445474C with colored striping the entire length of pipe in accordance with AWWA C901 or AWWA C906.
 - a) Striping shall be Cell Class PE445474E.
 - b) Cell Classifications are to be in accordance with ASTM D3350.
 - 2) The HDPE pipe shall be rated for use at a pressure class of 200 psi.
 - 3) The outside diameter of the pipe shall be based upon ductile iron pipe size sizing system.
 - 4) Homogeneous throughout and free of:
 - a) Abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth
 - b) Cracks
 - c) Kinking
 - d) Flattening
 - e) Holes
 - f) Blisters
 - g) Other defects
 - c. All pipe shall be color coded for the intended service. The color coding shall be permanently co-extruded stripes on the pipe outside surface as part of the pipe's manufacturing process. Painting HDPE pipe to accomplish color coding is not permitted. Color coding shall be as follows:
 - 1) Sewer – green
 - 2) Water – blue
 - 3) Reuse – purple
 - d. Pipe with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, which are larger/deeper than 10 percent of the wall thickness, shall not be used and shall be removed from the construction site.
 - e. Pipe and fittings shall be uniform in color, opacity, density, and other physical properties.
 - f. Pipe Markings
 - 1) In accordance with ASTM D3350
 - 2) Minimum pipe markings shall be as follows:
 - a) Intervals uniformly at 6-inch
 - b) Manufacturer's Name or Trademark and production record
 - c) Nominal pipe size
 - d) ASTM or Dimension Ratio (DR) designation
 - e) Cell classification
 - f) Seal of testing agency that verified the suitability of the pipe
 - g. Dimension Classification
 - 1) Potable and force main applications shall be Ductile Iron Pipe Size (DIPS/DIOD).
 - 2) 1-inch and 2-inch potable water service lines shall be of copper tube size (CTS) and in accordance with all AWWA C901 standards.
 - 3) All other uses may be Iron Pipe Size (IPS).
- 2. Connections
 - a. Use only manufactured fittings in accordance with ASTM D3261
 - b. HDPE fabricated fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.

- 1) For pressure applications, a minimum pressure rating of 200 psi is required for all fittings.
3. Bolts and Nuts
 - a. Bolts and nuts shall be SAE Type 316 stainless steel.
 - 1) An internal stainless steel stiffener sleeve that is expanded hydraulically to create an interference fit with the pipe must also be used.
 - b. Van-Stone style, ductile iron, convoluted or flat-plate, backup rings and bolt materials shall follow the guidelines of Plastic Pipe Institute Technical Note # 38, and shall have the bolt holes and bolt circles conforming to one of these standards:
 - 1) ASME B-16.5 Class 150
 - 2) ASME B-16.47 Series A Class 150
 - 3) ASME B-16.1 Class 125
 - 4) AWWA C207 Class 150 Series B, D, or E
 - c. The backup ring shall provide a long term pressure rating equal to or greater than the pressure class of the pipe with which the flange adapter assembly will be used, and such pressure rating shall be marked on the backup ring.
4. Tracer Wire in accordance with Section 33 05 91.
5. Polyethylene Repair Clamp
 - a. Smith-Blair Full Circle Clamp Style 228 or 263.
 - b. Should any other mechanical restraints be required, they shall be in accordance with Sections 33 14 12 and 33 05 22.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install pipe, fittings, specials, and appurtenances in accordance with this Section and the pipe manufacturer's recommendations.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 33 05 06.
4. Embed pipe in accordance with Section 33 05 06.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.

- a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe for handling the pipe.
3. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals, and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Pipe Joining

1. Join pipe in accordance with ASTM F2620.
2. Fabricated fittings shall be marked in accordance with ASTM F 2206.
3. Operators must be certified by the manufacturer to use the fusion equipment.
4. Follow the time and temperature recommendations of the manufacturer.
5. Joints shall be stronger than the pipe itself, be properly aligned, and contain no gaps or voids.
6. Butt Fusion
 - a. Butt Fusion fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of PE445474C.
 - b. Butt Fusion fittings shall meet the requirements of ASTM D3261.
7. Electrofusion
 - a. Electrofusion fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification of PE445474C.
 - b. Electrofusion fittings shall have a manufacturing standard of ASTM F1055.
 - c. All electrofusion fittings shall be suitable for use as pressure conduits and have nominal burst values of four times the Working Pressure Rating of the fitting. Markings shall be according to ASTM F 1055.
8. Flange and Mechanical Joints
 - a. Flange and Mechanical Joint Adapters shall have a material designation code of PE4710 or higher and a minimum Cell Classification of PE445474C.
 - b. Flange and Mechanical Joint Adapters can be made to ASTM D 3261 or if machined, must meet the requirements of ASTM F 2206.
 - c. Marking for molded or machined flange adapters or MJ Adapters shall be per ASTM D 3261.
 - d. Fabricated flange adapters shall be per ASTM F 2206.
9. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine that shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.
10. Mechanical Connection
 - a. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and ductile iron fittings shall use flange or mechanical joint adapters and other devices in conformance with AWWA Manual of Practice M55, Chapter 6.

D. Tracer Wire Installation in accordance with Section 33 05 91.

3.5 REPAIR

- A. Repair any damaged pipe, fittings, specials, and appurtenances in accordance with this Section and the pipe manufacturer's recommendations. Faulty fusion joints must be removed and remade.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

- A. Potable Water Mains
 - 1. Hydrostatic testing:
 - a. Hydrostatically test the mains in accordance with Section 33 01 12.
- B. Sewer Force Mains
 - 1. Hydrostatic testing:
 - a. Hydrostatically test the mains in accordance with Section 33 01 12.
- C. Gravity Sewer Mains
 - 1. Closed Circuit Television (CCTV) Inspection
 - a. Provide a Post-CCTV Inspection in accordance with Section 33 01 15.
 - 2. Sewer Pipe Testing
 - a. Test pipe in accordance with Section 33 01 13.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

- A. Potable Water Mains
 - 1. Cleaning, disinfection, and bacteriological testing of water mains:
 - a. Clean, flush, pig, disinfect, and bacteriological test the mains in accordance with Section 33 01 12.

B. Sewer Force Mains

1. Cleaning of sewer force mains
 - a. Clean the mains in accordance with Section 33 01 12.

C. Gravity Sewer Mains

1. Cleaning of sewer mains:
 - a. Clean the mains in accordance with Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 41
CURED IN PLACE PIPE (CIPP)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cured in Place Pipe (CIPP) 15-inch through 60-inch for gravity sanitary sewer rehabilitation.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 13 – Cleaning and Approval.
 - 2. Section 33 01 15 – Closed Circuit Television (CCTV) Inspection.
 - 3. Section 33 01 16 – Bypass Pumping of Existing Sewer Systems.
 - 4. Section 33 31 16 – Sanitary Sewer Service Connections and Service Line.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Cured in Place Pipe (CIPP)
 - a. Measurement
 - 1) Measured horizontally along the surface from center line to center line of the manhole or appurtenance.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “CIPP” installed for:
 - a) Various sizes.
 - c. The price bid shall include:
 - 1) Mobilization
 - 2) Bypass pumping
 - 3) Pre-CCTV
 - 4) Furnishing and installing CIPP as specified by the Drawings
 - 5) Hauling
 - 6) Disposal of excess material
 - 7) Clean-up
 - 8) Cleaning
 - 9) Testing

2. Hydraulic Mechanical Cleaning (Chain Knocking)
 - a. Measurement
 - 1) Measured horizontally along the ground surface following the pipe centerline for the length identified during Pre-CCTV inspection and directed by the City.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Sewer Pipe, Hydraulic Mechanical Cleaning”.
 - c. The price bid shall include:
 - 1) Mobilization
 - 2) Furnishing equipment
 - 3) Cleaning
 - 4) Disposing of excess material
 - 5) Clean-up
3. Point Repair
 - a. Measurement
 - 1) Measured horizontally along the ground surface following the pipe centerline for the length identified during the Pre-CCTV inspection and directed by the City.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Sewer Pipe, Point Repair” installed for:
 - a) Various sizes.
 - c. The price bid shall include:
 - 1) Furnishing and installing pipe as specified by the Drawings
 - 2) Pre-CCTV
 - 3) Repair clamps or couplings
 - 4) Pavement removal
 - 5) Excavation
 - 6) Hauling
 - 7) Bypass Pumping Piping
 - 8) Disposal of excess material
 - 9) Furnishing, placement, and compaction of embedment
 - 10) Furnishing, placement, and compaction of backfill
 - 11) Clean-up
 - 12) Cleaning
 - 13) Testing
4. Service Reinstatement, CIPP
 - a. Measurement
 - 1) Measurement for this item shall be per each service reconnected.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Service Reinstatement, CIPP”.
 - c. The price bid shall include:
 - 1) Mobilization
 - 2) Furnishing and installing CIPP as specified by the Drawings
 - 3) Hauling

- 4) Disposal of excess material
- 5) Clean-up
- 6) Cleaning
- 7) Testing

1.3 REFERENCES

A. Abbreviations

1. CIPP – Cured in Place Pipe
2. CCTV – Closed Circuit Television

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO).
3. ASTM International (ASTM):
 - a. D5813, Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems.
 - b. F1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
 - c. F1743, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).
4. International Organization for Standardization (ISO):
 - a. 9000, Quality Management System - Fundamentals and Vocabulary.
5. Occupational Safety and Health Administration (OSHA).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Coordinate with City, franchise utilities, etc. as specified in the Drawings.
2. Provide advanced notice prior to commencing actual lining activities, as specified in the Drawings, in order to allow the City to provide appropriate advanced notice to affected residents.
3. Review the location and number of insertion or access pits with the City Inspector prior to excavation.

B. Sequencing

1. Provide a bypass pumping plan, for existing 15-inch and larger sewer lines, detailing collection and discharge locations and method of bypass pumping in accordance with Section 33 01 16, prior to the start of construction.
2. Provide a phasing plan with the sequence of construction prior to the start of construction.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Special Procedure Submittals
 - 1. Provide a bypass pumping plan for existing 15-inch and larger sewer lines, in accordance with Section 33 01 16.
 - 2. Provide a phasing plan with the sequence of construction prior to the start of construction.
- B. Product Data
 - 1. Flexible Liner (tube)
 - a. Tabular summary by sewer segment noting required CIPP thickness per section
 - 2. Resin
 - a. Technical data sheet showing physical and chemical properties
 - b. Test results of chemical resistance testing performed by resin manufacturer
- C. Shop Drawings
 - 1. Provide calculations to support CIPP design thickness after curing. List the following criteria used for the calculations:
 - a. Assumed host pipe condition
 - b. Ground water table elevation
 - c. Depth of cover at deepest location
 - d. Modulus of soil stiffness
 - e. Long term modulus of elasticity
 - f. Live loading
 - g. Factor of safety against buckling
 - h. Assumed pipe ovality
- D. Certificates
 - 1. Furnish an affidavit certifying all CIPP is in accordance with all applicable ASTM standards and this Section.
- E. Source Quality Control Submittals
 - 1. Manufacturer to provide third party test results supporting the long-term performance and structural strength of the pipe being manufactured
- F. Submit Contractor and personnel experience records in accordance with Article 1.9.
- G. Submit manufacturer and installer certifications in accordance with Article 1.9.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturing and Installation
 - a. Finished pipe shall be the product of 1 manufacturer.
 - b. Liner manufacturing operations shall be performed at 1 location.
 - c. The pipe manufacturer shall:
 - 1) Have performed a minimum of 50,000 feet of successful installation in the United States
 - 2. All pipe furnished and installed shall be in conformance with ASTM D5813 and F1216 (8-inch through 60-inch).

B. Certifications

1. Manufacturing
 - a. Operate pipe manufacturing under a quality management system certified by third party ISO 9000. Provide proof of certification upon request.
2. Installation
 - a. If the installer is not also the manufacturer, then installer must provide certification from the manufacturer stating he/she is licensed and fully trained as an installer of the product upon request.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Follow manufacturer's recommendation on all storage and handling requirements.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

A. General

1. All pipe furnished and installed shall be in conformance with ASTM D5813 and F1216 (8-inch through 60-inch).

B. Performance / Design Criteria

1. Liner (tube)
 - a. Design liner for a 50-year service life under continuous loading conditions.
 - b. Consider no bonding to the original pipe wall.
 - c. Base design on a fully deteriorated host pipe condition as defined in ASTM F1216.
 - d. Calculate wall thickness per ASTM F1216 Appendix X1.
 - 1) Assume the following values for the design:
 - a) Safety Factor (N) = 2.0
 - b) Ovality (C) = 5 percent
 - c) Enhancement Factor (K) = 7.0
 - d) Groundwater Depth (H_w) = at proposed ground surface, feet
 - e) Soil Depth (H) = per Drawings, feet
 - f) Soil Modulus (E') = 1,000, psi
 - g) Soil Density (w) = 130 pounds per cubic foot
 - h) Live Load = ASSHTO HS 20
 - 2) The minimum allowable wall thickness for fiberglass liner is 2.8 millimeters and can be increased as necessary to meet ASTM F1216 Appendix X1 design formula.
 - 3) The minimum allowable wall thickness for felt liner is 6.0 millimeters and can be increased as necessary to meet ASTM F1216 Appendix X1 design formula.
 - 4) Fiberglass or felt products below the stated minimum wall thickness will not be allowed under any circumstances.

C. Materials

1. Liner (tube)

- a. The liner consists of absorbent non-woven felt or seamless spirally wound glass fiber.
- b. Construct liner to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.
- c. The wet-out liner shall have a relatively uniform thickness that, when compressed at installation pressures, will equal or exceed the calculated minimum design CIPP wall thickness.
- d. Manufacture liner to a size sufficient to tightly fit the internal circumference and length of the original pipe. Make allowance for circumferential stretching during construction.
- e. Manufacture to length necessary to fully span the distance between manholes. Include sufficient amount of material for sealing at manholes and product sample, if required.
- f. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so a clear, detailed examination with CCTV inspection per Section 33 01 30 can be made.

2. Resin

- a. The resin system will be manufactured by an approved company selected by the CIPP liner manufacturer. Provide documentation of approval, if requested.
- b. The resin system shall be corrosion resistant polyester or vinyl ester system including all required catalysts and initiators to create a composite system in accordance with the requirements of ASTM F1216, ASTM D5813, and ASTM F1743.
- c. Produce a proper CIPP system resistant to abrasion caused by solid, grit, or sand.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Inspection

1. Prior to installation, conduct an inspection of the existing pipe identified for rehabilitation along with surrounding job site conditions.
2. Complete a Pre-CCTV inspection.
3. Observe flows at different times of the date to determine or verify flow conditions in preparation for bypass pumping.
4. Verify accessibility conditions and coordinate with city regarding easement access and limitations.
5. Confirm full circumference of the host pipe prior to lining to ensure the pipe can be rehabilitated without compromising the CIPP system.

B. Host Pipe Preparation

1. Clean pipe in accordance with Section 33 01 13.
2. Inspect pipe in accordance with the requirements of this Section.
3. Prepare for bypass pumping in accordance with Section 33 01 16.
4. If host pipe is severely tuberculated, perform hydraulic mechanical cleaning (chain knocking).

C. Liner (tube) Preparation

1. Resin Impregnation
 - a. Impregnate the liner in a saturation facility where the environment can be consistently controlled.
 - b. Use sufficient quantity of resin to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the potential loss of resin during installation through cracks and irregularities in the original pipe wall.
 - c. Vacuum impregnate the resin utilizing a motorized pinch roller to set proper thickness.
2. If transported to the site, refrigerate as necessary to maintain stable environment for the impregnated liner.

3.4 INSTALLATION

A. Safety

1. Carry out operation in accordance with all OSHA and manufacturer safety requirements including, but not limited to, safety requirements involving confined space entry.

B. Liner installation

1. The impregnated liner can be placed in the pipe by either direct inversion or the pull in place method.
2. Direct inversion installation in accordance with ASTM F1216.
3. Pulled in place installation in accordance with ASTM F1743.
4. The finished CIPP should be continuous over the entire length of the run and be smooth and free from substantial wrinkles, as well as defects and improper service connections.

C. Curing

1. Curing of the CIPP may be done by water, steam or Ultra Violet (UV) light source, depending on the liner type and resin. Each method must follow the recommendation of the manufacturer.
2. Place a sufficient amount of temperature and/or monitoring gauges within the system to insure curing throughout the liner is consistent and uniform. A minimum of 2 gauges are required, 1 at each end of the liner.
3. Upon completion of the curing process provide the City with the monitoring data.

D. Reinstatement of lateral connections

1. After the liner pipe is cured in place have the lateral connections reinstated within 18 hours or as curing time recommended by manufacturer.
2. Reinstall the service by cutting the liner from the inside of the pipe. For small diameter pipe a remote operated cutting device may be used. For larger pipe the liner may be cut by hand.
3. An internal cut is considered acceptable if the bottom 1/3 of the opening matches the existing tap invert, there are no jagged edges and a minimum of 95 percent of the tap opening is restored.
4. Blind holes, over cutting and holes that miss the tap must be repaired to the satisfaction of the City.
5. If additional Work is required to restore the lateral connection outside of the pipe, follow the requirements of Section 33 01 16.

3.5 REPAIR

- A. If the CIPP is deemed unacceptable by the City, provide a method of repair or replacement for review and approval by the City.

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Closed Circuit Television (CCTV) Inspection
 - a. Perform a Post-CCTV Inspection in accordance with Section 33 01 15.
2. The inspection must be completed and the quality of installation must be acceptable to the City prior to restoring services.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Cleaning of sewer mains:

1. Clean the mains in accordance with Section 33 01 13.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 50

AUGER BORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Minimum requirements for auger boring using 48-inch and smaller casing pipe with lengths less than 250 feet at the locations shown on the Drawings

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 05 06 – Pipe Bedding and Backfill Material
2. Section 33 05 52 – Jacking and Steel Casing

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

- a. This Item is considered subsidiary to steel casing pipe construction.

2. Payment

- a. The Work performed and materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of By Other Than Open Cut to be complete in place, and no other compensation will be allowed.

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. Occupational Safety and Health Administration (OSHA)

- a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation

- 1. Provide written notice to the City at least 3 workdays in advance of the planned launch of auger boring operations.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

- 1. Submit the following:
 - a. Detailed description of the methods and equipment to be used in completing each reach of boring operation.
 - b. Description of intended survey methods to ensure the tunnel is advanced and within the line and grade tolerances specified in the Drawings.
 - c. Shaft layout drawings
 - 1) Detailing dimensions and locations of all equipment, including overall Work area boundaries, crane, front-end loader, forklift, spoil stockpiles, spoil hauling equipment, pumps, generator, pipe storage area, tool trailer or containers, fences, and staging area
 - 2) Required for all shaft locations and shall be to scale or show correct dimensions.
 - 3) Layout such that all equipment and operations are completely contained within the allowable construction areas specified in the Drawings.
 - d. Schedule in accordance with Division 1 to include the following activities as independent items:
 - 1) Mobilization
 - 2) Shaft excavation and support
 - 3) Water control at shafts
 - 4) Working slab construction
 - 5) Thrust wall construction
 - 6) Auger Boring
 - 7) Shaft backfill
 - 8) Site restoration

- 9) Cleanup
- 10) Demobilization

B. Daily Records

1. Submit daily records to the City's Inspector by noon on the day following any data or records taken.
2. Daily records shall include:
 - a. Date
 - b. Time
 - c. Name of operator
 - d. Bore drive identification
 - e. Installed casing and corresponding tunnel length
 - f. Time required to bore each ring
 - g. Time required to set subsequent ring
 - h. Spoil volumes
 - i. Grout volumes and pressures (if required)
 - j. Soil conditions, including occurrences of unstable soils and estimated groundwater inflow rates, if any
 - k. Line and grade offsets
 - l. Any movement of the guidance system
 - m. Problems encountered during boring
 - n. Durations and reasons for delays
 - o. Manually recorded observations made:
 - 1) At intervals of not less than 2 every 5 feet
 - 2) As conditions change
 - 3) As directed by the City

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Contractor
 - a. All boring Work shall be performed by an experienced subcontractor or Contractor who has at least 5 years of experience in performing tunneling Work and has completed at least 5 boring projects of similar diameter and ground conditions.
 - 1) At least 1 of the projects shall have an individual boring length equal to or greater in length than the longest tunnel on this project.

- 2) Submit details of referenced projects including City's name and contact information, project superintendent and machine operators.
- b. The project superintendent shall have at least 5 years of experience supervising boring construction.
 - 1) The Contractor may be required to submit details of referenced project including City's name, contact information and project superintendent.
- c. The site safety representative and personnel responsible for air quality monitoring shall be experienced in tunnel construction and shall have current certification by OSHA.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Description

1. Steel Casing Pipe shall be in accordance with Section 33 05 22.
2. Tunnel Liner Plate is not permitted for use with Auger Boring.

B. Design Criteria

1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Reports anticipated
2. Tolerance
 - a. Pressurized Carrier pipe
 - 1) Lateral or vertical variation in the final position of the pipe casing from the line and grade established by the Drawings shall be permitted only to the extent of 1 inch in 10 feet provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe and clearances from other underground utilities or structures.
 - b. Gravity Carrier Pipe

- 1) Lateral variation in the final position of the pipe casing from the line and grade established by the Drawings shall be permitted only to the extent of 1 inch in 10 feet provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe and clearances from other underground utilities or structures.
- 2) Grades shown on Drawings must be maintained vertically.
3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.
 - a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities or surface features (i.e. pavement, structures, railroad tracks, etc.)
 - b. Repair any damage caused by ground movements at no cost to the City.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Boring shall not begin until the following have been completed:
 1. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.
 - a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities in accordance with Division 1.
 - 1) Repair damage to existing utilities resulting from excavation at no additional cost to the City.
 - b. Follow notification requirements of permit provider where applicable.
 2. Complete pit excavations and support systems for each drive in accordance with the requirements of the Specifications.

3.4 INSTALLATION

A. General

1. Immediately notify the City if any problems are encountered with equipment or materials or if the Contractor believes the conditions encountered are materially and significantly different than those represented within the Contract Documents.
2. Where pipe is required to be installed under railroad embankments or under highways, streets or other facilities, construction shall be performed in such a manner so as to not interfere with the operation of the railroad, street, highway or other facility, and so as not to weaken or damage any embankment or structure.
3. During construction operations, furnish and maintain barricades and lights to safeguard traffic and pedestrians until such time as the backfill has been completed and then remove from the site.
4. Properly manage and dispose of groundwater inflows to the shafts in accordance with requirements of specifications and all permit conditions.
 - a. Discharge of groundwater inflow into sanitary sewers is not allowed without proper approval and permits.
5. Furnish all necessary equipment, power, water and utilities for tunneling, spoil removal and disposal, grouting and other associated Work required for the methods of construction.
6. Promptly clean up, remove and dispose of any spoil or slurry spillage.
7. Do not disturb roadways, railroads, canal channels, adjacent structures, landscaped areas or existing utilities.
 - a. Any damage shall be immediately repaired to original or better condition and to the satisfaction of the Engineer or permit grantor at no additional cost to the City.
8. Whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the Work.
9. Notify the Texas One Call system (800-245-4545) to request marking of utilities by utility owners / operators that subscribe to One Call, and shall individually notify all other known or suspected utilities to request marking of these utilities.
 - a. Confirm that all requested locates are made prior to commencing boring operations.

- b. Visually confirm and stake necessary existing lines, cables, or other underground facilities including exposing necessary crossing utilities and utilities within 10 feet laterally of the designed tunnel.
- c. Control drilling and grouting practices to prevent damage to existing utilities.

B. Boring Methods

- 1. Tunnel liner plate shall not be used for auger boring.
- 2. The Contractor shall be fully responsible for ensuring the methods used are adequate for the protection of workers, pipe, property and the public and to provide a finished product as required.
- 3. Blasting is not allowed.

C. Pits and Trenches

- 1. If the grade of the pipe at the end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe.
- 2. Wherever end trenches are cut in the sides of the embankment or beyond it, such Work shall be sheeted securely and braced in a manner to prevent earth from caving in.
- 3. The location of the pit shall meet the approval of the City.
- 4. The pits of trenches excavated to facilitate these operations shall be backfilled in accordance with Section 33 05 10 immediately after the casing and carrier pipe installation has been completed.

D. Boring

- 1. Install steel casing pipe by boring hole with the earth auger and simultaneously jacking pipe into place.
- 2. The boring shall proceed from a pit provided for the boring equipment and workmen.
- 3. Pilot Hole, required for 24-inch and larger casings
 - a. By this method an approximate 2-inch hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the Work pit.
 - b. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.
 - c. Pilot hole to be bored mechanically.

- d. Other methods of maintaining line and grade on the casing may be approved if acceptable to the Engineer.
 - e. Placed excavated material near the top of the working pit and disposed of as required.
 - 1) If no room is available, immediate haul off is required.
 - 4. The use of water or other fluids in connection with the boring operation will be permitted only to the extent required to lubricate cuttings.
 - a. Jetting or sluicing will not be permitted.
 - 5. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to:
 - a. Consolidate cuttings of the bit
 - b. Seal the walls of the hole
 - c. Furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter
 - 6. When the cutting operation begins, the operation shall be carried on without interruption, insofar as practical, until the casing is in place.
 - 7. Allowable variation from the line and grade shall be as specified in this Specification.
 - 8. All voids in excess of 2 inches between bore and outside of casing shall be pressure grouted.
- E. Contact Grouting
- 1. Contact grout any voids caused by or encountered during the boring.
 - a. Modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.
- F. Control of Line and Grade
- 1. Monitor line and grade continuously during boring operations.
 - a. Record deviation with respect to design line and grade once at each casing joint.
 - 2. If the pipe installation does not meet the specified tolerances, correct the installation, including any necessary redesign of the pipeline or structures and acquisition of necessary easements.

3.5 CLEANUP AND RESTORATION

- A. After completion of the boring, all construction debris, spoils, oil, grease and other materials shall be removed from the pipe, pits and all Work areas.
- B. Restoration shall follow construction as the Work progresses and shall be completed as soon as reasonably possible.
 - 1. Restore and repair any damage resulting from surface settlement caused by shaft excavation or boring.
 - 2. Any property damaged or destroyed shall be restored to a condition equal to or better than existing prior to construction.
 - 3. Restoration shall be completed no later than 30 days after boring is complete, or earlier if required as part of a permit or easement agreement.
 - 4. This provision for restoration shall include all property affected by the construction operations.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Field Tests and Inspections
 - 1. Allow access to the City and furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection, including, but not limited to the following:
 - a. The City shall have access to the boring system prior to, during and following all boring operations.
 - b. The City shall have access to the tunneling shafts prior to, during and following all boring operations.
 - 1) This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.
 - 2) The Contractor shall provide safe access in accordance with all safety regulations.
 - c. The City shall have access to spoils removed from the boring excavation prior to, during and following all boring operations.
 - 1) The City shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

B. Safety

1. The Contractor is responsible for safety on the job site.
 - a. Perform all Work in accordance with the current applicable regulations of the Federal, State and local agencies.
 - b. In the event of conflict, comply with the more restrictive applicable requirement.
2. No gasoline powered equipment shall be permitted in receiving shafts/pits.
 - a. Diesel, electrical, hydraulic, and air powered equipment are acceptable, subject to applicable local, State and Federal regulations.
3. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
 - a. Perform all required air and gas monitoring.
 - b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground Work areas.
4. Perform all Work in accordance with all current applicable regulations and safety requirements of the Federal, State and Local agencies.
5. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
 - a. In the event of conflict, comply with the more stringent requirements.
6. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
 - a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 52

JACKING AND STEEL CASING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Minimum requirements for manufacturing, furnishing and transporting Steel Casing Pipe to be installed by Open Cut or By Other than Open Cut at the locations shown on the Drawings

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 05 06 – Pipe Bedding and Backfill Material
2. Section 33 05 50 – Auger Boring
3. Section 33 05 53 – Hand Tunneling
4. Section 33 05 54 – Installation of Carrier Pipe in Casing

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Open Cut

a. Measurement

- 1) Measured horizontally along the surface for length of Steel Casing Pipe installed

b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “Casing, By Open Cut” installed for:

a) Various Sizes

- c. The price bid shall include:
 - 1) Furnishing and installing Steel Casing as specified by the Drawings
 - 2) Mobilization
 - 3) Pavement removal
 - 4) Excavation
 - 5) Hauling
 - 6) Disposal of excess material
 - 7) Furnishing, placement, and compaction of embedment
 - 8) Furnishing, placement, and compaction of backfill
 - 9) Clean-up
- 2. By Other than Open Cut
 - a. Measurement
 - 1) Measured horizontally along the surface for length of Steel Casing installed (Pipe included).
 - b. Payment
 - 1) The Work performed and materials furnished for casing and pipe in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot of "Casing/Jacking and Steel Pipe, By Other than Open Cut" installed for:
 - a) Various Sizes
 - c. The price bid shall include:
 - 1) Furnishing and installing Steel Casing and Pipe as specified by the Drawings
 - 2) Mobilization
 - 3) Launching shaft
 - 4) Receiving shaft
 - 5) Pavement removal
 - 6) Excavation
 - 7) Hauling
 - 8) Disposal of excess material

- 9) Furnishing, placement, and compaction of backfill
- 10) Clean-up

1.3 REFERENCES

A. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. ASTM International (ASTM):
 - a. A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS Sizes 4 and over).
- 3. American Water Works Association (AWWA):
 - a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

- 1. Exterior Coating
 - a. Material data
 - b. Field touch-up procedures
- 2. Interior Coating
 - a. Material data
 - b. Field touch-up procedures

B. Shop Drawings

1. Auger Boring see Section 33 05 50.
2. For Tunneling, provide the following:
 - a. Furnish details for Steel Casing Pipe outlining the following:
 - 1) Grout/lubrication ports
 - 2) Joint details
 - 3) Other miscellaneous items for furnishing and fabricating pipe
 - b. Submit calculations in a neat, legible format that is sealed by a Licensed Professional Engineer in Texas, consistent with the information provided in the geotechnical report, and includes:
 - 1) Calculations confirming that pipe jacking capacity is adequate to resist the anticipated jacking loads for each crossing with a minimum factor of safety of 2
 - 2) Calculations confirming that pipe capacity is adequate to safely support all other anticipated loads, including earth and groundwater pressures, surcharge loads, and handling loads
 - 3) Calculations confirming that jointing method will support all loading conditions

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Handling, and Storage

1. Prior to delivery of the pipe, end/internal bracing shall be furnished and installed, as recommended by the manufacturer, for protection during shipping and storage.
2. Deliver, handle and store pipe in accordance with the Manufacturer's recommendations to protect coating systems.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Design Criteria

1. The EOR is fully responsible for the design of Steel Casing Pipe that meets or exceeds the design requirements of this Specification and that is specifically designed for installation by the intended trenchless method.
2. For Steel Casing Pipe utilized for tunneling projects, consider the following:
 - a. Design of the casing pipe shall account for all installation and service loads including:
 - 1) Jacking loads
 - 2) External groundwater and earth loads
 - 3) Traffic loads
 - 4) Practical consideration for handling, shipping and other construction operations
 - 5) Any other live or dead loads reasonably anticipated
 - b. Design shall be sealed and signed by a registered Professional Engineer licensed in the State of Texas.
 - c. The allowable jacking capacity shall not exceed 50 percent of the minimum steel yield stress.
3. All pipe intended for use as casing pipe shall be manufactured in accordance with the specifications for steel carrier pipe except that the wall thickness may be reduced, the Kraft paper wrap is not required, and the compliance with UL and TFIC is not required.
4. Steel Casing Pipe shall be solid welded and have a minimum wall thickness as follows:

Casing Pipe Diameter (inches)	Minimum Wall Thickness (inches)

8 - 36	0.250
8 – 36 (Underneath Railroad Tracks)	0.500
Greater than 36	Specified by design engineer

5. Steel Casing Pipe shall be provided with inside diameter sufficient to efficiently install the required carrier pipe with casing spacers as required in Section 33 05 54.
 - a. Allowable casing diameters are shown on the Drawings for each crossing.
6. Furnish in lengths that are compatible with Contractor’s shaft sizes and allowable Work areas.
7. Random segments of pipe will not be permitted for straight runs of casing.
 - a. Closing piece segments, however, shall be acceptable.
8. Spacers and End Seals shall be “Advance Products and Systems, INC.” or approved equal; see City of League City “Pipe Casing Detail” for other info.

Move to Carrier Pipe Spec

9. When required by installation method, provide grout/lubricant ports along the pipe at intervals of 10 feet or less.
 - a. Ports and fittings shall be attached to the pipe in a manner that will not materially affect the strength of the pipe nor interfere with installation of carrier pipe.
 - b. Plugs for sealing the fittings shall be provided by the Contractor and shall be capable of withstanding all external and internal pressures and loads without leaking.

B. Materials

1. Provide new, smooth-wall, carbon steel pipe conforming to ASTM A139, Grade B.
2. Dimensional Tolerances
 - a. Furnishing and installing Steel Casing Pipe with dimensional tolerances that are compatible with performance requirements and proposed installation methods that meet or exceed the specific requirements below:

- 1) Minimum wall thickness at any point shall be at least 87.5 percent of the nominal wall thickness.
 - 2) Outside circumference within 1.0 percent or 3/4 inch of the nominal circumference, whichever is less.
 - 3) Outside diameter of the pipe shall be within 1/8 inch of the nominal outside diameter.
 - 4) Roundness such that the difference between the major and minor outside diameters shall not exceed 0.5 percent of the specified nominal outside diameter or 1/4 inch, whichever is less.
 - 5) Maximum allowable straightness deviation of 1/8 inch in any 10-foot length.
3. All steel pipes shall have square ends.
- a. The ends of pipe sections shall not vary by more than 1/8 inch at any point from a true plane perpendicular to the axis of the pipe and passing through the center of the pipe at the end.
 - b. When pipe ends have to be beveled for welding, the ends shall be beveled on the outside to an angle of 35 degrees with a tolerance of $\pm 2\frac{1}{2}$ degrees and with a width of root face 1/16 inch $\pm$ 1/32 inch.
4. Steel Casing Pipe shall be fabricated with longitudinal weld seams.
- a. All girth weld seams shall be ground flush.

C. Finishes

1. Provide inside and outside of Steel Casing Pipe with a coal-tar protective coating in accordance with the requirements of AWWA C203.
 - a. Touch up after field welds shall provide coating equal to those specified above.

2.2 ACCESSORIES [NOT USED]

2.3 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Steel Casing

1. Install Steel Casing Pipe for By Other than Open Cut in accordance with Section 33 05 23. Install Steel Casing Pipe for Open Cut in accordance with Section 33 05 24.
 - a. Steel Casing Pipe connections shall be achieved by full penetration field butt welding or an integral machine press-fit connection (Permalok or equal) prior to installation of the pipe, depending on the type of carrier pipe.
 - b. Allowable joint types for each crossing are shown on the Drawings.
 - c. Field butt welding a square end piece of steel pipe to a 35-degree beveled end of steel pipe is acceptable.
 - d. Integral machined press-fit connections shall be installed in accordance with the manufacturer's installation procedures and recommendations.
2. Carrier pipe shall be installed inside Steel Casing Pipe in accordance with Section 33 05 54.
3. Contact grouting of the annulus outside the casing pipe shall be performed in accordance with Section 33 05 23.

B. JACKING

1. Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided.
2. A suitable jacking head, usually of timber and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe.
3. A suitable jacking frame or back stop shall be provided.

4. The pipe to be jacked shall be set on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade.
5. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe.
6. In general, embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into space thus provided.
7. When jacking of pipe commences, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
8. Any pipe damaged in jacking operations shall be removed and replaced.
9. The pits, shafts or trenches excavated to facilitate jacking operations shall be backfilled immediately after the jacking of the pipe has been completed.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 53

HAND TUNNELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Minimum requirements for Hand Tunneling using steel casing or casing pipe at the locations shown on the Drawings
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 05 51 – Metal Liner Plate
 - 2. Section 33 05 52 – Steel Casing Pipe

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. This Item is considered subsidiary to Steel Casing installation.
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this Item are considered subsidiary the unit price bid per linear foot of By Other than Open Cut installation of Steel Casing to be completed in place, and no other compensation will be allowed.

