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PIGEON FORGE DEPARTMENT OF PUBLIC WORKS
WATER AND SEWER IMPROVEMENT GUIDANCE MANUAL

1. PURPOSE
The City of Pigeon Forge Department of Public Works endeavors to partner with Developers, Engineers, and Contractors to promote growth within the City Limits of Pigeon Forge and within Sevier County. The Department is committed to doing this while maintaining stringent standards on the distribution and storage of potable water and the collection of wastewater from its Service Area. The Mission of the Department is to provide sanitary services which protect both the customers within the Service Area and the waters of the State of Tennessee.

2. USE OF MANUAL
This Guidance Manual has been prepared to assist Developers, Engineers, and Contractors with the requirements of constructing infrastructure improvements within the jurisdiction of the Pigeon Forge Department of Public Works. The Guidance Manual outlines application and approval procedures that must be adhered to prior to extension of water or sewer service to any development. The Guidance Manual also summarizes basic design and construction requirements for infrastructure improvements which connect to the City of Pigeon Forge water and sewer systems.

This Guidance Manual should not be utilized as a comprehensive design and construction guide. The Manual does not include provisions for every situation that may arise. The use of sound engineering principals combined with adherence to the design criteria mandated by the State of Tennessee is necessary for the successful completion of water and sewage construction projects.

The City of Pigeon Forge reserves the right to deny any request for water or sewer service inside or outside the City Limits. The Department also reserves the right to review the design of any extension of service and determine the most advantageous sizing of that extension to meet the needs of the entire system.
1. DRINKING WATER PROJECT WITHIN CITY LIMITS
   a. Submit request for waterline extension to Director of Public Works.
      Information shall include:
      i. Name of Developer with address and telephone number
      ii. Name of Engineer with address and telephone number
      iii. Name and location of proposed development (include sketch or map with Tax Map Number and Parcel Number)
      iv. Available platting and/or water service plans
      v. Topographic and boundary surveys
      vi. Use of development (ie. Commercial, Overnight rental, Single Family Residential, etc.)
      vii. Approximate number of water system customers (or Single Family Equivalents) to be added to system
      viii. Minimum and maximum elevations on property
      ix. Maximum finished floor elevation within development
      x. Estimate of daily and peak hourly water consumption
      xi. Approximate start and completion dates for construction.
   b. Director of Public Works will notify Developer in a timely manner of the availability of water service.

2. DRINKING WATER PROJECT OUTSIDE CITY LIMITS
   a. Request permission of the Sevier County Water Board to connect to the county owned waterline if applicable.
   b. Submit request for waterline extension to Director of Public Works.
      Information shall include:
      i. Written permission to connect to a county owned line from the Sevier County Water Board where applicable
      ii. Name of Developer with address and telephone number
      iii. Name of Engineer with address and telephone number
      iv. Name and location of proposed development (include sketch or map with Tax Map Number and Parcel Number)
      v. Available platting and/or water service plans
      vi. Topographic and boundary surveys
      vii. Use of development (ie. Commercial, Overnight rental, Single Family Residential, etc.)
      viii. Approximate number of water system customers (or Single Family Equivalents) to be added to system
      ix. Minimum and maximum elevations on property
      x. Maximum finished floor elevation within development
      xi. Estimate of daily and peak hourly water consumption
      xii. Approximate start and completion dates for construction.
c. Requests for water outside the City Limits must be analyzed by the City's Engineer within a hydraulic model and reviewed against the City's Master Plan for Water Services. A nominal fee of $500.00 payable to the City of Pigeon Forge must be submitted with each request to cover this analysis.

d. Upon approval of the plans by the City's Engineer, requests for water outside the City Limits will then be submitted to the City Commission for approval. Developers shall:
   i. Submit a letter requesting to be placed on the agenda for the next available City Commission meeting shall be addressed to the City Manager. This letter shall include the developer's name, address, contact person's phone number, general information on the development (number of unit's to be served, general location, etc.) and the request to connect to the City's water service.
   ii. The developer or his representative must be present at the City Commission meeting to represent the request and answer any questions the Commissioners may have.

e. Upon City Commission's approval, the Director of Public Works will notify Developer in a timely manner of the availability of water service.

f. A fee of one thousand dollars per lot in the development is to be paid to the City of Pigeon Forge.

g. Maintenance easement documents suitable for recording shall be provided to the City prior to commencing construction.

3. SEWER PROJECT WITHIN CITY LIMITS
   a. Submit request for sewer extension to Director of Public Works. Information Shall include:
      i. Name of Developer with address and telephone number
      ii. Name of Engineer with address and telephone number
      iii. Name and location of proposed development (include sketch or map with Tax Map Number and Parcel Number)
      iv. Available platting and/or sewer service plans
      v. Topographic and boundary surveys
      vi. Use of development (eg. Commercial, Overnight rental, Single Family Residential, etc.)
      vii. Approximate number of sewer system customers (or Single Family Equivalents) to be added to system
      viii. Minimum and Maximum elevations on property
      ix. Estimate of daily and peak hourly sewer flows
      x. Approximate start and completion dates for construction.
   b. Director of Public Works will notify Developer in a timely manner of the availability of sewer service.
4. SEWER PROJECT OUTSIDE CITY LIMITS
   a. The City of Pigeon Forge does not offer sewer service to entities outside the City Limits. Developers must contact the Sevier County authorities for approval of alternative systems.

5. UPON COMPLETION OF ALL PROJECTS
   a. Before system is placed into service:
      i. All work must have been approved by the City Construction Inspector
      ii. All waterlines must be pressure tested, disinfected, and receive an approved bacteriological test from the City Water Plant Operator
      iii. All sewerlines must pass mandrel, air and pressure tests
      iv. All pump stations must pass an operational test at their design flows
      v. All water storage tanks must be properly disinfected, pass a leakage test and receive an approved bacteriological test from the City Water Plant Operator
      vi. One hardcopy and one electronic copy (in AutoCad or Microstation) of record drawings must be provided for the Public Works Department's files
      vii. The attached System Acceptance Checklists must be completed and signed by all listed parties
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      i. Name of Developer with address and telephone number
      ii. Name of Engineer with address and telephone number
      iii. Name and location of proposed development (include sketch or map with Tax Map Number and Parcel Number)
      iv. Available platting and/or water service plans
      v. Topographic and boundary surveys
      vi. Use of development (i.e. Commercial, Overnight rental, Single Family Residential, etc.)
      vii. Approximate number of water system customers (or Single Family Equivalents) to be added to system
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      ix. Minimum and Maximum elevations on property
      x. Maximum finished floor elevation within development
      xi. Estimate of daily and peak hourly water consumption
      xii. Approximate start and completion dates for construction.
vii. Highest and lowest finished floor elevations for all existing and proposed structures shall be indicated.

viii. Inclusion of any water or sewer pump station or water storage tank shall require additional review by the City of Pigeon Forge. Such items shall be identified and submitted to the Department of Public Works prior to bidding or procurement of said equipment.

d. Specifications-
   i. Any equipment or installation specification which differs from the City of Pigeon Forge Standard Waterline or Sewerline Specifications must be submitted for approval to the Department of Public Works prior to beginning any construction.
1. DRINKING WATER PROJECT WITHIN CITY LIMITS
   a. Submit request for waterline extension to Director of Public Works. Information shall include:
      i. Name of Developer with address and telephone number
      ii. Name of Engineer with address and telephone number
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      ix. Minimum and Maximum elevations on property
      x. Maximum finished floor elevation within development
      xi. Estimate of daily and peak hourly water consumption
      xii. Approximate start and completion dates for construction.
f. Record drawings indicating changes to the approved plans shall be submitted to the Department of Public Works.
g. Permanent easements shall be deeded to the City of Pigeon Forge upon acceptance of infrastructure line improvements. Pump station and tank sites shall be deeded fee simple to the City of Pigeon Forge.
h. Developers will return all copies of Plans and Specifications to the Department of Public Works prior to closeout of the project.

2. PRELIMINARY MATTERS
   a. Developers shall obtain permanent easements across adjacent landowners where necessary at their own expense for water and sewer projects. In addition, easements shall be included for all infrastructure within the development. Minimum permanent easement width for new pipelines shall be 15 ft. Easements shall be deeded to the City of Pigeon Forge after completion of construction.
   b. Preconstruction DVDs shall be provided to the City of Pigeon Forge for any work within any public right-of-way or easement obtained for construction. Videos shall be DVD format and shall be utilized to evaluate restoration after construction completion.
   c. Developers are required to acquire all permits required for construction, grading, utility crossings, stormwater discharge, etc. Copies of these permits may be required by the City of Pigeon Forge.

3. WATER DISTRIBUTION SYSTEM DESIGN
   a. Any distribution system connected to the City of Pigeon Forge water system shall be designed to provide fire flow at a minimum rate of 500 gallons per minute for 120 minutes at a residual pressure of 20 psi (measured at the highest point in the development’s water system). If fire flow is provided by a gravity storage tank, this minimum pressure shall be maintained with the tank at its minimum water level. Additional fire flow capacity may be required depending upon the type and density of structures within a proposed development. The Department of Public Works should be contacted for specific requirements.
   b. Fire hydrants are required along distribution lines at intervals not to exceed 500 feet. A minimum clear distance of 3 feet shall be maintained around all fire hydrants.
   c. Isolation valves are required at intersections of distribution lines and along mains at intervals not to exceed 1000 feet. Placement of isolation valves shall be at fire hydrants to facilitate easy location.
   d. Distribution systems shall be designed to limit maximum pressures to less than 150 psi at all points within the system.
4. WATERLINE CONSTRUCTION
   a. All waterlines shall have a minimum cover of 36”.
   b. Sufficiently sized air release valves shall be located at all high
      significant high points along the length of the waterline.
   c. Automatic Flushing Valves may be required on rural unlooped
      waterlines.
   d. Reduced Pressure Backflow Devices may be required for
      commercial developments. The Department of Public Works shall
      make the determination which developments are subject to this
      provision.
   e. Pipelines which cross public roadways owned and/or maintained by
      the State of Tennessee or Sevier County must be located within
      casing pipes.
   f. All waterlines shall have a minimum of 36” separation from gas,
      electrical, and telecommunications lines.
   g. All water lines regardless of pipe material shall have 6” of crushed
      stone bedding and 12” of crushed stone cover.

5. SEWERLINE AND FORCE MAIN CONSTRUCTION
   a. All lines shall have a minimum cover of 36”.
   b. Sufficiently sized air release or combination air release valves shall
      be located at all significant high points along the length of
      forcemain pipelines.
   c. Pipelines which cross public roadways owned and/or maintained by
      the State of Tennessee or Sevier County must be located within
      casing pipes.

6. WATER BOOSTER STATIONS
   a. Pump on demand type booster stations are not permissible within
      the Pigeon Forge Water System. Ground storage tanks or elevated
      water storage tanks are required on the discharge side of all
      booster stations to provide for fire protection and to allow storage
      capacity in the event of pump station failure. Hydropneumatic
      storage tanks in lieu of gravity storage tanks will only be approved
      for small developments serving fewer than 50 single-family
      equivalent units.
   b. In general, water booster stations shall be located with all operable
      equipment above grade, within a structure fabricated by the pump
      station manufacturer. Enclosures shall be UL Listed and shall
      conform to the Standard Building Code. Hypochlorite dosing may
      be required at the station site. If required, a separate chemical
      dosing room will be provided as an integral part of the pump station
      enclosure.
c. Pumps shall be end-suction centrifugal pumps where possible. Turbine pumps will only be approved under extenuating circumstances (ie. Extremely low flow/ high pressure applications).

d. Any piping under flooring shall be ductile iron.

e. Surge release valves shall be included within the station, and shall discharge to atmospheric pressure outside the station.

f. A low pressure suction shutoff mechanism shall be included with the pump station. The mechanism shall not permit pressures in the suction line to drop below 20 psi.

g. Stations serving more than 10 residences must include provisions to interface with the City's SCADA system located at the Water Treatment Plant.

h. Station sites shall provide a minimum 20 feet of clear, level area on all sides of the station within the fenced limits of the property. Paved access to the site shall meet City of Pigeon Forge standards for road construction. A gravel driveway around the station shall be provided to allow service trucks access to all four sides of the structure. Permanent restoration of the site after construction shall minimize erosion of the site.

i. Other provisions of the TDEC Public Drinking Water Design Criteria shall be adhered to.

7. WATER STORAGE TANKS

a. Storage tanks shall be sized to provide required residential, commercial and fire flows. Tanks shall be designed so that 20 psi minimum system pressure is sustained with the water level at its lowest operating level.

b. To prevent stagnant water, inlet pipes shall terminate within 3 feet of the overflow elevation within the tank.

c. Only cylindrical welded steel, glass fused bolted steel, or prestressed concrete tanks will be allowed. Rectangular tanks will not be permitted.

d. All storage tanks shall have a level sensor and a chlorine analyzer interfaced to the Water Treatment Plant SCADA system.

e. A chlorine analyzer and hypochlorite dosing system may be required in instances where reasonable turnover of storage tanks cannot be assured. If so, the equipment shall be housed within an approved weatherproof enclosure.

f. Tank sites shall provide a minimum 20 feet of clear, level area on all sides of the tank within the fenced limits of the property. Access to the site shall meet City of Pigeon Forge standards for road construction. A gravel driveway around the site shall be provided to allow service trucks access to all four sides of the structure. Permanent restoration of the site after construction shall minimize erosion of the site.
g. Tanks serving more than 10 residences must include provisions to interface with the City’s SCADA system located at the Water Treatment Plant. If, at anytime, the station servers more than 10 residences through additional connections or any other means, it shall be upgraded to interface with the City’s SCADA system located at the Sewage Treatment Plant.

h. Other provisions of the TDEC Public Drinking Water Design Criteria shall be adhered to.

8. SEWAGE LIFT STATIONS

a. The City of Pigeon Forge endeavors to limit the number of sewage lift stations within the collection system. If gravity sewer service can be provided with reasonable depths of cut, the City reserves the right to modify sewer service plans to require such gravity service.

b. Sewage lift stations shall utilized submersible pumps, where possible. Pumps shall be able to pass a 3" diameter sphere. Grinder pumps will only be considered on a case-by-case basis, and only in developments containing less than 10 residences.

c. All stations shall have an emergency bypass connection located on the pump station parcel.

d. Station sites shall provide a minimum 20 feet of clear, level area on all sides of the station within the fenced limits of the property. Access to the site shall meet City of Pigeon Forge standards for road construction. A gravel driveway around the station shall be provided to allow service trucks access to all four sides of the structure. Permanent restoration of the site after construction shall minimize erosion of the site.

e. Stations serving more than 10 residences must include provisions to interface with the City’s SCADA system located at the Sewage Treatment Plant. If, at anytime, the station servers more than 10 residences through additional connections or any other means, it shall be upgraded to interface with the City’s SCADA system located at the Sewage Treatment Plant.

f. Other provisions of the TDEC Design Criteria for Sewage Works shall be adhered to.
CITY OF PIGEON FORGE
WATER SYSTEM ACCEPTANCE CHECKLIST

1. System Pressure Tested
2. System Disinfected
3. Bacteria Testing Satisfactory
4. Successful Fire Flow Testing of System
5. Booster Station/Tanks Inspected and Approved
6. Telemetry Installed and Tested
7. Erosion Control Approved
8. Property Restoration Complete
9. Record Drawings Submitted
10. Service Contracts Submitted
11. All Easements Acquired and Transferred to City
12. All Warranty Deeds Transferred to City
13. All Documentation Submitted on One-Year Warranty
14. All Testing and Development Fees Paid
15. Punchlist Items and Deficiencies Corrected
16. Construction is in Accordance with Guidance Manual

_____________________________  _______________________________
Contractor  Developer
Emergency Phone #  Emergency Phone #
_____________________________  _______________________________
Fire Department  Water Treatment Plant
_____________________________  _______________________________
Chief Building Inspector  Utilities Superintendent
_____________________________  _______________________________
Construction Inspector  Public Works Department

F:\Standard Water and Sewer Specs 2013\Tab 1- Front End\3PF Water System Acceptance Checklist.docx
CITY OF PIGEON FORGE  
SEWER SYSTEM ACCEPTANCE CHECKLIST

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<tr>
<td>1</td>
<td>Sewer Lines Air and Mandrel Tested</td>
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<td>2</td>
<td>Force Mains Pressure Tested</td>
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<tr>
<td>3</td>
<td>Lift Stations Inspected and Approved</td>
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</tbody>
</table>

Contractor  
Emergency Phone # ____________________________  

Developer  
Emergency Phone # ____________________________  

Fire Department  

Water Treatment Plant  

Chief Building Inspector  

Utilities Superintendent  

Construction Inspector  

Public Works Department
DATE: February 2014

PROCEDURE FOR WATER TESTING

• The Public Works Construction Inspector determines that the water is to be tested and sends customer to City Hall Utility Department Clerks.

• Contractor is responsible for flushing line prior to bacteriological testing.

• Contractor is charged a $100.00 fee for water test per each 2500 liner feet of line to be tested and a work order is generated.

• Line will be retested at time of meter connection.

• Work order is sent to Public Works Construction Inspector and stamped “APPROVED” for test.

• Work order is then sent to Utility Department Superintendent to take the water sample.

• The Utility Department takes water sample and the “BACTERIOLOGICAL EXAMINATION OF NEW LINES” report to the Water Treatment Plant Supervisor, who then tests the water sample.

• If the Water Treatment Plant approves sample, the work order is stamped “APPROVED” and returned to City Hall Utility Department Clerks along with a copy of the “BACTERIOLOGICAL EXAMINATION OF NEW LINES” report. Copies of both are also sent to Public Works Administration, the Construction Inspector, and the Utility Department Superintendent.

• Upon approval, the Utility Department Superintendent informs the customer, who then must pay meter deposit and tap fee to begin water service.
CITY OF PIGEON FORGE
WATER AND SEWER SYSTEM
CONTACT LIST FOR ACCEPTANCE

PUBLIC WORKS DEPARTMENT
MARK MILLER (865) 429-7312

CONSTRUCTION INSPECTOR
BRANDON WILLIAMS (865) 429-7312

UTILITIES SUPERINTENDENT
JERRY SUTTON (865) 453-3043

CHIEF BUILDING INSPECTOR
JOE DUNN (865) 429-7312

WATER TREATMENT PLANT
LYNN LIGHT (865) 453-1275

WASTEWATER TREATMENT PLANT
MARTIN CROSS (865) 428-3558

FIRE DEPARTMENT
ROGER PRICE (865) 429-7312
SECTION 2

STANDARD WATERLINE SPECIFICATIONS
PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The work covered by this Section relates to erosion and sediment control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. It is the Contractor’s responsibility to develop an erosion control plan utilizing the methods outlined in this section or any additional methods deemed necessary. This plan shall be submitted prior to any work being undertaken on this project. The Contractor shall furnish, install and maintain the erosion control measures outlined in this erosion control plan. The Contractor shall adjust and update the plan and provide additional erosion control devices at no additional cost to Owner should the results of the initial plan fail to comply with applicable codes and laws. Contractors shall be responsible for obtaining and adhering to all construction, erosion control, and stormwater permits required in conjunction with this construction.

1.02 COORDINATION OF TEMPORARY AND PERMANENT CONTROLS

A. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion and sediment control features to insure economical, effective, and continuous erosion and sediment control throughout the construction and post-construction period.

1.03 CONTRACTOR’S RESPONSIBILITY TO COMPLY WITH LAW

A. It is the intent of this Section to provide a written plan to insure that PL 100-4, Section 319, TCA 69-3-101, et. seq., Subsection 69-3-108 and Subsection 69-3-114, and Division of Construction Grants and Loans General Permit for Utility Line Crossings, Chapter 1200-4-7.09 are met. Since the Contractor is responsible for the construction means and methods which in turn are responsible for insuring that construction does not harm the Waters of Tennessee, the Contractor is solely responsible for insuring that the above-mentioned laws and regulations are met.

PART 2– PRODUCTS

2.01 BALED HAY OR STRAY

A. The Contractor shall furnish and place baled hay or straw along the top of the bank of paved ditches and/or as shown on the plans prior to construction. Baled hay or straw shall be embedded in ground 4 to 6 inches to prevent water from flowing under them. The bales shall be anchored securely to the ground by wooden stakes
driven through the bales into the ground. Bales to be removed after they have served their purpose as determined by the Engineer. The Contractor shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

2.02 SILT FENCE

A. The Contractor shall furnish and place temporary silt fences either upstream or downstream of construction as required along waterways or other areas where siltation is a problem. Contractor shall choose location according to where he plans to put excavated material. The silt fences shall be constructed of wire mesh fabric with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored in the soil. The filter cloth shall have approved backing or a built-in reinforced structure between the post and fabric as recommended by the manufacturer to support the filter cloth.

B. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc. as directed by the Engineer.

3.03 SEDIMENT STRUCTURES

A. Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditchlines atop waste sites; in the ditchlines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

B. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

END OF SECTION
SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 GENERAL

A. The work covered by this section consists of furnishing all materials and equipment and performing all labor necessary for Site Preparation and Development which includes, but is not limited to clearing, excavating, backfilling, grading and grassing, and all incidentals as shown on the Plans.

B. The work specified under this Section which constitutes Site Preparation shall be performed in such a chronological order as to leave the site in the best possible finished condition. The order of this work is subject to the Engineer’s approval but such approval shall in no way relieve the Contractor of any responsibilities for repair of work damaged by his acts or acts of God.

1.02 SUBSURFACE CONDITIONS

A. The Contractor affirms by the submission of his bid that he has examined the location of the work and has informed himself fully as to the site conditions, the configuration of the ground, the character, quality and quantity of the materials to be encountered, the equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work to be done.

1.03 CLEARING AND STRIPPING OF TOPSOIL

A. The site shall be cleared of all obstructions interfering with the construction of new work.

B. The Contractor shall strip the entire area within cut, fill, and graded areas to remove all topsoil, vegetable matter, stumps, roots, and other objectionable materials. Topsoil and vegetable matter shall be carefully stockpiled and preserved for reuse. Roots and stumps shall be grubbed out and removed from the property entirely. The base of all embankments and fills shall be scarified and rolled so that the base will be well bonded with the first layers of fill. The disposal of refuse will be the responsibility of the Contractor.

1.04 STRUCTURES ON EARTH

A. When structures rest on earth, all loam, organic, or other undesirable material shall be removed as required by the Engineer. When filling is required to bring such excavated area to the levels required to receive structures, the fill shall be compacted by tamping and rolling to obtain 98% of maximum density as per ASTM D-698-66T Method A. Layers shall be not more than six (6") inches thick.
B. Where shown on the Plans or otherwise required under structures, the Contractor shall place and compact crushed stone in twelve (12") inches or thinner layers. Materials shall meet the same requirements as those given for concrete except gradation.

1.05 CATCH BASINS AND STORM DRAINS

A. Catch basins, drop inlets, and other special drainage structures shall be constructed in accordance with the Details shown on the Plans.

B. Storm sewers and appurtenances shall be constructed as shown on the Plans and specified herein.

C. Generally, all storm drainage pipes crossing under roadways shall be corrugated metal culvert pipe or reinforced concrete pipe with end walls at both ends and all other storm sewers are shown as reinforced or non-reinforced concrete pipe. Corrugated metal pipe and/or concrete pipe may be used interchangeably PROVIDED the proposed substitution is approved in advance by the Engineer and the substitute material provides equal or greater strength.

1.06 FINISH GRADING AND TOPSOILING

A. Finish grading shall be performed in accordance with the finished elevations and grades shown on the Plans and shall be made to blend into conformation with remaining natural ground surfaces. All finished grading surfaces shall be left smooth and free to drain. The tops of all cuts shall have berm ditches. Selected materials, which have been obtained from stripping the site, shall be spread upon the slopes of fills and all other areas at the site to a uniform depth and compacted suitable for planting. Excess four (4) to six (6) inches of material in areas to be grassed shall be topsoil. All stone chips, gravel, etc. shall be removed by raking or by hand so that lawn mowing will be safe and practical.

1.07 SEEDING, SODDING, AND LANDSCAPING

A. All graded areas, which shall include all areas at the site shall be left smooth and thickly sown with a mixture of Blue Grass, Italian Rye Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Engineer. When the final grading has been completed, the entire area to be seeded shall be lined with raw agricultural lime at the rate of 3 tons per acre and fertilized with ammonium nitrate at the rate of 5 lbs. per 1000 square feet and an approved commercial fertilizer at the rate of 10 lbs. per 1000 square feet. The analysis of the commercial fertilizer shall be determined by soil tests. After the fertilizer has been distributed, the Contractor shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two operations broadcast either by hand or by approved sowing equipment. The application shall be 30 pounds per acre for each operation. If the Engineer determines to use “hulled” or “unhulled” Bermuda, the application rate shall be seven pounds per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or other approved
device. All seed shall be certified not more than three percent weed. The seeded area shall then be covered with straw at the rate of 1-1/2 tons per acre.

B. Any necessary reseeding or repairing shall be accomplished by the Contractor prior to final acceptance. Unless otherwise approved in writing by the Engineer, seeding shall be limited to the following planting periods: Spring - March 1 through May 10 or Fall - August 15 through October 31. If the construction work is brought to completion when, in the opinion of the Engineer, the season is not favorable for the seeding of the grounds, the Contractor shall delay this item of the work until the proper season for such seeding as directed by the Engineer.

C. Sodding is required on all slopes 3 horizontal to 1 vertical or steeper unless the said slope to receive rip-rap. Sod shall be Bermuda or other approved type reasonably free of weeds and carefully cut, transported, and laid. Sod shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid, and the finished surface shall be true to grade, even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas, and shall be raked to insure sealing the sod joints.

D. The Contractor shall be responsible for all seeding and/or sodding necessary to restore the construction area to its original condition.

1.08 FINAL CLEAN-UP

A. Before the work is considered as complete, all rubbish and unused material due to or connected with the construction shall be removed and the premises left in a condition satisfactory to the Engineer. Streets, curbs, crosswalks, pavements, sidewalks, fences, and other public and private property disturbed or damaged shall be restored to their former condition at the Contractor’s expense. Final acceptance will be withheld until such work is completed.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL

A. The work required under this section consists of all clearing, grubbing, shrub removal and related items necessary to complete the work.

B. The Contractor shall protect shrubs, pavement and other items adjacent to his work.

C. Where adjacent surface areas within the project site, but outside the contract limits, are disturbed as a result of work under this contract, they shall be cleaned of all debris and restored to original condition.

1.02 BENCH MARKS AND MONUMENTS

A. The Contractor shall protect all bench marks, monuments, and other reference points; if disturbed or destroyed, the Contractor shall replace at his own expense as directed by the Engineer.

1.03 CLEARING

A. Clearing shall be removal of all shrubs, trees, sod, and other landscape items as directed by Engineer.

B. Site around tanks shall be cleared for a 30 foot radius.

1.04 GRUBBING

A. Grubbing shall be removal of all stumps, roots, trash, rubbish, vegetable matter to a depth of not less than 18" within limits directed by the Engineer.

1.05 REMOVAL OF SHRUBS AND SOD

A. Remove all shrubs and sod from area to be occupied by Construction.

B. All shrubs and sod shall be replanted at locations determined by Engineer.

1.06 LIMITS OF WORK

A. The contract limits are shown on the drawings. All areas within the contract limits shall be cleared as specified.

END OF SECTION

02110-1
SECTION 02206

RESTORATION OF STREET SURFACES

PART 1 - GENERAL

1.01 GENERAL

A. The various street surfaces disturbed, damaged, or destroyed during the performance of the work shall be restored and maintained as specified herein and as shown and directed. Included in this classification are pavements and surfaces of all types, pavement bases, curbs, and sidewalks.

B. The quality of workmanship and materials used in the restoration shall produce a street surface equal to or better than that which existed before the work began.

1.02 STANDARDS

A. The materials used in restoring any permanent base or surface shall be of the type and kind in the base and surface existing prior to its removal.

B. The work of restoration shall be conducted in accordance with the requirements of the Owner’s specifications for such work in force at the date of the “Notice to Bidders” and the latest edition of Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, whichever is applicable.

1.03 TIME

A. Permanent restoration of all street surfaces shall be completed immediately after trenches have been completely and satisfactorily backfilled. However, if, in the opinion of the Engineer, field conditions are such that permanent restoration is not possible, the Contractor shall immediately proceed with temporary restoration.

1.04 TEMPORARY RESTORATION

A. Upon completion of satisfactorily backfilling, the street or sidewalk damaged or destroyed shall be promptly placed in condition for temporary use until such time as the permanent restoration can be made.

B. Curbs, where possible, shall be temporarily reset in their place as part of the work of temporary restoration of pavement.

C. Damaged or destroyed sidewalks shall be temporarily restored immediately upon the placing of the backfilling either by relaying the old sidewalk pavement or by laying a pavement of wooden planks of sufficient strength to carry such traffic suitably fastened and flush with the adjacent sidewalk or otherwise as directed.
D. Pavements and other road surfaces shall be temporarily restored by placing thereon to proper line and grade a layer of crushed stone or other approved material. Where the existing pavement is laid on other than a cement concrete base, this layer shall have a thickness equal to or greater than the thickness of the existing wearing binder surface plus six (6) inches. Where the existing pavement is laid on a cement concrete base, the temporary surface shall be of any thickness satisfactory to withstand the traffic loads as directed by the Engineer. The material shall be compacted by rolling or tamping until thoroughly keyed. This temporary base or surface shall be treated with an application of suitable bitumen material to consolidate further the surfacing and to eliminate dust nuisance, or the Contractor may use satisfactory cold patch material.

E. Temporary work shall be maintained in a suitable and safe condition for traffic until the permanent pavement is to be installed.

F. Until permanent restoration, all temporary work and adjacent street surfaces shall be maintained in a condition similar to that existing before construction with regard to dust, mud, and other foreign matter.

1.05 PERMANENT RESTORATION

A. Where temporary restoration of streets has been made, permanent restoration shall be as follows:

1. After due notice, the temporary resurfacing materials shall be removed as directed by the Engineer. Where the existing pavement is laid without a base or on a base other than cement concrete, only enough of the temporary materials shall be removed to provide space for the wearing and binder surface. The remaining materials shall be shaped and compacted as hereinafter specified in Subsection 02221-1.04 to act as the permanent base. Where the existing pavement is laid on a cement concrete base, sufficient amount of the temporary materials shall be removed to provide space for the concrete base and the wearing surface. The concrete base shall be constructed of Class D Concrete, and will be measured and paid for as such. The subgrade shall be thoroughly compacted and brought to the required grade and cross section to receive the permanent pavement. Service boxes, manhole tops, and step stones within the street surface cut for the sewer and not conforming to the new work shall be set to established grade.

2. The top surface shall conform with the grade of the existing adjacent pavement and the entire replacement shall match the existing pavement.

B. Where temporary restoration of streets is not necessary, permanent restoration shall be as follows:

1. After backfill and consolidation as specified in Section 02221, crushed stone shall be placed thereon to form a base of not less than 8 inches in depth after compaction to receive the wearing and binder surface. The wearing
and binder surface shall be replaced to correspond in kind to the existing pavement. Compaction of the base, wearing, and binder surface shall be accomplished separately by using not less than an 8-ton roller.

2. The pavement, in all instances, shall be cut back the minimum distance on each side of 6 inches, however where the pavement has been broken or cracked due to pipe laying beyond the limits specified, the pavement shall be removed and cut back 6 inches beyond the cracked or broken pavement. The cut shall be sharp and clean and a suitable tack coat shall be applied to all surfaces prior to paving.

END OF SECTION
SECTION 02220

EARTH EXCAVATION

PART 1 - GENERAL

1.01 GENERAL

A. Earth excavation shall be made to the widths and depths necessary for constructing all structures and pipe lines included in this Contract, and includes the excavation of any material defined as earth which is desirable to be excavated for any purpose pertinent to the construction of the work.