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB-17, Standard Specifications for Highway Bridges.
 - 3. Occupational Safety and Health Administration (OSHA)
 - a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation
 - 1. The Contractor shall provide written notice to the City at least 72 hours in advance of the planned launch of tunneling operations.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Submit the following, when required by the Contract Documents:
 - a. Detailed description of the methods and equipment to be used in completing each reach of tunnel
 - b. Description of the survey methods that will be used to ensure that the tunnel is advanced as shown on the Drawings and within the line and grade tolerances specified
 - c. Shaft layout drawings
 - 1) Detailing dimensions and locations of all equipment, including overall Work area boundaries, crane, front-end loader, forklift, spoil stockpiles, spoil hauling equipment, pumps, generator, pipe storage area, tool trailer or containers, fences, and staging area
 - 2) Shaft layout drawings will be required for all shaft locations and shall be to scale, or show correct dimensions.
 - 3) Layout such that all equipment and operations shall be completely contained within the allowable construction areas shown on the Drawings
 - d. Schedule in accordance with Division 1 to include the following activities as independent items:
 - 1) Mobilization
 - 2) Shaft excavation and support
 - 3) Water control at shafts
 - 4) Working slab construction
 - 5) Thrust wall construction
 - 6) Tunneling
 - 7) Shaft backfill
 - 8) Site restoration
 - 9) Cleanup
 - 10) Demobilization
2. For all projects, provide the following for Contact Grouting:
 - a. Contact Grouting (outside of casing) Work Plan and Methods including:
 - 1) Grouting methods
 - 2) Details of equipment
 - 3) Grouting procedures and sequences including:
 - a) Injection methods
 - b) Injection pressures
 - c) Monitoring and recording equipment
 - d) Pressure gauge calibration data
 - e) Materials
 - 4) Grout mix details including:
 - a) Proportions
 - b) Admixtures including:
 - (1) Manufacturer's literature

- (2) Laboratory test data verifying the strength of the proposed grout mix
- (3) Proposed grout densities
- (4) Viscosity
- (5) Initial set time of grout
 - (a) Data for these requirements shall be derived from trial batches from an approved testing laboratory.
- 5) Submit a minimum of 3 other similar projects where the proposed grout mix design was used.
- 6) Submit anticipated volumes of grout to be pumped for each application and reach grouted.

B. Daily Records

- 1. Submit samples of the tunneling logs or records to be used at least 7 days prior to beginning Hand Tunneling.
- 2. Submit daily records to the City's Inspector by noon on the day following the shift for which the data or records were taken.
- 3. Daily records shall include:
 - a. Date
 - b. Time
 - c. Name of operator
 - d. Tunnel drive identification
 - e. Installed liner ring and corresponding tunnel length
 - f. Time required to tunnel each ring
 - g. Time required to set subsequent ring
 - h. Spoil volumes (muck carts per liner ring and estimated volume of spoil in each muck cart)
 - i. Grout volumes and pressures
 - j. Soil conditions, including occurrences of unstable soils and estimated groundwater inflow rates, if any
 - k. Line and grade offsets
 - l. Any movement of the guidance system
 - m. Problems encountered during tunneling
 - n. Durations and reasons for delays
 - o. Manually recorded observations made:
 - 1) At intervals of not less than 2 every 5 feet
 - 2) As conditions change
 - 3) As directed by the City and/or Engineer

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

- 1. Failure to meet the qualification requirements is failure to fulfill the Contract and the Contractor will be required to obtain a subcontractor that meets the qualification requirements.
- 2. Contractor

- a. All tunneling Work shall be performed by an experienced subcontractor or Contractor who has at least 5 years of experience in performing tunneling Work or has completed at least 5 projects of similar diameter in similar ground conditions.
- 3. All Work by the Contractor shall be done in the presence of the City unless the City grants prior written approval to perform such Work in City's absence.
- 4. The Contractor shall allow access to the City and/or Engineer and shall furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection including, but not limited to, the following:
 - a. The City and/or Engineer shall have access to the tunneling system prior to, during and following all tunneling operations.
 - b. The City and/or Engineer shall have access to the tunneling shafts prior to, during and following all tunneling operations.
 - 1) This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.
 - 2) The Contractor shall provide safe access in accordance with all safety regulations.
 - c. The City and/or Engineer shall have access to spoils removed from the tunnel excavation prior to, during and following all tunneling operations.
 - 1) The City shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Description

- 1. Tunnel Liner Plate shall be in accordance with Section 33 05 51.
- 2. Casing Pipe shall be in accordance with Section 33 05 52.

B. Design Criteria

- 1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Reports
- 2. Tolerance
 - a. Accurately maintain the face of the excavation inside the tunnel so as to allow the absolute minimum of void space outside the casing/liner plate.
 - b. Maintain a maximum of ½ inch tolerance between the outside of the casing/liner plate and the excavation wherever possible.
 - c. The tunnel diameter shall not be greater than 2 inches larger than the casing/liner outer diameter (O.D.).

3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.
 - a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities and facilities.
 - b. Repair any damage caused by ground movements at no cost to the City.
4. Grout for voids shall consist of one-part standard Portland cement and four parts of fine, clean sand mixed with potable water to produce a homogenous, workable mix.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Tunneling shall not begin until the following have been completed:
 1. All required submittals have been made and the City and/or Engineer has reviewed and accepted all submittals.
 2. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.
 - a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities.
 - 1) Repair damage to existing utilities resulting from excavation at no additional cost to the City.
 3. Shaft excavations and support systems for each drive completed in accordance with the requirements of the Specifications.
 4. Site safety representative has prepared a code of safe practices in accordance with OSHA requirements.
 - a. Provide the Engineer and City with a copy of each prior to starting shaft construction or tunneling.
 - b. Hold safety meetings and provide safety instruction for new employees as required by OSHA.
 5. All specified settlement monitoring points have been installed, approved and baselined in accordance with the Contract Documents.
- B. Verification of Stability
 1. Confirm that the ground will remain stable without movement of soil or water while the entry/exit location shoring is removed and while the tunnel is launched or received into a shaft.
 2. Demonstrate that all soils have been stabilized at all tunnel portal locations to:
 - a. Prevent the inflow of weak, running or flowing soils.
 - b. Prevent the inflow of loose rock.
 - c. Prevent and control groundwater inflows.

3.4 INSTALLATION

A. Tunnel Methods

1. Perform tunnel excavation by methods consistent with good practice and with due regard for the safety of personnel, protection of property, and progress of the Work.
2. The methods of excavating in tunnels, whether by hand digging, mechanical means, or use of hydraulic or compressed air tools, shall be accomplished by procedures which are acceptable to the City of League City Public Works Department.
3. The City of League City Public Works Department will not attempt to dictate specific working methods, but it shall be the contractor's responsibility to ascertain beforehand that the methods which he desires to use will be acceptable to the City of League City Public Works Department, taking into account the actual job conditions expected.
4. The tunnel shall be permanently lined with galvanized steel deformed plates as described in Section 33 05 51 – Metal Liner Plate. As tunneling proceeds and following as closely behind erection of the liner plate as working space will permit, the annular space between the outside of the steel liner plates and the tunnel wall shall be filled with grout in such a manner and by such methods as to completely fill the space and leave it free of voids.
5. Pipe shall be handled and placed in tunnels by the use of proper cradle bedding, skids, wedges, guide rails or other approved means. The contractor's methods for setting pipe and making joints must be approved by the City of League City Public Works Department prior to their use.
6. The Contractor shall be fully responsible to:
 - a. Ensure the methods used are adequate for the protection of workers, pipe, property and the public
 - b. Provide a finished product as required.

B. General

1. The Contractor shall immediately notify the City, in writing, if and when any problems are encountered with equipment or materials, or if the Contractor believes the conditions encountered are materially and significantly different than those represented within the Contract Documents.
2. Properly manage and dispose of groundwater inflows to the shafts in accordance with requirements of Specifications and all permit conditions.
 - a. Discharge of groundwater inflow into sanitary sewers is not allowed without proper approval and permits.
3. Furnish all necessary equipment, power, water and utilities for tunneling, spoil removal and disposal, grouting and other associated Work required for the methods of construction.
4. Promptly clean up. Remove and dispose of any spoil or slurry spillage.
5. Whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the Work. Operations outside of City working window (7AM – 7PM) shall be pre-approved by City prior to mobilization.

C. Installation with Steel Casing Pipe

1. Jack the pipe from the low or downstream end, unless specified otherwise.
 - a. Provide heavy duty jacks suitable for forcing the pipe through the embankment.

- 1) When operating jacks, apply pressure evenly.
- b. Provide a suitable jacking head and bracing between jacks so that pressure will be applied to the pipe uniformly around the ring of the pipe.
- c. Provide a suitable jacking frame or back stop.
- d. Set the pipe to be jacked on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade.
- e. Place the whole jacking assembly so as to line up with the direction and grade of the pipe.
- f. In general, excavate embankment material just ahead of the pipe and remove material through the pipe.
- g. Force the pipe through the embankment with jacks into the space excavated.
2. The excavation for the underside of the pipe, for at least 1/3 of the circumference of the pipe, shall conform to the contour and grade of the pipe.
 - a. Provide a clearance of not more than 2 inches for the upper half of the pipe.
 - 1) This clearance shall be tapered off to 0 at the point where the excavation conforms to the contour of the pipe.
 - b. Extend the distance of the excavation beyond the end of the pipe depending on the character of the material, but do not exceed 2 feet in any case.
 - 1) Decrease the distance if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.
3. If desired, use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.
4. When jacking of pipe has begun, carry on the operation without interruption to prevent the pipe from becoming firmly set in the embankment.
 - a. Remove and replace any pipe damaged in the jacking operations.
 - b. The Contractor shall absorb the entire expense.

D. Installation

- a. In no case shall ground movements cause damage to adjacent structures, roadways, or utilities.
- b. The Contractor shall repair any damage resulting from construction activities, at no additional cost to the City and without extensions of schedule for completion.

E. Grouting

1. Suitable equipment for the expeditious placement of the grout shall be furnished.
2. Pressure grout any voids caused by or encountered during the tunneling.
 - a. Modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.
3. Install contact grout in the void space between the outside of the casing/tunnel liner and the excavation.
 - a. For tunnel liner plate, install pressure grout mix at the end of each workday or more often, as conditions warrant.
4. Install pressure grouting through grout fittings for the casing/tunnel liner plate 48-inches in diameter or larger.
 - a. Grout fittings shall be fabricated into tunnel liner plate at a maximum spacing of 6 feet.
 - b. Remove and plug grout fittings after pressure grouting.

5. Install pressure grout from the low end for all crossings where grout fittings are not used.
 - a. Seal the low end and pressure grout until grout is extruded from the opposite end.

F. Control of Line and Grade

1. Confirm that all established benchmarks and control points provided for the Contractor's use are accurate.
 - a. Use these benchmarks to furnish and maintain all reference lines and grades for tunneling.
 - b. Use lines and grades to establish the location of the pipe using a laser or theodolite guidance system.
 - c. Submit to the City copies of field notes used to establish all lines and grades and allow the Engineer to check guidance system setup prior to beginning each tunneling drive.
 - d. Provide access for the City to perform survey checks of the guidance system and the line and grade of the carrier pipe on a daily basis during tunneling operations.
 - e. The Contractor remains fully responsible for the accuracy of the Work and the correction of it, as required.
2. The casing/tunnel liner shall be installed in accordance with the following tolerances:
 - a. Variations from design line or grade: ± 2 inches maximum
 - 1) If the installation is offline or grade, make the necessary corrections and return to the design alignment and grade at a rate of not more than 1 inch per 25 feet.
3. Monitor line and grade continuously during tunneling operations.
 - a. Record deviation with respect to design line and grade once at each pipe joint and submit records to Engineer daily.
4. If the pipe installation does not meet the specified tolerances, correct the installation, including any necessary redesign of the pipeline or structures and acquisition of necessary easements.

G. Obstructions

1. If the tunneling operations should encounter an object or condition that impedes the forward progress of the shield, notify the City immediately.
2. Correct the condition and remove, clear or otherwise make it possible for the shield to advance past any objects or obstructions that impede forward progress.
3. Proceed with removal of the object or obstruction by methods submitted by the Contractor and accepted by the City and/or Engineer.
4. Compensation
 - a. The Contractor will receive compensation by change order for removal of obstructions, as defined as metallic debris, reinforced concrete, rocks, whole trees and other hard objects with a maximum dimension larger than 50 percent of the outer diameter of the shield which:
 - 1) Cannot be broken up by the cutting tools with diligent effort, and
 - 2) Are located partially or wholly within the cross-sectional area of the bore
 - 3) Contain utilities or ditch lines located longitudinally within the tunnel horizon
 - b. Payment will be negotiated with the Contractor on a case-by-case basis.
 - c. The City and/or Engineer shall be provided an opportunity to view obstruction prior to removal.
 - 1) Any removal process that does not allow direct inspection of the nature and position of the obstruction will not be considered for payment.

- d. No additional compensation will be allowed for removing, clearing or otherwise making it possible for the shield to advance past objects consisting of cobbles, boulders, wood, reinforced concrete, and other objects or debris with maximum lateral dimensions less than 50 percent of the outer diameter of the shield.

3.5 CLEANUP AND RESTORATION

- A. After completion of the tunneling, all construction debris, spoils, oil, grease and other materials shall be removed from the tunneling pipe, shafts and all Work areas.
 - 1. Cleaning shall be incidental to the construction.
- B. Restoration shall follow construction as the Work progresses and shall be completed as soon as reasonably possible.
 - 1. Restore and repair any damage resulting from surface settlement caused by shaft excavation or tunneling.
 - 2. Any property damaged or destroyed, shall be restored to a condition equal to or better than that to which it existed prior to construction.
 - 3. Restoration shall be completed no later than 30 days after tunneling is complete, or earlier if required as part of a permit or easement agreement.
 - 4. This provision for restoration shall include all property affected by the construction operations.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Safety
 - 1. No gasoline powered equipment shall be permitted in receiving shafts/pits.
 - a. Diesel, electrical, hydraulic and air powered equipment are acceptable, subject to applicable local, State, and Federal regulations.
 - 2. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
 - a. Perform all required air and gas monitoring.
 - b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground Work areas.
 - 3. Perform all Work in accordance with all current applicable regulations and safety requirements of the Federal, State, and Local agencies. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
 - a. In the event of conflict, comply with the more stringent requirements.
 - 4. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
 - a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 54
INSTALLATION OF CARRIER PIPE IN CASING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Requirements for the installation of carrier pipe into steel casing at locations specified in the Drawings.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 01 31 – Sewer and Manhole Testing.
 - 2. Section 33 05 06 – Utility Trench Excavation, Embedment, and Backfill.
 - 3. Section 33 14 10 – Ductile Iron Pipe and Fittings.
 - 4. Section 33 14 11 – Polyvinyl Chloride (PVC) Pressure Pipe.
 - 5. Section 33 14 12 – Concrete Pressure Pipe, Bar-Wrapped Steel Cylinder Type.
 - 6. Section 33 14 13 – Buried Steel Pipe.
 - 7. Section 33 14 14 – High Density Polyethylene (HDPE) Pipe.
 - 8. Section 33 31 10 – Fiberglass Reinforced Pipe for Gravity Sanitary Sewers.
 - 9. Section 33 31 14 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Installation of Gravity Sanitary Sewer or Force Main Carrier Pipe in Casing.
 - a. Measurement
 - 1) See specification for Steel Casing (33 05 52).
 - 2) Measured horizontally along the ground surface for Sanitary Sewer Carrier Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be incidental in the unit price of the pipe material:
 - a) Various Sizes.
 - b) Various Materials.

- c. The price bid shall include:
 - 1) Furnishing and installing Sanitary Sewer Carrier Pipe in Casing as specified by the Drawings
 - 2) Annular grouting, if required
 - 3) Casing spacers
 - 4) End seals
 - 5) Excavation
 - 6) Hauling
 - 7) Disposal of excess material
 - 8) Clean-up
- 2. Installation of Force Main Carrier Pipe in Casing
 - a. Measurement
 - 1) See specification for Steel Casing (33 05 52).
 - 2) Measured horizontally along the ground surface for Force Main Carrier Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Force Main Carrier Pipe” installed for:
 - a) Various Sizes.
 - b) Various Materials.
 - c. The price bid shall include:
 - 1) Furnishing and installing Force Main Carrier Pipe in Casing as specified by the Drawings
 - 2) Annular grouting, if required
 - 3) Casing spacers
 - 4) End seals
 - 5) Excavation
 - 6) Hauling
 - 7) Disposal of excess material
 - 8) Clean-up
- 3. Installation of Water Carrier Pipe in Casing
 - a. Measurement
 - 1) See specification for Steel Casing (33 05 52).
 - 2) Measured horizontally along the ground surface for Water Carrier Pipe installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Water Carrier Pipe” installed for:
 - a) Various Sizes.
 - b) Various Materials.
 - c. The price bid shall include:
 - 1) Furnishing and installing Water Carrier Pipe in Casing as specified by the Drawings
 - 2) Annular grouting, if required
 - 3) Joint restraint
 - 4) Casing spacers
 - 5) End seals
 - 6) Excavation

- 7) Hauling
- 8) Disposal of excess material
- 9) Clean-up

1.3 REFERENCES

A. Abbreviations

1. LDCC – Low Density Cellular Concrete (Grout)
2. PVC – Polyvinyl Chloride
3. DIP – Ductile Iron Pipe
4. HDPE – High Density Polyethylene
5. FRP – Fiberglass Reinforced Pipe

B. Definitions

1. Carrier Pipe – Permanent pipe for operational use that is used to convey flows.
2. Casing – A steel pipe or tunnel liner that supports the ground and provides a stable underground excavation for installation of the carrier pipe.
3. Annular Grouting – Grouting of the space between the casing and carrier pipe.

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society of Testing and Materials (ASTM):
 - a. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - b. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or [50 mm] Cube Specimens).
 - c. D2241, Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
3. International Organization for Standardization (ISO):
 - a. 9001, Quality Management Systems - Requirements.
4. Occupational Safety and Health Administration (OSHA):
 - a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.
5. American Water Works Association (AWWA):
 - a. C200, Steel Water Pipe - 6 Inches and Larger.
 - b. C303, Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
 - c. C900, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 IN through 60 IN, for Water Transmission and Distribution.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Casing Spacers
 - a. Material Data
 - 2. Annular Grout Mix
 - a. Material Data
- B. Shop Drawings
 - 1. Casing Spacers
 - a. Detail drawings and manufacturer's information for the casing spacers that will be used.
 - 1) Include dimensions, component materials, and documentation of manufacturer's ISO 9001:2000 certification.
 - b. Alternatives to casing spacers may be allowed by the City on a case-by-case basis.
 - 1) For consideration of an alternate method, submit a substitution request in accordance with Section 01 25 00.
 - 2. End seal or bulkhead designs and locations for casing/liners.
 - 3. Additional requirements for installations of carrier pipe 24-inch and larger:
 - a. Submit Work plan describing the carrier pipe installation equipment, materials and construction methods to be employed.
 - b. For installations without holding jacks or a restrained spacer, provide buoyant force calculations for the pipe during grouting, and measures which will be employed to prevent pipe flotation.
 - 1) Calculations sealed by a Professional Engineer Licensed in the State of Texas
 - c. Description of methods and devices to prevent buckling of carrier pipe during annular grouting, if required.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Certifications
 - 1. Casing spacer manufacturer shall be certified in accordance with ISO 9001:2000.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Performance / Design Criteria

1. Install carrier pipe within the horizontal and vertical tolerances as indicated in Part 3 of this Section, incorporating all support/spacer dimensions required.
2. The following carrier pipe materials are permitted for installation in casing as indicated:

- *Include appropriate Specifications below. Delete or Strike-thru if not used*

	Diameter (inches)	Material	Section Reference
Water Line	6-12	DIP (Restrained)	33 05 19
		PVC (C900, Restrained)	33 05 31
		HDPE	33 05 33
	16-30	DIP (Restrained)	33 05 19
		AWWA C303 (Restrained)	33 05 xx
		HDPE	33 05 33
	36 and greater	DIP (Restrained)	33 05 19
		AWWA C303 (Restrained)	33 05 xx
		AWWA C200 (Restrained)	33 05 xx
		HDPE	33 05 33

	Diameter (inches)	Material	Section Reference
Gravity Sanitary Sewer	8-12	DIP (with Ceramic Epoxy)	33 05 19
		PVC (D2241 or D3034)	33 31 xx
		PVC (C900)	33 05 31
		HDPE	33 05 38
	14-16	DIP (with Ceramic Epoxy)	33 05 19
		PVC (C900)	33 05 31
		PVC (D3034)	33 31 xx
	18-24	DIP (with Ceramic Epoxy)	33 05 19
		FRP	33 05 36
		PVC (C900)	33 14 11
		PVC (D3034)	33 31 xx
	30 and greater	DIP (with Ceramic Epoxy)	33 05 19
FRP		33 05 36	
Sewer Force Main	All Sizes	DIP (with Ceramic Epoxy, Restrained)	33 05 19
		HDPE	33 05 38

3. The minimum casing pipe or liner diameter required for nominal carrier pipe diameters will be as indicated below:

Nominal Carrier Pipe Size, All Materials (inches)	Minimum Casing Diameter (inches)	Minimum Liner Plate Diameter (inches)
8 and Smaller	18	48
10 - 15	24	48
16 – 18	30	48
20 - 21	36	48
24 – 27	42	48
30	48	54
Greater than 30	Project Specific Design	Project Specific Design

4. End Seals
 - a. Provide end seals at each end of the casing or liner plate to contain the grout backfill and/or to close the casing/liner ends to prevent the inflow of water or soil.
 - 1) Water Piping and Sewer Force Mains less than 24-inch diameter:
 - a) Mortared brick with non-shrink grout,
 - b) Link Seal manufactured by GPT, or
 - c) Approved equal.
 - 2) Water Piping and Sewer Force Mains 24-inch diameter and greater:
 - a) Use pull-on, 1/8-inch-thick synthetic rubber end seals, Model C manufactured by GPT, or
 - b) Approved equal.
5. Casing Spacers (Insulators)
 - a. Provide casing spacers to support the carrier pipe during installation.
 - b. Provide restrained-style casing spacers to hold carrier pipe stable to prevent floating or movement.
 - c. Provide dielectric strength sufficient to electrically isolate each component from one another and from casing/liner.
 - d. Carrier pipe less than 12-inch diameter and in casing or liner less than or equal to 150 linear feet:
 - 1) Provide stainless steel, neoprene or approved equal spacers.
 - 2) Provide sufficient height to allow a minimum clearance per City Details between the outside of carrier pipe bells or external restraint system and the inside of the casing/liner surface.
 - e. Carrier pipe 12-inch diameter and larger, or all piping in casing/liner greater than 150 linear feet:
 - 1) Minimum 14 gauge
 - 2) Coated steel for gravity sanitary sewer
 - 3) Suitable for supporting weight of carrier pipe without deformation or collapse during installation
 - 4) Risers:
 - a) Design for proposed loading
 - b) 10-gauge steel
 - c) Stainless steel for water line and sewer force main
 - d) Provide sufficient height with attached runner to allow a minimum clearance of 2 inches between the outside of carrier pipe bells or couplings and the inside of the casing/liner surface.
 - 5) Runners:

- a) Pressure-molded glass reinforced polymer or UHMW
- b) Minimum 2 inches in width
- c) Minimum 11 inches in length
- d) Attach to the band or riser with minimum 3/8-inch welded steel or stainless-steel studs.
- e) Recess runner studs and nuts well below wearing surface of the runner.
 - (1) Fill recess with corrosion inhibiting filler.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Carrier pipe installation may not begin until completion of the following tasks:
 - a. All required submittals have been provided, reviewed, and accepted.
 - b. All casing/liner joints are watertight, and no water is entering casing or liner from any sources.
 - c. All contact grouting is complete, if required.
 - d. Casing/liner alignment record drawings have been submitted and accepted by City to document deviations due to casing/liner installation.
 - e. Site safety representative has prepared a code of safe practices and an emergency plan in accordance with applicable requirements.
2. Install the carrier pipe within the casing or liner between the limits and to the lines and grades specified in the Drawings. Utilize methods which include due regard for safety of workers, adjacent structures and improvements, utilities, and the public.

B. Control of Line and Grade

1. Install carrier pipe inside the casing or liner within the following tolerances:
 - a. Horizontally +/- 2 inches from design line
 - b. Vertically +/- 1 inch from design grade
2. Check line and grade set up prior to beginning carrier pipe installation.
3. Perform survey checks of line-and-grade of carrier pipe during installation operations.
4. Contractor is fully responsible for the accuracy of the carrier pipe installation, and correction of the installation, if required.
 - a. Where the carrier pipe installation does not satisfy specified tolerances, correct the installation, including if necessary, redesign of the pipe or structures at no additional cost to City.

C. Installation of Carrier Pipe

1. Pipe Installation

- a. Remove all loose soil from casing or liner.
 - b. Grind smooth all rough welds at casing joints.
 - c. Install carrier pipe so that there is no metallic contact between the carrier pipe and the casing or liner.
 - d. Install carrier pipe without sliding or dragging it on the ground or in the casing/liner in a manner that could damage the pipe or coatings.
 - 1) If guide rails are used, place cement mortar on both sides of the rails.
 - e. Electrically isolate the carrier pipe from the casing spacers and from the casing/liner.
 - f. Grade the bottom of the trench adjacent to each end of the casing/liner to provide firm, uniform, and continuous support for the pipe. If the trench requires backfilling to establish the final trench bottom grade, place the backfill in 6-inch lifts and compact in accordance with Section 33 05 06 prior to installing the carrier pipe.
 - g. After the casing/liner has been placed, pump dry and maintain a dry surface until the carrier pipe and end seals are installed.
2. Installation of Casing Spacers
 - a. Provide casing spacers, insulators, or other approved devices to prevent flotation, movement, or damage to the pipe during installation.
 - b. Assemble and securely fashion casing spacers to pipeline to be installed in casing or liner.
 - c. Correctly assemble, evenly tighten, and prevent damage to pipe or casing spacer during tightening and pipe insertion.
 - d. Install spacers in accordance with manufacturer's recommendations.
 - e. Coat the casing spacer runners with a non-corrosive/environmentally safe lubricant to minimize friction when installing the carrier pipe.
 3. Casing Spacer Spacing
 - a. Distance between spacers will be per manufacturer recommendations.
 - b. If the casing or liner is angled or bent, add 1 additional spacer and adjust spacing evenly.
 - c. Provide 2 end spacers at each casing/liner end, within 6 inches of end of casing/liner.
 - d. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.
 4. After Carrier Pipe Installation
 - a. Verify electrical discontinuity between water carrier pipe and the casing/liner.
 - 1) If continuity exists, remedy the short by all means necessary, including removing and reinstalling the carrier pipe.
 - b. If steel pipe is used and not welded prior to installing in casing/liner, welding of pipe will only be allowed after annular grouting is complete (if applicable).
- D. Installation of End Seals (Water and Sewer Force Main)
1. Pipe 24-inches and greater in diameter:
 - a. Ground end of casing/liner minimum 6 inches and maximum 12 inches.
 - b. Place pull-on synthetic rubber end seals on the pipe and pull over the end casing/liner. Securely fasten with stainless steel bands.
- E. Annular Grouting (For Gravity Sewer Only) Only where approved by City Engineer
1. Prepare pipe as necessary to prevent the pipe from floating during grouting operations as necessary.
 2. Mixing of Grout

- a. Mix material in equipment of sufficient size to provide the desired amount of grout material for each stage in a single operation.
 - 1) The equipment shall be capable of mixing the grout at the required densities for the approved procedure and shall be capable of changing the densities as required by field conditions.
3. Backfill Annular Space with Grout
 - a. Prior to filling the annular space, test the gravity sewer carrier pipe in accordance with Section 33 01 04.
 - b. Verify from the manufacturer, the maximum allowable external pressure the carrier pipe may experience, and do not exceed this grout injection pressure.
 - c. After the installation of the carrier pipe, fill the remaining space (all voids) with LDCC grout.
 - 1) All exterior surfaces of the carrier pipe wall and interior surfaces of the casing/liner shall be in contact with grout.
 - 2) Pump grout through a pipe or hose.
 - 3) Use grout pipes, or other appropriate materials, to avoid damage to carrier pipe during grouting.
4. Injection of LDCC Grout
 - a. Grout injection pressure shall not exceed the carrier pipe manufacturer's recommendations, or 5 psi, whichever is lower.
 - b. Provide pumping equipment of a size sufficient to inject grout at a volume, velocity, and pressure compatible with the size/volume of the annular space.
 - c. Once grouting operations begin, proceed with uninterrupted grouting, unless grouting procedures require multiple stages.
 - d. Grout placements shall not be terminated until the estimated volume of annular grout has been injected.
5. Block the carrier pipe during grouting to prevent flotation during grout installation.
6. Protect and preserve the interior surfaces of the casing from damage during grouting.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Grouting Reports and Records

1. Required for the following scenarios:
 - a. Carrier pipe 24-inch and greater
 - b. Carrier pipe of any size longer than 150 feet
2. Maintain and submit daily logs of grouting operations including:
 - a. Grouting locations
 - b. Pressures
 - c. Volumes
 - d. Grout mix pumped
 - e. Time of pumping
 - f. Any problems or unusual observations

B. Grout Strength Tests

1. Perform testing for 24-hour and 28-day compressive strength for the cylinder molds (ASTM C39) or grout cubes (ASTM C109) obtained during grouting operations.
2. Provide and test at least 1 set of 4-cylinder molds or grout cubes for each 100 cubic yards of grout injected, but not less than 1 set for each grouting shift.
3. Test remaining samples as directed by City.

C. Safety

1. Contractor is responsible for safety on the job site.
 - a. Perform all Work in accordance with the current applicable regulations of the Federal, State and local agencies.
 - 1) Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
 - 2) In the event of a conflict, comply with the more stringent requirement.
2. No gasoline powered equipment shall be permitted in jacking/launching shafts and receiving shafts/pits.
 - a. Diesel, electrical, hydraulic, and air powered equipment is acceptable subject to applicable Federal, State, and local regulations.
3. Methods of construction shall be such as to ensure the safety of the Work, Contractor, subcontractor, other personnel on the Site, and the public.
4. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
 - a. Perform all required air and gas monitoring.
 - b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground Work areas.
5. If personnel will enter the pipe during construction, develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
 - a. Keep all equipment required for emergency response at the Site in accordance with all applicable Federal, State, and local requirements.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 57

WATER LINE LOWERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Locations where existing water lines are crossed by a new storm sewer, sanitary sewer, or water transmission main and the existing water line is to be lowered under proposed improvement without a design profile provided in the Drawings
2. Locations where a new water line is installed and crosses an existing underground conflict which requires the water line to be lowered greater than two feet below the standard depth and has not been detailed in the Drawings
3. Water lines 12-inch and larger are excluded from this Section and should be specifically designed for lowering and paid for by unit price items

B. Deviations from this City of League City Standard Specification:

1. None.

C. Related Specification Sections include but are not limited to:

1. Section 33 05 19 – Ductile Iron Pipe and Fittings.
2. Section 33 05 31 – Polyvinyl Chloride (PVC) Pressure Pipe.
3. Section 33 14 25 – Connection to Existing System.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Water Line Lowering

a. Measurement

- 1) Measurement for this item shall be per each by size of each Water Line Lowering performed.

b. Payment

- 1) The Work performed and the materials furnished in accordance with this item shall be paid for at the unit price bid per each “Water Line Lowering” installed for:
 - a) Various Sizes.
 - b) Various Materials.

c. The price bid shall include:

- 1) Furnishing and installing Ductile Iron or PVC Pipe and Ductile Iron Fittings
- 2) Polyethylene encasement
- 3) Paving removal
- 4) Excavation
- 5) Hauling
- 6) Disposal of excess material
- 7) Furnishing and placement of embedment
- 8) Furnishing, placement, and compaction of backfill
- 9) Thrust restraint

- 10) Bolts and nuts
- 11) Gaskets
- 12) Clean-up
- 13) Cleaning
- 14) Disinfection
- 15) Testing
- 16) Connections to the existing water line

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. Texas Administration Code:
 - a. Chapter 290, (30 TAC §290), Public Drinking Water.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Materials

1. If existing pipe material is ductile iron, use ductile iron pipe in accordance with this Section. For all other pipe materials, use PVC in accordance with this Section.
2. When crossing under storm drain pipe 24-in and larger, use ductile iron pipe in accordance with this Section.
3. When crossing under sanitary sewer, use ductile iron pipe in accordance with this Section.
4. Ductile Iron Pipe shall be in accordance with Section 33 05 19.
5. Ductile Iron Fittings with retainer glands shall be in accordance with Section 33 05 19.
6. Polyvinyl Chloride (PVC) Pressure Pipe shall be in accordance with Section 33 05 31.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

A. Evaluation and Assessment

1. Verify elevation of conflict which requires the water line to be relocated.

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Water lines lowered to resolve conflicts between the water line and a proposed utility shall be lowered to maintain a 2-foot separation between the outside diameters of the water line and the other buried utilities.
 - a. When approved by the City, the separation may be reduced to 12-inches.

B. Water Lines Crossing Sanitary Sewer

- a. Water lines crossing sanitary sewer shall be in accordance with Chapter 290, (30 TAC §290), Public Drinking Water and with Chapter 217, (30 TAC §217), Design Criteria for Sewerage System, no exceptions will be made.

C. Water Lines Crossing under Storm Drains

1. Water lines crossing less than 2 feet below storm drains shall be constructed of PVC or Ductile Iron Pipe in accordance with Section 33 05 19 or 33 05 31.

D. Install Ductile Iron Pipe in accordance with Section 33 05 31.

E. Install Ductile Iron Fittings with retainer glands in accordance with Section 33 05 31.

F. Install Polyvinyl Chloride (PVC) Pressure Pipe in accordance with Section 33 05 31.

G. Disinfect and test water line in accordance with Section 33 01 12.

H. Complete connections to existing water mains in accordance with Section 33 14 25.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Hydrostatic testing of water mains:

1. Hydrostatically test the mains in accordance with Section 33 01 12.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. Cleaning, disinfection, and bacteriological testing of water mains:

1. Clean, flush, pig, disinfect, and bacteriological test the mains in accordance with Section 33 01 12.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 60
PRE-CAST CONCRETE MANHOLES AND BASES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sanitary Sewer, Water Appurtenance, or Reclaimed Water Appurtenance
Precast Concrete Manholes
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 03 30 53 – Concrete
 - 2. Section 33 01 14 – Sewer and Manhole Testing
 - 3. Section 33 05 64 – Adjusting Manholes, Inlets, Valve Boxes, and Other
Structures
 - 4. Section 33 31 30 – Liners for Sanitary Sewer Structures

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Manhole
 - a. Measurement
 - 1) Measurement for this Item shall be per each concrete manhole
installed.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with
this Item shall be paid for at the unit price bid per each “Manhole”
installed for:
 - a) Various sizes
 - b) Various types
 - c. The price bid will include:
 - 1) Manhole structure complete in place
 - 2) Excavation

- 3) Forms
- 4) Reinforcing steel (if required)
- 5) Concrete
- 6) Backfill
- 7) Foundation
- 8) Drop pipe
- 9) Stubs
- 10) Frame
- 11) Cover
- 12) Grade rings
- 13) Pipe connections
- 14) Pavement removal
- 15) Hauling
- 16) Disposal of excess material
- 17) Placement and compaction of backfill
- 18) Clean-up

2. Extra Depth Manhole

a. Measurement

- 1) Measured per each vertical foot of manhole depth beyond 6 feet from rim to flow line, measured to the nearest foot.

b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per vertical foot for “Extra Depth Manhole” specified for:

- a) Various sizes

c. The price bid will include:

- 1) Manhole structure complete in place
- 2) Excavation
- 3) Forms
- 4) Reinforcing steel (if required)
- 5) Concrete
- 6) Backfill

- 7) Foundation
- 8) Drop pipe
- 9) Stubs
- 10) Frame
- 11) Cover
- 12) Grade rings
- 13) Pipe connections
- 14) Pavement removal
- 15) Hauling
- 16) Disposal of excess material
- 17) Placement and compaction of backfill
- 18) Clean-up

1.3 REFERENCES

A. Definitions

1. Manhole Type

- a. Standard Manhole
 - 1) Up to 6 feet deep (from rim to flowline).
- b. Standard Drop Manhole
 - 1) Same as Standard Manhole with external drop connection(s).
- c. Extra Depth Manhole
 - 1) Additional manhole depth in excess of 6 feet (from rim to flowline).

B. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. ASTM International (ASTM):
 - a. C443, Standard Specification for Joint for Concrete Pipe and Manholes, Using Rubber Gaskets
 - b. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - c. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes, and Laterals.
 - d. D1187, Standard Specification for Asphalt-Base Emulsion for Use as Protective Coatings for Metal

- e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Precast Concrete Manhole
 - 2. Drop connection materials
 - 3. Pipe connections at manhole walls
 - 4. Stubs and stub plugs
 - 5. Admixtures
 - 6. Concrete Mix Design

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Materials
 - 1. Precast reinforced concrete sections shall be in accordance with ASTM C478.
 - 2. Precast Joints
 - a. Provide gaskets in accordance with ASTM C443.
 - b. Minimize number of joints.

- c. Joint length to increase with manhole depth.
 - 1) For example, use long joints at the bottom of manhole and shorter joints toward the top.
- d. Include manufacturer's stamp on each section.
- 3. Lifting Devices
 - a. Manhole sections and cones may be furnished with lift lugs or lift holes.
 - 1) If lift lugs are provided, place 180 degrees apart.
 - 2) If lift holes are provided, place 180 degrees apart and grout during manhole installation.
- 4. Frame, cover, and grade rings in accordance with Section 33 05 81.
- 5. Pipe Connections
 - a. Utilize an elastomeric PVC or rubber boot-type connector installed in a circular block out opening conforming to ASTM C923.
- 6. Drop piping in accordance with City Details.
 - a. Use same material as sanitary sewer main.
- 7. Steps are not allowed.
- B. Finishes
 - 1. **Interior lining is required for all pre-cast concrete manholes in accordance with Section 33 31 30.**
- C. Manhole Sizing
 - 1. 4-foot diameter
 - a. Used with pipe ranging from 8-inch to 12-inch for depths 12-feet or less.
 - 2. 5-foot diameter
 - a. Used with pipe ranging from 8-inch to 12-inch for depths greater than 12-feet.
 - b. Used with pipe ranging from 15-inch to 27-inch.
 - 3. 6-foot diameter
 - a. Used with pipe ranging from 30-inch to 36-inch.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

A. Evaluation and Assessment

1. Verify lines and grades are in accordance with the Drawings.

3.3 PREPARATION

A. Foundation Preparation

1. Excavate 8 inches below manhole foundation.
2. Replace excavated soil with course aggregate; creating a stable base for manhole construction.
 - a. If soil conditions or ground water prevent use of course aggregate base a 2-inch mud slab may be substituted.

3.4 INSTALLATION

A. Manhole

1. Construct manhole to dimensions shown on Drawings.
2. Precast Sections
 - a. Provide bell-and-spigot design incorporating a premolded joint sealing compound for wastewater use.
 - b. Clean bell spigot and gaskets, lubricate and join.
 - c. Minimize number of segments.
 - d. Use long joints used at the bottom and shorter joints toward the top.

B. Antimicrobial Additive

1. All concrete manholes shall have an antimicrobial additive added into the concrete mix design per manufactures specifications. The liquid antibacterial additive shall be an EPA registered material.
2. The amount used shall be as recommended by the manufacture and included in the total water content of the concrete mix design. The additive shall be added into the concrete mix water to ensure even distribution of the additive throughout the concrete mixture.

C. Invert

1. Construct invert channels to provide a smooth waterway with no disruption of flow at pipe-manhole connections.
2. Manholes shall have inverts in them in which flow channels to the spring line of the pipes are constructed.
3. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature.
 - a. Provide curves for side inlets.

4. For all standard manholes provide inverts equal in depth to one-half the diameter of the pipes connected to that manhole.

D. Drop Manhole Connection

1. Install drop connection when sewer line enters manhole higher than 24 inches above the invert.

E. Final Rim Elevation

1. Install concrete grade rings for height adjustment.
 - a. Construct grade ring on load bearing shoulder of manhole.
 - b. Use sealant between rings as shown on Drawings.
2. Set frame on top of manhole or grade rings using continuous water sealant.
3. Remove debris, stones and dirt to ensure a watertight seal.
4. Do not use steel shims, wood, stones or other unspecified material to obtain the final surface elevation of the manhole frame.

F. Internal coating

1. All interior concrete above the manhole invert shall be coated complete with Thane Coat or approved equal, per manufactures recommendation.

G. External coating

1. Remove dirt, dust, oil and other contaminants that could interfere with adhesion of the coating.
2. Cure manhole for 3 days before backfilling around the structure.
3. Application will follow manufacturer's recommendation.

H. Modifications and Pipe Penetrations

1. Conform to City Details.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Perform vacuum test in accordance with Section 33 01 14.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 62

FIBERGLASS MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-Fiber-Reinforced Polyester (Fiberglass) Sanitary Sewer Manholes
 - 2. Fiberglass Sanitary Sewer Manholes will only be allowed where approved by City Engineer.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 01 14 – Sewer and Manhole Testing
 - 2. Section 33 05 60 – Pre-cast Concrete Manholes and Bases
 - 3. Section 33 31 30 – Liners for Sanitary Sewer Structures

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Manhole
 - a. Measurement
 - 1) Measurement for this Item shall be pre each “Fiberglass Manhole” installed.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Fiberglass Manhole” installed for:
 - a) Various sizes
 - b) Various types
 - c. The price bid shall include:
 - 1) Manhole structure complete in place
 - 2) Excavation
 - 3) Furnishing, placing and compaction of backfill
 - 4) Drop pipe
 - 5) Stubs
 - 6) Frame
 - 7) Cover
 - 8) Grade rings
 - 9) Pipe connections
 - 10) Pavement removal
 - 11) Hauling
 - 12) Disposal of excess material
 - 13) Clean-up
 - 2. Extra Depth Manhole
 - a. Measurement

- 1) Measurement for added depth beyond 6 feet shall be per vertical foot, measured to the nearest 1/10 foot.
- b. Payment
 - 1) The Work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” shall be paid for at the unit price bid per vertical foot for “Fiberglass Extra Depth Manhole” specified for:
 - a) Various Sizes
- c. The price bid shall include:
 - 1) Manhole structure complete in place
 - 2) Excavation
 - 3) Furnishing, placing and compaction of backfill
 - 4) Drop pipe
 - 5) Stubs
 - 6) Frame
 - 7) Cover
 - 8) Grade rings
 - 9) Pipe connections
 - 10) Pavement removal
 - 11) Hauling
 - 12) Disposal of excess material
 - 13) Clean-up

1.3 REFERENCES

A. Definitions

1. Manhole Type
 - a. Standard Drop Manhole (See City Standard Details)
 - 1) Same as Standard Manhole with external drop connection (s)
 - b. Type “A” Manhole (See City Standard Details)
 - 1) Manhole set on a reinforced concrete block placed around 39-inch and larger sewer pipe.

B. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - b. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - c. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - d. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
 - e. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections.
 - f. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manholes Structures, Pipes, and Laterals.
 - g. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

- h. ASTM C1244 – Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
- i. ASTM C1628 - Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
- j. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
- k. ASTM D2996 – Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- l. ASTM D2997 – Standard Specification for Centrifugally-Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- m. ASTM D3753 – Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wet wells.
- n. ASTM D4258 – Standard Practice for Surface Cleaning of Concrete.
- o. ASTM D4259 – Standard Practice for Abrading Concrete.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Design and fabrication details of Fiberglass Manhole components
 - 2. Installation instructions for Fiberglass Manholes
 - 3. Drop connection materials
 - 4. Pipe connections at manhole walls
 - 5. Materials for stubs and stub plugs, if applicable
 - 6. Grade ring materials
 - 7. External coating materials
 - 8. Plugs for hydrostatic testing
- A. Shop Drawings
 - 1. Design and fabrication details of Fiberglass Manholes
- B. Certifications

1.7 MANUFACTURER'S CERTIFICATION VERIFYING FIBERGLASS MANHOLES MEET OR EXCEED THE REQUIREMENTS OF ASTM D3753.CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY

A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Materials

1. Resin
 - a. Commercial grade unsaturated polyester resin or other suitable vinyl ester resin.
2. Reinforcing Materials
 - a. Commercial grade "E" type glass in the form of mat, continuous roving, chop roving, roving fabric, or a combination of the above, with a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
3. Interior Surfacing Material
 - a. Resin-rich layer of 0.010 to 0.020 inch thick.
4. Exterior Surface
 - a. Provide a UV inhibitor in the resin to a minimum of 0.125 inches.
 - 1) Gel coat, paint, or other coatings are not permitted.
5. Fillers and Additives
 - a. Inert to the environment and manhole construction.
 - b. Thixotropic agents, catalysts, promoters, etc. may be added as required by the specific manufacturing process to be used to meet the requirements of this Section. The resulting reinforced-plastic material be in accordance with the requirements of this Section.
 - 1) Sand is not permitted as a filler.
6. Stub Outs
 - a. Factory install and glass in pipe stubs for all connections.
 - 1) Field cuts of fiberglass manhole are not permitted.
 - 2) Boot type connectors are not permitted.
 - b. Pipe stubs to be installed shall be in accordance with City Standards.
 - 1) Use same material as sanitary sewer main.
7. Invert and manhole bench should be factory installed.
 - a. Provide invert depth to spring line of pipe, and taper manhole bench to top of largest pipe at manhole wall.

C. Performance / Design Criteria

1. Provide Prefabricated Fiberglass Manholes in accordance with the shape, size, dimensions, and details specified in the Drawings.
2. Unless modified in the Drawings, use manhole sections in accordance with ASTM D3753.
3. Provide the following markings in 1-inch minimum tall, stenciled letters on the inside and outside of the barrel:
 - a. Manufacturer's name or trademark
 - b. Manufacturer's factory location
 - c. Manufacturer's serial number
 - d. Total height and nominal diameter
 - e. Complies with ASTM D3753
4. Provide wall section thickness for depth of manhole according to ASTM D3753, but not less than 0.48 inches in thickness.
5. Provide fabricated reducer bonded at factory to form a continuous unit at top of manhole barrel to accept grade rings, frame, and cover.
6. Provide factory installed fiberglass bottom with 3-inch minimum anti-flotation flange.
7. Load Rating
 - a. Complete manhole shall be designed to meet the following requirements:
 - 1) HS-20 load rated, allowing a minimum dynamic load rating of 16,000 pounds when tested in accordance with ASTM D3753.
 - a) To establish this rating, the manhole may not leak, crack, or suffer other damage when load tested to 40,000 pounds and shall not deflect vertically downward more than 0.25-inches at the point of load application when loaded to 24,000 pounds.
8. Stiffness
 - a. The manhole cylinder shall have the minimum pipe stiffness value as indicated below when tested in accordance with ASTM D3753:

Height (feet)	F/AY (psi)
0 to 10	1.26
10 to 20	2.01
21 to 25	3.02
26 to 30	5.24

D. Manhole Sizing

1. 4-foot diameter
 - a. Used with pipe ranging from 8-inch to 12-inch for depths 12-feet or less.
2. 5-foot diameter
 - a. Used with pipe ranging from 8-inch to 12-inch for depths greater than 12-feet.
 - b. Used with pipe ranging from 15-inch to 27-inch.
3. 6-foot diameter
 - a. Used with pipe ranging from 30-inch to 36-inch.

E. Fiberglass Manhole Locations

1. Only permitted in non-paved areas which will not be paved in the future, unless approved by City.

- F. Drop Piping
 - 1. Drop piping in accordance with City Standards.
 - a. Use same material as sanitary sewer main.
- G. Concrete Manhole Base
 - 1. Class 'S' concrete.
- H. Reinforcing Steel
 - 1. In accordance with manufacturer recommendations
- I. Frame, Cover, and Grade Rings

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

- A. Evaluation and Assessment
 - 1. Verify lines and grades are in accordance with the Drawings.

3.3 PREPARATION

- A. Foundation Preparation
 - 1. Excavate 20-inches below proposed manhole foundation.
 - 2. Replace bottom 12-inches of excavated soil with crushed rock in accordance with Section 33 05 06.
 - a. If soil conditions or ground water prevent use of crushed rock base, a 4-inch mud slab may be substituted if permitted by City.
 - 1) Do not place forms on mud slab until concrete is demonstrated to have cured to 2,000 psi compressive strength, or 7-days have elapsed.
 - 3. Replace top 8-inches of excavated soil with Class 'A' concrete a minimum of 12-inches outside proposed manhole barrel and install in accordance with Section 03 30 00.
 - 4. Embed No. 4 steel reinforcement hooks at 12-inch centers in concrete foundation circumferentially to prevent manhole flotation.
 - 5. Do not place fiberglass manhole on foundation until concrete is demonstrated to have cured to 3,000 psi compressive strength, or 14-days have elapsed.

3.4 INSTALLATION

- A. General
 - 1. Manhole
 - a. Construct manhole to dimensions shown on Drawings.
 - b. Construct manhole base section in accordance with manufacturer recommendations.
 - c. Lower manhole barrel onto base section.
 - d. Seal with manufacturer's gasket or approved sealant.
 - e. Wrap joint with external sealing material a minimum of 12 inches in width.

- f. Where cast-in-place base is used, support manhole barrel in place and brace it from sides of excavation to prevent any movement of barrel during concrete placement and while concrete is setting.
 - 1) Provide minimum clearance between reinforcing steel and manhole barrel bottom as shown on Drawings.
 - 2) Do not support manhole barrel on reinforcing steel.
 - 3) Place bead of water swelling sealant around inside of barrel near bottom, as shown on Drawings, to form seal.
- 2. Pipe connections at Manhole
 - a. Construct pipe stubs for future connections at locations and with materials indicated on Drawings.
 - 1) Install stub plugs at interior of manhole and wood or plastic bulkhead at the end of the stub.
 - b. Cut manhole barrel for pipe penetrations following curvature of pipe and install Insert-a-Tee.
 - 1) Seal cut edges with resin.
 - 2) Hole may be circular or cutout with semi-circular top, which extends to bottom of barrel.
 - 3) Manhole penetrations and installation of Inset-a-Tee shall be per manufacturers recommendations.
- 3. Invert
 - a. Construct invert channels to provide a smooth waterway with no disruption of flow at pipe-manhole connections.
 - b. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature.
 - 1) Provide curves for side inlets.
- 4. Drop Manhole Connection
 - a. Install drop connection when sewer line enters manhole higher than 24 inches above the invert.
 - b. At drop pipe connections through fiberglass barrel, cut circular hole sized to requirements of manufactured connector.
 - 1) Seal cut edge with resin.
 - 2) Install watertight connector according to manufacturer's recommendations.
- 5. Final Rim Elevation
 - a. Install concrete grade rings for height adjustment. Rim elevation shall be 2 to 4 inches above finished landscape grade.
 - 1) Construct grade ring on load bearing shoulder of manhole.
 - 2) Use sealant between rings as shown on Drawings.
 - b. Set frame on top of manhole or grade rings using continuous water sealant.
 - c. Remove debris, stones and dirt to ensure a watertight seal.
 - d. Do not use steel shims, wood, stones or other unspecified material to obtain the final surface elevation of the manhole frame.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Perform testing in accordance with Section 33 01 14.

END OF SECTION

SECTION 33 05 64

ADJUSTING MANHOLES, INLETS, VALVE BOXES, AND OTHER STRUCTURES TO GRADE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vertical adjustments to manholes, inlets, valve boxes, cathodic protection test stations, and other miscellaneous structures to a new grade.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 30 53 – Concrete.
 - 2. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 3. Section 33 05 60 – Pre-cast Concrete Manholes and Bases.
 - 4. Section 33 05 62 – Fiberglass Manholes.
 - 5. Section 33 05 67 – Frames, Rings, Covers, and Inflow Protection Devices.
 - 6. Section 33 05 84 – Gate Valves.
 - 7. Section 33 14 19 – Fire Hydrants.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Manhole – Minor Adjustment
 - a. Measurement
 - 1) Measured per each manhole to be adjusted less than 6 inches to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Manhole Adjustment, Minor” completed.

- c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Grade rings
 - 6) Reuse of the existing manhole frame and cover
 - 7) Furnishing, placement, and compaction of embedment and backfill
 - 8) Concrete base material
 - 9) Permanent asphalt patch or concrete paving repair, as required
 - 10) Clean-up
- 2. Manhole – Major Adjustment
 - a. Measurement
 - 1) Measured per each manhole to be adjusted greater than 6 inches and requiring structural modification to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Manhole Adjustment, Major” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Structural modifications and grade rings
 - 6) Reuse of the existing manhole frame and cover
 - 7) Furnishing, placement, and compaction of embedment and backfill
 - 8) Concrete base material
 - 9) Permanent asphalt patch or concrete paving repair, as required
 - 10) Clean-up
- 3. Manhole – Major Adjustment with Frame and Cover
 - a. Measurement
 - 1) Measured per each manhole to be adjusted greater than 6 inches, requiring structural modification, and a new frame and cover to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Manhole Adjustment, Major with Frame and Cover” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Structural modifications and grade rings
 - 6) Frame and cover
 - 7) Furnishing, placement, and compaction of embedment and backfill
 - 8) Concrete base material

- 9) Permanent asphalt patch or concrete paving repair, as required
- 10) Clean-up
- 4. Inlet Adjustment
 - a. Measurement
 - 1) Measured per each adjustment of an inlet requiring structural modifications to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Inlet Adjustment” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Structural modifications
 - 6) Reuse of frame and covers (if applicable)
 - 7) Furnishing, placement, and compaction of embedment and backfill
 - 8) Concrete base material, as required
 - 9) Surface restoration, permanent asphalt patch, or concrete paving repair, as required
 - 10) Clean-up
- 5. Valve Box Adjustment
 - a. Measurement
 - 1) Measured per each valve box adjustment to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Valve Box Adjustment” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Adjustment device
 - 6) Furnishing, placement, and compaction of embedment and backfill
 - 7) Concrete base material, as required
 - 8) Surface restoration, permanent asphalt patch, or concrete paving repair, as required
 - 9) Clean-up
- 6. Cathodic Protection Test Station Adjustment
 - a. Measurement
 - 1) Measured per each adjustment of a cathodic protection test station to the grade specified in the Drawings.

- b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Cathodic Protection Test Station Adjustment” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Adjustment device
 - 6) Furnishing, placement, and compaction of embedment and backfill
 - 7) Concrete base material, as required
 - 8) Surface restoration, permanent asphalt patch, or concrete paving repair, as required
 - 9) Clean-up
7. Fire Hydrant Adjustment
- a. Measurement
 - 1) Measured per each fire hydrant adjustment, requiring stem extensions, to the grade specified in the Drawings/City Details.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Fire Hydrant Stem Extension” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Adjustment materials
 - 6) Furnishing, placement, and compaction of embedment and backfill
 - 7) Concrete base material, as required
 - 8) Surface restoration, permanent asphalt patch, or concrete paving repair, as required
 - 9) Clean-up
8. Miscellaneous Structure Adjustment
- a. Measurement
 - 1) Measured per each structure adjustment requiring structural modifications to the grade specified in the Drawings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Miscellaneous Structure Adjustment” completed.
 - c. The price bid shall include:
 - 1) Pavement removal
 - 2) Excavation
 - 3) Hauling
 - 4) Disposal of excess material
 - 5) Structural Modifications
 - 6) Furnishing, placement, and compaction of embedment and backfill
 - 7) Concrete base material

- 8) Permanent asphalt patch or concrete paving repair, as required
- 9) Clean-up

1.3 REFERENCES

A. Abbreviations

- 1. CLSM – Controlled Low Strength Material

B. Definitions

- 1. Minor Adjustment
 - a. Refers to a small elevation change, less than 6 inches, performed on an existing manhole which does not require structural modifications.
- 2. Major Adjustment
 - a. Refers to a significant elevation change, greater than 6 inches, performed on an existing manhole which requires structural modification.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS [NOT USED]

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS [NOT USED]

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Cast-in-Place Concrete

- 1. In accordance with Sections 03 00 00 and 03 30 00.

B. Controlled Low Strength Material (CLSM)

- 1. In accordance with Section 03 34 13.

C. Modifications to Existing Concrete Structures

- 1. In accordance with Section 03 80 00.

- D. Grade Rings
 - 1. In accordance with Section 33 05 67.
- E. Frame and Cover
 - 1. In accordance with Section 33 05 67.
- F. Backfill material
 - 1. In accordance with Section 33 05 06.
- G. Water valve box extension
 - 1. In accordance with Section 33 05 84.
- H. Fire Hydrant Adjustment
 - 1. In accordance with Section 33 14 19.
- I. Precast Concrete Manholes
 - 1. In accordance with Section 33 05 60.
- J. Fiberglass Manholes
 - 1. In accordance with Section 33 05 62.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

- A. Verification of Conditions
 - 1. Examine existing structure to be adjusted for damage or defects that may affect grade adjustment.
 - a. Report issue to City for consideration before beginning adjustment.

3.3 PREPARATION

- A. Grade Verification
 - 1. For major adjustments, confirm the grade change noted on Drawings is consistent with field measurements.
 - a. If not consistent, coordinate with City to verify final grade before beginning adjustment.

3.4 ADJUSTMENT

- A. Manholes, Inlets, and Miscellaneous Structures
 - 1. For sanitary sewer adjustments, replace all 24-inch frame and cover assemblies with 32-inch frame and cover assemblies.
 - 2. Protect the bottom of structures using wood forms shaped to fit the structure to prevent debris falling into the invert, inlet, or outlet piping during adjustments.
 - a. Do not use any more than a 2-piece bottom.
 - 3. Use the least number of grade rings necessary to meet required grade.

- a. The maximum height of proposed and existing grade rings shall be no more than 18-inches for any combination of grade rings.
- b. Use least amount of grade rings necessary.
 - 1) For example, use 3, 4-inch rings in lieu of 6, 2-inch rings.
- c. Adjustments which result in 18-inches or more of grade rings will be considered major adjustments and will require structural modifications to existing structure to accommodate this requirement.

B. Valve Boxes

1. Utilize standard 2-piece adjustable valve box for adjusting to final grade as shown on the Drawings/Details.

C. Fire Hydrants

1. Limit vertical adjustments to an increase of 2 vertical feet.
2. Decreasing grade for fire hydrants is not permitted and requires a complete replacement of fire hydrant assembly in accordance with Section 33 14 19.

D. Backfill and Grading

1. Backfill area of excavation surrounding each adjustment in accordance with Section 33 05 06.

E. Pavement Repair

1. If required, perform pavement repair in accordance with Section 32 01 17 or Section 32 01 29.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 67

FRAMES, RINGS, COVERS, AND INFLOW PROTECTION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast iron frame and cover used as access port into water, sanitary sewer, and storm drain structures such as manholes or vaults.
 - 2. Concrete and HDPE (where approved by City Engineer) grade rings for adjusting frame and cover grades.
 - 3. Concrete collars for manholes in unimproved areas and asphalt pavement.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 30 53 – Concrete.
 - 2. Section 33 05 64 – Adjusting Manholes, Inlets, Valve Boxes, and Other Structures to Grade.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Cast-Iron Frame Cover and Grade Rings
 - a. Measurement
 - 1) This item is considered subsidiary to the structure containing the frame, cover, and grade rings.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item are subsidiary to the unit price bid per each structure complete in place and no other compensation will be allowed.
 - 2. Concrete Collars
 - a. Measurement
 - 1) Measured per each concrete collar installed on an existing manhole.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Concrete Collar” installed on an existing manhole.

- c. The price bid shall include:
 - 1) Concrete Collar
 - 2) Excavation
 - 3) Forms
 - 4) Reinforcing Steel
 - 5) Concrete
 - 6) Backfill
 - 7) Pavement Removal
 - 8) Hauling
 - 9) Disposal of excess material
 - 10) Furnishing, placement, and compaction of backfill
 - 11) Clean-up
 - 12) Additional pavement around perimeter of concrete collar as required for rim adjustment on existing manhole

1.3 REFERENCES

A. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
- 2. ASTM International (ASTM)
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A536, Standard Specification for Ductile Iron Castings.
- 3. American Association of State Highways and Transportation Officials (AASHTO)
 - a. AASHTO M306 – Standard Specification for Drainage, Sewer, Utility and Related Castings

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the Engineer or the City prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

- 1. All moldings shall display:
 - a. Approved Molder
 - b. Molding date
 - c. Country of origin

2. Provide manufacturer's:
 - a. Specifications
 - b. Load tables
 - c. Dimension diagrams
 - d. Anchor details
 - e. Installation instructions
- B. Certificates
 1. Manufacturer shall certify that all moldings conform to the ASTM and AASHTO designations.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS

- A. Manufacturers
 1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00 unless otherwise specified on the plans.
 - a. The manufacturer must comply with this Specification and related Sections.
 2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
- B. Castings
 1. All castings shall be manufactured true to pattern, component parts shall fit together in a satisfactory manner.

2. Ferrous castings shall be of uniform quality, free from blow holes, shrinkage, distortions, and other strength defects. They shall be smooth and cleaned by shot blasting.
3. Gray Iron used in the manufacture of castings shall conform to ASTM A 48 Class 35B.
4. Ductile Iron casting shall conform to ASTM A 536.
5. The mill test reports or manufacturer's certification to the EOR for each lot or shipment of steel and iron materials shall be provided to the office of the Public Works Department. For castings, also furnish a manufacturer's certification stating that the casting meets the proof-load testing requirements of AASHTO M 306.

C. Standard Dimensions

1. Sanitary Sewer and Water
 - a. Provide a clear opening of 30 inches for all sanitary sewer frames and cover assemblies unless otherwise specified in the Contract Documents.
2. Storm Drain
 - a. Provide a clear opening of 32 inches for all storm drain inlet, manhole, and junction structure frame and cover assemblies unless otherwise specified in the Contract Documents.

D. Standard Labels

1. Water
 - a. Cast lid with the word "WATER" in 1-inch minimum letters across the lid and in accordance with the Drawings/Details.
2. Sanitary Sewer
 - a. Cast lid with the words "SANITARY SEWER" in 1-inch minimum letters across the lid and in accordance with the Drawings/Details.
3. Storm Drain
 - a. Cast lid with the phrases "DUMP NO WASTE DRAINS TO RIVER", "STORM SEWER", and bass picture, in accordance with the Drawings/Details.

E. Hinged Covers are not permitted

F. Grade Rings

1. Provide grade rings in sizes from 2 inch up to 6 inch.
2. New structures should be constructed such that the total height of grade rings is no more than 6 inches.
3. Total grade ring height on existing structures as result of an adjustment shall be limited to the height specified in Section 33 05 64.

- 4. Materials
 - a. Concrete

G. Covers

- 1. Round frames and covers shall have machine bearing surfaces to prevent rocking and rattling.
- 2. Frame and cover castings must meet the proof-load testing requirement of AASHTO M 306.
- 3. Castings shall be customized for the City of League City and shall be manufactured and installed in accordance with the City of League City "Standard Details."

H. Joint Sealant

- 1. All grade rings shall be grouted together with non-shrink grout in accordance with the Drawings/Details.

I. Concrete Collar

- 1. Concrete and reinforcing steel in accordance with Section 03 00 00.
- 2. Cast concrete collar in accordance with Section 03 30 00.

J. Inflow Protection Devices

- 1. Inflow protection devices and its associated valve body and components shall be manufactured from Stainless Steel suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gasses associated with wastewater collection systems.
- 2. The thickness shall not be less than 3/32" nor greater than 3/16.
- 3. The gasket shall be made of closed cell neoprene and shall form a long-lasting seal.
- 4. The gas relief valve shall be designed at a pressure of one (1) pound.
- 5. The valve shall be positioned so that it is protected and will not be broken by any movement of the cover.
- 6. The inflow protection insert shall be manufactured to fit the manhole frame rim upon which the manhole cover rests.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Grade Rings

1. Place as indicated in the Drawings.
2. Do not use steel shims, wood, stones, or other unspecified material to obtain final surface elevation of the manhole frame.
3. Clean surfaces of dirt, sand, mud, or other foreign matter before placing sealant.
4. Seal each grade ring with sealant specified in this Section and as indicated in the Drawings.

B. Frame and Cover

1. Water
 - a. For water structures install frame, cover, and grade rings in accordance with the Drawings.
2. Sanitary Sewer
 - a. For sanitary sewer structures outside the 100-yr flood plain, install standard frame, cover, and grade rings in accordance with the Drawings/Details.
 - b. For sanitary sewer structures within the 100-yr flood plain, install water-tight frame, cover, inflow disk, and grade rings in accordance with the Drawings/Details.
3. Storm Drain
 - a. For storm drain structures install frame, cover, and grade rings in accordance with the Drawings.

C. Joint Sealing

1. Seal frame, grade rings, and structure with non-shrink grout.

D. Concrete Collar

1. Install concrete collar in accordance with the Drawings in unimproved and asphalt areas.

E. Inflow Disks

1. Stainless Steel Inflow Disks shall be installed in manholes located within the 100-year floodplain or as directed by Public Works Department.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 84

GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient Seated (Wedge) Gate Valves 4-inch through 24-inch for use with potable water mains
 - a. 24-inch valves may require an integral bypass
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 05 19 – Ductile Iron Pipe and Fittings
 - 2. Section 33 05 22 – Nuts, Bolts, and Gaskets

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Gate Valve
 - a. Measurement
 - 1) Measurement for this Item shall be per each.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Gate Valve” installed for:
 - a) Various sizes
 - c. The price bid shall include:
 - 1) Furnishing and installing Gate Valves with connections as specified in the Drawings
 - 2) Valve box
 - 3) Extension
 - 4) Extensions for valves in vaults
 - 5) Valve vault and appurtenances (for 16-inch and larger gate valves)

- 6) Petrolatum tape for connections to steel flanges
- 7) 2-inch risers (for 16-inch and larger gate valves)
- 8) Isolation kits when installed with flanged connections
- 9) Polyethylene encasement
- 10) Pavement removal
- 11) Excavation
- 12) Hauling
- 13) Disposal of excess material
- 14) Furnishing, placement and compaction of embedment
- 15) Furnishing, placement and compaction of backfill
- 16) Clean-up
- 17) Cleaning
- 18) Disinfection
- 19) Testing

2. Cut-in Gate Valve

a. Measurement

- 1) Measurement for this Item shall be per each.

b. Payment

- 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each "Cut-in Gate Valve" installed for:
 - a) Various sizes

c. The price bid shall include:

- 1) Furnishing and installing Gate Valves with connections as specified in the Drawings
- 2) System dewatering
- 3) Connections to existing pipe materials
- 4) Valve box
- 5) Extension
- 6) Extensions for valves in vaults
- 7) Valve vault and appurtenances (for 16-inch and larger gate valves)
- 8) Petrolatum tape for connections to steel flanges

- 9) 2-inch risers (for 16-inch and larger gate valves)
- 10) Isolation kits when installed with flanged connections
- 11) Polyethylene encasement
- 12) Pavement removal
- 13) Excavation
- 14) Hauling
- 15) Disposal of excess material
- 16) Furnishing, placement and compaction of embedment
- 17) Furnishing, placement and compaction of backfill
- 18) Clean-up
- 19) Cleaning
- 20) Disinfection
- 21) Testing

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. NRS – Non Rising Stem
- 2. OS&Y – Outside Screw and Yoke

B. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. American Association of State Highway and Transportation Officials (AASHTO).
- 3. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
- 4. American Iron and Steel Institute (AISI).
- 5. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - c. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
 - d. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

- e. A536, Standard Specification for Ductile Iron Castings.
 - f. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - g. B633, Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
6. American Water Works Association (AWWA):
- a. C509, Resilient-Seated Gate Valves for Water Supply Service.
 - b. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
 - c. C550, Protective Interior Coatings for Valves and Hydrants.
 - d. C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 IN through 12 IN, for Water Transmission and Distribution.
7. American Water Works Association/American National Standards Institute (AWWA/ANSI):
- a. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
8. NSF International (NSF):
- a. 61, Drinking Water System Components – Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Resilient Seated (Wedge) Gate Valve noting the pressure rating and coating system supplied, including:
 - a. Dimensions, weights, material list, and detailed drawings
 - b. Joint type
 - c. Maximum torque recommended by the manufacturer for the valve size
 - 2. Polyethylene encasement and tape
 - a. Whether the film is linear low density or high density cross linked polyethylene

- b. The thickness of the film provided
- 3. Thrust Restraint, if required by contract Documents
 - a. Retainer glands
 - b. Thrust harnesses
 - c. Any other means
- 4. Instructions for field repair of fusion bonded epoxy coating
- 5. Gaskets
- B. Certificates
 - 1. Furnish an affidavit certifying that all Resilient Seated (Wedge) Gate Valves meet the provisions of this Section, each valve meets Specifications, all inspections have been made and that all tests have been performed in accordance with AWWA C509 or AWWA C515.
 - 2. Furnish a certificate stating that buried bolts and nuts conform to ASTM B117.
 - 3. Furnish affidavit that Resilient Seated (Wedge) Gate Valve manufacturer has five year's experience manufacturing Resilient Seated Gate Valves of similar service and size with experience record.
 - 4. Furnish affidavit that Resilient Seated (Wedge) Gate Valve manufacturer owns or controls any foreign factory/foundry that supplies valve casings and can certify that the Resilient Seated (Wedge) Gate Valve manufacturer is in control of quality control at the foreign factory/foundry.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturers
 - a. Valves 16-inch and larger shall be the product of 1 manufacturer for each project.
 - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
 - b. For valves less than 16-inch, valves of each size shall be the product of 1 manufacturer, unless approved by the City.
 - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.

- c. Valves shall meet or exceed AWWA C509 or AWWA C515.
- d. For valves equipped with a bypass, the bypass valve must be of the same manufacturer as the main valve.
- e. Resilient Seated Gate Valves shall be new.
- f. Resilient Seated Gate Valve Manufacturer shall not have less than 5 years of successful experience manufacturing of Resilient Seated Gate Valves of similar service and size and indicated or demonstrate an experience record that is satisfactory to the Engineer and City. This experience record will be thoroughly investigated by the Engineer, and acceptance will be at the sole discretion of the Engineer and City.
- g. Casings for Resilient Seated Gate Valve, such as valve body, wedge, and bypass; that are not manufactured within the United States of America, shall be manufactured by factories/foundries that are owned or controlled (partial ownership) such that the Resilient Seated Gate Valve Manufacturer can control and guarantee quality at the foreign factory/foundry.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

- 1. Protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
- 2. Protect all equipment and parts against any damage during a prolonged period at the site.
- 3. Protect the finished surfaces of all exposed flanges by wooden blank flanges, strongly built and securely bolted thereto.
- 4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
- 5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
- 6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY

A. Manufacturer Warranty

- 1. Manufacturer's Warranty shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Description

1. Regulatory Requirements

- a. Gate valves shall be resilient seat and shall meet or exceed AWWA C509 and shall meet or exceed the requirements of this Specification.

C. All valve components in contact with potable water shall conform to the requirements of NSF 61 and NSF 372 Materials.

1. Valve Body

a. Valve body:

- 1) Cast iron per ASTM A 126, Class B or
- 2) Ductile iron per ASTM A536

b. Bonnet and bonnet cover: cast iron per ASTM A 126, Class B

c. Flanged ends: Furnish in accordance with AWWA/ANSI C115/A21.15.

d. Mechanical Joints: Furnish with outlets which conform to AWWA/ANSI C111/A21.11.

e. Valve interior and exterior surfaces: fusion bonded epoxy coated, minimum 8 mils for a holiday free surface, meeting AWWA C550 requirements. All parts to be epoxy coated must be shot blasted just prior to application of epoxy.

f. Buried valves: Provide with polyethylene encasement in accordance with AWWA/ANSI C105/A21.5.

- 1) Polyethylene encasement: Furnish in accordance with Section 33 05 19.

g. Valves shall have an unobstructed waterway equal to or greater than the full normal diameter of the valve.

h. All valves shall be wrapped with 8-mil polyethylene film with all edges and laps securely taped to provide continuous wrap.

- i. Where not otherwise noted, all valves shall be mechanical joint with gasket and mega-lug type restraint to match the pipe material.
- 2. Stem
 - a. Non-rising stem made of cast, forged or rolled bronze shown in AWWA C 509.
 - b. Two stems shall be provided and shall be of the "O" ring type.
 - c. "O" Ring
 - 1) One above and one below the thrust collar.
 - 2) Upper "O" ring must be protected from contact with ground water by an external stem seal.
 - d. The stem nut, also made of bronze, must be independent of the gate to protect against stem binding.
 - e. Valve shall be designed such that no metal fasteners or screw other than the stem and stem nut are exposed to water.
- 3. Sealing Mechanism
 - a. Shall consist of a cast iron gate, having vulcanized synthetic rubber coating.
 - b. Resilient-sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.
- 4. Valve Gate
 - a. Shall have no metal seams or edges on the water way when in the fully closed position.
 - b. Shall be designed that no sliding or rubber on the seating surfaces is required to compress the rubber.
 - c. Shall be designed such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate.
- 5. Seating mechanism: shall have no metal-to-metal stops.
- 6. Gate Valve Bolts and Nuts
 - a. Bonnet, Stuffing Box and Gear Box - Hex head bolt, and hex nut: Steel ASTM A307 Gr. B, Zinc Plate per ASTM B633, SC3 for non-buried service (4-inch through 12-inch valves) or as specified in 2.2.C.4.b.
 - b. Hex head bolt and hex nut: AISI 304 stainless steel for buried service (all sizes) and for valves 16-inch through 36-inch (non-buried service)
- 7. Bolts and Nuts
 - a. Bonnet bolts: stainless steel
 - b. Mechanical Joints

a) Provide bolts and nuts in accordance with Section 33 05 22.

c. Flanged Ends

- 1) Meet requirements of AWWA C115 or AWWA C207 depending on pipe material.
- 2) Provide bolts and nuts in accordance with Section 33 05 22.
- 3) Flanged isolation kits shall be provided when connecting to buried steel or concrete pressure pipe. Kits shall conform to Section 33 04 10.

8. Joints

- a. Valves: flanged, or mechanical-joint or any combination of these as specified on the Drawings or in the project Specifications
 - 1) Flanged-joints: AWWA/ANSI C115/A21.15, ASME B16.1, Class 125
 - a) Flange bolt circles and bolt holes shall match those of ASME B16.1, Class 125.
 - b) Field fabricated flanges are prohibited.
 - 2) Steel or concrete pressure pipe
 - a) Use flange-joints unless otherwise specified in the Contract Documents.
 - 3) Ductile Iron or PVC pressure pipe
 - a) Use mechanical joints with mechanically restrained retainer glands unless otherwise specified in the Contract Documents.

9. Operating Nuts

- a. Supply for buried service valves
- b. 1-15/16-inch square at the top, 2-inch at the base, and 1-3/4-inch high
- c. Cast an arrow showing the direction of opening with the word "OPEN" on the operating nut base.
- d. To open, the operating nut shall be turned to the **LEFT (COUNTERCLOCKWISE)** direction.
 - 1) Paint nut black per AWWA specifications
- e. Connect the operating nut to the shaft with a shear pin that prevents the nut from transferring torque to that shaft or the gear box that exceeds the manufacturer's recommended torque.
- f. Furnish handwheel operators for non-buried service, or when shown in the Drawings.