B. The term "earth" as used herein shall include all materials which, in the opinion of the Engineer, do not require blasting, baring, or wedging for their removal from their original beds. Specifically excluded are all ledge and bed rock and boulders or pieces of masonry larger than one cubic yard in volume.

C. The method of making excavation below ground water shall be submitted in detail to the Engineer and his approval obtained before such work is started.

1.02 AUTHORIZED ADDITIONAL EXCAVATION

A. In case the materials encountered at the elevations shown are not suitable, or in case it is found desirable or necessary to remove to an additional depth as the Engineer may direct, in writing, the Contractor shall refill such excavated space with either Class D concrete or selected fill materials as ordered. Additional earth excavation so ordered and concrete or selected fill materials ordered for filling such additional excavation will be paid for under the appropriate unit price Contract Items, or at a price negotiated by the Owner and the Contractor.

1.03 UNAUTHORIZED EXCAVATION

A. Wherever the excavation is carried beyond or below the lines and grades shown or given by the Engineer, except as specified in Section 02220-1.02, all such excavated space shall be refilled with such material and in such manner as may be directed in order to insure the stability of the various structures. Beneath all structures or pipe lines, space excavated without authority shall be refilled by the Contractor at his own expense with Class D concrete or selected fill materials, as ordered by the Engineer.

1.04 SEGREGATION AND DISPOSAL OF MATERIAL

A. Topsoil suitable for final grading and landscaping and excavating material suitable for backfilling or embankments, shall be stockpiled separately on the site in locations approved by the Engineer. Surplus excavated material shall be disposed of in locations on the site as indicated or approved by the Engineer or disposal areas obtained by the Contractor.
1.05 SHORING AND SHEETING

A. All excavations shall be properly shored, sheeted and braced to furnish working conditions acceptable to OSHA standards to prevent shifting of material, to prevent damage to the structures or other work, and to avoid delay to the work. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength and to meet the standards set by OSHA. If, at any point, the sheeting or supports furnished are inadequate or unsuited for the purpose, the Contractor shall provide the additional sheeting and supports necessary to bring the sheeting and shoring supports into compliance with the standards of OSHA. The sole responsibility for the design, methods of installation, and adequacy of the sheeting and supports shall be and shall remain that of the Contractor.

B. In general, sheeting for pipe lines shall not be driven below the elevation of the top of the pipe. If, in order to obtain a dry trench or satisfactory working conditions, it is necessary to drive the sheeting below that elevation, the sheeting shall be cut off and let in place below the top of the pipe at no additional cost.

C. The sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by ramming or other methods.

D. The safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack of inadequacy of the sheeting, shoring and bracing shall be the sole responsibility of the Contractor.

1.06 SHEETING LEFT IN PLACE

A. Any or all sheeting or bracing to be left in place necessary for the purpose of preventing injury to the structures or to other property or to persons shall be the sole responsibility of the Contractor and shall be done in accordance with OSHA standards. If left in place, such sheeting shall be prepared and carried out in accordance with standards set by OSHA.

1.07 REMOVAL OF WATER

A. At all times during the excavation period and until completion and acceptance of the work at final inspection, ample means and equipment shall be provided with which to remove promptly and dispose of properly all water entering any excavation or other parts of the work. The excavation shall be kept dry. No water shall be allowed to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set satisfactory to the Engineer, and in any event, not sooner than 12 hours after placing the masonry. Water pumped or drained from the work hereunder shall be disposed of in a suitable manner without damage to adjacent property or to other work under construction. Water shall be discharged into sanitary sewers. No water containing settleable solids shall be discharged into
storm sewers. Any and all damage caused by dewatering the work shall be promptly repaired by the Contractor at his expense.

1.08 STRUCTURE EXCAVATION

A. The site of all excavations for structures shall first be cleared of all trees and obstructions unless otherwise directed preparatory to excavation.

B. The excavations shall be of sufficient size and only of sufficient size to permit the work to be economically and properly constructed in the manner and of the size specified. Wherever the nature of the ground will permit, the bottom of the excavation shall have the shape and dimensions of the underside of the structure.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL

A. All excavation shall be backfilled to the original surface of the ground or to such other grades as may be shown or directed. For areas to be covered by topsoil, backfill shall be left 6 inches below the finished grades shown on the Plans. In all backfilling, all compressible and destructible rubbish and refuse which might cause later settlement and all lumber and braces shall be removed from the excavated space before backfilling is started, except that sheeting and bracing to be left in place or removed as the work progresses as specified in Section 02220, paragraphs 5 and 6.

B. Backfilling, unless otherwise specified, shall be done with sound materials, free from waste, objectionable organic matter, rubbish, boggy or other unsuitable materials. No frozen material shall be used for backfilling.

C. All waterlines shall have a minimum of 6" bedding with crushed stone and shall have a minimum 12" of crushed stone backfill over the top of the pipe.

1.02 BACKFILL AND TAMPPING

A. Initial backfill surrounding the pipe and to a one-foot minimum depth of cover shall be crushed stone, free from rocks greater than ½" diameter, dirt clods, or frozen material. If automatic tampers are used, care should be exercised to avoid damaging the pipe.

B. In water pipe installations, the top of the bells can be left exposed for visual inspection during the test, if required.

C. Complete backfill with a uniformly dense backfill load using machines, if desired. This backfill should be free of frozen lumps and rocks over 6" in diameter and free of stumps, etc. The backfill should be placed and spread in approximately uniform layers in such a manner as to completely fill the trench with a uniformly dense backfill load on the pipe and avoid unfilled spaces in the backfill. Rolling equipment should not be used until a minimum of 18 inches of backfill material has been placed over the top of the pipe. Hydrohammer compaction will not be allowed except with 48" of cover.

1.03 BACKFILL CONSOLIDATION

A. In paved, sodded or seeded areas, each layer of backfill shall be consolidated at optimum moisture content by pneumatic or machine tampers to such density that paving, sodding or seeding can proceed immediately after the backfilling is
completed without danger of settlement (8+/- inches layers). It is estimated that a density of approximately 95 percent of maximum after compaction, determined as specified in Subsection 02221-1.04, will be required. In the event that settlement does occur, the Contractor shall immediately, at his own expense, resurface or retop affected areas to bring them up to proper grade.

1.04 SPECIAL CONSOLIDATION

A. Where structures, pipe lines, walks, roadways, or railroad tracks are to be supported on backfilled excavations or embankments without sufficient available time for normal settlement and where selected fill is not specified or ordered, special provisions shall be made for consolidation of the fill. The entire backfill or embankment shall be made with material meeting the requirements set forth below. If such material is not available from the excavation, suitable material shall be obtained from borrow. No material shall be used which has not been approved in advance as to quality and source by the Engineer. Samples shall be submitted at least one week in advance of the desired date of approval. Approval of the samples will not constitute approval of the entire source, but only in so far as the material continues to meet the requirements. If visual inspection indicated that the material varies from the approved sample, the work shall be stopped until additional representative samples can be obtained and analyzed. Not less than one sample shall be submitted for every 100 cubic yards or fraction thereof of the material to be used.

B. The material shall be a combination of sand, silt and clay well graded, of which not more than 30 percent shall be retained on a No. 4 sieve and not less than 55 percent nor more than 85 percent shall be sand passing a No. 4 sieve and retained on a No. 200 sieve. The material shall have a liquid level not greater than 35 as determined by AASHO Des. T89. Gravel or stones shall not be larger than one-third the depth of the layer to be compacted. The material shall contain no trash, brick, broken concrete or cinders.

C. The fill material shall be placed in uniform horizontal layers 6 inches in thickness. Stones, if present, shall be disturbed throughout the mass so that all interstices are solidly filled with fine material.

D. The material in each layer of fill at the time of compaction shall have a moisture content within 2 percent of the optimum value for compaction as determined by the AASHO Standard Method of Test for the Compaction and Density of Soils, Des. T99, except that the soil shall be compacted in the specified mold in 5 equal lifts by a 10-pound hammer falling freely at a distance of 18 inches with 25 blows per layer.

E. When the fill materials are too dry, the Contractor shall wet the surface of the preceding layer to an amount directed by the Engineer, and shall then add water to the new layer by sprinkling and mixing as required to bring the material to the optimum moisture content specified.

F. When the material is too wet, it shall be allowed to dry until the optimum moisture content is reached.
G. Each layer of fill shall be compacted by means of a mechanical tamper or other approved method which will give the desired results until the density of compaction is at least equal to 9 percent of the optimum density of the material as determined by the test specified above. Determination of the density of the material in place shall be in accordance with AASHO Des. T99.

1.05 SELECTED FILL MATERIAL

A. Selected fill material shall consist of any pea gravel, gravel, crushed stone, or other granular or similar material approved by the Engineer that can be readily and thoroughly compacted. Sand or other fine materials that have a tendency to flow under pressure when wet will not be acceptable. Selected fill material for small spaces shall be placed as specified in Subsection 02221-1.02.

1.06 PIPE COVER

A. Minimum cover over the top of pipe shall not be less than 3.0 feet where pipe is not subjected to traffic or where ductile iron pipe is used. The minimum cover where the pipe is subjected to traffic shall not be less than 4.0 feet.

B. Where the cover is insufficient, an earth fill shall be constructed, ductile iron pipe shall be used, or the pipe shall be encased in concrete as shown on the Plans or directed by the Engineer in the field.

1.07 BACKFILL AROUND BELOW GRADE STRUCTURES

A. Excavated areas around below grade structures shall be backfilled and consolidated with selected fill material. Consolidation shall be as hereinbefore specified.

1.08 BACKFILL IN ROADWAYS

A. Excavated areas in roadways shall be backfilled to their full depth with selected fill material as specified in Subsection 02221-1.05.

END OF SECTION
SECTION 02665
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 GENERAL

A. The work covered by this Section of the specifications consists of materials necessary for the satisfactory completion of the water distribution system. All materials used on the job shall be new and conform to the standards and descriptions listed herein.

1.02 INSPECTION

A. All pipe and accessories shall be laid, jointed and tested under pressure for defects and leakage in the manner specified. All material found during the progress of the work to have cracks, flaws or other defects will be rejected. All defective material furnished by the Contractor shall be promptly removed by him from the jobsite. Any material furnished by the Owner and found defective shall promptly be removed from the jobsite by the Owner. The City of Pigeon Forge will provide periodic observation of construction activities. The City reserves the right to request that underground utility installations not be covered until their inspector has an opportunity to observe the quality of the installation and materials.

1.03 RESPONSIBILITY FOR MATERIAL

A. Material furnished by the Contractor shall be his responsibility and he shall replace at his own expense all such material found defective or damaged in handling. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

B. The Contractor’s responsibility for material furnished by the Owner shall begin at the point of delivery thereof to said Contractor. The Contractor shall examine all materials furnished by the Owner at the time and place of delivery to him and shall reject all defective materials. After acceptance, the Contractor is responsible as specified in paragraph above.

C. The Contractor shall be responsible for the safe storage of material intended for the work that is furnished by or to him and accepted by him until it has been incorporated in the complete project.

D. All materials furnished by the Contractor shall be delivered and distributed at the jobsite by the Contractor. All materials furnished by the Owner shall be delivered and distributed at the jobsite by the Owner as directed by the Contractor.
1.04 DUCTILE CAST IRON

A. Ductile cast iron pipe shall conform to the latest revision of ANSI/AWWA C151/A21.51 and be furnished with joints and fittings conforming to the latest revisions of ANSI/AWWA C110/A21.10 and C111/A21.11. Ductile cast iron pipe and fittings shall be provided as shown in the plans in accordance with these specifications.

B. Mechanical joints shall have the same pressure rating as the pipe or fittings of which they are a part. Joints shall be provided with either ductile iron or gray iron glands with an asphaltic coating unless otherwise specified. Mechanical joints shall be manufactured by American Cast Iron Pipe Company or Romac and be provided with a gland, rubber gasket, and tee head allow steel bolts with hex nuts for each socket. The City of Pigeon Forge reserves the right to reject any mechanical joint system.

C. If push-on joints are to be used with the ductile cast iron pipe, the joints shall be (1) "Tyton" joints as manufactured by the U.S. Pipe and Foundry Company, or (2) "Fastite" joints as manufactured by the American Cast Iron Pipe Company, or (3) "Super Bell-Tite" joints as manufactured by James B. Clow and Sons, or (4) an approved equal. The push-on joints shall have the same pressure rating as the pipe fittings of which they are a part. Fittings shall have an asphaltic coating and be cement lined and seal coated with an asphaltic material.

D. Flanged joints, restrained joints, and ball and socket joints shall be in accordance with the latest revisions of ANSI/AWWA C110/A21.10 and C111/A21.11 and manufactured by U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, the Clow Corporation, or by an approved equivalent.

E. Unless otherwise specified on the Plans, the pipe shall have a minimum wall thickness in accordance with the following table:

<table>
<thead>
<tr>
<th>SIZES</th>
<th>PRESSURE CLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inch through 12 inch</td>
<td>350</td>
</tr>
<tr>
<td>14 inch through 21 inch</td>
<td>350</td>
</tr>
</tbody>
</table>

F. The wall thickness shall be designed in strict accordance with ANSI/AWWA C150/A21.50 or the latest revision thereof.

G. Ductile cast iron pipe shall be cement lined, and seal coated conforming to ANSI/AWWA C104/A21.4 Specifications, the latest revision thereof. The thickness of the coating shall be not less than 1/16 inch for 4-12 inch pipe, 3/32 inch for 14-24 inch pipe and 1/8 inch for 30-48 inch pipe.

1.05 POLYVINYL CHLORIDE (PVC)

A. PVC pipe shall conform to the latest revision of AWWA C900/905 and be furnished with joints and fittings conforming to the latest revisions of AWWA C907/909. PVC pipe and fittings shall be provided as shown in the plans in accordance with these specifications and meet NSF 61 certification requirements.
B. Mechanical joints shall have the same pressure rating as the pipe or fittings of which they are a part. Mechanical joints shall be manufactured by Romac or American Cast Iron Pipe Company. Romac style restraint shall be “grip ring” and American Cast Iron Pipe Company shall be “Mega Lug.” Other systems will not be allowed.

C. Push on pipe joints shall incorporate a rubber gasket that is integral to the pipe as supplied from the manufacturer. Lubricant shall be used as recommended and shall not adversely affect the potable water quality. The gasketed joint shall meet the laboratory performance requirements specified in ASTM D3139.

D. The pressure class of the pipe must exceed the maximum working pressure of the system. For pipe (4”) inches through (12”) inches in diameter, pipe shall be minimum pressure class 305 psi (DR14) with integral wall thickness bell. For pipe (14”) and larger, minimum pressure class shall be DIP 350 with integral wall thickness bell ends and furnished in cast iron pipe equivalent outside diameters.

1.06 SERVICE LINES

A. Service lines shall be ¾” Type K copper. Tubing shall be connected to fittings, meters, corporation stops, etc., using Mueller water service stops and fittings or approved equal. Service lines shall be continuous.

B. Meter box will be Rhino brand model MB-4, 18”x18” with model FB-18 Lid.

C. Meters are not to be located in an area subject to vehicular loads such as driveways or entrance roads. If site restrictions are such that meter must be located in roadway, driveway, or other area intended for use by vehicles, meter box and lid must be of cast iron or concrete construction and load rated for vehicular loads. Lid must be cast with lettering indicating purpose of the box.

D. Meter yoke shall be AY McDonald brand model 12-70-2-QFQP33996 with ¾” brass gate valve on the customer side and ¾” female adapter (compression) on the inlet side.

E. Tapping saddle for PVC pipe ¾” service tap shall be brass hinge type.

F. At a minimum, one meter shall be provided per structure. Master meters will not be permitted except for condos, hotels, or multi family housing structures. City of Pigeon Forge reserves the right to dictate meter quantity and location and its sole discretion.

G. A curb stop shall be installed at the property line for all services.

H. The City of Pigeon Forge shall provide the water meter.

1.07 FITTINGS

A. Fittings shall be ductile iron with push-on or mechanical joints conforming to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 Specifications.
B. For joining existing pipe or proposed ductile iron pipe with polyvinyl chloride pipe on
the branch, tapped tees and adapters shall be used as recommended by the
manufacturer.

1.08 GATE VALVES

A. Gate valves shall be the resilient seated wedge type, epoxy coated to AWWA C550,
cast iron body design. They shall comply with the AWWA Gate Valve Standard C-
509 as latest revised.

B. Valves shall be rated for zero leakage at 200 psi water working pressure and have a
400 psi hydrostatic test for structural soundness for 4" thru 12". All testing shall be
conducted in accordance with AWWA C-509.

C. All gate valves shall be furnished with mechanical joint end connections unless
flanged connections are requested by the Contractor. The end-connections
furnished shall be suitable for connection to ductile iron pipe. Slip-on joints will not
be allowed.

D. The gate valves shall be of the non-rising stem type with the stem being a high
strength bronze material. The valves shall be furnished with O-ring seals protected
by a weather seal.

E. The inside and outside of all valves shall be coated with epoxy meeting AWWA
C550 latest revision. The gate shall be totally encapsulated in rubber.

F. All gate valves shall have the name of monogram of the manufacturer, the year the
valve casting was made, the size of the valve, and the working water pressure cast
on the body of the valve.

G. All gate valves shall be provided with a 2-inch square operating nut on which the
word "OPEN" and an arrow are cast to denote the proper direction the valves turn to
open and shall open by turning to the left (counter clockwise). Valves shall be
installed with a three-piece, screw type adjustable roadway type cast iron valve box.
The top of the box shall be coated in the field with black asphaltum varnish. They
shall be set vertically and properly adjusted so that the cover will be in the same
plane as the finished surface of the ground or street.

H. Gate valves shall be installed in a vertical position.

1.09 FLUSHING HYDRANTS

A. Flushing hydrants will be required at the end of water service lines at the discretion
of the City.

B. City reserves the right to dictate which lines will or will not require flushing hydrants
or automatic flushing hydrants with de-chlorination.
C. Automatic flushing hydrants shall be installed at the end of unlooped rural waterlines. Units shall be fully programmable, battery powered, standard discharge units, with automatic de-chlorination, Hydro-Guard HG-4 or Eclipse 9800.

D. Flushing hydrants shall include a pressure reducing valve and 2” meter.

E. Blow-offs consisting of a 2-inch pipe turned up will not be permitted.

1.10 CHECK VALVES

A. Check valves shall be Horizontal Swing Check Valve unless otherwise specified as manufactured by the Clow Corporation or an approved equal. Check valves shall conform to the latest revision of ANSI/AWWA C-508.

B. Check valves shall be of the iron body, bronze mounted, non-assisted, swing-check type with mechanical-joint or flanged ends that are installed horizontally in water systems. The end type is as shown on the Plans. Seating shall be the resilient material to metal seat construction. The swing check valve, when fully open, shall have a net flow area not less than the area of the circle with a diameter equal to the nominal pipe size.

1.11 AIR RELEASE VALVES

A. Air release valves are to be located at high points on the waterline as shown on the Plans or as directed by the Engineer.

B. Valves shall be APCO Model 200A, or approved equal.

C. Materials of Construction shall be as follows:

1. Body and Cover- Cast Iron
2. Float- Stainless Steel
3. Seat- Buna-N
4. All Internal Parts- Stainless Steel

1.12 BUTTERFLY VALVES

A. Butterfly valves shall be utilized if the line size exceeds 12”.

B. All butterfly valves shall be as manufactured by Henry Pratt Company or an approved equal.

C. Butterfly valves shall be mechanical joint and shall be rated for 250 psi working pressure. Shafts shall be constructed of Type 304, 18-8 Stainless Steel. Packing shall be of Chevron V. The valve body shall be extra heavy cast iron, with mechanical joint end connections. Bearings shall be chemically inert nylon and shall be liberally sized and self-lubricating. The disc shall be lens shaped and designed to minimize pressure drip and turbulence. Material shall be gray ductile iron with Ni-Chrome seating surface. The seat shall be bonded to the valve body and shall be

02665- 5
Buna-N. All valves shall be furnished with fully greased packed actuators with 2” operating nuts. Extension stems shall be provided as necessary. Actuators will open when operated counterclockwise.

1.13 ALTITUDE VALVES

A. Altitude control valves shall be the solenoid operated, single acting type functioning to close off at maximum water level in the tank or reservoir. The valve shall open to replenish the tank supply when the water level drops below a pre-determined level. All altitude control valves shall be as manufactured by Golden Anderson or an approved equal.

B. The valve shall be of semi-steel body and cover, with non-corrosive trim construction throughout. The valve body shall be provided with one flanged cover opening at the top from which all inside parts are accessible. No guides, rods, springs, or cushion cylinders shall be within the confines of the water passageway which would cause turbulence or increase pressure drop. The valve shall be completely lined with bronze down to and forming the seat. The piston shall be all bronze construction with the piston cups, liner cups, and seat washer constructed of renewable leather and rubber material. The valve shall be flanged, faced, and drilled in accordance with the most recently published ANSI B16.1 Standards.

C. This valve shall be designed such that no metal-to-metal contacts occur within the main valve; all wear will be absorbed by the renewable leather or rubber cups and seat ring. The piston shall be of the differential design providing for approximately twice the area above the piston as below it. Piston movement shall be regulated by the action of a 3-way type pilot valve. The pilot valve shall be provided with a strainer thus preventing the passage of foreign particles. The valve must be cushioned to prevent hammer and shock when closing. A regulating device shall be provided to adjust the speed of the valve closing. An indicator rod directly attached to the piston shall show the position of the piston at all times.

1.14 VALVES

A. Valves 1-1/2” and smaller shall be all bronze, solid wedge disc, O-ring packing, threaded ends, and non-rising stem. Valves shall be rated for 200 psi.

1.15 FIRE HYDRANTS

A. Fire hydrants shall be of the compression type, opening against and closing with the water pressure. They shall conform to the specification of the American Water Works Association, C-502 as extended and/or modified herein. Hydrants shall be Super Centurion 250 as manufactured by Mueller or Model 129 as manufactured by M&H.

B. All hydrants shall be 4-1/2 inch valve opening size.

C. The inlet connection shall be 6-inch mechanical joint including glands, gaskets, bolts and nuts.
D. Hydrants shall have one pumper and two 2-1/2" hose connections threaded to conform to the standards now in use in the system. The hydrants shall open by turning to the left (counter-clockwise). Size and shape of operating nut shall be Pent. 1-1/2" P. to F. The operating nut shall be made of bronze.

E. Hydrants shall be of a suitable length of a trench three feet and nine inches deep, measured from the surface of the ground to the bottom of the connecting pipe, unless otherwise shown on the Plans.

F. All hydrants shall be equipped with an operating lock nut/weather shield which shall function as thrust bearing to retain the bronze operating nut. An O-ring seal shall be provided to prevent entry of weather elements. The O-ring seal plate shall prevent water from entering bonnet during operation. The bonnet shall be sealed from moisture. The drain valve shall be bronze, shall be an integral part of the main valve top plate and shall operate within the bronze cylinder seat of the hydrant.

G. Hydrants shall be equipped with the "traffic" or "breakable" features to allow for breakage without damage to main valve or lower rod.

H. Hydrant shall be painted from the factory with Sherman Williams KEM 400 4084 Safety Yellow enamel paint.

I. Fire hydrants shall have 36" clearance around the hydrant and shall have a minimum of 18" from the ground to the bottom of the nozzle cap.

1.16 PIPE LAYING - DUCTILE IRON

A. Handling of Pipe: Satisfactory and proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All material shall be carefully lowered into the trench. Under no conditions shall materials be dropped or dumped into the ditch.

B. Cleaning Pipe and Fittings: All lumps, blisters, and excess coatings shall be removed from the ends of each section of pipe and fittings and the spigot and bell shall be wire brushed, wiped clean and dry and be free from oil and grease prior to laying. Every precaution shall be taken to prevent the entrance of foreign material into the pipe.

C. Laying Pipe: After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced into the bell to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints.

D. Mechanical Jointing of Pipe and Fittings: After placing the pipe in the trench, wash socket and plain end with soapy water, then slip gland followed by gasket over spigot end of pipe. The gasket is now washed with soapy water after which the pipe is inserted into the socket. The gasket is then pushed into position so that it is evenly seated in the socket. The gland is then moved into position against the face.
of the gas ket and bolts are inserted and made finger tight. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining the same distance between the gland and the face of the flange at all points around the socket. This is accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. This procedure or cycle should be repeated until all bolts are within 60 to 90 foot pounds torque. If the joint is not effectively sealed at the upper torque limit, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts shall not be permitted.

E. Slip Type Gasket Joints for Pipe: After placing the pipe in the trench and before assembly, the inside of the bell and the outside of the plain or spigot end of the pipe shall be thoroughly cleaned from the end of the pipe to the painted stripe. The groove retaining the gasket in the bell must be also thoroughly cleaned. After taking the above precautions, the gasket is carefully inserted into the groove provided for same in bell of pipe. At this point, check to assure that the gasket is properly installed. Apply a coating of the lubricant to the outside of the pipe from the plain end to the strip. Also apply a coating of the lubricant to the outside surface of the gasket. Center the plain end of the pipe in the bell and push "home" the spigot. The spigot shall be pressed into the socket to the full depth of the strip. The spigot under no circumstances shall be seated against the bell such as to prevent deflection of the pipe. When using plain end of field cut pipe, the end shall be beveled to insure proper installation.

F. Setting Valves and Fittings: Valves, fittings, plugs and caps shall be set and jointed to the pipe as herein before specified for pipe cleaning, laying and jointing. Locations shall be as shown on the Plans or as directed in the field. A valve box or pit shall be provided for every valve as shown on the Plans or specified herein. Drainage of mains shall be accomplished by means of blow-offs as shown on the Plans or specified herein. Anchorage for valve fittings, caps, plugs, or bends shall be provided with reaction backing or metal harness.

G. Testing: Hydrostatic Test: Each section of new piping shall be given a hydrostatic test at a pressure of not less than 150 pounds per square inch and measurements taken for leakage in the section. Leakage is defined as the quantity of water to be supplied into the section pipe under test, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. The allowable leakage shall be based upon the following formula:

\[ L = \frac{SDP^{1/2}}{133,200} \]

where

- \( L \) = Allowable leakage in gallon per hour
- \( S \) = Length of pipe tested in feet
- \( D \) = Pipe diameter in inches
- \( P \) = Average test pressure during leakage test in pounds per square inch
1.17 PIPE LAYING - PVC

A. Handling of Pipe: Satisfactory and proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All material shall be carefully lowered into the trench. Under no conditions shall materials be dropped or dumped into the ditch. Installation procedures shall be in accordance with AWWA C600/605.

B. Cleaning Pipe and Fittings: All lumps, blisters, and excess coatings shall be removed from the ends of each section of pipe and fittings and the spigot and bell shall be wire brushed, wiped clean and dry and be free from oil and grease prior to laying. Every precaution shall be taken to prevent the entrance of foreign material into the pipe.

C. Laying Pipe: After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced into the bell to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the joints.

D. Mechanical Jointing of Pipe and Fittings: After placing the pipe in the trench, wash socket and plain end with soapy water, then slip gland followed by gasket over spigot end of pipe. The gasket is now washed with soapy water after which the pipe is inserted into the socket. The gasket is then pushed into position so that it is evenly seated in the socket. The gland is then moved into position against the face of the gasket and bolts are inserted and made finger tight. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining the same distance between the gland and the face of the flange at all points around the socket. This is accomplished by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. This procedure or cycle should be repeated until all bolts are within 60 to 90 foot pounds torque. If the joint is not effectively sealed at the upper torque limit, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts shall not be permitted.

E. Slip Type Gasket Joints for Pipe: After placing the pipe in the trench and before assembly, the inside of the bell and the outside of the plain or spigot end of the pipe shall be thoroughly cleaned from the end of the pipe to the painted stripe. The groove retaining the gasket in the bell must be also thoroughly cleaned. After taking the above precautions, the gasket is carefully inserted into the groove provided for same in bell of pipe. At this point, check to assure that the gasket is properly installed. Apply a coating of the lubricant to the outside of the pipe from the plain end to the strip. Also apply a coating of the lubricant to the outside surface of the gasket. Center the plain end of the pipe in the bell and push "home" the spigot. The spigot shall be pressed into the socket to the full depth of the strip. The spigot under no circumstances shall be seated against the bell such as to prevent deflection of the pipe. When using plain end of field cut pipe, the end shall be beveled to insure proper installation.
F. Setting Valves and Fittings: Valves, fittings, plugs and caps shall be set and jointed to the pipe as herein before specified for pipe cleaning, laying and jointing. Locations shall be as shown on the Plans or as directed in the field. A valve box or pit shall be provided for every valve as shown on the Plans or specified herein. Drainage of mains shall be accomplished by means of blow-offs as shown on the Plans or specified herein. Anchorage for valve fittings, caps, plugs, or bends shall be provided with reaction backing or metal harness.

G. Testing: Hydrostatic Test: Each section of new piping shall be given a hydrostatic test at a pressure of not less than 150 pounds per square inch and measurements taken for leakage in the section. Leakage is defined as the quantity of water to be supplied into the section pipe under test, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. The allowable leakage shall be based upon the following formula:

\[ Q = \frac{LDP^{1/2}}{148,000} \]

where

- \( Q \) = Allowable make-up water in gallons per hour
- \( L \) = Length of pipe section being tested in feet
- \( D \) = Pipe diameter in inches
- \( P \) = Average test pressure during leakage test in pounds per square inch

1.18 DISINFECTION OF LINES

A. The new finished water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the Engineer.

B. After all hydrostatic testing as described herein has been successfully completed, a solution of hypochlorite using HTH or equal shall be introduced into the section of the lines being disinfected at an amount sufficient to insure a chlorine dosage of at least 50 ppm in the lines. While the solution is being applied, the water shall be allowed to escape at the ends of the lines until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe. The chlorinated water shall be allowed to remain in the pipe for 24 hours. A residual of at least 10 ppm should be present in the pipe at the end of the 24-hour period. After the chlorinated water has remained in the line for 24 hours, the line shall be thoroughly flushed and filled with water from the system. A bacteriological sample will then be taken by the City Personnel. Developers shall contact the City of Pigeon Forge Water Treatment Plant at (865) 453-1275 to schedule the test. If a negative sample is obtained, the line shall be thoroughly flushed and then may be connected to the system. If a positive sample is obtained, the disinfection procedure must be repeated until a negative sample is obtained. The cost of the bacteriological test will be borne by the Contractor. The cost of the test shall be $100 per sample. This fee shall be paid to the City Hall Utility Clerk along with applicable tap fees prior to connection to the City system. The required water will be supplied by the Owner. Disinfection is to be included in the cost of the pipe.
1.19 CONNECTIONS TO EXISTING LINES

A. Connection of the new water line to existing water lines shall be accomplished, including all valves, fittings, and pipe, in accordance with the details shown on the drawings. The Contractor shall verify in the field the type and size of existing pipe prior to undertaking to make the connections.

B. Water service will not be supplied until all testing requirements have been fulfilled, all fees have been paid, all easements have been recorded, and record drawings have been submitted.

1.20 SETTING FIRE HYDRANTS

A. Hydrants shall be located as shown on the drawings or as directed in the field. Hydrants shall be set on a concrete base as indicated on the drawings which shall have set sufficiently to support the hydrant. After the joints have been made, a concrete thrust block shall be poured between the back of the hydrant and the undisturbed earth behind it. Concrete shall be kept clear of the weep hole at the base of the hydrant. The bridle rods and collars shall not be less than \( \frac{3}{4} \) inch stock and shall be protected by a coat of acid resistant paint. Not less than seven cubic feet of stone as shown on the drawings shall be placed around the base of each hydrant to insure drainage from the weep holes before placement of backfill. All hydrants shall be set with the steamer or pumper connection facing the road unless otherwise directed.