10. Gearing

- a. Gate valves that are 24 inch: Equip with a spur gear.
- b. Bevel gears for horizontally mounted valves are not allowed.
- c. The spur gear shall be designed and supplied by the manufacturer of the valve as an integral part of the gate valve.

11. Gaskets

- a. Provide gaskets in accordance with Section 33 05 22.

2.3 ACCESSORIES

- A. All gate valves shall have the following accessories provided as part of the gate valve installation:
 - 1. Unless otherwise noted, all valve stems shall be adjusted, or extensions provided to situate the operating nut no more than 60" below the proposed grade of finished project.
 - 2. Furnish joint components such as gaskets, glands, lubricant, bolts, and nuts in sufficient quantity for assembly of each joint.
 - 3. A hand-wheel or wrench nut shall be provided for operating the valve for non-buried applications.
 - 4. Valve Boxes: provide for buried service gate valves, shall be adjustable thread type cast iron and shall be those types and models approved by the City of League City Public Works department and shown in the "Standard Details."
 - a. Valve boxes shall be as listed in the City of League City Standard Products List in attached in Section 01 60 00.
 - b. Valve box covers shall be so designed that they can be easily removed to provide access to valve operating nut.
 - c. Valve box covers must be designed to stay in position and resist damage under AASHTO HS 20 traffic loads.
 - d. Each cover shall be casted with the word "WATER" on the upper surface.
 - e. Cast iron valve boxes and covers shall conform to ASTM A48, Class 35B.
 - 1) Valve box covers shall be round for potable water applications and square for reclaimed water applications.
 - f. Box extension material shall be AWWA C900 PVC or ductile iron.

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. All valves shall be installed in vertical position when utilized in normal pipeline installation.
2. Valves shall be placed at line and grade as indicated on the Drawings.

3.5 REPAIR/RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL

A. Field Inspections

1. Before acceptance of the installed valve, the City Field Operations Staff shall have the opportunity to operate the valve.
2. The City shall be given the opportunity to inspect all buried flanges before they are covered.
3. The Operator will be assessing the ease of access to the operating nut within the valve box and ease of operating the valve from a fully closed to fully opened position.
4. If access and operation of the valve meet the City's criteria, then the valve will be accepted as installed.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria, at the Contractor's expense.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 85 BUTTERFLY VALVES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. AWWA Rubber-Seated Butterfly Valves 36-inch through 72-inch for potable water applications in accordance with AWWA C504.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 2. Section 33 05 22 – Nuts, Bolts, and Gaskets.
 - 3. Section 33 05 60 – Pre-cast Concrete Manholes and Bases.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Measurement for this item shall be per each “AWWA Butterfly Valve” installed.
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “AWWA Butterfly Valve” installed for:
 - 1) Various sizes.
 - 3. The price bid shall include:
 - a. Furnishing and installing AWWA Butterfly Valves as specified in the Drawings
 - b. AWWA Butterfly Valve vault and other appurtenances as indicated in the Drawings
 - c. Valve nut extension
 - d. Isolation kits
 - e. Pavement removal
 - f. Excavation
 - g. Hauling
 - h. Disposal of excess material
 - i. Furnishing, placing and compaction of embedment
 - j. Furnishing, placing and compaction of backfill
 - k. Clean-up
 - l. Cleaning
 - m. Disinfection
 - n. Testing

1.3 REFERENCES

- A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American National Standards Institute (ANSI):
 - a. B1.1, Unified Inch Screw Thread Series.
3. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125 and 250).
4. ASTM International (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. A536, Standard Specification for Ductile Iron Castings.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
6. American Water Works Association (AWWA):
 - a. C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 IN through 144 IN.
 - b. C115, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - c. C504, Rubber-Seated Butterfly Valves.
 - d. C550, Protective Interior Coatings for Valves and Hydrants.
7. NSF International (NSF):
 - a. 61, Drinking Water System Components – Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.
8. Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 10/NACE No. 2, Near-White Blast Cleaning.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 1. Rubber-Seated Butterfly Valves stating:
 - a. Material
 - b. Valve and Actuator Coating System
 - c. Working pressure rating
 - d. Test pressure rating
 - e. Valve classification
 - f. Valve Seat Type and bonding method to disc or body
 - g. Valve-port diameter
 - h. Valve Torque required
 - i. Actuator Type and maximum torque
 - j. Total net assembled weight
 - k. Valve operator and extension stems
 - l. Opening direction

B. Shop Drawings

1. For below grade applications:
 - a. Cast-in-place concrete vault/manhole in accordance with shop drawing requirements set forth in Section 01 33 00.
 - b. Vault appurtenances in accordance with shop drawing requirements set forth in Section 01 33 00.

C. Certificates

1. Furnish an affidavit certifying all AWWA Rubber-Seated Butterfly Valves meet the provisions of this Section and have been hydrostatically tested at the factory and meet the requirements of AWWA C504.
2. Furnish an affidavit certifying the coating for all AWWA Rubber-Seated Butterfly Valves meets the provisions of this Section and meets the requirements of AWWA C504.
3. Furnish an affidavit certifying AWWA Rubber-Seated Butterfly Valve manufacturer owns or controls any foreign factory/foundry that supplies valve casings and can certify the Resilient Seated (Wedge) Gate Valve manufacturer is in control of quality control at the foreign factory/foundry.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Operation and Maintenance Manual

1. Furnish Operation and Maintenance Manual in accordance with Division 1.

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
 - a. Rubber-Seated Butterfly Valves and manual actuators of the same size shall be the product of 1 manufacturer for each project.
 - 1) Change orders, specials, and field changes may be provided by a different manufacturer upon City approval.
 - b. Rubber-Seated Butterfly Valves shall be in conformance with AWWA C504.
 - c. Casings for Rubber-Seated Butterfly Valves not manufactured within the United States of America shall be manufactured by factories/foundries that are owned or controlled (partial ownership) such that the Rubber-Seated Butterfly Valve Manufacturer can control and guarantee quality at the foreign factory/foundry.
2. The AWWA Rubber-Seated Butterfly Valve shall be the product of a manufacturer regularly engaged in the manufacturing of AWWA Rubber-Seated Butterfly Valves having similar service and size.
3. Unit Responsibility
 - a. All equipment specified under this Section is to be furnished by the valve manufacturer who is responsible for the adequacy and compatibility of all unit components including, but not limited to, the valve, actuator, and extension stems.
 - b. Any component of each complete unit not provided by the valve manufacturer shall be designed, fabricated, tested, and installed by factory-authorized representatives experienced in the design and manufacture of the equipment.

- 1) This includes, but is not limited to, coordination of the torque required to properly operate the valve.
- 2) This does not relieve the Contractor of the overall responsibility for this portion of the Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges by wooden blank flanges.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Standard Product List
 - a. See League City Standard Product List for approved manufacturers.

B. Description

1. Regulatory Requirements
 - a. AWWA Rubber-Seated Butterfly Valves shall be new and in accordance with AWWA C504 and this Section.
 - b. All AWWA Rubber-Seated Butterfly Valve components in contact with potable water shall be in accordance with the requirements of NSF 61 and 372.

C. Materials

1. Valve Body
 - a. Provide short-body, ductile iron ASTM A536 Grade 65-45-12 valve body.
2. Joints
 - a. Flanged end:
 - 1) Class 125 Standard flanged face ends
 - 2) Drilled in accordance with ASME B16.1 standard for cast iron flanges
 - 3) Designed for the test pressure of the valve
 - 4) Used with Buried Steel Pipe or Concrete Pressure Pipe unless otherwise noted in the Contract Documents.

- a) Provide with flange isolation kits in accordance with Section 33 01 12.
- b. Mechanical joint end:
 - 1) In accordance with AWWA/ANSI C111/A21.11.
 - 2) Used with Ductile Iron Pipe unless otherwise noted in the Contract Documents.
- 3. Bolts and Nuts
 - a. Flanged Ends
 - 1) In accordance with AWWA C115 or AWWA C207 depending on pipe material.
 - 2) Provide bolts and nuts in accordance with Section 33 05 22.
 - b. Tapped Bolts
 - 1) Butterfly Valve manufacturer to provide tapped bolts with ANSI B1.1 UNC thread.
- 4. Gaskets
 - a. Provide gaskets in accordance with Section 33 05 22.
- 5. Disc Requirements:
 - a. Ductile iron ASTM A536 Grade 64-45-12
 - 1) Disc and shaft connection shall be made with tapered pins of either monel or stainless steel.
- 6. Valve Shaft Requirements:
 - a. Type 304 stainless steel
 - b. 1-piece unit or stub-shaft type
 - 1) Insert stub shaft into the valve disc hubs for distance of 1.5 times the shaft diameter.
 - c. Minimum diameter in accordance with AWWA C504
 - d. Horizontal orientation

7. Shaft Seal Requirements:
 - a. Self-compensating V-type packing with a minimum of 4 sealing rings.
 - b. Design shall allow adjustment or replacement without removing the valve shaft.
 - c. Match shaft seal material type to the valve seat material type.
8. Valve Bearings
 - a. Non-metallic and permanently lubricated.
9. Valve Seat
 - a. Seats on Body
 - 1) The seat shall be EPDM for water and molded in and bonded to the valve body.
 - 2) Provide a 360-degree continuous, uninterrupted seating surface.
 - 3) Field adjustable around the full 360-degree circumference and replaceable without dismantling the actuator, disc, or shaft and without removing the valve from the line.
 - 4) Retained in the valve body by mechanical means without retaining rings, segments, screws, or hardware of any kind in the flow stream.
 - 5) Contain an integral shaft seal protecting the valve bearings and packing from any line debris.
10. Performance / Design Criteria
 - a. Valve Classification shall be Class 250B.

D. Finishes

1. Unless otherwise specified in the Contract Documents, exterior and interior metallic surfaces of each valve shall be shop fusion bonded epoxy coated in accordance with AWWA C550.
2. Painting and Coatings
 - a. All surfaces of the valve shall be clean, dry, and free from grease before applying paint or coating.
 - b. The valve interior and exterior surfaces, except for the seating surfaces, shall be provided with the manufacturer's standard coating or as specified in the Contract Documents.
 - c. All internal exposed surfaces that are susceptible to corrosion shall be coated with a Polyamide cured, rust inhibiting epoxy.
 - d. Surfaces to be coated shall be prepared and sand-blasted in accordance with SSPC SP 10/NACE No. 2.
 - e. Final coating thickness shall be 16-mils minimum.
 - f. All surfaces shall be inspected for proper dry film thickness using a magnetic dry film thickness gauge.
 - g. Tests for invisible holidays shall be conducted using a low voltage, wet sponge holiday or leak detector.

E. Marking for Identification

1. For each Rubber-Seated Butterfly Valve, clearly mark with the following information:
 - a. Valve size
 - b. Class for which it is designated
 - c. Name of manufacturer
 - d. Date of manufacturer

2.3 ACCESSORIES

- A. Rubber-Seated Butterfly Valves shall have the following accessories provided as part of the valve installation:
1. Place below grade Rubber-Seated Butterfly Valves within a concrete vault or manhole or as shown on the Drawings.
 2. Manual Actuators
 - a. Provide all valves with manual actuators, unless otherwise specified in the Drawings.
 - b. Open valves by turning the actuator counter-clockwise and close valves by turning the actuator clockwise.
 - c. Manual actuators shall be fully greased, packed, and have adjustable stops in the open and closed position.
 - 1) The actuator shall have an adjustable mechanical stop which will withstand an input torque of 450 foot-pounds against the stop.
 - 2) The actuator shall have a built-in packing leak bypass to eliminate possible packing leakage into the actuator housing.
 - d. Butterfly valves in a vault shall be furnished with a 2-inch operating nut.
 - 1) The actuator shall be placed in a vault as indicated on the Drawings and have extension to the top of the vault.
 - e. Butterfly valves in plant, pump station, or tank service applications located above ground shall be provided with a 16-inch minimum diameter handwheel operator.
 - 1) Handwheels shall be painted black.
 - f. Valve Position Indicator
 - 1) Provide position indicator with mechanical dial indicator as follows:
 - a) Highly visible
 - b) Containing "Open" and "Closed" legend at the end of a 90-degree arc
 - c) Pointer to show the disc position (Closed-0 degree and Open-90 degree)
 - d) Arc graduated in degrees
 - g. Worm Gear: Provide valves with worm gear, as follows:
 - 1) In accordance with AWWA C504.
 - 2) Worm gear drive sleeve and worm shaft shall be of solid, 1-piece design; bolted segments or pinned worms will not be acceptable. Drive sleeve shall include an integral spline to accept a removable bottom-entry spline bushing for valve shaft connection.
 - 3) If required for torque purposes, spur gear reducers may be provided for increased torque outputs and to reduce handwheel diameter. Worm gear operator shall include handwheel with maximum 80-pound rim pull or a 2-inch AWWA Nut with a maximum 150 ft.-lbs required input torque.
 - 4) Materials of Construction
 - a) Housing: Ductile Iron
 - b) Drive sleeve: Bronze
 - c) Worm: Alloy steel with splined input drive connection
 - d) Bearings: Heavy duty tapered roller bearings
 - e) Finish: Thermostatically Applied Polyester Powdercoat
 - f) Fasteners: Stainless steel
 - 5) Manual gears shall be capable of being field retrofit with an electric motor operator in the future without major modifications.

- a) With spur gear removed, splined worm gear input shaft and motor adapter flange shall be easily added to accept a multi-turn “torque-only” electric valve actuator.
 - (1) Supplier shall include the Number of Turns required to complete on Open-to-Close stroke in the Equipment Submittal.
- 3. Extension Stem
 - a. Provide keyed solid extension stem of sufficient length to bring the operating nut up to within 1 foot of the surface of the ground, when the operating nut on the valve is 3 feet or more beneath the surface of the ground
 - 1) Not required for City stock orders.
 - 2) Do not bolt or attach extension stems to the valve-operating nut.
 - 3) Extension stems shall be of cold rolled steel with a cross-sectional area of 1 square-inch, fitting loosely enough to allow deflection.
- 4. 2-inch Taps
 - a. Provide two, 2-inch taps on each side of the valve, 12 inches from the valve body.
 - 1) Taps shall be C.C. thread with flare, with insulated adaptor kit.
 - 2) Provide copper riser between corporation stop and curb stop.
 - 3) Install curb stop 12 inches from the vault top
 - a) Reachable by hand from the vault lid
- 5. Joint components such as gaskets, glands, lubricant, bolts, and nuts shall be furnished in sufficient quantity for assembly of each joint.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

- 1. Each valve shall be shop tested for leaks in the closed position with the valve horizontal.
 - a. The upper surface of the valve disc shall be visible and covered with a pool of water at 0 psi pressure.
 - b. Air pressure equivalent to the design rating of the valve shall be applied to the lower face of the disc for at least 5 minutes with no indication of leakage (i.e. bubbles in the water pool) during the test period.
- 2. The valve body shall be hydrostatically tested at twice the rated pressure for 10 minutes with the valve in the slightly open position.
 - a. During this test, there shall be no leakage or seeping through the valve body, weld, or valve trunnions.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install Rubber-Seated Butterfly Valves in accordance with the instructions of the manufacturer and as shown on the Drawings.
2. For buried applications, Rubber-Seated Butterfly Valves shall be:
 - a. Placed in a concrete vault.
 - b. Or directly buried with actuator accessible in concrete manhole.
 - c. In either case, the installation shall be in accordance with the Drawings.
3. All excavations shall be backfilled in accordance with Section 33 05 06.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Inspections

1. Provide the City the opportunity to operate the valve prior to acceptance of the installed Rubber-Seated Butterfly Valve.
 - a. The operator will assess the ease of access to the operating nut within the valve box and ease of operating the valve from a fully closed to fully opened position.
 - b. If access and operation of the Rubber-Seated Butterfly Valve meet the City's criteria, the valve will be accepted as installed.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria, at the Contractor's expense.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 86
COMBINATION AIR VALVE ASSEMBLIES FOR SEWER FORCE MAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. 2-inch through 8-inch Combination Air-Release and Air/Vacuum Valve Assemblies (Combination Air Valves) for sanitary sewer force mains to include:
 - a. Combination air-release and air/vacuum valve
 - b. Tap to force main
 - c. Inlet piping and appurtenances
 - d. Vent piping and appurtenances
 - e. Vault enclosure and appurtenances
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 2. Section 33 05 19 – Ductile Iron Pipe and Fittings.
 - 3. Section 33 05 38 – High Density Polyethylene (HDPE) Pipe.
 - 4. Section 33 05 60 – Pre-cast Concrete Manholes and Bases.
 - 5. Section 33 05 67 – Frames, Rings, Covers, and Inflow Protection Devices.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - 1) Measured by each “Sewer Air Release Valve and Vault” installed
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Sewer Air Release Valve and Vault” installed for:
 - 1) Various inlet sizes
 - 3. The price bid shall include:
 - a. Furnishing and installing Combination Air Valves with appurtenances as specified in the Drawings
 - b. Air valve vault and appurtenances
 - c. Tapping the main
 - d. Isolation valves
 - e. Fittings
 - f. Vent piping
 - g. Vent cover and/or enclosure
 - h. Vent enclosure and/or pipe bollard protection, if required
 - i. Excavation and backfill

1.3 REFERENCES

A. Definitions

1. Combination Air Valve: A device having the features of both an air-release valve and an air/vacuum valve
2. Inlet: The opening at the base of the Combination Air Valve mechanism through which air from the force main enters
3. Inlet Piping: The piping and appurtenances between the force main and the valve inlet
4. Orifice: The opening in the Combination Air Valve mechanism through which air is expelled from or admitted into the force main
5. Outlet: The opening at the top of Combination Air Valve mechanism, including the orifice, through which air enters or exits the force main
6. Vent Piping: The piping and appurtenances from the Combination Air Valve outlet to its termination point

B. Reference Standards

1. Reference standards cited in this Section refer and Drawings/Details.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Combination Air Valves, air/vacuum valves, or combination air valves stating:
 - a. Application type
 - b. Working pressure rating
 - c. Test pressure rating
 - d. Surge pressure rating
 - e. Inlet size
 - f. Small orifice size
 - g. Large orifice size
 - h. Cleaning ports
2. Valve vault and appurtenances
3. Tapping appurtenances
4. Isolation valves
5. Fittings
6. Vent piping (elbow)

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

- a. The Combination Air Valve shall be new and the product of a manufacturer regularly engaged in the manufacturing of air release/air vacuum valves having similar service and size.

B. Certifications

1. Obtain an Affidavit of Compliance from the valve manufacturer in accordance with AWWA C512.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges by wooden blank flanges.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Description

1. Regulatory Requirements
 - a. Combination Air Valves in accordance with the requirements of AWWA C512 and this Section.

C. Performance / Design Criteria

1. Capacities (H-TEC max pressure is 250psi)
 - a. Application = Sanitary Sewer

- b. Working Pressure from 10 psi to 150 psi
 - c. Test Pressure = 225 psi
 - d. Surge Pressure = 100 psi minimum, unless stated otherwise in the Contract Documents
 - e. Size
 - 1) Each orifice size must be sufficient to meet the requirements set forth in AWWA Manual M51 and specified on the Drawings.
 - 2. Function
 - a. High volume discharge during force main filling
 - b. High volume intake through the large orifice
 - c. Pressurized air discharge
 - d. Surge Dampening/Controlled discharge rates
 - 1) Provide valve with an integral surge alleviation mechanism which operates automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of the separated water columns.
 - a) Achieve the limitation of the pressure rise by decelerating the approaching water, prior to valve closure.
 - e. Operate effectively with the presence of solids encountered in sanitary sewer
- D. Materials
- 1. Combination Air Valve
 - a. Internal parts
 - 1) Non-corroding material such as stainless steel
 - b. Valve body
 - 1) Nylon body for 2" valves
 - 2) AISI 304 or AISI 316 stainless steel for 3" and larger
 - 3) Equipped with intake and discharge flanges
 - c. Inlet/Discharge orifice area
 - 1) Equal to the nominal size of the valve or greater
- E. Finishes
- 1. Finish Materials
 - a. Supply any ductile iron material with a factory applied fusion bonded epoxy coating with a final coating thickness of 16 mils minimum.

2.3 ACCESSORIES

- A. For 2-inch to 8-inch Combination Air Valve Assemblies:
- 1. Tap
 - a. Ductile Iron Pipe:
 - 1) Mechanical joint by flanged outlet ductile iron tee, same size as valve assembly.
 - 2) Ductile iron blind flange with flange by threaded spool piece.
 - 2. Isolation Valves
 - a. Flange by flange resilient seated gate valve with hand wheel, of same size as valve assembly.
 - 3. Vent Piping
 - a. Same material as valve body
 - 1) Size elbow to match size of valve assembly outlet.
 - 4. Vault

- a. Provide a flat top, precast concrete manhole in accordance with Sections 33 05 60.
 - 1) 6-foot diameter manhole for 2-inch through 4-inch combination air valve assemblies
 - 2) 7-foot diameter manhole for 6-inch and 8-inch combination air valve assemblies
 - b. Provide frame, cover, and grade rings in accordance with Section 33 05 67.
 - c. Secure Air Valve to vault wall using a galvanized or stainless-steel bracket by approved manufacturer, in accordance with the Drawings.
 - d. Provide 4-inch PVC drainpipe and crushed rock in accordance with the Drawings/Details.
5. Pipe Embedment
- a. Concrete encase sewer main entirely beneath proposed vault.
- B. Finishes
1. Ductile iron pipe and fittings shall be asphaltic coated and ceramic epoxy lined in accordance with Section 33 05 19.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Testing and inspection of Combination Air Valves shall be in accordance with AWWA C512.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install in accordance with manufacturer's recommendations and as specified in the Drawings.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Inspections

1. The valve shall perform as intended with no deformation, leaking, or damage of any kind for the pressure ranges indicated.
2. Before acceptance of the installed valve, provide the City the opportunity to inspect and operate the valve.
3. The City will assess the ease of access to the operating nut and ease of operation.
4. If access and operation of the valve and its appurtenances meet the City Standard Detail, the valve will be accepted as installed.

5. The Combination Air Valve assembly shall be free from any leaks.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria at the Contractor's expense.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 05 91
UTILITY MARKERS, LOCATORS, AND TRACER WIRE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Buried and surface utility markers for utility construction
 - 2. Surface utility markers for water and sewer mains as indicated in the Drawings
- B. Deviations from this City of League City Standard Specification:
 - 1. None.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Measurement
 - a. Measurement for this item will be by lump sum.
 - 2. Payment
 - a. The Work performed and materials furnished in accordance with this item will be paid for at the lump sum price bid for "Utility Markers".
 - 3. The price bid shall include:
 - a. Furnishing and installing surface markers as specified in the Drawings
 - b. Furnishing and installing tracer wire for all PVC and HDPE water lines and HDPE force mains
 - c. Furnishing and installing detectable warning tape for all buried pipelines
 - d. Continuity testing of tracer wire
 - e. Replacement of non-continuous tracer wire
 - f. Mobilization
 - g. Pavement removal
 - h. Excavation
 - i. Hauling
 - j. Disposal of excess material
 - k. Furnishing, placement, and compaction of backfill
 - l. Clean-up

1.3 REFERENCES

- A. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. American Public Works Association (APWA):
 - a. Uniform Color Code.
 - 3. ASTM International (ASTM):
 - a. B170, Standard Specification for Oxygen-Free Electrolytic Copper – Refinery Shapes.

- b. B227, Standard Specification for Hard-Drawn Copper-Clad Steel Wire.
- c. B910/B910M, Standard Specification for Annealed Copper-Clad Steel Wire.
- d. B1010/B1010M, Standard Specification for Copper-Clad Steel Electrical Conductor for Tracer Wire Applications.
- e. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Buried Markers
 - 2. Surface Markers

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Manufacturers
 - 1. Provide new Utility Markers/Locators from a manufacturer regularly engaged in the manufacturing of Utility Markers/Locators.
- B. Materials
 - 1. Buried Markers
 - a. Detectable Warning Tape
 - 1) 5.0 mil overall thickness
 - 2) Width – 3 inch minimum
 - 3) Weight – 27.5 pounds per inch per 1,000 square feet
 - 4) Triple Layer with:
 - a) Minimum thickness 0.35 mils solid aluminum foil encased in a protective inert plastic jacket
 - (1) 100 percent virgin low density polyethylene

- (2) Impervious to all known alkalis, acids, chemical reagents, and solvents within soil
 - (3) Aluminum foil visible to both sides
- 5) Locatable by conductive and inductive methods
- 6) Printing encased to avoid ink rub-off
- 7) Color and Legends
 - a) Potable water lines
 - (1) Color – Blue (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Potable Water Line Below (repeated every 24 inches)
 - b) Reclaimed water lines
 - (1) Color – Purple (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Reclaimed Water Line Below (repeated every 24 inches)
 - c) Sewer Line
 - (1) Color – Green (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Sewer Line Below (repeated every 24 inches)
- b. Tracer Wire and Appurtenances
 - 1) Tracer Wire
 - a) Color
 - (1) Blue for domestic water (potable) lines.
 - (2) Green for sanitary sewer gravity lines and force mains.
 - (3) Purple for raw and recycled water (non-potable) lines.
 - b) Open Cut Installation
 - (1) Copper-clad steel 12-AWG high strength, high carbon tracer wire in accordance with ASTM B170, B227, B910/910M, and B1010/1010M.
 - (2) Minimum 450 lb. tensile break load
 - (3) Minimum 30 mils minimum high molecular-high density polyethylene jacket in accordance with ASTM D1248.
 - c) Directional Bore or Carrier Pipe Installation
 - (1) Two (2) Copper-clad steel 12-AWG high strength, high carbon tracer wires in accordance with ASTM B170, B227, B910/910M, and B1010/1010M.
 - (2) Minimum 1,150 lb. tensile break load
 - (3) Minimum 45 mils high molecular-high density polyethylene jacket in accordance with ASTM D1248.
 - d) Pipe Bursting Installation
 - (1) 7 x 7 stranded copper-clad steel 12-AWG high strength, high carbon tracer wire in accordance with ASTM B170, B227, B910/910M, and B1010/1010M.
 - (2) Minimum 4,700 lb. tensile break load
 - (3) Minimum 50 mils high molecular-high density polyethylene jacket in accordance with ASTM D1248.
 - 2) Connectors
 - a) Splice along continuous runs of tracer wire for repair of a wire break, or replacement of a failed segment of wire with 3M Brand DBR Direct Bury Splice Kit or approved equal.
 - (1) Provide secure connection for two or more wires.
 - (2) Provide moisture sealing by means of a dielectric non-hardening silicone sealant.
 - (3) Splice Kit shall be intended for use in direct bury applications.
 - (4) Rated for a minimum of 50V.

- b) Branch connections for laterals, turnouts, services, and appurtenances shall utilize DryConn Direct Bury Lug Aqua, or approved equal.
 - (1) Provide secure connection one or two wires to the main tracer wire without cutting the main tracer wire.
 - (2) Provide moisture sealing by means of a dielectric non-hardening silicone sealant.
 - (3) Branch connector shall be intended for use in direct bury applications.
 - (4) Rated for a minimum of 50V.
 - 3) Grounding
 - a) Grounding is required for all dead-ends/stub-outs
 - b) Drive-in magnesium grounding anode rod with a minimum of 20-feet of 12-AWG red HDPE insulated copper-clad steel wire connected to the rod and specifically manufactured for this purpose.
2. Surface Markers
- a. Provide as follows:
 - 1) 4-inch wide, 6-feet minimum length, fiberglass composite, double-sided marker, or approved equal
 - 2) Posts with colored, ultraviolet resistant decals as follows:
 - a) Water Lines
 - (1) Color – Blue (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Potable Water Line Below
 - b) Reclaimed water lines
 - (1) Color – Purple (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Reclaimed Water Line Below
 - c) Sewer lines
 - (1) Color – Green (in accordance with APWA Uniform Color Code)
 - (2) Legend – Caution Sewer Line Below

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Buried Markers

- 1. Detectable Warning Tape – For all underground water and sanitary sewer lines
 - a. Install in accordance with manufacturer's recommendations below natural ground surface and directly above the utility for which it is marking.
 - 1) Allow 18 inches minimum between utility and marker.
 - 2) Bury to a depth of 3 feet or as close to the grade as is practical for optimum protection and detectability.
- 2. Tracer Wire and Appurtenances

- a. Install tracer wire such that it can be easily accessed for connection of line tracing equipment, wire can be located without loss or deterioration of low frequency signal, and without distortion of signal caused by more than one wire being installed in close proximity to another.
 - b. Install tracer wire in the same trench or inside casing with pipe during pipe installation.
 - 1) Secure wire to the pipe at a maximum of 5-foot intervals and in accordance with manufacturer recommendations, and the City Standard Details.
 - a) Do not place the tracer wire between service saddles and the main.
 - 2) Securely bond all wire joints with an approved watertight connector to provide electrical continuity.
 - 3) Install wire at all tracer wire access points in accordance with City Standard Details, providing no less than 24-inches of coiled wire.
 - c. Provide continuous tracer wire without splices from each tracer wire access point, except where approved by City for spliced-in repair or replacement connections.
 - d. Install tracer wire as a continuous single wire. No looping or coiling of wire is permitted.
 - e. Protect wire insulation from damage during installation of embedment and backfill.
 - f. Replace all wire that has broken, cut, or damaged insulation
 - g. Treat all connections between existing metallic pipe and plastic pipe as a mainline dead-end, and ground using an approved waterproof connection to a grounding anode, buried at the same depth as the tracer wire.
 - h. Connect new tracer wire to an existing utility that is being extended or tied into, using approved splice connectors.
 - i. At all main end caps, extend a minimum of 6 feet of tracer wire beyond the end of the pipe, coil, and secured to the pipe for future connections. Splice the end of the tracer wire to a grounding rod in accordance with manufacturer's recommendations and City Standard Details and bury grounding rod at the same elevation as the main.
 - j. Place tracer wire access valve boxes spaced in accordance with City Standard Details.
- B. Surface Markers
- 1. Bury a minimum of 2 feet deep, with a minimum of 4 feet above ground
 - 2. The warning sign for all surface markers shall be 21 inches (not including decaled portion).
 - 3. Place surface markers near fixed objects, if possible
 - 4. Place Surface Markers at the following locations:
 - a. Unimproved areas only
 - b. Buried Features
 - 1) Place directly above a buried feature.
 - c. Above-Ground Features
 - 1) Place a maximum of 2 feet away from an above-ground feature.
 - d. Water lines 12-inches and larger:
 - 1) Each right-of-way line (or end of casing pipe) for:
 - a) Highway crossings
 - b) Railroad crossings
 - 2) Utility crossings such as:
 - a) High pressure or large diameter gas lines
 - b) Fiber optic lines
 - c) Underground electric transmission lines
 - d) Or other locations specified in the Drawings or directed by the City

- e. For sanitary sewer lines:
 - 1) In undeveloped areas, place marker maximum of 2 feet away from an above-ground feature such as a manhole or combination air valve vault.
- f. Place at 500-foot intervals along the pipeline.
- g. As specified in Drawings.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Testing

- 1. After all trench backfill is completed and prior to final surface repair, perform continuity and trace tests on all tracer wire in the presence of the City.
- 2. If the tracer wire is found to be non-continuous after testing, repair or replace the failed segment of wire.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 14 12

WATER SERVICES AND SERVICE CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lead-free 1-inch to 2-inch water service lines from the water main to the right-of-way, fittings and water meter boxes complete in place, as shown on the Drawings, directed by the Engineer, and specified herein for:
 - a. Service Connecting Fitting
 - b. Corporation Stops
 - c. Curb Stops
 - d. Service Saddles
 - e. Brass Goods
 - f. Functional Requirements
 - g. Meter Boxes and Vaults
 - h. No Water Service Lines Can Be Installed During Development Unless Approved by City Engineer.

B. Deviations from this City of League City Standard Specification

1. None.

C. Products Installed but not Furnished Under this Section

1. Water meters for various sizes

D. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 01 13 – Cleaning and Approval
2. Section 33 05 06 – Pipe Bedding and Backfill Material
3. Section 33 14 25 – Connections to Existing System

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. New Water Service

a. Measurement

- 1) Measurement for this Item shall be per each new "Water Service" complete in place from the tap of the main to the installation of the meter box and associated appurtenances where the service line is installed by open cut construction.

b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Water Service" installed for:
 - a) Various sizes

c. The price bid shall include:

- 1) Furnishing and installing New Service Line as specified by the Drawings
- 2) Submitting product data
- 3) Tapping saddle
- 4) Corporation stop
- 5) Curb stop
- 6) Fittings
- 7) Service line installed by open cut
- 8) Connection to meter
- 9) Meter Box and Lid
- 10) Pavement removal
- 11) Excavation
- 12) Hauling
- 13) Disposal of excess material
- 14) Surface Restoration associated with Meter Box installation and connection, excluding grass (seeding, sodding or hydro-mulch paid separately)
- 15) Clean-up
- 16) Disinfection
- 17) Testing

2. New Bored Water Service

a. Measurement

- 1) Measurement for this Item shall be per each new Water Service complete in place from the tap of the main to the installation of the meter box and

associated appurtenances where the service line is installed by trenchless method.

b. Payment

- 1) The Work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid per each "Bored Water Service" installed for:
 - a) Various sizes

c. The price bid shall include:

- 1) Submitting product data
- 2) Tapping saddle
- 3) Corporation stop
- 4) Curb stop
- 5) Fittings
- 6) Service line installed by trenchless method
- 7) Connection to meter
- 8) Meter Box and Lid
- 9) Pavement removal
- 10) Excavation
- 11) Hauling
- 12) Disposal of excess material
- 13) Surface restoration associated with Meter Box installation and connection, excluding grass (seeding, sodding or hydro-mulch paid separately)
- 14) Clean-up
- 15) Disinfection
- 16) Testing

3. Water Meter Service Reconnect

a. Measurement

- 1) Measurement for this Item shall be per each Water Meter Service Reconnect complete in place from public service line connection to private service line connection.

b. Payment

- 1) The Work performed in conjunction with relocation of the meter, associated private service line, fittings and meter box 5 feet or less in any direction from centerline of existing meter location and the materials furnished in

accordance with this Item will be paid for at the unit price bid per each
“Water Meter Service, Reconnection” installed for:

a) Various size of services

c. The price bid shall include:

- 1) Private service line
- 2) Fittings
- 3) Private connection to water meter
- 4) Connection to existing private service line
- 5) Cut and crimp of existing service
- 6) Removal and Disposal or Salvage of existing 2-inch or smaller water meter,
as directed by City
- 7) Pavement removal
- 8) Excavation
- 9) Hauling
- 10) Disposal of excess material
- 11) Surface restoration for area disturbed for installation of meter box,
excluding grass (seeding, sodding or hydro-mulch paid separately)
- 12) Clean-up
- 13) Cleaning
- 14) Disinfection
- 15) Testing

4. Private Water Service Relocation

a. Measurement

- 1) Measurement for this Item shall be per linear foot of Private Service relocation complete in place from the meter box to a connection to the existing service line on private property.

b. Payment

- 1) The Work performed in conjunction with Private Service Line installation where the meter and meter boxes are moved more than 5 feet in any direction from centerline of existing meter location and materials furnished in accordance with the Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot of “Private Water Service” performed for:

a) Various service sizes

c. The price bid shall include:

- 1) Obtaining appropriate permit
- 2) Obtaining Right of Entry
- 3) Submitting product data
- 4) Private service line
- 5) Fittings
- 6) Backflow preventer, check valve, and isolation valve relocation, if applicable
- 7) Connection to existing private service line
- 8) Pavement removal and replacement
- 9) Excavation
- 10) Hauling
- 11) Disposal of excess material
- 12) Surface restoration, excluding grass (seeding, sodding or hydro-mulch paid separately)
- 13) Clean-up
- 14) Cleaning
- 15) Disinfection
- 16) Testing

1.3 REFERENCES

A. Definitions

1. New Service
 - a. Installation of new 1-inch to 2-inch Water Service Line by open cut construction from the water main to the right-of-way, including corporation stop, curb stop, fittings and water meter boxes complete in place, as shown on the Drawings.
2. New Service (Bored)
 - a. Installation of new 1-inch to 2-inch Water Service Line by trenchless construction method from the water main to the right-of-way, including corporation stop, curb stop, fittings and water meter boxes complete in place, as shown on the Drawings.
3. Meter Service Reconnection
 - a. Relocation and reconnection of the private service line from an existing meter to be abandoned and a new meter installed that lies within 5 feet of the existing meter.
4. Private Service Relocation

- a. Relocation and reconnection of private service line behind the water meter where the existing meter to be abandoned and the new meter installed is greater than 5 feet of the existing meter. A licensed plumber is required to relocate the private service.
- 5. Lead-free
 - a. Lead-free pipes and plumbing fittings and fixtures shall contain less than 0.25 percent lead in accordance with the reduction of Lead in Drinking Water Act (P.L. 111-380).

B. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A536, Standard Specification for Ductile Iron Castings.
 - c. B88, Standard Specification for Seamless Copper Water Tube.
 - d. B98, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
 - e. C131, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - f. C150, Standard Specification for Portland Cement.
 - g. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - h. C857 (RL), Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - i. D883, Standard Terminology Relating to Plastics.
 - j. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
- 3. American Water Works Association (AWWA):
 - a. C700, Cold-Water Meters - Displacement Type, Bronze Main Case.
 - b. C800, Underground Service Line Valves and Fittings.
- 4. NSF International (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.
- 5. Reduction of Lead in Drinking Water Act

- a. Public Law 111-380 (P.L. 111-380)
- 6. General Services Administration (GSA):
 - a. RR-F-621E, Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling

- 1. Provide advance notice for service interruptions and meet requirements of Division 0 and Division 1.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data, if applicable:

- 1. Tapping Saddle
- 2. Corporation stop
- 3. Curb Stop
- 4. Service Line
- 5. Meter Box
- 6. Meter Box Lid

B. Certificates and Test Reports

- 1. Prior to shipment of any Water Service components, the manufacturer shall submit the following:
 - a. A Certificate of Adequacy of Design stating that the components to be furnished comply with all regulatory requirements identified in this Section including:
 - 1) The Reduction of Lead in Drinking Water Act (P.L. 111-380)
 - 2) AWWA C800
 - 3) NSF 61

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers

- a. Water Services shall meet or exceed the latest revisions of AWWA C800, NSF 61, the Reduction of Lead in Drinking Water Act and shall meet or exceed the requirements of this Specification.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
4. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS

- A. Water meters for various sizes

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

- A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
3. The Water Services and appurtenances shall be new, and the product of a manufacturer regularly engaged in the manufacturing of Water Services and appurtenances having similar service and size.

B. Description

1. Regulatory Requirements
 - a. **All materials shall conform to the Reduction of Lead in Drinking Water Act (P.L. 111 or most current version). This Act defines "Lead-free" for pipes and other appurtenances to be less than 0.25 percent lead.**
 - b. Water Services shall meet or exceed the latest revisions of AWWA C800 and shall meet or exceed the requirements of this Specification.
 - c. All Water Services components in contact with potable water shall conform to the requirements of NSF 61.

C. Materials/Design Criteria

1. Service Lines
 - a. Provide thick wall Black Polyethylene tubing.
 - b. Furnish in the annealed conditions, unless otherwise specified in the Contract Documents.
 - c. Copper service lines are not allowed.
2. Service Couplings
 - a. Fitting Ends
 - 1) Pack joint compression fittings.
 - 2) Provide coupling nuts with a machined bearing skirt of a length equal to the tubing outer diameter (O.D.).
 - b. Provide with hexagonal wrench grip compatible with the coupling size.
 - c. Provide lead-free service couplings in accordance with the Reduction of Lead in Drinking Water Act.
3. Corporation stops

- a. Corporation stops shall be new and made of brass conforming to this specification.
 - b. Inlet ends shall be standard corporation stop thread as per Table1 AWWA C 800, iron pipe thread, or locking insert type.
 - c. Valve body shall be taper plug type "J" ring seat ball type, or rubber seat ball type.
 - d. Outlet end shall be compression type fitting.
 - e. Provide lead-free corporation stops in accordance with the Reduction of Lead in Drinking Water Act.
4. Curb Stops
- a. Curb stops shall be new and conform to this specification.
 - b. Inlet end shall be compression type fitting.
 - c. Valve body shall be straight through, or angled meter stop design equipped with padlock wings and shall be of either of the "O" ring seal straight plug type or rubber seat ball type.
 - d. Outlet shall be female iron pipe thread or swivel nut meter spud thread on 3/4" and 1" stops and two-hole flange on 1-1 1/2" and 2" sizes.
5. Straight Adapters
- a. Brass castings and threads per AWWA C800
 - b. Provide lead-free straight adapters in accordance with the Reduction of Lead in Drinking Water Act.
6. Three Part Copper Unions
- a. Brass castings and threads per AWWA C800
 - b. Provide lead-free Three-Part Copper Unions in accordance with the Reduction of Lead in Drinking Water Act.
7. Straight Meter Couplings
- a. Brass castings per AWWA C800
 - b. Threads per AWWA C700
 - c. Tailpiece with outside iron pipe thread
 - d. Chamfer corners on threaded end of meter nut.
 - e. Machine inside and outside of tailpiece.
 - f. Provide lead-free Straight Meter Couplings in accordance with the Reduction of Lead in Drinking Water Act.

8. Branch Connections

- a. Brass castings per AWWA C800
- b. Inlet and outlet connections per AWWA C800
- c. Provide lead-free branch connections in accordance with the Reduction of Lead in Drinking Water Act.

9. Service Saddles

- a. Service saddles for two-inch and smaller services shall be single strap stainless steel epoxy coated.
- b. Castings
 - 1) Epoxy coated ductile iron castings per AWWA C800
 - 2) Free of porosity with sharp edges removed
 - 3) Saddle
 - a) Form to fit firmly against side of maximum diameter of water main with approximately 180 degrees wrap around.
 - 4) Outlet
 - a) Design outlet boss for no thread distortion by bending moments.
 - b) Tapped for taper threaded corporation stop conforming to AWWA C800.
- c. Straps
 - 1) Conform to ASTM B98.
 - 2) Form flat to fit uniformly against the wall of the water main.
 - 3) Shall be single wide bend straps
 - 4) Rod diameter not less than 5/8 inch flattened to 1 inch on one side.
 - 5) Straps shall be threaded 5/8 inch (11-NC-2A) for a distance such that ½ inch remains after clamp is fully tightened on the pipe.
 - 6) Chamfer strap ends to protect the starting threads.
 - 7) The threads shall be full and free from shear.
 - 8) 4-inch and larger pipe shall be in accordance with Section 33 14 25.
- d. Nuts

- 1) Stainless steel material
 - a) Same material as straps
- 2) Dimensions equal to or larger than heavy hexagon nuts
- 3) Tapped 5/8 inch (11-NC-2B)

e. Gaskets

- 1) Neoprene rubber material

f. Cemented to saddle and positioned to facilitate installation

10. Brass Goods

- a. All brass stops, couplings, bends, connections, nipples, and miscellaneous brass pipe fittings and accessories used in meter connections, copper service lines, air release piping assemblies and wherever needed in the water distribution system, shall conform to the standards set within AWWA C 800-current, and ASTM B 62, except as herein modified or supplemented.
- b. Unless otherwise noted, the goods described herein shall be fabricated of standard red brass (waterworks brass: 85-5-5-5) exposed threads shall be covered with plastic caps or sheathing to protect the threads.

11. Meter Boxes and Lids shall be those types and models listed and shown in the "Standard Details," unless otherwise designated.

12. Horizontal Check Valve

- a. Equip 1 ½-inch and 2-inch Water Services with a horizontal check valve, with pipe plug, only if specified in the Drawings.
- b. If an existing backflow preventer is present, the Contractor is to leave it, and is not required to provide an additional horizontal check valve.
- c. Provide lead-free horizontal check valves in accordance with the Reduction of Lead in Drinking Water Act.

13. Functional Requirements

- a. Corporation stop thread (where used) shall conform to Table 1, Figure 1, AWWA C 800 (corporation stops with iron pipe threads are also permitted).
- b. Iron pipe threads shall conform to ANSI B2.1 - 1960 and Table 9, Figure 9, of AWWA C 800.

- c. Cooper fittings threads shall conform to Table 2 and 3, Figure 2 and 3 of AWWA C 800 and ANSI B1.1960 with tolerance of Class 2 flanges shall conform to ANSI 6.1 Class 125 (or Class 250 where noted), as dimensions, drillings, etc.
 - d. All fittings shall be suitable for use at hydrostatic working pressures up to 150 psi.
14. Service Marker
- a. 3 inch wide, 5 mil blue vinyl tape

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. At the City's option, the manufacturer shall be required to provide certification records showing conformance of materials, design and testing to these Specifications.
2. The test procedures shall conform to AWWA C800.
 - a. In the event that a chosen valve fails the City's hydrostatic test, the cost of the test shall be at the expense of the supplier.
 - b. Proof testing of the remainder of the valves shall be at the cost and responsibility of the supplier.
 - c. These tests will be the basis of acceptance or rejection of the remainder of the shipment by the City.
3. The City reserves the right to select products at random for testing. The failure of materials to conform to the applicable Specification may result in the rejection of the entire shipment.

B. Marking

1. Service saddle castings shall be clearly marked by letters and numerals cast thereon showing:
 - a. Manufacturer's name
 - b. Type
 - c. Size of Pipe

PART 3 - EXECUTION

3.1 INSTALLERS

- A. A licensed plumber is required for installations on the outlet side of the service meter.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install Water Services and appurtenances in accordance with AWWA C800.
2. Install Water Service Lines 5 feet north or east of center of lot frontage on lots 75 feet or wider, or where shown on Drawings.
3. Install Water Service Lines on lot center line on lots less than 75 feet wide, unless otherwise shown on the Drawings.
4. Install services at a minimum depth of 36 inches below final grade/proposed top of curb, unless otherwise specified in the Contract Documents.
5. Perform leak tests in accordance with Section 33 01 13.
6. Replace existing $\frac{3}{4}$ -inch Service Lines with 1-inch new Service Line, tap, and corporation.
7. Install replaced or relocated services with the service main tap and service line being in line with the service meter, unless otherwise directed by the City.
8. Excavate, embed and backfill trenches in accordance with Section 33 05 06.

B. Handling

1. Haul and distribute Service Lines fittings at the project site and handle with care to avoid damage.
 - a. Inspect each segment of Service Line and reject or repair any damaged pipe prior to lowering into the trench.
 - b. Do not handle the pipe in such a way that will damage the pipe.
2. At the close of each operating day:
 - a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
 - b. Effectively seal the open end of the pipe using a gasketed night cap.

C. Service Line Installation

1. Service Taps

- a. Only ductile iron pipe may be directly tapped.
- b. Install service taps and/or tap assemblies of the specified size as indicated on the Drawings, or as specified by the Engineer.
- c. Perform taps on a water system that are under pressure.
- d. Taps consist of:
 - 1) For Concrete Pressure Pipe or Steel Pipe
 - a) Standard internal pipe threaded holes in the pipe walls
 - (1) Made during pipe fabrication
 - (2) Provide tapered threaded outlet with cc threads for up to 2-inch.
 - (3) Provide flange outlet with flange to thread insulator adaptor kits for 4-inch and larger taps.
 - 2) Other pipe materials
 - a) Bronze service clamp with a sealed, threaded port through which the pipe wall is drilled to complete a service port
- e. Tap Assemblies
 - 1) Consist of corporation stop with iron to copper connection attached to:
 - a) Copper tubing terminating as shown on the City's Standard Detail
 - b) May be required adjacent to gate valves
 - c) Install as shown on the Drawings, or as directed by the Engineer.
 - d) When required, shall be included in the unit price bid for installing gate valve.
 - 2) Chlorination and testing purposes
 - a) No separate payment will be made for taps required for testing and chlorination.

2. Installation of Water Services

- a. Install tap and Service Line in accordance with City Details.
- b. Install meter box in accordance with City Details.
 - 1) Adjustment of the Service Line to proper meter placement height shall be considered as part of the Meter Box installation.

3. Trenching

- a. Provide a trench width sufficiently wide to allow for 2 inches of granular embedment on either side of the Service Line.
 4. Bed and cover tap and service to meter box with bank sand, use remaining spoil to fill to grade.
 5. Bored Services
 - a. Services shall be bored utilizing a pilot hole having a diameter $\frac{1}{2}$ inch to $\frac{3}{4}$ inches larger than the Service Line.
 6. Arrangement
 - a. Arrange corporation stops, branches, curb stops, meter spuds, meter boxes and other associate appurtenances as shown in the City Detail, and to the approval of the Engineer.
 7. Service Marker
 - a. When Meter Box is not installed immediately subsequent to service installation:
 - 1) Mark Curb Stop with a strip of blue vinyl tape fastened to the end of the service and extending through the backfill approximately 6 inches above ground at the Meter Box location.
 - b. Installation of service taps only:
 - 1) Attach service marker tape to the corporation stop or plug and extend upward and normal to the main through the backfill at the adjacent trench edge to at least 6 inches above ground to flag the tap location.
 8. Corporation stops
 - a. Fully open corporation stop prior to backfill.
- D. Removal of Existing Water Meters
1. Remove, tag and collect existing Water Service meter for pickup by the City for reconditioning or replacement.
 2. After installation of the Water Service in the proposed location and receipt of a meter from the City inspector, install the meter.
 3. Reset the meter box as necessary to be flush with existing ground or as otherwise directed by the City.
 4. All such Work on the outlet side of the service meter shall be performed by a licensed plumber.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL

A. Field Tests and Inspections

1. Check each Water Service installation for leaks and full flow through the curb stop at the time the main is tested in accordance with Section 33 01 13.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 14 19

FIRE HYDRANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dry-barrel fire hydrants with 5¹/₄-inch main valve for use with potable water mains

B. Deviations from this City of League City Standard Specification

1. None.

C. Related Specification Sections include, but are not necessarily limited to:

1. Section 33 01 13 – Cleaning and Approval
2. Section 33 05 06 – Pipe Bedding and Backfill Material
3. Section 33 05 19 – Ductile Iron Pipe and Fittings
4. Section 33 05 24 – Steel Pipe and Fittings
5. Section 33 05 84 – Gate Valves

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

- a. Fire Hydrant Assembly

- 1) Measurement for this item shall be by each hydrant, complete in place.

2. Payment

- a. The Work performed and materials furnished in accordance with this Item and measured under “Measurement” will be paid for at the unit prices bid per each “Fire Hydrant Assembly” installed.

3. The price bid shall include:

- a. Furnishing and installing Fire Hydrants with appurtenances as specified in the Drawings
 - b. Dry-Barrel Fire Hydrant assembly from base to operating nut
 - c. Extension barrel and stem
 - d. 6” gate valve and lead pipe.

- e. Storz Nozzle Connection Cap.
- f. Adjusting hydrant to the appropriate height
- g. Painting
- h. Pavement Removal
- i. Excavation
- j. Freight, loading, unloading and handling
- k. Disposal of excess material
- l. Furnish, placement and compaction of embedment
- m. Furnish, placement and compaction of backfill
- n. Blocking, Braces and Rest
- o. Clean up
- p. Disinfection
- q. Testing

1.3 REFERENCES

A. Definitions

- 1. Base: The lateral connection to the fire hydrant lead; also called a shoe

B. Reference Standards

- 1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
- 2. American Water Works Association (AWWA):
 - a. C502, Dry-Barrel Fire Hydrants
 - b. Manual of Water Supply Practices M17 (AWWA Manual M17) – Installation, Field Testing, and Maintenance of Fire Hydrants
- 3. NSF International
 - a. 61, Drinking Water System Components – Health Effects
 - b. 372, Drinking Water System Components – Lead Content
- 4. National Fire Protection Association (NFPA)
 - a. 1963, Standard for Fire Hose Connections
- 5. Underwriters Laboratories, Inc. (UL)

- a. 246, Hydrants for Fire-Protection Service
- 6. Factory Mutual (FM)
 - a. Class Number 1510, Approval Standard for Fire Hydrant (Dry Barrel Type) for Private Fire Service

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to construction.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Dry-Barrel Fire Hydrant stating:
 - a. Main valve opening size
 - b. Nozzle arrangement and sizes
 - c. Operating nut size
 - d. Operating nut operating direction
 - e. Working pressure rating
 - f. Component assembly and materials
 - g. Coatings and Finishes

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturers
 - a. Dry-Barrel Fire Hydrants shall be the product of 1 manufacturer.
 - 1) Change orders, specials and field changes may be provided by a different manufacturer upon City approval.
 - 2. Dry-Barrel Fire Hydrants shall be in conformance with AWWA C502, UL 246 and FM 1510.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements

1. Store and handle in accordance with the guidelines as stated in AWWA C502 and AWWA Manual M17.
2. Protect all parts so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
3. Protect all equipment and parts against any damage during a prolonged period at the site.
4. Protect the finished surfaces of all exposed flanges by wooden blank flanges, strongly built and securely bolted thereto.
5. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
6. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
7. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY

A. Manufacturer Warranty

1. Manufacturer's Warranty shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [OR] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
3. The Dry-Barrel Fire Hydrant shall be new, and the product of a manufacturer regularly engaged in the manufacturing of Dry-Barrel Fire Hydrants having similar service and size.

B. Description

1. Regulatory Requirements
 - a. Dry-Barrel Fire Hydrant shall meet or exceed the latest revisions of AWWA C502 and shall meet or exceed the requirements of this Specification.

- b. All Dry-Barrel Fire Hydrant components in contact with potable water shall conform to the requirements of NSF 61.

C. Performance / Design Criteria

1. Capacities

- a. Rated working pressure of 250 psi or greater

2. Design Criteria

a. Operating nut

- 1) Non-rising, pentagonal shape nut measuring:
 - a) 1-1/2" from point of opposite flat
 - b) 1-1/4" depth for pentagon
- 2) Open by turning the operating nut to the left (**counterclockwise**)
 - a) Provide operating direction clearly marked with an embossed arrow.
- 3) Provide a weather cap which conceals the hold down nut.

b. Main Valve

- 1) Composition
 - a) Minimum 5-1/4" in diameter
 - b) Not less than 1" thick
 - c) Rubber or neoprene
- 2) Durometer hardness of 90 + 5 Compression type
 - a) Opening against pressure
 - b) Closing with pressure

c. Nozzles

- 1) 3-way arrangement
 - a) Nozzles shall thread counter-clockwise into barrel with "O" ring pressure seals
- 2) Nozzle sizes
 - a) Hose nozzles
 - (1) Two 2-1/2" hose nozzles
 - (a) 180 degrees apart
 - (b) Right hand National Standard Thread

- b) Pump nozzle
 - (1) 5” Storz quick connection pumper nozzle
 - (a) Storz connection shall have matching cap with cable tether
 - (b) Storz shall be free of louvers
- d. Hydrant Barrel Configuration
 - 1) Upper barrel
 - a) Shall be fabricated of cast iron.
 - 2) Breakable swivel flange
 - a) To join the upper and lower barrels approximately 2” above the final grade line
 - b) Shall have a minimum of eight bolts
 - c) Shall provide 360-degree rotation of upper barrel
 - 3) Pressure seal
 - a) Shall be cloth impregnated rubber gasket
 - b) An “O” ring is not acceptable.
 - 4) Breakable stem
 - a) Shall join the two-piece stem adjacent to the ground-line flange
 - b) Screws, pins, fasteners or bolts used in the coupling shall be stainless steel
 - c) Weakened portion of stem coupling shall be below the coupling pins.
 - 5) Lower barrel
 - a) Shall be fabricated of cast iron.
 - b) The ground line shall not be less than eighteen inches below the centerline of the lowest nozzle.
 - c) The ground line shall be clearly embossed on the lower barrel.
- e. Lubrication reservoir
 - 1) Shall be filled with a viscous, non-toxic lubricant
 - 2) Shall be sealed at the top and bottom with “O” rings.
 - 3) Design
 - a) The bearing surfaces and threaded parts are automatically lubricated when hydrant is operated.

- b) No less than two “O” rings separating the waterway from the oil reservoir and that portion of the stem making this seal shall be sleeved with bronze.
- c) An anti-friction washer shall be in place above the thrust collar to minimize operation torque.
- f. Bonnet
 - 1) Shall be attached to the upper barrel by not less than eight bolt utilizing a cloth impregnated rubber gasket as a pressure seal.
- g. Drain Valve
 - 1) Shall operate without springs, tubes, levers, toggles, or other intricate mechanism
 - 2) A gravel bed around the weep holes is required.
- h. Shoe connection
 - 1) Shall be a 6” approved mechanically restrained joint.
 - 2) Shall have ample blocking pads for sturdy setting and concrete blocking.
 - 3) A minimum of 6 bolts is required to fasten the shoe to the lower barrel.
 - 4) Interior, lower valve plate, and cap nut
 - a) Shall have a protective epoxy coating of at least 4 mils.
 - b) If cap nut is utilized, it must be locked in place with a stainless-steel lock washer or similar non-corrosive device.

D. Function

- 1. Drain Valve
 - a. Drain fire hydrant barrels when main valve is closed. Seal shut when open.

E. Materials

- 1. Furnish materials in accordance with AWWA C502.
- 2. Dry-Barrel Fire Hydrant Assembly
 - a. Internal parts
 - 1) Threads
 - a) Provide operating thread designed to avoid metal such as iron or steel threads against iron or steel parts.
 - 2) Stem
 - a) Stem Nuts
 - (1) Provide bronze stem nuts.

- (a) Grades per AWWA C502
 - b) Where needed, stem shall be grooved and sealed with O-rings.
- 3) Upper valve plate and seat ring
 - a) Shall be bronze.
 - b) Shall Work in conjunction to form an all-bronze drain-way.
 - c) Drain holes drilled in the shoe must be bronze lined.
 - d) Seat rings seals shall be “O” ring type.
 - e) Zinc content of bronze parts shall not exceed 16%.
- 4) Drain ring
 - a) Two drain openings are required.
 - b) The bronze seat ring must thread into a bronze drain ring or shoe bushing providing a bronze-to-bronze connection.
- 3. Provide crushed rock for placement around base conforming to Section 33 05 06.

F. Finishes

- 1. Primer Materials
 - a. Furnish primer for Dry-Barrel Fire Hydrants in accordance with AWWA C502.
- 2. Finish Materials
 - a. Dry-Barrel Fire Hydrant
 - 1) Exterior
 - a) Above grade
 - (1) Furnish exterior coating for above grade Dry-Barrel Fire Hydrant assembly components with an approved rust inhibiting paint and in accordance with AWWA C502.
 - (2) Body parts, bonnet, and caps shall be in the color Carmine Red.
 - (3) Dead end flushing hydrants should be blue in color.
 - b) Below grade
 - (1) Furnish exterior coating for below grade Dry-Barrel Fire Hydrant assembly components in accordance with AWWA C502.
 - 2) Interior
 - a) Interior coating for Dry-Barrel Fire Hydrants assemblies in accordance with AWWA C502

2.3 ACCESSORIES

A. Polyethylene Encasement

1. Provide polyethylene encasement.

B. Embedment

1. Provide crushed rock and filter fabric in accordance with Section 33 05 06.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Testing and inspection of Dry-Barrel Fire Hydrants in accordance with AWWA C502.

B. Markings

1. Provide each Dry-Barrel Fire Hydrant marked in accordance with AWWA C502.

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install in accordance with AWWA Manual of Water Supply Practice M17, manufacturer's recommendations and as shown on the Drawings.
2. Provide vertical installation with braces, rest and blocking in accordance with City Standard Details.
3. Excavate and backfill trenches in accordance with 33 05 06.
4. Embed Dry-Barrel Fire Hydrant assemblies in accordance with 33 05 06.
 - a. At the location of the weep holes, wrap barrel with polyethylene encasement and crushed rock with filter fabric to prevent dirt and debris from entering the fire hydrant.
5. Polyethylene encasement installation shall be in accordance with the applicable portion of Section 33 14 19.
6. Install concrete blocking and rest in accordance with Section 03 30 00 as indicated in the Drawings.
7. A minimum 3 cubic feet of crushed rock shall be placed around the base, in accordance with AWWA Manual of Water Supply Practice M17, to allow drain outlets to operate.
 - a. The crushed rock should extend 6 inches above the drain outlets and a minimum of 1 foot on all sides of the fire hydrant base.

8. Fire hydrant lead line shall be installed with a maximum cover of 7 feet.
 - a. Cover is measured from the invert at the fire hydrant base, vertical to ground elevation.
 - b. Fittings may be used along fire lead line to ensure minimum and maximum cover requirements are met.
9. All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb or future curb.
10. They shall be installed with the hydrant bury mark approximately 6" above level with the finish grade.
11. The contoured shoe of each hydrant shall be well braced against unexcavated earth at the end of the trench with concrete thrust blocking (taking care not to obstruct the hydrant drain holes) and each hydrant cradled with a minimum of 6" of concrete placed under the shoe.
12. A drainage pit 2 feet in diameter and 2 feet in depth, located about the drain ring housing, shall be filled with coarse gravel.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD CONTROL

A. Field Inspections

1. The Dry-Barrel Fire Hydrant and assembly shall perform as intended with no deformation, leaking or damage of any kind for the pressure ranges indicated.
2. City inspector will issue final inspection notice to City staff.
3. City Field Operations Staff and Fire Department Staff shall have the opportunity to inspect and operate the hydrant, to ensure that the fire hydrant was installed in accordance with AWWA Manual of Water Supply Practice M17. This includes but is not limited to:
 - a. Operation of Nozzles and operating nut are not obstructed.
 - b. Drain valve is not obstructed or plugged
4. Keep fire hydrant wrapped or covered to identify that it is out of service until the water line it's connected to is put in service.

B. Non-Conforming Work

1. If access and operation of the Dry-Barrel Fire Hydrant or its appurtenances do not meet the criteria of the AWWA Manual of Water Supply Practice M17, the Contractor will remedy the situation criteria, at the Contractor's expense.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 14 25

CONNECTIONS TO EXISTING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Connection to existing water mains to include, but not limited to:
 - a. Cutting in a tee for a branch connection
 - b. Extending from an existing water main
 - c. Installing a tapping sleeve and valve
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include, but are not necessarily limited to:
 - 1. Section 33 01 13 – Cleaning and Approval
 - 2. Section 33 05 06 – Pipe Bedding and Backfill Material
 - 3. Section 33 05 19 – Ductile Iron Pipe and Fittings
 - 4. Section 33 05 22 – Nuts, Bolts, and Gaskets

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Connection to an existing unpressurized League City Water Distribution System Main that does not require the City to take part of the water system out of service
 - a. Measurement
 - 1) This Item is considered subsidiary to the water pipe being installed.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item are subsidiary to the unit price bid per linear foot of water pipe complete in place, and no other compensation will be allowed.
 - 2. Connection to an existing pressurized League City Water Distribution System Main that requires a shutdown of some part of the water system
 - a. Measurement
 - 1) Measurement for this Item shall be per each connection completed.

- b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Connection to Existing Water Main” installed for:
 - a) Various sizes of existing water distribution main
- c. The price bid shall include all aspects of making the connection including, but not limited to:
 - 1) Preparing submittals
 - 2) Dewatering
 - 3) Exploratory excavation (as needed)
 - 4) Coordination and notification
 - 5) Remobilization
 - 6) Temporary lighting
 - 7) Polyethylene encasement
 - 8) Make-up pieces
 - 9) Linings
 - 10) Pavement removal
 - 11) Excavation
 - 12) Hauling
 - 13) Disposal of excess material
 - 14) Clean-up
 - 15) Cleaning
 - 16) Disinfection
 - 17) Testing
- 3. Connection to an existing pressurized League City Water Distribution System Main by Tapping Sleeve and Valve:
 - a. Measurement
 - 1) Measurement for this Item shall be per each connection completed.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this Item shall be paid for at the unit price bid per each “Tapping Sleeve and Valve” installed for:
 - a) Various sizes of connecting main

- b) Various sizes of existing water distribution main
- c. The price bid shall include all aspects of making the connection including, but not limited to:
 - 1) Preparing submittals
 - 2) Dewatering
 - 3) Exploratory excavation (as needed)
 - 4) Coordination and notification
 - 5) Tapping Sleeve and Tapping Valve
 - 6) Remobilization
 - 7) Temporary lighting
 - 8) Polyethylene encasement
 - 9) Make-up pieces
 - 10) Linings
 - 11) Pavement removal
 - 12) Excavation
 - 13) Hauling
 - 14) Disposal of excess material
 - 15) Clean-up
 - 16) Cleaning
 - 17) Disinfection
 - 18) Testing

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Society of Mechanical Engineers (ASME):
 - a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250)
3. ASTM International (ASTM):
 - a. A36, Standard Specification for Carbon Structural Steel.
 - b. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

- c. A194, Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - d. A242, Standard Specification for High-Strength Low-Alloy Structural Steel.
 - e. A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - f. A285, Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength.
 - g. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - h. D2000, Standard Classification System for Rubber Products in Automotive Applications.
4. American Water Works Association (AWWA):
- a. C200, Steel Water Pipe - 6 IN and Larger.
 - b. C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 IN through 144 IN.
 - c. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 - d. C223, Fabricated Steel and Stainless Steel Tapping Sleeves.
5. American Water Works Association/American National Standards Institute (AWWA/ANSI):
- a. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - b. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - c. C115A21/15, Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
6. NSF International (NSF):
- a. 61, Drinking Water System Components – Health Effects.
7. Manufacturers Standardization Society of the Valve and Fitting Industry Inc. (MSS):
- a. SP-60, Connecting flange Joint Between Tapping Sleeves and Tapping Valves.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meetings

- 1. Required for any connections to an existing, pressurized 16-inch or larger City water distribution system main that requires a shutdown of some part of the water system
- 2. May also be required for connections that involve shutting water service off to certain critical businesses

3. Schedule a pre-installation meeting a minimum of 3 weeks prior to proposed time for the Work to occur.
 4. The meeting shall include the Contractor, City Inspector and City Valve Crew.
 5. Review Work procedures as submitted and any adjustments made for current field conditions.
 6. Verify that all valves and plugs to be used have adequate thrust restraint or blocking.
 7. Schedule a test shutdown with the City.
 8. Schedule the date for the connection to the existing system.
- B. Scheduling
1. Schedule Work to make all connections to existing 16-inch and larger mains:
 - a. During the period from November through April, unless otherwise approved by the City
 - b. During normal business hours from Monday through Friday, unless otherwise approved by the City
 2. Schedule City Valve Crew by 1:00 P.M. a minimum of 2 business days prior to planned disruption to the existing water system.
 - a. In the event that other water system activities do not allow the existing main to be dewatered at the requested time, schedule Work to allow the connection at an alternate time acceptable to the City.
 - 1) If water main cannot be taken out of service at the originally requested time, coordination will be required with the City to discuss rescheduling and compensation for mobilization.
 - 2) No additional payment will be provided if the schedule was altered at the Contractor's request.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery and/or fabrication for specials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Product Data, if applicable
 1. Tapping Sleeve noting the pressure rating and coating system supplied including:
 - a. Dimensions, weights, material list, and detailed drawings

- b. Maximum torque recommended by the manufacturer for the valve by size

B. Submittals

1. Provide a detailed sequence of Work for 12-inch or larger connections if required by City that includes:
 - a. Results of exploratory excavation
 - b. Dewatering
 - c. Procedure for connecting to the existing water main
 - d. Time period for completing Work from when the water is shut down to when the main is back in service
 - e. Testing and repressurization procedures
2. Welders that are assigned to work on connection to concrete cylinder or steel pipe must be certified and provide Welding Certificates, upon request, in accordance with AWWA C200.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Protect parts so that no damage or deterioration occurs during a prolonged delay from the time of shipment until installation is completed.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges using wooden flanges, strongly built and securely bolted thereto.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being exposed to direct sunlight and extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY

A. Manufacturer Warranty

1. Manufacturer's warranty shall be in accordance with Division 1.

PART 2 - PRODUCTS

2.1 CITY-FURNISHED [or] CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the manufacturers as listed by the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Description

1. Regulatory Requirements
 - a. Tapping Sleeves shall meet or exceed AWWA C223 and the requirements of this Specification.
 - b. All valve components in contact with potable water shall conform to the requirements of NSF 61.

C. Tapping Sleeve Materials

1. Body
 - a. Full-body mechanical joint cast iron tapping sleeves shall be used for four-inch and larger connections to an existing water line.
 - b. Finish: fusion bonded epoxy coating to an average 12 mil thickness. Fusion applied per AWWA C213.
 - c. All buried tapping sleeves shall be provided with polyethylene encasement in accordance with AWWA/ANSI C105/A21.5.
2. Flange
 - a. Carbon Steel per ASTM A36 in accordance with AWWA C207 and ASME B16.1 Class 125.
 - b. Recessed for tapping valve per MSS SP-60

3. Bolts and Nuts
 - a. Flanged Ends
 - 1) Outlet flange shall conform to class 125 ANSI B 16.1.
 - 2) Provide bolts and nuts in accordance with Section 33 05 22.
4. Gaskets
 - a. Provide gaskets in accordance with Section 33 05 22.
5. Test Plug
 - a. ¾-inch NPT carbon steel with square head and fusion bonded epoxy coating

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION

- A. Verification of Conditions
 1. Verify by exploratory excavation, if needed, that existing water main is as depicted in the Drawings and that the location is suitable for a connection to the existing water main.
 - a. Excavate and backfill trench for the exploratory excavation in accordance with 33 05 06.
 2. Verify that all equipment and materials are available on-site prior to the shutdown of the existing main.
 3. Pipe lines shall be completed, tested and authorized for connection to the existing system in accordance with Section 33 01 13.

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. General
 1. Connections to an existing system shall be accomplished without interrupting normal service, wherever possible.
 2. Upon disruption of the existing water main, continue Work until the connection is complete and the existing water main is back in service.

- a. The contractor shall be responsible for the advance notification to individuals affected by the interruption of service.
 - b. Notifications must be written and include the date, time and the proposed duration of interrupted service.
 3. In-line installations and extensions that require the operation of valves within the serviced system shall be scheduled in advance and must be approved by the Public Work Department.
 - a. City personnel will make all shut-outs on existing mains.
 4. Unless otherwise approved, connections to an existing system shall be pressure tapped.
 - a. A pressure tap shall consist of connecting new piping to the existing water system by drilling into the existing pipe while it is carrying water under normal pressure, without taking the existing piping out of service.
 - b. The contractor shall perform all excavation, furnish and install tapping sleeve, valves and accessories in conformance with these specifications and provide the tapping machine and drill the tap and shall block, cradle and backfill the piping, valve and all accessories.
 5. All service connections shall be constructed in accordance with "Standards Details," and all service connections shall be inspected prior to any cover up by a representative from the City's Line Repair Department.
- B. Procedure
1. Expose the proposed connection point.
 2. Dewater the existing water line so the chlorinated water is not unlawfully discharged.
 3. Maintain the water that may bleed by existing valves or plugs during installation within the Work area to a reasonable level.
 - a. Control the water in such a way that it does not interfere with the proper installation of the connection or create a discharge of chlorinated water.
 4. If any discharge of chlorinated water occurs, discharged water shall be de-chlorinated in accordance with Section 33 01 13.
 5. Cut and remove existing water main in order to make the connection.
 6. Verify that the existing pipe line is suitable for the proposed connection.
 7. Place trench foundation and bedding in accordance with 33 05 06.

8. In the event that a tapping sleeve and valve is used, the coupon from the existing water main shall be submitted to the City.
9. Prevent embedment, backfill, soil, water or other debris from entering the pipeline.
10. Establish thrust restraint as provided for in the Drawings.
11. Clean and disinfect the pipeline associated with the connection in accordance with Section 33 01 13.
12. Place embedment to the top of the pipe zone.
13. Request that the City Valve Crew re-pressurize the pipeline.
14. Directionally flush the connection in accordance with Section 33 01 13.
15. Request that City Valve Crew open all remaining valves.

3.5 REPAIR/RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 14 30

COMBINATION AIR VALVE ASSEMBLIES FOR POTABLE WATER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. 1-inch to 8-inch Combination Air-Release and Air/Vacuum Valve Assemblies (Combination Air Valves) for potable water systems including:
 - a. Combination air-release and air/vacuum valve
 - b. Tap to water main
 - c. Lead-free Inlet piping and appurtenances
 - d. Vent piping and appurtenances
 - e. Vault enclosure and appurtenances
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 2. Section 33 05 19 – Ductile Iron Pipe and Fittings.
 - 3. Section 33 05 60 – Pre-cast Concrete Manholes and Bases.
 - 4. Section 33 05 84 – Gate Valves.
 - 5. Section 33 14 12 – Water Services and Service Connections.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Water Air Release Valve and Vault
 - a. Measurement
 - 1) Measured by each “Water Air Release Valve and Vault” installed.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each “Water Air Release Valve and Vault installed for:
 - a) Various inlet sizes.
 - c. The price bid shall include:
 - 1) Furnishing and installing Combination Air Valves as specified in the Drawings
 - 2) Air valve vault and appurtenances
 - 3) Tapping the main
 - 4) Isolation valves
 - 5) Fittings
 - 6) Vent piping
 - 7) Vent cover and/or enclosure (if required)
 - 8) Vent enclosure and/or pipe bollard protection (if required)
 - 9) Excavation and backfill

1.3 REFERENCES

A. Definitions

1. Combination Air Valve: A device having the features of both an air-release valve and an air/vacuum valve
2. Inlet: The opening at the base of the Combination Air Valve mechanism through which air and water from the pipeline enters
3. Inlet Piping: The piping and appurtenances between the pipeline and the valve inlet
4. Lead-free: Lead-free pipes and plumbing fittings and fixtures shall contain less than 0.25 percent lead in accordance with the reduction of Lead in Drinking Water Act (P.L. 111-380)
5. Orifice: The opening in the Combination Air Valve mechanism through which air is expelled from or admitted into the pipeline or piping system. Some valves may have multiple orifices
6. Outlet: The opening at the top of Combination Air Valve mechanism, including the orifice, through which air enters or exits the Air Valve
7. Vent Piping: The piping and appurtenances from the Combination Air Valve outlet to its termination point outside the vault

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Iron and Steel Institute (AISI).
3. ASTM International (ASTM):
 - a. A123, Standard Specification for Zinc (Hot-Dip) Galvanized) Coatings on Iron and Steel Products.
 - b. A536, Standard Specification for Ductile Iron Castings.
4. American Water Works Association (AWWA):
 - a. M51, Air-Release, Air/Vacuum, and Combination Air Valves.
5. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
 - a. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
6. NSF International (NSF):
 - a. 61, Drinking Water System Components - Health Effects.
 - b. 372, Drinking Water System Components – Lead Content.
7. Reduction of Lead in Drinking Water Act
 - a. Public Law 111-380 (P.L. 111-380).

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Combination Air Valves
 - a. Application type
 - b. Working pressure rating
 - c. Test pressure rating
 - d. Surge pressure rating
 - e. Inlet size
 - f. Small orifice size
 - g. Large orifice size
2. Valve vault and appurtenances
3. Tapping appurtenances
4. Isolation valves
5. Fittings
6. Vent piping
7. Vent cover and/or enclosure
8. Vent enclosure and/or pipe bollard protection

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
 - a. Combination Air Valves of the same size shall be the product of 1 manufacturer, unless approved by the City.
 - b. Combination air valves shall be in conformance with AWWA C512.

B. Certifications

1. Obtain an Affidavit of Compliance from the valve manufacturer in accordance with AWWA C512.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Protect all parts such that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
2. Protect all equipment and parts against any damage during a prolonged period at the site.
3. Protect the finished surfaces of all exposed flanges by wooden blank flanges.
4. Protect finished iron or steel surfaces not painted to prevent rust and corrosion.
5. Prevent plastic and similar brittle items from being directly exposed to sunlight or extremes in temperature.
6. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Standard Product List
 - a. See League City Standard Product List for approved manufacturers.

B. Description

1. Regulatory Requirements
 - a. Combination Air Valves in accordance with the requirements of AWWA C512 and this Section.
 - b. All Combination Air Valve components in contact with potable water shall conform to the requirements of NSF 61 and NSF 372.

C. Performance / Design Criteria

1. Capacities
 - a. Water Application = Potable Water
 - b. Working Pressure from 10 psi to 150 psi
 - c. Maximum Test Pressure = 200 psi
 - d. Surge Pressure = 100 psi minimum, unless stated otherwise in the Contract Documents
 - e. Size
 - 1) Each orifice size must be sufficient to meet the requirements set forth in AWWA M51 and specified in the Drawings.
2. Function
 - a. High volume discharge during pipeline filling
 - b. High volume intake through the large orifice
 - c. Pressurized air discharge
 - d. Surge Dampening/Controlled discharge rates
 - 1) Provide valve with an integral surge alleviation mechanism which operates automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of the separated water columns.
 - a) Achieve the limitation of the pressure rise by decelerating the approaching water, prior to valve closure.

D. Materials

1. Combination Air Valve
 - a. Internal parts
 - 1) Non-corroding material such as stainless steel or high-density polyethylene
 - b. Valve body
 - 1) AISI 304 stainless steel or ASTM A536 ductile iron
 - 2) Equipped with intake and discharge flanges
 - c. Inlet/Discharge orifice area
 - 1) Equal to the nominal size of the valve

E. Finishes

1. Finish Materials

- a. Supply all ductile iron Combination Air Valves with a factory applied fusion bonded epoxy coating with a final coating thickness of 16 mils minimum.

2.3 ACCESSORIES

A. For 1-inch and 2-inch Combination Air Valve Assemblies:

- 1. Tap
 - a. Provide 4-inch flanged outlet with blind flange and threaded tap (C.C. thread with flare) of same size as valve.
 - b. Provide corporation stop of same size as valve.
- 2. Inlet Piping and Isolation Valve
 - a. Same size as valve assembly between the tap and the isolation valve with the following:
 - 1) Threaded, lead-free brass piping
 - 2) Threaded, lead-free brass elbows
 - 3) Threaded, lead-free brass 1/4 turn ball valve.
- 3. Vent Piping
 - a. Stainless steel piping and fittings in accordance with ASTM A123, same size as valve assembly.
 - 1) Underground piping should be threaded and include a pipe union inside enclosure to allow disassembly.
 - 2) Provide frangible connection at ground level designed to be breakable upon impact.
 - 3) Pipe to extend a minimum 2 feet above ground level.
- 4. Vent Screen
 - a. Stainless Steel (AISI 304)
- 5. Vent Piping - Dropover Enclosure
 - a. Channell SPH-1420 thermoplastic enclosure, or approved equal
- 6. Air Valve Enclosure
 - a. Provide a Bass & Hays 55A Water Meter Box/Can in accordance with Section 33 14 12.
- 7. Pipe Embedment
 - a. Embed inlet piping in crushed rock in accordance with Section 33 05 06.
 - b. Embed water main piping in same embedment required for water main specified in the Drawings.

B. For 3-inch to 8-inch Combination Air Valve Assemblies:

- 1. Tap
 - a. Buried Steel or Concrete Pressure Pipe:
 - 1) Fabricated flanged outlet
 - a) 24-inch outlet for 24-inch water mains
 - b) 30-inch outlet for 30-inch and larger water mains
 - 2) Fabricated steel reducing flange of same size as valve assembly.
 - 3) Provide flange isolation kit between isolation valve and reducing flange.
 - b. Ductile Iron or PVC Pipe:
 - 1) Mechanical joint by flanged ductile iron tee in accordance with Section 33 05 19.
 - a) Outlet same size as main for 24-inch and smaller water mains
 - b) 30-inch flanged outlet for 30-inch and larger water mains
 - 2) Ductile iron blind flange with threaded by flanged spool piece of same size as valve assembly.

2. Isolation Valves
 - a. Flange by flange resilient seated gate valve with hand wheel in accordance with Section 33 05 84, of same size as valve assembly.
3. Vent Piping
 - a. Ductile iron piping and fittings in accordance with Section 33 05 19.
 - 1) Size pipe to match size of valve assembly outlet, but no less than 4-inch diameter.
 - 2) Provide flange joints for all pipe and fittings, except for 1 mechanical joint solid sleeve inside enclosure to allow disassembly.
 - 3) Provide frangible connection at ground level designed to be breakable upon impact.
 - 4) Pipe to extend a minimum 2 feet above ground level.
4. Vent Screen
 - a. Stainless Steel (AISI 304)
5. Vent Piping - Dropover Enclosure
 - a. Channell SPH-1420 thermoplastic enclosure, or approved equal
6. Vault
 - a. Provide a flat top, cast-in-place, or precast concrete manhole in accordance with Sections 33 05 60.
 - 1) 6-foot diameter manhole for 3-inch and 4-inch combination air valve assemblies
 - 2) 7-foot diameter manhole for 6-inch and 8-inch combination air valve assemblies
 - b. Provide frame, cover, and grade rings.
 - c. Secure Air Valve to vault wall using a galvanized or stainless-steel bracket manufactured by Grinell, or equal, in accordance with the Drawings.
 - d. Provide 4-inch PVC drainpipe and crushed rock in accordance with Section 33 05 06 and the Drawings.
7. Pipe Embedment
 - a. Concrete encase water main entirely beneath proposed vault in accordance with Section 33 05 06.

C. Finishes

1. Steel pipe and fittings shall be hot-dip galvanized in accordance with ASTM A123.
2. Ductile iron pipe and fittings shall be coated and lined in accordance with Section 33 05 19.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Test and inspect Combination Air Valves in accordance with AWWA C512.

B. Markings

1. Mark each Combination Air Valve in accordance with AWWA C512.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install in accordance with manufacturer's recommendations and as specified in the Drawings.
2. Wrap all buried ductile iron pipe and fittings with polyethylene encasement in accordance with Section 33 05 19.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

A. Field Inspections

1. Ensure both the large and small orifices connect to the vent piping.
2. The valve shall perform as intended with no deformation, leaking or damage of any kind for the pressure ranges indicated.
3. Before acceptance of the installed valve, provide the City the opportunity to inspect and operate the valve.
 - a. The City will assess the ease of operating the ball valves and corporation stops, where applicable.
4. The Combination Air Valve assembly shall be free from any leaks.

B. Non-Conforming Work

1. If access and operation of the valve or its appurtenances does not meet the City's criteria, the Contractor will remedy the situation until it meets the City's criteria, at the Contractor's expense.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 31 16
SANITARY SEWER SERVICE CONNECTIONS AND SERVICE LINE

PART 1 - GENERAL

1.1 SUMMARY

- A. Sanitary sewer service connections, service line, and cleanout appurtenances for:
 - 1. New Service.
 - 2. New Bored Service.
 - 3. New Service (City performed).
 - 4. Private Service Relocations.
 - 5. Service Reinstatement.
 - 6. Sanitary Sewer Mainline Cleanout.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to
 - 1. Section 33 05 06 – Pipe Bedding and Backfill Material.
 - 2. Section 33 05 19 – Ductile Iron Pipe and Fittings.
 - 3. Section 33 05 31 – Polyvinyl Chloride (PVC) Pressure Pipe.
 - 4. Section 33 05 32 – Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe.
 - 5. Section 33 05 38 – High Density Polyethylene (HDPE) Pipe.

1.2 PRICE AND PAYMENT PROCEDURES

- 1. New Sewer Service
 - a. Measurement
 - 1) Measurement for this Item shall be per each “Sewer Service” complete in place.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this Item will be paid for at the unit price bid per each “Sewer Service” installed for:
 - a) Various sizes.
 - b) Various materials.
 - c. The price bid shall include:
 - 1) Furnishing and installing New Sanitary Sewer Service Line as specified by the Drawings
 - 2) Service line installed by open cut
 - 3) Temporary lighting
 - 4) Traffic Control associated with connection
 - 5) Pavement removal
 - 6) Plating of open trenches
 - 7) Excavation
 - 8) Hauling
 - 9) Disposal of excess material
 - 10) Wye connection to main

- 11) Fittings
 - 12) Cleanout and cap with box
 - 13) Surface restoration
 - 14) Furnishing, placement, and compaction of embedment
 - 15) Furnishing, placement, and compaction of backfill
 - 16) Concrete encasement for deep services
 - 17) Clean-up
2. New Bored Sewer Service
- a. Measurement
 - 1) Measurement for this Item shall be per each “Bored Sewer Service” complete in place.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this Item will be paid for at the unit price bid per each “Sewer Service” installed for:
 - a) Various sizes.
 - b) Various materials.
 - c. The price bid shall include:
 - 1) Furnishing and installing New Sanitary Sewer Service Line as specified by the Drawings
 - 2) Service line installed by directional drilling
 - 3) Temporary lighting
 - 4) Traffic Control associated with connection
 - 5) Pavement removal
 - 6) Plating of open trenches
 - 7) Excavation
 - 8) Hauling
 - 9) Disposal of excess material
 - 10) Wye connection to main
 - 11) Fittings
 - 12) Cleanout and cap with box
 - 13) Surface restoration
 - 14) Furnishing, placement, and compaction of embedment
 - 15) Furnishing, placement, and compaction of backfill
 - 16) Concrete encasement for deep services
 - 17) Clean-up
3. Private Service Relocation
- a. Measurement
 - 1) Measured horizontally along the surface from center line to center line of the fitting, manhole, or appurtenance.
 - b. Payment
 - 1) The Work performed and the materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Private Sewer Service” installed for:
 - a) Various sizes.
 - b) Various materials.
 - c. The price shall include:
 - 1) Obtaining required Permit(s)
 - 2) Obtaining Right of Entry

- 3) Performing relocation as specified in the Drawings
 - 4) Excavation
 - 5) Hauling
 - 6) Disposal of excess material
 - 7) Service Line - private side by plumber
 - 8) Fittings
 - 9) Furnishing, placement, and compaction of embedment
 - 10) Furnishing, placement, and compaction of backfill
 - 11) Clean-up
 - 12) Surface restoration
4. Sanitary Sewer Mainline Cleanout
- a. Measurement
 - 1) Measurement for this item shall be per each "Sanitary Sewer Mainline Cleanout" complete in place.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item will be paid for at the unit price bid per each "Sanitary Sewer Mainline Cleanout" installed for:
 - a) Various sizes.
 - b) Various materials.
 - c. The price bid shall include:
 - 1) Furnishing and installing Sanitary Sewer Mainline Cleanout as specified by the Drawings
 - 2) Temporary lighting
 - 3) Traffic Control associated with connection
 - 4) Pavement removal
 - 5) Plating of open trenches
 - 6) Excavation
 - 7) Hauling
 - 8) Disposal of excess material
 - 9) Wye connection to main
 - 10) Fittings
 - 11) Cleanout and cap with box
 - 12) Surface restoration
 - 13) Furnishing, placement, and compaction of embedment
 - 14) Furnishing, placement, and compaction of backfill
 - 15) Concrete encasement
 - 16) Clean-up

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section, unless a date is specifically cited.
2. ASTM International (ASTM):
 - a. ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

- b. ASTM C1173, Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
- c. ASTM D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- d. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Scheduling

- 1. Provide advance notice for service interruption to property owner in accordance with Section 01 35 13.
- 2. Service interruptions may only occur during normal business hours from Monday through Friday, unless otherwise approved by the City.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product data shall include, if applicable:

- 1. Wye connection or saddle
- 2. Fittings (including type of cleanout)
- 3. Service line

B. Certificates

- 1. Furnish an affidavit certifying service line and fittings are in accordance with this Section.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

- 1. Pipe manufactured more than 2 years prior to installation date will not be accepted by the City.

B. Storage and Handling Requirements

- 1. Pipe and other material shall be stored and handled in accordance with the manufacturer's guidelines.
- 2. Protect pipe from UV exposure.
 - a. When long-term storage (more than 2-months) with exposure to direct sunlight is unavoidable, cover PVC pipe with an opaque material and provide adequate air circulation above and around the pipe as required to prevent excessive heat accumulation.
- 3. Secure and maintain a location to store the material in accordance with Section 01 66 00.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.
3. The services and appurtenances shall be new, and the product of a manufacturer regularly engaged in the manufacturing of services and appurtenances having similar service and size.

B. Materials/Design Criteria

1. Service Line and Fittings (including wye connections)
 - a. Service line pipe and fittings shall meet the requirements and be of the same material as the corresponding main line pipe to which it is connected.
 - 1) PVC Pipe and Fittings
 - a) City Right-of-Way
 - (1) In accordance with Section 33 05 31 or 33 05 32.
 - (2) Pipe shall be green in color. Any discoloration in the pipe shall be sufficient cause for rejection.
 - 2) Private plumbing
 - a) Schedule 40 in accordance with ASTM D1785.
 - 3) Ductile Iron Pipe and Fittings
 - a) Lined with ceramic epoxy in accordance with Section 33 05 19.
 - 4) HDPE Pipe and Fittings
 - a) In accordance with Section 33 05 33.
2. Service saddle
 - a. Only allowed when connecting a new service to an existing sanitary sewer main
 - b. "Inserta Tee" type service connections preferred.
 - c. Be a 1-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket for seal against main
 - d. Use saddle to fit outside diameter of main
 - e. Use saddle with grooves to retain band clamps
 - f. Use at least 2 stainless steel band clamps for securing saddles to the main
3. Cleanout and Box
 - a. Unpaved Areas per City Standard Details.
 - b. Paved Areas per City Standard Details
4. Coupling
 - a. For connections between new PVC pipe stub out and existing clay and concrete service line, use rubber sleeve couplings with stainless steel double-band repair sleeves with shear guard to connect to the line.
 - b. Follow manufacturer recommendations for all pipe materials.

2.2 ACCESSORIES [NOT USED]

2.3 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS

- A. A licensed plumber is required for installations of the service line on private property.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. General

1. Install service line, fittings, and cleanouts in accordance with this Section, Section 33 05 06, and the pipe manufacturer's recommendations.

B. Handling

1. Haul and distribute service lines, fittings, and cleanouts at the project site and handle with care to avoid damage.
 - a. Inspect each segment of service line and reject or repair any damaged pipe prior to lowering into the trench.
2. Do not handle the pipe in such a way that will damage the pipe.

C. Service Line

1. All service leads shall be constructed per the City Detail.
2. Sewer service leads shall be installed integrally with the construction of the sewer main, where possible, using "All Bell" gasket fittings.
3. The minimum service connection shall be six (6) inches in diameter and 4 inch for single connections where approved.
4. Direct taps on an existing PVC sewer main shall be Inserta Tee.
5. Risers or vertical stacks shall be required for service leads to sewer mains eight (8) feet and deeper. Connection fittings and pipe material shall be same as specified above.
6. Lay service line at a minimum grade of 2 percent, as shown on City Standard details, or at lines and grades as indicated in the Drawings.
7. If service line is installed by bore as an alternative to open cut, the cost associated with open cut installation, such as pavement removal, trenching, embedment, backfill, and pavement patch will not be included as part of the bore installation.
8. Excavate and backfill trenches in accordance with 33 05 06.
9. Embed pipe in accordance with 33 05 06.

D. Cleanout

1. Install out of paved areas such as driveways, streets, and sidewalks whenever possible.
 - a. When not possible, install cast iron boot and cap and reference the City Standard Details.
 - b. Maximum depth 5ft.

E. Service line connection to main

1. Orient fitting at the 10:00 or 2:00 position.
2. New service on new or replacement main
 - a. Determine location of service connections before main installation so the service fittings can be installed during main installation.
 - b. Connect service line to main with an Inserta Tee.
3. Reconnection to main after pipe enlargement or slip lining
 - a. Tapping the existing main and installing a strap on wye connection may be used.
 - b. Allow the new main to recover from imposed stretch before tapping and service installation.
 - 1) Follow manufacturer's recommendation for the length of time needed.
 - c. Extend service line from main to property line or easement line before connecting to the existing service line.
4. New service on existing main
 - a. Connect service line to main with Inserta Tee.
 - b. Tapping the existing main and installing a strap on wye connection may be used if approved.

F. Service Taps into Manholes

1. Chipping into manhole will not be allowed.
2. Service taps into existing manholes shall be a minimum of 6-inches in diameter and be made by means of core cutting into the manhole with approved equipment.
3. The core cut shall be of sufficient size as to allow for 6-inch service line and approved gasket type (Link-Seal) sealing material.
4. Upon passing inspection the core cut shall be grouted over with Quikrete or approved equal non shrink grout inside and out per ASTM C1107.
5. On inside of manhole, all exposed cured grout and any concrete exposed from tap shall be coated with Thane Coat or approved equal, feathered out onto manhole wall a minimum of 6 inches from edge of core cut.

G. Private Service Relocation

1. Requirements for the relocation of service line on private property:
 - a. A licensed plumber must be used to install service line on private property.
 - b. Obtain permit from City for Work on private property.
 - c. Pay for any inspection or permit fees associated with Work on private property.
 - d. Verify (by Exploratory Excavation of Existing Utilities) the elevations at the building cleanout and compare to data on the Drawings before beginning service installation.
 - e. Submit elevation information to the City inspector.
 - f. Verify the 2 percent slope installation requirement can be met.
 - 1) If the 2 percent slope cannot be met, verify with the City that the line may be installed at the lesser slope.

H. Saddles

1. Saddles shall be installed in accordance with manufacturer's recommendation.
2. Holes for saddle connections shall be made by a mechanical hole cutter to conform to the fitting.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION

A. Service Relocation

1. All relocations that are not installed as designed or fail to meet the City code shall be reinstalled at the Contractor's expense.

3.7 FIELD QUALITY CONTROL

A. Inspections

1. Private property service line requires approval by the City plumbing inspector before final acceptance.
2. Cleanout stack shall be vertical and cleaning wye should be visible from the cleanout above. If cleanout stack is not vertical and the cleanout wye is not visible, then the cleanout stack must be re-installed at no additional cost.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 31 30

LINERS FOR SANITARY SEWER STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Application of a corrosion protection coating system to concrete utility structures such as manholes, lift station wet wells, junction boxes, or other concrete facilities that may require protection from corrosive materials.
 - a. This covers rehabilitation of existing sanitary sewer structures and newly installed sanitary sewer structures.
2. Structures to be coated include all force main discharge manholes, pre-cast manholes, junction structures, lift station wet wells, the manhole preceding a wet well, and any other manhole or structure as specified in the Drawings.

B. Related Specification Sections include but are not limited to:

1. Section 33 01 14 – Sewer and Manhole Testing.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Manholes
 - a. Measurement
 - 1) Measured per vertical foot of coating, as measured from the benching to the bottom of the grade rings for new Cast-in-Place manhole installation and from the benching to the bottom of the frame for all types of manhole rehabilitations.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per vertical foot of “Manhole Liner” applied for:
 - a) Various sizes.
 - b) Various types.
 - c. The price bid shall include:
 - 1) Removal of roots
 - 2) Removal of existing liner
 - 3) Eliminating any leaks
 - 4) Removal of steps
 - 5) Repair/seal connection of the existing frame to chimney
 - 6) Repairs of any cracks in the existing structure chimney, corbel (cone), wall, bench, including any replacement of damaged rebar, and pipe
 - 7) Surface cleaning and preparation
 - 8) Furnishing and installing liner as specified by the Drawings
 - 9) Hauling
 - 10) Disposal of excess material
 - 11) Site Clean-up
 - 12) Manhole and Invert Cleaning

- 13) Testing
- 2. Non-Manhole Structures
 - a. Measurement
 - 1) Measured per square foot of area where the liner is applied.
 - b. Payment
 - 1) The Work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per square foot of “Structure Liner” applied.
 - c. The price bid shall include:
 - 1) Removal of roots
 - 2) Removal of existing liner
 - 3) Eliminating any leaks
 - 4) Removal of steps
 - 5) Repair/seal connection of the existing frame to chimney
 - 6) Repairs of any cracks in the existing structure chimney, corbel (cone), wall, bench, including any replacement of damaged rebar, and pipe
 - 7) Surface cleaning and preparation
 - 8) Furnishing and installing Liner as specified by the Drawings
 - 9) Lining of wet well floor in new applications only
 - 10) Hauling
 - 11) Disposal of excess material
 - 12) Site Clean-up
 - 13) Manhole and Invert Cleaning
 - 14) Testing

1.3 REFERENCES

- A. Definitions
 - 1. Liner – Mechanical installation.
 - 2. Coating – Spray or manual installation
- B. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. ASTM International (ASTM):
 - a. D543, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
 - b. D638, Standard Test Method for Tensile Properties of Plastics.
 - c. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
 - d. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - e. D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
 - f. D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
 - 3. The Society for Protective Coatings/NACE International (SSPC/NACE):
 - a. SP 13/NACE No. 6, Surface Preparation of Concrete.
 - b. SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequencing

1. All paving activities, including any final grade adjustments for manholes outside pavement, shall be completed before Contractor begins lining Work.
2. After liner installation, Contractor shall wait a minimum of 48 hours to allow the liner material to fully cure before returning the system to normal service.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Technical data sheet on each product used.
2. Material Safety Data Sheet (MSDS) for each product used.
3. Technical data sheet and project specific data for repair materials to be top-coated with the lining product including application, cure time, and surface preparation procedures.
4. Material and method for repair of leaks or cracks in the structure. For repair Work on existing structures, manholes.
5. Newly installed manholes (including Developer projects) that have been identified with cracks, voids, signs of infiltration, other structural defects, or other related construction damage.

B. Certification

1. Current documentation from coating product manufacturer certifying Contractor's training (and/or licensure) as an approved installer and equipment compliance with the Quality Assurance requirements.

1.7 CLOSEOUT SUBMITTALS

A. Testing Documentation

1. Provide test results required in Article 3.7 to City.
 - a. Include the following manhole or structure location information:
 - 1) Station number.
 - 2) GIS ID number, if provided during construction.
 - b. Inspection report of each manhole/structure tested.

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Qualifications

1. Contractor
 - a. Trained by, or have training approved and certified by, the coating product manufacturer for the handling, mixing, application, and inspection of the coating product(s) to be used.

- b. Initiate and enforce quality control procedures consistent with the lining product(s) manufacturer recommendations and applicable NACE or SSPC standards.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Keep materials dry, protected from weather, and stored under cover.
3. Store lining materials per manufacturer's recommendation.
4. Do not store near flame, heat, or strong oxidants.
5. Handle lining materials according to their material safety data sheets.

1.11 FIELD CONDITIONS

- A. Provide confined space entry, flow diversion, and/or bypass plans as necessary to perform the specified Work. Active flows shall be diverted with flow through plugs as required to ensure that flow is maintained off the surfaces to be lined.

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-FURNISHED PRODUCTS [NOT USED]

2.2 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Manufacturers

1. Only the manufacturers as listed on the City's Standard Products List will be considered as shown in Section 01 60 00.
 - a. The manufacturer must comply with this Specification and related Sections.
2. Any product that is not listed on the Standard Products List is considered a substitution and shall be submitted in accordance with Section 01 25 00.

B. Repair and Resurfacing Products

1. Compatible with the specified coating product(s) in order to bond effectively, thus forming a composite system
2. Used and applied in accordance with the manufacturer's recommendations

C. Lining Product

1. Capable of being installed and curing properly within a manhole or other concrete structure.
2. Resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems, and capable of adhering to typical manhole structure substrate

D. Coating Application Equipment

1. Manufacturer approved, heated, plural component spray equipment.
2. Hard to reach areas, primer application, and touch-up may be performed using hand tools.
3. Applicator shall use approved specialty equipment adequate in size, capacity, and number sufficient to accomplish the Work in a timely manner.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS

- A. All installers shall be certified applicators approved by the manufacturers. Applicator shall use adequate number of skilled, trained, experienced workmen for the approved product.

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. Manhole Preparation

1. Manhole preparation shall be per manufacturer's recommendations

B. Surface Preparation

1. Remove oils, roots, grease, incompatible existing coatings, linings, waxes, form release, curing compounds, efflorescence, sealers, salts or other contaminants which may affect the performance and adhesion of the lining to the substrate.
2. Remove any steps found in the structure.
3. Remove concrete and/or mortar damaged by corrosion, chemical attack, or other means of degradation so only sound substrate remains.
4. Surface preparation method, or combination of methods, to be used are high pressure water cleaning, high pressure water jetting, abrasive blasting, shotblasting, grinding, scarifying, detergent water cleaning, hot water blasting, and others in accordance with SSPC SP 13/NACE No. 6.
5. All methods used shall be performed in a manner that provides a uniform, sound, clean, neutralized, surface suitable for the specified lining product.
6. After completion of surface preparation, inspect for leaks, cracks, holes, exposed rebar, ring and cover condition, invert condition, and inlet/outlet pipe condition.
7. After defects in the structure have been identified, seal cracks, repair exposed rebar with new rebar to match existing, repair leaks and cracks with grout or other methods approved by the Manufacturer.
 - a. All new rebar shall be embedded in 1 1/2-inch epoxy mastic.
 - b. Replace/seal connection between existing frame and chimney if found loose or not attached.

3.4 INSTALLATION

A. General

1. Perform coating after the sewer line installation/repairs, grade adjustments, and grouting are complete.
2. Perform application procedures in accordance with the recommendations of the lining product manufacturer, including environmental controls, product handling, mixing, and application.

B. Temperature

1. Only perform application if surface temperature is per manufacturer's recommendations.
2. Make no application if freezing is expected to occur inside the manhole within 24 hours after application.

C. Coating

1. Spray apply in accordance with the manufacturer's recommendation at a minimum film thickness as noted in Section 2.2.
2. Apply coating from and including the bench to the bottom of the grade rings for new installations and to the bottom of the frame for rehab projects.
3. After walls are lined, remove bench covers and spray bench/trough to at a minimum the same thickness as the walls.
4. Apply any topcoat or additional coats within the product's recoat window.
 - a. Additional surface preparation is required if the recoat window is exceeded.
5. Allow a minimum of 3 hours of cure time or be hard to touch before reactivating flow.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD QUALITY CONTROL

- A. Each structure will be visually inspected by the City the same day following the application.
- B. Groundwater infiltration of the system shall be zero.
- C. All pipe connections shall be open and clear.
- D. The inspector will check for deficiencies, pinholes, voids, cracks, uncured spots, delamination, and thin spots. Any deficiencies in the liner shall be marked and repaired according to the procedures outlined by the Manufacturer.
- E. If leaks are detected they will be chipped back, plugged, and coated immediately with protective epoxy resin lining.
 1. Make repair 24 hours after leak detection.
- F. Lining Thickness Testing
 1. Wet Film Thickness Testing
 - a. Take wet film thickness gauge measurements in accordance with ASTM D4414 at 3 locations within the manhole, 2 spaced equally apart along the wall and 1 on the bench.
 - 1) Document and attest measurements and provide to the City.
 2. Thickness Testing for modified polymer liner system
 - a. Upon installation of the Final Corrosion Barrier, insert probe into substrate for depth of system measurement at 3 locations within the manhole, 2 spaced equally apart along the wall and 1 on the bench.
 - 1) Document and attest measurements and provide to the City.
- G. Post Installation Lining Tests
 1. Holiday Detection Testing

- a. Holiday Detection test the liner in accordance with NACE SP0188. Mark all detected holidays. Repair all holidays in accordance with coating manufacturer's recommendations.
 - 1) Document and attest all test results and repairs made and provide to the City.
 - 2) Contractor shall mark any location that shows a spark or potential for a pinhole and repair these locations in accordance with manufacturer recommendations.

H. Non-Conforming Work

1. City reserves the right to require additional testing depending on the rate of failure.
 - a. City will select testing locations.
2. Repair all defects according to the manufacturer's recommendations.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 42 11

STORMWATER PIPE AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufacturer, material, and installation requirements for:
 - a. Reinforced concrete pipe (circular, arch, and elliptical)
 - 1) RCP sizes under 18 inches are only permitted when written approval has been provided by the City Engineer prior to construction activities starting.
 - b. Reinforced concrete box
 - 1) RCB extended curb is only permitted when written approval has been provided by the City Engineer prior to construction activities starting.

B. Deviations from this City of League City Standard Specification:

1. None.

C. Related Specification Sections include but are not limited to:

1. Section 03 00 00 – Concrete and Concrete Reinforcing.
2. Section 03 30 00 – Cast-In-Place Concrete.
3. Section 33 01 30 – Closed Circuit Television (CCTV) Inspection.
4. Section 33 05 05 – Utility Trench, Excavation, Embedment, and Backfill.
5. Section 33 05 81 – Frame, Cover, and Grade Rings.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Reinforced Concrete Pipe
 - a. Measurement
 - 1) Measured per linear foot of Reinforced Concrete Pipe installed.
 - 2) Per linear foot from inside wall of manhole or JB.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Reinforced Concrete Pipe installed for:
 - a) Various sizes.
 - b) Various classes (Class III through V).
 - c. The price bid shall include:
 - 1) Furnishing and installing Reinforced Concrete Pipe as specified by the Drawings
 - 2) Hauling
 - 3) Fittings
 - 4) Joints
 - 5) Gaskets
 - 6) Dewatering
 - 7) Excavation

- 8) Furnishing, placement and compaction of embedment
 - 9) Furnishing, placement and compaction of backfill
 - 10) Disposal of excess material
 - 11) Connection to existing structures, pipes, and boxes
 - 12) Plugs
 - 13) Repair or replacing of materials
 - 14) Clean-up
2. Reinforced Concrete Arch Pipe
- a. Measurement
 - 1) Measured per linear foot of Reinforced Concrete Pipe installed.
 - 2) Per linear foot from inside wall of manhole or JB.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Reinforced Concrete Pipe installed for:
 - a) Various sizes.
 - b) Various classes (Class III through V).
 - c. The price bid shall include:
 - 1) Furnishing and installing Reinforced Concrete Arch Pipe as specified by the Drawings
 - 2) Hauling
 - 3) Fittings
 - 4) Joints
 - 5) Gaskets
 - 6) Dewatering
 - 7) Excavation
 - 8) Furnishing, placement and compaction of embedment
 - 9) Furnishing, placement and compaction of backfill
 - 10) Disposal of excess material
 - 11) Connection to existing structures, pipes, and boxes
 - 12) Plugs
 - 13) Repair or replacing of materials
 - 14) Clean-up
3. Reinforced Concrete Elliptical Pipe
- a. Measurement
 - 1) Measured per linear foot of Reinforced Concrete Pipe installed.
 - 2) Per linear foot from inside wall of manhole or JB.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for Reinforced Concrete Pipe installed for:
 - a) Various sizes.
 - b) Various classes (Class III through V).
 - c. The price bid shall include:
 - 1) Furnishing and installing Reinforced Concrete Elliptical Pipe as specified by the Drawings
 - 2) Hauling
 - 3) Fittings

- 4) Joints
 - 5) Gaskets
 - 6) Dewatering
 - 7) Excavation
 - 8) Furnishing, placement and compaction of embedment
 - 9) Furnishing, placement and compaction of backfill
 - 10) Disposal of excess material
 - 11) Connection to existing structures, pipes, and boxes
 - 12) Plugs
 - 13) Repair or replacing of materials
 - 14) Clean-up
4. Reinforced Concrete Box
- a. Measurement
 - 1) Measured per linear foot of Reinforced Concrete Box installed.
 - 2) Per linear foot from inside wall of manhole or JB.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per linear foot for Reinforced Concrete Box installed for:
 - a) Various sizes.
 - b) Various classes (Class III through V).
 - c. The price bid shall include:
 - 1) Furnishing and installing Reinforced Concrete Box as specified by the Drawings
 - 2) Curb less than 12 inches
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering
 - 11) Forms
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Joint sealant
 - 24) Excavation
 - 25) Furnishing, placement and compaction of embedment
 - 26) Furnishing, placement and compaction of backfill
 - 27) Disposal of excess material

- 28) Connection to existing structures, pipes, and boxes
- 29) Clean-up
- 5. RCB Extended Curb
 - a. Measurement
 - 1) Measured per linear foot of RCB Extended Curb installed.
 - 2) Per linear foot from inside wall of manhole or JB.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for RCB Extended Curb installed for:
 - a) Various heights (1 through 5 FT).
 - b) Linear foot is measured along the span length of the single or multiple box culvert length that the extended curb is needed.
 - c. The price bid shall include:
 - 1) Furnishing and installing RCB Extended Curb as specified by the Drawings
 - 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Dewatering
 - 10) Forms
 - 11) Trial batches (as needed)
 - 12) Materials and work needed for any corrective action
 - 13) Concrete
 - 14) Aggregate
 - 15) Supplementary cementing materials
 - 16) Concrete additives
 - 17) Mixing
 - 18) Placement of concrete
 - 19) Finishing of concrete
 - 20) Curing and curing compounds
 - 21) Sawing
 - 22) Connections
 - 23) Fittings
 - 24) Joints
 - 25) Joint sealant
 - 26) Excavation
 - 27) Furnishing, placement and compaction of embedment
 - 28) Furnishing, placement and compaction of backfill
 - 29) Disposal of excess material
 - 30) Connection to existing structures, pipes, and boxes
 - 31) Clean-up

1.3 REFERENCES

A. Abbreviations and Acronyms

1. LRFD – Load Resistance Factor Design
2. PSI – Pounds per Square Inch
3. RCP – Reinforced Concrete Pipe
4. RCB – Reinforced Concrete Box

B. Definitions

1. RCB Curb and Extended Curb
 - a. Any curb shorter than 12 inches from the top of the box to the top of the curb will be considered subsidiary to the RCB. Any curb taller than 12 inches will be included under RCB Extended Curb.

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO LRFD – AASHTO LRFD Bridge Design Specifications.
 - b. M36, Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
 - c. M170, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - d. M206, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe.
 - e. M207, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
 - f. M259, Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
 - g. M273, Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than Two Feet of Cover Subjected to Highway Loadings.
 - h. M274, Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe.
3. American Society for Testing and Materials (ASTM):
 - a. ASTM A760, Standard Specification for, Metallic-Coated for Sewers and Drains.
 - b. ASTM A929, Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe.
 - c. ASTM C76, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - d. ASTM C270, Standard Specification for Mortar for Unit Masonry.
 - e. ASTM C443, Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.
 - f. ASTM C506, Arch Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - g. ASTM C507, Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
 - h. ASTM C655, Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
 - i. ASTM C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - j. ASTM C1433, Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers.
 - k. ASTM C1577, Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designated According to AASHTO LRFD.