B. After setting, the paint shall be touched up or the hydrant repainted as directed. All hydrants shall be connected to the main via a 6-inch valve as shown on the drawings.

1.21 TAPPING

A. Tapping shall be with a machine approved by the Inspector.

B. Tapping may be dry or under pressure, as required.

C. Tapping shall be by competent personnel.

D. Tapping valves shall be Mueller Company Model H-667, American - Darling or approved equal.

E. Tapping saddles shall be Romac SST or approved equal.

1.22 BEDDING AND COVER

A. All water mains shall be laid with a minimum 6" of crushed stone bedding and 12" of crushed stone backfill.
1.23 RELATION TO SEWER MAINS

A. All water mains shall be laid with a minimum ten foot (10') horizontal separation, measured edge to edge, from any sewer main.

B. If conditions physically prohibit a ten-foot separation, the water main may, upon the approval of the Engineer, be laid in a separate trench with the elevation of 18" above the top of the sewer main.

C. Where sewer and water mains cross, the invert of the water main shall be separated from the crown of the sewer main by 18". The water main shall be installed above the sewer main.

D. If conditions physically prohibit an 18" separation, the sewer main shall be constructed of ductile iron pipe with mechanical joints for a distance of ten feet (10') either side of the crossing.

1.23 RELATION TO GAS, TELECOMMUNICATIONS, ELECTRICAL, AND CABLE LINES

A. All water mains shall be laid with a minimum three foot (3') horizontal separation, measured edge to edge, from any other utility including gas and electrical lines.

1.24 CONFLICT WITH EXISTING UTILITIES

A. Horizontal Conflict: Horizontal distance shall be defined as the actual horizontal separation between the edge of a utility, main, or service and the closest edge of the proposed water main. The horizontal distance shall be at least 3 feet between the water main and other utilities (except sewer, which is 10 feet). The Contractor must change the proposed alignment of the water main to avoid horizontal conflicts.

B. Vertical Conflict: Vertical distance shall be defined as the actual vertical separation between the edge of a utility, main, or service and the closest edge of the proposed water main. The vertical distance shall be at least 18" between the water main and other utilities. The Contractor must change the proposed alignment of the water main to avoid horizontal conflicts.
PART 1 - GENERAL

1.01 GENERAL

A. The materials covered under this section are cement, sand, crushed stone, gravel and water for use in concrete mortar and grout.

1.02 CEMENT

A. Except as otherwise specified, all cement used on the work shall be either air-entraining Portland cement or standard Portland cement. Cement shall be a domestic product from a source approved by the Engineer before the cement is ordered. If standard Portland cement is used, an air-entraining agent meeting the requirements of ASTM Des. C260 shall be added to the concrete at the time of mixing in an amount sufficient to produce from four to six percent entrained air in the concrete.

B. Air-entraining cement shall meet the requirements of ASTM Des. C175, Type 1A or Type 11A, and standard Portland cement shall meet the requirements of ASTM Des. C150, Type 1 or Type 11.

C. Standard Portland cement without an air-entraining agent shall be used in the manufacture of concrete pressure pipe.

D. The Engineer shall have the right at all times to inspect the materials, the processes of manufacture, the laboratory records of the analyses and tests made at the cement works, and to supervise the packing.

1.03 HIGH-EARLY STRENGTH CEMENT

A. In case high-early strength cement is required for special parts of the work, it shall be a true Portland cement with no chemicals or other substances added to expedite hardening, and of a brand approved by the Engineer. The cement shall meet the requirements of ASTM Des. C150, Type III or C175, Type IIIA. High-early strength cement shall be used only with the approval of the Engineer.

1.04 DELIVERY AND STORAGE OF CEMENT

A. Cement delivered to the jobsite shall be in strong, well-made bags plainly marked with the brand name of manufacturer, and net weight. Packages received in damaged condition will be rejected or they may be accepted as fractional packages when permitted by the Engineer.
B. For ready-mixed concrete, cement may be delivered in bulk provided that the batching plant meets the requirements of ASTM Des. C94.

C. Cement shall be stored in a weather tight building having a wooden floor raised above ground and shall be protected from dampness. Cement that has deteriorated from storage shall not be used. Cement remaining in storage, prior to use, for a period greater than six months after test, shall be retested and shall be rejected if it fails to meet any of the requirements of these Specifications. Accepted cement which has been in storage for more than one year from the time of original acceptance shall not be used.

1.05 SAMPLES OF AGGREGATES

A. At least 15 days before the first concrete is to be used, a 50-pound representative sample of each aggregate shall be submitted to the Engineer for approval. As the work proceeds, additional samples shall be submitted if, and when required, by the Engineer.

1.06 FINE AGGREGATE

A. Fine aggregate shall be natural sharp sand meeting the requirements of ASTM Des. C33, except as modified herein.

B. Fine aggregate for concrete shall meet the requirements for grading in ASTM Des. C33.

C. Fine aggregate for mortar and grout shall be well graded within the following limits by weight when tested in accordance with ASTM Des. C136.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percentage Passing Mortar</th>
<th>Percentage Passing Grout</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>No. 8</td>
<td>96 to 100</td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td>70 to 90</td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td>40 to 70</td>
<td>50</td>
</tr>
<tr>
<td>No. 50</td>
<td>15 to 35</td>
<td></td>
</tr>
<tr>
<td>No. 100</td>
<td>5 to 15</td>
<td></td>
</tr>
</tbody>
</table>

1.07 COARSE AGGREGATE

A. Coarse aggregate shall consist of gravel or crushed stone and shall meet the requirements of ASTM Des. C33, except that no exceptions shall be made in the requirements for passing the soundness test as set forth in Paragraph 10A of those Specifications. Coarse aggregate shall be graded according to Sizes 467 and 57 in Table II.

03010-2
B. Size No. 57 shall be used for all thin or closely reinforced concrete work, such as floors and roofs less than 7 inches thick, walls less than 9 inches thick, all beams, girders, struts, columns and all fireproofing. For all other concrete work, Size No. 467 shall be used.

1.08 STORAGE AND HANDLING OF AGGREGATES

A. Aggregates shall be kept clean and free from all other materials during transportation and handling. They shall be kept separated from each other at the site until measured in batches and placed in the mixer.

B. Unless finish screening is provided at the batch plant, aggregates shall be stockpiled in a manner to prevent segregation in accordance with ACI Standard 614.

1.09 ADMIXTURES

A. The use of admixtures in concrete, other than air-entraining agents as hereinbefore specified, will not be permitted.

1.10 WATER

A. Water used in mixing concrete shall be clean and shall not contain deleterious amounts of acids, alkalis or organic materials. All water shall be furnished from sources approved by the Engineer.

END OF SECTION
SECTION 03150

CONCRETE AND REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL

A. Concrete shall be of two classes as follows:

1. Class C shall be used for manhole bases and tops, sidewalks and pavements.

2. Class D concrete shall be used for pipe cradle, anchor and encasement, filling soil stabilization and similar purposes.

1.02 MATERIALS

A. Cement shall meet the requirements of ASTM Des. C150, Type I or Type II.

B. Coarse aggregate shall meet the requirements of ASTM Des. C33.

C. Fine aggregate shall meet the requirements of ASTM Des. C33.

1.03 CONCRETE

A. All concrete shall be ready mixed and shall meet the requirements of ASTM Des. C94.

B. The compressive strength of concrete at 28 days shall be not less than the following:

<table>
<thead>
<tr>
<th>Class</th>
<th>Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>3000</td>
</tr>
<tr>
<td>D</td>
<td>2000</td>
</tr>
</tbody>
</table>

C. The concrete shall have a slump of not less than 2 inches nor more than 4 inches when tested in accordance with ASTM Des. C143.

D. The amount of water per sack of cement shall not exceed 6 gallons for Class C concrete nor 8 gallons for Class D concrete.

1.04 FORMS

A. Forms shall conform to the shape, lines, and dimensions of the member as shown on the Plans. They shall be substantial, properly braced, and tied together so as to maintain position and shape and to resist all pressures to which they may be subjected. They shall be sufficiently tight to prevent leakage of mortar.
1.05 PLACING CONCRETE

A. Concrete shall be deposited as closely as possible to its final resting place and in no case more than eight feet distant in a horizontal direction. It shall be handled and placed so as to prevent any segregation of the material. In other respects, the handling and placing of concrete shall conform to the recommendation of the ACI.

1.06 CURING

A. Concrete exposed to the atmosphere shall be protected against too rapid drying for a period of at least seven days. It shall be kept moist by sprinkling, covering with soaked quilted covers or impermeable paper, coating with sprayed-on during membrane, or other means acceptable to the Engineer.

1.07 REINFORCING STEEL

A. Reinforcing bars shall meet the requirements of ASTM Des. A305 and shall be of steel meeting the requirements of ASTM Des. A15, Intermediate Grade.

B. Reinforcing mesh shall meet the requirements of ASTM Des. A185.

C. Reinforcing steel shall be fully protected from moisture, grease, dirt, mortar or concrete and shall be cleaned of all rust, mill scale, and dirt before being finally incorporated in the work.

D. Reinforcing steel shall be placed and held in position so that the concrete cover as measured from the surface of the bar shall be not less than 2 inches.

END OF SECTION
SECTION 3

SUPPLEMENTAL SPECIFICATIONS FOR BOOSTER STATIONS, WATER STORAGE TANKS, STEEL TANK PAINTING, CHLORINE ANALYZERS, PERISTALTIC METERING PUMPS, WATER SYSTEM TELEMETRY
SECTION 02445

VINYL COATED CHAIN LINK FENCING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall furnish and install PVC or polyolefin elastomer-coated chain link fencing and accessories for commercial use.

B. Fences shall be located around all tanks, pump stations, and other above ground structures.

1.02 SUBMITTALS

A. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories and post foundations.

B. Product data: Manufacturer’s catalog cuts indicating material compliance and specified options.

C. Color selection for PVC finishes. Color shall be green.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Products from qualified manufacturers having a minimum of five years experience manufacturing thermally fused chain link fencing will be acceptable as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size gauge of metal parts and fabrication.

B. Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

C. Approved Manufacturers: Anchor Fence/Master Halco, Baltimore, MD or approved equal.

2.02 CHAIN LINK FENCE FABRIC

A. PVC or polyolefin elastomer coating, 7 mil (0.18mm) to 15 mil (0.38mm) thickness, thermally fused to zinc-coated steel core wire: Per ASTM F668 Class 2b. Core wire tensile strength 75,000 psi (517 MPa).

B. Size: Helically wound and woven to height of 6 feet with 2-inch diamond mesh, 9 gauge, with a core wire diameter of 0.148 inch and a breakload of 1290 lbf. Color: Black or Green. Submit color chart for final selection.
C. Selvage of fabric twisted at top and at bottom.

D. Fence shall have three (3) strands of barbed wire around the top of the fence.

E. Fence shall have a minimum height of six (6) feet.

2.03 STEEL FENCE FRAMING

A. Steel pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi (170 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area.

B. Steel pipe - Type II: Cold formed and welded steel pipe complying with ASTM F 1043, Group IC, with minimum yield strength of 50,000 psi (344 MPa), sizes as indicated. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/ft² (275 g/m²) minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/ft² (275 g/m²) zinc or Type D, zinc pigmented, 81% nominal coating, minimum 3 mils (0.08 mm) thick.

C. Formed steel (“C”) sections: Roll formed steel shapes complying with ASTM F 1043, Group II, produced from 45,000 psi (310 MPa) yield strength steel; sizes as indicated. External coating per ASTM F 1043, Type A, minimum average 2.0 oz/ft² (610 g/m²) of zinc per ASTM A123, or 4.0 oz/ft² (1220 g/m²) per ASTM A525.

D. Steel square sections: [ASTM A 500, Grade B] Steel having minimum yield strength of 40,000 psi (275 MPa); sizes as indicated. Hot-dipped galvanized with minimum 1.8 oz/ft² (550 g/m²) of coated surface area.

E. PVC or polyolefin elastomer coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10 to 15 mils (0.254 - 0.38 mm) thermally fused in color to match fabric.

F. End and Corner Post 2.875" od 9.11 lbs/ft
   Top Rail and Braces 1.660 od 2.27 lbs/ft

2.04 GATES

A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F 900 using aluminum tubular members, 2" (50 mm) square, weighing 0.94 lb/ft (1.39 kg/m). Fusion or stainless steel welded connections forming rigid one-piece unit. Polyolefin coated frames thermally fused with minimum 10 mils (0.254 mm) per ASTM 1043 after fabrication. Coating before fabrication will not be allowed.

B. At a minimum, gate shall have two 6' leafs that have latch that is capable of being secured with a padlock.

2.05 ACCESSORIES
A. Chain link fence accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. “C” shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

C. Top rail and brace rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7” expansion sleeve with spring, allowing for expansion and contraction of top rail.

E. Wire ties: 9 gauge [0.148"] galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge [0.092"] for rails and braces. Hog ring ties of 12-1/2 gauge [0.0985"] for attachment of fabric to tension wire.

F. Brace and tension (stretcher bar) bands: Pressed steel. At square post provide tension bar clips.

G. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16” x 3/4” or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

H. Tension wire: Thermally fused PVC or polyolefin elastomer applied to metallic coated steel wire: Per ASTM F 1664 Class 2 b, 7 gauge, [0.177"] diameter core wire with tensile strength of 75,000 psi (517 MPa).

I. Truss rods & tightener: Steel rods with minimum diameter of 5/16”. Capable of withstanding a tension of minimum 2,000 lbs.

J. Nuts and bolts are galvanized but not vinyl coated. Cans of PVC touch up paint shall be provided to color coat nuts and bolts.

K. Barbed wire: Thermally fused PVC-coated steel wire double-strand, 13-3/4 gauge, [0.083"] twisted line wire with galvanized steel, 4 point barbs (without PVC finish) spaced approximately 3” on center. Fence shall have 3 strand evenly spaced on top of fence as seen in detail.


1. Provide 90° 3 strands, single arm.
2. Provide intermediate arms with hole for passage of top rail.

2.06 SETTING MATERIALS

02445-3
A. Concrete: Minimum 28 day compressive strength of 3,000 psi (20 MPa).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.
B. Ensure property lines and legal boundaries of work are clearly established.

3.02 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F 567 and manufacturer’s instructions.
B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.
C. Space line posts uniformly at 10’ (3048 mm) on center.
D. Concrete set terminal and gate posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6" deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36” below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.
E. Anchor line posts: With protective cap, drive post 36” into ground. Slightly below ground level install drive anchor shoe fitting. Install 2 diagonal drive anchors and tighten in the shoe.
F. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
G. Bracing: Install horizontal pipe brace at mid-height for fences 6’ and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.
H. Tension wire: Provide tension wires at top and at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge [0.0985"] hog rings 24” oc.
I. Center Rails (for fabric height 12’ and over). Install mid rails between posts with fittings and accessories.
J. Bottom Rails: Install bottom rails between posts with fittings and accessories where the fence crosses a ditch or as required at the gate for support.
3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2" between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15" on center and to rails, braces, and tension wire at 24" on center.

B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15" on center.

3.04 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.05 CLEANING

A. Clean up debris and unused material, and remove from the site.

3.06 MEASUREMENT AND PAYMENT

A. Measurement and payment shall be in accordance with the Bid Schedule.

B. If no unit(s) for this work are included in the Bid Schedule, cost(s) for this shall be incorporated into other bid items.

C. Payment for work outside the limits of construction indicated in the plans or otherwise specified shall not be made unless approved in advance by the Engineer.

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. This specification includes the general requirements for design and construction of pre-engineered water booster stations. Because of varying site conditions and operational considerations, these specifications should only be used as a guideline in the design and construction of water booster stations. Developers and their engineers shall schedule a meeting with the Department of Public Works early in the design process to determine if additional requirements will be necessary.

B. Pumping systems shall include the enclosure, frame, pumps, meters, valves, fittings, piping electrical equipment, HVAC, controls and other ancillary equipment as specified herein or as necessary for a fully operational automatic booster station. All equipment shall be assembled by a single supplier who shall bear unitary responsibility for the station’s quality.

C. All equipment shall be manufactured by either the Gorman Rupp Company, EFI, or Flowtronex. Gorman Rupp is represented by Southern Sales Company, (615) 254-0066. EFI is represented by Brann & Whittemore, (615) 377-9444. Flowtronex is represented by Mike Bartley, (704) 453-3876.

1.2 CODES AND STANDARDS

A. REFERENCE STANDARDS
1. Hydraulic Institute Standards
2. ANSI - American National Standards Institute
3. NEMA - National Electrical Manufacturers Association
4. UL - Underwriters Laboratory
5. ETL - Electrical Testing Laboratories
6. NEC - National Electric Code
7. AWWA - American Water Works Association
8. ASTM - American Society for the Testing of Materials
9. NSF - National Sanitation Foundation

B. Fabrication and manufacture shall be in compliance with all local, state, and federal codes having jurisdiction in the project area.

C. The booster station manufacturer will be responsible for providing all plans, documents, and calculations as required for building approval.

D. Station shall be located and constructed to minimize erosion of site. Engineer shall perform analysis to determine impact of pump station on existing storm water flow.
through the site and certify the station will not experience or cause any erosion.

E. Upon approval of the pump station, developer shall grant City of Pigeon Forge fee simple deed to property. Deed shall include proper access to pump station location.

F. Temporary power intended to serve permanent installations will be allowed for no more than forty-five (45) days. After that time has elapsed, City will disconnect temporary power supply until permanent electrical connection is complete. Under no circumstances will a system be allowed to operate on temporary power.

G. Pumps stations are to have paved dedicated access from roadway.

H. Site inside fence must be paved or graveled at the discretion of the City.

1.3 QUALITY CONTROL

A. Manufacturer must have been engaged regularly in the manufacture of booster stations for a minimum of ten years.

B. The booster station shall be in compliance with the Underwriter Laboratory standard for assembled equipment under the Packaged Pumping Systems (QCZJ) UL listing category. The station shall bear the UL label indicating compliance with this standard.

C. All welders shall be certified in welding and be employees of the booster station manufacturer.

D. Pump station manufacturer shall assemble, install, mount, and integrate all electrical apparatus.

1.4 SPECIAL WARRANTY

A. A warranty by the pump station manufacturer shall be provided:
   1. The warranty shall provide for the replacement and/or repair of all equipment and materials provided with the station due to defect or workmanship for a period of one year from the date of acceptance by the Owner.
   2. The booster station manufacturer shall be the one-point contact for all equipment provided.
   3. All labor and parts including removal, modifications, and replacement shall be included in the warranty.
   4. The one-year warranty period will apply regardless of individual component, standard manufacturer warranties.

1.5 SERVICE CONTRACT

A. In addition to the Special Warranty, a 5-year service contract shall be supplied to the City of Pigeon Forge prior to acceptance of the booster station. This service
contract period will begin on the day the station is accepted by the City. The service provider under this contract shall be the licensed service representative in the area. The contract shall include:

1. 24-hour per day/365 day per year telephone support. At a minimum, the service provider shall maintain a call center where emergency assistance may be obtained.
2. 6-Hour Response Time - If unable to resolve issues over the telephone, service technicians certified by the equipment manufacturer shall be dispatched to the pump station site. Technicians shall be on-site within six hours of the time of the call by the City of Pigeon Forge.

PART 2 - PRODUCTS

2.1 BOOSTER STATION

A. GENERAL
1. Provide clearances above, below and around equipment to provide for safe servicing, removal and reinstallation of that equipment.
2. Doors shall be located and sized to facilitate removal and replacement of equipment without requiring the enclosure to be altered or removed.
3. Structure shall include beam with a chain and hoist for removal of the pumps and motors.

B. MODULAR STRUCTURE
1. Modular enclosure shall be affixed to a steel deck structure. The completed booster station shall be one piece when delivered to the Site and not require disassembling to off-load. The Enclosure shall incorporate, at minimum, two rooms, one shall be for the pumps, controls and electrical equipment, and the other shall be for chemical feed.
2. Side and Ceiling Panels:
   a. Interior and Exterior Skin: 26-gauge galvanized steel with sprayed and baked polyester coating in the pump room. In the chemical room, interior panels shall be Marlite FRP or equal.
   b. Poured-in-place polyurethane foam core bonded to metal skins.
   c. Fire Rating: UL rated flame spread of 25 or lower and smoke generation of 450 or lower when tested in accordance with ASTM E-84-76.
   d. Thickness: Minimum four inches.
3. Panels shall be tongue-and-groove and fasten together using a cam-action locking arm system that draws panels tight together. Provide cam lock wrench with building.
4. Doors:
   a. Size: Double door 72" x 78" clear opening.
   b. Interior and exterior skins identical to wall panels for the pump room. Doors and hardware for the chemical room shall be corrosion resistant RFP and aluminum.
5. Roof:
   a. Single piece EPDM membrane system covering ceiling panels.
   b. Thickness: Minimum 45 mil.
   c. Color: White
   d. Design Wind Load: Minimum 80 MPH or as required by codes.
   e. Roof hatches equal to Bilco ME-50 shall be located over pumps and motors for equipment removal.

6. Safety Floor Matting:
   b. Thickness: ½ inch.
   c. Coverage: From entrance to the control panels and entire NEC clearance area.

7. Chemical Room Exposed Metal:
   a. All exposed ferrous metal within the Chemical Room shall receive a 12-16 mil DFT coating with TNEMEC Series 120 “Vinester” in accordance with the manufacturer’s instructions for surface preparation, prime coating, and finish coating.

C. BASE FRAME
   1. Constructed of standard structural steel members or tubing.
   2. Floor: ¾-inch steel across top of frame.
   3. Provide floor drains.
   4. Provide eyelet devices welded to the frame at the pipe inlet and outlet points designed to withstand movement between the buried pipe and the booster station.

D. PUMPING EQUIPMENT
   1. Number of pumps: Minimum of two. One duty pump capable of delivering the rated capacity and one full capacity redundant on-line spare.
   2. Type: Horizontal, end suction close-coupled centrifugal, where possible. Turbine pumps may be utilized in special situations. The City of Pigeon Forge shall be consulted should turbine pumps be required.
   3. Casing: Cast iron; provide taps for suction and discharge gages. Class 125 suction and discharge flanges shall be utilized unless pressures necessitate Class 300.
   4. Impeller: Bronze; enclosed, multi-vane, statically and hydraulically...
balanced.
5. Wear Rings: Bronze; replaceable.
6. Shaft Sleeves: Bronze; shall cover full length of shaft and protect shaft from liquid, bronze.
7. Seal: Mechanical with carbon rotating face and Ni-Resist stationary face and all stainless steel metal parts.
8. Motor:
   a. Open drip proof, designed to carry all radial thrust loads.
   b. Premium efficiency.
   c. Inverter duty rated motors shall be utilized if greater than 40 HP.
   d. Rotational speed shall be less than 1800 rpm.

E. PIPING
1. All piping and fittings shall be steel.
2. Steel Pipe and Fittings
   a. Material:
      1) 4-inch and smaller: ASTM A53 (CW).
      2) Above 4-inch: ASTM A53 (ERW) Grade B.
   b. Class:
      1) 10-inch and below: Schedule 40.
      2) Above 10-inch: Standard weight (0.375-inch wall).
   c. Flanges: Conform to ASTM A105/A181 and ANSI B16.5
   d. Supports: Use steel sections or tubing. Cut to match pipe and fully weld to floor or pipe at each end. Design to resist transverse and lateral forces.
   e. Interior Coating:
      1) Fusion bonded epoxy.
      3) Total dry mil thickness of 12.0 to 14.0 mils.
      4) Quality Standards: ASTM B117 1,000-hour Salt Spray Resistance; ASTM D2247 1,000-hour Humidity Resistance; ASTM G14-72 Impact Resistance (160 inch-pounds).
3. Valves, Meters and Accessories
   a. Pump Control Valves:
      1) Pilot-controlled, hydraulically operated diaphragm-type automatic control valve.
      2) Cast iron body with flanged connections.
      3) Pilot shall be a four-way solenoid-control electrically interlocked with the booster pump controls and operate on a 115-volt, 60-cycle AC power source. Energize to open main valve.
      4) Provide two variable-position limit switches activated by stem when valve is in the full open or full closed position.
      5) Provide field-adjustable slow opening and closing control.
      6) Provide strainer for water entering pilot assembly.
      7) Provide shut-off cocks to isolate pilot assembly.
8) Provide built-in check valve to close main valve in the event of power loss.
9) Manufacturer: Cla-Val or approved equal.

b. Isolation Valves:
1) 3-inch and below: Bronze body ball or gate valves.
2) Above 3-inch: Resilient wedge gate valve per AWWA C509.

c. Flow Meter:
1) Type: Electromagnetic. Microprocessor-based displaying totalized and instantaneous flow in full pipe.
2) Suitable for installation through a 2" corporation stop.
3) Power: 120-volt AC.
4) Accuracy: 0.5% of flow rate over a 33:1 turndown.
5) Transmitter shall be within a NEMA 4X enclosure relayed to the station SCADA system.
6) Provide 4-20 ma analog flow signal.
7) Manufacturer: Marsh McBarrey Model 284 or equal.

d. Pressure Gages:
1) Glycerin filled with built-in snubber.
2) 4 ½-inch dial.
3) Provide isolation stopcock.
4) Suction pressure: 0 to 100 psi to 10-psi intervals with graduation marks every one-psi.
5) Discharge pressure: 0 to 200 psi in 20-psi intervals with graduation marks every two-psi.
6) Mount gages off the pipe, clear of vibration, and provide a flexible connection line to the pipe.

e. Pressure Control:
1) Power: 120 VAC, 60 Hz.
2) Low pressure cut-off, field-adjustable up to 150 psi.

f. Provide flanged restrained elastomer connector on pump inlet for vibration control.

g. Surge Relief Valve:
1) Pilot-controlled, hydraulically operated diaphragm-type automatic control valve.
2) Cast iron body with flanged connections.
3) Pilot shall be a direct-acting, adjustable, spring loaded, normally closed unit designed to close the main valve whenever the sensed pressure is below the pilot spring setting.
4) The relief valve shall function to limit the discharge header pressure to the value set in the control pilot.
5) Provide field-adjustable slow opening and closing control.
6) Provide strainer for water entering pilot assembly.
7) Provide shut-off cocks to isolate pilot assembly.
8) Provide built-in check valve to close main valve in the event of power loss.
9) Manufacturer: Cla-Val or approved equal.

h. Miscellaneous: Provide restrained adapters, couplings, and unions.
to permit the easy removal of pumps, valves, meter and strainer.

4. Hydropneumatic Tanks
   a. Hydropneumatic tanks will only be allowed under extenuating circumstances and only when less than 50 single family equivalents will be tied to the water system.
   b. Pumping systems utilizing hydropneumatic tanks must be equipped with a high flow pump capable of meeting the required fire flows within the system.
   c. The equipment capsule shall be complete with two (2) diaphragm type hydro pneumatic ASME coded storage tanks. Storage tanks and bladders shall be rated at 50% over the design pressure of the water system.
   d. The hydro pneumatic storage tanks shall feature deep drawn steel upper and lower domes with side shell construction specifically designed for diaphragm type storage tanks. Storage tank welding shall be carefully done to eliminate rough spots and sharp edges. The storage tank base shall be designed so as to permit free airflow to prevent moisture from accumulating beneath the storage tank.
   e. The hydro pneumatic storage tank internals shall include two (2) separate pieces. The first piece shall be a heavy duty butyl diaphragm that effectively separates the air chamber from the water chamber. The shape of the diaphragm shall conform exactly to the shell configuration and shall be of seamless construction meeting FDA requirements for potable water.
   f. The second piece shall be a polypropylene liner that conforms exactly to the lower dome and acts as the water receptacle. Water shall never touch steel.
   g. The polypropylene liner shall be 100% non corrosive and will not be bonded to the steel shell wall or lower dome. A mechanical clamping ring shall permanently affix the diaphragm and the liner to the shell groove. The polypropylene liner shall be tested and accepted by the National Sanitation Foundation.
   h. Hydropneumatic storage tanks shall be Wessels Company or approved equal.

5. By Pass Hydrants
   a. Every pump station shall have a standard fire hydrant on the suction and discharge side of the pump station to allow a temporary pumping arrangement incase of a fire or emergency.

F. PAINTING AND EXTERIOR SURFACES
   1. Exterior surfaces shall be metal, concrete, or other approved durable surface. Wood finishes are not allowed without prior written approval.
   2. Paint all exposed interior and exterior metal surfaces including base frame, floor, piping, pumps, fittings, valves, etc.
   3. Do not paint surfaces already containing finished coatings from the manufacturer such as side panels, control panels and other metals not requiring painting for corrosion protection such as stainless steel and
aluminum. Do not paint plastic or rubber surfaces or other flexible conduits.

4. Surface Preparation: Abrasive blast all exposed surfaces to SSPC-SP6.
5. Apply two coats of Tnemec Series 66 Hi-Build Epoxoline at 2.0-4.0 mils DFT each. Finished dry thickness 4.0-8.0 mils DFT.

G. HVAC EQUIPMENT
1. Heater
   a. Provide one wall or roof-mounted electric unit in each room.
   b. Capable of maintaining temperature at 50°F in station.
   c. UL listed.
   d. Adjustable thermostat with OFF-AUTO-CONSTANT switch.

2. Air Conditioner
   a. Provide one wall or roof-mounted unit in each room.
   b. UV resistant shroud.
   c. Permanent washable polyurethane filter.
   d. Three-speed fan with adjustable airflow direction.
   e. Capable of maintaining temperature at 80°F in station.
   f. Adjustable thermostat with OFF-AUTO-CONSTANT switch.
   g. Heater and air conditioner units may share compound thermostat.

3. Exhaust Fan
   a. Provide one wall mount unit in each room.
   b. Size per local code for required air exchange flow rate.
   c. 120 volt, 60 Hz, 1725 RPM totally enclosed motor, Class F insulation.
   d. Solid cast aluminum frame, non-corrosive fasteners, anti-vibration supports.
   e. UL listed and CSA certified.
   f. Aluminum fixed louver with insect screen mounted exterior opposite of fan.
   g. Wall-mount thermostat and HAND-AUTO switch.
   h. Exhaust fan for the chemical room shall be interlocked to a door switch so that the fan activates when the door opens. Fan shall either de-energize via timer or via a switch.

4. Motorized Air Return Shutter
   a. Provide one wall-mounted unit in each room.
   b. 16-gauge extruded aluminum frame.
   c. 120 volt, 60 Hz single phase electric motor.
   d. Aluminum fixed louver with insect screen mounted exterior opposite of shutter.
   e. Operation of shutter from start/stop operation.

5. Dehumidifier
   a. Provide one portable unit.
   b. Capacity: 25 pints per 24 hours (AHAM Standard DH-1)
   c. 120 volt
   d. UL listed
   e. Condensate piped to sump or outside building.
   f. Dial-controlled adjustable humidistat.

6. Openings
   a. All openings that allow for air passage into or out of the station shall
be equipped with an insect screen.

H. ELECTRICAL EQUIPMENT

1. Control Panel
   a. NEMA 4X Enclosure
   b. Shall incorporate circuit breakers, motor starters, time delay relays and control relays.
   c. One (1) main breaker.
   d. Branch breakers, one for each pump.
   e. One (1) transformer breaker, primary side.
   f. One (1) transformer breaker, secondary side.
   g. One (1) phase monitor breaker.
   h. Nine (9) auxiliary circuit breakers for: controls, lights, heater, air conditioner, dehumidifier, exhaust fan, convenience outlets, telemetry, spare.
   i. Provide place to keep record documents of electrical control schematic and wiring diagram inside door.

2. Pump Starters
   a. Starter design shall be based on site specific date. In general, motors 40 HP or larger shall require RVSS starters.
   b. Control shall be provided as described below.

3. Running Time Meter
   a. Provide for each pump.
   b. Dust and moisture proof molded plastic case.
   c. Register in tenths of hours up to 99999.9 hours before repeating.
   d. Power supply: 115 volt, 60 Hz.

4. Phase Monitor
   a. Provide to protect three-phase equipment against phase loss, under voltage and phase reversal conditions.
   b. Shut down equipment through relay upon fault condition.
   c. Monitor both delta and wye systems.
   d. Automatic reset with adjustable voltage delay.
   e. LED indicators to show normal and alarm conditions and to show phase sequence.
   f. Audible alarm.
   g. UL approved and CSA certified.

5. Surge Arrester
   a. Provide secondary surge arrester for lightning protection.
   b. Housing: Noryl and ultrasonically sealed.
   c. Valve Blocks: Metal oxide with insulating ceramic collar.
   d. Annular gap design.
   e. Permanently crimped lead wire to upper electrode forming part of gap structure.
   f. UL listed and CSA certified.

6. Power Transformer
   a. Dry step down transformer sized for station loads.
   c. Wall-mounted.
d. NEMA 4X weatherproof enclosure.
e. Noise levels within NEMA and ANSI standards.
f. Insulation: Class 180C.
g. UL listed for indoor/outdoor application.

7. Telemetry Interface Panel
   a. NEMA 4X enclosure
   b. 12” x 12” with 1-inch telemetry entrance conduit complete.

8. Telemetry Panel
   a. Panel shall be in accordance with Section 16901.

9. Conduits and Wiring
   a. Service entrance conduits: Rigid steel conduit sized to accept in-bound service conductors and telemetry cables. Continuous from main control panel through enclosure in wall or floor.
   b. Hardwire all equipment except dehumidifier.
   c. All wiring outside control panel shall be run in conduit.
   d. Flexible Conduit: Use where conductors connect to pumps, motors or other electrical equipment. Shall be liquid tight, non-metallic, non-conductive, and corrosion resistant and UL listed. Comply with Article 351 of NEC.
   f. Motor Control Conductors: Size for load. Ampacity shall exceed 125 percent of motor full load current rating for all motors of one (1) horsepower or more. Provide dual rated type THHN/THWN, as required in Article 310 and 430-B of NEC, Schedule 310-13 for flame retardant, heat resistant, thermoplastic, copper conductors in a nylon or equivalent outer covering.
   g. Control and Accessory Wiring: Size for load, type MTW/AWM as required in Article 310 and 670 NEC, Schedule 310-13 and NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors. Comply with NMTBA and UL listed.

10. Receptacles: Provide two (2) duplex ground fault circuit interrupter type receptacles, one (1) of which to be located adjacent to the main control panel.

11. Lighting
   a. Interior: Provide three or more two-tube 32 watt per tube electronic start, enclosed and gasketed, 48-inch minimum length fluorescent light fixtures in each room. One panel shall be located over the main control panel.
   b. Exterior: Provide one (1) 50 watt, high-pressure sodium light fixture with Class H normal power factor reactor type ballast and photocell near the entry door. Lamp shall operate automatically dusk to dawn.
   c. Light switches shall have night glow and be located adjacent to entry door.

12. Auxiliary Power Connection
   a. Double throw switch shall be furnished on the building exterior to
transfer the electrical load from one supply to another. The transfer switch shall be non-fusible, 3-pole, 460 VAC, 600 amp.

b. The manual transfer switch shall be a Model DT366Urk as manufactured by Cutler Hammer.

c. The manual transfer switch shall include a receptacle assembly, Model AP4004ERS as manufactured by Appleton.

I. CONTROLS

1. Control Panel Face - Provide the following on the panel face:

   a. Selector switches:
      1) LOCAL-REMOTE (L-R)
      2) HAND-OFF-AUTO (H-O-A) (one for each pump)
      3) HAND-OFF-AUTO (H-O-A) (for bypass control valve)
      4) PUMP MODE BYPASS VALVE MODEL (PM-BVM)
      5) HAND-OFF-AUTO (H-O-A) (exhaust fan)
      6) LOW PRESSURE CUT-OFF RESET (for suction and discharge cut-off switches)

   b. Indicator lights: Oil tight, full voltage
      1) Pump in operation - Green (one for each pump)
      2) Low pressure suction-side alarm - Red
      3) Low pressure discharge-side alarm - Red

   c. Lockable intrusion alarm switch.

   d. Run time meters for each pump.

   e. Flow meter LED displaying gallons per minute. (may be omitted if LED display is integral part of flow meter)

   f. Provide nameplates for all switches and indicators.

2. Intrusion Alarm

   a. Alarm condition when main entrance door is opened. System shall send digital signal to telemetry.

   b. Provide time delay reset adjustable from 10 seconds to 10 minutes with LED power indicator. Time delay relay shall be DIN rail socket type, removable without disturbing wiring.

3. Description of Operation

   a. Lead Pump Call: The site operation shall have logic that shall call for a lead pump based on the level of water in the remote water storage tank. The lead pump call shall energize when the level of the remote tank site falls to a point equal to or less than the lead pump call set point. The lead pump call shall be turned off when the level of the remote storage tank rises to a point equal to or greater than the lead pump call set point. In the event of a low suction alarm condition or a high discharge alarm condition, the call for lead pump shall be suspended until the condition clears.

   b. Lag Pump Call: The site operation shall have logic that shall call for a lag pump based upon the level of water in the remote water storage tank. The lag pump call shall energize when the level of the remote tank site falls to a point equal to or less than the lag pump call set point. The lag pump call shall be turned off when the level of the remote storage tank rises to a point equal to or greater than the
lag pump call off set point. In the event of a low suction alarm condition or a high discharge alarm condition, the call for lag pump shall be suspended until the condition clears.

c. Pump Failure: The site operation shall have logic that shall activate alarm indicators and outputs when a pump is called to operate, is in the automatic mode of operation, and fails to provide a positive motor engaged indication or if an input from the called pump's motor starter overload indicates a thermal overload trip.

d. Automatic Transfer of Pump Call Upon Failure: The site operation shall have logic that shall transfer the pump call of a failed pump to the next available pump. This shall override the alternation logic.

e. Alternation of Pumps: The site operation shall have logic that shall alternate the lead pump duty after the completion of a pumping cycle. This mode shall have two selectable modes, automatic and manual. In the automatic mode, the logic shall automatically alternate the lead duty through all the pumps. In the manual mode, the operator must select which pump is desired to be the lead pump at all times.

4. Telemetry Input/Output Contacts:
   a. Provide telemetry input and output contacts in accordance with Section 16901.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Enclosure and Pumping Equipment
   1. Install, level, align, and lubricate pump station as indicated on project drawings.
   2. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery.
   3. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping.

B. Electrical Equipment
   1. All mounting and installation shall be performed in accordance with UL Standards 508 and the NEC.
   2. Service entrance, power distribution, control, and starting equipment panels shall be constructed in accordance with UL Standard 508.
   3. Main distribution panel shall contain a UL label indicating a Service Entrance SE rating and is suitable for service entrance equipment.
   4. Panels shall be shop inspected by UL or constructed in a UL recognized facility.
   5. Properly ground all electrical equipment including pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacles, air conditioner, dehumidifier, lights, switches, exhaust fans and pressure switch per Section 250 of NEC.
   6. Install ground wires in conduit and terminate at the control panel to an aluminum bus dedicated and labeled for grounding. Bus shall be provided
space for copper ground wire to earth at time of installation.

7. Metal framing members shall be used solely to support electrical components.

C. Testing

1. Perform hydrostatic test of station after fully assembled including pipe, pumps, valves, fittings and taps.
   a. Test pressure shall be the greater of 150 psi or the shut-off head of the pumps.
   b. Maintain test pressure for 20 minutes.
   c. No leakage shall be evident during test procedure.

2. Conduct electrical test to ensure all equipment and controls are operating properly.

3. Perform certified performance test on each pump.

4. Submit certified test results to the Owner.

3.2 COMMISSIONING SERVICES

A. START-UP

1. Provide a start-up service technician certified by the pump station manufacturer to provide overall start-up services for the booster station including all electrical equipment.

2. Provide a start-up service technician certified by the manufacturer for the pumps and pump control valves. The overall start-up technician may be the same technician for the pump and/or pump control valve provided the respective manufacturers approve them.

3. Provide one full day at the jobsite for start-up and training of the Owner’s personnel.

4. Provide a Start-Up Service Report indicating the station is working properly and identifying any changes made during start-up.

5. Make return trips as required to correct deficient items at no additional cost to the Owner.

6. Provide three (3) copies of bound O&M manuals, including Start-Up Report.

END OF SECTION
SECTION 11213
CHLORINE ANALYZER

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall furnish, install, and place into operation one (1) wall-mounted chlorine analyzer. The analyzer shall be used to measure the chlorine residual in potable water at either water booster stations or water storage tanks.

B. The chlorine analyzer shall be installed in accordance with manufacturer’s recommendations.

C. This system shall be supplied as a complete system, including chemicals, power cords, pumps, etc. and shall be suitable for wall mounting.

D. The analyzer shall be supplied with spare parts for the particular pump and chemicals for a year of operation.

E. The analyzer shall be capable of sending a 4-20 ma signal through the Pigeon Forge’s SCADA system for indication of system operation, chlorine level and water distribution alarms.

F. If located at a water storage tank, the analyzer shall be installed within an approved weatherproof enclosure.

1.02 ACCEPTABLE MANUFACTURER

A. Hach, Model CL17

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Peristaltic Metering Pump - Section 11214

B. Factory-Built Water Booster Pump Stations - Section 11212

C. Potable Water Storage Tanks - Section 13411

PART 2 - PRODUCTS

2.01 ANALYZER

A. The chlorine analyzer shall employ a DPD colorimetric method of measurement using DPD indicator and buffer solution. The analyzer shall be capable of measuring free or total residual chlorine by changing the indicator and buffering solution. A measurement shall be taken every 2.5 minutes and the results displayed by a three-digit LCD read-out in the range of 0 to 5 mg/L. The read-out shall be an
integral part of the analyzer housing. The analyzer shall be designed for 30 days unattended operation and use only 473 mL of each reagent per month.

B. The LCD display shall have a minimum of 3-1/2 digit measurement read-out and six character alphanumeric scrolling text line.

C. Operating with an LED light source with a peak wavelength of 510 nm. The instrument shall be constructed to measure a sample blank before sample measurement to provide automatic zero reference to compensate for sample color and turbidity and changes in light intensity due to voltage fluctuations or light source aging. The instrument shall provide a minimum detection limit of 0.035 mg/L or better. The instrument shall have a precision better than +/- 5% or 0.005 or 0.035 mg/L as CL₂. The minimum detection limit shall be no greater than 0.035 mg/L.

D. The analyzer shall be microprocessor-controlled and provide a 4-20 mA recorder output, as well as two alarms. Each alarm is user-selectable for sample concentration alarms (high and low) analyzer system warnings, or analyzer shutdown alarms. The instrument shall be capable of having the alarms selected from a remote location or at the unit. The system warning shall activate for minor variations in analyzer performance. A system alarm shall activate for major variations in analyzer performance and it shall shut down the analyzer until corrective action is taken. The microprocessor also shall provide self-diagnostic functions accessible through an alphanumeric, menu-driven keyboard. Two SPDT normally open/normally closed dry contact relays rated at 5A resistive load, a 230 VAC shall be provided.

E. Recorder outputs shall be a 4-20 mA. Recorder span minimum and maximum values shall be operator programmable at the menu-driven keyboard over the entire operating range.

F. The chlorine analyzer shall be housed in an IP-62 rated APB plastic enclosure which is designed for wall mounting. The enclosure shall have two clear polycarbonate windows for viewing the measurement readout and reagent levels.

G. Power requirements shall be 230 VAC, 60 Hz, 90 VA maximum.

H. The analyzer shall use no more than 200 mL/min. of potable water for analyzer. The used sample water shall be piped to the floor drain or trench.

2.02 SPARE PARTS

A. The analyzer shall be supplied with the following spare parts:

1. Maintenance kit with pre-assemble tubing.

2. Serial I/O kit.

3. Reagent for free chlorine measurement for one year.

4. Buffer for free chlorine measurement for one year.
PART 3 - EXECUTION

3.01 START-UP, TESTING AND TRAINING

A. General - The Contractor shall be responsible for the successful start-up and testing of the chlorine analyzer. The Contractor shall provide all necessary facilities, manpower, chemicals, tools, etc. required during this phase of the Contract.

B. Start-Up - The start-up of the chlorine analyzer shall be accomplished under the supervision of a certified representative of the manufacturer.

C. Certification - The Contractor shall submit a written certification signed by a representative of the analyzer manufacturer that the system is installed correctly and is in proper operational condition prior to start-up.

D. Training - The Contractor shall supply a minimum of one (1) day (4 hours) of training for the plant personnel in the operation and maintenance of the chlorine analyzer.

END OF SECTION
SECTION 11214
PERISTALTIC METERING PUMP

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall furnish, install, and place into operation one complete metering pump system. The system shall include one peristaltic pump, controller, power supply, mounting assembly, piping, valves, injection nozzle and any appurtenances necessary for a complete operational system.

B. If located at the booster pump station, the metering system shall be installed in a separate room in the modular structure.

C. If located at a water storage tank site, the metering system shall be located within an approved weatherproof shelter.

D. The metering system shall be controlled to maintain a minimum chlorine level within the waterline or tank.

1.02 ACCEPTABLE EQUIPMENT

A. Stenner Model SVP4

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Factory-Built Water Booster Pump Stations - Section 11212

B. Potable Water Storage Tanks - Section 13411

C. Chlorine Analyzer - Section 11213

PART 2 - PRODUCTS

2.01 PERISTALTIC PUMP

A. The metering pump shall be capable of supplying 40 gallons per day of 12% sodium hypochlorite solution at 100 psi discharge pressure.

B. The peristaltic tube shall be sufficient for continuous contact with 12% sodium hypochlorite.

C. The pump shall be self-priming up to a static lift of 25 feet.

D. The pump shall be supplied with a controller capable of adjusting flow over a 20:1 turndown range based upon an analog 4-20 mA input.
E. The pump controller shall include a 4-character LED display and a 4-button keypad (up, down, on/off, prime).

PART 3 - EXECUTION

3.01 START-UP, TESTING AND TRAINING

A. General - The Contractor shall be responsible for the successful start-up and testing of the peristaltic metering pump system. The Contractor shall provide all necessary facilities, manpower, chemicals, tools, etc. required during this phase of the Contract.

B. Start-Up - The start-up of the peristaltic metering pump system shall be accomplished under the supervision of a certified representative of the manufacturer.

C. Certification - The Contractor shall submit a written certification signed by a representative of the peristaltic metering pump system manufacturer that the system is installed correctly and is in proper operational condition prior to start-up.

END OF SECTION
SECTION 13411
POTABLE WATER STORAGE TANKS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The intent of this specification is to provide general minimum guidelines for the design and construction of potable water storage tanks for the City of Pigeon Forge Water Distribution System. Due to the varying nature of site-specific conditions, the specifications are not intended to be specific. Developers/Contractors intending to include storage tanks within their projects shall notify the Department of Public Works to discuss details regarding the detailed design of the tank.

B. These specifications cover the design, furnishing, fabrication, erection, and painting (welded steel tank) of potable water storage tanks, complete with foundation, excavation, forms, piping and all specified accessories.

C. A soil investigation by a reputable Geotechnical Consultant must be performed and submitted to the Department of Public Works prior to tank design. Foundation shall be designed by Developer's Engineer, based on recommendations of the Geotechnical Consultant.

1.02 ACCEPTABLE STORAGE TANKS

A. Only welded steel/epoxy coated, bolted steel/glass lined, or pre-stressed cylindrical concrete water storage tanks will be permitted. The Department of Public Works reserves the right to dictate which tank system is utilized based upon site-specific information. In general, the following guidelines apply:
   1. Capacity less than 500,000 gallons - Bolted Steel/Glass Lined or Welded Steel/Epoxy coated tanks may be utilized.
   2. Capacity greater than 500,000 gallons - Welded Steel/Epoxy Coated or Pre-stressed Cylindrical Concrete tanks may be utilized.
   3. Maximum tank height is fifty (50) feet.

B. Storage tanks will, at a minimum, meet all requirements of the Tennessee Department of Environment and Conservation Community Public Water Systems Design Criteria.

1.03 QUALIFICATION OF MANUFACTURERS

A. Tank manufacturers/contractors must have at least ten (10) years of professional experience producing/building storage tanks for municipal potable water use which meet all applicable AWWA Standards. Tank manufacturers/contractors must submit a list of at least ten (10) similar installations for consideration. Manufacturers/Contractors shall have on staff a full-time professional engineer,
registered in Tennessee, who shall have no less than five years experience in the
design and field construction of drinking water storage tanks, and who shall be in
responsible engineering charge of the work to be done. All working drawings and
design calculations shall carry the seal of such registered professional engineer.

1.04 MINIMUM DESIGN/CONSTRUCTION STANDARDS

A. Design, fabrication and construction of bolted steel tanks shall meet all requirements
of AWWA D103 of latest revision. All components must additionally meet the
requirements of NSF 61 for potable water use. Tanks shall be as manufactured by
Aquastore Engineered Storage Products, Dekalb, Illinois or approved equal.

B. Design, fabrication and construction of welded steel tanks shall meet all
requirements of AWWA D100. The interior and exterior coatings shall additionally
meet the requirements of specification Section 13412 and AWWA D102. Tanks
shall be as manufactured by Caldwell Tanks, Louisville, Kentucky, or approved
equal.

C. Design and construction of pre-stressed cylindrical concrete tanks shall be in
accordance with ANSI/WWA D110 of latest revision. Tanks shall be as
constructed by Crom Corporation, Gainesville, Florida or approved equal.

D. Design and construction of all potable water storage tanks shall include applicable
provisions for seismic, wind and snow loadings. Confirmation of tank design shall
be submitted to the Department of Public Works prior to procurement.

E. The foundation design shall be based upon data from the Geotechnical Report, and
shall be in strict accordance with ACI 318-Building Code Requirements for
Reinforced Concrete.

F. Upon approval of the tank, developer shall grant City of Pigeon Forge fee simple
deed to property. Deed shall include proper access to tank location.

G. Site around tank shall be cleared of trees for a radius of thirty (30) feet from the
edge of the tank.

H. Temporary power intended to serve permanent installations will be allowed for no
more than forty-five (45) days. After that time has elapsed, City will disconnect
temporary power supply until permanent electrical connection is complete. Under
no circumstances will a system be allowed to operate on temporary power.

PART 2 - PRODUCTS

2.01 GENERAL

A. Tank Materials
   1. Tank construction and materials shall be in accordance with the applicable
A. AWWA Standards.

2. For steel tanks, the outside painting color shall be Forest Green unless otherwise agreed to by the City of Pigeon Forge.

B. Level Indication

a. A manual level indicator shall be mounted to the outside of the storage tank.

b. Either an ultrasonic level transmitter or a submerged pressure transducer shall be utilized to determine the water depth inside the tank. The level transmitter shall relay a 4-20 mA signal to a radio telemetry unit (RTU) for transmittance to the Water Treatment Plant SCADA system. Requirements for the level transmitter and SCADA system are included in Section 16901.

C. Roof Vent

1. All tanks shall have a properly sized vent assembly in accordance with the applicable AWWA Standard (D-100, D-103, D-110). The vent assembly shall be furnished and installed above the maximum water level and be of sufficient capacity so that at the maximum design rate of water fill or withdrawal, the resulting interior pressure or vacuum shall not exceed 0.5” water column.

2. The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.

3. The vent shall be so designed and constructed as to prevent the entrance of birds and/or animals by including an expanded aluminum screen (1/2 inch) opening. An insect screen of 23 to 25 mesh polyester monofilament shall be provided and designed to open should the screen become plugged by ice formation.

D. Overflow Pipe

1. All tanks will have a properly sized overflow assembly in accordance with the applicable AWWA standard. Overflow pipes shall be sized sufficiently to expel water at the maximum water fill rate without allowing pressurization of the tank.

2. The terminus of the overflow must be protected from erosion and from insect/pest intrusion. The terminus must also be located such that submersion of the outlet is not allowed. An iron body, fully bronze-mounted with flanged end flap valve, Clow, M & H or equal shall be mounted at the terminus of the overflow pipe. A stainless steel, 24 mesh screen shall be inserted within the valve to prevent insect intrusion.

3. A suitable weir shall be provided inside the tank with the crest located at High Water Level.

E. Outside Tank Ladder

1. An outside tank ladder shall be furnished and installed.

2. Ladders shall be fabricated of aluminum and utilize grooved, skid-resistant rungs.

3. Safety cage and step-off platforms shall be fabricated of galvanized steel. Offset ladders shall be utilized on all climbs exceeding 25 feet. Ladders
shall be equipped with a hinged lockable entry device.

4. Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.

F. Inside Tank Ladder
1. Inside ladder shall be all fiberglass with Type 316 stainless steel fasteners. Provide safe climbing device for interior ladder.
2. Ladders shall be equipped with a fall arrest system meeting OSHA regulations. The system shall be supplied complete with safety harnesses, locking mechanisms, lanyards and accessories for two persons.

G. Shell Access Manhole
1. One 24-inch diameter shell manhole shall be provided near grade level to allow access to the tank interior. The manhole lid shall be hinged or otherwise self-supported and open outward.

H. Roof Hatches
1. Storage tanks shall be constructed with a roof access hatch. Hatch shall be a minimum 24" diameter and allow access from the roof to the interior of the tank. The hatch will be constructed of corrosion resistant materials, and will be hinged and equipped with a locking mechanism.
2. Welded steel tanks shall additionally be constructed with a second roof access hatch. The hatch will be 24-inch diameter and flanged with a removable cover. This hatch shall be constructed so that an exhaust fan may be connected for ventilation during painting operations.
3. All access openings shall have a minimum 4-inch curb.
4. Entry alarm sensors shall be installed on roof hatches and interlocked into the tank telemetry system to alarm of the Water Treatment Plant.

I. Identification Plate
1. A tank identification plate shall be mounted above a shell manhole. The identification plate shall be corrosion resistant and contain the following information:
   a. Tank Contractor
   b. Contractor's project or file number
   c. Tank capacity
   d. Tank diameter and height to High Water Level
   e. Date erected

J. Cathodic Protection
1. Steel tanks shall incorporate a passive Cathodic protection anode system for the tank based upon data provided by the City.
2. Attachment of rectifier boxes, anodes, or wiring to the tank structure shall be approved by the tank manufacturer.
3. Electrical Continuity between the entire tank structure and the protection system shall be the responsibility of the tank manufacturer.
K. Inlet Pipe
   1. To prevent water stagnation within the tank, the inlet pipe shall terminate within 3 feet of the overflow elevation of the tank.

L. Handrail system on the roof of a potable water storage tank, traveling from the opening of the shell ladder to the roof vent.

   Refer to OSHA Standard 1910.23 (e)(1) latest revision

   1. A standard railing shall consist of top rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.

   OSHA Standard 1910.23 (e)(3)(iv)

   2. The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.

M. Confined Space Entry

   1. “Confined Space” entry signs are to be placed on all openings to the interior of the storage tank, i.e. man way openings and hatch openings.

N. Frost Proof Yard Hydrant

   1. All tanks shall require a frost proof yard hydrant on the discharge line of the tank.

O. Site

   1. Site inside fence must be paved or graveled at the discretion of the City.
   2. Site around tanks shall be cleared for a 30 foot radius.

P. Baffles

   1. Depending on tank geometry, baffles maybe required.
   2. Baffles shall be constructed of material typically used in water tank baffling applications.
PART 3 - EXECUTION

3.01 TANK CONSTRUCTION

A. All construction methods shall be in accordance with the provisions of the applicable AWWA Standard.

3.02 DISINFECTION

A. When the tank is ready to be filled, the Contractor shall disinfect the tank with a chlorine solution. The interior surfaces of the tank shall be thoroughly washed and disinfected in accordance with the requirements of AWWA C652, Section 4.2, Chlorination Method 2.

3.03 SAMPLING AND TESTING

A. After the chlorination procedure is completed, and before the storage tank is placed in service, Owner will collect water samples from the full tank for bacteriological analysis. If the results are favorable, the tank may be placed in service. In the event the bacteriological tests are unsatisfactory, the Owner will undertake to determine and correct the cause. In the event the cause is found to result from improper cleaning and/or disinfection, the Contractor will be billed for the additional expense to the Owner for correcting the problem.

3.04 WARRANTY

A. Water Storage Tank Installers/Contractors shall guarantee workmanship and materials on the complete structural portion of the tank for five years from the date that the City of Pigeon Forge Department of Public Works accepts the tank. In case of leakage or structural defects are noted within this period, the Tank Installer/Contractor shall promptly repair the tank at its own expense.

B. Interior and exterior coatings shall additionally be guaranteed for five years from the date of acceptance.

C. Tank appurtenances and accessories shall be guaranteed against defects in materials or workmanship for a period of five years from the date of acceptance.

D. Warranty inspections will be scheduled prior to the termination of the warranty periods. Defects identified in these inspections will be corrected by the Tank Installer/Contractor with two weeks of receiving notice of the defects.

E. Should defects be noted which compromise the structural integrity of the tank or finished water quality within the system, the Tank Installer/Contractor will be required to correct the deficiency immediately.

END OF SECTION
SECTION 13412  
WELDED STEEL TANK PAINTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work covered by this Section includes cleaning, abrasive blast cleaning, and painting of all interior and exterior steel surfaces. Other items include cleaning and disinfection of the tank after coating, sampling and testing (by OWNER), final acceptance of the project, and the tank and paint system warranties.

1.2 REFERENCE STANDARDS

A. Work performed and materials used must comply with the latest revisions of the following standards:

1. AWWA (American Water Works Association) D100 Standard for Welded Steel Tanks for Water Storage.
2. AWWA D102 Standard for Painting Steel Water Storage Tanks.
4. NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.

1.3 SUBMITTALS

A. Before beginning the work, the Contractor shall provide the Engineer with the following information:

1. Name of the protective coating supplier and manufacturers data for the paint systems being used, including MSDS sheets.
2. A listing of the specific products proposed for use including but not limited to: abrasive materials, paint, solvents, and thinners.
3. Product data sheets for each of the proposed materials.
4. Samples of the color specified for Owner approval.

1.4 QUALITY CONTROL

A. Only paint and painting materials as specified shall be used.

B. Paint shall be delivered in unbroken containers bearing the designated name, specification number, color, directions for use, manufacturer, and date of manufacture.

C. All manufacturers’ instructions shall be carefully followed in the preparation, application, curing or drying and handling of the paint.
D. All prime, intermediate and finish coating materials shall be applied in different color shades.

E. Paint shall be stored in a location that is protected from the elements, well-ventilated and free from excessive heat or open flame sources.

F. The Contractor shall obtain the Inspector’s written approval of the steel surface preparation and of each coat of paint, before applying succeeding coats. Such approval will not relieve the Contractor of his obligations under the Contract.

G. The Contractor shall record environmental conditions, at the beginning of each daily operation, thirty minutes before painting begins, and every hour during painting operations, on the Environmental Conditions Report (see Appendix).

H. Painting shall be performed by skilled painters using the materials and methods specified.

1.5 HEALTH AND SAFETY

A. The Contractor shall comply with all regulations as established by the Occupational Safety and Health Act and other government authorities. Up-to-date Material Safety Data Sheets shall be available on-site for all products used. Workers shall wear proper protection devices. Where ventilation is used, all equipment shall be explosion proof. Temporary ladders and scaffolding systems shall conform to applicable safety requirements. It shall be the responsibility of the Contractor to adequately protect, shield, or cover all structure, machinery, equipment, and openings as required to prevent damage or contamination from the work procedures. The work area shall be kept clean at all times, consistent with the type of work being performed.

1.6 TESTING

A. Dry coating thickness measurements shall be made using a Magnetic Gauge. Tolerances to be in accordance with SSPC-PA 2 Measurement of Dry Coating Thickness with Magnetic Gauges. Additional costs shall be applied as required to obtain the specific thickness. The Inspector will perform Holiday Testing as soon as the work is sufficiently cured according to the manufacturer’s recommendations. All pinholes and deficiencies will be repaired.

1.7 SITE CONDITIONS

A. The Contractor shall ensure that surface and ambient conditions are in accordance with the manufacturer’s instructions immediately prior to and during application and for the period of curing. No paint shall be applied when the surrounding air temperature as measured in the shade is above or below the manufacturer’s specifications. No paint shall be applied when the temperature of the surface to be painted is below manufacturer’s recommended application temperature. Painting shall not be applied to wet or damp surfaces or when the ambient temperature is less than 5 degrees above the dew point.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specified paint products are those manufactured by TNEMEC Co., Inc., Kansas City, MO, and are specified as the standard of quality required for use on this project.

B. Products for each specified function and system shall be of a single manufacturer.

2.2 INTERIOR COATING SYSTEM

A. Surface Preparation

1. **Shop Surface Preparation**: Remove all visible oil, grease, soil, dirt, and other soluble contaminants in accordance with SSPC-SP1. The surface shall be abrasive blast cleaned to a Near White Finish in accordance with the recommended methods outlined in The Society for Protective Coatings Specification SSPC-SP10 (NACE No. 2). A surface profile of 1.5 to 2.5 mils is required.

2. **Field Surface Preparation**: After erection and prior to field touch-up, remove all visible oil, grease, soil, dirt and other soluble contaminants in accordance with SSPC-SP1. Weld slag, weld spatter, rough edges and sharp edges of weld seams shall be ground smooth. All rusted, abraded, and unpainted areas shall be abrasive blast cleaned to a Near White Finish in accordance with the recommended methods outlined in The Society for Protective Coatings Specification SSPC-SP10 (NACE No. 2). A surface profile of 1.5 to 2.5 mils is required.

B. Interior Coating System

1. **Type**: Zinc/Epoxy Coating System

2. **Shop Prime Coat**: Immediately after abrasive blasting and before any rusting occurs, apply one coat of Tnemec Series 91-H2O Hydro-Zinc 2000 primer at a dry film thickness of 2.5 to 3.5 mils.

3. **Field Spot Prime Coat**: Immediately after abrasive blasting and before any rusting occurs, apply one coat of Tnemec Series 91-H2O Hydro-Zinc 2000 zinc primer to all bare steel surfaces. The coating shall be applied at a dry film thickness of 2.5 to 3.5 mils.

4. **Field Stripe Coat**: Apply one complete coat of Tnemec 20-1255 Pota-Pox Beige to all weld seams by brush or roller.

5. **Field Intermediate Coat**: Apply one complete coat of Tnemec Series 20-1255 Beige Pota-Pox applied at a dry film thickness of 4.0 to 6.0 mils.

6. **Field Finish Coat**: Apply one complete coat of Tnemec Series 20-15BL Tank White Pota-Pox applied at a dry film thickness of 4.0 to 6.0 mils.
2.3 EXTERIOR COATING SYSTEM

A. SURFACE PREPARATION

1. **Shop Surface Preparation:** Remove all visible oil, grease, soil, dirt, and other soluble contaminants in accordance with SSPC-SP1. The surface shall be abrasive blast cleaned to a Commercial Finish in accordance with the recommended methods outlined in The Society for Protective Coatings Specification SSPC-SP6 (NACE No. 3). A surface profile of 1.5 to 2.5 mils is required.

2. **Field Surface Preparation:** Remove all oil, grease, soil, dirt, and other soluble contaminants in accordance with SSPC-SP1. Weld slag, weld spatter, rough edges and sharp edges of weld seams shall be ground smooth. All rusted, abraded, and unpainted areas shall be abrasive blast cleaned to a Commercial Finish in accordance with the recommended methods outlined in The Society for Protective Coatings Specification SSPC-SP6 (NACE No. 3). A surface profile of 1.5 to 2.5 mils.

B. EXTERIOR COATING SYSTEM

1. **Type:** Zinc/Epoxy/Polyurethane

2. **Shop Prime Coat:** Immediately after abrasive blasting and before any rusting occurs, apply one coat of Tnemec Series 91-H2O Hydro-Zinc 2000 zinc primer to all bare steel surfaces. The coating shall be applied at a dry film thickness of 2.5 to 3.5 mils.

3. **Field Spot Prime Coat:** Immediately after blasting and before any rusting occurs, apply one coat of Tnemec Series 91-H2O Hydro-Zinc 2000 zinc primer to all bare steel surfaces. The coating shall be applied at a dry film thickness of 2.5 to 3.5 mils.

4. **Field Intermediate Coat:** Apply one complete coat of Tnemec Series 66-Color Build Epoxiline at a dry film thickness of 3.0 to 4.0 mils. To achieve complete finish coat coverage, the intermediate coat color should be noticeably different than the specified finish coat color. When feasible, the field intermediate coat should be in the same finish coat color family (blue, beige, gray, etc.) with a difference in light reflectance value of about 10%.

5. **Field Finish Coat:** Apply one complete coat of Tnemec Series 1074/1075-Color Endura-Shield at a dry film thickness of 2.0 to 3.0 mils. Certain colors may require two coats depending upon the method of application and color of the intermediate coat. Color shall be selected by the Owner.

2.4 FILLER AND SURFACER FOR SEAM CAULKING

A. Elastomeric sealant, Sikaflex-1a as manufactured by the Sika Corporation, or approved equal.
PART 3 - EXECUTION

3.1 PRE-WORK INSPECTION

A. Examine surfaces to be coated and report conditions that would adversely affect appearance or performance of coating systems and which cannot be put into an acceptable condition by surface preparation methods specified in PART 2.

B. Do not proceed with surface preparation and application until surface is acceptable and authorization to proceed is given by the Engineer/Owner or his designated representative.

C. Contractor shall remove any water which remains in the bottom of the tank or bottom of the riser.

3.2 APPLICATION

A. Materials shall be mixed, thinned, and applied according to the manufacturer's printed instructions.

B. Prepare surfaces in accordance with coating manufacturer's recommendations and PART 2 of this specification.

C. Allow each coat to dry thoroughly before applying next coat. Provide adequate ventilation for tank interior to carry off solvents during drying phase.

3.3 INSPECTION

A. Degree of surface cleanliness and blast profile of steel surfaces shall conform to the specifications detailed in PART 2 - Surface Preparation. Reference SSPC or NACE visual standards and consult Testex tape to verify anchor pattern.

B. Wet film thickness readings for successive coats shall be taken as soon as possible at a frequency of at least one per 100 square feet.

C. Dry film thickness readings of steel surfaces shall be taken prior to the application of successive coats with a non-destructive magnetic type gauge in accordance with SSPC-PA-2.

D. All interior coated steel surfaces shall receive holiday testing with a Tinker and Rasor Model M-1, or equivalent, low voltage holiday detector. Any areas failing this test shall be marked and receive an additional repair coat in accordance with Section 2.02 - Interior Wet Coating System until satisfactory test results are achieved.

E. The final film is to be visually inspected and should be free of sags, runs, wrinkles and other excessive film-build characteristics and surface defects.

3.4 ACCEPTANCE OF WORK

A. All surface preparation shall be approved by the Engineer/Owner before primer is applied. The Contractor shall request acceptance of each coat before applying next coat and shall correct work that is not acceptable and request re-inspection. All
rigging to remain in place, and Contractor shall aid in use of rigging for all inspections by Owner's Representative.

3.5 CLEANING AND DISINFECTION

A. GENERAL

The Contractor shall be responsible for removing from the tank all containers, debris, and foreign material of every description and for leaving the interior of the tank in a clean and sanitary condition. After the recommended paint curing time has elapsed and the tank is ready to be filled, the Contractor shall disinfect the tank using the procedure as outlined hereinafter. Contractor shall provide all necessary chlorine bearing compounds and equipment required for cleaning, disinfecting, and flushing operations.

B. CLEANING

Allow a minimum of 7 days curing after application of final coat to tank interior before cleaning, flushing, sterilizing, or filling with water.

After painting, remove all scaffolding, planks, tools, rags, blast media, and all other materials not part of the structural or operating facilities of the tank. Thoroughly clean and wash the walls, floor, roof, and operating facilities of the tank by use of a high pressure (100 psi minimum) water jet, sweeping, scrubbing, and other effective means. Flush out and otherwise remove from the tank all water, debris, and foreign materials accumulated during this cleaning operation. Thoroughly clean and flush out the bottom of the tank and the inlet/outlet pipe.

C. DISINFECTION

When the tank is ready to be filled, the Contractor shall disinfect the tank with a chlorine solution. The interior surfaces of the tank shall be thoroughly washed and disinfected in accordance with the requirements of AWWA C652-92, Section 4.3, Chlorination Method 3 (See Appendix).

D. SAMPLING AND TESTING

After the chlorination procedure is completed, and before the storage tank is placed in service, Owner will collect water samples from the full tank for bacteriological analysis. If the results are favorable, the tank may be placed in service. If the event the bacteriological tests are unsatisfactory, the Owner will undertake to determine and correct the cause. In the event the cause is found to result from improper cleaning and/or disinfection, the Contractor will be billed for the additional expense to the Owner for correcting the problem.

3.6 ACCEPTANCE OF COMPLETED WORK

A. Upon completion of work, including disinfection, The Contractor shall remove all debris and shall restore the area surrounding the tank to at least as good condition as before he moved in. When the Contractor requests a final inspection, Engineer will inspect the work for completeness in accordance with the Contract Documents. Any deficiencies shall be promptly corrected by the Contractor.
Final acceptance cannot be made until the Contractor furnishes to the Owner a notarized Waiver and Release of Lien from each supplier of goods and services. A copy of the required form is included in the Appendix.

Payment in full of the Final Application for Payment shall constitute acceptance of the Work by the Owner subject to conditions of the Contract Documents.

3.7 WARRANTY

A. The Contractor shall guarantee the work which he performs to be free from defects in material and workmanship for a period of two years from date of acceptance. The Contractor shall guarantee the water tank to be free from leakage upon completion of the project.

This warranty shall cover all work performed by the Contractor under the terms of the contract or as extra work authorized in writing by the Owner. The Contractor shall not be relieved from the terms of the warranty because of any additional work which may be recommended, but which was not performed because it was not authorized by the Owner.

A first anniversary inspection will be conducted by Pigeon Forge staff or authorized agent in accordance with Section 9 of AWWA D102, latest revision. Following that inspection, Contractor must return within a reasonable period of time to correct observed defects.

END OF SECTION
SECTION 16901

WATER
INSTRUMENTATION/TELEMETRY MONITORING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The project’s general contractor (CONTRACTOR) shall provide all services and equipment defined in this section and as specifically noted on contract drawings and other specification sections.

B. All RTU configuration and programming will be provided by the City of Pigeon Forge’s telemetry supplier (TELE-SUPPLIER). This TELE-SUPPLIER will be responsible for providing System Integration services at remote sites and at the central Pigeon Forge Water Treatment Plant. The TELE-SUPPLIER shall program and configure the remote telemetry RTU and radio system, and be responsible for providing a radio survey to assure accurate communications with the city’s main Water Treatment Plant. The contractor will provide an allowance of $10,000.00 in his bid/estimate for system integration services by the TELE-SUPPLIER. On projects funded by the city, this allowance will be deducted from the CONTRACTOR’S final contract amount. On all other projects the OWNER/DEVELOPER will pay the allowance directly to the city to cover the cost of integration services.

C. The TELE-SUPPLIER is not involved in the actual pump station control. The control system shall be provided by the pump supplier.

D. The CONTRACTOR shall provide the RTU panel, antenna tower, and antenna. The ELECTRICAL CONTRACTOR shall furnish field instruments below that do not come as part of the pump station control package. The ELECTRICAL CONTRACTOR shall provide the associated wiring/cabling between the RTU panel, the field instruments and antenna.

1.02 SUBMITTALS

A. General

1. Shop drawings shall provide a true and complete record of equipment as manufactured, delivered and installed. Shop drawings shall demonstrate that the equipment furnished complies with provisions required by this contract. Submittals shall be transmitted in electronic form.

B. Provide drawings of RTU panel and enclosure. These drawings shall include:

a. Wiring diagrams showing all power connections to equipment within and on panels.
b. Fuse and breaker sizes.
c. Grounding scheme.
d. Wiring of relays, analog line surge protectors, etc.
e. Show all wiring numbers and terminal block designations.
f. Cabinets shall be drawn to scale.
g. List material, fabrication and painting specifications.
h. Show elevation of panel front cover. Including, location of door handles, windows, lifting lugs, and enclosure mounted items.

1.03 CODES AND STANDARDS

A. All equipment shall be installed in compliance with Federal, State and Local codes.

1.04 RTU/SCADA CONTROL SYSTEM OVERVIEW

A. The RTU system will consist of one RTU panel at the remote pump station. This RTU will communicate with the Pigeon Forge central SCADA computer system. All RTUs shall be provided with radios and associated antennas to communicate half duplex over Pigeon Forge’s existing licensed radio frequency (173.3125 MHz). The Polling Master RTU will poll the remote RTU and transfer the information from it and all other remote RTUs to the Water Treatment Plant RTU. Because of the mountainous terrain in the Pigeon Forge area, some RTUs may need to be used as repeater stations for some other RTUs. This information, from the remote RTUs, will be displayed via the Water Treatment Plant’s SCADA system. The TELE-SUPPLIER is responsible for the design of the central SCADA HMI required at the Water Treatment Plant to monitor all of the I/O at all of the remote RTU locations.

B. The CONTRACTOR shall provide the RTU control panel, antenna tower, and antenna. All associated wiring/cabling between the RTU control panel and the field instruments and antenna shall also be provided by the CONTRACTOR.

C. All downtime of pump stations, raw water intake, and tanks shall be coordinated with the OWNER. All downtime must be pre-approved by the OWNER five (5) days prior to downtime.

D. The TELE-SUPPLIER shall provide all programming at the remote RTU PLC associated with local monitoring and radio communications. There shall be no loss of local control functionality at any of the remote locations as a result of this project. The TELE-SUPPLIER will provide the OWNER with a detailed description of the exact operation of the new RTU system.

E. All HMI screen design shall be coordinated with the OWNER by the TELE-SUPPLIER. Screen design shall follow all Water Treatment Plant standards including color scheme, navigation buttons, trending, historical logging, report generation, symbology, etc. The TELE-SUPPLIER is responsible for generating (daily, monthly, yearly) reports and miscellaneous reports required by the owner in Excel VBA.
F. The CONTRACTOR shall furnish all antennae towers, antennas, radios, and miscellaneous equipment required for an operational radio system. The TELE-SUPPLIER shall coordinate antennae tower heights with topographical information as to insure that all remote sites are able to communicate with the main polling site. The TELE-SUPPLIER shall provide the results of this study and provide the CONTRACTOR with the exact height of the antennae tower. The TELE-SUPPLIER shall account for the height of trees and other obstacles that may interfere with radio communication. All control panels shall be NEMA 3R with heaters and other equipment necessary to operate in the weather conditions to which they will be installed. All control panels shall also have a battery backup, sized to provide a minimum of 1 hour of back-up power under normal operating conditions. All PLCs shall be powered by the 24VDC battery/battery charger.

G. The Factory Witness Test shall take place at Pigeon Forge Water Treatment Plant. All testing shall be done in conjunction with the Water Treatment Plant's PLC testing to assure compatibility. The CONTRACTOR is also responsible for all equipment installation and transportation.

1.06 COORDINATION WITH ELECTRICAL CONTRACTOR

A. The ELECTRICAL CONTRACTOR shall provide (2) two 20A 120VAC circuits to the RTU control panel [(3)#12AWG, 1#12G in ¾" conduit]. The CONTRACTOR shall provide the concrete pad and/or foundation and mount the antenna tower. The ELECTRICAL CONTRACTOR shall mount the RTU control panel to the wall and run/terminate all conduits and cables to it.

B. Remote RTU Control Panel Instrument List

<table>
<thead>
<tr>
<th>Description</th>
<th>Signal Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Alarm</td>
<td>Discrete</td>
</tr>
<tr>
<td>Loss of Power Alarm</td>
<td>Discrete</td>
</tr>
<tr>
<td>Pump Start/Stop Status (no control)</td>
<td>Discrete</td>
</tr>
<tr>
<td>Suction Pressure</td>
<td>Analog</td>
</tr>
<tr>
<td>Discharge Pressure</td>
<td>Analog</td>
</tr>
<tr>
<td>Tanks Level (if applicable)</td>
<td>Analog</td>
</tr>
<tr>
<td>Chlorine concentration</td>
<td>Analog</td>
</tr>
</tbody>
</table>

PART 2 – PRODUCTS

2.01 RTU PANEL

A. The power feeding the control panel shall be a dedicated 120V, 15A fused circuit. The incoming power shall be terminated in terminal strips. A 15A circuit breaker shall be placed between the terminal strips and a 120VAC/120VAC isolation transformer. The power shall then travel through a 1.5A fuse before feeding a GFCI receptacle, which feeds a line protection unit. The protection unit supplies a
120VAC/24VDC power supply and a GFCI receptacle. The power supply shall power a battery dropout relay/power supply and the PLC. This power dropout relay shall also provide the 12VDC needed for the radio. The power supply shall also feed field instruments associated with this panel. Appropriate means is required to protect the field instruments and PLC from reverse voltage. Surge suppression shall be provided on all field wiring exiting the RTU panel. Two 12V batteries shall be connected in series and be protected by the battery dropout relay. The PLC I/O shall be connected to terminal strips. The data radio used shall be able to use DF-1 protocol and communicate over the city's radio system's frequency. This digital radio shall provide all handshaking and error checking to guarantee reliable communication within the OWNER'S FCC approved frequency rating. The RTU panel shall be fully tested for operation and radio communication prior to integration by the TELE-SUPPLIER. See 3.05 TESTING for exact RTU panel testing requirements.

2.02 PROGRAMMABLE LOGIC CONTROLLERS (PLC's)

A. General

1. The Programmable Controller shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.

2. The PLC in the RTU panel shall be a MicroLogix 1500 or SLC 5/03 Programmable Controller Unit manufactured by Allen Bradley. All 120V units shall be model #1764-24BWA, and all 24VDC units shall be model #1764-28BXB. Each PLC shall be equipped with a memory module and real time clock. Each PLC shall also include appropriate input and output cards to transmit and receive the required analog and discrete signals described above.

2.03 SPARE HARDWARE

A. Each PLC rack shall have 20% spare physical slots for future I/O cards to be added. Provide 1 spare for each of the following:

1. One (1) spare piece of hardware for all panel equipment in critical system pump stations. For example: processors, power supplies, surge suppressors, and I/O modules. The spare processor shall be preloaded by the TELE-SUPPLIER with the same configuration as the online processor to enable quick swap maintenance.
2.04 RADIO TRANSCIEVERS AND ACCESSORIES

A. Antenna and Coaxial Cable

The radio antenna shall be a five element Yagi, constructed with 3/8" diameter aluminum rod elements and 1-1/16" diameter aluminum pipe element support. The antenna shall have 8.0db forward gain with a 20.0db front-to-back ratio. The antenna shall be wind rated for a 100 MPH wind speed. The antennas shall be MC-Yagi, Decibel Products DB292, or Celwave PD390.

The antenna shall be cabled to the transmitter enclosure connection by 7/8 inch Andrew Heliax coaxial cable by Andrew, Inc.

B. Antenna Lightning Protection

Coaxial connection to enclosures shall be by means of a coaxial type bulk-head lightning arrester. The units shall be rated at 1 kilowatt with a minimum 500V and maximum 2000V breakdown voltage. Coaxial lightning arresters shall be a PD-593 or PolyPhaser IS-B50LU-CO.

C. Antenna Mounting Systems

The antennas shall be mounted at a height above ground that is consistent with FCC rules and regulations and provides adequate signal fade margin as described earlier. The CONTRACTOR shall verify exact antenna tower height with the TELE-SUPPLIER prior to bid. The antenna shall be mounted as follows:

1. A bracketed antenna tower shall be supplied at all remote RTU locations. The tower shall be assembled from 10ft sections built on an 18" equilateral triangle design. Tower sections shall be constructed of 1-1/4" steel tubing with continuous solid steel rod “zig-zag” cross-bracing electrically welded to the tubing. The entire 10’ sections shall be Hot-Dip Galvanized after fabrication for long life. The antenna towers shall be Rohn Model 45G. CONTRACTOR to submit guy and anchor details for engineers approval.

D. The transceiver shall be a digital packet radio or of equivalent means to communicate over the frequency of 173.3125 MHz.

2.05 INSTRUMENTATION AND ACCESSORIES

A. General

All items in the RTU system (electronic cards, power supplies, radios, time delays, relays, etc.) shall be of plug-in construction or make use of a plug-in wiring harness and be interchangeable without recalibration. To insure field reparable by non-technical personnel, equipment that must be unwired for replacement will not be accepted.
The following instrumentation devices and techniques shall be used as specifically called for in the PLC and Telemetry input/output sections of this specification.

B. Power Supplies

The common 24 VDC power supplies shall provide ±0.1% line and load regulation with ±10% input variations. The input/output isolation shall be 100 Mohms DC (900Volts AC) with output transient response of 50 microseconds maximum. The power supply shall be sized to operate the remote unit equipment with or without the back-up battery in place. Power Supplies shall be an ELPAC Series OLV, Sola SLS, or approved equal.

C. Battery Back-up Operation

Provide battery back-up operation for PLC and Telemetry System. Two 12 VDC rechargeable batteries shall be connected in a series configuration to provide the 24 VDC necessary for the RTU PLC. The rechargeable batteries shall be the sealed solid gelled electrolyte type, designed for float or stand-by service. Batteries shall be sized to maintain 1-hour service at zero degrees Celsius. The remote shall include a plug-in charging module to recharge the battery when power is resumed, maintain the charge between outages, and provide a low voltage cut-off to protect the battery from excessive discharge during prolonged outages. All discrete and analog inputs (i.e. switch closures, pressure, level, flows, etc.) shall continue to function on battery back-up. Batteries shall be Globe Gel/Cell, Power Sonic, or an approved equal.

D. Single Phase 120VAC Power Line Lightning Protection

Each new site in the system shall be equipped with a combination AC line filter and lightning arrester. The unit shall provide 3-stage lighting/transient protection including inductive and capacitive filtering, MOV overvoltage protection, and three terminal gas discharge tube lightning protection. The unit shall be a TT-LPU, TrippLite ISOBAR IB-2-0, or StediWatt Model 1120-3.

2.06 ACCEPTABLE MANUFACTURERS

A. Relays shall be Potter & Brumfield, or equal.

B. Enclosures shall be Hoffman, or equal.

C. Surge Suppressors shall be Edco, or equal.

D. GFCI Receptacles shall be Hubbell, or equal.

E. Circuit Breakers shall be Square D, or equal.
F. Fuses and Fuseblocks shall be Littlefuse, or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Panel and field raceway systems shall separate discrete, analog and power wiring. An exception shall be made for motor starter control wiring associated with motors, which shall be run in conduit with power conductors. In no case shall wire bundles contain mixed signal types.

B. CONTRACTOR shall verify location of all hazardous classified areas as defined by the National Electric Code. Proper wiring methods and equipment as detailed in the National Electric Code shall be provided in these hazardous classified areas.

C. All process variable signal displays shall read out in linear process units, unless otherwise noted.

D. All instrumentation and control equipment shall be suitable for the environment in which it is installed. CONTRACTOR shall take into consideration relative humidity, corrosive vapors, ambient temperatures, dust, splashing water, etc. All equipment cabinets and devices provided by the CONTRACTOR shall be heavy-duty type designed for continuous industrial service.

E. All equipment shall be of modular construction and shall be capable of future field expansion. Equipment shall be located to easily facilitate future expansion. Provide space next to control panels to facilitate the installation of a future control panel of the same size as the one installed to handle future expansion.

F. All electrical equipment supplied shall be designed for 117V nominal, 60Hz alternating current. Equipment shall be designed to withstand ±10% voltage sags and/or distortion.

G. Instrumentation and control equipment shall be UL listed. Control panels shall be built by a certified UL panel building shop capable of UL labeling the custom panel they build as a complete assembly with a unique UL ID serial number.

H. The control system shall be configured in such a way as to provide orderly shutdown and automatic restart when power outages occur.

I. Operation of the control system shall not require any knowledge of software programming.

J. All instrumentation signal cable shall bear an outer shield that is to be continuous from source to destination and grounded per manufacturers recommendations. However, in no case shall the shield be grounded at more than one place.
K. The CONTRACTOR shall insure that all field wiring for power and signal circuits are installed in accordance with best standard industrial practice and provide all necessary system grounding to insure a satisfactory functioning installation.

3.02 CONTROL PANELS AND FIELD WIRING

A. The RTU panel is to be designed and fabricated by a U.L. Certified Panel Builder.

B. All major pieces of equipment in panels shall be identified by permanent engraved labels. Attach labels to panels with stainless steel self-tapping screws. Identify the following electrical equipment as a minimum:
   1. Motor control centers, and individual devices installed therein.
   2. Panelboards.
   3. Safety switches and disconnects.
   5. Telephone cabinets.
   6. Individually mounted circuit breakers.
   7. Relays.
   8. Transformers.
   9. PLC’s
   10. UPS’s
   11. VFD’s
   12. Control push buttons
   13. Solenoid valves

C. Identify electrical equipment with permanently attached black phenolic plates with 1/4” white engraved lettering on the face of each, attached with two sheet metal screws. Colors shall match existing scheme presently used throughout the facility.

D. All control and instrumentation wiring shall be named and labeled at both ends. **Labels at both ends of the same wire shall be identical.** Label names shall be selected to indicate where the wire runs to and from. For example, a wire running from Panel CP2080 to Level Transmitter LT1000 shall be labeled “CP2080-LT1000” at both ends of the wire.

E. Panel mounted equipment shall be arranged in a manner that allows servicing, adjustment, testing, removal without disconnecting, or removal of other components. All components shall be mounted on removable plates, not directly attached to cabinet enclosure.

F. Panels located outdoors shall have radiant shields or a small awning to shield them from direct sunlight.

G. All exterior panel mounted equipment shall be installed with suitable gaskets, faceplates, or other accessories as required to maintain the NEMA rating of the panel.

16901-8
H. All conduit and cable penetrations shall be provided with ground bushings, hubs, gasketed locknuts or other accessories as required to maintain the NEMA rating of the panel.

I. Provide print storage pockets on the inside of each panel. These pockets should be of sufficient size to hold all prints and operations manuals associated with panel. Place a reduced set of all drawings associated with panel in its pockets. All panels shall be suitable for top and/or bottom conduit entry.

J. Wiring.

1. All wiring entering or exiting control panels shall terminate on the Master Terminal Board. The Master Terminal Board is a plate mounted in the panel for termination of external wiring. All external wiring shall enter panel and terminate on one side of terminal blocks mounted on the Master Terminal Board. Wiring from components within the panel shall terminate on the other side of the terminal blocks.

2. Wiring between the Master Terminal Board and components within the panel shall be factory installed.

3. All terminal blocks and wires shall be uniquely named and labeled. This means that even small jumper wires shall have unique names and be labeled. (ie. J21, J22, J32, etc.) All wire label identifications shall be identified on loop and panel wiring diagrams. Labels at both ends of the same wire shall be identical.

4. The Master Terminal Board shall have a minimum of 20% spares.

5. Terminal blocks shall be arranged in vertical rows and separated into groups (Incoming 120VAC power, 120VAC Discrete Inputs, 120VAC Discrete Outputs, 24VDC Discrete Inputs, 24VDC Discrete Outputs, 4-20mA Analog Inputs, 4-20mA Analog Outputs, etc.). The line AC control terminal block shall be used to terminate 120v power conductors fed from 208/120, three-phase panelboards. Provide circuit breakers on circuits 120VAC (and higher) for overcurrent protection and convenient disconnection means.

6. Terminal blocks shall be barrier type (equivalent to Buchanan Cat# 0625) with the appropriate voltage rating. They shall be raised channel mounted type.

7. Wire connectors shall be the snap-on fork type (equivalent to Thomas and Betts) with insulated barrel for crimp type compression connection to the wire.

8. Group all wiring in rigid gray vinyl wire duct. (Equivalent to PANDUIT Style G)
9. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6\" of the side panel, an adjacent terminal, or a piece of equipment.

10. All 120V and above power wiring shall be identified as such.

11. Signal wiring of different types shall be color-coded to easily identify the signal types. (ie. 120VAC=red, 24VDC=blue, etc.)

K. Each control loop or system shall be individually protected by fuses or breakers. All overcurrent protection devices shall be clearly labeled and located for ease of maintenance.

L. Provide isolation relays (equivalent to Potter & Brumfield KUP, 10Amp, 3PDT contacts, plug-in type, w/ associated relay socket rail mount) on all discrete outputs.

M. Provide surge suppressor (equivalent to EDCO PC642C, plug-in type) for all input and output low voltage signals.

N. All panels shall be fabricated of not less than USS 14-gauge steel. All wall-mounted panels shall be manufactured by Hoffman, Stahlin, Robroy Industries or approved equivalent.

O. Provide UL approved GFCI 15 amp Duplex receptacle in surface mounted two gang box with stainless steel coverplate in panel or plug in of portable equipment.

P. Provide Thermostatically controlled space heater (equivalent to Hoffman D-AH1001A) in all outdoor panels.

3.03 PLC INSTALLATION

A. Within the enclosure all I/O racks, processor racks, and power supplies shall be grounded to meet the manufacturer's specifications.

B. All cables (with associated plugs, connectors and receptacles) shall be designed for commercial use to withstand an industrial environment.

C. Each limit switch, push-button, or other input device shall be connected to only one individual input point.

D. Each output device shall be connected to only one individual output point.

E. PLC input and output cards shall be configured to fail in a safe manner. Determination of fail safe position (ie. 2mA, 20mA, last-value, open, closed, etc.) shall be determined by the OWNER.
3.04 DOCUMENTATION

A. As-built documentation shall include all previous submittals as described in this specification updated to reflect the as-built system. Any errors in or modifications to the system resulting from the factory and/or field acceptance tests shall be incorporated in this documentation.

B. Maintenance Manuals shall describe preventive and corrective procedures required to keep the system in good operating condition. Hardware maintenance manuals shall include:

1. Diagnostic procedures for troubleshooting system.
2. Preventative maintenance instructions.
3. Corrective maintenance instructions.
4. Operation information.
5. Spare parts information including identification of all equipment. Identification shall include all information necessary to order new equipment. Name and address of local distributor carrying this equipment shall also be supplied. All spare parts equipment lists shall be cross-referenced to equipment name on drawings and designation on loop drawings.

C. The TELE-SUPPLIER provide operating instruction manuals with adequate information pertaining to the following outline:

1. System specifications
2. Electrical power requirements
3. Application considerations
4. Assembly and installation procedures
5. Power up procedures
6. Troubleshooting procedures
7. Programming procedures
8. Explanation of internal fault diagnostics
9. Shut down procedures
10. Recommended spare parts list

Labeled tabs shall separate these 10 manual sections.

3.05 TESTING

A. The RTU panel shall be tested by the CONTRACTOR for operation and reliable radio communication. This test is to allow the CONTRACTOR to verify that the RTU panel has been built and wired properly for radio communication (error checking, handshaking, signal modulation). This test shall be performed at the site of the Pump Station with the TELE-SUPPLIER present.
3.06 TRAINING

A. The TELE-SUPPLIER shall train the operators at the Water Treatment Plant on the operation and monitoring of the new RTU.

B. The TELE-SUPPLIER shall review all changes to the graphic display at the Water Treatment Plant that were made during this project.

C. The CONTRACTOR shall train the maintenance personnel on all instrument operation and calibration associated with the new telemetry system.

END OF SECTION
SECTION 4

STANDARD SEWER SPECIFICATIONS
PART 1 – GENERAL

1.01 SCOPE OF WORK
A. The work covered by this Section relates to erosion and sediment control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. It is the Contractor’s responsibility to develop an erosion control plan utilizing the methods outlined in this section or any additional methods deemed necessary. This plan shall be submitted prior to any work being undertaken on this project. The Contractor shall furnish, install and maintain the erosion control measures outlined in this erosion control plan. The Contractor shall adjust and update the plan and provide additional erosion control devices at no additional cost to Owner should the results of the initial plan fail to comply with applicable codes and laws. Contractors shall be responsible for obtaining and adhering to all construction, erosion control, and stormwater permits required in conjunction with this construction.

1.02 COORDINATION OF TEMPORARY AND PERMANENT CONTROLS
A. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion and sediment control features to insure economical, effective, and continuous erosion and sediment control throughout the construction and post-construction period.

1.03 CONTRACTOR’S RESPONSIBILITY TO COMPLY WITH LAW
A. It is the intent of this Section to provide a written plan to insure that PL 100-4, Section 319, TCA 69-3-101, et. seg., Subsection 69-3-108 and Subsection 69-3-114, and Division of Construction Grants and Loans General Permit for Utility Line Crossings, Chapter 1200-4-7.09 are met. Since the Contractor is responsible for the construction means and methods which in turn are responsible for insuring that construction does not harm the Waters of Tennessee, the Contractor is solely responsible for insuring that the above-mentioned laws and regulations are met.

PART 2 - PRODUCTS

2.01 BALED HAY OR STRAY
A. The Contractor shall furnish and place baled hay or straw along the top of the bank of paved ditches and/or as shown on the plans prior to construction. Baled hay or straw shall be embedded in ground 4 to 6 inches to prevent water from flowing under them. The bales shall be anchored securely to the ground by wooden stakes
driven through the bales into the ground. Bales to be removed after they have served their purpose as determined by the Engineer. The Contractor shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.

2.02 SILT FENCE

A. The Contractor shall furnish and place temporary silt fences either upstream or downstream of construction as required along waterways or other areas where siltation is a problem. Contractor shall choose location according to where he plans to put excavated material. The silt fences shall be constructed of wire mesh fabric with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored in the soil. The filter cloth shall have approved backing or a built-in reinforced structure between the post and fabric as recommended by the manufacturer to support the filter cloth.

B. The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the Engineer. The silt accumulation at the fence may be left in place and seeded, removed, etc. as directed by the Engineer.

3.03 SEDIMENT STRUCTURES

A. Sediment structures shall be utilized to control sediment at the foot of embankments where slope drains outlet; at the bottom as well as in the ditchlines atop waste sites; in the ditchlines or borrow pits. Sediment structures may be used in most drainage situations to prevent excessive siltation of pipe structures. All sediment structures shall be at least twice as long as they are wide.

B. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed, and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

END OF SECTION
SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.01 GENERAL

A. The work covered by this section consists of furnishing all materials and equipment and performing all labor necessary for Site Preparation and Development which includes, but is not limited to clearing, excavating, backfilling, grading and grassing, and all incidentals as shown on the Plans.

B. The work specified under this Section which constitutes Site Preparation shall be performed in such a chronological order as to leave the site in the best possible finished condition. The order of this work is subject to the Engineer's approval but such approval shall in no way relieve the Contractor of any responsibilities for repair of work damaged by his acts or acts of God.

1.02 SUBSURFACE CONDITIONS

A. The Contractor affirms by the submission of his bid that he has examined the location of the work and has informed himself fully as to the site conditions, the configuration of the ground, the character, quality and quantity of the materials to be encountered, the equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work to be done.

1.03 CLEARING AND STRIPPING OF TOPSOIL

A. The site shall be cleared of all obstructions interfering with the construction of new work.

B. The Contractor shall strip the entire area within cut, fill, and graded areas to remove all topsoil, vegetable matter, stumps, roots, and other objectionable materials. Topsoil and vegetable matter shall be carefully stockpiled and preserved for reuse. Roots and stumps shall be grubbed out and removed from the property entirely. The base of all embankments and fills shall be scarified and rolled so that the base will be well bonded with the first layers of fill. The disposal of refuse will be the responsibility of the Contractor.

1.04 STRUCTURES ON EARTH

A. When structures rest on earth, all loam, organic, or other undesirable material shall be removed as required by the Engineer. When filling is required to bring such excavated area to the levels required to receive structures, the fill shall be compacted by tamping and rolling to obtain 98% of maximum density as per ASTM D-698-66T Method A. Layers shall be not more than six (6") inches thick.
B. Where shown on the Plans or otherwise required under structures, the Contractor shall place and compact crushed stone in twelve (12") inches or thinner layers. Materials shall meet the same requirements as those given for concrete except gradation.

1.05 CATCH BASINS AND STORM DRAINS

A. Catch basins, drop inlets, and other special drainage structures shall be constructed in accordance with the Details shown on the Plans.

B. Storm sewers and appurtenances shall be constructed as shown on the Plans and specified herein.

C. Generally, all storm drainage pipes crossing under roadways shall be corrugated metal culvert pipe or reinforced concrete pipe with end walls at both ends and all other storm sewers are shown as reinforced or non-reinforced concrete pipe. Corrugated metal pipe and/or concrete pipe may be used interchangeably PROVIDED the proposed substitution is approved in advance by the Engineer and the substitute material provides equal or greater strength.

1.06 FINISH GRADING AND TOPSOILING

A. Finish grading shall be performed in accordance with the finished elevations and grades shown on the Plans and shall be made to blend into conformation with remaining natural ground surfaces. All finished grading surfaces shall be left smooth and free to drain. The tops of all cuts shall have berm ditches. Selected materials, which have been obtained from stripping the site, shall be spread upon the slopes of fills and all other areas at the site to a uniform depth and compacted suitable for planting. Excess four (4) to six (6) inches of material in areas to be grassed shall be topsoil. All stone chips, gravel, etc. shall be removed by raking or by hand so that lawn mowing will be safe and practical.

1.07 SEEDING, SODDING, AND LANDSCAPING

A. All graded areas, which shall include all areas at the site shall be left smooth and thickly sown with a mixture of Blue Grass, Italian Rye Grass, Kentucky Fescue #31 and/or such other grasses as are specified by the Engineer. When the final grading has been completed, the entire area to be seeded shall be lined with raw agricultural lime at the rate of 3 tons per acre and fertilized with ammonium nitrate at the rate of 5 lbs. per 1000 square feet and an approved commercial fertilizer at the rate of 10 lbs. per 1000 square feet. The analysis of the commercial fertilizer shall be determined by soil tests. After the fertilizer has been distributed, the Contractor shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be sowed in two operations broadcast either by hand or by approved sowing equipment. The application shall be 30 pounds per acre for each operation. If the Engineer determines to use “hulled” or “unhulled” Bermuda, the application rate shall be seven pounds per acre. After the seed has been distributed, the Contractor shall then lightly cover the seed by use of a drag or other approved
device. All seed shall be certified not more than three percent weed. The seeded area shall then be covered with straw at the rate of 1-1/2 tons per acre.

B. Any necessary reseeding or repairing shall be accomplished by the Contractor prior to final acceptance. Unless otherwise approved in writing by the Engineer, seeding shall be limited to the following planting periods: Spring - March 1 through May 10 or Fall - August 15 through October 31. If the construction work is brought to completion when, in the opinion of the Engineer, the season is not favorable for the seeding of the grounds, the Contractor shall delay this item of the work until the proper season for such seeding as directed by the Engineer.

C. Sodding is required on all slopes 3 horizontal to 1 vertical or steeper unless the said slope to receive rip-rap. Sod shall be Bermuda or other approved type reasonably free of weeds and carefully cut, transported, and laid. Sod shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid, and the finished surface shall be true to grade, even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas, and shall be raked to insure sealing the sod joints.

D. The Contractor shall be responsible for all seeding and/or sodding necessary to restore the construction area to its original condition.

1.08 FINAL CLEAN-UP

A. Before the work is considered as complete, all rubbish and unused material due to or connected with the construction shall be removed and the premises left in a condition satisfactory to the Engineer. Streets, curbs, crosswalks, pavements, sidewalks, fences, and other public and private property disturbed or damaged shall be restored to their former condition at the Contractor’s expense. Final acceptance will be withheld until such work is completed.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL

A. The work required under this section consists of all clearing, grubbing, shrub removal and related items necessary to complete the work.

B. The Contractor shall protect shrubs, pavement and other items adjacent to his work.

C. Where adjacent surface areas within the project site, but outside the contract limits, are disturbed as a result of work under this contract, they shall be cleaned of all debris and restored to original condition.

1.02 BENCH MARKS AND MONUMENTS

A. The Contractor shall protect all bench marks, monuments, and other reference points; if disturbed or destroyed, the Contractor shall replace at his own expense as directed by the Engineer.

1.03 CLEARING

A. Clearing shall be removal of all shrubs, trees, sod, and other landscape items as directed by Engineer.

B. Site around tanks shall be cleared for a 30 foot radius.

1.04 GRUBBING

A. Grubbing shall be removal of all stumps, roots, trash, rubbish, vegetable matter to a depth of not less than 18" within limits directed by the Engineer.

1.05 REMOVAL OF SHRUBS AND SOD

A. Remove all shrubs and sod from area to be occupied by Construction.

B. All shrubs and sod shall be replanted at locations determined by Engineer.

1.06 LIMITS OF WORK

A. The contract limits are shown on the drawings. All areas within the contract limits shall be cleared as specified.

END OF SECTION

02110-1
PART 1 - GENERAL

1.01 GENERAL

A. Rock excavation shall include the excavation and disposal of all rock within the boundary lines and grades shown on the Plans and given by the Engineer.

B. The term "rock" as used herein shall include all materials which, in the opinion of the Engineer, require blasting, barring or wedging for their removal from their original beds and which have compressive strengths in their natural undisturbed state in excess of 300 psi, and specifically includes all ledge or bed rock and boulders or pieces of masonry larger than one cubic yard in volume.

C. For excavation in which pipe will be laid, the rock shall be excavated to a depth of at least six inches below the bottom of the barrel and bell of the pipe and filled in to the proper grade with selected fill material properly shaped and compacted placing. Compacting and shaping of the selected fill material shall be included as part of the rock excavation and no extra payment will be made therefore.

1.02 DISPOSAL

A. Where excavated rock can be mixed with earth so that each piece is completely surrounded by fine material, it may be used for backfill or embankment as specified in Section 02221. All excess excavated rock shall be disposed of in disposal areas obtained by the Contractor.

1.03 BLASTING

A. Blasting shall be performed by workmen experienced in the handling of explosives and as approved by the Engineer as to number, length, placing, direction, and loading of holes. The charges used shall not make the excavation unduly large or irregular nor shatter the rock upon or against which masonry or concrete will be built nor injure existing structures at the site or in the vicinity thereof. Each blast shall be covered with heavy timber or steel mats. Blasting will not be permitted within 25 feet of completed pipes or structures. Blasts in tunnels shall be such that the material surrounding the tunnel base proper shall not be loosened or displaced. Whenever the Engineer determines that further blasting may injure or damage adjacent rock, masonry, utility lines, or other structures, blasting shall be discontinued. In such case, the remaining rock shall be excavated by barring, wedging, or other approved method.

B. Where sewers, gas, water, steam, or other utility ducts for lines, basin connections or other structures have been exposed during excavation, such structures shall be adequately protected from damage before proceeding with the blasting. Any
structure damage by blasting shall be promptly repaired by the Contractor at his own expense.

C. Blasting shall not be carried on within 300 feet of any radio transmitter or radio-frequency emission equipment such as high-frequency welders. The blasting caps shall be kept in tightly closed all-metal cans when in the vicinity of such equipment.

1.04 EXPLOSIVES

A. A sufficient quantity of explosives to avoid delay to the work shall be kept on the site, but at no time will there be a quantity in excess of that which will be required for use within the following twelve hours. Such explosives shall be stored, handled, and used in conformance with all State and local laws, ordinances and regulations governing the storage and use of explosives. The Contractor shall take out permits and execute a bond for blasting.

B. The magazine keeper shall keep accurate daily records and shall account for each piece of explosive, detonator and equipment from the time of delivery at the magazine until used or removed from the site.

1.05 RESPONSIBILITY

A. The methods of handling, use, and storage of explosives and any damage to persons or property resulting therefrom shall be the sole responsibility of the Contractor. Approval by the Engineer of these methods or his failure to order that blasting be discontinued shall not relieve the Contractor of any of this responsibility.
SECTION 02206

RESTORATION OF STREET SURFACES

PART 1 - GENERAL

1.01 GENERAL

A. The various street surfaces disturbed, damaged, or destroyed during the performance of the work shall be restored and maintained as specified herein and as shown and directed. Included in this classification are pavements and surfaces of all types, pavement bases, curbs, and sidewalks.

B. The quality of workmanship and materials used in the restoration shall produce a street surface equal to or better than that which existed before the work began.

1.02 STANDARDS

A. The materials used in restoring any permanent base or surface shall be of the type and kind in the base and surface existing prior to its removal.

B. The work of restoration shall be conducted in accordance with the requirements of the Owner’s specifications for such work in force at the date of the “Notice to Bidders” and the latest edition of Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, whichever is applicable.

1.03 TIME

A. Permanent restoration of all street surfaces shall be completed immediately after trenches have been completely and satisfactorily backfilled. However, if, in the opinion of the Engineer, field conditions are such that permanent restoration is not possible, the Contractor shall immediately proceed with temporary restoration.

1.04 TEMPORARY RESTORATION

A. Upon completion of satisfactorily backfilling, the street or sidewalk damaged or destroyed shall be promptly placed in condition for temporary use until such time as the permanent restoration can be made.

B. Curbs, where possible, shall be temporarily reset in their place as part of the work of temporary restoration of pavement.

C. Damaged or destroyed sidewalks shall be temporarily restored immediately upon the placing of the backfilling either by relaying the old sidewalk pavement or by laying a pavement of wooden planks of sufficient strength to carry such traffic suitably fastened and flush with the adjacent sidewalk or otherwise as directed.
D. Pavements and other road surfaces shall be temporarily restored by placing thereon
to proper line and grade a layer of crushed stone or other approved material. Where
the existing pavement is laid on other than a cement concrete base, this layer shall
have a thickness equal to or greater than the thickness of the existing wearing
binder surface plus six (6) inches. Where the existing pavement is laid on a cement
concrete base, the temporary surface shall be of any thickness satisfactory to
withstand the traffic loads as directed by the Engineer. The material shall be
compacted by rolling or tamping until thoroughly keyed. This temporary base or
surface shall be treated with an application of suitable bitumen material to
consolidate further the surfacing and to eliminate dust nuisance, or the Contractor
may use satisfactory cold patch material.

E. Temporary work shall be maintained in a suitable and safe condition for traffic until
the permanent pavement is to be installed.

F. Until permanent restoration, all temporary work and adjacent street surfaces shall be
maintained in a condition similar to that existing before construction with regard to
dust, mud, and other foreign matter.

1.05 PERMANENT RESTORATION

A. Where temporary restoration of streets has been made, permanent restoration shall
be as follows:

1. After due notice, the temporary resurfacing materials shall be removed as
directed by the Engineer. Where the existing pavement is laid without a
base or on a base other than cement concrete, only enough of the
temporary materials shall be removed to provide space for the wearing and
binder surface. The remaining materials shall be shaped and compacted as
hereinafter specified in Subsection 02221-1.04 to act as the permanent
base. Where the existing pavement is laid on a cement concrete base,
sufficient amount of the temporary materials shall be removed to provide
space for the concrete base and the wearing surface. The concrete base
shall be constructed of Class D Concrete, and will be measured and paid for
as such. The subgrade shall be thoroughly compacted and brought to the
required grade and cross section to receive the permanent pavement.
Service boxes, manhole tops, and step stones within the street surface cut
for the sewer and not conforming to the new work shall be set to established
grade.

2. The top surface shall conform with the grade of the existing adjacent
pavement and the entire replacement shall match the existing pavement.

B. Where temporary restoration of streets is not necessary, permanent restoration shall
be as follows:

1. After backfill and consolidation as specified in Section 02221, crushed stone
shall be placed thereon to form a base of not less than 8 inches in depth
after compaction to receive the wearing and binder surface. The wearing
and binder surface shall be replaced to correspond in kind to the existing pavement. Compaction of the base, wearing, and binder surface shall be accomplished separately by using not less than an 8-ton roller.

2. The pavement, in all instances, shall be cut back the minimum distance on each side of 6 inches, however where the pavement has been broken or cracked due to pipe laying beyond the limits specified, the pavement shall be removed and cut back 6 inches beyond the cracked or broken pavement. The cut shall be sharp and clean and a suitable tack coat shall be applied to all surfaces prior to paving.

END OF SECTION
SECTION 02220

EARTH EXCAVATION

PART 1 - GENERAL

1.01 GENERAL

A. Earth excavation shall be made to the widths and depths necessary for constructing all structures and pipe lines included in this Contract, and includes the excavation of any material defined as earth which is desirable to be excavated for any purpose pertinent to the construction of the work.

B. The term “earth” as used herein shall include all materials which, in the opinion of the Engineer, do not require blasting, barring, or wedging for their removal from their original beds. Specifically excluded are all ledge and bed rock and boulders or pieces of masonry larger than one cubic yard in volume.

C. The method of making excavation below ground water shall be submitted in detail to the Engineer and his approval obtained before such work is started.

1.02 AUTHORIZED ADDITIONAL EXCAVATION

A. In case the materials encountered at the elevations shown are not suitable, or in case it is found desirable or necessary to remove to an additional depth as the Engineer may direct, in writing, the Contractor shall refill such excavated space with either Class D concrete or selected fill materials as ordered. Additional earth excavation so ordered and concrete or selected fill materials ordered for filling such additional excavation will be paid for under the appropriate unit price Contract Items, or at a price negotiated by the Owner and the Contractor.

1.03 UNAUTHORIZED EXCAVATION

A. Wherever the excavation is carried beyond or below the lines and grades shown or given by the Engineer, except as specified in Section 02220-1.02, all such excavated space shall be refilled with such material and in such manner as may be directed in order to insure the stability of the various structures. Beneath all structures or pipe lines, space excavated without authority shall be refilled by the Contractor at his own expense with Class D concrete or selected fill materials, as ordered by the Engineer.

1.04 SEGREGATION AND DISPOSAL OF MATERIAL

A. Topsoil suitable for final grading and landscaping and excavating material suitable for backfilling or embankments, shall be stockpiled separately on the site in locations approved by the Engineer. Surplus excavated material shall be disposed of in locations on the site as indicated or approved by the Engineer or disposal areas obtained by the Contractor.

02220-1
1.05 SHORING AND SHEETING

A. All excavations shall be properly shored, sheeted and braced to furnish working conditions acceptable to OSHA standards to prevent shifting of material, to prevent damage to the structures or other work, and to avoid delay to the work. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength and to meet the standards set by OSHA. If, at any point, the sheeting or supports furnished are inadequate or unsuited for the purpose, the Contractor shall provide the additional sheeting and supports necessary to bring the sheeting and shoring supports into compliance with the standards of OSHA. The sole responsibility for the design, methods of installation, and adequacy of the sheeting and supports shall be and shall remain that of the Contractor.

B. In general, sheeting for pipe lines shall not be driven below the elevation of the top of the pipe. If, in order to obtain a dry trench or satisfactory working conditions, it is necessary to drive the sheeting below that elevation, the sheeting shall be cut off and let in place below the top of the pipe at no additional cost.

C. The sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by ramming or other methods.

D. The safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack of inadequacy of the sheeting, shoring and bracing shall be the sole responsibility of the Contractor.

1.06 SHEETING LEFT IN PLACE

A. Any or all sheeting or bracing to be left in place necessary for the purpose of preventing injury to the structures or to other property or to persons shall be the sole responsibility of the Contractor and shall be done in accordance with OSHA standards. If left in place, such sheeting shall be prepared and carried out in accordance with standards set by OSHA.

1.07 REMOVAL OF WATER

A. At all times during the excavation period and until completion and acceptance of the work at final inspection, ample means and equipment shall be provided with which to remove promptly and dispose of properly all water entering any excavation or other parts of the work. The excavation shall be kept dry. No water shall be allowed to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set satisfactory to the Engineer, and in any event, not sooner than 12 hours after placing the masonry. Water pumped or drained from the work hereunder shall be disposed of in a suitable manner without damage to adjacent property or to other work under construction. Water shall be discharged into sanitary sewers. No water containing settleable solids shall be discharged into
storm sewers. Any and all damage caused by dewatering the work shall be promptly repaired by the Contractor at his expense.

1.08 STRUCTURE EXCAVATION

A. The site of all excavations for structures shall first be cleared of all trees and obstructions unless otherwise directed preparatory to excavation.

B. The excavations shall be of sufficient size and only of sufficient size to permit the work to be economically and properly constructed in the manner and of the size specified. Wherever the nature of the ground will permit, the bottom of the excavation shall have the shape and dimensions of the underside of the structure.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL

A. All excavation shall be backfilled to the original surface of the ground or to such other grades as may be shown or directed. For areas to be covered by topsoil, backfill shall be left 6 inches below the finished grades shown on the Plans. In all backfilling, all compressible and destructible rubbish and refuse which might cause later settlement and all lumber and braces shall be removed from the excavated space before backfilling is started, except that sheeting and bracing to be left in place or removed as the work progresses as specified in Section 02220, paragraphs 5 and 6.

B. Backfilling, unless otherwise specified, shall be done with sound materials, free from waste, objectionable organic matter, rubbish, boggy or other unsuitable materials. No frozen material shall be used for backfilling.

C. All waterlines shall have a minimum of 6” bedding with crushed stone and shall have a minimum 12” of crushed stone backfill over the top of the pipe.

1.02 BACKFILL AND TAMPPING

A. Initial backfill surrounding the pipe and to a one-foot minimum depth of cover shall be crushed stone, free from rocks greater than ½” diameter, dirt clods, or frozen material. If automatic tampers are used, care should be exercised to avoid damaging the pipe.

B. In water pipe installations, the top of the bells can be left exposed for visual inspection during the test, if required.

C. Complete backfill with a uniformly dense backfill load using machines, if desired. This backfill should be free of frozen lumps and rocks over 6” in diameter and free of stumps, etc. The backfill should be placed and spread in approximately uniform layers in such a manner as to completely fill the trench with a uniformly dense backfill load on the pipe and avoid unfilled spaces in the backfill. Rolling equipment should not be used until a minimum of 18 inches of backfill material has been placed over the top of the pipe. Hydrohammer compaction will not be allowed except with 48” of cover.

1.03 BACKFILL CONSOLIDATION

A. In paved, sodded or seeded areas, each layer of backfill shall be consolidated at optimum moisture content by pneumatic or machine tampers to such density that paving, sodding or seeding can proceed immediately after the backfilling is
completed without danger of settlement (8+/- inches layers). It is estimated that a
density of approximately 95 percent of maximum after compaction, determined as
specified in Subsection 02221-1.04, will be required. In the event that settlement
does occur, the Contractor shall immediately, at his own expense, resurface or retop
affected areas to bring them up to proper grade.

1.04 SPECIAL CONSOLIDATION

A. Where structures, pipe lines, walks, roadways, or railroad tracks are to be supported
on backfilled excavations or embankments without sufficient available time for
normal settlement and where selected fill is not specified or ordered, special
provisions shall be made for consolidation of the fill. The entire backfill or
embankment shall be made with material meeting the requirements set forth below.
If such material is not available from the excavation, suitable material shall be
obtained from borrow. No material shall be used which has not been approved in
advance as to quality and source by the Engineer. Samples shall be submitted at
least one week in advance of the desired date of approval. Approval of the samples
will not constitute approval of the entire source, but only as far as the material
continues to meet the requirements. If visual inspection indicated that the material
varies from the approved sample, the work shall be stopped until additional
representative samples can be obtained and analyzed. Not less than one sample
shall be submitted for every 100 cubic yards or fraction thereof of the material to be
used.

B. The material shall be a combination of sand, silt and clay well graded, of which not
more than 30 percent shall be retained on a No. 4 sieve and not less than 55
percent nor more than 85 percent shall be sand passing a No. 4 sieve and retained
on a No. 200 sieve. The material shall have a liquid level not greater than 35 as
determined by AASHO Des. T89. Gravel or stones shall not be larger than one-third
the depth of the layer to be compacted. The material shall contain no trash, brick,
broken concrete or cinders.

C. The fill material shall be placed in uniform horizontal layers 6 inches in thickness.
Stones, if present, shall be disturbed throughout the mass so that all interstices are
solidly filled with fine material.

D. The material in each layer of fill at the time of compaction shall have a moisture
content within 2 percent of the optimum value for compaction as determined by the
AASHO Standard Method of Test for the Compaction and Density of Soils, Des.
T99, except that the soil shall be compacted in the specified mold in 5 equal lifts by
a 10-pound hammer falling freely at a distance of 18 inches with 25 blows per layer.

E. When the fill materials are too dry, the Contractor shall wet the surface of the
preceding layer to an amount directed by the Engineer, and shall then add water to
the new layer by sprinkling and mixing as required to bring the material to the
optimum moisture content specified.

F. When the material is too wet, it shall be allowed to dry until the optimum moisture
content is reached.
G. Each layer of fill shall be compacted by means of a mechanical tamper or other approved method which will give the desired results until the density of compaction is at least equal to 9 percent of the optimum density of the material as determined by the test specified above. Determination of the density of the material in place shall be in accordance with AASHO Des. T99.

1.05 SELECTED FILL MATERIAL

A. Selected fill material shall consist of any pea gravel, gravel, crushed stone, or other granular or similar material approved by the Engineer that can be readily and thoroughly compacted. Sand or other fine materials that have a tendency to flow under pressure when wet will not be acceptable. Selected fill material for small spaces shall be placed as specified in Subsection 02221-1.02.

1.06 PIPE COVER

A. Minimum cover over the top of pipe shall not be less than 3.0 feet where pipe is not subjected to traffic or where ductile iron pipe is used. The minimum cover where the pipe is subjected to traffic shall not be less than 4.0 feet.

B. Where the cover is insufficient, an earth fill shall be constructed, ductile iron pipe shall be used, or the pipe shall be encased in concrete as shown on the Plans or directed by the Engineer in the field.

1.07 BACKFILL AROUND BELOW GRADE STRUCTURES

A. Excavated areas around below grade structures shall be backfilled and consolidated with selected fill material. Consolidation shall be as hereinbefore specified.

1.08 BACKFILL IN ROADWAYS

A. Excavated areas in roadways shall be backfilled to their full depth with selected fill material as specified in Subsection 02221-1.05.

END OF SECTION
SECTION 02605

MANHOLES

PART 1 - GENERAL

1.01 GENERAL

A. Manholes shall be constructed of pre-cast concrete manhole sections with eccentric cones unless directed otherwise by the Engineer. Cast-in-place concrete or brick manholes will not be allowed.

1.02 MATERIALS AND WORKMANSHIP

A. Pre-cast concrete manhole sections shall meet the requirements of ASTM-C478.

B. Each pre-cast concrete riser section shall be constructed with a tongue and groove joint and sealed using two (2) pieces of butyl rubber sealant. Sealant shall also be utilized at connection points for grade rings and castings.

C. The outside of the manhole shall have a 4-inch wide non curing butyl tape on all joints.

D. The inside of all manhole structures shall be cleaned and grouted at the joints.

E. The butyl rubber sealant shall meet or exceed the requirements of Federal Specification (GSA-FSS) SS-S-00210.

F. The concrete manhole base shall be constructed to have a smooth invert channel with circular shaped bottom with a radius equal to the inside radius of the sewer section.

G. Care must be taken to cut subgrade for manhole base as level as possible. A 6" layer of crushed stone shall be used as a bedding course.

H. The top rim of manhole frames and covers shall be set to conform with finished grade and anchor bolted to the manhole.

I. Manhole steps are to be copolymer polypropylene plastic reinforced with ½" grade 60 reinforcement. The steps shall have a serrated thread and tall end lugs to prevent the feet from slipping forward, backward, or sideways off of the step.

J. Xypex Admin C-1000 (Dye) shall be added to the concrete mix at the time of batching. Dosage rate and sequence of procedures shall be determined by manufacturer and manhole supplier. Manhole supplier shall submit this information to the City as part of review. Finished manhole must be able to resist pH of 3-11 constant and spikes of 2-12 pH. Color shall be incorporated into the admixture which shall be visible in the finished manhole as verification of the presence of...
Xypex. Manhole supplier shall also provide certification that Xypex was added at the proper dosage.

K. Connections to manholes shall include resilient pipe connectors manufactured in accordance with ASTM C-923. The connection shall consist of a durable rubber boot which shall be clamped securely to the cutout in the manhole wall and to the pipe by means of stainless steel clamps or bands. The void area between the pipe and connector shall be sealed with an approved flexible gasket material. Resilient connectors shall be Kor-n-Seal, Press-Boot, or approved equal.

L. Manhole castings shall conform to ASTM A48 of latest revision, Class 30B. Covers shall be of solid type. Bearing surfaces of frames and covers shall be machined to provide a solid bearing to prevent rocking. Pattern drawings and weights shall be submitted to the Department of Public Works for approval.

M. Castings shall be bolted to the manhole with a minimum of four (4) stainless steel bolts tightened such that the butyl sealant provides a water tight barrier between the concrete surface and the casting.

N. Watertight covers shall incorporate gaskets and stainless steel bolts in lieu of locking-bar type systems.

O. All lift holes shall be filled with grout prior to backfilling of the manhole structure.

1.03 MANHOLE DIAMETERS

A. The minimum diameter of manholes should be 48 inches; larger diameters are preferable. The minimum clear opening in the manhole frame shall be 24 inches to provide safe access for emergencies.

B. Manholes connecting significant industries to the system should be larger, to provide space for monitoring and sampling equipment.

1.04 TESTING

A. All manholes provided with watertight frames and covers shall be vacuum tested at 10” of mercury (Hg) for 60 seconds. The manhole shall not lose more than 1 psi vacuum pressure during test.

B. All new or rehabilitated manholes with watertight frames and covers shall be vacuum tested to assure watertightness before backfilling. The exterior surface of these manholes must be painted with waterproofing material as the vacuum is being pulled to seal the pores of the concrete.

END OF SECTION
SECTION 02731
SEWERS AND FORCE MAINS

PART 1 - GENERAL

1.01 GENERAL

A. The laying and jointing of sewer pipes shall be done in accordance with ASTM Recommended Practice D-2321-Underground Installation of Flexible Thermoplastic Sewer Pipe - as modified or supplemented by the specifications of this section. The laying and jointing of force mains shall be done in accordance with ASTM Recommended Practice D-2774-Underground Installation of Thermoplastic Pressure Piping - as modified or supplemented by the specifications of this section.

B. During loading, transportation, and unloading, care shall be taken to prevent injury to the pipe.

C. Pieces shall be examined for defects and no pipe shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor at his own expense.

1.02 TRENCH PREPARATION

A. The clear width of the trench, measured at the pipe, shall be held to the minimum practical to permit proper laying and jointing of the pipes. This width should only be enough to provide adequate space for jointing the pipe properly or approximately the outside diameter of the pipe plus 16 inches.

B. The bottom of the trench shall be carefully graded, compassed, and formed to fit the bottom of the barrel of the pipe as shown on the Plans. Where the trench bottom is in rock, it shall be excavated to a sufficient depth below grade to insure that no part of the pipe or fittings shall be in contact with solid rock, and brought back to grade with a bed of thoroughly compacted granular material having a minimum thickness of 6 inches below the bell and barrel of the pipe. All PVC pipe shall be installed on a minimum bedding of 6” crushed stone with ¼” as largest.

C. Crushed stone shall be placed in the trench to a sufficient height so that upon completion of compaction, the entire upper surface of the crushed stone shall be no lower than the bottom of the barrel of the pipe. The upper surface of the crushed stone shall be shaped as necessary to provide grade for the pipe. Bell holes shall be made in the crushed stone so that the pipe shall be supported on its barrel portion only and the pipe laid to line and grade in the manner described in the drawings.

D. When the pipe is properly positioned, crushed stone shall be pulled or scraped up against the pipe and suitably rammed into place along the barrel of the pipe only, to
firmly hold the pipe in position. Care shall be taken during the operations to insure that the pipe shall not be disturbed. The pipe shall then be backfilled with crushed stone from the crushed stone bedding to a point at least 6" above the top of the pipe and to the same elevation out to the trench wall. Care shall be taken when placing this crushed stone backfill to assure that the pipe shall not be disturbed.

E. All cost of furnishing and placing the crushed stone as described shall be included in the price bid per foot of PVC pipe.

F. Compaction from top of pipe to natural ground or sub-base shall be compacted in layers not to exceed 6" in uncompacted thickness and shall be compacted to 95% maximum laboratory density obtained in accordance with ASTM Specifications D1557, Method D (Modified Proctor).

G. Where ground water is to be encountered, the Contractor shall make every effort to secure an absolutely dry trench bottom. If all efforts fail to obtain this condition and the Engineer determines that the trench bottom is unsuitable for pipe foundation, he will order, in writing, the kind of stabilization to be constructed, as provided for under the appropriate Contract Item.

H. If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry trench bottom by insufficient use of all known methods of trench dewatering, the Engineer may then order the Contractor to excavate below grade and place sufficient selected fill material over the trench bottom at the Contractor's own expense.

I. Pipe laying will be permitted only in dry trenches having a stable bottom.

J. In general, sheeting shall not be driven below the elevation of the top of the pipe. If, in order to obtain a dry trench or satisfactory working conditions, it is necessary to drive the sheeting below the elevation, it shall be cut off and left in place below the top of the pipe at no additional cost.

1.03 JOINING THE PIPE

A. The following steps shall be taken to insure proper joining of the pipe:

1. Wipe the inside of the bell of the pipe with a clean dry rag to remove grease, sand or mud which may have accumulated in the gasket “groove”.

2. Insert the gasket into the groove, seating it evenly in the groove with the groove with the flat side of the gasket at the base of the groove and the gasket slot facing the spigot end of the pipe.

3. Lubricate the beveled end of the spigot only.

4. Align spigot and bell.
5. Push spigot into the bell up to within ½" of the stop mark. (If the spigot is not pushed in up to the stop mark, the joint has not been correctly made.)

NOTE: WHEN MAKING A FIELD CUT, ALWAYS BEVEL THE CUT END OF THE PIPE BEFORE MAKING A CONNECTION.

1.04 FITTINGS

A. If it is desired to place a fitting at a location other than at the end of a pipe section, the pipe may be sawed making a square cut with a fine toothed saw. Clean burrs from inside of the pipe wall and bevel the end similar to factory-finished pipe end using a curved tooth file. Assembly pipe fitting in similar manner as coupling pipe. Fittings can be furnished with double bell to allow for use of the remaining portion of the pipe. This remaining piece should also be beveled for easy assembly by inserting in bell to the same depth as marked pipe.

1.05 FLOTATION

A. The actual flotation or buoyancy per lineal foot of I.P.P.C. - P.V.C. plastic sewer pipe is 6" at 11.08 lbs., 8" at 19.64 lbs., 10" at 30.67 lbs., and 12" at 44.17 lbs. Therefore, installed pipe should never be left for any length of time without at least one foot of backfill above the top of the pipe.

1.06 DEFLECTION

A. After completion and in addition to other tests required herein, the pipe shall pass a go mandrel (or effective equivalent), the size to be determined in the field as described below.

B. Flexible pipe deflection under earth loading may be calculated using the formula presented in the ASCE/WPCF publication Design and Construction of Sanitary and Storm Sewers.

C. Deflection Testing

1. Deflection testing of all flexible pipe is required. The test shall be conducted after the backfill has been in place at least 24 hours.

2. No pipe shall exceed a deflection of 5%.

3. The test should be run with a rigid ball or an Engineer-approved 9-arm mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test must be performed by manually pulling the test device through the line.

1.07 PLASTIC PIPE AND FITTINGS - GRAVITY SEWERS

A. General - All plastic pipe shall be solid wall polyvinyl chloride (PVC) sewer pipe and fitting shall meet the minimum requirements of SDR 26 in ASTM D3034. SDR 26 or
ductile iron pipe will be required when depths of cover exceed 20 feet. Nominal laying lengths shall be 20'-0". Flexibility with one 20-foot pipe length fixed in adjacent pipe length may be deflected in any direction .93 feet.

B. Joints - Components for joining shall consist of a gasket, spigot and bell. Solvent cemented fittings shall be unacceptable. The bell shall be formed integrally with the pipe or fitting and shall have a raceway or groove which is specially formed to accept and retain the gasket. The pipe spigot shall have a bevel and an insertion stop mark. The bevel shall be at 10° angle with the pipe axis and to a depth of ½ to 2/3 the wall thickness. The distance from the spigot end to the insertion stop mark shall provide adequate allowance for both expansion and contraction over a range of 100° F (38° C) at each joint. The assembled joint shall be designed so the gasket shall be radially compressed to assure a positive water-tight seal for all installation conditions recommended by the manufacturer and under all combinations of production tolerances for the joint components. Each size joint shall be qualified to have no leakage under various test conditions in conformance with ASTM Specification D3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

C. Fittings - Fittings shall be made from white PVC compound having physical properties and chemical resistance of cell classifications 12454-B, 12454-C, or 13343-C, as defined in ASTM Specification D1784, Rigid Polyvinyl Chloride Compounds. All fittings shall be SDR 26. Dimensions shall be per manufacturer's standards.

1.08 PLASTIC PIPE AND FITTINGS - FORCE MAIN (PRESSURE PIPE)

A. General - All plastic pipe shall be solid wall polyvinyl chloride (PVC) pressure pipe meeting the requirements of ASTM Specifications D1784 and D2241 and Commercial Standard PS22-70. The dimension ration shall be Standard Dimension Ratio SDR 14 with a pressure rating of 200 psi at 73.4 degrees Fahrenheit. Normal laying length shall not exceed 20 feet.

B. Joints - All joints of both pipe and fittings shall comply with ASTM Specification D3139, Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. Joint bells shall be formed integrally with the pipe or fitting and shall have a raceway or groove which is specially formed to accept and retain the gasket. Pipe spigots shall be beveled and shall have insertion stop marks. Qualification tests of the joint design shall result in no leakage under various laboratory test conditions of joint alignment and pressure at 2-1/2 times rated pressure and at 22" (56° Hg vacuum).

C. Fittings - Fittings for PVC pressure pipe shall be cast iron or ductile iron and cost of fittings shall be included in unit price per foot of pipe.

D. Detection Wire - All PVC force mains shall be equipped with detection 10 gauge solid detection wire with Kearney. Wire shall be wrapped with electrical tape.

1.09 TEMPORARY BULKHEADS
A. At the ends of contract sections where adjoining sewer sections have not been completed and in connections built into sewers where adjoining sewers or structures have not been completed and are not ready to be connected, temporary bulkheads approved by the Engineer shall be built. Such bulkheads encountered in connecting sewers or structures embraced in this Contract, or sewers or structures previously built, shall be moved by the Contractor when the need for them has passed or when ordered by the Engineer.

1.10 CONCRETE WATER STOPS

A. Concrete water stops shall be constructed five (5) feet to ten (10) feet upstream of all manholes, on each side of all creek crossings, and at other locations as shown in the Plans.

B. Water stops shall be constructed from Class “D” concrete (2000 psi) and shall be keyed into undisturbed soil a minimum of 12 inches into the side of the trench and 12 inches below the bottom of the trench. The top of the water stop shall extend a minimum of 12” above the top of the pipe. The use of bagged, pre-mixed concrete (Sack-crete) shall not be permitted.

C. The Contractor may substitute clay material for concrete with the permission of the Engineer.

1.11 PRELIMINARY TESTING OF SEWERS

A. After the pipe joints have been approved and the trench has been backfilled and tamped as specified for hand tamping in Section 02221-2, the completed line between manholes shall be inspected by the Engineers. Any section of pipe when inspected from either end must show a full circle of light at the far end. Pipes must be free of stoppage, and no gasket material or joint compound may protrude into the pipe. The line of pipe must be on a uniform grade, free from humps or depressions. Such defects, if encountered, shall be remedied by and at the expense of the Contractor to the satisfaction of the Engineer.

B. The leakage outward or inward (exfiltration or infiltration) shall not exceed the following limits, 25 gallons per inch of pipe diameter per mile per day.

C. Low pressure air testing shall be performed as per ASTM C-828 on all gravity pipe. The time required for the pressure to drop from the stabilized 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time (the test criteria should be based on the air loss rate. The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert (one foot of H2O = 0.433 psi).

D. The following table gives the minimum test times and allowable air loss values for various pipe size per 100 ft.
<table>
<thead>
<tr>
<th>PIPE SIZE (Inches)</th>
<th>TIME ALLOWABLE AIR LOSS (Sec/100 ft)</th>
<th>Q (Ft³/Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>42</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>90</td>
<td>2.5</td>
</tr>
<tr>
<td>12</td>
<td>108</td>
<td>3.0</td>
</tr>
<tr>
<td>15</td>
<td>126</td>
<td>4.0</td>
</tr>
<tr>
<td>18</td>
<td>144</td>
<td>5.0</td>
</tr>
<tr>
<td>21</td>
<td>180</td>
<td>5.5</td>
</tr>
<tr>
<td>24</td>
<td>216</td>
<td>6.0</td>
</tr>
<tr>
<td>27</td>
<td>252</td>
<td>6.5</td>
</tr>
<tr>
<td>30</td>
<td>288</td>
<td>7.0</td>
</tr>
</tbody>
</table>

1.12 CONNECTIONS TO EXISTING SEWERS

A. Where it is necessary to connect to existing sewers or manholes, and where the existing stub-outs or fittings are not compatible to the pipe being used, the existing stub-outs or fittings shall be removed and a stub-out or fitting installed that is compatible with the pipe being used.

1.13 SERVICE LATERALS

A. PVC Service Laterals shall be equipped with detection tape. The end of service shall be marked with wooden plank as directed by the Engineer. Connection of the lot sewer service to the service lateral shall include a Fernco connector with stainless steel bands.

1.14 SEPARATION FROM WATER MAINS

A. Where sewer and water mains cross, the invert of the water main shall be separated from the crown of the sewer main by 18". The water main shall be installed above the sewer main.

B. If conditions physically prohibit an 18" separation, the sewer main shall be constructed of ductile iron pipe with mechanical joints for a distance of ten feet (10') either side of the crossing.

END OF SECTION
PART 1 - GENERAL

1.01 GENERAL

A. All sewer lines, force mains, and appurtenances shall be tested for leakage by the Contractor under the direction of the Engineer. All sewer lines shall be tested by means of the air test specified herein. Also, all sewers, including manholes and other appurtenances, shall be given a final infiltration test after completion. Infiltration tests may be made either on entire completed trunk systems or on sections of the systems at the Contractor’s option. All force mains shall be tested by means of a hydrostatic pressure test as specified herein.

B. All tests shall be conducted in a manner to minimize as much as possible any interference with the Contractor’s work or progress.

C. The Contractor shall notify the Inspector when the work is ready for testing, and tests shall be made as soon thereafter as possible. Personnel for witnessing tests and reading meters, gauges or other measuring devices will be furnished by the Engineer, but all other labor, equipment, and materials, including meters, gauges, air compressors, blower, fuel, bulkheads, and accessory equipment shall be furnished by the Contractor. The Contractor shall obtain written approval of testing equipment from the Inspector prior to making the tests.

D. A vacuum test is acceptable in lieu of or in conjunction with an air pressure test at the discretion of the City Inspector.

1.02 AIR TEST

A. Length of line tested at one time shall be limited to the length between adjacent manholes.

B. Air test procedures shall be as follows:

1. Low pressure air testing for all pipes should be performed as per ASTM C-828. The time required for the pressure to drop from the stabilized 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time (the test criteria should be based on the air loss rate. The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert \[\text{one foot of } H_2O = 0.433 \text{ psi}\]).

C. The following table gives the minimum test times and allowable air loss values for various pipe size per 100 ft.
### TEST TABLE

<table>
<thead>
<tr>
<th>Pipe Size (inches)</th>
<th>Time, T (sec/100 ft)</th>
<th>Allowable Air Loss, O ft. 3/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>42</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>72</td>
<td>2.0</td>
</tr>
<tr>
<td>10</td>
<td>90</td>
<td>2.5</td>
</tr>
<tr>
<td>12</td>
<td>108</td>
<td>3.0</td>
</tr>
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<td>126</td>
<td>4.0</td>
</tr>
<tr>
<td>18</td>
<td>144</td>
<td>5.0</td>
</tr>
<tr>
<td>21</td>
<td>180</td>
<td>5.5</td>
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<tr>
<td>24</td>
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<td>6.0</td>
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<tr>
<td>27</td>
<td>252</td>
<td>6.5</td>
</tr>
<tr>
<td>30</td>
<td>288</td>
<td>7.0</td>
</tr>
</tbody>
</table>

D. If the test is not passed, the leak shall be found and repaired to the satisfaction of the Engineer.

E. House sewers shall be considered part of the lateral to which they are connected and no adjustment of time shall be allowed to compensate for the smaller diameter of the house sewers.

F. The pressure gauge used shall be supplied by the Contractor, shall have minimum divisions of 0.10 psi, and shall have an accuracy of 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six month intervals or when requested by the Engineer. In addition, the Engineer may compare the Contractor’s gauge with a properly calibrated gauge at any time.

### 1.03 FORCE MAIN PRESSURE TESTS

A. Force mains shall be tested as a whole or in sections, valved or bulkheaded at the ends. All force mains shall be tested at a minimum pressure of at least 50 percent above the design operating pressure for at least 30 minutes. The pressure shall be applied to the piping, after it has been purged of air, through a tap in the pipe by means of a hand pump or other approved method.

B. The leakage shall not exceed the amount given by the following formula:

$$L = \frac{NDP^{1/2}}{7400}$$

in which

- \(L\) = allowable leakage in gallon per hour
- \(N\) = number of joints in the length of pipe line tested
- \(D\) = nominal diameter of pipe in inches
- \(T\) = average test pressure in psig

Any leaks shall be located and made tight until the pipeline meets the above tests.
1.04 FINAL INSPECTION

A. Upon completion of the work herein contracted for, the Engineer and the Contractor will carefully inspect all sewers, appurtenances and all other work done by the Contractor. In each stretch of sewer intended to be straight, light shall be visible from one end to the other. Any broken or cracked pipe shall be replaced with sound ones. Any deposits found in the sewers, protruding cement or packing, shall be removed and the sewer left clean and free through its entire length. All manholes and all other appurtenances shall be of specified size and form, of neat appearance, and shall be set to proper grade. In general, the work shall conform to these specifications, and if found not to do so in any respect, it shall be brought to the proper condition by cleaning, pointing, or if necessary, by excavating and rebuilding, all at the expense of the Contractor.

END OF SECTION
SECTION 03010
CONCRETE, MORTAR, AND GROUT MATERIALS

PART 1 - GENERAL

1.01 GENERAL

A. The materials covered under this section are cement, sand, crushed stone, gravel and water for use in concrete mortar and grout.

1.02 CEMENT

A. Except as otherwise specified, all cement used on the work shall be either air-entraining Portland cement or standard Portland cement. Cement shall be a domestic product from a source approved by the Engineer before the cement is ordered. If standard Portland cement is used, an air-entraining agent meeting the requirements of ASTM Des. C260 shall be added to the concrete at the time of mixing in an amount sufficient to produce from four to six percent entrained air in the concrete.

B. Air-entraining cement shall meet the requirements of ASTM Des. C175, Type 1A or Type 11A, and standard Portland cement shall meet the requirements of ASTM Des. C150, Type 1 or Type 11.

C. Standard Portland cement without an air-entraining agent shall be used in the manufacture of concrete pressure pipe.

D. The Engineer shall have the right at all times to inspect the materials, the processes of manufacture, the laboratory records of the analyses and tests made at the cement works, and to supervise the packing.

1.03 HIGH-EARLY STRENGTH CEMENT

A. In case high-early strength cement is required for special parts of the work, it shall be a true Portland cement with no chemicals or other substances added to expedite hardening, and of a brand approved by the Engineer. The cement shall meet the requirements of ASTM Des. C150, Type III or C175, Type IIIA. High-early strength cement shall be used only with the approval of the Engineer.

1.04 DELIVERY AND STORAGE OF CEMENT

A. Cement delivered to the jobsite shall be in strong, well-made bags plainly marked with the brand name of manufacturer, and net weight. Packages received in damaged condition will be rejected or they may be accepted as fractional packages when permitted by the Engineer.
B. For ready-mixed concrete, cement may be delivered in bulk provided that the batching plant meets the requirements of ASTM Des. C94.

C. Cement shall be stored in a weather tight building having a wooden floor raised above ground and shall be protected from dampness. Cement that has deteriorated from storage shall not be used. Cement remaining in storage, prior to use, for a period greater than six months after test, shall be retested and shall be rejected if it fails to meet any of the requirements of these Specifications. Accepted cement which has been in storage for more than one year from the time of original acceptance shall not be used.

1.05 SAMPLES OF AGGREGATES

A. At least 15 days before the first concrete is to be used, a 50-pound representative sample of each aggregate shall be submitted to the Engineer for approval. As the work proceeds, additional samples shall be submitted if, and when required, by the Engineer.

1.06 FINE AGGREGATE

A. Fine aggregate shall be natural sharp sand meeting the requirements of ASTM Des. C33, except as modified herein.

B. Fine aggregate for concrete shall meet the requirements for grading in ASTM Des. C33.

C. Fine aggregate for mortar and grout shall be well graded within the following limits by weight when tested in accordance with ASTM Des. C136.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percentage Passing</th>
<th>Mortar</th>
<th>Grout</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>No. 8</td>
<td>96 to 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 16</td>
<td>70 to 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 30</td>
<td>40 to 70</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>No. 50</td>
<td>15 to 35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 100</td>
<td>5 to 15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.07 COARSE AGGREGATE

A. Coarse aggregate shall consist of gravel or crushed stone and shall meet the requirements of ASTM Des. C33, except that no exceptions shall be made in the requirements for passing the soundness test as set forth in Paragraph 10A of those Specifications. Coarse aggregate shall be graded according to Sizes 467 and 57 in Table II.
B. Size No. 57 shall be used for all thin or closely reinforced concrete work, such as floors and roofs less than 7 inches thick, walls less than 9 inches thick, all beams, girders, struts, columns and all fireproofing. For all other concrete work, Size No. 467 shall be used.

1.08 STORAGE AND HANDLING OF AGGREGATES

A. Aggregates shall be kept clean and free from all other materials during transportation and handling. They shall be kept separated from each other at the site until measured in batches and placed in the mixer.

B. Unless finish screening is provided at the batch plant, aggregates shall be stockpiled in a manner to prevent segregation in accordance with ACI Standard 614.

1.09 ADMIXTURES

A. The use of admixtures in concrete, other than air-entraining agents as hereinbefore specified, will not be permitted.

1.10 WATER

A. Water used in mixing concrete shall be clean and shall not contain deleterious amounts of acids, alkalis or organic materials. All water shall be furnished from sources approved by the Engineer.

END OF SECTION
SECTION 03150

CONCRETE AND REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL

A. Concrete shall be of two classes as follows:

1. Class C shall be used for manhole bases and tops, sidewalks and pavements.

2. Class D concrete shall be used for pipe cradle, anchor and encasement, filling soil stabilization and similar purposes.

1.02 MATERIALS

A. Cement shall meet the requirements of ASTM Des. C150, Type I or Type II.

B. Coarse aggregate shall meet the requirements of ASTM Des. C33.

C. Fine aggregate shall meet the requirements of ASTM Des. C33.

1.03 CONCRETE

A. All concrete shall be ready mixed and shall meet the requirements of ASTM Des. C94.

B. The compressive strength of concrete at 28 days shall be not less than the following:

<table>
<thead>
<tr>
<th>Class</th>
<th>Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class C</td>
<td>3000 psi</td>
</tr>
<tr>
<td>Class D</td>
<td>2000 psi</td>
</tr>
</tbody>
</table>

C. The concrete shall have a slump of not less than 2 inches nor more than 4 inches when tested in accordance with ASTM Des. C143.

D. The amount of water per sack of cement shall not exceed 6 gallons for Class C concrete nor 8 gallons for Class D concrete.

1.04 FORMS

A. Forms shall conform to the shape, lines, and dimensions of the member as shown on the Plans. They shall be substantial, properly braced, and tied together so as to maintain position and shape and to resist all pressures to which they may be subjected. They shall be sufficiently tight to prevent leakage of mortar.
1.05 PLACING CONCRETE

A. Concrete shall be deposited as closely as possible to its final resting place and in no case more than eight feet distant in a horizontal direction. It shall be handled and placed so as to prevent any segregation of the material. In other respects, the handling and placing of concrete shall conform to the recommendation of the ACI.

1.06 CURING

A. Concrete exposed to the atmosphere shall be protected against too rapid drying for a period of at least seven days. It shall be kept moist by sprinkling, covering with soaked quilted covers or impermeable paper, coating with sprayed-on during membrane, or other means acceptable to the Engineer.

1.07 REINFORCING STEEL

A. Reinforcing bars shall meet the requirements of ASTM Des. A305 and shall be of steel meeting the requirements of ASTM Des. A15, Intermediate Grade.

B. Reinforcing mesh shall meet the requirements of ASTM Des. A185.

C. Reinforcing steel shall be fully protected from moisture, grease, dirt, mortar or concrete and shall be cleaned of all rust, mill scale, and dirt before being finally incorporated in the work.

D. Reinforcing steel shall be placed and held in position so that the concrete cover as measured from the surface of the bar shall be not less than 2 inches.

END OF SECTION
SECTION 5
SUPPLEMENTAL SPECIFICATIONS FOR SUBMERSIBLE SEWER LIFT STATIONS, SEWER SYSTEM TELEMETRY
SECTION 02445

VINYL COATED CHAIN LINK FENCING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall furnish and install PVC or polyolefin elastomer-coated chain link fencing and accessories for commercial use.

B. Fences shall be located around all tanks, pump stations, and other above ground structures.

1.02 SUBMITTALS

A. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories and post foundations.

B. Product data: Manufacturer's catalog cuts indicating material compliance and specified options.

C. Color selection for PVC finishes. Color shall be green.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Products from qualified manufacturers having a minimum of five years experience manufacturing thermally fused chain link fencing will be acceptable as equal, if approved in writing, ten days prior to bidding, and if they meet the following specifications for design, size gauge of metal parts and fabrication.

B. Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

C. Approved Manufacturers: Anchor Fence/Master Halco, Baltimore, MD or approved equal.

2.02 CHAIN LINK FENCE FABRIC

A. PVC or polyolefin elastomer coating, 7 mil (0.18mm) to 15 mil (0.38mm) thickness, thermally fused to zinc-coated steel core wire: Per ASTM F668 Class 2b. Core wire tensile strength 75,000 psi (517 MPa).

B. Size: Helically wound and woven to height of 6 feet with 2-inch diamond mesh, 9 gauge, with a core wire diameter of 0.148 inch and a breakload of 1290 lbf. Color: Black or Green. Submit color chart for final selection.
C. Selvage of fabric twisted at top and at bottom.

D. Fence shall have three (3) strands of barbed wire around the top of the fence.

E. Fence shall have a minimum height of six (6) feet.

2.03 STEEL FENCE FRAMING

A. Steel pipe - Type I: ASTM F 1083, standard weight schedule 40; minimum yield strength of 25,000 psi (170 MPa); sizes as indicated. Hot-dipped galvanized with minimum average 1.8 oz/ft² (550 g/m²) of coated surface area.

B. Steel pipe - Type II: Cold formed and welded steel pipe complying with ASTM F 1043, Group IC, with minimum yield strength of 50,000 psi (344 MPa), sizes as indicated. Protective coating per ASTM F 1043, external coating Type B, zinc with organic overcoat, 0.9 oz/ft² (275 g/m²) minimum zinc coating with chromate conversion coating and verifiable polymer film. Internal coating Type B, minimum 0.9 oz/ft² (275 g/m²) zinc or Type D, zinc pigmented, 81% nominal coating, minimum 3 mils (0.08 mm) thick.

C. Formed steel ("C") sections: Roll formed steel shapes complying with ASTM F 1043, Group II, produced from 45,000 psi (310 MPa) yield strength steel; sizes as indicated. External coating per ASTM F 1043, Type A, minimum average 2.0 oz/ft² (610 g/m²) of zinc per ASTM A 123, or 4.0 oz/ft² (1220 g/m²) per ASTM A 525.

D. Steel square sections: [ASTM A 500, Grade B] Steel having minimum yield strength of 40,000 psi (275 MPa); sizes as indicated. Hot-dipped galvanized with minimum 1.8 oz/ft² (550 g/m²) of coated surface area.

E. PVC or polyolefin elastomer coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10 to 15 mils (0.254 - 0.38 mm) thermally fused in color to match fabric.

F. End and Corner Post 2.875” od 9.11 lbs/ft
   Top Rail and Braces 1.660 od 2.27 lbs/ft

2.04 GATES

A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F 900 using aluminum tubular members, 2” (50 mm) square, weighing 0.94 lb/ft (1.39 kg/m). Fusion or stainless steel welded connections forming rigid one-piece unit. Polyolefin coated frames thermally fused with minimum 10 mils (0.254 mm) per ASTM 1043 after fabrication. Coating before fabrication will not be allowed.

B. At a minimum, gate shall have two 6' leafs that have latch that is capable of being secured with a padlock.

2.05 ACCESSORIES
A. Chain link fence accessories: [ASTM F 626] Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary. “C” shaped line post without top rail or barbed wire supporting arms do not require post caps. (Where top rail is used, provide tops to permit passage of top rail.)

C. Top rail and brace rail ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.

D. Top rail sleeves: 7” expansion sleeve with spring, allowing for expansion and contraction of top rail.

E. Wire ties: 9 gauge [0.148"] galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge [0.092"] for rails and braces. Hog ring ties of 12-1/2 gauge [0.0985"] for attachment of fabric to tension wire.

F. Brace and tension (stretcher bar) bands: Pressed steel. At square post provide tension bar clips.

G. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16” x 3/4” or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

H. Tension wire: Thermally fused PVC or polyolefin elastomer applied to metallic coated steel wire: Per ASTM F 1664 Class 2 b, 7 gauge, [0.177"] diameter core wire with tensile strength of 75,000 psi (517 MPa).

I. Truss rods & tightener: Steel rods with minimum diameter of 5/16”. Capable of withstanding a tension of minimum 2,000 lbs.

J. Nuts and bolts are galvanized but not vinyl coated. Cans of PVC touch up paint shall be provided to color coat nuts and bolts.

K. Barbed wire: Thermally fused PVC-coated steel wire double-strand, 13-3/4 gauge, [0.083"] twisted line wire with galvanized steel, 4 point barbs (without PVC finish) spaced approximately 3” on center. Fence shall have 3 strands evenly spaced on top of fence as seen in detail.


1. Provide 90° 3 strands, single arm.
2. Provide intermediate arms with hole for passage of top rail.

2.06 SETTING MATERIALS
A. Concrete: Minimum 28 day compressive strength of 3,000 psi (20 MPa).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations.

B. Ensure property lines and legal boundaries of work are clearly established.

3.02 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F 567 and manufacturer’s instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30° or more.

C. Space line posts uniformly at 10’ (3048 mm) on center.

D. Concrete set terminal and gate posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6” deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36” below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.

E. Anchor line posts: With protective cap, drive post 36” into ground. Slightly below ground level install drive anchor shoe fitting. Install 2 diagonal drive anchors and tighten in the shoe.

F. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

G. Bracing: Install horizontal pipe brace at mid-height for fences 6’ and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.

H. Tension wire: Provide tension wires at top and at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge [0.0855"] hog rings 24” oc.

I. Center Rails (for fabric height 12’ and over). Install mid rails between posts with fittings and accessories.

J. Bottom Rails: Install bottom rails between posts with fittings and accessories where the fence crosses a ditch or as required at the gate for support.
3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2” between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15” on center and to rails, braces, and tension wire at 24” on center.

B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15” on center.

3.04 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.05 CLEANING

A. Clean up debris and unused material, and remove from the site.

3.06 MEASUREMENT AND PAYMENT

A. Measurement and payment shall be in accordance with the Bid Schedule.

B. If no unit(s) for this work are included in the Bid Schedule, cost(s) for this shall be incorporated into other bid items.

C. Payment for work outside the limits of construction indicated in the plans or otherwise specified shall not be made unless approved in advance by the Engineer.

END OF SECTION
SECTION 11391

SUBMERSIBLE SEWER LIFT STATIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This specification includes the general requirements for design and construction of submersible sewer lift stations. Because of varying site conditions and operational considerations, these specifications should only be used as a guideline in the design and construction of sewer lift stations. Developers and their engineers shall schedule a meeting with the Department of Public Works early in the design process to determine if additional requirements will be necessary. Pump station configurations other than those specified (including grinder pumps) will only be considered on a case-by-case basis. The City of Pigeon Forge shall be contacted for requirements in these situations.

B. Pumping systems shall incorporate fully automatic equipment, capable of handling raw, unscreened sewage. All equipment components shall be furnished and assembled by a single supplier.

C. It is the intent of the City of Pigeon Forge to simplify operation and maintenance of the stations by standardizing on select manufacturers. Therefore, all equipment shall be assembled and furnished by the Gorman Rupp Company, Flygt or Hydromatic. Gorman Rupp is represented by Southern Sales Company, (615) 254-0066. Flygt is represented by Nedrow & Associates, (615) 867-7576, Hydromatic is represented by Water & Waste Equipment (423) 479-2084.

1.2 PUMPING SYSTEMS

A. Contractor shall furnish and install one factory built duplex, automatically controlled, submersible pump station. The station shall be complete with all equipment specified herein. Pumps shall be installed in a pre-cast concrete wet well. Check valves and isolation valves shall be installed in a watertight below grade valve vault.

B. Principle items of equipment shall include a minimum of two sewage pumps, motors, internal piping, valves, motor control panel, automatic liquid level control system, and internal wiring.

C. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted.

1.3 CODES AND STANDARDS

A. REFERENCE STANDARDS

1. Hydraulic Institute Standards
2. ANSI - American National Standards Institute
3. NEMA - National Electrical Manufacturers Association
4. UL - Underwriters Laboratory
5. ETL - Electrical Testing Laboratories
B. Fabrication and manufacture shall be in compliance with all local, state, and federal codes having jurisdiction in the project area.

C. Upon approval of the lift station, developer shall grant City of Pigeon Forge fee simple deed to property. Deed shall include proper access to pump station location.

D. Temporary power intended to serve permanent installations will be allowed for no more than forty-five (45) days. After that time has elapsed, City will disconnect temporary power supply until permanent electrical connection is complete. Under no circumstances will a system be allowed to operate on temporary power.

1.4 SPECIAL WARRANTY

A. A warranty by the pump station manufacturer shall be provided.
   1. The warranty shall provide for the replacement and/or repair of all equipment and materials provided with the station due to defect or workmanship for a period of one year from the date of acceptance by the Owner.
   2. The pump station manufacturer shall be the one-point contact for all equipment provided.
   3. All labor and parts including removal, modifications, and replacement shall be included in the warranty.
   4. The one-year warranty period will apply regardless of individual component, standard manufacturer warranties.

1.5 SERVICE CONTRACT

A. In addition to the Special Warranty, a five-year service contract shall be supplied to the City of Pigeon Forge prior to acceptance of the pump station. This service contract period will begin on the day the station is accepted by the City. The service provider under this contract shall be the licensed service representative in the area. The contract shall include:
   1. 24-hour per day/365 day per year telephone support. At a minimum, the service provider shall maintain a call center where emergency assistance may be obtained.
   2. 6-hour response time - If unable to resolve issues over the telephone, service technicians certified by the equipment manufacturer shall be dispatched to the pump station site. Technicians shall be on-site within six hours of the time of the call by the City of Pigeon Forge.

PART 2 - PRODUCTS

2.1 WETWELL

A. Pump stations shall include either pre-cast or cast-in-place wetwells of sufficient size to limit pump start times to a minimum of 10 minutes or as specified by the pump manufacturer.

B. Wetwell design shall include grout fillets to prevent solids deposition.

C. Wetwell and influent line design shall minimize turbulence around the pumps.
D. Wetwells shall have an aluminum access hatch directly above each pump.

2.2 PUMP DESIGN

A. The pump(s) must be submersible slide rail type and be properly selected with the necessary characteristics to deliver the required flow and total dynamic head.

B. Hydraulic Components and Solids Handling:
1. The pump casing shall be of gray iron with a gray iron or ductile iron slide rail guide shoe attached to the discharge flange as an integral assembly. Casing shall be easily removable from the motor for full inspection of impeller.
2. All pump openings and passages shall be of adequate size to pass 3\textquotedbl} diameter spheres (minimum) and any trash or stringy material which may pass through a sewage collection system.
3. The impeller shall have a tapered locking fit onto the shaft and further be secured by a key and locking bolt. Impeller fasteners shall be non-corroding.
4. A hoisting bail shall provide for proper balance of pump and détente from the discharge connection while using a single lift cable.
5. All other major pump components such as stator housing, seal housing, and bearing brackets must be of structural grade steel or gray iron - Class 30. All external surfaces coming into contact with sewage shall be protected by an epoxy coating of 8 mils minimum thickness. All exposed fasteners and lock washers shall be of 304 stainless steel.

C. Pump Motor:
1. Motor Description:
   a. The submersible pump motor shall operate in accordance with the electrical power required and available. The motor and pump must be connected to form an integral unit. Motor shall be a squirrel-cage, induction type in an air-filled watertight enclosure. The motor shall conform to NEMA design Class B, and incorporate Class F insulation materials to withstand a continuous operating temperature of 155\degree C (311\degree F). The pump and motor shall be capable of handling liquids with a maximum temperature of 40\degree C (104\degree F).
   b. Motor shall be capable of sustaining a minimum of 10 starts per hour. The motor shall operate while only partially submerged and not require a cooling jacket or any other means of auxiliary cooling during normal continuous operation.
   c. Motor housing shall be of cast iron. The stator shall consist of copper windings with copper connectors applied to high-grade electrical steel laminations. The stator shall be held securely in place by a heat-shrink fit into the motor housing. Any other means of securing the stator which would require penetration of the motor housing shall not be considered acceptable.
2. Watertight Integrity:
   a. All static seals at water tight mating surfaces shall be of nitrile \textquotedbl}O\textquotedbl} ring type. Use of auxiliary sealing compounds shall not be required. The power and control cables shall enter the motor through a terminal housing. The entrance shall be sealed with a rubber grommet and clamp set which when compressed longitudinally causes a radial watertight seal. The clamp set shall prevent all
slippage and rotation of cable while engaged, yet may be easily removed and reused during routine maintenance. Any other cable entrance design requiring use of epoxies, silicones, or similar caulking materials shall be considered unacceptable.

b. The pump and electrical cables shall be capable of continuous submersion without loss of waterproof integrity to a depth of 65 feet.

c. The water tight integrity of the motor housing and shaft seal shall be tested during manufacture by pressurizing the motor cavity and submerging in water with motor operating.

3. Motor Protection:

   a. The motor shall be protected from thermal and moisture damage. Thermal protection shall consist of three separate thermostatic switches embedded into the stator windings. Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature set point. Any moisture in the motor housing shall be detected by a mechanically activated moisture sensing micro-switch. The switch shall be sensitive enough to detect airborne moisture and terminate operation of motor before liquid enters the cavity. Use of probes or floats that rely on the presence of liquid to initiate signal shall not be considered acceptable. The thermal and moisture sensing devices shall be connected to the pump control panel by the Contractor.

2.2 AUTOMATIC DISCHARGE CONNECTION

A. Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well. The design must insure an automatic and firm connection of the pump to the discharge piping when lowered into place.

B. A stainless steel base plate with integral guide rail pilots shall be provided along with all hardware and anchor bolts required for permanent installation to the wet well floor. The base plate shall be designed with an integral 90° elbow, or adapt to a commercially available elbow for connection to the vertical discharge piping utilizing standard ANSI 125 lbs. flanges. The manufacturer shall provide all necessary drawings to insure proper installation and alignment of base plate within the sump.

C. Each pump shall be provided with a replaceable stainless steel slide rail guide shoe attached to pump discharge flange. A replaceable neoprene seal shall be provided as an integral part of the guide shoe to form a seal with the base plate connection and eliminate the possibility of leakage and erosive wear during operation. The seal shall contact mating faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable.

D. Upper guide rail pilots, and a lifting cable shall be furnished for each pump. Bottom pilots shall be an integral part of the base plate for ease of installation and proper alignment.
E. The guide shoe shall direct the pump down two vertical guide rails and onto the discharge connection in a simple lineal movement. The build-up of sludge and grease on guide rails shall not present problems during the lifting operation. The guide shoe shall be designed with integral hooks at the top to transmit full weight of the pump to the base plate flange. No portion of the pump shall be supported directly on the bottom of the wet well, guide rails, or lifting cable.

F. Lifting cable shall consist of a stainless steel braided wire cable attached to the pump lifting bail. An eyelet shall be provided at the upper end of this cable for attaching to the wet well access frame.

G. All bolts, machine screws, nuts, washers, and lock washers for complete assembly of access cover, guide rails, and discharge elbow shall be stainless steel.

2.3 WET WELL ACCESS

A. The wet well access shall be fabricated from welded aluminum sections. A hinged aluminum door shall be provided for each pump. The hinged door shall be fabricated from ¹⁄₄" thick aluminum with non-skid diamond tread on upper surface. All hardware on access assembly shall be stainless steel with a flush upper surface without protrusions. For safety, the door shall have a 300-lbs/sq. ft. rating and be fitted with a recessed staple for padlock. Door shall be furnished with a flush aluminum drop handle and automatic hold open arm. Access door shall be Bilco or approved equal.

2.4 VALVES AND PIPING

A. Each pump shall be equipped with a full flow type check valve, capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. The valve seat shall be constructed of stainless steel and shall be replaceable. The valve body shall be cast iron and incorporate a 3" cleanout port. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings, replaceable without requiring access to interior of valve body. Valve shall be rated at 175 psi water working pressure, 350 psi hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. Each discharge line shall be equipped with a 2-way plug valve to permit isolation of the pumps from the common discharge header. The plug valve shall be non-lubricated type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip-tight shut-off plug mounted in stainless steel or Teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface. Valves shall have ports designed to pass 3" spherical solids.

C. Piping:
   1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and Class 53 thickness.
   2. Flanges shall be cast iron Class 125 and comply with ANSI B16.1.
3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within $\frac{1}{2}^\circ$ between flanges. Flanges shall be faced and a gasket finish applied.

D. Discharge Bypass Piping:
1. The station header pipe shall incorporate a 2-way plug valve to permit emergency access to the pump station force main after isolation of the pumps. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. Valve shall be furnished with a drip-tight shut-off plug mounted in stainless steel or Teflon over phenolic bearings, and shall have a resilient facing bonded to the sealing surface. The bypass piping shall terminate with a male quick-connect fitting.

E. Discharge Gauge Kit:
1. The pump station shall be equipped with a glycerin-filled pressure gauge to monitor discharge pressures. Gauge shall be a minimum of 4 inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full scale reading. Pressure gauge shall be graduated 0 to 140 feet water column minimum. Gauge kit shall be mounted within the valve vault and shall be complete with all hoses, fittings and a shut-off valve installed in the connection to the discharge piping.

2.5 ELECTRICAL CONTROL COMPONENTS

A. Panel Enclosure:
1. The electrical control equipment shall be mounted within a 36" x 30" x 14" NEMA 3R stainless steel, dead front type control enclosure. The enclosure door shall be hinged and sealed with a neoprene gasket. It shall include a removable plated steel back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Operator controls shall be mounted on the enclosure door. The control panel shall be equipped with vapor emission type corrosion inhibitors.

2. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures.

3. The lift station shall be equipped with a 500VA step-down transformer to supply 115 volt, AC, single-phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door, and a pad lockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position.

4. The control panel shall be equipped with a transient voltage surge suppressor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize silicon-oxide varistors encapsulated in a non-conductive housing. The arrestor shall have a current rating of 60,000 amps, and a Joule rating of 1,500.

B. Motor Branch Components:
1. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor.
2. An open frame, across-the-line, NEMA rated magnetic motor starter shall be furnished for each pump motor under 40 HP. RVSS starters may be required for larger motors.
3. Overload relays shall be solid state block type, having visual trip indication with trip-free operation.

C. Other Control Components:
1. The control circuit shall be protected by a normal duty thermal-magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.
2. Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system. Manual operation shall override the liquid level control system. Selector switches shall be heavy duty, oil-tight design, with contacts rated NEMA A300 minimum.
3. Pump alternator relay contacts shall operate after pump shutdown. Relay contacts shall be rated 10 amperes minimum at 120 volts non-inductive.
4. Control panels shall be equipped with one oil-tight pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is on or should be running.
5. Six digit elapsed time indicators (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in “hours” and “tenth of hours”.
6. A switch shall be provided to permit the station operator to select automatic alternation of the pumps, to select pump number one to be the lead pump for each pumping cycle or to select pump number two to be the lead pump for each pumping cycle. Selector switch shall be oil-tight design, with contacts rated NEMA A300 minimum.
7. The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.
8. The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.
9. The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing and shall utilize the contacts in the pump motor.
10. A duplex GFCI utility receptacle providing 115VAC, 60 Hz single phase current shall be mounted on the door panel of the control enclosure. Receptacle circuit shall be protected by a 20 Amp thermal-magnetic circuit breaker.
11. The control panel shall include provisions for power by a portable generator. A double throw switch shall be included. The generator receptacle shall be an Appleton Powertite AP4004ERS.

D. Wiring:
1. The control panel, as furnished by the manufacturer, shall be completely wired. The Contractor shall field connect the power feeder lines to the main terminal block, final connections to the remote alarm devices, and the connections between the pump and the pump motor control. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with
applicable standards and specifications set forth by the National Electric Code (NEC).

2. All user serviceable wiring shall be Type MTW or THW, 600 volts, and shall be color coded as follows:
   a. Line and load circuits, AC or DC power — Black
   b. AC control circuit less than line voltage — Red
   c. DC control circuit — Blue
   d. Interlock control circuit, from external source
   e. Equipment grounding conductor — Green
   f. Current carrying ground — White
   g. Hot with circuit breaker open — Orange

3. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be of 16 gauge minimum, Type MTW or THW, 600 volts. Power wiring shall be 14 gauge minimum.

4. The ampacity of motor branch conductors and other power conductors shall not exceed the temperature rating of the connecting terminals. Wires shall be clearly numbered at each end in accordance with the electrical diagrams. All wires on the sub-plate shall be bundled and tied.

5. Wires connected to components mounted on the enclosure door shall be bundled and tied in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be provided to allow the door to swing to its full open position without undue stress or abrasion on the wire or insulation. Bundles shall be held in place on each side of the hinge by mechanical fastening devices.

E. Conduit requirements are as follows:
1. All conduit and fittings shall be UL listed.
2. Liquid tight flexible metal conduit shall be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight, polyvinyl chloride cover.
3. Conduit shall be supported in accordance with Articles 346, 347 and 350 of the National Electric Code.
4. Conduit shall be sized according to the National Electric Code.

F. Grounding:
1. The pump control manufacturer shall provide a common ground bar mounted on the enclosure back plate. The mounting surface of the ground bar shall have any paint removed before making final connections.
2. The Contractor shall make the field connections to the main ground lug and each pump motor in accordance with the National Electric Code.

G. Identification:
1. A permanent corrosion resistant name plate(s) shall be attached to the control and include the following information:
   a. Equipment serial number
   b. Supply voltage, phase and frequency
   c. Current rating of the minimum main conductor
   d. Electrical wiring diagram number
   e. Motor horsepower and full load current
   f. Motor overload heater element
   g. Motor circuit breaker trip current rating
   h. Name and location of equipment manufacturer
2. Control components shall be permanently marked using the same identification shown on the electrical diagram. Identification label shall be mounted adjacent to the device.

3. Switches, indicators, and instruments shall be plainly marked to indicate function, position, etc. Marking shall be mounted adjacent to and above the device.

H. Telemetry
1. Telemetry shall be provided in accordance with Pigeon Forge Wastewater Treatment Plant requirements. Wastewater Treatment Plant personnel shall be contacted at (865) 428-3558 for exact requirements.

2.6 LIQUID LEVEL CONTROL (ULTRASONIC TRANSMITTER TYPE)

A. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

B. The level control system shall be capable of operating as either an air bubbler type level control system, submersible transducer type system, or ultrasonic transmitter type system.

C. The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.

D. The level control system shall utilize an electronic pressure switch which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating. These levels shall be adjustable as described below.

1. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.

2. The electronic pressure switch shall be capable of operating on a supply voltage of 12VDC in an ambient temperature range of -10°C (14 degrees F) through 55 degrees C (131 degrees F). Control range shall be 0 to 12.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be retained using a non-volatile lithium battery back-up.

3. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators and output relays.
   a. The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the ultrasonic transducer system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range
shall be 0-15 psi, temperature compensated from -40 degrees C (-40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 0.25% full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.

b. The electronic pressure switch shall incorporate a digital backlighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and the pre-set start and stop level for both lead and lag pump. The display shall include twenty (20), 0.19” high alpha-numeric characters calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.

c. Level adjustments shall be electronic comparator set-points to control the levels at which the lead and lag pumps start and stop. Each of the level settings shall be easily adjustable with the use of membrane type switches, and accessible to the pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.

d. Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The "ON" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA Size 4 contactor. A pilot relay shall be incorporated for loads greater than a Size 4 contactor.

4. The electronic pressure switch shall be equipped with an output board which shall include LED status indicators and a connector with cable for connection to the main unit.

5. The electronic pressure switch shall be equipped with pump start delay(s) preset at a fixed delay time of five (5) seconds.

6. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.

7. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.

8. The electronic pressure switch shall be capable of controlling liquid levels in either a pump up or pump down application.

9. The electronic pressure switch shall be equipped with a security access code to prevent accidental set-up changes and provide liquid level set-point lock-out.

10. The electronic pressure switch shall be equipped with one (1) 0-33 ft. W.C. input, one (1) scalable analog input of either 0-5VDC, 0-10VDC, or 4-20mA, and one (1) 4-20mA scalable output. Output is powered by 10VDC supply. Load resistance for 4-20mA output shall be 100-400 ohms.

11. The electronic pressure switch shall include a DC power supply to convert 120VAC control power to 12VDC EPS power. The power supply shall be 500 mA (6W) minimum and be UL listed Class II power limited power supply.

12. The electronic pressure switch shall be contained within a NEMA 4X enclosure including a polycarbonate face and stainless steel case.
13. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.

14. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a low liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a low wet well level exists. The alarm signal shall be maintained until the cause for the low wet well level has been corrected and the circuit has been manually reset. A low liquid level condition shall disable both pump motors. When the wet well rises above the low level point, both pump motors shall be automatically enabled. Low water alarm shall be furnished with a dry contact wired to terminal blocks.

E. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are underway. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil tight design with contacts rated NEMA A300 minimum.

F. Ultrasonic Transmitter System:
   1. The level control system shall utilize an ultrasonic level transmitter housed in a NEMA 4X electrical enclosure with a sensor designed to mount at the top of the wet well. The transmitter shall provide a proportional level signal for distribution to the display and electronic comparators of the electronic pressure switch, and remainder of the level control system. Transmitter full scale operating range shall be 1-31 ft., and shall provide a 4-20mA output signal. The sensor shall have a 12° conical beam angle, and a pressure range of -10 to +50 psig minimum. The transmitter shall be a microprocessor-based unit capable of easy calibration. The ultrasonic transmitter shall be Milltronics Multi-Ranger.

G. Alarm Light:
   1. Station manufacturer will supply one 115 volt AC alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light shall be mounted on the control panel.

H. Alarm Horn:
   1. Station manufacturer will supply one 115 volt AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rain water from collecting in any part of the horn. The alarm horn shall be mounted on the control panel.

I. Redundant High Water Alarm:
   1. A redundant high water alarm float and sensor shall be supplied. When activated, the sensor will output a signal to the alarm light, alarm horn and the remote monitoring system to indicate that a high water condition exists.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacturer shall provide written instruction for proper handling. Immediately after off-loading, Contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer’s representative of any unacceptable conditions noted with shipper.

3.2 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

C. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.3 FIELD QUALITY CONTROL

A. Operational Test:

1. Prior to acceptance by Owner, an operational test of all pumps, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed from the wet well, Contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturers Start-up Services:

1. Coordinate station start-up with manufacturer’s technical representative. The representative or factory service technician will inspect the completed installation. Calibrate and adjust instrumentation, correct or supervise
correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.4 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.5 PROTECTION

A. The pump station should be placed into service immediately. If operation is delayed, station is to be stored and maintained per manufacturer’s written instructions.

END OF SECTION
SECTION 6

STANDARD DETAILS
<table>
<thead>
<tr>
<th>SIZE OF PIPE</th>
<th>TEES &amp; PLUG</th>
<th>90° BEND</th>
<th>45° BEND</th>
<th>22 1/2° BEND</th>
<th>11 1/4° BEND</th>
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TABLE BASED ON 225 P.S.I. OR 150 P.S.I.
WORKING PRESSURE PLUS 50% SURGE ALLOWANCE. THRUST BLOCK DIMENSIONS SHALL BE INCREASED AS NEEDED IF WORKING PRESSURE EXCEEDS 150 P.S.I.

NOTE: CONCRETE USED FOR BLOCKING SHALL BE 3000 P.S.I. - 3500# SQ. IN. EARTH
PRESSURES ARE FIGURED AT 4000# PER SQ. FT. BEARING AREA SHALL BE INCREASED WHEN POURED AGAINST SAND, LOOSE FILL, WET EARTH, CINDRES, ETC.

NOT TO SCALE

TABLE OF DIMENSIONS FOR CONCRETE THRUST BLOCKS
CONCRETE KICKER

90° BEND

22-1/2° BEND

NOTE: LEAVE APPROX. 12" CLEARANCE FROM KICKER TO BELL JOINT WHERE B & S FITTINGS ARE USED

45° BEND & 11-1/4° BEND

TEE

6" MIN.

SECTIONAL VIEW TEES, CROSSINGS, & BENDS

PLUG PIECE OF 6" PIPE TO BE USED ONLY WHEN SPECIFIED ON LAYOUT SHEET

CROSS

NOT TO SCALE

TYPICAL CONCRETE THRUST BLOCKING

Smith Seckman Reid, Inc.

144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

REV. DATE: 12-22-03
NOTE: PROVIDE NO ANCHOR ON GRADES LESS THAN 20% UNLESS NOTED.
PROVIDE ANCHOR AT EACH JOINT ON GRADES BETWEEN 20% AND 34%.
FOR CONDITIONS OTHER THAN SHOWN HEREON PROVIDE ANCHORS AS REQUIRED BY THE CONTRACT OR AS REQUIRED BY THE ENGINEER IN THE FIELD.
NOTE:
ALL JOINTS LOCATED WITHIN CASINGS SHALL BE RESTRAINED JOINTS

SECTION A-A

CASING PIPE DETAIL

Smith Seckman Reid, Inc.
144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax 865.560.9623
www.ssrd-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

NOTE:
AS REQUIRED TO SUPPORT DIP PIPE (2 PER JOINT MIN.)

PLAN VIEW

CARRIER PIPE

CASING PIPE

SKIDS

STAINLESS STEEL BANDS

CONC. OR BRICK BULKHEAD AT EACH END

SKID MATERIAL PER SPECS

STAINLESS STEEL BANDS OR STRAPS

NOT TO SCALE
24"X24" PRECAST CONCRETE PAD IF VALVE IS IN UNPAVED AREA

FINISHED GRADE

DEPTH OF BURIAL SHALL BE MIN. 36"

CAST IRON VALVE BOX BASE - RESTING ON VALVE

NAME OF SERVICE CAST IN TOP

2 PIECE SREW TYPE CAST IRON VALVE BOX SLEEVE WITH COVER FOR ROADWAY OR UNDERGROUND INSTALLATION AS REQUIRED.

WATER MAIN-SEE PLAN FOR SIZE AND LOCATION.

SEE PLANS AND SPECIFICATIONS FOR SIZE AND TYPE OF VALVE.

SUPPORT VALVE WITH BLOCK

NOT TO SCALE

VALVE BOX SETTING

Smith Seckman Reid, Inc.

1-44 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

REV. DATE: 12-22-03

DET. NO. 5
2 1/2" HOSE CONNECTION

HYDRANT TO BE PLUMB WITH STEAMER OUTLET FACING THE STREET. PROVIDE HYDRANT BARREL EXTENSION WHERE REQUIRED TO BRING HYDRANT TO GRADE

24"X24" PRECAST CONCRETE PAD IF VALVE IS IN UNPAVED AREA

2 PIECE SREW TYPE CAST IRON VALVE BOX SLEEVE WITH COVER FOR ROADWAY OR UNDERGROUND INSTALLATION AS REQUIRED.

CONC. THRUST BLOCK

6" ANCHOR COUPLING

LOCKING COUPLING

3000 P.S.I. CONC. THRUST BLOCK. DO NOT BLOCK HYDRANT WEEP HOLES WITH CONCRETE

LOCKING TEE

7 CU. FT. MIN. CLEAN CRUSHED STONE AROUND WEEP HOLES

NOTE: FIRE HYDRANT SHALL NOT BE SET CLOSER THAN 3' FROM THE NEAREST OBSTRUCTION

NOT TO SCALE
DETECTION TAPE & PVC COATED 10 GAUGE TRACER REQUIRED FOR COPPER SERVICE LINE. TRACER SHALL BE STUBBED INTO ADJOINING VALVE BOXES.

SPLIT BOLT CONNECTOR REQ'D.

METAL TOP FB-18

FIN. GRADE

3/4" TYPE "K" SERVICE LINE

CURB STOP @ PROPERTY LINE

GOOSE NECK

CORP. STOP

METER SETTER - MUELLER H-14180

3/4" FEMALE ADAPTER

3/4" BRASS GATE VALVE

WATER MAIN

SERVICE CLAMP (PVC) W/ S.S. BANDS OR DIRECT TAP (DIP)

EXIST. SERVICE TO HOUSE (VERIFY SIZE, MATERIAL & LOCATION)

SPLIT BOLT CONNECTOR

J.R. KEARNEY

NOTE:
CONTRACTOR TO MAKE CONNECTION TO EXIST. SERVICE LINE USING FITTINGS OR ADAPTORS AS REQUIRED.

NOT TO SCALE

WATER SERVICE LINE CONNECTION DETAIL

Smith Seckman Reid, Inc.

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Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

REV. DATE: 8-23-10

SECT. NO. 7
MANHOLE FRAME & COVER VULCAN NO. V-1380 OR EQUAL

PRECAST CONCRETE MANHOLE

24"

Poured Concrete or Precast Blocks

FILL WITH NON-SHRINK GROUT

1" AIR RELEASE VALVE BY APCO, MODEL 200 w/ 1 1/2" ORIFICE, OR EQUAL

1" THREADED GATE VALVE

FILLING SADDLE

1" BRASS COUPLING

WATER MAIN

1" AIR RELIEF VALVE

Fill with Non-Shrink Grout.

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Fax: 865.560.9623
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STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

NOT TO SCALE

REV. DATE: 12-22-03
DISCHARGE

AIR GAP

DECHLORINATION CHAMBER

FROST DEPTH

PROGRAMMABLE POD MOUNTED TO 2" PVC PIPE

TO STORM SEWER, SANITARY SEWER OR RETENTION POND

DRAIN w/FILTER FABRIC

6" PVC PIPE (BY OTHERS)

12" PVC PIPE

MOLDED ENCLOSURE

(19" WIDE x 17" TALL x 31.5" LONG)

CAMLOCK HANDLES

PROGRAMMING INTERFACE PLUG-IN

SELF DRAINING DOUBLE CHECK VALVE ASSEMBLY

2" SOLENOID VALVE WITH-IN WATER-TIGHT HOUSING

CAMLOCK RELEASE SYSTEM

SEAL BASE

2" SUPPLY PIPE (BY OTHERS)

2" WATER METER & PRV INSTALLED PER DETAIL 7

DISTRIBUTION LINE

2" CORP. STOP

SOIL OR 57 STONE

NOTE:
SPECIFIC MODEL NO. AS DIRECTED BY CITY OF PIGEON FORGE BASED ON SITE SPECIFIC CONDITIONS

NOT TO SCALE

2" SELF FLUSHING HYDRANT

Smith Seckman Reid, Inc.
1-14 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF PIGEON FORGE, TENNESSEE

REV. DATE: 8-23-10
CONCRETE GRADE RINGS FOR ADJUSTMENT TO FINAL FINISHED GRADE.

JOIN TS ARE TO BE MADE WATER TIGHT WITH FLEXIBLE BUTYL RESIN WATER STOP AROUND PIPE TO BE A RESILIENT CONNECTOR AS MANUFACTURED BY KOR-N-SEAL OR EQUAL

PRECAST CONCRETE BASE

WATER STOP AROUND PIPE TO BE A RESILIENT CONNECTOR AS MANUFACTURED BY KOR-N-SEAL OR EQUAL

3000 P.S.I. CONCRETE

BENCH HEIGHT = \frac{1}{4} \times \text{PIPE DIA.}

6" CRUSHED STONE BASE

MANHOLE FRAME AND COVER AS SHOWN ON DRAWINGS & OTHER STANDARD DETAILS

FINAL FINISHED GRADE OR PAVING.

BACKFILL AS SPECIFIED.

ALL MANHOLE SECTIONS & BASE AS PER ASTM C-478.

MIN. 4'-0"

NOT TO SCALE
PREFORMED RUBBER GASKET PLACED BEFORE INSTALLATION

PRECAST MANHOLE SECTIONS

NOTE:
MASTIC SHALL PROTRUDE FROM BOTH INSIDE AND OUTSIDE OF EACH JOINT.

GASKET FOR PRECAST MANHOLE SECTIONS

NOT TO SCALE
RESILIENT CONNECTION TO MANHOLE

- MANHOLE STRUCTURE
- RESILIENT CONNECTOR
- EXTERNAL BAND (S.S.)
- FLOW
- 4" MIN.
- CRUSHED STONE BEDDING
- 1:2 GROUT OR BRICK & CEMENT MORTAR.

NOT TO SCALE

RESILIENT CONNECTOR
EXTERNAL BAND (S.S.)
M.H. FRAME

1:2 GROUT
1" MIN. THICKNESS
EXPOSED EDGE OF
PRECAST ADJUSTING RING.

SLAB OR TOP
OF M.H. RISER

NOT TO SCALE

MANHOLE CASTING INSTALLATION

144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

SMITH
SECKMAN
REID, INC.

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

M:1\10470050\CADD\DETAILS\MASTER.DGN
REV. DATE: 12-22-03
DET. NO. 13
WATERTIGHT MANHOLE FRAME AND COVER

ASTM-A48 CLASS 30
VULCAN V-2380 FRAME AND COVER
BEARING SURFACES MACHINED

FRAME  165 LBS.
COVER  195 LBS.
TOTAL  360 LBS.

NOT TO SCALE
FORCE MAIN CONNECTION

SMITH SECKMAN REID, INC.
144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF PIGEON FORGE, TENNESSEE

NOT TO SCALE

FORCE MAIN

OVERFLOW LEVEL

MANHOLE BASE

GRAVITY SEWER

CONCRETE FILL

RESILIENT CONNECTOR TYP.

90° FORCE MAIN ENTRANCE
MJ & PE 90° D.I. BEND

CONCRETE FILL

4" MIN
MOUND OVER TRENCH TO ALLOW FOR SETTLEMENT

SELECT BACKFILL NO ROCKS OVER 6" ALLOWED. FILL TO TOP OF TRENCH WITH CRUSHED STONE UNDER ALL PAVED AREAS

#57 CRUSHED STONE

SEWER LINES, WHEN IN RELATION TO WATER LINES, MUST COMPLY WITH "TENNESSEE STATE STANDARDS"

SPLIT BOLT CONNECTORS REQUIRED AT ALL TRACER WIRE TERMINATION POINTS

DETECTION TAPE & PVC COATED 10 GAUGE TRACER REQUIRED FOR PVC PIPE. TRACER SHALL BE STUBBED INTO ADJOINING VALVE BOXES & METER BOXES.

NOTE: TRACER WIRE TO BE INSTALLED IN ALL SERVICE METERS AND CONNECTED TO MAIN LINE TRACER WIRE W/ SPLIT BOLT CONNECTOR.

#57 CRUSHED STONE TO BASE OF PAVEMENT

SPLIT BOLT CONNECTORS REQUIRED AT ALL TRACER WIRE TERMINATION POINTS

DETECTION TAPE & PVC COATED 10 GAUGE TRACER REQUIRED FOR PVC PIPE. TRACER SHALL BE STUBBED INTO ADJOINING VALVE BOXES.

BITUMINOUS SURFACE

SECTION (IN GRASS AREAS)

SECTION IN PAVED AREAS (SEE PAVEMENT REPLACEMENT DETAIL)

NOT TO SCALE

TYPICAL TRENCH SECTION
BEFORE DIGGING CALL
865-453-3043
CITY OF
PIGEON FORGE

NOTE:
MARKER TO BE CARSONITE
UTILITY MARKER OR APPROVED
EQUAL, POST COLOR WHITE,
DECAL COLOR BLUE WITH
BLACK LETTERING.

3000 P.S.I. CONCRETE

NOT TO SCALE

UTILITY MARKER DETAIL

CITY OF
PIGEON FORGE, TENNESSEE

Smith
Seckman
Reid, Inc.

144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ss-inc.com

STANDARD DETAILS

REV. DATE: 12-22-03

DET. NO.

18
NOTE: RESILIENT CONNECTOR REQUIRED AT BOTH MANHOLE PENETRATIONS

"M" = 8" WHERE "N" = 8" TO 18"
"M" = 12" WHERE "N" = 21" TO 30"

8" MIN.

#57 CRUSHED STONE BACKFILL

3000 P.S.I. CONCRETE

8" MIN.

6" MIN. BEDDING AS REQUIRED

UNDISTURBED EARTH

\[ \text{\% OF SEWER TO BE AT SAME ELEVATION AS SPRING LINE OF MAIN LINE SEWER OR PROVIDE A MINIMUM OF 0.2 FT. INVERT DROP ACROSS MANHOLE.} \]

NOT TO SCALE

DROP PIPE ASSEMBLY FOR STANDARD MANHOLES

STANDARD DETAILS

CITY OF
PIGEON FORGE, TENNESSEE

Smith
Seckman
Reid, Inc.

144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax 865.560.9623
www.ssr-inc.com

STANDARD DETAILS

CITY OF
PIGEON FORGE, TENNESSEE

NOT TO SCALE

DROP PIPE ASSEMBLY FOR STANDARD MANHOLES

NOT TO SCALE
Pavement / Connection to sewer shall be through service tee or approved service saddle.

Plan

Property line

Natural ground

Surveyors Hub flush w/ ground. Reference from 2 points.

Min. Gr. 1/4"/ft.

6" PVC House Sewer Service

Section

Sewer main

Compacted stone

Service line

Mueller "Max-Fit" type connector or equal required at connection to house sewer.

NOT TO SCALE

6" PVC HOUSE SEWER SERVICE

Smith
Seckman
Reid, Inc.

144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax 865.560.9633
www.ssr-inc.com

Standard Details
City of
Pigeon Forge, Tennessee

DET. NO
20
6" P.V.C. CLEANOUT FITTING WITH THREADED CAP

6" P.V.C. SERVICE LINE TO PUBLIC SEWER

TRANSITION SHALL BE MULLER "MAX-FIT" COUPLING W/ S.S. CLAMPS OR EQUAL, (AS NEEDED)

UNDISTURBED EARTH

APPROPRIATE PIPE BEDDING MATERIAL

NOTE:
ALL FITTINGS AND LINES TO BE PVC, SOLVENT WELD (SDR-35).
DEVICE SHOULD BE INSTALLED AFTER FINAL GRADING HAS BEEN PERFORMED.

SEWER SERVICE LINE INSPECTION ASSEMBLY

Smith Seckman Reid, Inc.
144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

SM:10470050/CADD/DETAILS/MASTER.DGN
REV. DATE: 12-22-03

DET. NO. 21
SELECT BACKFILL
NO ROCKS OVER
6" ALLOWED. FILL
TO TOP OF TRENCH
WITH CRUSHED
STONE UNDER ALL
PAVED AREAS

3000 P.S.I. CONCRETE

9" MIN.

9" MIN.
PAVEMENT REPLACEMENT

3" COMPACTED BINDER, TYPE "B", MODIFIED

UTILITY LINE

#57 CRUSHED STONE BACKFILL COMPACTED IN 6" LAYERS

EXISTING GROUND

NOT TO SCALE

Smith Seckman Reid, Inc.
144 Market Place Boulevard
Knoxville, TN 37922
865.560.9622
Fax: 865.560.9623
www.ssr-inc.com

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE

REV. DATE: 12-22-03

DET. NO. 23
APPROVED BACKING

6' MIN.

BOTTOM OF TRENCH

WOOD OR STEEL POST

FILTER CLOTH FABRIC

EXIST. GROUND

6' TO 10' POST SPACING

ELEVATION

APPROVED BACKING BETWEEN POST AND FABRIC

FILTER CLOTH FABRIC

EXIST. GROUND

BACKFILL TRENCH

6' MIN.

DESI RABLE DETAIL OF TRENCH AND FILTER CLOTH

SECTION

NOT TO SCALE

TEMPORARY SIL T FENCE
SET BALES IN TRENCH
4" DEEP MIN. BACKFILL
AND COMPACT EXCAVATED
SOIL.

DRAINAGE FLOW

WOOD
STAKE

BALE

NOT TO SCALE

STRAW BALE BARRIER

STANDARD DETAILS
CITY OF
PIGEON FORGE, TENNESSEE