- l. ASTM C1619, Standard Specifications for Elastomeric Seals for Joining Concrete Structures.
- m. ASTM C1677, Standard Specification for Joints for Concrete Box, Using Rubber Gaskets.
- 4. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. DMS-7310, Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to purchasing of materials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Shop Drawings:
 - 1. Product Data
 - a. Reinforced Concrete Pipe and Reinforced Concrete Box
 - 1) Provide the following information on the product data submittal:
 - a) Product Type
 - b) Class of Concrete
 - c) Average length of pipe or box section
 - d) Type of jointing material used
 - e) Manufacturer recommendations for storage, handling, and installation of pipe, boxes, and joints.
- B. Information Submittals:
 - 1. Certificates:
 - a. Provide the manufacturer's certificate of compliance providing their product meets the physical testing requirements of this specification and DMS 7310 for the materials referenced which may include, but are not limited to:
 - 1) Concrete mix design and reinforcing
 - 2) Reinforced concrete pipe
 - 3) Reinforced concrete arch pipe
 - 4) Reinforced concrete elliptical pipe
 - 5) Reinforced concrete box
 - 6) Jointing materials
 - 7) Corrugated Metal pip
 - 2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. General
 - a. Keep all pipes and boxes clean and drained during storage.
 - b. Transport, handle, and store pipe, boxes, and fittings as recommended by the supplier or manufacturer.
 - c. Replace any pipe or box that is damaged during transport prior to installation at no cost to the City.
3. Reinforced Concrete Pipe (RCP)
 - a. Markings
 - 1) Mark each section of reinforced concrete pipe with the following information:
 - a) Class of pipe
 - b) ASTM designation
 - c) Date of manufacture
 - d) Pipe size
 - e) Name or trademark of fabricator and plant location
 - f) Designated fabricator's approval stamp
 - g) Pipe to be used for jacking and boring (when applicable)
 - h) Designation "SR" for pipe meeting sulfate-resistant concrete plan requirements (when applicable)
 - 2) Clearly mark 1 end of each section during manufacturing or immediately after for elliptical pipes.
 - 3) For Non-Circular Pipes: Mark the pipe on the inside and outside of opposite walls to show the location of the top or bottom of the pipe as it should be installed.
4. Reinforced Concrete Box
 - a. Store and ship machine-made precast boxes in accordance with DMS-7310.
 - b. Markings:
 - 1) Mark precast boxes with the following information:
 - a) Name or trademark of manufacturer
 - b) ASTM designation
 - c) Date of manufacture
 - d) Box size
 - e) Minimum and maximum fill heights
 - f) Designated fabricator's approval stamp
 - g) Boxes to be used for jacking and boring (when applicable)
 - h) Designation "SR" for boxes meeting sulfate-resistant concrete plan requirements (when applicable)
 - 2) Mark 1 end of each box section without lifting holes on the inside and outside walls to indicate the top or bottom as it will be installed.
 - 3) Indent markings into the box section or paint them on each box with waterproof paint.
5. Pre-Formed Flexible Joint Sealants

- a. Store pre-formed flexible joint sealants in an area warmed naturally or artificially to above 70 degrees Fahrenheit in an approved manner when the atmospheric temperature is below 60 degrees Fahrenheit.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MANUFACTURERS

- A. Concrete (RCP and RCB):
 1. Class P:
 - a. Provide Class P concrete in accordance with Section 03 00 00 with greater than 2 feet of cover, including top bedding.
 2. Class S:
 - a. Provide Class S concrete in accordance with Section 03 00 00 with 0 to 2 feet of cover, including top bedding.
 3. Machine-Made Precast:
 - a. Provide the class of concrete required based on available cover. Provide machine-made precast reinforced concrete box, when possible, in accordance with DMS-7310.
 4. Cast-in-Place:
 - a. Provide the class of concrete required based on available cover. Conform to requirements in Section 03 30 00 and DMS-7310.
 5. Formed Precast:
 - a. Not permitted for use.
- B. Reinforcement (Cast-in-Place RCB):
 1. Provide grade 60 steel reinforcing in accordance with Section 03 00 00.
 2. Provide a minimum of 2 inches of cover on all reinforcing unless otherwise noted.
- C. Reinforced Concrete Pipe (RCP):
 1. Circular Pipe
 - a. In accordance with ASTM C76, ASTM C655, and AASHTO M170.
 - b. Provide circular pipe based on the classes specified in the Drawings and Table 1. Provide the required class of pipe based on the pipe cover from:
 - 1) Top of ground to top of pipe
 - 2) Top of pavement to top of pipe
 - c. If the Drawings do not show the correct pipe class based on cover, obtain written direction from the City prior to installing the pipe.

Table 1
Circular Pipe Class and D-Load

Pipe Class	D-Load	Minimum Pipe Cover (FT)
3 (III)	1,350	2
4 (IV)	2,000	1 to 2
5 (V)	3,000	Direct Traffic Loading (0 to 1)

2. Arch Pipe
 - a. In accordance with ASTM C506 and AASHTO M206.
 - b. Maintain a minimum 1-foot cover from top of ground or pavement to top of pipe.
 - c. Provide arch pipe design sizes in accordance with Table 2.

Table 2
Arch Pipe

Design Size	Equivalent Diameter (in.)	Rise (in.)	Span (in.)
1	18	13.5	22
2	21	15.5	26
3	24	18	28.5
4	30	22.5	36.25
5	36	26 – 5/8	43.75
6	42	31 – 5/16	51 – 1/8
7	48	36	58.5
8	54	40	65
9	60	45	73
10	72	54	88

3. Elliptical Pipe
 - a. In accordance with ASTM C507 and AASHTO M207
 - b. Maintain a minimum 1-foot cover from top of ground or pavement to top of pipe.
 - c. Provide elliptical pipe design sizes in accordance with Table 3.

Table 3
Elliptical Pipe

Design Size	Equivalent Diameter (in.)	Rise (in.)	Span (in.)
1	18	14	23
2	24	19	30
3	27	22	34
4	30	24	38
5	33	27	42
6	36	29	45
7	39	32	49
8	42	34	53
9	48	38	60
10	54	43	68

D. Reinforced Concrete Box (RCB)

1. In accordance with ASTM C1433, AASTHO M259, and AASTHO M273.
2. Lifting Holes:
 - a. Provide no more than 4 lifting holes in each section for precast boxes.
 - b. Lifting holes may be cast-in-place or drilled by manufacturer. Ensure no reinforcing has been cut.
 - c. Provide lifting holes large enough for adequate lifting devices based on the size and weight of the box section.
 - d. Use lifting holes no larger than 3 inches in diameter.
 - e. Repair any spalled areas around lifting holes.
 - f. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.

Table 4
Specification for Corrugated Metal Pipe

E. Jointing Materials

1. Concrete Pipe and Box Joints and Fittings
 - a. Use any of the following materials to make joints unless otherwise specified on the Drawings. Provide a manufacturer's certificate of compliance for all jointing materials except mortar.
 - 1) Rubber Gaskets:
 - a) Type: ASTM C1619 Class A or C
 - b) Provide gaskets in accordance with the requirements of ASTM C443 for design of the pipe joints and permissible variations in dimensions.
 - 2) Pre-Formed Flexible Joint Sealants:
 - a) Used for sealing tongue-and-groove concrete pipe
 - b) Joint Characteristics:
 - (1) In accordance with the requirements of ASTM C990, and
 - (2) do not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strengths,
 - (3) are in extruded rope form, and
 - (4) are in accordance with the manufacturer's recommendations for size and are large enough to properly seal the joint.
 - c) Protect joint sealant with a suitable wrapper that maintains the integrity of the jointing material when the wrapper is removed.

F. Cast Iron Frame and Cover

1. Provide a frame and cover marked "Storm Sewer" in accordance with Section 33 05 81.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections

1. Reinforced Concrete Pipe (RCP)
 - a. Provide manufacturer certification the RCP has been tested in accordance with DMS-7310.
2. Reinforced Concrete Box Culverts (RCB)
 - a. Machine-Made Precast:

- 1) Provide manufacturer certification the RCB has been tested in accordance with DMS-7310.
- b. Cast-In-Place:
 - 1) Test cast-in-place RCB in accordance with Section 03 30 00 and Section 03 00 00.

B. Non-Conforming Materials

1. Reinforced Concrete Pipe (RCP)
 - a. Any individual section of pipe may be rejected if the pipe does not conform to the conditions stated in the Annex of DMS-7310, Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification.
 - b. Any individual section of pipe may be rejected if the City determines pipe has excessive cracks, fractures, gouges, or any other surface deformations.
2. Reinforced Concrete Box (RCB)
 - a. Any individual section of box may be rejected if the City determines the box has excessive cracks, fractures, gouges, or any other surface deformations.
 - b. Any individual section of box may be rejected if the following tolerance requirements are not met.
 - 1) General requirements:
 - a) In accordance with permissible variations listed in ASTM C1577
 - b) Sides do not vary from perpendicular to the top and bottom by more than 0.5 inch when measure diagonally between opposite interior corners.
 - 2) Wall and Slab Thicknesses:
 - a) Verify all box wall and slab thicknesses match the thicknesses specified in the Drawings.
 - b) Occasional deficiencies are allowed when the deficiencies are not greater than 3/16 inch or 5% of the thickness, whichever is greater.
 - c) Wall and slab thicknesses greater than specified in the Drawings are acceptable if the jointing is not affected.
 - 3) Deviations from the above tolerances is not acceptable. Any box found to be non-compliant will be removed and replaced at no cost to the City.

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

A. Excavation, Shaping, Bedding, and Backfill

1. Perform excavation, shaping, bedding, and backfill in accordance with Section 33 05 06.
2. Take care when placing and compacting the backfill to avoid any movement of storm water pipe and boxes or damage to the joints.
3. Do not use heavy earth-moving equipment to haul over the pipes or boxes until a minimum of 4 feet of permanent or temporary compacted fill has been placed over the structure unless otherwise specified in the Drawings or permitted in writing.
4. Corrugated Metal Pipe

- a. The City and Contractor to visually inspect the inside periphery of the pipes for local or unequal deformation caused by improper construction methods before adding each new layer of loose backfill material.
- b. Continue inspections until a minimum of 24 inches of cover is obtained.
- c. Remove and replace any pipe the City considers deformed or non-conforming at no cost to the City.

B. Jacking, Boring, or Tunneling

1. Jacking, boring, or tunneling is not recommended for installing storm sewer pipe or boxes. Prior approval is required before any jacking, boring, or tunneling operation begins.
2. If jacking, boring, or tunneling is required, provide a design based on the specific installation conditions such as the soil conditions, installation methods, anticipated deflection angles, and jacking stresses.
3. Provide design notes and Drawings signed and sealed by a Texas licensed professional Engineer.
4. Additional Reinforced Concrete Box Requirements
 - a. In accordance with TxDOT Item 476.
 - b. The box ends must be square and no point should deviate more than 3/8 inch from a plane placed on the end of the box that is perpendicular to the sides.
 - c. Wall and Slab Thickness:
 - 1) Minimum thickness as specified in the Drawings
 - 2) No greater than 0.5 inches than the thickness specified on the Drawings

C. Pipe Laying

1. General:
 - a. Where possible, install the pipe so that the top of pipe is below any pavement subgrade, unless otherwise specified in the Drawings.
 - b. Maintain a minimum 0.5 percent slope unless otherwise shown on the Drawings.
 - c. Start the laying of pipe on the bedding at the outlet end with the spigot or tongue end pointing downstream.
 - d. Proceed towards the inlet end with the abutting sections properly matched true to the established lines and grades specified in the Drawings.
 - e. Fit, match, and lay the pipe to form a smooth and uniform conduit.
 - f. Lower sections of pipe into the trench without damaging the pipe or disturbing the bedding and the sides of the trench.
 - g. Carefully clean the ends of the pipe before the pipe is placed.
 - h. Prevent the earth or bedding material from entering the pipe as it is laid.
2. Reinforced Concrete Pipe
 - a. General:
 - 1) Cut cross trenches in the foundation to allow the barrel of the pipe to rest firmly on the bedding where bell-an-spigot pipe is used.
 - 2) Cut cross trenches no more than 2 inches larger than the bell ends of the pipe.
 - 3) Lay multiple lines of reinforced concrete pipe with the centerlines of the individual barrels parallel.
 - 4) Use the clear distances between outer surfaces of adjacent pipes shown in Table 6 unless otherwise specified in the Drawings.
 - 5) Use the equivalent diameter from Table 2 or 3 for arch or horizontal elliptical pipe to determine the clear distance requirement in Table 5.
 - b. Elliptical Pipe:

- 1) Lay the pipe so the markings for the top or bottom are not more than 5 degrees from the vertical plane through the longitudinal axis of the pipe.
- 2) Remove and re-lay any pipe that is not in alignment or shows excessive settlement after laying at no cost to the City.

Table 5
Minimum Clear Distance Between RCP

Equivalent Diameter (Inches)	Minimum Clear Distance
18	9 inches
24	11 inches
30	1 foot, 1 inch
36	1 foot, 3 inches
42	1 foot, 5 inches
48	1 foot, 7 inches
54	1 foot, 11 inches
60 to 84 inches	2 feet

Table 6
Minimum Clear Distance Between CMP

Equivalent Diameter (Inches)	Minimum Clear Distance (Inches)
18	1 foot, 2 inches
21	1 foot, 3 inches
24	1 foot, 5 inches

D. Placement of Boxes

1. Where possible, place the box so the top of box is below any pavement subgrade, unless otherwise shown on the Drawings.
2. Maintain a minimum 0.5 percent slope unless otherwise specified in the Drawings.
3. Place the box sections in accordance with the Drawings.
4. Place material to be used between barrels as specified in the Drawings or as directed by the City.
5. Start laying the boxes on the bedding at the outlet end.
6. Proceed toward the inlet end with the abutting sections properly matched true to the established lines and grades specified in the Drawings.
7. Fit, match, and lay the boxes to form a smooth and uniform conduit.
8. Lower the box sections into the trench, for trench installations, without damaging the box or disturbing the bedding and the sides of the trench.
9. Carefully clean the ends of the box before it is placed.
10. Prevent the earth or bedding material from entering the box as it is laid.
11. Remove and re-lay any box section that is not in alignment or shows excessive settlement after laying at no cost to the City.

E. Jointing

1. Reinforced Concrete Pipe (RCP) and Concrete Box (RCB)
 - a. Provide an appropriate rolling device for conveyance through small-size pipe structures.

- b. Allowable joint deflection is one half of the published manufacturer's allowance unless written approval is obtained from the City Engineer.
- c. Joints Sealed with Rubber Gaskets:
 - 1) Make the joint assembly according to the recommendations of the gasket manufacturer.
 - 2) Make joints watertight when using rubber gaskets.
 - 3) Backfill after the joint has been inspected and approved.
 - 4) Reinforced Concrete Box (RCB)
 - a) Box joints for rubber gasketed material may be substituted for tongue and groove joints.
 - b) Provide rubber gasket joints for RCB in accordance with the requirements of ASTM C1677.
- d. Joints Using Pre-Formed Flexible Joint Sealants:
 - 1) Install pre-formed flexible joint sealants in accordance with the manufacturer's recommendations.
 - 2) Place the joint sealer so no dirt or other deleterious materials encounter the joint sealing material.
 - 3) Pull or push home the pipe with enough force to properly seal the joint.
 - 4) Remove any joint material pushed out into the interior of the pipe that would obstruct the flow.
 - 5) Apply flexible joint sealants to the pipe joints immediately before placing pipe in trench and connecting pipe to previously laid pipe.
 - 6) Backfill after the joint has been inspected and approved.

F. Connections and Stub Ends

- 1. Reinforced Concrete Pipe (RCP)
 - a. Make connections of concrete pipe to existing pipes, pipe storm drains, or storm drain appurtenances as specified in the Drawings.
 - b. Mortar or concrete the bottom of existing structures if necessary to eliminate any drainage pockets created by the connections with a Type S mortar in accordance with the requirements of ASTM C270.
 - c. Repair any damage to the existing structure resulting from making the connections.
 - d. Make connections between concrete pipe and corrugated metal pipe with a suitable concrete collar and a minimum thickness of 4 inches.
 - 1) Corrugated metal pipe is not permitted for use within the City's right-of-way unless otherwise specified in the Drawings or herein.
 - 2) Prior to connecting to an existing CMP storm system:
 - a) Remove any existing corrugated metal pipe to the City's right-of-way.
 - b) Replace with an equivalent sized RCP.
 - e. Finish stub ends for connections to future work not shown on the Drawings by installing watertight plugs into the free end of the pipe. Plugs are considered subsidiary to the RCP unless a separate bid item is provided.
 - f. Fill lift holes with concrete, mortar, or precast concrete plugs after the pipe is in place.
- 2. Reinforced Concrete Box (RCB)
 - a. Make connections of boxes to existing boxes, pipes, drains, or drain appurtenances as specified in the Drawings.
 - b. Mortar or concrete the bottom of existing structures if necessary to eliminate any drainage pockets created by the connections with a Type S mortar in accordance with the requirements of ASTM C270.

- c. Connect boxes to any required headwalls, wingwalls, safety end treatments, riprap, or other structures as specified in the Drawings or as directed by the City. Connections will be considered subsidiary to the RCB.
- d. Repair any damage to the existing structure resulting from making the connections.
- e. Finish stub ends for connections to future work by installing watertight plugs into the free end of the box. Plugs are considered subsidiary to the RCB unless a separate bid item is provided.
- f. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.

G. Extending Existing Box Culverts

- 1. Any curb less than 12 inches will be considered subsidiary to the RCB. Any curb taller than 12 inches will be included under the RCB Extended Curb bid item.
- 2. Break back and extend existing box culverts in accordance with TxDOT Item 420 and 422.
 - a. If extending the existing box culvert is required, provide design notes and Drawings signed and sealed by a Texas licensed professional Engineer.

3.5 REPAIR

- A. Make repairs if necessary for reinforced concrete pipe and machine-made precast boxes in accordance with DMS-7310.
- B. Reinforced Concrete Box (RCB)
 - 1. Cracks:
 - a. Fine cracks on the surface of the section that do not extend to the plan of the nearest reinforcement are acceptable unless the cracks are numerous and extensive. The City will determine if the cracks are considered non-conforming.
 - b. Remove and replace any concrete box considered non-conforming at no cost to the City.
 - 2. Excessive damage, honeycomb, or cracking will be subject to structural review by the City.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. Site Tests and Inspections
 - 1. Reinforced Concrete Pipe and Box
 - a. Provide access for inspection of the finished pipe at the project site before and during installation.
 - 2. Stormwater Mains and Laterals
 - a. Closed Circuit Television (CCTV) Inspection
 - 1) Provide a Post-CCTV Inspection in accordance with Section 33 01 15.
- B. Non-Conforming Work
 - 1. Remove and replace any pipe or box damaged by the Contractor during installation at no cost to the City.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 42 23
STORMWATER HEADWALLS, WINGWALLS, AND END TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for:
 - a. Headwall
 - b. Wingwall (each and square foot)
 - c. Pipe culvert end treatment
 - d. Box culvert end treatment
 - e. RCB extended curb (1 to 5 FT)
 - 2. Precast items are only permitted when written approval has been provided by the City prior to construction activities starting.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 31 37 00 – Riprap.
 - 4. Section 33 05 05 – Utility Trench, Excavation, Embedment, and Backfill.
 - 5. Section 33 42 11 – Stormwater Pipe and Boxes.
- D. Standard Details
 - 1. Refer to City of League City and TxDOT standard details for headwalls, wingwalls, and end treatments for pipe and box culverts.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Headwall
 - a. Measurement
 - 1) Measured per each Headwall installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Headwall installed for:
 - a) Various pipe sizes.
 - b) Various pipe types (circular or arch).
 - c) Various angles (0, 15, 30, or 45 degree skew).
 - d) Flared or Parallel
 - c. The price bid shall include:
 - 1) Furnishing and installing Headwall as specified by the Drawings

- 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Dewatering
 - 10) Forms
 - 11) Reinforcing
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Excavation
 - 28) Furnishing, placement and compaction of embedment
 - 29) Furnishing, placement and compaction of backfill
 - 30) Disposal of excess material
 - 31) Clean-up
2. Wingwall
- a. Measurement
 - 1) Measured per [each or square yard of wall face] Wingwall installed.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per [each or square yard of wall face] for Wingwall installed for:
 - a) Various heights (2 through 8) [only used when measured per each]
 - b) Straight, Flared, or Parallel Wings
 - c) Skewed or Non- Skewed
 - c. The price bid shall include:
 - 1) Furnishing and installing Wingwall as specified by the Drawings
 - 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing

- 9) Dewatering
 - 10) Forms
 - 11) Reinforcing
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Furnishing, placement and compaction of embedment
 - 28) Furnishing, placement and compaction of backfill
 - 29) Disposal of excess material
 - 30) Clean-up
3. Pipe Culvert End Treatment
- a. Measurement
 - 1) Measured per each of End Treatment type installed.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for End Treatment type installed for:
 - a) Mitered Pipe, Straight Wings, or Flared Wings
 - b) Pipe Size
 - c) Skew Angle for Flared Wings (0, 15, or 30)
 - d) Wall height for Flared and Straight Wings
 - e) Slope, horizontal: vertical
 - f) Cross Drainage or Parallel Drainage
 - g) Examples:
 - (1) PET, 12” Dia, Mitered (4:1) (C)
 - (2) PET, 36” Dia, Straight (HW=4) (4:1) (P)
 - (3) PET, 48” Dia, Flared (15 DEG) (HW=8) (4:1) (C)
 - c. The price bid shall include:
 - 1) Furnishing and installing Pipe Culvert End Treatment as specified by the Drawings
 - 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Dewatering

- 10) Forms
 - 11) Reinforcing
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Furnishing, placement and compaction of embedment
 - 28) Furnishing, placement and compaction of backfill
 - 29) Disposal of excess material
 - 30) Clean-up
4. Box Culvert End Treatment
- a. Measurement
 - 1) Measured per each End Treatment type installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for End Treatment type installed for:
 - a) Straight or Flared Wings
 - b) Box span length
 - c) Wall height
 - d) Skew Angle for Flared Wings (0, 15, or 30)
 - e) Slope, horizontal:vertical
 - f) Cross Drainage or Parallel Drainage
 - g) Examples:
 - (1) BET, Straight (S=5 FT) (HW=5 FT) (4:1) (P)
 - (2) BET, Flared (S=5 FT) (HW=5 FT) (0 DEG) (4:1) (C)
 - c. The price bid shall include:
 - 1) Furnishing and installing Box Culvert End Treatment as specified by the Drawings
 - 2) Water
 - 3) Loading
 - 4) Unloading
 - 5) Storing
 - 6) Hauling
 - 7) Handling of materials
 - 8) Traffic control for all testing
 - 9) Dewatering
 - 10) Forms
 - 11) Reinforcing

- 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Furnishing, placement and compaction of embedment
 - 28) Furnishing, placement and compaction of backfill
 - 29) Disposal of excess material
 - 30) Clean-up
5. Pipe Runners
- a. Measurement
 - 1) Measured per each end treatment where Pipe Runners are installed.
 - b. Payment
 - 1) The work performed, and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each end treatment where Pipe Runners are installed.
 - a) This bid item is only used for existing end treatments where pipe runners need to be replaced or installed.
 - b) Pipe runners are subsidiary to the installation of an end treatment.
 - c. The price bid shall include:
 - 1) Furnishing and installing Pipe Runners as specified by the Drawings
 - 2) Removal of existing pipe runners
 - 3) Bonding agents
 - 4) Repair or replacing of materials

1.3 REFERENCES

A. Abbreviations and Acronyms

1. ET – End Treatment
2. SET – Safety End Treatment
3. RCB – Reinforced Concrete Box
4. RCP – Reinforced Concrete Pipe

B. Definitions

1. Headwalls
 - a. All walls, including wings, at the ends of a single-barrel and multiple-barrel pipe culvert structure.
2. Wingwall
 - a. All walls at the ends of a single-barrel or multiple-barrel box culvert structures.

3. RCB Curb
 - a. Any curb shorter than 12 inches from the top of the box to the top of the curb will be considered subsidiary to the RCB. Any curb taller than 12 inches will be included under RCB Extended Curb.

C. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society for Testing and Materials (ASTM):
 - a. ASTM A1085 – Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
 - b. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. Texas Department of Transportation Standards
 - a. DMS-4675 – Cementitious Grouts and Mortars for Miscellaneous Applications.
 - b. DMS-6100 – Epoxies and Adhesives.
 - c. DMS-7310 – Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification.

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to purchasing of materials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings:

1. Headwalls, Wingwalls, End Treatments, and Riprap
 - a. Provide the following information on the shop drawing submittal:
 - 1) Product type and description
 - 2) Class of concrete
 - 3) Concrete mix design (only for cast-in-place)
 - 4) Connection/jointing material used
 - 5) Manufacturer recommendations for storage, handling, and installation.
2. Product Data
 - a. Provide a product data sheet for the following:
 - 1) Pipe Runners
 - 2) Mortar, if applicable
 - 3) Epoxy, if applicable
 - 4) Jointing Material
 - 5) Any bonding material

B. Information Submittals:

1. Certificates:

- a. Provide the manufacturer's certificate of compliance that their product meets the physical testing requirements of this specification, DMS 7310, and DMS 4675 for the materials referenced which may include, but are not limited to:
 - 1) Concrete mix design and reinforcing (if using precast)
 - 2) Mortar
 - 3) Pipe runners
- 2. Equipment Submittals:
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements
 - 1. Do not place any loads on precast items before design strength has been reached.
 - 2. Do not ship items until design strength requirements have been met.
- B. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
 - 2. Store precast items on a level surface.
- C. Markings:
 - 1. Mark all precast items or mitered RCP before shipment from the manufacturer:
 - a. Name or trademark of manufacturer
 - b. Product designation (Type and Size)
 - c. ASTM designation
 - d. Date of manufacture
 - e. Designated fabricator's approval stamp
 - 2. Indent markings or paint them on with waterproof paint.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

- A. Concrete:
 - 1. Headwalls, Wingwalls, and End Treatments:
 - a. Class P in accordance with Section 03 00 00 unless otherwise specified in the Drawings.

2. RCB Extended Curb:
 - a. Class P in accordance with Section 03 00 00 unless otherwise specified in the Drawings.
3. Riprap:
 - a. Class A in accordance with Section 03 00 00 unless otherwise specified in the Drawings.
4. Precast:
 - a. Provide the class of concrete required based on the use. Provide machine-made precast or precast items that are supplied by a manufacturer. Formed precast is not permitted by Contractor.
5. Cast-In-Place:
 - a. Fabricate in accordance with Section 03 30 00.
- B. Reinforcement:
 1. Provide Grade 60 reinforcing steel in accordance with Section 03 00 00 unless otherwise specified in the Drawings.
- C. Mitered RCP:
 1. Provide mitered RCP in accordance with Section 33 42 11, the Drawings, and this Section.
 2. Mitering or providing a mitered RCP section is considered subsidiary to pertinent items.
- D. Riprap:
 1. Mitered RCP:
 - a. Provide riprap as specified in the Drawings around the mitered end of the RCP. Riprap will be considered subsidiary to a mitered end treatment. No separate pay will be given for riprap.
 2. Straight or Flared End Treatments:
 - a. Provide riprap only when specified in the Drawings
- E. Pipe Runners
 1. Pipe runners are subsidiary to the construction of any end treatment. No separate pay will be given for pipe runners installed on new end treatments.
 2. When pipe runners are installed on existing end treatments, the pipe runners will be paid for per each end treatment that pipe runners are installed on. Payment will not be given per each pipe runner.
 3. Provide pipe runners in accordance with the following standards:
 - a. ASTM A1085;
 - b. ASTM A53, Type E or S, Grade B;
 - c. ASTM A500, Grade B; or
 - d. API 5L, Grade X42.
- F. Mortar:
 1. Provide mortar in accordance with DMS-4675.
- G. Jointing Materials
 1. Provide jointing materials in accordance with Section 33 42 11.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

- A. Remove portions of existing structures.
- B. Remove any existing pipe or box to the nearest joint as needed to construct the proposed headwall, wingwall, or end treatment. Removal of stormwater pipe and box segments to construct the headwall, wingwall, or end treatment will be considered subsidiary to the construction of the stormwater structure.

3.4 CONSTRUCTION

- A. Cast-In-Place:
 - 1. Construct cast-in-place headwalls, wingwalls, and end treatments in accordance with Section 03 00 00, 03 30 00, and this Section.
- B. Precast End Treatments
 - 1. Formed precast end treatments will not be permitted.
 - 2. Provide cast-in-place or machine-made end treatments.
 - 3. Provide certification letters stating that the machine-made items were made in accordance with this Section.
- C. Construct Riprap in accordance with Section 31 37 00.
- D. Construction Joint:
 - 1. Construct a construction joint when new concrete is placed next to existing concrete or concrete that has already hardened. Roughen and clean concrete surfaces in contact with new construction before placing forms to create a construction joint.
 - 2. Thoroughly clean the concrete surface of all loose material, dirt, and foreign matter.
 - 3. Saturate the hardened concrete with water.
 - 4. Remove all free water and moisten the surface before concrete or bonding grout is placed against it.
 - 5. Ensure the surface of the existing concrete is in a saturated surface-dry condition just before placing subsequent concrete by performing the following:
 - a. Wet the existing concrete by ponding water on the surface for 24 hours before placing subsequent concrete.
 - b. Use high-pressure water blasting 15 to 30 minutes before placing the concrete if ponding is not possible to achieve saturated surface-dry conditions.
 - c. A saturated surface-dry condition is achieved when the surface remains damp when exposed to sunlight for 15 minutes.
 - 6. Draw forms tight against the existing concrete to avoid mortar loss and offsets at joints.
 - 7. Bonding Agents:
 - a. Bonding agents are not required unless specified in the Drawings.
 - b. If a bonding agent is required, coat the joint surface with bonding mortar, grout, epoxy, or other material.

- c. Mortar:
 - 1) Place bonding mortar or grout on a surface that is in a saturated surface-dry condition state.
 - 2) Place the concrete before the bonding mortar or grout dries.
- d. Epoxy:
 - 1) Provide Type V epoxy per DMS-6100 for bonding fresh concrete to hardened concrete.
 - 2) Place the bonding epoxy on a clean, dry surface, and place the fresh concrete while the epoxy is still tacky.
- e. Other Bonding Material:
 - 1) Obtain approval from the City before using an alternative bonding material.
 - 2) Place in accordance with the manufacturer's recommendations.
- E. Lifting Holes
 - 1. Provide no more than 4 lifting holes in each section for precast boxes.
 - 2. Lifting holes may be cast-in-place or drilled by manufacturer. Ensure no reinforcing has been cut.
 - 3. Provide lifting holes large enough for adequate lifting devices based on the size and weight of the box section.
 - 4. Use lifting holes no larger than 3 inches in diameter.
 - 5. Repair any spalled areas around lifting holes.
 - 6. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.
- F. Excavation, Shaping, Bedding, and Backfill
 - 1. Perform excavation, shaping, bedding, and backfill in accordance with Section 33 05 06.
 - 2. Backfill around junction boxes, manholes risers, pipes, and boxes in accordance with Section 33 05 06 and 33 42 11.
 - 3. Take care when placing and compacting the backfill to avoid any movement of the stormwater structures.
 - 4. Bed precast items on foundations of firm and stable material accurately shaped to conform to the bases of the items.
- G. Pipe or Box Connections:
 - 1. Make connections to new or existing structures in accordance with the Drawings.

3.5 REPAIR

- A. Manufacturer defects or minor accidental damage may be accepted with proper repair.
- B. The City will determine if an item can be repaired or will need to be replaced.
- C. Replace any non-conforming item at no cost to the City.
- D. Repair any items as needed and obtain written acceptance from the City.
 - 1. A repaired item is required to be sound, properly finished, and cured in accordance with this Section and all applicable Sections prior to acceptance.

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

A. Non-Conforming Work

1. Precast items may be rejected for not meeting any one of the specification requirements herein.
2. Individual items may be rejected for:
 - a. fractures or cracks passing through the wall, or
 - b. surface defects indicating honeycombed or open texture surfaces.
3. Remove and replace rejected items at no cost to the City.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 42 30

STORMWATER JUNCTION BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufacturer, material, and installation requirements for stormwater junction boxes.
 - 2. Precast items are only permitted when written approval has been provided by the City prior to construction activities starting.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 33 05 05 – Utility Trench, Excavation, Embedment, and Backfill.
 - 4. Section 33 01 35 – Adjusting Manholes, Inlets, Valve Boxes, and Other Structures to Grade.
 - 5. Section 33 05 81 – Frame, Cover, and Grade Rings.
 - 6. Section 33 42 11 – Stormwater Pipe and Boxes.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Stormwater Junction Box
 - a. Measurement
 - 1) Measured per each Stormwater Junction Box installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Stormwater Junction Box installed for:
 - a) Various Sizes.
 - c. The price bid shall include:
 - 1) Furnishing and installing Stormwater Junction Box as specified by the Drawings
 - 2) Staged construction
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering
 - 11) Forms

- 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Manhole lid cover
 - 15) Concrete
 - 16) Aggregate
 - 17) Supplementary cementing materials
 - 18) Concrete additives
 - 19) Mixing
 - 20) Placement of concrete
 - 21) Finishing of concrete
 - 22) Curing and curing compounds
 - 23) Sawing
 - 24) Connections
 - 25) Fittings
 - 26) Joints
 - 27) Joint sealant
 - 28) Connection to existing structures, pipes, and boxes
 - 29) Plugs
 - 30) Excavation
 - 31) Furnishing, placement and compaction of embedment
 - 32) Furnishing, placement and compaction of backfill
 - 33) Disposal of excess material
2. Stormwater Manhole Riser
- a. Measurement
 - 1) Measured per each Stormwater Manhole Riser installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Stormwater Manhole Riser installed for:
 - a) Various Depth Ranges. (0 to 4’, 4’ to 8’, 8’ to 12’, Greater than 12’)
 - c. The price bid shall include:
 - 1) Furnishing and installing Stormwater Manhole Riser as specified by the Drawings
 - 2) Staged construction
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering
 - 11) Forms
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing

- 19) Placement of concrete
- 20) Finishing of concrete
- 21) Curing and curing compounds
- 22) Sawing
- 23) Connections
- 24) Fittings
- 25) Joints
- 26) Joint sealant
- 27) Connection to existing structures, pipes, and boxes
- 28) Plugs
- 29) Excavation
- 30) Furnishing, placement, and compaction of embedment
- 31) Furnishing, placement, and compaction of backfill
- 32) Disposal of excess material

1.3 REFERENCES

A. Abbreviations and Acronyms

- 1. JB – Junction Box
- 2. PSI – Pounds per Square Inch
- 3. RCB – Reinforced Concrete Box
- 4. RCP – Reinforced Concrete Pipe

B. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
- 2. American Society for Testing and Materials (ASTM):
 - a. C478, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
 - b. D4101, Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- 3. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. 4675, Cementitious Grouts and Mortars for Miscellaneous Applications
 - b. 6100, Epoxies and Adhesives
 - c. 7310, Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to purchasing of materials.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Shop Drawings:
 - 1. Stormwater Junction Boxes and Manhole Risers

- a. Provide the following information on the shop drawing submittal:
 - 1) Product type and size
 - 2) Class of concrete
 - 3) Concrete mix design (only for cast-in-place)
 - 4) Connection/jointing material used
 - 5) Manufacturer recommendations for storage, handling, and installation.
- 2. Product Data
 - a. Provide a material data sheet for review and approval for:
 - 1) Mortar, if applicable
 - 2) Epoxy, if applicable
 - 3) Jointing Material
 - 4) Any bonding material
- B. Information Submittals:
 - 1. Certificates:
 - a. Provide the manufacturer's certificate of compliance that their product meets the physical testing requirements of this Section, DMS 6100, DMS 7310, and DMS 4675 (if applicable) for the applicable materials used.
 - 2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements
 - 1. Do not place any loads on precast items before design strength has been reached.
 - 2. Do not ship items until design strength requirements have been met.
- B. Storage and Handling Requirements
 - 1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
 - 2. Store precast items on a level surface.
- C. Markings:
 - 1. Mark precast boxes with the following information:
 - a. Name or trademark of manufacturer
 - b. Product designation
 - c. ASTM designation
 - d. Date of manufacture
 - e. Designated fabricator's approval stamp
 - f. Designation "SR" for boxes meeting sulfate-resistant concrete plan requirements (when applicable)

2. Indent markings or paint them on with waterproof paint.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Inlet Frame & Cover
 - a. Provide in accordance with Standard Product List or approved equal.
2. Substitution requests for other manufacturers or models shall be processed in accordance with Section 01 25 00.

B. Concrete

1. Cast-In-Place:
 - a. Provide Class C in accordance with Section 03 00 00 unless otherwise specified in the Drawings.
2. Precast:
 - a. Provide Class H with a minimum compressive strength of 5,000 PSI in accordance with Section 03 00 00
 - 1) Provide machine-made precast inlets in accordance with DMS-7310

C. Reinforcement

1. Provide grade 60 steel reinforcing in accordance with Section 03 00 00.
2. Provide a minimum of 2 inches of cover on all reinforcing unless otherwise noted.

D. Cast Iron Frame and Cover

1. Provide a frame and cover marked "Storm Sewer" in accordance with Section 33 05 67.
 - a. Provide Pick Slots
 - b. Provide a 32-inch diameter frame and cover that provides minimum 30-inch diameter opening

E. Steps:

1. Provide polypropylene supports and steps at least 12 inches wide in accordance with ASTM D4101 and ASTM C478, Section 16, "Steps and Ladders".

F. Mortar:

1. Provide mortar in accordance with DMS-4675.

G. Epoxy:

1. Provide Type V epoxy per DMS-6100 for bonding fresh concrete to hardened concrete.
2. Place the bonding epoxy on a clean, dry surface, and place the fresh concrete while the epoxy is still tacky.

H. Jointing Materials

1. Provide jointing materials in accordance with Section 33 42 11.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. Construct junction boxes and manhole risers in 1 or 2 stages. Use the following steps if constructing in 2 stages:
 - 1. No separate pay will be given for staging construction of junction boxes and manhole risers.
 - 2. Stage 1:
 - a. Construct the storm drainpipe or box and attach the base of the junction box or manhole riser.
 - b. Provide a temporary plug for the exposed end of the storm drain if needed.
 - c. Follow all safety requirements for Federal, State, and local requirements when leaving a junction box or manhole riser exposed.
 - 3. Stage 2:
 - a. Excavate to expose the top of the stage 1 construction (if needed) and complete the junction box or manhole riser in accordance with the Drawings and this Section.
 - b. Coordinate construction of the junction box or manhole riser top with paving operations.
 - c. Finalize construction of subgrade, asphalt base/surface course, or concrete pavement and adjust the top of the junction box or manhole riser as needed to be flush with the final pavement level.
 - 1) All adjustments to grade of the junction boxes and manhole risers will be considered subsidiary to the construction of the junction box or manhole riser regardless of how many times the top needs to be adjusted due to phasing of the project.
 - d. Remove any temporary plugs prior to completion of the junction box or manhole riser.
 - e. Furnish and install any frames, grates, rings, and covers.
 - f. Clean all debris from the walls and bottom of the junction box or reinforced concrete box.
- B. Cast-In-Place Junction Boxes and Manhole Risers:
 - 1. Construct cast-in-place junction boxes and manhole risers in accordance with Section 03 00 00, 03 30 00, and this Section.
- C. Precast Junction Boxes and Manhole Risers
 - 1. Precast junction boxes and manhole risers are only permitted when written approval has been provided by the City prior to construction activities starting.
 - 2. Formed precast junction boxes and manhole risers will not be permitted.
 - 3. Provide cast-in-place or machine-made precast junction boxes and manhole risers.

4. Construct machine-made items in accordance with ASTM C478 and this Section.
5. Provide certification letters stating the machine-made items were made in accordance with DMS-7310 and ASTM C478 and conform to the product permissible variations and rejection criteria stated in ASTM C478.

D. Steps

1. Cast-In-Place:
 - a. Cast steps into the junction box or manhole riser walls
2. Precast:
 - a. Drill and epoxy or grout steps in place in accordance with manufacturer's recommendations.

E. Lifting Holes

1. Provide no more than 4 lifting holes in each section for precast boxes.
2. Lifting holes may be cast-in-place or drilled by manufacturer. Ensure no reinforcing has been cut.
3. Provide lifting holes large enough for adequate lifting devices based on the size and weight of the box section.
4. Use lifting holes no larger than 3 inches in diameter.
5. Repair any spalled areas around lifting holes.
6. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.

F. Excavation, Shaping, Bedding, and Backfill

1. Perform excavation, shaping, bedding, and backfill in accordance with Section 33 05 06.
2. Backfill around junction boxes, manholes risers, pipes, and boxes in accordance with Section 33 05 06 and 33 42 11.
3. Take care when placing and compacting the backfill to avoid any movement or damage to the junction boxes, manhole risers, storm water pipe and boxes, or their joints.
4. Do not use heavy earth-moving equipment over pipes or boxes until a minimum of 4 feet of permanent or temporary compacted fill has been placed over the structure unless otherwise specified in the Drawings or permitted in writing.

G. Stormwater Junction Box

1. Provide the appropriately sized junction box based on the maximum inside pipe diameter shown in Table 1.
2. For a junction box larger than 8-feet tall or wide, provide a structural design.
3. Connections to Reinforced Concrete Pipe (RCP)
 - a. Construct junction boxes before completion of stormwater pipes into or through the junction box.
 - b. Neatly cut all stormwater pipes at the inside face of the junction box walls.

Table 1
Junction Box Sizes

Square Junction Box Sizes	Maximum Pipe Inside Diameter
4-foot square	36 inches
5-foot square	42 inches
6-foot square	54 inches
7-foot square	66 inches
8-foot square	72 inches

- Square Junction Box Sizes are given based on a 0-degree skew. If there is a skew entering into the junction box, a larger size may be required.

H. Stormwater Manhole Riser

- A manhole riser may be used in the following conditions:
 - Stormwater Junction Boxes:
 - Use only when specified in the Drawings or by the City. If both of the following conditions are met, a manhole riser may be used in conjunction with the base of a junction box to reduce the surface foot-print.
 - When the size of a junction box is 6-feet or larger
 - When the depth of the junction box is greater than 2-feet larger than the outside diameter of the pipe.
 - Reinforced Concrete Box (RCB) Access:
 - Provide a manhole riser where access is needed.
- If a Stormwater Manhole Riser is used in conjunction with a Stormwater Junction Box, the manhole riser will be considered subsidiary to the Stormwater Junction Box.
- Constructing the Manhole Riser
 - Provide a 48-inch diameter manhole riser with a flat top. A manhole cone is not needed unless otherwise specified.
 - Thicken the junction box or RCB section top slab to a minimum of 12 inches when using a manhole riser.
 - Cast the manhole riser with the RCB box when providing a cast-in-place manhole riser and RCB per the Drawings.
 - When providing a precast manhole riser and RCB, connect the riser to the junction box base or RCB per the Drawings.
- Connections to Reinforced Concrete Box (RCB)
 - For manhole risers that connect directly to the top slab of an RCB, install the manhole riser in conjunction with the placement of the RCB.
 - For RCB connections to one side of junction box base, install the junction box base before or in conjunction with the placement of the RCB.
 - Backfill the junction box or manhole riser and RCB at the same time.

I. Inverts

- Shape and route floor inverts passing out or through the junction box base as specified in the Drawings.
- Shape by adding and shaping mortar or concrete after the base is placed or by placing the required additional material with the base.

J. Frame, Grates, and Covers

- Provide a 32-inch frame and cover in accordance with Section 33 05 67.

- a. A grated cover will not be permitted unless otherwise specified in the Drawings or approved by the City.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. When a structure is left open without supervision, provide structurally adequate fencing or cover.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 42 31

STORMWATER DROP INLETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for drop (Type E) inlets.
 - 2. Precast inlets are only permitted when written approval has been provided by the City prior to construction activities starting.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 33 05 05 – Utility Trench, Excavation, Embedment, and Backfill.
 - 4. Section 33 01 35 – Adjusting Manholes, Inlets, Valve Boxes, and Other Structures to Grade.
 - 5. Section 33 05 81 – Frame, Cover, and Grade Rings.
 - 6. Section 33 42 11 – Stormwater Pipe and Boxes.
 - 7. Section 33 42 30 – Stormwater Junction Boxes.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Drop Inlet (Type E)
 - a. Measurement
 - 1) Measured per each Drop Inlet installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Drop Inlet (Type E) installed for:
 - a) Various sizes. (3 to 5 feet)
 - c. The price bid shall include:
 - 1) Furnishing and installing Drop Inlet as specified by the Drawings
 - 2) Staged construction
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering

- 11) Forms
- 12) Trial batches (as needed)
- 13) Materials and work needed for any corrective action
- 14) Concrete
- 15) Aggregate
- 16) Supplementary cementing materials
- 17) Concrete additives
- 18) Mixing
- 19) Placement of concrete
- 20) Finishing of concrete
- 21) Curing and curing compounds
- 22) Sawing
- 23) Connections
- 24) Fittings
- 25) Joints
- 26) Joint sealant
- 27) Connection to existing structures, pipes, and boxes
- 28) Plugs
- 29) Excavation
- 30) Furnishing, placement and compaction of embedment
- 31) Furnishing, placement and compaction of backfill
- 32) Disposal of excess material
- 33) Clean-up

1.3 REFERENCES

A. Abbreviations

1. PSI – Pounds per Square Inch

B. Reference Standards

1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM):
 - a. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
 - b. ASTM D4101 – Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
3. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. 4675, Cementitious Grouts and Mortars for Miscellaneous Applications
 - b. 6100, Epoxies and Adhesives
 - c. 7310, Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- #### **A. Submittals shall be in accordance with Section 01 33 00.**

B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings:

1. Stormwater Curb and Drop Inlets
 - a. Provide the following information on the shop drawing submittal:
 - 1) Product type and size
 - 2) Class of concrete
 - 3) Concrete mix design, for cast-in-place components only
 - 4) Connection/jointing material used
 - 5) Manufacturer recommendations for storage, handling, and installation
2. Product Data
 - a. Provide a material data sheet for review and approval for:
 - 1) Mortar
 - 2) Epoxy
 - 3) Jointing Material
 - 4) Any bonding material

B. Information Submittals:

1. Certificates:
 - a. Provide manufacturer's certificate of compliance stating their product is in accordance with the physical testing requirements of this Section, DMS 6100, DMS 7310, and DMS 4675 (if applicable) for the applicable materials used.
2. Equipment Information
 - a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. Do not place any loads on precast items before design strength has been reached.
2. Do not ship items until design strength requirements have been met.

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Store precast items on a level surface.

C. Markings:

1. Mark precast inlets and other items with the following information:
 - a. Name or trademark of manufacturer
 - b. Product designation

- c. ASTM designation
 - d. Date of manufacture
 - e. Designated fabricator's approval stamp
 - f. Designation "SR" for boxes meeting sulfate-resistant concrete plan requirements, if applicable
2. Indent markings or paint them on with waterproof paint.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

- 1. Inlet Frame & Cover
 - a. Provide in accordance with Standard Product List or approved equal.
- 2. Substitution requests for other manufacturers or models shall be processed in accordance with Section 01 25 00.

B. Concrete

- 1. Cast-In-Place:
 - a. Non-Traffic Loaded Inlets:
 - 1) Class A in accordance with Section 03 00 00
 - b. Traffic Loaded Inlets:
 - 1) Class P in accordance with Section 03 00 00
- 2. Precast:
 - a. Class H with a minimum compressive strength of 5,000 PSI in accordance with Section 03 00 00
 - 1) Provide machine-made precast inlets in accordance with DMS-7310.

C. Reinforcement

- 1. Provide grade 60 steel reinforcing in accordance with Section 03 00 00.
- 2. Provide a minimum of 2 inches of cover on all reinforcing unless otherwise noted.

D. Cast Iron Frame and Cover

- 1. Provide a frame and cover marked "Storm Sewer" in accordance with Section 33 05 67.
- 2. Provide Pick Slots
- 3. Provide a 32-inch diameter frame and cover that provides minimum 30-inch diameter opening

E. Steps:

- 1. Provide polypropylene supports and steps that are at least 12 inches wide that meet the requirements of ASTM D4101 and ASTM C478, Section 16, "Steps and Ladders".

F. Mortar:

1. Provide mortar in accordance with DMS-4675.

G. Jointing Materials

1. Provide jointing materials in accordance with Section 33 42 11.

H. Epoxy:

1. Provide Type V epoxy per DMS-6100 for bonding fresh concrete to hardened concrete.
2. Place the bonding epoxy on a clean, dry surface, and place the fresh concrete while the epoxy is still tacky.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. Construct inlets in 1 or 2 stages. Use the following steps if constructing in 2 stages:
1. No separate pay will be given for staging construction of junction boxes and manhole risers.
 2. Stage 1:
 - a. Construct the storm drainpipe or box and attach the pipe to the base of the inlet.
 - b. Provide a temporary plug for either end of the storm pipe if needed.
 - c. Backfill as necessary and in accordance with the Drawings around the Stage 1 construction.
 - d. Follow all safety requirements for Federal, State, and local requirements when leaving an inlet base exposed.
 3. Stage 2:
 - a. Excavate to expose the top of the stage 1 construction (if needed) and complete the inlet in accordance with the Drawings and this Section.
 - b. Coordinate construction of the inlet top with paving operations.
 - c. After completion of the subgrade, asphalt base/surface course, concrete pavement, or surrounding ground, construct the inlet top and/or aprons in accordance with the Drawings.
 - d. Remove any temporary plugs prior to the completion of the inlet.
 - e. Furnish and install any frames, grates, rings, and covers.
 - f. Clean all debris from the walls and bottom of inlet base.
- B. Cast-In-Place Inlets:
1. Where possible, use precast inlet bases with cast-in-place inlet tops.
 2. Construct cast-in-place inlet bases and tops in accordance with Section 03 00 00, 03 30 00, and this Section.
 3. Forms for all cast-in-place inlet components will be required unless otherwise approved.

C. Precast Inlets

1. Formed precast inlet bases and tops will not be permitted.
2. Provide machine-made precast inlet bases and tops.
3. Construct machine-made items in accordance with ASTM C478 and this Section.
4. Provide certification letters stating the machine-made items were made in accordance with DMS-7310 and ASTM C478 and conform to the product permissible variations and rejection criteria stated in ASTM C478.

D. Steps

1. Cast-In-Place:
 - a. Cast steps into inlet walls.
2. Precast:
 - a. Drill and epoxy or grout steps in place in accordance with manufacturer's recommendations.

E. Lifting Holes

1. Provide no more than 4 lifting holes in each section for precast boxes.
2. Lifting holes may be cast-in-place or drilled by manufacturer. Ensure no reinforcing has been cut.
3. Provide lifting holes large enough for adequate lifting devices based on the size and weight of the box section.
4. Use lifting holes no larger than 3 inches in diameter.
5. Repair any spalled areas around lifting holes.
6. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.

F. Excavation, Shaping, Bedding, and Backfill

1. Perform excavation, shaping, bedding, and backfill in accordance with Section 33 05 06.
2. Backfill around inlets, pipes, and boxes in accordance with Section 33 05 06 and 33 42 11.
3. Take care when placing and compacting the backfill to avoid any movement or damage to inlet bases, storm water pipe, boxes, or their joints.
4. Do not use heavy earth-moving equipment to haul over the pipes or boxes until a minimum of 4 feet of permanent or temporary compacted fill has been placed over the structure unless otherwise specified in the Drawings or permitted in writing.

G. Connections to Reinforced Concrete Pipe (RCP)

1. Construct inlet bases before completion of stormwater pipes into or through the inlet.
2. Neatly cut all stormwater pipes at the inside face of the junction box walls.

H. Connections to Reinforced Concrete Box (RCB)

1. Construct inlet bases before completion of stormwater pipes into or through the inlet.
2. Neatly cut all stormwater pipes at the inside face of the junction box walls.

I. Connections to Reinforced Concrete Box (RCB)

1. For inlets that connect directly to the top slab of an RCB, install the inlet base in conjunction with the placement of the RCB.
2. Backfill the junction box or manhole riser and RCB at the same time.

J. Inverts

1. Shape and route floor inverts passing out or through the inlet as specified in the Drawings.
2. Shape by adding and shaping mortar or concrete after the base is placed or by placing the required additional material with the base.

K. Inlet Top Construction and Finishing

1. Complete the inlet base and top in accordance with the Drawings in either 1 or 2 stages.
2. Form openings for the inlets and recesses in curb and gutter as specified in the Drawings.
3. Construct the inlet top concurrent with paving operations when possible.
4. Backfill and grade the surrounding area to the elevations specified in the Drawings

L. Frame, Grates, and Covers

1. Provide a 32-inch frame and cover in accordance with Section 33 05 67.
2. A grated cover will not be permitted unless otherwise approved or specified in the Drawings.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. When a structure is left open without supervision, provide fencing or a cover that is structurally adequate.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 33 42 33

STORMWATER CURB INLETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Material and installation requirements for curb inlets.
 - 2. Precast inlets are only permitted when written approval has been provided by the City prior to construction activities starting.
- B. Deviations from this City of League City Standard Specification:
 - 1. None.
- C. Related Specification Sections include but are not limited to:
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-In-Place Concrete.
 - 3. Section 33 05 05 – Utility Trench, Excavation, Embedment, and Backfill.
 - 4. Section 33 01 35 – Adjusting Manholes, Inlets, Valve Boxes, and Other Structures to Grade.
 - 5. Section 33 05 81 – Frame, Cover, and Grade Rings.
 - 6. Section 33 42 11 – Stormwater Pipe and Boxes.
 - 7. Section 33 42 30 – Stormwater Junction Boxes.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Standard Curb Inlet (Type C)
 - a. Measurement
 - 1) Measured per each Standard Curb Inlet installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Standard Curb Inlet installed for:
 - a) Various sizes. (5 to 15 feet)
 - c. The price bid shall include:
 - 1) Furnishing and installing Standard Curb Inlet as specified by the Drawings
 - 2) Staged construction
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering

- 11) Forms
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives
 - 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Connection to existing structures, pipes, and boxes
 - 28) Plugs
 - 29) Excavation
 - 30) Furnishing, placement and compaction of embedment
 - 31) Furnishing, placement and compaction of backfill
 - 32) Disposal of excess material
 - 33) Clean-up
2. Recessed Curb Inlet (Type C-1)
- a. Measurement
 - 1) Measured per each Recessed Curb Inlet installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit price bid per each for Recessed Curb Inlet installed for:
 - a) Various sizes. (5 to 30 feet)
 - c. The price bid shall include:
 - 1) Furnishing and installing Recessed Curb Inlet as specified by the Drawings
 - 2) Staged construction
 - 3) Water
 - 4) Loading
 - 5) Unloading
 - 6) Storing
 - 7) Hauling
 - 8) Handling of materials
 - 9) Traffic control for all testing
 - 10) Dewatering
 - 11) Forms
 - 12) Trial batches (as needed)
 - 13) Materials and work needed for any corrective action
 - 14) Concrete
 - 15) Aggregate
 - 16) Supplementary cementing materials
 - 17) Concrete additives

- 18) Mixing
 - 19) Placement of concrete
 - 20) Finishing of concrete
 - 21) Curing and curing compounds
 - 22) Sawing
 - 23) Connections
 - 24) Fittings
 - 25) Joints
 - 26) Joint sealant
 - 27) Connection to existing structures, pipes, and boxes
 - 28) Plugs
 - 29) Excavation
 - 30) Furnishing, placement and compaction of embedment
 - 31) Furnishing, placement and compaction of backfill
 - 32) Disposal of excess material
 - 33) Clean-up
3. Type 2 Curb Inlet (Type C-2)
- a. Measurement
 - 1) Measured per each Type 2 Curb Inlet installed.
 - b. Payment
 - 1) The work performed and materials furnished in accordance with this item and measured as provided under “Measurement” will be paid for at the unit price bid per each for Type 2 Curb Inlet installed for:
 - a) Various sizes. (5 to 30 feet)
 - c. The price bid shall include:
 - 1) Furnishing and installing Type 2 Curb Inlet as specified by the Drawings
 - 2) Staged construction
 - 3) Hauling
 - 4) Water
 - 5) Loading
 - 6) Unloading
 - 7) Storing
 - 8) Hauling
 - 9) Handling of materials
 - 10) Traffic control for all testing
 - 11) Dewatering
 - 12) Forms
 - 13) Trial batches (as needed)
 - 14) Materials and work needed for any corrective action
 - 15) Concrete
 - 16) Aggregate
 - 17) Supplementary cementing materials
 - 18) Concrete additives
 - 19) Mixing
 - 20) Placement of concrete
 - 21) Finishing of concrete
 - 22) Curing and curing compounds
 - 23) Sawing
 - 24) Connections

- 25) Fittings
- 26) Joints
- 27) Joint sealant
- 28) Connection to existing structures, pipes, and boxes
- 29) Plugs
- 30) Excavation
- 31) Furnishing, placement and compaction of embedment
- 32) Furnishing, placement and compaction of backfill
- 33) Disposal of excess material
- 34) Clean-up

1.3 REFERENCES

A. Abbreviations

- 1. PSI – Pounds per Square Inch

B. Reference Standards

- 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
- 2. American Society for Testing and Materials (ASTM):
 - a. ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
 - b. ASTM D4101 – Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- 3. Texas Department of Transportation (TxDOT) Departmental Material Specifications (DMS):
 - a. 4675, Cementitious Grouts and Mortars for Miscellaneous Applications
 - b. 6100, Epoxies and Adhesives
 - c. 7310, Reinforced Concrete Pipe and Machine-Made Precast Concrete Box Culvert Fabrication and Plant Qualification

1.4 ADMINISTRATIVE REQUIREMENTS [NOT USED]

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings:

- 1. Stormwater Curb and Drop Inlets
 - a. Provide the following information on the shop drawing submittal:
 - 1) Product type and size
 - 2) Class of concrete
 - 3) Concrete mix design, for cast-in-place components only
 - 4) Connection/jointing material used
 - 5) Manufacturer recommendations for storage, handling, and installation
- 2. Product Data

- a. Provide a material data sheet for review and approval for:

- 1) Mortar
- 2) Epoxy
- 3) Jointing Material
- 4) Any bonding material

B. Information Submittals:

1. Certificates:

- a. Provide manufacturer's certificate of compliance stating their product is in accordance with the physical testing requirements of this Section, DMS 6100, DMS 7310, and DMS 4675 (if applicable) for the applicable materials used.

2. Equipment Information

- a. Submittal for all major equipment to include:
 - 1) Equipment name and description
 - 2) Size
 - 3) Intended use

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements

1. Do not place any loads on precast items before design strength has been reached.
2. Do not ship items until design strength requirements have been met.

B. Storage and Handling Requirements

1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
2. Store precast items on a level surface.

C. Markings:

1. Mark precast inlets and other items with the following information:
 - a. Name or trademark of manufacturer
 - b. Product designation
 - c. ASTM designation
 - d. Date of manufacture
 - e. Designated fabricator's approval stamp
 - f. Designation "SR" for boxes meeting sulfate-resistant concrete plan requirements, if applicable
2. Indent markings or paint them on with waterproof paint.

1.11 FIELD CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 MATERIALS

A. Manufacturers

1. Inlet Frame & Cover
 - a. Provide in accordance with Standard Product List or approved equal.
2. Substitution requests for other manufacturers or models shall be processed in accordance with Section 01 25 00.

B. Concrete

1. Cast-In-Place:
 - a. Non-Traffic Loaded Inlets:
 - 1) Class A in accordance with Section 03 00 00
 - b. Traffic Loaded Inlets:
 - 1) Class P in accordance with Section 03 00 00
2. Precast:
 - a. Class H with a minimum compressive strength of 5,000 PSI in accordance with Section 03 00 00
 - 1) Provide machine-made precast inlets in accordance with DMS-7310.

C. Reinforcement

1. Provide grade 60 steel reinforcing in accordance with Section 03 00 00.
2. Provide a minimum of 2 inches of cover on all reinforcing unless otherwise noted.

D. Cast Iron Frame and Cover

1. Provide a frame and cover marked "Storm Sewer" in accordance with Section 33 05 67.
2. Provide Pick Slots
3. Provide a 32-inch diameter frame and cover that provides minimum 30-inch diameter opening

E. Steps:

1. Provide polypropylene supports and steps that are at least 12 inches wide that meet the requirements of ASTM D4101 and ASTM C478, Section 16, "Steps and Ladders".

F. Mortar:

1. Provide mortar in accordance with DMS-4675.

G. Jointing Materials

1. Provide jointing materials in accordance with Section 33 42 11.

H. Epoxy:

1. Provide Type V epoxy per DMS-6100 for bonding fresh concrete to hardened concrete.
2. Place the bonding epoxy on a clean, dry surface, and place the fresh concrete while the epoxy is still tacky.

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION

- A. Construct inlets in 1 or 2 stages. Use the following steps if constructing in 2 stages:
 - 1. No separate pay will be given for staging construction of junction boxes and manhole risers.
 - 2. Stage 1:
 - a. Construct the storm drainpipe or box and attach the pipe to the base of the inlet.
 - b. Provide a temporary plug for either end of the storm pipe if needed.
 - c. Backfill as necessary and in accordance with the Drawings around the Stage 1 construction.
 - d. Follow all safety requirements for Federal, State, and local requirements when leaving an inlet base exposed.
 - 3. Stage 2:
 - a. Excavate to expose the top of the stage 1 construction (if needed) and complete the inlet in accordance with the Drawings and this Section.
 - b. Coordinate construction of the inlet top with paving operations.
 - c. After completion of the subgrade, asphalt base/surface course, concrete pavement, or surrounding ground, construct the inlet top and/or aprons in accordance with the Drawings.
 - d. Remove any temporary plugs prior to the completion of the inlet.
 - e. Furnish and install any frames, grates, rings, and covers.
 - f. Clean all debris from the walls and bottom of inlet base.
- B. Cast-In-Place Inlets:
 - 1. Where possible, use precast inlet bases with cast-in-place inlet tops.
 - 2. Construct cast-in-place inlet bases and tops in accordance with Section 03 00 00, 03 30 00, and this Section.
 - 3. Forms for all cast-in-place inlet components will be required unless otherwise approved.
- C. Precast Inlets
 - 1. Formed precast inlet bases and tops will not be permitted.
 - 2. Provide machine-made precast inlet bases and tops.
 - 3. Construct machine-made items in accordance with ASTM C478 and this Section.
 - 4. Provide certification letters stating the machine-made items were made in accordance with DMS-7310 and ASTM C478 and conform to the product permissible variations and rejection criteria stated in ASTM C478.
- D. Steps
 - 1. Cast-In-Place:
 - a. Cast steps into inlet walls.
 - 2. Precast:

- a. Drill and epoxy or grout steps in place in accordance with manufacturer's recommendations.

E. Lifting Holes

1. Provide no more than 4 lifting holes in each section for precast boxes.
2. Lifting holes may be cast-in-place or drilled by manufacturer. Ensure no reinforcing has been cut.
3. Provide lifting holes large enough for adequate lifting devices based on the size and weight of the box section.
4. Use lifting holes no larger than 3 inches in diameter.
5. Repair any spalled areas around lifting holes.
6. Fill lifting holes with mortar or concrete and cure. Precast concrete or mortar plugs may be used.

F. Excavation, Shaping, Bedding, and Backfill

1. Perform excavation, shaping, bedding, and backfill in accordance with Section 33 05 06.
2. Backfill around inlets, pipes, and boxes in accordance with Section 33 05 06 and 33 42 11.
3. Take care when placing and compacting the backfill to avoid any movement or damage to inlet bases, storm water pipe, boxes, or their joints.
4. Do not use heavy earth-moving equipment to haul over the pipes or boxes until a minimum of 4 feet of permanent or temporary compacted fill has been placed over the structure unless otherwise specified in the Drawings or permitted in writing.

G. Connections to Reinforced Concrete Pipe (RCP)

1. Construct inlet bases before completion of stormwater pipes into or through the inlet.
2. Neatly cut all stormwater pipes at the inside face of the junction box walls.

H. Connections to Reinforced Concrete Box (RCB)

1. Construct inlet bases before completion of stormwater pipes into or through the inlet.
2. Neatly cut all stormwater pipes at the inside face of the junction box walls.

I. Connections to Reinforced Concrete Box (RCB)

1. For inlets that connect directly to the top slab of an RCB, install the inlet base in conjunction with the placement of the RCB.
2. Backfill the junction box or manhole riser and RCB at the same time.

J. Inverts

1. Shape and route floor inverts passing out or through the inlet as specified in the Drawings.
2. Shape by adding and shaping mortar or concrete after the base is placed or by placing the required additional material with the base.

K. Inlet Top Construction and Finishing

1. Complete the inlet base and top in accordance with the Drawings in either 1 or 2 stages.
2. Form openings for the inlets and recesses in curb and gutter as specified in the Drawings.
3. Construct the inlet top concurrent with paving operations when possible.
4. Backfill and grade the surrounding area to the elevations specified in the Drawings

L. Frame, Grates, and Covers

1. Provide a 32-inch frame and cover in accordance with Section 33 05 67.
2. A grated cover will not be permitted unless otherwise approved or specified in the Drawings.

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL

- A. When a structure is left open without supervision, provide fencing or a cover that is structurally adequate.

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

SECTION 41 14 00

BATCHING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Batching equipment and plant requirements.
- B. Deviations from this City of League City Standard Specification
 - 1. None.
- C. Related Specification Sections include but are not necessarily limited to
 - 1. Section 03 00 00 – Concrete and Concrete Reinforcing.
 - 2. Section 03 30 00 – Cast-in-Place Concrete.
 - 3. Section 31 37 00 – Rip Rap.
 - 4. Section 32 05 16 – Aggregates for Exterior Improvements.
 - 5. Section 32 12 16 – Asphalt Paving.
 - 6. Section 32 13 13 – Concrete Paving.
 - 7. Section 32 13 16 – Decorative Concrete Paving.
 - 8. Section 32 32 00 – Retaining Walls.

1.2 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. Batching equipment and/or plants, tools, testing, and incidentals are subsidiary to the various items bid.
 - 2. Batch plants are not permitted for use in the production of concrete or asphalt without approval by the City.

1.3 REFERENCES

- A. Abbreviations and Acronyms
 - 1. NRMCA – National Ready Mixed Concrete Association
- B. Reference Standards
 - 1. Reference standards cited in this Section refer to the current reference standard published at the time of the latest revision date logged at the end of this Section unless a date is specifically cited.
 - 2. American Society for Testing and Materials (ASTM):
 - a. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
 - b. ASTM C685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
 - 3. Texas Department of Transportation (TxDOT) Test Procedures:
 - a. Tex-920-K, Verifying the Accuracy of Drum Mix Plant Belt Scales
 - b. Tex-921-K, Verifying the Accuracy of Hot Mix Asphalt Meters

4. Texas Department of Transportation, Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (TxDOT):
 - a. Item 320, Equipment for Asphalt Concrete Pavement.
 - b. Item 520, Weighing and Measuring Equipment.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Batching Meeting
 1. On-Site Batch Plant
 - a. Considered on-site if the plant is within 500 feet of the site and was erected specifically for the project.
 - b. Conduct a walkthrough with the City prior to producing concrete or asphalt.
 2. Off-Site Batch Plant
 - a. No walkthrough is required for an off-site batch plant.
 - b. The City may request a walkthrough at any time.

1.5 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00.
- B. All submittals shall be approved by the City prior to delivery.

1.6 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

- A. Shop Drawings
 1. Batch Plants
 - a. Provide mix designs produced and tested using the proposed batch-plant.
 - b. If a batch-plant is erected after the start of construction, provide revised mix designs.
 - c. Provide test results verifying the batch plant can produce concrete in accordance with the mix design requirements of the concrete class specified in the Drawings.
 2. Volumetric Mixers
 - a. Provide test results verifying the concrete produced is in accordance with ASTM C685.
 3. Agitators and Truck and Stationary Mixers
 - a. Provide test results verifying the concrete produced is in accordance with ASTM C94.
- B. Samples
 1. Produce all concrete or asphalt samples using the batch plant.
- C. Certificates
 1. Batch Plant and Truck Mixer Certifications
 - a. Obtain recertification every year, when the plant is relocated, and when the plant is erected.
 - b. Provide certifications dated within a year of construction notice to proceed or when the plant was erected, whichever is the most recent.
 - c. Volumetric Mixed Concrete
 - 1) Provide information verifying the capacity and performance are in accordance with the Volumetric Mixer Manufacturers Bureau or equivalent.
 - 2) Provide information verifying the mixer and the concrete produced are in accordance with ASTM C685.
 - d. Ready Mixed Concrete

- 1) Provide a current Certification of Ready Mixed Concrete Production Facilities from the NRMCA, or equivalent.

1.7 CLOSEOUT SUBMITTALS [NOT USED]

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE

A. Concrete Plants and Mixing Equipment

1. General

- a. Produce concrete in accordance with the requirements of ASTM C94/C94M, NRMCA, Sections 03 00 00, 03 30 00, 31 37 00, 32 05 16, 32 13 13, 32 13 16, 32 32 00, and this Section.
- b. Utilize a commercial concrete plant to produce all structural concrete unless otherwise approved by the City.
- c. Comply with all TCEQ permit requirements for portable facilities.

2. Commercial Concrete Plants

- a. Ensure the concrete being transported from a commercial concrete plant is in accordance with the requirements of Sections 03 00 00, 03 30 00, 31 37 00, 32 05 16, 32 13 13, 32 13 16, 32 32 00, and this Section.

3. Batch Plant

- a. Provide a batch plant in accordance with the requirements of the NRMCA and is certified through NRMCA or an equivalent organization.
- b. Provide a batch plant that accurately measures volume and weight of water and admixtures.
- c. Scales
 - 1) Check all scales before beginning operations, after each move, and a minimum of once every 6 months.
 - 2) Immediately correct deficiencies and recalibrate.
 - 3) Provide a record of calibration showing scales in compliance with ASTM C94 requirements.
 - 4) Check batching accuracy of volumetric water batching devices a minimum of every 90 days.
 - 5) Check batching accuracy of chemical admixture dispensing devices a minimum of every 6 months.
 - 6) Perform daily checks as necessary to ensure measuring accuracy.
 - 7) Verify the accuracy of drum mix plant belt scales in accordance with Tex-920-K.

4. Volumetric Mixers

- a. Provide volumetric mixers with rating plates defining the capacity and the performance of the mixer in accordance with the Volumetric Mixer Manufacturers Bureau or equivalent.
- b. Provide volumetric mixers in accordance with ASTM C685.

5. Agitators, Truck Mixers, and Stationary Mixers (Ready Mixed Concrete)

- a. Provide stationery and truck mixers capable of combining the ingredients of the concrete into a thoroughly mixed and uniform mass in accordance with ASTM C94.
- b. Provide a measuring gauge capable of determining how much water or air entraining admixture is added to the mixer.

- 1) Provide documentation to the City specifying the weight or volume of water or admixture added.
- c. Provide mixing trucks with back-up alarms.
- d. Sample concrete per ASTM C94 Alternate Procedure 2.
- e. Follow the manufacturer's instructions for adding water, air entraining admixtures, rotation speed, and number of drum revolutions before discharge.
- f. Admixtures:
 - 1) Air Entraining
 - a) Follow manufacturer's recommendations for adding admixture.
 - 2) All of Admixtures
 - a) All other admixtures must be added either at a batch plant or a commercial plant. No other admixtures can be added directly to the mixer.
- g. Inspect and maintain mixers and agitators. Keep them free of concrete buildup, and repair or replace worn or damaged blades or fins.
- h. Provide trucks that are equipped with actuated counters that measure the number of drum revolutions. Start counting revolutions at the time of mixing starting at mixing speeds.
6. Hauling Equipment
 - a. Provide equipment capable of maintaining the mixed concrete in a thoroughly mixed and uniform mass and discharging the concrete uniformly.
 - b. Provide equipment with smooth, mortar-tight metal containers equipped with gates that prevent accidental discharge of the concrete when using non-agitating equipment for transporting concrete.
 - c. Provide equipment with back-up alarms.
 - d. Perform uniformity testing in accordance with Tex-472-A at the request of the City.
 - e. Deliver concrete in accordance with supplier recommendations.
 - f. Provide clean equipment, free of built-up concrete.
7. Delivery Tickets:
 - a. Tickets from the haul truck and the batch or commercial plant are required for all concrete being delivered.
 - 1) The City will verify that the haul ticket and the plant ticket match and that no additional water or admixtures have been added to the haul truck.
 - b. Provide delivery ticket from the batch or commercial plant containing the following information:
 - 1) Water added by receiver of concrete
 - 2) Water withheld
 - 3) Weight of cementitious material
 - 4) Type and amount of admixtures
 - 5) Maximum size of aggregate
 - 6) Weight of aggregate
 - c. Provide delivery ticket for the batch of concrete containing the following information:
 - 1) Name of concrete supplier
 - 2) Serial number of ticket
 - 3) Date
 - 4) Truck number
 - 5) Name of purchaser
 - 6) Specific designation of job (name and location)
 - 7) Specific class, design identification, and designation of the concrete

- 8) Amount of concrete in cubic yards
 - 9) Time loaded or of first mixing of cement and aggregates
 - 10) Water added by receiver of concrete
 - 11) Water withheld
 - 12) Weight of cementitious material
 - 13) Type and amount of admixtures
 - 14) Maximum size of aggregate
 - 15) Weight of aggregate
8. Testing Equipment
- a. Furnish and maintain equipment capable of performing all testing required in accordance with ASTM C94/C94M, NRMCA, Sections 03 00 00, 03 30 00, 31 37 00, 32 05 16, 32 13 13, 32 13 16, 32 32 00, and this Section.
- B. Asphalt Production Equipment
1. Provide asphalt production equipment in accordance with the requirements of TxDOT Item 320 and TxDOT Item 520.
 2. Equipment Requirements:
 - a. Drum-mix type, weigh-batch, or modified weigh-batch mixing plants that ensure a uniform, continuous production
 - b. Automatic proportioning and measuring devices with interlock cut-off circuits that stop operations if the control system malfunctions
 - c. Visible readouts indicating the weight or volume of asphalt and aggregate proportions
 - d. Safe and accurate means to take required samples by inspection forces
 - e. Permanent means to check the output of metering devices and to perform calibration and weight checks
 - f. Additive-feed systems to ensure a uniform, continuous material flow in the desired proportion
 3. Verify the accuracy of hot mix asphalt meters in accordance with Tex-921-K.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling Requirements
1. Secure and maintain a location to store the material in accordance with Section 01 66 00.
- B. In accordance with the requirements of Sections 03 00 00, 03 30 00, 32 05 16, 31 37 00, 32 12 16, 32 13 13, 32 13 16, and 32 32 00.

1.11 FIELD CONDITIONS

1.12 WARRANTY [NOT USED]

PART 2 - PRODUCTS [NOT USED]

2.1 CITY-SUPPLIED PRODUCTS [NOT USED]

2.2 EQUIPMENT [NOT USED]

2.3 ACCESSORIES [NOT USED]

2.4 SOURCE QUALITY CONTROL [NOT USED]

PART 3 - EXECUTION [NOT USED]

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION [NOT USED]

3.4 INSTALLATION [NOT USED]

3.5 REPAIR [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING [NOT USED]

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION