

Technical Specifications for Water and Sewer Construction

Prepared by:



Water Resources Engineering Division
408 North Adams Street
Tallahassee, Florida 32301

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Section 1 – General Construction Information _____ **1 Page**

 1.1 General 1 of 1

 1.2 Measurement and Payment..... 1 of 1

 1.3 Warranty Repairs..... 1 of 1

 1.4 Environmental Management System (EMS)..... 1 of 1

Section 2 – Environmental Controls _____ **9 Pages**

 2.1 General 1 of 9

 2.2 Erosion and Sedimentation Control Measures..... 2 of 9

 2.3 Tree Protection 3 of 9

 2.4 Dust Control..... 6 of 9

 2.5 Noise Control 6 of 9

 2.6 Cleanup..... 6 of 9

 2.7 Temporary Cover 6 of 9

 2.8 Manufactured Material 7 of 9

 2.9 Monitoring by Contractor..... 7 of 9

 2.10 Work within Jurisdictional Wetlands..... 7 of 9

 2.11 Additional Control Measures..... 9 of 9

Section 3 – Testing and Laboratory Services _____ **2 Pages**

 3.1 Testing Requirements 1 of 2

 3.2 Payment for Testing Services 1 of 2

 3.3 Additional Testing 1 of 2

 3.4 Testing Laboratory 1 of 2

 3.5 Contractor’s Responsibilities 2 of 2

Section 4 – Excavating, Backfilling, and Compacting for Utilities _____ **15 Pages**

 4.1 General 1 of 15

 4.2 Products 4 of 15

 4.3 Execution 9 of 15

Section 5 – Horizontal Directional Drilling _____ **7 Pages**

 5.1 General 1 of 7

 5.2 Products 2 of 7

 5.3 Execution 4 of 7



Section 6 – Jacking and Boring _____ **7 Pages**

6.1 General 1 of 7

6.2 Products 1 of 7

6.3 Execution 4 of 7

Section 7 – Distribution and Transmission System Piping _____ **14 Pages**

7.1 General 1 of 14

7.2 Products 1 of 14

7.3 Execution 7 of 14

Section 8 – Distribution and Transmission System Valves and Appurtenances _____ **15 Pages**

8.1 General 1 of 15

8.2 Products 1 of 15

8.3 Execution 10 of 15

Section 9 – Sanitary Sewer Collection System _____ **21 Pages**

9.1 General 1 of 21

9.2 Products 2 of 21

9.3 Execution 10 of 21

Section 10 – Submersible Pump Stations _____ **11 Pages**

10.1 General 1 of 11

10.2 Products 3 of 11

10.3 Execution 8 of 11

Section 11 – Electrical and Field Wiring _____ **14 Pages**

11.1 General 1 of 14

11.2 Basic Materials and Methods 4 of 14

11.3 Service and Distribution 6 of 14

11.4 Special Systems..... 8 of 14

11.5 Start-Up 12 of 14

Start-Up Checklist (2 Pages) 13 of 14

Section 12 – As-Built Survey _____ **10 Pages**

12.1 General 1 of 10

12.2 Products..... 1 of 10

12.3 Execution 2 of 10



Appendix – Standard Construction Details for Water and Sewer Construction

General Pipeline Installation _____ 4 Pages

 Standard Laying Conditions 1 of 4

 Pipe Trench and Asphalt Patch Within Public R/W and All Improved Areas 2 of 4

 Pipe Trench Within Unimproved Areas..... 3 of 4

 Jack and Bore..... 4 of 4

Thrust Restraints _____ 6 Pages

 Valves 1 of 6

 Dead Ends..... 2 of 6

 Tees 3 of 6

 Horizontal Bends 4 of 6

 Vertical Bends..... 5 of 6

 Reducers..... 6 of 6

Utility Conflicts and Adjustments _____ 6 Pages

 Main Lowering 1 of 6

 Pipe Encasement for Utility Crossing w/ Less Than 12” Vertical Separation 2 of 6

 Reverse Connection 3 of 6

 Water Service Adjustment (Improved Areas) 4 of 6

 Water Service Adjustment (Unimproved Areas) 5 of 6

 Valve Abandonment 6 of 6

Services and Connections _____ 7 Pages

 5/8-inch and 1-inch Water Service and Meter Setting 1 of 7

 1.5-inch and 2-inch Water Service 2 of 7

 Manifolds for 5/8-inch Meters 3 of 7

 Fire Line with Metered Services 4 of 7

 Fire Hydrant Connection 5 of 7

 Manual 2” Flush Stand 6 of 7

 Valve Box Placement 7 of 7

Sanitary Sewer Collection System _____ 11 Pages

 Manhole Frame and Cover Placement..... 1 of 11

 Manhole Frame and Cover Detail 2 of 11

 48-inch Manhole (Standard) 3 of 11



48-inch Manhole (Saddle) 4 of 11

48-inch Manhole (Shallow) 5 of 11

Manhole Bench with Matching Crowns 6 of 11

Manhole Bench with Offset Crowns..... 7 of 11

Sanitary Sewer Lateral 8 of 11

Sanitary Sewer Cleanout 9 of 11

Adjustment of Existing Sewer Lateral 10 of 11

Existing Sewer Lateral Disconnection 11 of 11

Air Valves _____ 2 Pages

Force Main Air Valve and Vault (Within Vehicle Travel Lane) 1 of 2

Force Main Air Valve and Vault (Outside Vehicle Travel Lane)..... 2 of 2

Sanitary Sewer Pump Stations _____ 6 Pages

Site Layout 1 of 6

Pump Station Details with Above Ground Valve Array 2 of 6

Pump Station Details with Valve Vault 3 of 6

Miscellaneous Pump Station Details 4 of 6

Electromagnetic Flow Meter Details 5 of 6

Pump Station Notes 6 of 6

Duplex Pump Station Electric Details _____ 12 Pages

Electrical Site Plan E-01 of 12

Electrical - 230V, 15HP, or Less

 Control Panel Layout E-02 of 12

 Wiring Diagram E-03 of 12

 Interconnect Diagram E-04 of 12

Electrical - 230V, 20-50HP

 Control Panel Layout (Interior Dead Front) E-05 of 12

 Control Panel Layout (Interior Back Panel)..... E-06 of 12

 Wiring Diagram E-07 of 12

 Interconnect Diagram E-08 of 12



TABLE OF CONTENTS

Electrical - 480V, 40-100HP

Control Panel Layout (Interior Dead Front) E-09 of 12

Control Panel Layout (Interior Back Panel) E-10 of 12

Wiring Diagram E-11 of 12

Interconnect Diagram E-12 of 12

END OF TABLE OF CONTENTS

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1.1 General

Refer to the General Provisions of the Contract Documents and General Notes of the approved construction plans.

1.2 Measurement and Payment

Measurement and Payment for all work performed under the Contract will be in accordance with the City of Tallahassee Pay Item Manual for Water and Sewer Construction and the Contract Documents. No payment will be made to the Contractor for additional quantities and/or work performed that is not included in the Bid Form of the Contract without written approval by the City.

1.3 Warranty Repairs

When repairs are required within the two year warranty period, the Contractor must first make all necessary repairs, then patch the damaged asphalt surface in accordance with the jurisdictional agency's requirements, and then mill and resurface the **FULL ROAD WIDTH** with 1-inch thick SP-9.5 asphalt to a minimum distance of 25-feet each direction from the pavement cuts, or as required by the roadway's jurisdictional agency.

1.4 Environmental Management System (EMS)

The Contractor is required to follow all rules and regulations established by EMS (Environmental Management System) documents as well as any other pertinent rules and regulations that relate to the project. The City of Tallahassee Underground Utilities Environmental Policy Statement and a Contractor's informational brochure are available at <http://www.talgov.com/you/you-learn-utilities-water-ems-water.aspx>

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2.1 General

2.1.1 Contractor's Responsibility

It is the Contractor's responsibility to maintain a clean work zone to limit erosion and the release of sediments into stormwater collection systems and the tracking of materials beyond the active work limits.

Environmental controls shown on the plans, and as directed by the City during construction, are minimum requirements. The Contractor is solely responsible for the prevention, control and abatement of erosion, water pollution, and the transport of eroded materials; and any property damage resulting to and from the project as a result of Contractor failing to prevent, control, or abate erosion or water pollution.

All trees are to be protected unless specifically identified on the plans to be removed. Tree barricades will be installed and maintained around all trees to be protected or as directed by the Engineer/COT Environmental Inspector.

The Contractor shall ensure that a foreman or supervisor who has been certified under Florida Stormwater, Erosion and Sedimentation Control Inspector training program is available in person or by phone at all times during the construction activities. The Contractor shall designate that person or persons at the pre-construction meeting and that person or persons must attend the pre-construction meeting.

The Contractor shall employ a certified arborist to mitigate impacts to trees as a result of construction activities and shall coordinate these tree-related issues with the City's Environmental Inspector.

The City may have a separate Certified Arborist on staff for the project. The Contractor is required to notify the City's Certified Arborist prior to and during excavation activities within the CPZ of all trees to ensure proper tree impact mitigation measures are implemented. The City's Arborist will not perform the mitigation.

The Contractor shall make every reasonable effort to schedule and conduct the project construction in a manner that will minimize any adverse effects on the adjacent property, or on public or private use of the adjacent property, and on the environment, including fish, wildlife, water quality, air quality, and natural resources of the area. Any such adverse effects that occur are the responsibility and liability of the Contractor.

Safety of the traveling public, as related to the adequacy of the driving surface as a result of standing stormwater runoff, erosion, or sediment accumulation created by the introduction of inlet protection or other control measures, is the responsibility of the Contractor.

2.1.2 Contractor's Liability

The Contractor shall be liable for any and all penalties, fines, damages, and restitution payments against the project by City, State, local environmental agencies, and the courts which result from failure to control erosion, water pollution, and stormwater runoff across or from the project site and shall indemnify and defend the City from and against all such claims. The Contractor shall be liable for citizen's claims of environmental damage and the City shall be held harmless from such claims.

2.1.3 Prevention-Primary Control

The primary means of erosion control employed by the Contractor shall be prevention. Prevention methods that are to be employed include:

- a. Prepare and follow a construction phasing schedule that limits disturbed surfaces to the minimum necessary for proper execution of the immediate construction activities.
- b. Limit the amount of clearing and grading to only the areas necessary.
- c. Limit the number of construction accesses and locations for non-essential activities which result in ancillary disturbances, i.e., parking, material storage, etc.
- d. Temporarily divert runoff from the area to be worked and return it after completion.

2.2 Erosion and Sedimentation Control Measures

Erosion and sedimentation controls are required to avoid the release of sediments beyond the work limits. Trench spoils and stockpiled backfill materials must be placed to avoid deposition within the roadside ditches or other stormwater conveyance systems. All materials shall be bounded by silt fencing or staked hay bales as needed. The removal of deposited materials within ditches and conveyance systems is the responsibility of the Contractor. The removal of such material shall be coordinated with the City's Environmental Inspector by the Contractor.

More stringent erosion and sediment control measures may be required, during any phase of development, at the discretion of the City of Tallahassee's/County's Environmental Inspector, or other jurisdictional agency. Erosion and sediment control measures depicted in the plans are typically limited to inlet protection and silt fences. If erosion cannot be prevented, then it must be controlled at or near the source using methods that include:

- a. Temporary mulch, hydro-mulch with quick growing grass, sod or other stabilization when unprotected soils will be exposed without working them for several days (particularly during inclement or threatening weather.)
- b. Temporary gravel construction entrances.

- c. Installation of a series of straw bale and/or silt fence barriers from near the top of the grade to the bottom, instead of only at the bottom.
- d. Storm drain inlet protection, limited to inlets within the active construction limits and a minimum of two inlets downstream of the active construction limits.
- e. Installation of permanent grass, sod or other stabilization as soon as possible.
- f. Surface roughening.

The Contractor is referred to FDEP's The Florida Development Manual: A Guide to Sound Land and Water Management, Erosion Control and Water Quality Section; Leon County's Environmental Management Act; and Erosion and Sediment Control Handbook by Goldman, Bursztynksy, and Jackson for guidance in erosion prevention control.

Any disturbed areas that will be left exposed more than 30 days, and not subject to construction traffic, will immediately receive a temporary seeding. If the season prevents the establishment of a temporary cover, the disturbed areas will be mulched with straw or equivalent material, at a rate of two (2) tons per acre, according to State standards.

2.3 Tree Protection

No trenching or excavation shall be allowed within the CPZ of protected trees, except where debits have been noted on plans or mitigation has been approved and performed.

The Contractor is responsible for the protection of all trees and landscaping within the project limits, as well as trees on adjacent properties that may be damaged by construction, and will be solely liable for damage to vegetation on properties adjacent to construction work zones. Any tree-related penalties, imposed by the City or property owner for the trees that are shown to be protected or outside the project limits, shall be paid by the Contractor. **The Contractor is required to have a Certified Arborist on staff for the project during excavation activities within the Critical Protection Zone (CPZ) of all trees to ensure proper tree impact mitigation techniques are implemented.** The cost for the Contractor's Arborist and for all arboricultural measures required shall be included under the lump sum price for Tree Protection. Tree mitigation techniques shall be in compliance with the requirements contained in the COT Land Development Code, Chapter 5 Environmental Management, Article IV, Sec. 5-83, Tree protection and removal standards or Environmental Management Act, Chapter 10, Section 10-4.363, Land Development Code of the Leon County Code of Laws. Specifically, the following minimum tree impact mitigation practices are required:

- a. If root structure is present during trenching and excavation, root pruning shall be required. The Contractor's Certified Arborist shall be required to be on site for proper root pruning. All root removal shall be limited to the least extent possible or as directed on site by the City/County Environmental Inspector/Certified Arborist.

- b. All root pruning shall be done immediately upon exposure of tree roots $\frac{3}{4}$ " in diameter and larger during trenching and excavation, cleanly cut with a handsaw, and covered immediately with soil or kept moistened with wet burlap or peat moss until the trench can be filled. When it is not possible to backfill the same day, the roots shall be recut with a handsaw a reasonable distance from the original cut and backfilled immediately to avoid soil or root dehydration. All encountered roots shall be treated as appropriate (as determined by the Contractor's arborist).
- c. Where excavation machinery is required to operate within the Critical Protection Zone (CPZ) of existing trees or any appendage of the machinery comes in contact with the tree during excavation, a tree barricade shall be incorporated. The type of barricade to be constructed, when construction development occurs in close proximity to a tree, is a girdling structure of vertical boards to be placed around the trunk, so as to protect the tree bark. All tree and girdling protection barricades are to be installed prior to initiation of any construction activity and are to remain in place until all construction activities are completed.
- d. Under no circumstances shall any vehicle, construction material or fill material be stored within the Critical Protection Zone of existing trees.
- e. If overhead tree limbs are intruding into the proposed work area and may be injured by machinery or trucking maneuvers, the Contractor's Certified Arborist shall be required to be on site for proper removal of said tree limbs.
- f. These procedures may be required, all or in part, by the City/County Environmental Inspector/Certified Arborist or variations thereof and are not limited to those listed herein.
- g. The Contractor shall not enter onto private property to accomplish tree protection without specific instruction by the City/County to do so.
- h. These measures will be considered as arboricultural mitigation, allowing construction to proceed without accruing debits.

The tree protection shall be enforced in all areas deemed necessary by the City and shall conform to the following treatments:

2.3.1 Treatment A

A continuous band of 2 x 4 wood, $\frac{3}{4}$ -inch or thicker plywood, or other suitable material approved by the Engineer attached to tree trunks by wire, metal banding, or other means sufficient to secure the band against accidental removal by any construction equipment. The band should extend from the ground level to a height of 4 feet. Scrap or low grade material may be used. This treatment is intended to be used whenever there is danger of construction equipment coming close enough to trees to possibly contact and damage their trunks.

2.3.2 Treatment B

Wood chips or wood debris from branch chippers shall be spread from the base of the tree out to the edge of the drip zone and to a depth of 3 inches. Such cover shall be maintained during the course of construction.

2.3.3 Treatment C

All roots shall be clean cut to the depth of construction impact and at a point immediately outside of the lateral limits of construction. Roots may be cut using a trenching machine or saw (not a backhoe or similar equipment) which will sever the roots without tearing, ripping or pulling. The resultant trench shall be backfilled immediately and a high quality slow release fertilizer broadcast over the fill at a rate of 2 pounds of nitrogen per 1,000 square feet. A fertilizer having at least 50% slow release N and a ratio as close to 4-1-2 as possible shall be used. Locally available products such as Graco Turf and Nursery Special 13-6-6, Lesco 50% SCU 24-5-11, Lesco SC Nursery fertilizer, or Osmocote 18-6-12 are acceptable.

2.3.4 Treatment D

A barricade shall be constructed to protect the entire drip zone of trees. The barricade shall be constructed so as to prevent the movement of equipment or vehicles of any kind (including concrete shoot washing), removal of existing ground cover, or any activity which could result in soil disturbance, soil compaction, or physical scarring of tree roots or trunks.

2.3.5 Treatment E

Wood chips or chipper debris shall be mounded around the bottom of tree trunks so as to cover any exposed roots. Wood chips shall be spread to a depth of 8 inches and cover shall be maintained during the course of construction.

Trimming of branches or roots shall be limited to minimum clearance necessary and done by making clean, unbroken cuts.

Top soils shall be stripped from all areas to be excavated or filled. Top soils shall be stockpiled on the site at locations approved by the Engineer and spread over the excavated or filled areas after completion of earthwork.

The Contractor shall comply with all local and State environmental laws.

2.4 Dust Control

If, in the opinion of the City or the Engineer it is necessary to control dust during construction period, the Contractor shall furnish and apply water until the surface is wet. Temporary vegetative cover shall be established or mulch shall be applied in accordance with State standards for erosion control.

2.5 Noise Control

Noise in excess of the "Permissible Noise Exposures" as defined by OSHA shall not be allowed in any area that may be occupied by the public. The City shall have the right to mitigate situations in which noise creates a nuisance to the public. This could include but not be limited to requiring mufflers on internal combustion engines and setting certain hours for activities such as concrete demolition and pile driving. There shall be no additional compensation for the mitigation of these nuisances.

2.6 Cleanup

The Contractor is required to mechanically sweep the active construction limits a minimum of once weekly. All soil washed, dropped, spilled, or tracked outside the limit of disturbance or onto public rights-of-way will be removed immediately. Soil or construction debris that is deposited on paved areas subject to traffic shall be removed at the beginning and end of each workday, and prior to and following rainfall events. More frequent schedules may be necessary to prevent runoff pollution and provide traffic safety. The Contractor shall determine the schedule for cleaning paved areas closed to all traffic (including local traffic); however, cleaning shall be scheduled or erosion control devices provided to prevent water pollution.

If the Contractor fails to adequately remove soil or debris on paved areas as noted above, the City may cause such removal to be accomplished. The cost incurred to cover direct and indirect costs shall be deducted from the Contractor's next approved payment request.

2.7 Temporary Cover

When disturbed, unprotected soils, outside the roadway limits (areas of subgrade stabilization), will be exposed without working them for 10 days or more, the Contractor shall provide temporary erosion control cover (e.g. mulching & hydro-mulching) within 2 days of the last grading work on the area, and in accordance with the "Excavating, Backfilling, and Compacting for Utilities" specification.

2.8 Manufactured Material

Installations of commercially manufactured erosion control material shall be designed, constructed, and maintained in accordance with the manufacturer's recommendations, the erosion control references cited herein, these Specifications, the Plans, and industry standards.

2.9 Monitoring by Contractor (or Representative)

The Contractor shall ensure that a Representative (i.e. foreman or supervisor) who has been certified under Florida Stormwater, Erosion and Sedimentation Control Inspector training program is available in person or by phone at all times during the construction activities. The Contractor shall designate that person or persons at the pre-construction meeting and that person or persons must attend the pre-construction meeting.

The Contractor shall monitor the effectiveness of inlet protection and provide additional protection if warranted. No sediments are intended to enter the curb inlets. The Contractor shall conduct and maintain the work in such condition to provide adequate drainage at all times and shall monitor the performance of the storm water inlets while impeded by the inlet protection. Street flooding is not to be introduced as a result of the inlet protection.

The Contractor (or Representative) shall inspect all erosion and sedimentation controls at least once a week, regardless of rainfall; during all rainfall events; and immediately following any significant storm event (0.50 inches rainfall, or greater) to ensure that all erosion control measures are in place and functioning properly.

A crew shall be available within 2 hours, when necessary, to repair, replace, or construct erosion control facilities and to repair or cleanup erosion damages. Adequate equipment and materials for this work shall also be readily available. The Contractor shall be capable of being reached by telephone 24 hours each day, 7 days a week. While in route and on the job, he shall be capable of being reached by mobile telephone. The telephone number shall be furnished to the City.

2.10 Work within Jurisdictional Wetlands

No work shall take place within jurisdictional wetlands unless it has been permitted. When work is required within jurisdictional wetlands, the Contractor is required to comply with all permit conditions. Typical activities required for the construction, maintenance, and repair of utility lines and associated facilities in waters of the United States are as follows:

Utility Lines: The construction, maintenance, or repair of utility lines, including outfall and intake structures and the associated excavation, backfill, or bedding for the utility lines, in all waters of the United States, provided there is no change in preconstruction contours. A "utility line" is defined as any pipe or pipeline for the transportation of any

gaseous, liquid, liquefiable, or slurry substance, for any purpose, an any cable, line, or wire for the transmission for any purpose of electrical energy, telephone, and telegraph messages, and radio and television communication.

Material resulting from trench excavation may be temporarily side cast (up to three months) into waters of the United States, provided the material is not placed in such a manner that it is dispersed by currents or other forces. The District Engineer may extend the period of temporary side casting not to exceed a total of 180 days, where appropriate.

Within the wetland limits identified on the plans, backfill trenches with excavated material only. No select fill shall be used within the wetland limits. All excavated materials that are not used as backfill shall be removed from the project and disposed of in a legal manner by the Contractor. Spoil material shall not be wasted on site.

For a trench with a top width greater than three feet in herbaceous wetlands, the upper layer (6"-12") of the soil horizon shall initially be scraped and segregated into a spoil bank resulting from the excavation of the trench for the utility line. The upper layer of the soil horizon shall be replaced as the last step of restored grades to facilitate natural re-vegetation.

Furthermore, the trench cannot be constructed in such a manner as to drain waters of the United States (e.g., backfilling with extensive gravel layers, creating a french drain effect). For example, utility line trenches can be backfilled with clay blocks to ensure that the trench does not drain the waters of the United States through which the utility line is installed. Any exposed slopes and stream banks must be stabilized immediately upon completion of the utility line crossing of each water body.

Whenever possible, excavated material shall be placed on an upland site. However, when this is not feasible, temporary stockpiling may be authorized provided that:

- a. All excavated material stockpiled in a vegetated wetland is placed on filter cloth, mats, or some other semi-permeable surface. The material will be stabilized with straw bales, filter cloth, etc. to prevent reentry into the waterway.
- b. **All excavated material must be placed back into the trench to the original contour and all excess excavated material must be completely removed from the wetlands within 30 days after the pipeline has been laid through the wetlands area.** Permission must be granted by the District Engineer or his authorized representatives if the material is to be stockpiled longer than 30 days.

Soil Erosion and Sediment Controls: Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within water of the United States during periods of low-flow or no-flow.

Equipment: Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

2.11 Additional Control Measures

Additional control measures, above and beyond those minimum requirements shown on the plans and included herein, may be required during any phase of development and construction, at the discretion of the City or County Environmental Inspector.

The City may direct the Contractor to provide additional control measures, or repair existing control measures, when deemed necessary. If the Contractor fails to install or repair such measures as directed by the City within 12 hours, the City may cause such work to be performed. The cost incurred to cover direct and indirect costs shall be deducted from the Contractor's next approved payment request.

The Contractor shall be responsible for all fines imposed by regulatory agencies with jurisdiction.

END OF SECTION 2

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3.1 Testing Requirements

Perform all testing services of materials, equipment, and workmanship required by the Contract Documents. All materials and equipment used in the performance of work under are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents.

The City may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the City shall be allowed on account of such testing and certification.

3.2 Payment for Testing Services

For capital improvement projects, the City will pay for the initial testing services required by the Contract Documents. If the tests, or any subsequent retests, indicate the materials, equipment, and workmanship fail to meet the requirements of the Contract Documents, the total costs of the retests shall be deducted from any payments due the Contractor.

For development projects, the developer (or the developer's contractor) shall pay for all testing services.

3.3 Additional Testing

In addition to the minimum testing requirements established in the Contract Documents, the City may at any time, and at their expense, elect to have construction materials, equipment, and workmanship tested for conformity with the Contract Documents.

The Contractor may, at their own expense, employ and pay for the services of the same, or a separate and equally qualified independent testing laboratory, to perform additional inspections, sampling and testing for the Contractor's convenience.

3.4 Testing Laboratory

All testing services shall be provided by an independent testing laboratory. Perform all testing in accordance with industry standards and provide testing results signed and sealed by a Florida Licensed Professional Engineer.

Employees of the laboratory shall in no way relieve the Contractor of their obligations to perform the work of the Contract. The Laboratory does **NOT** have the authority to:

- a. Release, revoke, alter or enlarge on requirements of Contract Documents.
- b. Approve or accept any portion of the work.
- c. Perform any duties of the Contractor.

3.5 Contractor's Responsibilities

Provide safe access to all work areas and manufacturer's operations that require testing services and cooperate with laboratory personnel to facilitate the execution of the required testing services. Notify laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Upon such notice, if tests or inspections cannot be performed in a timely manner due to the Contractor's negligence, the Contractor shall reimburse City for laboratory personnel and travel expenses incurred.

Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other material mixes, which require control by the testing laboratory. Provide for the storage and curing of test samples, when required.

END OF SECTION 3

4.1 General

4.1.1 Scope of Work

Work under this section includes clearing and grubbing, excavation, backfill, compaction, pavement removal and replacement, site restoration and cleanup for construction of underground pipelines, pumping stations, wells, and tanks, and their related structures. Pipe materials and pipeline construction are covered in other appropriate sections of these Specifications.

4.1.2 Site Conditions

For the purpose of this section, the following definitions apply:

Improved Areas – Improved areas shall include all streets, medians, sidewalks, trails, driveways, and parking lots; as well as all areas within 4-feet of any improved area or above-ground structure; or within a 2(H):1(V) (or greater) slope within 10-feet of any improved area or above-ground structure. For the purpose of this definition and specification section, all public rights-of-way shall be considered improved area.

Unimproved Areas – Unimproved areas shall include easements, vacated right-of-way, green spaces, or other general areas not considered an improved area as defined above.

Above-Ground Structure – Above ground structures shall include all buildings, walls, fences, signs, signal poles, utility poles and cabinets, or other above-ground features requiring a solid and stable foundation.

The Contractor shall examine the site and review the available test borings and/or undertake his own soil borings prior to submitting his bid, taking into consideration all conditions that may affect his work. The City and Engineer will not assume responsibility for variations of subsoil quality or conditions at locations other than places shown at the time the investigation was made.

The Contractor is reminded that he is solely responsible for the locating and protecting all utilities and that the information shown on the Drawings concerning size, type, and location of underground and other utilities is based on information provided by the utility owners, available records, and field survey information. The information may not reflect actual conditions, include all utilities in the area, either in service or abandoned, or show the utilities in the correct horizontal or vertical locations. The Contractor shall make their own determination as to size, type, and location of existing utilities as necessary to avoid damage from proposed work activities.

The Contractor shall notify *Sunshine State One-Call of Florida* at least five days in advance of any construction activities.

All existing underground utilities and facilities (shown on the Plans), or where their locations are made known to the Contractor prior to excavation, shall be protected from damage; and if damaged, shall be repaired to equal prior serviceability or replaced in kind at the Contractor's expense. Repairs or replacement shall be made at the earliest practicable time and in no case shall the Contractor leave the job at the end of the day without making all such repairs or satisfactory arrangements for subsequent repair.

If in the opinion of the City, the repair is not made in a reasonable period of time or satisfactory fashion the City shall make arrangements for such repair at the Contractor's expense.

4.1.3 Submittals

Contractor shall obtain approval of the Engineer for fill materials prior to the date of anticipated use of such material

4.1.4 Safety Precautions

The Contractor shall provide and maintain adequate barricades, construction signs, flashers and guards as required in pedestrian and vehicular traffic areas. All safety rules and regulations of local, County, State and Federal authorities shall be observed. Proper storage of construction materials and plans, as well as guard-watchmen service, if necessary, shall be provided.

Where trenches will be in paved streets, temporary patching of asphalt will be required and will be provided for the entire time between compaction, pavement removal and final repaving. "Street Closed to Through Traffic" signs and "Detour" routes shall be indicated and maintained by the Contractor when job is located in a public street or way. Signing shall be provided in accordance with OSHA regulations and the State of Florida Manual of Traffic Control. Base material shall be on location prior to roadway cuts. Street closures and detour schedules are to be submitted to the appropriate governing agency for review and approval.

The Contractor shall furnish temporary or permanent support, adequate protection and maintenance of all underground facilities and utilities encountered. Support, protection, maintenance and restoration are the Contractor's responsibility as part of construction process.

OSHA Construction Standards for excavation require that at least one member of the crew on site be in possession of a state competency card. Any pipe installed without compliance shall not be inspected, and hence ineligible for refunding.

4.1.5 Shoring, Sheeting and Bracing

Where sheet pilings, shoring, sheeting, bracing or other supports are called for on the Plans or where they otherwise are necessary to protect adjacent property or the work or are necessary for safety of workmen or the public, they shall be designed, furnished, placed, maintained and removed by the Contractor.

Design, planning, installation and removal of all sheeting, shoring, sheet piling and bracing shall be accomplished in a manner so as to maintain required trench or excavated section with an undisturbed state of soils at and below excavation bottom (must adhere to OSHA and Florida Trench Safety Act requirements).

Use of horizontal struts below barrel of pipe or use of pipe as support for trench bracing is not permitted. Use of soldier pile and horizontal lagging method of support of a traveling shield shall require the review of engineer prior to their use.

Sheet piling and timbers used in trench excavations shall be withdrawn in such a manner so as to prevent subsequent settlement or misalignment of pipe or additional backfill loadings, which might overload pipe. Where, in the opinion of the Engineer, removal of sheeting and shoring will or may cause damage to the work or to adjacent buildings utilities or property, the Engineer may direct Contractor to leave all or a portion of sheeting and shoring in place. Payment for sheeting and shoring left in place will be incidental to the contract unless identified in the bid schedule.

Movable trench boxes may be used and must comply with OSHA and Florida Trench Safety standards for the depth used.

The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

4.1.6 Control of Water

Furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during construction. Dewater and dispose of water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public. The Contractor shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies and shall have available at all times competent workmen for operation of pumping equipment. Dewatering systems shall not be shut down

between shifts, on holidays or weekends, or during work stoppages without written approval from the Engineer.

Control of ground water shall be such that softening of the bottom of excavations or visible water shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of natural soils.

Static water level shall be drawn below bottom of excavation so as to maintain undisturbed state or natural soils and allow placement of backfill to required density. Dewatering system shall be installed and operated so that ground water level outside excavation is not reduced to extent that would damage or endanger adjacent structures or property.

Release of ground water to its static level shall be performed in a manner so as to maintain undisturbed state of natural foundation soils, prevent disturbance of compacted fill or backfill and prevent flotation or movement of all structures and pipelines.

4.1.7 Environmental Controls

During construction operations, the Contractor shall install and maintain temporary environmental controls to prevent, control, and abate erosion, water pollution, dust, noise, or other nuisances in accordance with the "Environmental Controls" section.

4.2 Products

4.2.1 Select Backfill

Select backfill material shall be required for all trenches within public rights-of-way and all improved areas (as defined herein) where the City will own and maintain the buried utility.

Select backfill material shall be a select granular material free from organic matter and of such size and gradation that desired compaction can be readily attained. The intent is to provide non-plastic soils meeting the requirements for AASHTO A-1-a, A-1-b, A-3 and some A-2-4. When tested in accordance with the latest ASTM D422, it shall conform to the following requirements:

- a. Maximum size not to exceed 3 inches.
- b. At least 95 percent, by dry weight, shall pass a 1½-inch sieve and not more than 25 percent shall pass a No. 200 sieve.

When tested in accordance with the latest ASTM D4318, it shall conform to the following requirements:

- a. Liquid Limit shall be less than 30.
- b. Plasticity Index shall be less than 10.

Material may be clean natural sand or gravel, imported quarry waste, select excavation, or a mixture thereof. Soil reports shall be submitted 10 days in advance of intended use for approval by the City.

4.2.2 Suitable Backfill

Suitable backfill material shall only be allowed for use in trenches in unimproved areas (as defined herein) or in improved areas where the buried utility will **NOT** be owned and maintained by the City.

Suitable material shall be material obtained from the Contractor’s excavations. Such backfill material shall be free of debris, deleterious materials, organic material, and expansive soils and shall contain no material larger than 4-inches. Under no conditions are destroyed pavement materials, curbs, broken concrete, etc., to be included in the backfill.

4.2.3 Gravel Base for Structures

Gravel base shall be clean, washed, well-graded rounded gravel or crushed rock of 1½-inch maximum size and ½-inch minimum size. No gravel base material shall be used unless the Engineer has reviewed it.

4.2.4 Bedding for Pipe and Manholes

Bedding material shall be ¾-inch nominal size coarse aggregate. When tested in accordance with the latest ASTM D422, it shall conform to the following gradation requirements:

Table 4.1 – Bedding Material Gradation Requirements	
Gradation	% Passing
Passing 1-inch sieve	100%
Passing ¾-inch sieve	90 - 100%
Passing ⅝-inch sieve	20 - 55%
Passing No. 4 Sieve	0 - 10%

Bedding material shall be used if, in the opinion of the City, the condition of the trench bottom is such that proper support of the pipe or manhole being installed cannot be achieved. Material shall be free from soft, laminated, and thin pieces. Limestone from the Brooksville formation may be permitted at the Contractor’s option if material furnished substantially meets requirements set forth.

Bedding material for all PVC pipe shall be free from any rock, stone, gravel, or crushed concrete larger than ¾-inch for a distance of 12 inches from the pipe. Materials shall be subject to approval by the City.

4.2.5 Clearing and Grubbing

Except for those areas which are designated to remain undisturbed or protected, remove vegetation such as trees, shrubs, grass, and roots which interferes with construction. If it becomes necessary to remove any vegetation that has been designated to remain undisturbed or protected to accomplish the work, the additional restoration requirements shall be determined by the City. Restore all areas within the limits of construction that are disturbed during construction with sod, unless indicated otherwise.

4.2.6 Pavement and Sidewalk Removal and Replacement

Pavement that is to be removed for open-cut trenching shall be cut vertically with a power-driven friction saw prior to removal. The surface shall be scored to sufficient depth to provide uniform, straight break lines. All removal of pavement shall conform to local, County, State or Federal requirements where applicable. Under no condition shall pavement be cut with a trenching machine, power shovel or backhoe. Width of cut of pavement or sidewalk shall be 2-feet wider than top of trench, one foot on each side of trench. In the event that trench excavation becomes wider than initial cut, pavement or sidewalk shall be re-cut to at least one foot back from all edges of actual excavation by the Contractor at his own expense.

Pavement, driveway or sidewalk material shall be separated from other excavated materials and shall not be placed in backfill, but shall be satisfactorily disposed of by the Contractor. Base materials shall be subject to the review of the Engineer.

Where trenches will be in paved streets, temporary patching of asphalt will be required for the entire time between pavement removal and final repaving. **Temporary asphalt patches shall be installed within 36-hours of pavement removal**, unless otherwise indicated by the City or roadway jurisdictional agency.

"Street Closed to Through Traffic" signs and "Detour" routes shall be indicated and maintained by the Contractor when job is located in a public street or way. Signing shall be provided in accordance with OSHA regulations, State of Florida Manual of Traffic Control, and approved Maintenance of Traffic plan.

Replace all pavement in accordance with the minimum standards established by the City of Tallahassee Public Works Department Flexible Pavement Design, current edition, or as required by the jurisdictional agency. Replace all side walk with base and surface materials conforming as closely as possible in thickness and quality to materials removed.

All street markings and other traffic control devices shall be restored to former conditions. Use safety Coatings Co. Roadrunner Traffic marking paint and Ferro Co. glass spheres or approved

equal. Pavement with traffic control devices and sidewalks shall be replaced as soon as practicable after compaction of backfill.

Workmanship and materials shall be in accordance with best standard practice for work of this type, and shall conform to the requirements of the latest issue of the FDOT Road and Bridge Manual.

Pipe crossings and installations along all State highways shall be made in accordance with details shown on the Plans and in full compliance with State Department of Transportation requirements. All materials and workmanship shall conform to Florida DOT specifications.

All necessary barricades, detours, lights and other protective measures shall be provided for protection of both pedestrians and vehicular traffic and shall conform to Florida DOT specifications. Final cleanup along State rights-of-way and inspection of repaired sections of State pavement shall be subject to the approval of the local maintenance engineer for the Florida DOT.

4.2.7 Curb and Gutter Removal and Replacement

Curb or curb and gutter removal, where required in construction of this work, shall be held to a minimum. Curb and gutter material to be removed shall be carefully separated from trench excavation material and shall be satisfactorily disposed of by the Contractor.

The Contractor shall replace all curb or curb and gutter, which has been removed. Curb or curb and gutter shall be replaced as soon as possible after backfill is placed and compacted and shall be a duplicate in all respects to original construction. Workmanship shall be in accordance with the controlling agency (City, County, and State).

4.2.8 Restoration of Roadway Crossings and Driveway Crossings

Clay, marl, shell or similar roadways and driveways that are crossed or traversed by trenches shall be restored to existing conditions prior to completion of excavation. The Contractor may reclaim existing material, if salvable, or they may furnish and install new material. There will be no additional compensation for this type of restoration unless specifically called for in the Special Provisions or on the Bid Proposal.

Pavement on paved roadway crossings is to be cut and removed or milled back according to the Standard Construction Details in the Appendix and as specified in this Technical Specification.

All street markings, signal loops, and signage are to be in place 7 days after final paving is complete.

4.2.9 Excavation

Perform all excavation of every description and of whatever substance encountered to alignment and depth that will result in construction of pipeline to the alignment and grade or depth of cover shown on the Plans.

All excavated material retained for backfill shall be piled in a manner so as not to endanger the work or obstruct sidewalks, driveways or drainage. Fire hydrants, valve vault and manhole covers and valve boxes, curb stop boxes, fire and police call boxes and other utility controls shall be unobstructed and accessible at all times during construction.

4.2.9.1 Common Excavation

Machine excavation shall be carried to a depth above final pipeline grade that will allow final grading as indicated on the Plans. Care shall be taken to not excavate below required depth. If excavation is carried below required depth, over cut depth shall be backfilled with select material furnished at Contractor's expense and compacted to provide pipe support at least equal to that of original material.

Contractor may, at his option, choose to over-cut trench and backfill. If Contractor so chooses, depth of over cut shall be such that a minimum of 6-inches of compacted backfill or bedding material will result under lowest projection of pipe bell. No additional payment will be made for this over-cut or for furnishing and placing of the required backfill material.

The Contractor shall exercise sound construction practices in excavating and maintaining the trench so no damage will occur to any foundation structure, pole line, pipeline or other facility because of sloughing of slopes or from any other cause. If, as a result of excavation, there is a disturbance of ground that endangers other property, the Contractor shall immediately take remedial action at his own expense. No act of the City or his representatives shall in any way affect liability of the Contractor for damages, expenses or costs that may result from trench excavation.

Trees, stumps and roots within limits of trench excavation shall be removed to a depth of at least 12-inches below bottom of trench. Stump and root holes shall be refilled to existing grade and compacted. No stumps, roots or organic matter of any description shall remain under concrete slabs or footings.

4.2.9.2 Trench Requirements

Trenches for gravity sewers shall be of such depth that the invert of pipe will be at elevations shown on the Plans, or as may be determined by the Engineer. Trench sides

from bottom to 24-inches above top of pipe shall be as vertical as soil conditions will permit and shall have a width in accordance with the Standard Construction Details.

The trench shall be dry when the bottom is prepared. A continuous trough shall be excavated by hand to receive the bottom 120-degrees of the pipe barrel. In addition, bell holes shall be excavated so that only the barrel of the pipe receives bearing pressure from, and is uniformly supported by the bottom of trench. Preparation of trench bottom and placement of pipe shall be such that final position of pipe is true to line and grade and uniformly supported throughout barrel of each pipe length. When pipe is placed in select backfill over rock or other over depth, additional backfill of same material shall be tamped on each side of barrel to height of spring line, thus forming a trough of firm, compacted bedding.

The minimum pipe laying condition for all pipe construction shall be Type 2 as shown on Standard Construction Details. Where the trench bottom will not assure proper line, grade or pipe support, and where materials exposed at the trench bottom may damage the pipe or impair its long-term operation, the Contractor will use a coarse aggregate bedding, as defined above.

4.3 Execution

4.3.1 Unsuitable Material

Unsuitable materials are soils exposed at the trench bottom or obtained from the Contractor's excavations that are compressible, expansive, contain extraneous rubble, offer uneven foundation support, or have natural moisture content three percent (or greater) in excess of its optimum moisture content. Unsuitable materials/soils will include, but not be limited to mulch, peat, expansive clays, boulders, soils in a quick condition, rubble, any portion of trees or similar vegetation, wood, or unyielding material such as rock.

The Contractor shall notify the Engineer immediately when unsuitable material is encountered. The Engineer will investigate questionable material to determine its suitability. Should the Engineer require soils testing be performed to aid in his determination, then tests revealing suitable materials shall be paid for by the Contractor.

Where the Engineer determines that unsuitable material is present below the pipe envelope which will not provide adequate support the contractor shall remove the unsuitable material as directed by the Engineer and replace the unsuitable material with 6 inches minimum of select backfill up to the bottom of the pipe envelope.

4.3.2 Placing Backfill

Contractor shall not perform any backfilling operation other than that necessary to hold pipe in place until the locations of connections and appurtenances have been recorded on the "as-built" drawings and the line has been inspected and released for backfilling.

4.3.2.1 Haunching

After pipe has been properly laid and inspected, suitable backfill shall be carefully placed and compacted around the pipe up to spring line of pipe. Backfill material shall be carefully placed in loose horizontal layers not exceeding 6-inches in loose depth, and equally on both sides of pipe, and shall be spaded, "walked in" and compacted to obtain a minimum density of 90% of maximum density as determined by ASTM D698 (Standard Proctor Density), except for depths 10-feet or less, where the minimum density allowed shall be 95% of maximum density. When one layer is completed on both sides of the pipe, a second layer shall be started. Backfill materials shall not be obtained from trench walls.

4.3.2.2 Pipe Envelope

After haunching has been properly compacted and inspected, select backfill shall be carefully placed around pipe and over pipe to the depth, as shown in the Standard Construction Details, in order to comply with the pipe envelope requirements. Backfill material shall be carefully placed in horizontal layers not exceeding 12-inches in loose depth and compacted to obtain a minimum density of 90% of maximum density as determined by ASTM D698 (Standard Proctor Density), except for depths 10-feet or less, where the minimum density allowed shall be 95% of maximum density. Backfill material shall not be obtained from trench walls.

4.3.2.3 Subsequent Backfill

Above the level of initial backfill, the trench shall be filled with material placed in accordance with one of the following three classifications: FDOT, Leon County, and all other situations. In improved areas, or areas proposed to be improved, the utility trench shall be backfilled with **select backfill only**; and the surface of the trench shall be prepared to receive base construction.

The compaction of fill material for utility trenches under improved areas shall be 100% of density, as measured by Standard Proctor.

In unimproved areas, and areas not proposed to be improved, the excavated topsoil shall be used last in the backfill, and the surface of the trench restored to its original elevation and condition.

The compaction of fill material for utility trenches under unimproved areas shall be 95% of density, as measured by Standard Proctor, within the pipe envelope. The compaction of fill material for the remainder of trench shall be compacted to firmness approximately equal to that of the soil adjacent to the pipe trench.

4.3.2.4 Backfill for Structures

Backfill for structures shall be compacted select sand backfill as specified above for a minimum distance of 10 feet from outside wall of structure or to undisturbed excavation wall if nearer.

4.3.2.5 Compaction by Flooding

The Contractor may elect to compact granular backfill materials above level of initial backfill by flooding provided he has secured prior approval from the Engineer for each location. When compaction by flooding is to be done, backfill material shall be coarse grained gravel, gravel-sand or sand, free of clay, having not more than five percent by weight which passes a No. 100 U.S. standard sieve and no material which passes a No. 200 U.S. standard sieve. In addition, the character of soil through which trench passes shall be clay-gravel or gravel-sand-silt mixtures which possess permeability sufficient to result in flooding water being drained away in a reasonable time (not to exceed three days). All tests required to determine if backfill material or soil adjacent to trench is suitable for compaction by flooding shall be the sole responsibility of the Contractor.

4.3.3 Testing

In addition to compaction testing required below, compaction tests may be made at locations as selected by the Engineer. The City will pay for tests revealing satisfactory compaction. The Contractor shall pay for tests revealing unsatisfactory compaction. Where unsatisfactory compaction is revealed by tests, the Contractor shall re-excavate, backfill, and re-compact as required to obtain required degree of compaction over entire depth of trench. The Engineer shall determine the limits of unsatisfactory backfill.

Testing schedule for utility pipeline construction shall be as required in other sections, and as specified in Table 4.2.

Table 4.2 – Schedule of Density Testing (Minimum Requirements)		
Backfill and Compaction Density Test Location	Method of Test	No. of Tests Required
Laboratory	AASHTO T99, ASTM-D698	1 for each type of soil used
Along Linear Utility (<i>in situ</i>)	AASHTO T147, T191, T204, or T205	1 per each 12-inches depth per 400 l.f. of utility
Around Structure (<i>in situ</i>)	AASHTO T147, T191, T204, or T205	1 per each 12-inches depth of structures
At services	AASHTO T147, T191, T204, or T205	1 for each 12-inch depth of 25% of the under pavement (at a minimum)

4.3.4 Disposal of Surplus Material

4.3.4.1 Unsalvable material

Excess excavated material; the Contractor shall dispose of unsalvable material and debris in a legal manner. If the Plans do not indicate a disposal area, then disposal areas shall be selected by the Contractor and submitted for approval to the Engineer.

4.3.4.2 Salvable material

All material to be removed or salvaged shall be inspected by the City or his representative immediately prior to removal. The City’s decision as to salvability will be final. Such material that is, in the opinion of the City or his representative, salvable shall be removed and stored by the Contractor within the site area as and where directed by the Engineer. Under no circumstances may existing structures, plant or facilities be removed from site area or demolished without obtaining approval from the City or his representative.

4.3.5 Cleanup and Restoration

4.3.5.1 General

Cleanup is an essential part of the work. As the work progresses and is completed, the Contractor shall clean site of all signs of operation. This cleanup shall be done as promptly as practicable and shall not be left until the end of construction period. No part of the work shall be considered complete and no payment will be made until cleanup is completed. The running end of the pipe will not advance more than 700 feet beyond cleanup within City and public right-of-way (does not apply to developer property). In addition to the 700-foot requirement, all areas disturbed over 30 days shall be cleaned up. Final pavement shall commence no later than 30 days after

pavement removal over any portion of the utilities installed. Failure to meet this requirement is reason to stop the job.

Included in cleanup is protection of road shoulders, ditch banks, and other natural or artificial slopes subject to rapid erosion. Except where soil-cement riprap is shown, this protection shall be by grassing and mulching. A satisfactory stand of grass shall be obtained by sprigging, sodding or seeding over entire work site. Seeding under direct supervision of a qualified nurseryman may, subject to approval by the Engineer, be substituted for sprigging or sodding in areas not specifically shown to be completely sodded.

4.3.5.2 Sprigging

Apply 4-8-4 fertilizer at the rate of 600 pounds per acre by means of mechanical spreaders to area to be sprigged. Live springs, which match existing grass, with roots uninjured, shall be immediately planted in rows. Distance between rows and between plants in rows shall not exceed one foot. After planting, the entire area shall be compacted lightly by means of culti-packers, tractors or rollers. After sprigging, Contractor shall water sprigs as required until Contract is complete and accepted by the City. Sod shall be watered as specified for sprigging. Water shall be provided by Contractor at his expense and whenever necessary to assure sustained growth and vitality.

4.3.5.3 Sodding

Sod shall be placed solidly in areas shown on Drawings.

Immediately before sod is placed, 4-8-4 fertilizer shall be applied at a rate of 600 pounds per acre by mechanical spreaders or broadcasting and raking.

Sod shall be watered as specified for sprigging. Water shall be provided by Contractor at his expense and whenever necessary to assure sustained growth and vitality.

For contracts that consist of greater than 5,000 S.F., Contractor will be required to install temporary irrigation system.

4.3.5.4 Seeding

All areas to be seeded shall be fertilized with 12-8-8 NPK dry fertilizer at the rate of 800 to 1,000 pounds per acre and thoroughly worked into the soil. Grass seed shall be a mixture of 20 parts of Bermuda and 80 parts of Pensacola Bahia seed, applied with mechanical distributors at the rate of 100 pounds per acre. During the months from October to January, the grass seed mixture shall be 50 parts winter rye and 50 parts

Pensacola Bahia seed. All seed and fertilizer used shall meet the requirements of the State Department of Agriculture and all applicable State laws.

The Contractor shall maintain adequate moisture and provide such care as is necessary in seeded areas to ensure an adequate growth of grass. All areas and spots that do not show a prompt growth shall be replanted at intervals of 20 days. Such water and replanting shall continue until a good growth of grass is established over the entire construction area. Sod shall be watered as specified for sprigging. Water shall be provided by Contractor at his expense and whenever necessary to assure sustained growth and vitality.

Prevention and repair of erosion in construction areas and such replanting as necessary to repair damage to seeded or grassed areas shall be the responsibility of the Contractor until final acceptance of the Project by the City.

Seeded areas shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 1½ tons of hay or straw per acre. Hay with noxious seeds or plants will not be acceptable. Rotted, brittle, molded hay will not be accepted. It is intended that mulch shall allow some sunlight to penetrate and air to circulate, at the same time shading the ground, reducing erosion and conserving soil moisture. Thickness of covering shall be adequate to hold soil, but sufficiently loose and open to favor development of grass. Immediately following spreading of mulch, material shall be anchored to soil by means of a seed drill, dish harrow set to cut only slightly, or other suitable equipment which will secure mulch firmly and prevent loss or bunching by wind or rain, or may be anchored with string lines placed at sufficient intervals. On slopes where machinery cannot be used, mulch may be retained in place by hand spading, string lines, or nonmetallic open weave fabric. Unless rain is imminent, mulched areas shall be watered immediately after placing. Upon completion, surface or mulched areas shall be free from clods of earth, bumps, or water holding pockets and to required grades.

4.3.5.5 Hydro-Seeding

Under this method, the seed and fertilizer, and mulch when required, shall be distributed over the area to be seeded as slurry composed of water, seed and fertilizer, and including mulch material. The types of seed and fertilizer and the requirements for seed, fertilizer, and water as specified shall apply to this work.

The equipment for mixing the slurry and for applying the slurry over the areas to be seeded shall be capable of applying uniform slurry over the entire area and shall meet the approval of the Engineer.

The mulch material shall be included in the slurry mixture and shall be applied at the rate of 1,000 pounds of mulch material per acre. Mulch material shall consist of wood cellulose fiber material especially prepared for this purpose. It shall be prepared in such a manner that it will contain no growth-inhibiting or germination-inhibiting factors and shall be dyed an appropriate color for readily determining the rate of spread by visual observation. The slurry shall be uniform and homogeneous forming a blotter like ground cover, impregnated uniformly with grassed seed, allowing the absorption of water and permitting rainfall and watering to percolate to the undersoil. Mulch material, other than wood cellulose fiber material (i.e., jute, cotton, netting and chemical adhesive soil stabilizers) shall be used when specified or approved by the Engineer.

The Contractor shall, at his expense, maintain the grassed areas in a satisfactory condition until final acceptance of the work.

END OF SECTION 4

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5.1 General

5.1.1 Scope of Work

The Contractor shall furnish and install underground pressure mains using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring. This Work shall include all drilling equipment, materials, piping, appurtenances, and labor for the complete and proper installation, testing, and placing into service of pressurized mains; and all required environmental protection and restoration requirements.

5.1.2 Quality Assurance

The directional drilling Contractor or Subcontractor shall have a minimum of 4-years of experience constructing and installing water, wastewater, or reclaimed water pressure mains of similar diameter and similar lengths.

All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.

The Contractor's operations shall be in conformance with the Directional Crossing Contractors Association (DCCA) published guidelines (latest edition) and pipe manufacturer's guidelines and recommendations.

5.1.3 Submittals

The Contractor shall provide the following submittals to the City for review and acceptance prior to construction:

- Work plan
- Pipe materials
- Pipe joining
- Fittings and adapters
- Directional drilling equipment and materials specifications

Prior to beginning Work, the Contractor must submit a work plan to the City detailing the procedure and schedule to be used to complete the work. The work plan should include, at a minimum, the following information:

- A description of all equipment to be used
- Down-hole tools
- A list of personnel and their qualifications and experience

- List of Subcontractors
- A schedule of work activity
- A safety plan and traffic control plan (if applicable)
- An environmental protection/materials management plan
- A contingency plan for possible problems

The Contractor will also submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the work. Equipment submittals shall include, but not be limited to the following information:

- Drilling rig
- Mud system
- Mud motors (if applicable)
- Down-hole tools
- Guidance system
- Calibration records
- Rig safety systems

5.2 Products

5.2.1 General

Provide the following equipment and materials for the horizontal directional drilling installation of pressure mains:

- A directional drilling rig of sufficient capacity to perform the bore and pullback operations
- A drilling fluid mixing, delivery, and recovery system of sufficient capacity to complete the crossing
- A drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused
- A magnetic guidance system to accurately guide boring operations
- A vacuum truck of sufficient capacity to handle the drilling fluid volume
- Trained and competent personnel shall operate the system
- Miscellaneous equipment and materials required to complete the installation in accordance with the plans and permit requirements

All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in proper working order throughout the drilling and pressure main installation.

5.2.2 Drilling System

The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing, and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

5.2.3 Pressure Mains

Pipe shall be fusible HDPE or PVC pipe with ductile iron pipe size (DIPS) outside diameters (OD) in accordance with AWWA C906 or C900 respectively. The dimension ratio (DR) of the pipe shall be based on the pipe material, joint type, drilling rig specifications, and in-situ conditions, and shall be suitable to withstand the pull-back forces required for the directional drilling without any permanent deformation in the pipe section or strength. The pull-back forces and pipe wall thickness shall be verified by the Contractor prior to submitting bid proposal.

In no case shall the pipe wall thickness be less than those required in other specification sections for operating pressure. For 4-inch and greater HDPE pipe (AWWA C906), the maximum dimension ratio (minimum wall thickness) shall be DR11. For 4-inch through 12-inch PVC pipe (AWWA C900), the maximum dimension (minimum wall thickness) ratio shall be DR18.

Fusible HDPE and PVC pipe for horizontal directional drilling applications shall be joined by means of zero leak-rate thermal heat butt-fusion welds. Joints shall provide axial pullout resistance. The bending radius pressure main shall not exceed 80 percent (0.80 X) of the manufacturer's recommended maximum bending radius for the size and type of pipe.

Pipe for potable water applications shall be NSF Approved.

5.2.4 Tracer Wire

The tracer wire shall be a direct burial #10 AWG high-strength copper-clad steel with a 30 mil high-density polyethylene coating on the outside for protection. The tracer wire shall be rated for 30 volts and meet APWA color coding requirements for the utility application. Approved products include Copperhead Industries, LLC - #10 AWG HS-CCS Tracer Wire; Pro-Line Safety Products - #10 AWG Pro-Trace HF-CCS Tracer Wire; or approved equal.

5.2.5 Drilling Fluids

Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material, such as bentonite or a polymer surfactant mixture producing slurry of custard-like consistency.

5.3 EXECUTION

5.3.1 Personnel Requirements

Responsible representatives of the Contractor and Subcontractor(s) shall be present at all times during directional drilling operations. A responsible representative as specified herein is defined as a person experienced in the type of work being performed and who has the authority to represent the Contractor in a routine decision making capacity concerning the manner and method of carrying out the Work.

The Contractor and Subcontractor(s) shall have sufficient number of competent workers on the Project at all times to ensure the utility placement is made in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the directional drilling operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site at the beginning of Work. A competent and experienced supervisor representing the Contractor or Subcontractor that is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the project site during the directional drilling operation.

5.3.2 Work Plan

Work plan should be comprehensive, realistic, and based on actual working conditions for this particular Project. Plan should document the requirements to complete the Project.

Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that the Contractor intends to use or might use shall be submitted.

5.3.3 Coordination of the Work

The Contractor shall notify the City at least 3-days in advance of starting Work. In addition, the actual crossing operation shall not begin until the City is present at the project site and agrees that proper preparations have been made. The City's approval for beginning shall in no way relieve the Contractor from the ultimate responsibility for the completion of the Work.

The Contractor and the City shall select a mutually convenient time for the crossing operation to begin in order to avoid schedule conflicts.

5.3.4 Procedure

The installation of appropriate safety and warning devices in accordance with the "FDOT Manual on Traffic Control and Safe Practices" shall be completed prior to beginning Work.

5.3.5 Installation

Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. Drilling mud shall be disposed of off-site in accordance with local, state, and federal requirements and/or permit conditions.

No other chemicals or polymer surfactant shall be used in the drilling fluid without written consent of the City and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe.

Pilot Hole: Pilot hole shall be drilled on bore path with no deviations greater than 2% of depth over a length of 100-feet. In the event that pilot does deviate from bore path more than 2% of depth in 100-feet, the Contractor shall notify the City. The City may require the Contractor to pullback and re-drill from the location along bore path before the deviation.

Reaming: Upon successful completion of pilot hole, the Contractor will ream borehole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

Pullback: After successfully reaming borehole to the required diameter, Contractor shall put the pipe through the borehole. In front of the pipe shall be a swivel and barrel reamer to compact bore-hole walls. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away head rated at the maximum safe pull pressure shall be utilized.

Tracer Wire: A minimum of three continuous tracer wires shall be attached with nylon wire ("zip") ties at different radial locations around the pipe to ensure continuity in at least one wire subsequent to installation. Contractor shall be required to provide as many wires as necessary to maintain continuity throughout the length of the directional bore. Splices along the length of the bore shall be permitted only in the event of a break in the tracer wire during installation. In such event, the wire shall be joined using a proper sized swage crimp on stripped bare wire ends with a double heat-shrink wrap.

As-built variance from the designed bore path shall not exceed \pm (plus or minus) 1-foot in the vertical plane and \pm 2-feet in the horizontal plane. The Contractor shall submit any proposed deviations from the design bore path with Shop Drawings.

The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole to avoid deformation of, or damage to, the pipe.

If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the City has been consulted.

The pipe shall be pulled back through the borehole using the wet insertion construction technique. The pipe shall be installed full of water.

The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement or distortion of surface features.

A boring log shall be kept with horizontal and vertical location every 10-feet. The horizontal location of the bore shall be marked in the field during the bore. The Surveyor shall locate these marks and include this information with the bore depths in the Record Drawings. The Surveyor may make a note on the drawing page containing the directional drill and provide an exception for the directional drill only, as the directional drill route cannot be uncovered and physically located.

The pipe shall be installed at a depth of no more than 15-feet below pavement, as measured from the top of pipe.

5.3.6 Field Testing

5.3.6.1 PVC Pipe

Perform hydrostatic testing for leakage following installation in accordance with the applicable specification sections.

5.3.6.2 HDPE Pipe

Perform hydrostatic testing for leakage following installation of the directional drill.

The total test duration (time), including initial pressurization, initial expansion, and time at test pressure must not exceed 8-hours. If the test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized and allowed to "relax" for a minimum of 8-hours before it is brought back up to test pressure. The test procedure consists of the initial expansion phase and leakage test phase.

The test pressure for all pressure pipe shall be 150-psi.

Initial Expansion Phase: During the initial expansion phase, the test section is pressurized to the test pressure and enough make-up liquid is added each hour for 3-hours to return to test pressure.

Leakage Test Phase: The leakage test phase follows immediately and shall be either 2 or 3-hours in duration. At the end of the time test, the test section shall be returned to test pressure by adding a measured amount of liquid. The amount of make-up liquid added shall not exceed the values provided in Table 5.1.

Table 5.1 - Allowance for Make-up Water Under Pressure*								
Test Duration (hours)	2	4	6	8	12	16	20	24
	Allowance/100-feet of Pipeline (gallons)							
2	0.11	0.25	0.60	1.00	2.30	3.30	5.50	8.90
3	0.19	0.40	0.90	1.50	3.40	5.50	8.00	13.30
*Applies to test period and not to initial expansion phase								

Mandrel Testing: Perform mandrel testing through the entire length of the installed pipe. The mandrel size shall be 90% of the inside diameter of the pipe.

END OF SECTION 5

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6.1 General

6.1.1 Scope of Work

Supply all labor, equipment, materials, and incidentals necessary to install casing pipe by the method of jacking and boring at the location(s) shown on the Plans and as specified herein.

This work shall include jack and bore equipment, excavating, sheeting, steel casing pipe, welding, casing spacers, end seals, coatings, location signs (as required), miscellaneous appurtenances, incidentals, and site restoration. Perform jacking and boring operations within the limits of the rights-of-way and/or easements shown on the Plans.

6.1.2 Submittals

Submit shop drawings to the Engineer for review showing a sketch of the jacking pit locations, proposed methods for installation, and material specifications for the casing pipe, casing spacers, end seals, and other miscellaneous appurtenances.

6.1.3 Quality Assurance

Steel casing pipe shall conform to ASTM Standards. All field and shop welds shall conform to American Welding Society Standard Specifications. Carrier pipes shall conform to the requirements of the applicable City of Tallahassee specifications.

Casing pipe to be installed may be inspected for compliance with these specifications by an independent laboratory selected and paid for by the City. The Contractor's and manufacturer's cooperation shall be required in these inspections.

For jack and bore casing installations under CSX, FDOT, or Leon County rights-of-way, comply with the specifications and/or permit requirements of that agency with jurisdiction.

6.2 Products

6.2.1 Steel Casing Pipe

Steel casings shall conform to the requirements of ASTM Designation A139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi. Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel or single-vee groove type joints. Welds shall be leak-proof, airtight, and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4-inch. The finished steel casing shall be

capable of withstanding the overburden and live loads as required by the jurisdictional agency for the application.

In CSX Railroad rights-of-way, where the carrier pipe is greater than 6-inches in diameter, the casing pipe inside diameter must be at least 4-inches larger than the maximum outside diameter of the carrier pipe, including the pipe bell.

In FDOT, Leon County, or City of Tallahassee rights-of-way, the casing pipe inside diameter must be at least 6-inches larger than the maximum outside diameter of the carrier pipe, including the pipe bell. The casing pipes shall have the minimum inside diameter and wall thickness as shown in Table 6.1.

Carrier Pipe Nominal Diameter (in.)	Roadway Crossing		CSX Railroad Crossing	
	Casing Pipe Minimum Inside Diameter (in.)	Casing Pipe Minimum Wall Thickness (in.)	Casing Pipe Minimum Inside Diameter (in.)	Casing Pipe Minimum Wall Thickness (in.)
6	16	.281	14	.250
8	18	.312	16	.281
10	20	.344	18	.312
12	22	.344	20	.344
14	24	.375	22	.344
16	28	.438	24	.375
18	30	.469	28	.438
20	32	.500	30	.469
24	36	.532	36	.532
30	42	.625	42	.625
36	48	.688	48	.688
42	56	.812	56	.812

*The table above is for "Fastite" or "Tyton" push-on type joint ductile iron pipe. For alternative carrier pipe materials, joint types, and sizes, verify the carrier pipe maximum outside diameter and the steel casing pipe minimum inside diameter and wall thickness.

6.2.2 Carrier Pipe

All pressurized carrier pipes for jack and bore installations shall be restrained joint ductile iron pipe, and shall be lined and coated in accordance with the technical specifications for the

pipeline application. Gravity sewers with bore lengths less than 60 feet can be DR26 PVC sewer pipe. Gravity sewers 60 feet or greater in length must be restrained joint ductile iron pipe, lined for sanitary sewer application.

6.2.3 Casing Spacers

Carrier pipes, inside of steel casing pipe, shall be supported by casing spacers. Casing spacers shall be bolt-on style split-shells manufactured from 14-gauge (minimum) Type 304 stainless steel, with a 0.090-inch thick (minimum) PVC lining. All nuts, bolts and washers shall be 304 stainless steel and compatible with the respective 304 stainless steel shell / band. Each spacer shall have low-friction skids/runners mechanically bolted to the risers. The runners shall be manufactured of an ultra-high molecular weight polyethylene or glass reinforced polymer. The risers and runner supports shall be of adequate spacing and height to position the carrier pipe in the center of casing with a minimum top clearance of 3/4-inch.

Table 6.2 – Casing Spacer Requirements				
Carrier Pipe Nominal Diameter (in.)	Minimum Spacer Length (in.)	Minimum Number of Runner Supports/Risers per Casing Spacer		
		Bottom	Top	Total
6	8	2	2	4
8	8	2	2	4
10	8	2	2	4
12	8	2	2	4
14	12	4	2	6
16	12	4	2	6
18	12	4	2	6
20	12	4	2	6
24	12	4	2	6
30	12	4	2	6
36	12	4	2	6
>36	To be determined by Engineer of Record*			

*All casing spacers for carrier pipes 36-inch diameter and larger shall be factory designed, taking in consideration the weight of the carrier pipe filled with water.

Approved products include Cascade Waterworks Mfg. - Model CCS; Calpico, Inc. – M(SS) Series; APS, Inc. – Model SSI; CCI Pipeline Systems – Model CSS; or approved equal.

6.2.4 Casing End Seals

Seal casing ends in the annular space to completely close both openings on each side of the casing. Acceptable methods include a mechanical link-type casing end seal or a masonry (brick and mortar) plug together with a manufactured molded skirt-type casing end seals.

The mechanical link-type casing end seal shall be interlinked rubber sealing elements that are compressible to create a water-tight seal between the casing pipe and the carrier pipe. The seal shall be manufactured from EPDM rubber elements with composite compression plates and stainless steel nuts and bolts. Approved products include APS, Inc. – Innerlynx S-316, Link-Seal – Model S-316, or approved equal.

The masonry plug shall be suitable for restraining the compacted earth load.

The skirt-type casing end seals shall be molded (seamless) rubber with stainless steel straps for securing the seal to the carrier pipe and the casing pipe. End seals shall be constructed of 1/8-inch thick (minimum) specially compounded synthetic rubber with stainless steel banding straps. Approved products include APS, Inc. – Model AM/AC, Cascade Waterworks Mfg. – Model CCES; Calpico, Inc. – Model C; or approved equal. Wrapped skirt end-seals are not permitted.

6.3 Execution

6.3.1 Inspection

All casing pipe to be installed shall be certified by the manufacturer for compliance with these specifications. Casing pipe shall be subject to careful examination and inspection before installation, and no piece shall be installed which is found to be damaged or defective. Any casing pipe found to be damaged or defective shall be repaired or replaced as determined by the City, and at no additional cost to the City.

6.3.2 Material Handling

Care shall be taken in loading, transporting, unloading, and installing casing pipe and carrier pipes to prevent damage to the pipe or coatings. Pipe shall not be dropped.

6.3.3 Casing Pipe Installation

All work shall be performed in accordance with these specifications and/or the requirements of the agency having jurisdiction of the right-of-way or easement in which the installation is proposed. Any special requirements of the jurisdictional agency shall be adhered to during the

performance of the Work. The special requirements shall be performed by the Contractor at no additional cost to the City.

The installation of the casing pipe shall proceed from a pit excavated at a safe distance from the edge of the roadway, railroad, or other structure. Construction shall not interrupt traffic on the roadways or railroads.

Field verify the horizontal and vertical location of all underground utilities and aboveground infrastructure, including utility poles, retaining walls, foundations, or other obstacles along the jack and bore alignment, prior to advancing the auger and/or casing pipe. Identify and resolve any conflicts with the proposed jack and bore alignment and existing underground utilities or aboveground infrastructure before excavating the jacking and receiving pits.

Maintain dry jacking and receiving pits and boreholes, free from groundwater infiltration or stormwater runoff. In the event of inclement weather, provide the necessary protection of the jacking and receiving pits to prevent infiltration and wash out. Provide all necessary equipment to protect and dewater the excavations and bore hole. Dewatering through the casing pipe is not permitted. Dewatering effluent shall be managed in accordance with the regulatory requirements and the Contract.

Install the casing pipe in accordance with approved jacking and boring methods. Install suitable reaction blocks for the jacking operation, as required. Installation of sheeting, bracing, and blocking are considered incidental to the Work. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions that might restrict or prohibit the advancement of the casing pipe.

Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

Maintain the necessary line and grade as indicated on the Plans. Installation of the casing pipes shall be at a horizontal and vertical alignment that will allow installation of the carrier pipe, within allowable tolerances, according to the Plans. Failure to meet the lines and grade as indicated on the Plans may result in remediation, at the discretion of, and no additional cost to the City and/or the jurisdictional agency.

Appropriate barricades, signage, and lighting will be provided if pits are open overnight. Excavations shall be completely enclosed with barricades.

The joining of sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field-welded pipe joints. The Contractor shall wire brush the welded joints and paint with an approved material.

After completion of jacking operation, clean the interior of the casing of all excess material and completely remove the reaction blocks, braces, and all other associated construction materials from the site. Complete as-built documentation, including end of casing locations, elevations, etc., for the jack and bore installation prior to backfilling the jacking and receiving pits. The jacking and receiving pits shall be excavated, backfilled and compacted in accordance with Section 5 - Excavating, Backfilling, and Compacting for Utilities.

The casing pipe is not to be used for linear restraint of the carrier pipe.

6.3.4 Other Equipment

Any equipment used on the job that has not been defined and covered previously in this section must be in proper working order and otherwise conform to the requirements as specified in other sections.

6.3.5 Personnel Requirements

Provide a competent and experienced supervisor that is thoroughly familiar with the equipment and type of work to be performed, and in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the job site during the actual crossing operation.

Provide a sufficient number of competent workers on the job at all times to ensure the jack and bore installation is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual jack and bore installation, where applicable, include: boring machine operator, certified welder(s) for joining additional casing sections; excavator operators, crane or lift operator for handling casing pipe, and laborers, as necessary for various related tasks, must be on the job site during the Work.

The City must be notified 48 hours in advance of starting Work. In addition, the jack and bore operation shall not begin until the City is present at the job site and agrees that proper preparations for the crossing have been made. The City's approval for beginning the Work shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the Work. The City shall be present on the job site at all times during the actual jack and bore operation and carrier pipe installation.

6.3.6 Carrier Pipe Installation

Gravity sewer pipe (carrier pipe) must be held to slope and azimuth indicated in the Plans and may have up to 0.10-foot \pm tolerance in the vertical plane and up to 0.50-foot \pm tolerance of the center line on the horizontal plane.

Wooden skid casing spacers are not acceptable.

All carrier pipes shall be installed with approved casing spacers. The size and type of casing spacers shall be sufficient to support the pipe so that the carrier pipe is centered within the casing pipe and restrained from cross-sectional horizontal and vertical movement. A minimum of three casing spacers per carrier pipe segment is required. Spacers on the bell end of the pipe shall be a maximum of 2 feet behind the bell. Spacers on the spigot end shall be positioned at the line marking the insertion limit into the bell, such that the casing spacer is in contact with the bell face when the pipe is properly seated. The third casing spacer (or remaining additional casing spacers) shall be evenly distributed between the two end spacers. All casing spacers shall be installed in accordance with the manufacturer's recommendations.

After the carrier pipe has been properly installed and tested, the ends of the casing pipe shall be sealed with masonry (brick and non-shrink mortar) plugs with a molded skirt-type casing end seal, or a mechanical link-type casing end seal, to prevent the infiltration of soil and ground water into the casing annular space. Skirt-type seals with banding straps and mechanical link-type seals shall be installed per the manufacturer's recommendations.

END OF SECTION 6

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7.1 General

7.1.1 Scope of Work

Supply all labor, equipment, materials and incidentals necessary to install, test, and place into operation all potable water distribution, sanitary sewer force main, and reclaimed water distribution system piping and fittings as shown on the drawings and as specified herein.

7.1.2 Submittals

Submit shop drawings to the City for review showing the manufacturer's drawings and specifications indicating complete details of all items. The details shall include material specifications, pressure class, certifications, joint types, gasket information, linings, coatings, installation and testing procedures, and other pertinent information necessary to assure that the proposed materials comply with all aspects of these technical specifications. The shop drawings shall be submitted to the Engineer for approval before fabrication and shipment of these items. The City shall not be responsible for items procured by the Contractor that have not been reviewed and approved through this submittal process.

7.1.3 Acceptance of Work

Until such time the City has formally accepted ownership and maintenance responsibility of the distribution and transmission system piping, the Contractor/Developer will be solely responsible for locating, maintaining, protecting, and repairing (if necessary) the distribution and transmission system piping, regardless of the cause of damage. The Contractor/Developer will be notified of acceptance in accordance with the guidelines outlined in the Contract Documents.

7.1.4 Manufacturer Testing of Pipe and Fittings

All pipe and fittings shall be domestic manufacture, and shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured.

7.2 Products

7.2.1 Ductile Iron Pipe

All ductile iron pipes shall be designed in accordance with the latest version of ANSI/AWWA C150/A21.50 for a rated water working pressure according to Table 7.1, which shall be adequate for the rated working pressure plus a surge allowance of 100 psi, using a 2-to-1 factor of safety on the sum of working pressure plus surge allowance.

Table 7.1 –Minimum Pressure Class for Ductile Iron Pressure Pipe			
Nominal Pipe Size (inches)	Pressure Class* (PSI)	Nominal Pipe Size (inches)	Pressure Class* (PSI)
8	350	20	250
10	350	24	250
12	350	30	250
14	250	36	250
16	250	42	250
18	250	48	250

*The minimum pressure class indicated in the table above is for pressure pipe installations under normal installation and loading conditions. The Engineer of Record shall determine if field conditions warrant a higher pressure class pipe due to special installation conditions or risk factors (i.e. excessive surge pressure, shallow cover, utility clearance, and/or excessive external loading conditions).

Ductile iron pipe shall be manufactured in the U.S.A. in accordance with the latest revision of ANSI/AWWA C151/A21.51. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture. Coatings and linings shall be as required for the intended application, per this specification. Approved ductile iron pipe manufacturers include American (Cast Iron Pipe Co.), U.S. Pipe, and McWane (Cast Iron Pipe Co.).

Ductile iron pipe for below ground installation shall be supplied in nominal lengths no greater than 20 feet and shall be furnished with push-on type joints, such as "Tyton" or "Fastite," unless otherwise shown on the drawings. Rubber gasket joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11, and be furnished complete with all accessories, including restraints when necessary.

Ductile iron pipe for above ground installation shall be furnished with flange type joints, unless otherwise shown on the drawings. Flanges shall be ductile iron and conform to ANSI/AWWA C115/A21.15. Flange gaskets shall be full-face type gaskets molded from high-quality styrene-butadiene rubber (SBR) and shall be pre-drilled to match flange bolt pattern. The flange and gasket shall be rated for a working pressure of 350 psi, unless otherwise specified.

The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe; additionally, the manufacturer's mark, country where cast, year produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

7.2.2 Ductile Iron Fittings

All ductile iron fittings shall be manufactured in the U.S.A. in accordance with the latest version of ANSI/AWWA C110/A21.10 or C153/A21.53.

All distribution and transmission pipe fittings for installation below ground shall be mechanical joint type ductile iron fittings. Rubber gasket joints for mechanical joint type ductile iron fittings shall conform to ANSI/AWWA C111/A21.11.

All distribution and transmission pipe fittings for installation above ground shall be flange joint type ductile iron fittings, and drilled to match ANSI/AWWA C115/A21.15 flanges. Flange gaskets shall be full-face type gaskets molded from high-quality styrene-butadiene rubber (SBR) and shall be pre-drilled to match flange bolt pattern. The flange and gasket shall be rated for a working pressure of 350 psi, unless otherwise specified.

Approved ductile iron fitting manufacturers include Tyler Union, Star Pipe Products (U.S.A.-Domestic), or approved equal.

7.2.3 Linings & Coatings for Ductile Iron Pipe and Fittings

Unless explicitly allowed within this specification, all interior linings and exterior coatings (including primers) shall be applied by a certified applicator at the foundry or certified application facility. All surfaces shall be prepared in accordance with the manufacturers' recommendations for the intended environment and the product(s) to be applied.

For potable water and reclaimed water applications, line the interior surface of all ductile iron pipe and fittings with a cement mortar lining and bituminous seal coat in accordance with ANSI/AWWA C104/A21.4. For buried applications, coat the exterior surface of all fittings with a 1.0 mil thick asphaltic coating in accordance with ANSI A21.51. For exposed or above ground applications, coat the exterior surface with an epoxy primer to a thickness of 5 mils and apply a top coat of epoxy to a minimum thickness of 15 mils. Approved primer and top coat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 435 Perma-Glaze (top coat), or approved equals. The top coat only may be field-applied by an experienced applicator and allowed to cure before installation.

For sanitary sewer and force main applications, line the interior surface of all ductile iron pipe and fittings to a minimum thickness of 40 mils (DFT) with a high solids (97% minimum) coal-tar free ceramic epoxy. Approved products include Tnemec Series 431 Perma-Shield PL or Permite Permax-CTF. For buried applications, coat the exterior surface of all buried fittings with a 1.0 mil thick asphaltic coating in accordance with ANSI A21.51. For exposed or above-ground applications, coat the exterior surface with an epoxy primer to a thickness of 5 mils and apply a

top coat of epoxy to a minimum thickness of 15 mils. Approved primer and top coat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 435 Perma-Glaze (top coat), or approved equals. The top coat only may be field-applied by an experienced applicator and allowed to cure before installation.

7.2.4 Polyvinyl Chloride (PVC) Pressure Pipe

PVC pressure pipe is an approved material for 4-inch through 8-inch below-ground installation of distribution and transmission mains, when other approved materials are not specifically required. For pipes larger than 8-inch, ductile iron or HDPE pressure pipe shall be used. PVC and HDPE pressure pipe shall not be used in above-ground applications.

All PVC pressure pipe shall be manufactured in the U.S.A. and shall conform to the latest version of AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-inches through 12-inches, for Water Transmission and Distribution." Approved PVC pressure pipe manufacturers included JM Eagle Corp., National Pipe & Plastics, North American Pipe Corp., and Diamond Plastics Corp.

PVC pressure pipe for installation below ground shall be supplied in nominal lengths no greater than 20 feet (+/- 1-inch) and shall be furnished with push-on type joints in compliance with ASTM D3139 and Rieber® gaskets conforming to ASTM F477, and be furnished complete with all accessories, including restraints when necessary. No solvent-cement joints will be allowed.

PVC pressure pipe shall have standard ductile iron pipe size (DIPS) outside diameter (OD) dimensions with a wall-thickness dimension ratio (DR) of 18, and a pressure class of 235 PSI per AWWA C900-07 [150 PSI per AWWA C900-97/Factory Mutual (FM) 1612]. Each standard laying length of pipe and integral bell shall be tested up to 600 PSI for a minimum of 5 seconds.

PVC pressure pipe shall be color coded and labeled according to the following applications:

Table 7.2 – Exterior Colors and Markings for Pressure Pipes		
Application	Color	Approvals, Listings, and Special Markings
Potable Water	Blue	NSF 61, UL 1285, FM 1612
Sanitary Sewer	Green	Sewer / Force Main
Reclaimed Water	Purple	Reclaimed Water

Other lettering and markings on the pipe shall include pipe size, OD basis, material code designation, dimension ratio, AWWA pressure class, AWWA C900, manufacturer’s name, and production code information.

PVC pipe which is damaged or show signs of sun exposure/ultraviolet degradation will not be considered for use.

7.2.5 High Density Polyethylene (HDPE) Pressure Pipe

HDPE pressure pipe is an approved material for all 4-inch and larger distribution and transmission mains, when other approved materials are not specifically required.

All HDPE pressure pipe shall be manufactured in the U.S.A. using PE4710 resin and shall conform to the latest version of AWWA C906, "Polyethylene (PE) Pressure Pipe and Fittings, 4-inches through 63-inches, for Water Distribution and Transmission." Approved HDPE pressure pipe manufacturers included JM Eagle Corp., ISCO Industries, and Performance Pipe.

HDPE pressure pipe shall be ductile iron pipe size (DIPS) outside diameter (OD) dimensions with a wall-thickness dimension ratio (DR) of 11 and a minimum pressure rating of 200 PSI, except when thicker materials are specifically required. All HDPE pipe shall be manufactured with a UV inhibitor to protect the pipe from degradation in direct sunlight. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specifications from the same raw material. The pipe shall be free of visible cracks, holes, foreign inclusions, voids or other injurious defects including discoloration. There shall be continuous color stripes along at least two opposite sides of the pipe exterior (preferably at the 3 and 9 o'clock positions) to identify the intended use of the pressure pipe. Stripe colors shall be the same as those used for PVC pressure pipe identification identified in Table 7.1 above.

HDPE pressure pipe that is gouged, scraped, or otherwise damaged resulting in a loss of at least ten percent of the pipe wall thickness shall not be used.

7.2.6 Tracer Wire

All distribution and transmission system piping and appurtenances shall have a continuous reinforced copper tracer wire secured to the pipe to prevent separation during and after installation. The tracer wire shall be a direct burial #10 AWG high-strength copper-clad steel with a 30 mil high-density polyethylene coating on the outside for protection. The tracer wire shall be rated for 30 volts and meet APWA color coding requirements for the utility application. Approved products include Copperhead Industries, LLC - #10 AWG HS-CCS Tracer Wire; Pro-Line Safety Products - #10 AWG Pro-Trace HF-CCS Tracer Wire; or approved equal.

When a splice is required on the tracer wire, a UL 486D Listed direct burial waterproof wire nut shall be used to join the ends of the wire. Wire nuts shall be installed per the manufacturer's specifications. Approved products include King Innovation® DryConn® King 6 Blue One-Step® wire nuts, or approved equal.

7.2.7 Thrust Restraints

7.2.7.1 Restraining Gaskets and Mechanical Thrust Restraints

When restrained joints are required for below ground installations, furnish and install restrained joint pipe and/or mechanical joint restraints in accordance with the Standard Construction Details, or as specified by the Engineer of Record. The type of thrust restraint required shall depend on the material and joint type of the pipe requiring restraint. Approved thrust restraints for various pipe materials and joint types are provided in Table 7.3.

Table 7.3 – Approved Thrust Restraints for Pressure Pipe and Fittings		
Pipe Material	Joint Type	Approved Restraints
DI	Push-On (12-inch and smaller)	American Fast-Grip® Gasket McWane Sure-Stop 350® U.S. Pipe Field-Lok® 350
DI	Push-On (14-inch and larger)	American Flex Ring / Field Flex Ring U.S. Pipe TR Flex®
DI	Mechanical (All sizes)	EBAA Iron Megalug® Series 1100 EBAA Iron Megalug® 15MJ00TD (Tru-Dual®) Sigma One-Lok™ D-Series SLDE (Domestic) Tyler Union TUF Grip™ Series 1000 (TLD/DI) U.S. Pipe MJ Field Lok® (DI)
PVC	Push-On	Diamond Plastics - Diamond Lok-21® Gasket EBAA Iron Megalug® 1900 JM Eagle - Eagle Loc 900™ Gasket Tyler Union TUF Grip™ Series 3000 (PP/PVC)
PVC	Mechanical	EBAA Iron Megalug® 2000PV EBAA Iron Megalug® 15MJ00TD (Tru-Dual®) Sigma One-Lok™ D-Series SLCE (Domestic) Tyler Union TUF Grip™ Series 2000 (TLP/PVC)
HDPE	Fusion Welded	No Restraints Required
HDPE	Mechanical	HDPE MJ Adapter w/ SS Stiffener

1. Concrete thrust blocks shall not be allowed unless approved in writing by the City.
2. Except for PVC Push-On joint restraints, split-design mechanical thrust restraints shall only be considered for adding restraint to existing DI and PVC pipes.
3. Bolts and nuts for mechanically restrained joints shall be hot dipped galvanized, low alloy, high-strength steel. All-thread rods and associated washers and nuts for restrained joints shall be Type 304 Stainless Steel.

7.2.7.2 Thrust Blocks

When concrete thrust blocks are required in lieu of, or in addition to, restraining gaskets and/or mechanical restraints, then the thrust blocks shall be sized and installed in accordance with the Engineer of Record design.

7.3 Execution

7.3.1 General

All streets and easements shall be cleared and graded to within 4 inches of the final grade prior to construction of the utility system.

All pressurized mains and service piping shall have minimum of 3 feet of cover and no more than 6 feet of cover, unless otherwise specified. Trench excavation, backfill and compaction shall meet the requirements of Excavating, Backfilling and Compacting for Utilities specification contained in this document. Type 2 bedding conditions shall be used for all pressure pipe installation, unless specified otherwise.

Pipe shall be handled according to the manufacturer's recommendations. Care shall be taken in loading, transporting, unloading, and storing pipe and fittings to prevent damage to the pipe or fitting, coatings, and linings. Use padded straps, not chains or cables, for lifting pipe, fittings and appurtenances. Pipe shall not be moved using a forklift in the end of the pipe. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed, and no piece shall be installed which is found to be damaged or defective. Any damaged pipe, fittings, coatings, and linings shall be repaired or replaced, as directed by the City. If any damaged or defective pipe is discovered after it has been laid, it shall be removed and replaced with a new pipe, in a satisfactory manner, and at no additional expense to the City.

All pipe and fittings shall be thoroughly cleaned before laying, and shall be kept clean until they are used in the work and placed into service. When pipe laying is not actively in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.

All pipe and fittings shall conform to the lines and grades required. Unless specifically indicated otherwise, underground piping shall slope uniformly between shown elevations.

All pressurized distribution and transmission mains shall be laid with a continuous insulated tracer wire to provide for location by metallic pipe locators. Tracer wire shall be wrapped a minimum of two times around each joint of pipe. When a splice is required on the tracer wire, a direct burial waterproof wire nut shall be used to join the wires.

Tracer wires shall be routed to the surface through valve boxes so as to extend at least 12-inches beyond valve box. Excess tracer wire shall be coiled under box lid and arranged so as not to interfere with valve operation. Tracer wire runs shall not exceed 1,000 feet without an access point. Extra valve box shall be provided where distances between valves exceeding 1,000 feet so there is no run longer than 1,000 feet. For runs longer than 1,000 feet, evenly split the distance between valves and the extra valve box(s).

The valve box will be supported above the top of the pipe by gravel bedding to eliminate any stress on the pipe at this point. An EMS marker will be buried adjacent to this valve box at a depth of 2 feet to help facilitate location.

7.3.2 Connection to Existing Lines

The City of Tallahassee Inspector shall be notified 48 hours prior to any connection to the existing water, sewer, or reclaimed water systems.

When connecting new pipe to existing pipe, the following work shall be performed:

- a. Expose buried lines to determine pipe material, diameter, and method of proposed connection (plugged end, tap, tie-in, etc.).
- b. Furnish and install piping, fittings, valves, and restraints necessary to complete the connection as intended in the plans.
- c. Provide all testing (pressure, bacteriological, etc.) for new pipe and fittings, as well as any existing pipe impacted by the connection, before placing into service.

24 hours before any utility service outage, there will be a reflective sign with flasher placed on each street coming into the affected area. The sign will be no smaller than 4 feet x 4 feet and will have an easy to read (4-inch letters) notice that utility service will be off tomorrow.

If the anticipated number of affected customers is less than 25, the Contractor will attempt to notify affected customers in person by 7PM the day before the outage, and leave a door hanger notice at the residence or business. If more than 25 customers are affected, then the Contractor will coordinate an electronic message notification through the City to be sent by 7PM the day before the outage (no personal contact attempted or door hangers placed). Affected critical use facilities may require a longer notification period.

All notifications shall include the date, time, duration, and type (water, sewer, gas, etc.) of anticipated service interruptions; the daytime and nighttime phone numbers of the Contractor; and the City number 891-4YOU (4968) (day & night).

7.3.3 Ductile Iron Pipe

Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600, and as otherwise provided herein.

Proper pipe alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings in addition to those shown on the plans shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench.

When cutting pipe is required, the cutting shall be done in accordance with approved methods stated in the Ductile Iron Pipe Research Association's "Installation Guide for Ductile Iron Pipe" leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on joints or mechanical joint fittings shall be beveled and de-burred to conform to the manufactured spigot end. Coatings and linings shall be undamaged by the cutting process. Coatings and linings requiring touch-up repairs shall be done in accordance with the manufacturers' recommendations.

7.3.3.1 Jointing Ductile-Iron Pipe

Unless otherwise noted, underground piping shall be push-on or mechanical joint types with thrust restraints as required by the City of Tallahassee.

Push-on joints shall be made in strict accordance with the manufacturer's instructions. A rubber gasket supplied by the pipe manufacturer shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is to be joined, and pushed home with a jack or other means. If a backhoe is used to bell the pipe, a timber header will be used between the pipe and backhoe bucket to avoid damage to the pipe. Contractor shall note the position of the painted gauge lines so as to properly position the plain end in the bell socket. ***Extreme care shall be taken to avoid over-belling the pipe to avoid damaging the pipe and/or lining.***

Mechanical joints at valves, fittings, and where designated on the drawings and/or as specified shall be in accordance with the "Notes on Method of Installation" under ANSI/AWWA C111/A21.11, AWWA C600 Section 3.4, and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tightened in a uniformed manner to the specified torque as noted below in Table 7.4.

Table 7.4: Mechanical-Joint Bolt Torque		
Pipe Size (inches)	Bolt Size Inches (mm)	Torque Ft.-Lbs. (N-m)
3	$\frac{5}{8}$ (16)	45 - 60 (61 - 81)
4 - 24	$\frac{3}{4}$ (19)	75 - 90 (102 - 122)
30 - 36	1 (25)	100 - 120 (136 - 163)
42 - 48	1 $\frac{1}{4}$ (32)	120 - 150 (163 - 203)

Ball joints, where designated on the drawings and/or as specified, shall be installed in strict accordance with the manufacturer’s instructions. Where ball joint assemblies occur at the face of structures or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.

Flanged joints shall be in accordance with ANSI/AWWA C115/A21.15, including its Appendix A and the instructions of the manufacturer. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

All valves, hydrants, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

If joint deflection is required to construct the water main as shown on the plans, the maximum deflection shall not exceed the maximum recommended deflections in the latest AWWA or manufacturers written directions (whichever is more stringent).

Fittings shown on the drawings is shown only as an assistance in illustrating a preferred means of installation in specific locations and is not intended to indicate all fittings necessary to effect the installation as shown in plans and profile views.

All taps on DIP pipe will be made by approved methods, using saddles or tapping sleeve and valve, when required.

7.3.4 Polyvinyl Chloride (PVC) Pressure Pipe

PVC piping shall be installed to the requirements of the manufacturer.

If joint deflection is required to construct the main as shown on the plans, the maximum deflection shall not exceed the manufacturer’s maximum recommended deflection. Deflected joint pipe shown on the drawings is shown only as assistance to illustrate a preferred means of installation in specific locations and is not intended to indicate all deflected joint pipe necessary to effect the installation as shown in plan and profile views.

If restrained joints are required, use only mechanical thrust restraints approved for PVC pipe. Under no circumstances shall setscrews be used on PVC pipe.

All taps on PVC pipe will be made through approved saddles or tapping sleeve and valve.

7.3.5 High Density Polyethylene (HDPE) Pipe

HDPE piping shall be installed to the requirements of the manufacturer. If restrained joints are shown on the plans, use manufacturer recommended fittings for HDPE pipe.

If joint deflection is required to construct the main as shown on the plans, the maximum deflection shall not exceed the manufacturer's maximum recommended deflection. Deflected joint pipe shown on the drawings is shown only as assistance to illustrate a preferred means of installation in specific locations and is not intended to indicate all deflected joint pipe necessary to effect the installation as shown in plan and profile views.

All taps on HDPE pipe will be made through approved saddles or tapping sleeve and valve.

7.3.6 Thrust Restraints

Restraining gaskets and/or mechanical thrust restraints shall be used to provide resistance to thrust forces generated in pressurized pipelines at all valves, bends, tees, reducers, and caps or plugs. The length of restrained pipe on each side of the valve and/or fitting shall be sufficient to provide adequate resisting force to prevent separation of the pipe joints and fittings.

The minimum number of restrained joints required for resisting thrust forces shall be determined by the pipe size, material, type of valve or fitting, operating conditions, pipe trench, and soil type. Minimum restrained lengths for many typical applications are provided in the Standard Construction Details, which have been calculated for various pipe material and fittings based on the following minimum design parameters:

Soil Designation: Good Sand (Unified Soil Classification: Type SM)
Safety Factor: 1.5
Trench Type: Type 2
Depth of Bury: 3 Feet
Test Pressure: 150 PSI

Any variations from the minimum restrained lengths provided in the Standard Construction Details and the design parameters above shall be requested in writing by an active Florida Licensed Professional Engineer, in good standing with Florida Board of Professional Engineers. Such requests shall include suggested changes to design parameters, supporting documentation, and new restrained length calculations, signed and sealed by the Professional Engineer.

Where concrete thrust blocks are required in addition to, or in lieu of, restraining gaskets and/or mechanical restraints, then the thrust blocks shall be sized and installed in accordance with these specifications and the Standard Construction Details.

Concrete thrust blocks shall have a load bearing area sufficient to resist the thrust forces at all valves and pipe fitting. Thrust forces shall be calculated using the same design criteria as for restrained lengths above. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Joints shall be protected by felt roofing paper or plastic sheeting prior to placing concrete thrust block. Wooden side forms shall be provided to achieve the required shape for concrete thrust blocks.

7.3.7 Pressure Tests of Distribution and Transmission System Piping

The City shall be notified 24 hours in advance of any testing. Hydrostatic pressure tests shall conform to Section 4 of the AWWA C600 latest edition, with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.

The pressure required for the field hydrostatic pressure test shall be made at 150 psi. Provide temporary plugs and blocking necessary to maintain the required test pressure. Wash stands at least 2-inches in diameter, pipe riser, and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 2 hours. All leaks evident shall be repaired. Distribution and transmission system piping, valves, and appurtenances that fail pressure tests shall be repaired and retested as necessary until test requirements are satisfied. Defective pipe and related appurtenances shall be removed and replaced at no additional cost to the City.

The piping systems, valves and appurtenances shall be tested in such sections, as may be directed by the Engineer, by shutting valves or installing temporary plugs, as required. The piping system, valves and appurtenances shall be filled with water, all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor.

Remove and adequately dispose of all blocking material and equipment after completion and acceptance by the field hydrostatic test, unless otherwise directed by the Engineer. Repair any damage to the pipe coating. Distribution and transmission system piping, valves, and appurtenances shall be totally flushed and cleaned prior to final acceptance.

7.3.8 Disinfecting Potable Water Pipelines

Before being placed in service, all potable water system piping shall be chlorinated in accordance with AWWA 651 latest edition, "Standard Procedure for Disinfecting Water Mains". The procedure shall be approved by the City. The location of the chlorination and sampling

points will be determined by the City in the field. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.

The procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being drawn at the other end of the line. The chlorine solution shall remain in the pipeline for 24 hours. Chlorine dosages shall be according to Table 7.5.

Table 7.5 – Ounces of Calcium Hypochlorite Granules to be Placed at Beginning of Main and at Each 500-foot Interval	
Pipe Diameter (in)	Calcium Hypochlorite Granules (oz)
4	0.5
6	1.0
8	2.0
12	4.0
16 and larger	8.0

Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. The City shall then make bacteriological sampling and analysis of the replacement water in full accordance with AWWA C651. The Contractor will be required to re-chlorinate, if necessary. The line shall not be placed in service until the disinfection requirements of the Florida Department Environmental Protection (FDEP) are satisfied. Water line flushing will be limited to the amount shown in Table 7.6.

Table 7.6: Line Flushing Parameters		
Minutes of Flow per 1,000 feet of pipe		
Line Diameter (inches)	Fire Hydrant with 2.5-inch hose connection	Fire Hydrant with 5-inch steamer connection
6	17	6
8	32	11
10	49	17
12	71 (1 hr 11 min)	24
14	96 (1 hr 36 min)	32
16	125 (2 hr 05 min)	42
18	159 (2 hr 39 min)	53
20	196 (3 hr 16 min)	66 (1 hr 06 min)
24	282 (4 hr 43 min)	94 (1 hr 34 min)

Special disinfecting procedures shall be used in connections to existing mains, and where the method outlined above is not practical.

No flushing can begin until the City has verified that a chlorine residual of not less than 10.0 ppm after the line has been filled for at least 24 hours. A City inspector is required to be on site to monitor all flushing activities. The Contractor shall meter and pay for any water used for flushing at standard City rates. City Ordinance 87-0-0108 and State Statute 812.14 will be enforced.

END OF SECTION 7

8.1 General

8.1.1 Scope of Work

Supply all labor, equipment, materials and incidentals necessary to install, test, and place into operation all potable water distribution, sanitary sewer force main, and reclaimed water distribution system valves and appurtenances as shown on the drawings and as specified herein.

8.1.2 Submittals

Submit shop drawings to the City for review showing the manufacturer's drawings and specifications indicating complete details of all items. The details shall include material specifications, pressure class, certifications, joint types, gasket information, linings, coatings, installation and testing procedures, and other pertinent information necessary to assure that the proposed materials comply with all aspects of these technical specifications. The shop drawings shall be submitted to the Engineer for approval before fabrication and shipment of these items. The City shall not be responsible for items procured by the Contractor that have not been reviewed and approved through this submittal process.

8.1.3 Acceptance of Work

Until such time the City has formally accepted ownership and maintenance responsibility of the distribution and transmission system piping, the Contractor/Developer will be solely responsible for locating, maintaining, protecting, and repairing (if necessary) the distribution and transmission system piping, regardless of the cause of damage. The Contractor/Developer will be notified of acceptance in accordance with the guidelines outlined in the Contract Documents.

8.1.4 Manufacturer Testing of Pipe and Fittings

All distribution and transmission system valves and appurtenances shall be domestic manufacture, and shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured.

8.2 Products

8.2.1 Resilient Wedge Gate Valves

Valves for distribution and transmission system pressure piping 4-inch and larger shall be cast iron or ductile iron body and bonnet, resilient wedge gate type valves with a water service pressure rating of 250 PSI. All valves shall be manufactured to meet the requirements of AWWA C509 (cast iron) or AWWA C515 (ductile iron), latest revisions. Approved resilient wedge gate

valve manufacturers are American Flow Control, Clow/M&H/Kennedy, U.S. Pipe/Mueller, and EJ Foundry.

The valve wedge shall be constructed of ductile iron and shall be fully encapsulated with a resilient EPDM rubber and provided with male type guides and polymer guide covers.

Buried valves shall have non-rising stems and a 2-inch square operating nut. For valves 4-inch through 12-inch, the operating nut shall attach directly to the valve stem. For valves 14-inch and greater, the operating nut shall operate a spur gear or bevel gear actuator to open and close the gate. Valves shall open by turning counter-clockwise (left) with arrow cast in metal to indicate direction of opening.

Valve stems shall be copper/bronze or manganese/bronze alloy and shall be sealed by at least three O-rings with two of the O-rings located above the thrust collar. The thrust collar shall have upper and lower thrust washers to reduce friction and minimize operating torque.

All internal and external ferrous surfaces of the valve body and bonnet shall have fusion-bonded epoxy coating, complying with ANSI/AWWA C550, applied by the manufacturer prior to assembly. Epoxy coatings for potable water system valves shall be certified to NSF/ANSI Standard 61.

Each valve shall have the manufacturer's name, pressure rating and year manufactured cast on the body. Prior to shipment from the factory, each valve shall be tested to a hydrostatic pressure of 350 psi.

8.2.2 Tapping Sleeves and Valves

All tapping valves will be resilient wedge type and designed for use with tapping equipment. All tapping valves will have an alignment ring to prevent misalignment with tapping sleeves. Tapping valves will close clockwise (right), open counter-clockwise (left), and be equipped with a non-rising stem and standard 2-inch square-operating nut. The tapping valve will be flanged (FL) X mechanical joint (MJ) with the manufacturer's gaskets. Tapping valves will meet or exceed all of the requirements for resilient wedge gate valves above.

All tapping sleeves for use on water mains 12-inch or less in diameter shall be constructed of Type 304 stainless steel. The branch of the tapping sleeve may be either extruded or welded to the tapping sleeve. All welds on the sleeve shall be fully passive to restore stainless steel characteristics. The flange shall be stainless steel with a recess to accept standard tapping valves. The flange shall conform to AWWA C207 Class D-ANSI 150-lb drilling. Bolt holes shall be aligned such that they straddle the pipe centerline. The sleeve will be equipped with a ¾-inch

stainless steel plug with a standard square head for hydrostatic testing. The gasket shall be of a 360-degree design and manufactured of gridded virgin GPR compounded for water service and complying with ASTM requirements. A 304 or 316 stainless steel armor shall be vulcanized to the gasket to bridge the gap between securing lugs. All bolts and nuts shall be 304 or 316 stainless steel with 5/8-inch National Coarse (NC) threads. The lifter bar shall be of adequate design to provide a heavy bearing surface for all nuts. Nlyatron GS washers shall be provided for lubrication. Approved tapping sleeves are Ford Fast (DOT) Model, JCM Model 432, Romac Model SST, or Mueller Model H304.

Sleeves for use on pipe 14-inch in diameter and larger will be ductile iron mechanical joint type. Approved types are Mueller H-615, American Series 2800, or U.S. Pipe T-9.

8.2.3 Cast Iron Valve Box and Lid

An adjustable two-piece screw-type asphalt-dipped cast iron valve box and heavy-duty drop-in lid rated for HS25 loading shall be provided for all valves larger than 1-inch. All valve boxes and lids shall be manufactured in the U.S.A. Lids shall be labeled WATER, SEWER, or RECLAIMED, depending on the valve application. Valves boxes in high traffic areas, as determined by the City, shall have a drop-in lid with an extra-deep 4-inch skirt. Approved valve box products include Tylor Union Model 6850, Bingham and Taylor Model 4905, and EJ Foundry Model 8550. Approved valve box lids for high traffic areas include Bingham and Taylor Model 4905-L4 and EJ Foundry Model 6800(4).

8.2.4 Potable Water and Reclaimed Water Services

All brass or bronze components shall be designed and manufactured in accordance with AWWA C800. Metal surfaces in contact with potable water shall be "lead free" and conform to UNS C89833, according to the latest revision of the Reduction of Lead in Drinking Water Act, 2011.

8.2.4.1 Service Taps and Saddles

8.2.4.1.1 1-Inch Water Service Taps

For water service taps on DI and CI pipe, direct taps shall be allowed. Taps shall be made to receive a male AWWA Tapered (CC) thread pattern corporation stop.

For water service taps on PVC and AC, a service saddle with a single 2-inch wide stainless steel band or strap shall be furnished. The saddle shall be of ductile iron and with an epoxy, nylon, or PE coating (10 mils minimum) and have a

female AWWA Taped (CC) thread pattern. Approved styles are Ford FC101, Romac 101N, Smith-Blair #315, JCM #405, or Cascade Model CNS1. No substitutes will be allowed.

For water service taps on HDPE pipe, an electro-fusion tapping tee (EFTT) shall be used. EFTT's shall have brass cutting teeth and CTS butt outlets and shall be NSF approved for potable water use, tested in accordance with AWWA C906, and approved for use on PE3408/PE4710 HDPE pipe. Approved styles include EFTT's as manufactured by Georg Fischer Central Plastics, or approved equal.

8.2.4.1.2 1-1/2 and 2-Inch Water Service Taps

For all 1½-inch and 2-inch water service taps, a more stable saddle is required. Saddles for these taps shall have multiple stainless steel straps for a minimum combined strap width of 3¼-inches. The saddle body shall be ductile iron and with an epoxy, nylon, or PE coating (10 mils minimum). Approved styles are Ford FC202, Romac 202N, Smith-Blair #317, JCM #406, and Cascade Model CNS2. No substitutes will be allowed.

8.2.4.2 Service Valves

Inlet and outlet connections for service valves shall be as shown in Table 8.1.

Table 8.1 – Water Service Valves Connection Requirements				
Service Size (inches)	Corporation Stop		Curb Stop	
	Inlet	Outlet	Inlet	Outlet
1	AWWA Taper / CC	CTS	CTS	FPT
1.5	FPT	FPT	CTS	FPT
2	FPT	FPT	CTS	FPT

8.2.4.2.1 Corporation Stops

Except for HDPE water mains, all water service taps shall be made using a brass or bronze quarter-turn ball-type valve at the connection to the main.

For 1-inch services, approved products include Ford FB1000-4, A.Y. McDonald #74701B-22, and Mueller 300™ P-25008N. No substitutions are allowed.

For 1½-inch or 2-inch services, with the valve shall be provided with a 2-inch square operating nut and installed with a valve box. Approved valves include

Ford #B11-XXX, A.Y. McDonald #76101, and Mueller B-20200. No substitutes are allowed.

For services on HDPE water mains, the corporation stop shall be an integrated valve contained within the electro-fusion tapping tee.

8.2.4.2.2 Curb Stops

Curb stops for all water service taps shall be made using a brass or bronze quarter-turn ball-type valve at the terminal end of the water service prior to the meter setting. All brass or bronze components shall be designed and manufactured in accordance with AWWA C800. Metal surfaces in contact with potable water shall be “lead free” and conform to UNS C89833, according to the latest revision of the Reduction of Lead in Drinking Water Act, 2011.

Approved products include Ford B41-XXX-W, A.Y. McDonald #76102-22-W, and Mueller 300™ P-25170N. No substitutions are allowed.

Inlet and outlet connections shall be as shown in Table 8.1.

8.2.4.3 Service Tubing

For 1-inch through 2-inch potable water and reclaimed water services, the service piping shall be either Type “K” copper tubing or high density polyethylene tubing. All joints shall be either fusion-welded or compression type. No flared or solder (sweat) joints shall be allowed.

Polyethylene services shall be HDPE DR9 (CTS) and shall be manufactured from a PE4710 resin listed with the Plastic Pipe Institute and meet or exceed all applicable requirements of AWWA C901, latest version. The exterior color shall meet APWA color coding requirements for the application – blue for potable water, purple for reclaimed water. It shall have a clear virgin high density polyethylene center. HDPE services shall be NSF approved for potable water use. The tubing shall have a UV protection and shall not be affected by direct sun light. It shall have a minimum working pressure of 200 PSI, or greater. Other than the connections at the corporation stop and curb stops, there shall be no fittings or joints in the water service piping from the main to the curb stop.

Service piping must comply with County and FDOT requirements when installing under roadways or easements of their jurisdiction.

8.2.4.4 Meter Settings

8.2.4.4.1 5/8-inch and 1-inch

All 5/8-inch and 1-inch water and reclaimed water meter settings shall include a meter yoke assembly with an angle valve inlet, standard expansion connection, and straight ball valve outlet.

Inlet and outlet connections for 5/8-inch and 1-inch meter setting valves shall be as shown in Table 8.2.

Service Size (inches)	Angle Key Valve		Customer Valve	
	Inlet	Outlet	Inlet	Outlet
1	CTS or FPT	Yoke	Yoke	FPT

Approved products for 5/8-inch and 1-inch water and reclaimed water meter settings shall include the following components:

5/8-inch Meters				
Manufacturer	Yoke	Angle Valve	Expander	Cust. Valve
Ford	501	AV19-313W	EC-1	B91-213W
Mueller	H5010	B-24278-N	H14234-1	B-24360-N
A.Y. McDonald	14-1	74644BY	714-1EHG	76101WY
1-inch Meters				
Manufacturer	Yoke	Angle Valve	Expander	Cust. Valve
Ford	504	AV19-444W	EC-4	B91-444W
Mueller	H5040	B24278-N	H14234-4	B-24360-N
A.Y. McDonald	14-4	74644BY	714-4EHG	76101WY

The product information above is intended to provide the Contractor with the approved manufacturers and model numbers of required meter setting components. In some instances, the Contractor must also provide the required component size information when ordering. The Contractor shall verify that all components are provided with the correct size connections for the meter setting application for which it is intended.

For 5/8-inch and 1-inch water and reclaimed water meter settings in non-deliberate and incidental traffic loading areas, a 12-inch x 17-inch x 12-inch deep flared rectangular solid plastic meter box and lid with AMR/AMI recessed hole shall be used. The meter box shall be constructed of solid polypropylene with UV inhibitors for sunlight protection. Approved products include DFW Plastics Series 1200 TT, or approved equal.

8.2.4.4.2 Meter Settings (1.5-inch and 2-inch)

All 1.5-inch and 2-inch water and reclaimed water meter settings shall include flanged meter assembly with bypass. Bypass configuration may be horizontal or vertical, depending on available space, and shall include a lockable ball-valve. Piping, fittings, and valves shall be lead-free brass/bronze, Type 304L stainless steel, or Schedule 40 galvanized iron.

Inlet and outlet connections for 1.5-inch and 2-inch meter setting valves shall be as shown in Table 8.4.

Service Size (inches)	Angle Key Valve		Customer Valve		Bypass Valve	
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
1.5	FPT	Flange	Flange	FPT	Flange	Flange
2	FPT	Flange	Flange	FPT	Flange	Flange

8.2.5 Tracer Wire

All distribution and transmission system appurtenances shall have a continuous reinforced copper tracer wire secured to the pipe to prevent separation during and after installation. The tracer wire and splices shall be the same as that specified for distribution and transmission system piping.

8.2.6 Dry Barrel Fire Hydrants

All fire hydrants shall fully comply with all provisions of AWWA C502, latest edition. Hydrants shall be the dry barrel type, which prevents the operating threads from coming into contact with the service water. Hydrants shall be of the compression type, opening against the line pressure and closing with the line pressure. Hydrant and piping shall be laid at accurate grade as specified on the Plans/Drawings.

Approved models are Mueller A423, or M.H. Reliant 929, and Clow Medallion. No substitutes will be allowed.

Hydrant specifications:

- a. The hydrant shall be equipped with weather bonnet/shield to protect the operating nut.
- b. A grease or oil reservoir and lubrication system that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated shall be provided. The lubrication system shall be completely sealed from the waterway by O-ring seals.
- c. The hydrant barrel shall be the traffic breakaway type with a safety stem coupling and frangible segments that permit full 360 degree rotation of the nozzle.
- d. Main valve opening of the hydrant shall not be less than 5 ¼ inches and shall open clockwise (turn to right looking from top).
- e. Hose threads and steamer threads shall be National Standard threads. Hydrants shall be supplied with a factory installed Storz connection on the steamer with an aluminum or aluminum alloy blind flange that will hold water pressure without leaking. All nozzle caps shall be furnished with a flat gasket to prevent leaking.
- f. The hydrant shall be designed to permit the removal of all working parts from the hydrant up through the barrel without disturbing the earth around the hydrant or disassembling the barrel.
- g. An all-bronze hydrant valve seat ring shall thread directly into an all-bronze drain ring and shall be located between the lower hydrant barrel and base securely retained in the position, or it may be threaded into a heavy bronze bushing in the hydrant base. The valve seat ring and drain ring shall have no less than two bronze drain ports and two bronze drain outlets.
- h. The hydrant shall be designed with an anti-friction bearing, so located that it will reduce the torque required to operate the hydrant.
- i. Operating nut and nozzle cap wrench nut shall be National Standard type.
- j. All hydrants shall be shop tested in accordance with AWWA C502 (latest revision).
- k. The interior of the hydrant shoes shall be located with a fusion-bonded epoxy coating of at least 6 mils.
- l. Hydrant exterior shall be painted with two coats of high visibility yellow enamel paint.

8.2.7 Air Valves

Combination air valves shall be provided, as needed, to protect the distribution and transmission system piping. The "air release" component shall be designed to automatically release small pockets of air to the atmosphere as they accumulate along a pipeline or piping

system when it is full and operating under pressure. The “air and vacuum” component shall be designed to automatically discharge or admit large volumes of air during the filling or draining of a pipeline or piping system. This valve will open to relieve negative pressures whenever water column separation occurs.

The Contractor shall notify the City of any deviations from the proposed pipeline profile during construction so that the air valve design can be reviewed and adjusted, if needed, to accommodate the actual installation conditions.

Each air valve assembly shall include all pipe, valves, fittings, structures, enclosures, and vent pipes. Each assembly shall be equipped with a manual blow-off, either integral to the air valve or connected to tee between the pipeline and the air valve. The blow-off size shall be determined by the Engineer; however, the minimum blow-off size shall be 2-inches.

Combination air valves for sewage and effluent (non-public access reclaimed water) applications shall be specifically designed to operate with liquids carrying solid particles. The combination air valve shall be made with a composite body and select corrosion-resistant polymer and stainless steel internal operating parts. The combination air valve shall be rated for a working pressure range of 3 PSI to 150 PSI, with a test pressure rating of 250 PSI. Approved products include A.R.I. Model D-Series, or approved equal.

Combination air valves for potable water and reclaimed water (public access) applications shall be specifically designed to operate with clear liquids (no solid particles). The combination air valve shall be made with an epoxy-coated ductile iron body and select corrosion-resistant polymer and stainless steel internal operating parts. The combination air valve shall be rated for a working pressure range of -3 PSI to 285 PSI. All valves shall be NSF Approved for potable water applications. Approved products include A.R.I. Model D-Series, or approved equal.

8.2.8 Check Valves

Check valves shall be the rubber flapper swing check type, designed to minimize slamming during the rapid reversal of flow in the piping system. All check valves shall fully comply with all provisions of AWWA C508, latest edition, and shall be rated for a cold working pressure of 250 psi. All internal check valve components shall be capable of being replaced without removing the valve body from the piping system.

The check valve body shall be ductile iron meeting ASTM A536, Gr. 65-45-12. The check valve seating component shall be mounted at a 45-degree angle to the centerline of the pipe with a full flow opening equivalent to the pipe flow area. The valve disc shall be Buna-N rubber encapsulated steel disc flapper with a maximum swing opening angle (disk stroke) of

35-degrees. The check valve body exterior and interior shall be coated with fusion-bonded epoxy. For potable water applications, the interior epoxy surface in contact with water shall be NSF-61 approved. For sewage applications, all exposed bolts for mounting and maintenance shall be stainless steel.

The check valve shall be equipped with a visual disk positing indicator and proximity/limit switch sensor with SCADA compatible output signal. Approved products include Val-Matic® - Surgebuster® Check Valve; DeZurik, Inc. – APCO CRF-100 Rubber Flapper Swing Check Valve; or approved equal.

8.3 Execution

8.3.1 General

Distribution and transmission system valves and appurtenances shall be installed in conjunction with the distribution and transmission system piping, and in accordance with the specifications that govern its installation.

Care shall be taken in storing, loading, transporting, and unloading valves and appurtenances to prevent damage. All items shall be handled according to the manufacturer's recommendations. All items shall be examined before installing, and no piece shall be installed which is found to be damaged or defective. Any damaged or defective items shall be repaired or replaced as directed by the Engineer. All items shall be subjected to a careful inspection just prior to being laid or installed. If any defective items are discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the City.

All items shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed, shall conform to the lines and grades required.

8.3.2 System Valves

All distribution and transmission system valves shall be restrained to pipe and fittings. All valves shall be set and jointed to the pipe in the proper locations as specified on the Plan.

8.3.3 Tapping Sleeves and Valves

All tapping valves and sleeves shall be hydrostatically tested prior to making the tap. Tap shall be installed horizontal to the water main. Proper equipment to install the tap shall be on-site prior to beginning the Work. Coordinate with the City Inspector regarding connection to the existing City water system with a minimum of 48 hours notification prior to tie-in. The City

reserves the right to delay the tap if, in the City's opinion, the proper equipment is not on-site. No hand powered tapping is allowed for taps larger than 2-inch.

8.3.4 Cast Iron Valve Box and Lid

All distribution and transmission system valves larger than 1-inch shall be installed with a two-piece adjustable cast iron valve box and lid in accordance with the Standard Construction Details. The valve boxes and lids shall be installed so as not to transmit shock or stress to the valve or pipe. Valve boxes will be centered on the operating nut and plumb with the finished surface, unless otherwise indicated on the Plan.

For valves located in paved roadways, the valves shall be left temporarily below the finished grade until final pavement is installed.

Take additional precautions when installing clusters of valves at tees and crosses so as to achieve proper compaction of backfill material between the valve boxes.

8.3.5 Potable Water and Reclaimed Water Services

8.3.5.1 Service Saddle & Taps

All service taps and service saddles shall be installed in accordance with the Standard Construction Details and the manufacturer specifications.

All 1-inch taps on ductile iron pipe shall be direct taps, and shall be made to receive an AWWA Tapered (CC) thread pattern corporation stop. All other sizes and materials will be tapped with a saddle. All service taps on DI, PVC, AC, and CI, will be located at 9:00 or 3:00 on the circumference of the pipe. Service taps on HDPE using electrofusion tapping tee will be located at 12:00 on the circumference of the pipe.

All taps shall be made under pressure. Pipe thread compound or Teflon® tape shall be used on all threaded connections.

8.3.5.2 Service Valves

Valves shall be installed per manufacturer's recommendations and according to the plans and specifications. A roadway valve box shall be provided for every valve larger than 1-inch corporation stops. The valve box shall be installed so as not to transmit shock or stress to the valve, main, or service piping. Valve boxes will be centered on the operating nut and plumb with the paved surface, unless otherwise indicated on the drawings.

Ensure that all corporation stops and electrofusion tapping saddles are in the open position upon completion of the work.

8.3.5.3 Service Tubing

Allowance for any possible movement in the main will be made by making a half loop in the service tubing at the tap.

No repair couplings will be allowed on new services. If a new service is damaged during construction, it shall be removed and a new service shall be installed.

8.3.5.4 Meter Settings

Meter settings shall be made in accordance with the Standard Construction Details. Provide adequate spacing around meter setting to make repairs without damage to sidewalks, driveways, walls, irrigation plumbing, or other features.

If a meter is not going to be set at the time of construction of the service line, then a 3M™ EMS Full-Range Marker – Water 1252 buried water marker and an above-ground service marker will be placed at the end of the service line. The above-ground marker will be constructed out of ½-inch schedule 40 PVC or Fiberglass strips and will meet APWA color coding requirements for the utility application. The marker shall be installed to a minimum height of 36-inches above grade, with a tee or anchor to hold it in place.

8.3.5.5 Meter Manifold

Any manifold greater than two meters shall be installed by the contractor. There shall be a maximum of five (5) ¾-inch meters per manifold on 1½-inch service lines, and a maximum of ten (10) ¾-inch meters per manifold on 2-inch service lines. All water meters must be located in green space (i.e., not under pavement, sidewalk, etc.) and must be located at least 5 feet from all building foundations.

8.3.6 Dry Barrel Fire Hydrants

Hydrants shall be installed with uppermost breakaway joint at or above ground level, but no more than 2-inches above ground level. The Storz connection shall face the nearest access roadway and shall be a minimum of 18-inches above grade. There shall not be any scallop or mound around the hydrant at finished grade.

Hydrant shall be provided with extension kit where necessary to adjust level of breakaway joint.

Connection between hydrant and main shall be straight ductile iron pipe. All joints shall be restrained from the main to the hydrant. A tracer wire shall be installed from the main to the breakaway flange on the hydrant and be visible. The tracer wire is to be a continuous loop or spliced per specifications to the tracer wire on the main.

Backfill around hydrant shall be compacted to 100% of maximum density as determined by ASTM D698 (Standard Proctor Density). Density testing shall meet the same requirements as backfill under roadway pavement.

8.3.7 Air Valves

Combination air valves for use in distribution and transmission system piping shall be constructed and installed in accordance to the Standard Construction Details, and as shown on the plans. All structures (manholes, vaults, and boxes) shall be constructed so that the top is flush with finished paved surfaces, and slightly (1 to 3-inches) above grade where structures are located in green spaces.

8.3.8 Thrust Restraints

Restraining gaskets and/or mechanical thrust restraints shall be used to provide resistance to thrust forces generated in pressurized pipelines at all valves, bends, tees, reducers, and caps or plugs. The length of restrained pipe on each side of the valve and/or fitting shall be sufficient to provide adequate resisting force to prevent separation of the pipe joints and fittings.

The minimum number of restrained joints required for resisting thrust forces shall be determined by the pipe size, material, type of valve or fitting, operating conditions, pipe trench, and soil type. Minimum restrained lengths for many typical applications are provided in the Standard Construction Details, which have been calculated for various pipe material and fittings based on the following minimum design parameters:

Soil Designation: Good Sand (Unified Soil Classification: Type SM)
Safety Factor: 1.5
Trench Type: Type 2
Depth of Bury: 3 Feet
Test Pressure: 150 PSI

Any variations from the minimum restrained lengths provided in the Standard Construction Details and the design parameters above shall be requested in writing by an active Florida Licensed Professional Engineer, in good standing with Florida Board of Professional Engineers. Such requests shall include suggested changes to design parameters, supporting

documentation, and new restrained length calculations, signed and sealed by the Professional Engineer.

Where concrete thrust blocks are required in addition to, or in lieu of, restraining gaskets and/or mechanical restraints, then the thrust blocks shall be sized and installed in accordance with these specifications and the Standard Construction Details.

Concrete thrust blocks shall have a load bearing area sufficient to resist the thrust forces at all valves and pipe fitting. Thrust forces shall be calculated using the same design criteria as for restrained lengths above. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Joints shall be protected by felt roofing paper or plastic sheeting prior to placing concrete thrust block. Wooden side forms shall be provided to achieve the required shape for concrete thrust blocks.

8.3.9 Pressure Tests of Distribution and Transmission Valves and Appurtenances

Hydrostatic pressure tests shall conform to Section 4 of the AWWA C600 latest edition, with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.

The pressure required for the field hydrostatic pressure test shall be made at 150 psi. Provide temporary plugs and blocking necessary to maintain in the required test pressure. Wash stands at least 2-inches in diameter, pipe riser, and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least 2 hours. All leaks evident shall be repaired. Distribution and transmission system piping, valves, and appurtenances that fail pressure tests shall be repaired and retested as necessary until test requirements are satisfied. Defective valves and appurtenances shall be removed and replaced at no additional cost to the City.

The piping systems, valves and appurtenances shall be tested in such sections, as may be directed by the Engineer, by shutting valves or installing temporary plugs, as required. The piping system, valves and appurtenances shall be filled with water, all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor.

Remove and adequately dispose of all blocking material and equipment after completion and acceptance by the field hydrostatic test, unless otherwise directed by the Engineer. Repair any damage to the pipe coating. Distribution and transmission system piping, valves, and appurtenances shall be totally flushed and cleaned prior to final acceptance.

The City shall be notified 24 hours in advance of any testing.

8.3.10 Disinfecting Potable Water Valves and Appurtenances

Before being placed in service, all potable water system valves and appurtenances shall be chlorinated in accordance with AWWA 651 latest edition, "Standard Procedure for Disinfecting Water Mains". The procedure shall be approved by the City. The location of the chlorination and sampling points will be determined by the City in the field. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.

The disinfection procedures shall be as specified for distribution and transmission system piping.

END OF SECTION 8

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9.1 General

9.1.1 Scope of Work

Supply all labor, equipment, materials and incidentals necessary to install, test, and place into operation all new sanitary sewer system manholes, piping, fittings, laterals, and related appurtenances as shown on the drawings and as specified herein. This specification **does not** cover the rehabilitation of existing sanitary sewer system manholes, piping, fittings, laterals, and related appurtenances.

9.1.2 Submittals

Submit shop drawings to the City for review showing the manufacturer's drawings and specifications indicating complete details of all items. The details shall include material specifications, pressure class, certifications, joint types, gasket information, linings, coatings, installation and testing procedures, and other pertinent information necessary to assure that the proposed materials comply with all aspects of these technical specifications. The shop drawings shall be submitted to the Engineer for approval before fabrication and shipment of these items. The City shall not be responsible for items procured by the Contractor that have not been reviewed and approved through this submittal process.

9.1.3 Acceptance of Work

Until such time the City has formally accepted ownership and maintenance responsibility of the sanitary sewer collection system infrastructure, the Contractor/Developer will be solely responsible for locating, maintaining, protecting, and repairing damage (if necessary), regardless of the cause of damage, the sanitary sewer system. The Contractor/Developer will be notified of acceptance in accordance with the guidelines outlined in the contract documents.

9.1.4 Manufacturer Testing of Manholes, Pipe, and Fittings

All manholes, pipe, fittings, and appurtenances shall be domestic manufacture, and shall be inspected and tested at the foundry, as required by the standard specifications to which the material is manufactured.

Inspection of the quality and condition of all materials shall be made at the site after delivery. Damaged or defective items shall be subject to rejection, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once and replaced at the Contractor's expense.

9.2 Products

9.2.1 General

All sewer mains shall be a minimum of 8-inch in diameter.

For gravity sewers to a maximum depth of 16 feet, as measured from finish grade to the flow line (invert) elevation, polyvinyl chloride (PVC) pipe or ductile iron (DI) pipe may be used, unless otherwise indicated on the drawings. For depths greater than 16-feet (as measured above), thick-wall PVC or ductile iron pipe may be used. For shallow depths with less than 30 inches cover, as measured from finish grade to the top of pipe, only ductile iron pipe shall be used.

9.2.2 Ductile Iron Pipe

All ductile iron pipes shall be designed in accordance with the latest version of ANSI/AWWA C150/A21.50 for a rated water working pressure according to Table 9.1, which shall be adequate for the rated working pressure plus a surge allowance of 100 psi, using a 2-to-1 factor of safety on the sum of working pressure plus surge allowance.

Nominal Pipe Size (inches)	Pressure Class* (PSI)	Nominal Pipe Size (inches)	Pressure Class* (PSI)
8	350	20	250
10	350	24	250
12	350	30	250
14	250	36	250
16	250	42	250
18	250	48	250

*The minimum pressure class indicated in the table above is for gravity sewer installations under normal installation and loading conditions. The Engineer of Record shall determine if field conditions warrant a higher pressure class pipe due to special installation conditions or risk factors (i.e. shallow cover, utility clearance, and/or excessive external loading conditions).

Ductile iron pipe shall be manufactured in the U.S.A. in accordance with the latest revision of ANSI/AWWA C151/A21.51. Each pipe shall be subjected to a hydrostatic pressure test at the point of manufacture. Coatings and linings shall be as required for the intended application, per this specification. Approved products include American (Cast Iron Pipe Co.), U.S. Pipe, and McWane (Cast Iron Pipe Co.).

Ductile iron pipe for installation below ground shall be supplied in nominal lengths no greater than 20 feet and shall be furnished with push-on type joints, such as "Tyton" or "Fastite," unless otherwise shown on the drawings. Rubber gasket joints for ductile iron pipe push-on type joints

shall conform to ANSI/AWWA C111/A21.11, latest revision. Joints shall be in accordance with the latest revision of ANSI/AWWA C111/A21.11, or latest revision, and be furnished complete with all accessories, including restraints when necessary.

The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe; additionally, the manufacturer's mark, country where cast, year produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

9.2.3 Ductile Iron Fittings

All ductile iron fittings shall be manufactured in the U.S.A. in accordance with the latest version of ANSI/AWWA C110/A21.10 or C153/A21.53.

All ductile iron sanitary sewer collection system fittings for installation below ground shall be mechanical or push-on type joint ductile iron fittings. Rubber gasket joints for mechanical joint type ductile iron fittings shall conform to ANSI/AWWA C111/A21.11, latest revision.

Approved ductile iron fitting manufacturers include Tyler Union, Star Pipe Products (U.S.A.-Domestic), or approved equal.

No service saddles will be allowed for new sewer collection system pipe installations. Transition fitting and adapters shall be suitable for the materials supplied.

9.2.4 Linings & Coatings for Ductile Iron Gravity Sewer Pipe and Fittings

Unless explicitly allowed within this specification, all interior linings and exterior coatings (including primers) shall be applied by a certified applicator at the foundry or certified application facility. All surfaces shall be prepared in accordance with the manufacturers' recommendations for the intended environment and the product(s) to be applied.

For sanitary sewer applications, line the interior surface of all ductile iron pipe and fittings to a minimum thickness of 40 mils (DFT) with a high solids (97% minimum) coal-tar free ceramic epoxy. Approved products include Tnemec Series 431 Perma-Shield PL or Permite Permax-CTF. For buried applications, coat the exterior surface of all buried fittings with a 1.0 mil thick asphaltic coating in accordance with ANSI A21.51. For exposed or above-ground applications, coat the exterior surface with an epoxy primer to a thickness of 5 mils and apply a top coat of epoxy to a minimum thickness of 15 mils. Approved primer and top coat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 435 Perma-Glaze (top coat), or approved equals. The top coat only may be field-applied by an experienced applicator and allowed to cure before installation..

9.2.5 Polyvinyl Chloride (PVC) Pipe

PVC sewer pipe and fittings are approved materials for 4-inch to 15-inch installation of sanitary sewer collection system components, when other materials are not specifically required. For pipes larger than 15-inch, ductile iron sewer pipe shall be used. PVC shall not be used in above ground applications.

All PVC sewer pipe and fittings shall be manufactured in the U.S.A. from extra strength polyvinyl chloride pipe conforming to ASTM D3034, and shall meet or exceed the requirements of ASTM D1784, Type 1, Grade 1 (12454-B). Standard PVC pipe for gravity sewer applications shall be DR26. Thick-wall PVC for installation depths greater than 16-feet shall be C-900, DR18. All PVC pipe for sanitary sewers and laterals shall be colored green. Approved PVC sewer pipe manufacturers include JM Eagle Corp., National Pipe & Plastics, North American Pipe Corp., and Diamond Plastics Corp. Approved PVC sewer fittings manufacturers include GPK Products, Inc., Multi Fittings Corp., as well as those manufactured by approved sewer pipe manufacturers.

PVC sewer pipe shall be supplied in nominal standard laying lengths no greater than 20 feet (+/- 1-inch) and shall be furnished with push-on type joints in compliance with ASTM D3212 and Rieber® gaskets conforming to ASTM F477, and be furnished complete with all accessories, including restraints when necessary. No solvent-cement joints will be allowed.

No service saddles will be allowed for new sewer collection system pipe installations. Transition fitting and adapters shall be suitable for the materials supplied.

All PVC materials shall be stored and handled in accordance with the manufacturer's specifications and shall not be stored in direct sunlight. PVC pipe and fittings, which show signs of ultraviolet degradation/sun exposure/discoloration, will not be considered for use.

9.2.6 High Density Polyethylene (HDPE) Pipe

HDPE pipe is an approved material for all 4-inch to 12-inch installation of sanitary sewer collection system components, when other materials are not specifically required. For pipes larger than 12-inch, PVC or ductile iron sewer pipe shall be used, as specified. HDPE shall not be used in above ground applications.

All HDPE pipe shall be manufactured in the U.S.A. using PE4710 resin and shall conform to the latest version of AWWA C906, "Polyethylene (PE) Pressure Pipe and Fittings, 4-inches through 63-inches, for Water Distribution and Transmission." Approved HDPE sewer pipe manufacturers included JM Eagle Corp., ISCO Industries, and Performance Pipe.

HDPE pipe for gravity sewer applications shall be iron pipe size (IPS) with a wall-thickness dimension ratio (DR) of 17, and a minimum pressure rating of 125 PSI. All HDPE pipe shall be

manufactured with a UV inhibitor to protect the pipe from degradation in direct sunlight. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specifications from the same raw material. The pipe shall be free of visible cracks, holes, foreign inclusions, voids or other injurious defects including discoloration. There shall be continuous color stripes along at least two opposite sides of the pipe exterior (preferably at the 3 and 9 o'clock positions) to identify the intended use of the pressure pipe. Stripe colors shall be GREEN for sewer applications.

Fusion-weld all HDPE pipe joints and shave the interior weld bead flat so that gravity flow is unobstructed.

HDPE pressure pipe that is gouged, scraped, or otherwise damaged resulting in a loss of at least ten percent of the pipe wall thickness shall not be used.

9.2.7 Pre-cast Concrete Manholes

9.2.7.1 General

Sanitary sewer manholes shall conform to ASTM C478 – "Standard Specification for Precast Reinforced Concrete Manhole Sections," latest revision. Concrete for precast manhole structures shall conform to ASTM C94, Type II cement, with a comprehensive strength of 4,000 psi. Manhole sections shall be allowed to properly cure within approved methods prior to removing forms, painting, and shipping structures. The date of manufacture and the name of the manufacturer or trademark shall be clearly marked on the outside of each pre-cast section when the form is removed and on the inside after painting.

Each pre-cast section shall have lifting holes capable of supporting the weight of the section. These holes shall be a maximum of 3½ inches deep and not penetrate the interior wall of the structure. The diameter of the lifting hole shall accommodate a min of 1½ inch lifting pin.

Sanitary sewer manholes shall be constructed as watertight structures from the bottom-most section and base to the top section and manhole access frame.

9.2.7.2 Manhole Joints

Precast manhole sections shall come standard with bell and spigot joints installed in the spigot-down orientation. Joints shall be sealed with an asphalt-based preformed flexible joint sealant in accordance with ASTM C990. Approved preformed flexible joint sealants include Henry Co. – RAM-NEK (RN103), Concrete Sealants, Inc. – ConSeal 102; or approved equal.

All outside manhole joints shall be sealed with self-adhesive rubber-asphalt based external concrete joint wrap. The wrap shall be a minimum of 6-inches wide. Approved products are Henry Co. – RUB’R-NEK (RU116); Concrete Sealants, Inc. – ConWrap; or approved equal.

9.2.7.3 Manhole Base and Riser Sections

The manhole base and first riser section shall be monolithic and supplied with a spigot-down or “female” joint orientation to mate with the precast barrel sections in a spigot-down orientation. The diameter of the manhole base and first riser section shall be determined by the sewer pipe diameter according to Table 9.2.

Table 9.2 – Manhole Base Sizes			
Largest Gravity Sewer Pipe Diameter (inches)	Manhole Base and First Riser Section		
	Inside Diameter (inches)	Min. Wall Thickness (inches)	Min. Base Thickness (inches)
8 - 15	48	5	6
18 - 24	60	6	8
27 - 42	72	7	8

9.2.7.4 Straddle or “Doghouse” Manhole Section

The straddle or “doghouse” manhole section will be fabricated in the same manner of the regular precast concrete manhole sections, except that formed openings will be provided in the base and walls to fit over the existing sewer piping.

9.2.7.5 Manhole Top Sections

Standard manhole top sections shall be eccentric cones vertically aligned with the centerline of manhole outfall pipe connection to the manhole. Where cover over the top of the gravity sewer pipe is less than 4 feet, the manholes shall have vertical walls with a flat precast concrete slab top with an offset manhole access opening vertically aligned with the centerline of manhole outfall pipe connection to the manhole. Precast concrete slabs over top section, when required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO HS25 loading.

The top elevation of eccentric cones or top slabs shall be set between 3 inches and 18 inches below bottom of manhole cover frame. It is the intent of this specification to provide a minimum of 3-inches to accommodate future grade changes without

disturbing manhole structure. Manhole grade adjustment rings shall be used to bring the manhole ring and cover flush with final grade.

Certain applications may require the ring and cover to be pre-cast into the top slab to allow for a flush surface. In these applications, the orientation of the ring and cover on the flat top component may be centered or offset as required by the manufacturer.

9.2.7.6 Manhole Grade Adjustment Rings

Manhole grade adjustment rings shall not be used for more than 18-inches of vertical adjustment. **No bricks will be allowed for manhole adjustments.** Grade adjustment rings may be tapered to achieve a finished manhole level with the road slope and shall be sized to accommodate the manhole frame and cover without restricting access opening. All grade adjustment rings shall be +/- 1/16-inch from required nominal dimensions and shall be designed for use with AASHTO HS-25 heavy-duty street traffic loading.

Manhole grade adjustment rings shall be precast concrete, injection molded HDPE, or ultra-high density rubber/rubber composite and shall be of uniform quality and free from cracks, holes, and any other surface defects. Seals between grade rings, manhole top, and frame shall be made with an ASTM C990/AASHTO M198 approved preformed 3/8-inch round butyl rubber adhesive sealant, unless otherwise directed by the manufacturer.

Precast concrete grade adjustment rings shall be a minimum of 3-inches thick and have one 6 Ga. or thicker continuous reinforcing wire. Approved HDPE grade adjustment ring products include Ladtech, Inc. – Ladtech System Manhole Adjustment Rings. Approved rubber/rubber composite grade adjustment ring products include EJ Foundry – Infra-Riser or Hamilton Kent, LLC. – Lifespan® Adjustment Riser.

Manhole grade adjustment rings shall be installed in accordance with the specifications and the manufacturer's recommendations.

9.2.7.7 Manhole Access Frame and Covers

All frame and cover castings shall be manufactured in the U.S.A and shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections.

All manhole covers shall have heavy-duty design load classifications. Covers shall be provided with pick holes that do not penetrate through to the inside of the manhole, and provided with the lettering according to the Standard Construction Details.

For standard manhole installations, where the manhole access cover finished elevation is flush to or within 6-inches of finished grade, manhole access frames and covers shall be two separate pieces. Manhole frame and covers shall be gray cast iron conforming to ASTM A48 – Class 35B and produced in accordance with AASHTO M306. Manhole frames shall have a minimum clear opening of 22½ -inches. Approved standard manhole frame and cover products include EJ Foundry – Model 1338; or U.S. Foundry – Model USF 170 w/ Type DY cover.

For raised manholes installations, where the manhole access cover finished elevation is above finished grade by more than 6-inches, the manhole frame and cover shall be a 120-degree hinged opening assembly with 90-degree blocking system to prevent accidental closure. Manhole frames shall be gray cast iron conforming to ASTM A48/AASHTO M105 – Class 35B and produced in accordance with AASHTO M306. Manhole covers shall be ductile iron produced in accordance with ASTM A536. The hinged manhole cover shall have a clear opening of 24-inches and shall be one-person operable. Approved raised manhole frame and cover products include EJ Foundry – ERGO Model 1040, or approved equal.

When approved by the City, structures in roadways requiring large access openings (such as air release valve manholes) may be provided with a large diameter composite manhole frame and cover. The frame and cover shall be manufactured of fiber-reinforced thermoset polymer resin with a molded non-skid texture. The composite frame and cover must meet HS25 load capacity and ASSHTO M306 proof-load testing requirements. The composite materials shall not be affected by common corrosive elements including H₂S sewer gas, petroleum products (oil, gasoline, diesel, and ethanol), de-icing solutions, and salt water. Approved products include GMI Composites, Inc. – Model 3800 Composite Frame and Cover, or approved equal.

Structures outside of the roadway requiring large access openings shall be provided with the same composite cover specified above, or with a rectangular polymer concrete box and cover. The polymer concrete boxes shall be open-bottom style, straight-wall boxes with bolted lids. The boxes may be stackable to achieve the desired depth. The complete assembly shall be rated for at least 20,000 pounds. Approved products include Highline Products – Model PHA3048xxH; Hubble, Inc. – Quazite® Tier 22 BOX, Model PG3048BAxx; or approved equal.

9.2.7.8 Manhole Finishes

The interior and mating surfaces of standard manhole shall be coated with 16 mils (DFT) heavy-duty coal tar epoxy coating containing not less than 74% (±2%) by volume

nonvolatile solids. Approved products include Carbolite Bitumastic 300M, or approved equal. This coating shall be self-priming, or applied with a primer as recommended by the manufacturer.

9.2.7.9 Manhole Linings

The interior of manholes with force main discharge connections, air release valves, or other high-corrosion applications, shall be lined with a protective coating to prevent sewer gas corrosion. Approved lining products include AGru America, Inc. – HDPE Sure Grip®; CCI Spectrum, Inc. – Spectrashield; GML Coatings, LLC. – Green Monster Liner; Quadex, Inc. – StructureGuard epoxy; or approved equal. These linings shall be applied in strict accordance with the manufacturer's recommendations by a certified installer.

9.2.7.10 Manhole Pipe Connections

Where pipes enter or exit manholes, flexible or resilient boot seals are required. Boot seals shall conform to ASTM C-923 – "Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals." Approved products include Trelleborg Pipe Seals Milford, Inc. – NPC Kor-N-Seal; A-Lok Products, Inc. – Z-Lok or Quik-Lok; or GU Florida, Inc. – GU Boot Hub.

9.2.7.11 Invert Flow Channels and Benches

Provide sewer manholes with an invert flow channel and bench. Shape the invert flow channel(s) to match the lower one-half of the connecting sewer pipe(s). Provide a smooth concrete finish without exposing aggregate when forming the invert flow channel and bench.

The width of the invert flow channel shall match the connecting sewer pipe diameter. Where the manhole outlet pipe is larger than the inflow pipe(s), the width shall be smooth tapered from a width matching the inlet pipe diameter, through the manhole, to width matching the outlet pipe diameter.

When the inlet pipe(s) crown elevation(s) match the outlet pipe crown elevation, the flow line elevation of the invert flow channels shall slope uniformly from each inlet connection to the outlet connection of the manhole. When the inlet pipe(s) crown elevation(s) do not match the crown elevation of the outlet pipe, but does not meet the criteria for requiring a drop connection, then the invert flow channel shall be uniformly sloped across the manhole from the outlet pipe invert elevation to an elevation equal to $0.25 \times D_i$ (where D_i is the incoming pipe diameter).

Form the elevation of the bench at the edge of the invert flow channel to match the spring line elevation of the connecting pipe(s). Slope the manhole bench from the edge of the flow channel upward and out to the manhole walls at a rate of 1-inch vertical to 12-inches horizontal (approximately 5 degrees).

Use pre-cast concrete invert channels and bench units conforming to ASTM C478, 4000-psi concrete for all manholes, unless specifically approved by the City. When approved, use FDOT Class I or Class II concrete for poured-in-place invert channels and benches.

Use FDOT Class I or Class II concrete for poured-in-place invert channels and benches on all straddle or "doghouse" manholes.

All terminal or "dead-end" manholes shall be provided with a full-length straight invert channel across the manhole.

Any deviations from this specification will require written approved equal by the City.

9.2.7.12 Drop Manhole Sections

An outside drop pipe will be provided for sewers entering a manhole at an elevation of 24-inches, or greater, above the manhole outlet pipe invert elevation. No drop connection shall be installed in the interior of the manhole. The manhole base, connection, and outside drop elbow shall be cast as a single unit, unless approved by the City. The entire drop connection (pipe, tees, and bends) shall be formed and encased in FDOT Class I Concrete.

9.2.7.13 Manhole Steps

NO MANHOLE STEPS SHALL BE ALLOWED.

9.3 Execution

9.3.1 General

It shall be the Contractor's responsibility to locate all underground utilities in advance of construction, and to identify and resolve any conflicts occur with the proposed line and grade. If approved in writing by the City, minor changes in the alignment, may be permitted to avoid conflicts with underground facilities. However, if a conflict is found between an existing utility and proposed grade, the Contractor is to furnish the City all pertinent information, so that remedial design can be performed.

Care shall be taken in loading, transporting, unloading, and storing pipe, fittings, manholes, and castings to prevent damage. Materials shall be handled according to the manufacturer's

recommendations. Sewer pipe shall not be moved using a forklift in the end of the pipe. All materials shall be subjected to a careful inspection just prior to being laid or installed, and no piece shall be installed which is found to be damaged or defective. Any damaged items shall be repaired or replaced, as directed by the City. If any damaged or defective items are discovered after it has been installed, it shall be removed and replaced with a new item, in a satisfactory manner, and at no additional expense to the City.

Set all survey grade stakes, lines, and levels for the construction of the sewer collection system in accordance with the design and survey information provided on the Plans. A land surveyor registered to practice in the State of Florida shall set all grades and alignment stakes for construction under this project and all costs thereof shall be borne by the Contractor. The requirements for this work to be accomplished by a registered land surveyor may be waived by the City in the event the Contractor desires to utilize his own personnel and furnish, in writing to the City, satisfactory evidence that his personnel are qualified to set the grade and alignment stakes. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes. Grade shall be verified at each manhole prior to the installation of additional pipe from that manhole. If a break in grade is detected the City shall be notified immediately.

Clear and grade all streets and easements to within 4-inches of the final grade prior to construction of the utility system.

Install sewer mains at a constant slope between manhole structures to the elevations shown on the Plans. No tangent pipe slope shall be less than the minimum slope outlined in the Design Specifications for the City of Tallahassee.

The method of pipe laying shall be subject to the approval of the City. Any main greater than 100-feet in length must be installed using a laser system designed for pipeline installation. The laser shall be capable of an accuracy of +/- 0.05%.

Manhole invert elevations shall not deviate more than 0.20-feet from design elevations. Manhole top elevations shall not deviate more than ¼-inches from finished roadway elevation or finished grade elevations, if outside of roadway. Centerline of manhole ring and cover shall not deviate more than 18-inches from designed horizontal location. Take extreme care to keep the pipe in exact alignment and elevation.

All sanitary sewer collection system piping shall be constructed to maintain the preferred separation requirements defined in Rule 62-555.314, F.A.C. Deviations from the preferred separation requirements shall be approved by the City in writing prior to installation. In all cases where sewer mains cross over or under water mains or storm drains, where a minimum clear distance between pipes is less than 18-inches, the sewer shall be ductile iron pipe or concrete

encased PVC pipe, for a distance of 10-feet to either side of point of crossing. There will be no sewer joint within 10-feet of the centerline of the water line or storm drain.

Dimensions of concrete encasement or pipe cradles shall conform to those shown on the Plans. Each pipe shall be supported on brick at two points to allow minimum thickness of concrete to be placed under pipe. Concrete shall be placed carefully around and over pipe to avoid displacement or floating of pipe. Trench shall be dewatered properly before placing of concrete. Backfill shall not be placed over poured-in-place concrete until 24 hours after pouring, unless authorized in writing by the City.

All trenches and excavations are to be kept dry and free from water at all times when work is in progress, and at no time is water to run through the sewer or its bedding material. All pipe and fittings shall be thoroughly cleaned before laying, and shall be kept clean until they are used in the work and placed into service. When laying is not in progress, including breaks, the open ends of the pipe shall be closed by watertight plug or other approved means.

Existing manholes are to be kept accessible at all times. (No stockpiling of materials, debris or equipment on top of the manholes).

9.3.2 Manhole Installation

9.3.2.1 General

Manholes located within an unimproved easement shall be installed with the final manhole frame and cover elevation a minimum of 18-inches above finish ground elevation. Manholes located within a landscaped easement shall be installed with the final manhole frame and cover elevation at finished grade unless, otherwise noted on plans. Manholes located within an unpaved roadway shall be installed with the final manhole frame and cover elevation at 12-inches below finished grade.

Within the limits of proposed street paving, manholes shall to be constructed such that the final manhole top section elevation is a minimum of 12-inches below the proposed finished grade shown on the Plans. During the roadway construction, after the base and structural asphalt courses are completed, manhole frame and cover shall be raised to match the finished road surface slope and elevation.

9.3.2.2 Inspection

All manhole sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. Imperfections may be repaired, subject to the approval of the City, after demonstration by the manufacturer that strong and permanent repairs will result. Repairs shall be carefully inspected before final

approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may also be utilized for repairs, subject to the approval of the City.

9.3.2.3 Manhole Base Installation

Excavate manhole trenches such that the precast manhole bottom is set on a level, stable, and unyielding subgrade. If in the opinion of the City, the natural soil is not capable of supporting the manhole structure, then over-excavate the manhole trench and use a compacted select fill or coarse aggregate bedding material to stabilize the subgrade such that it is stable and unyielding, and set the structure to the elevation shown on the Plans.

For large diameter manholes, and manholes where the bench and invert flow channel are not precast, form and pour the invert flow channel and bench using FDOT Class I or Class II concrete, and trowel the surfaces for a smooth concrete finish.

For straddle or "doghouse" manhole bases, the excavation for the structure shall be to a depth of 8 inches (minimum) below the invert of the existing pipe. After the structure has been installed, the formed base and wall openings shall be filled with FDOT Class II concrete. Once the base concrete is set and cured, the bench and invert flow channel shall be formed and poured around the spring line of the existing sewer pipe with FDOT Class I or Class II concrete, and trowel the surfaces for a smooth concrete finish.

The existing sewer pipe will remain intact until the sewer system has passed final inspection. Upon passing final inspection, the top half of the sewer pipe shall be cut from between the manhole walls (less 6-inches each side) flush to where the pipe spring line meets the bench. All rough pipe and concrete edges shall be ground smooth.

9.3.2.4 Joint Assembly

Clean all joining surfaces with a brush and remove any dirt, debris, flashing, or concrete high points, which could keep the joint from coming together or prevent the sealant from adhering to the concrete. If necessary, a joint primer can be applied to improve adhesion. When using a primer, allow the primer to properly dry before placing sealant.

Apply the joint sealant to the spigot end of the manhole section according to the manufacturer's directions. Where possible, the joint sealant shall be a single coil piece. Where the two ends meet together, join the sealant into one continuous strand by kneading the ends together where they meet. DO NOT STRETCH OR OVERLAP THE

SEALANT. Once the sealant is installed, do not compress the sealant or allow dirt to fall on the sealant.

When joining the manhole sections, properly align the upper and lower sections. Carefully lower the upper section until it makes even contact with the lower section. Continue lowering the upper section until the full weight is received by the lower section. The sealant must be compressed to a minimum of 50 percent to properly seal the joint. Once proper compression is achieved, do not lift up on the manhole section(s).

To apply the exterior joint wrap, begin by cleaning all joining surfaces with a brush and remove any dirt, debris, flashing, or concrete high points, which could prevent the sealant from adhering to the concrete. If necessary, a joint primer can be applied to improve adhesion. When using a primer, allow the primer to properly dry before placing sealant.

Apply joint wrap to the exterior horizontal joint by removing the release paper from the adhesive side and apply the wrap to the concrete. Continue around the joint by removing the release paper as the roll of wrap is unrolled. Press the wrap firmly by hand against the entire surface as it is applied to assure full contact.

Where joining two sections, or where two ends meet together, provide an overlap of approximately 2" and firmly press the overlapping strip onto the end of the underlying strip to seal the joint.

9.3.2.5 Manhole Grade Adjustment Ring Installation

NO BRICKS WILL BE USED FOR MANHOLE GRADE ADJUSTMENT.

Cut the asphalt and base concentrically around the manhole out to a minimum distance of 14-inches from the frame, and removed the material to a minimum depth of 16-inches. Adjust the manhole ring and cover using approved grade adjustment rings to match the finished grade and slope.

For grade adjustment greater than 3-inches up to a maximum of 18-inches, use Ladtech System grade adjustment rings or precast concrete rings in combination with rubber/rubber composite grade adjustment rings for final grade adjustment within the 3-inches of finish grade.

For Ladtech System grade adjustment rings and all precast concrete grade adjustment rings, seal all joints between the manhole structure, grade adjustment rings, and manhole frame with a 3/8-inch preformed butyl adhesive rope.

For rubber/rubber composite grade adjustment rings, seal all joints in contact with the rubber/rubber composite material with two concentric and continuous 3/8-inch beads of butyl rubber adhesive caulk.

Apply a joint wrap tape to seal around exterior joint of the manhole structure to grade ring connection, and around all precast concrete grade adjustment rings.

Backfill the excavated area around the manhole riser and frame with compacted fill, sub-base, and road base materials to match the typical road section. **DO NOT USE CONCRETE COLLAR.** Install matching asphalt mix patch to bring the final surface flush with finished road surface.

9.3.3 Connections to Existing Manholes

When beginning sewer construction, where the new system connects to an existing sewer system, install a sewer plug in the downstream pipe connection of the first new manhole prior to installing the first section of pipe working outward from the manhole. This plug shall be mechanically expanded to seal the pipe and shall be secured with at least a 3/8-inch diameter rope to prevent it from being pushed down the pipe. The plug is to remain in place to protect the existing downstream sewer system and will only be removed when the new sewer system has been cleaned, tested, and passed final inspection.

In cases where gravity sewers, services, and force mains connect to an existing pre-cast concrete manhole, and existing stub-outs for connection do not exist, the manhole structure shall be core-drilled. Core-drilled penetrations shall be as such as to accept a flexible boot seal appropriately sized for the pipe diameter used in the connection. The invert elevation of the connecting pipe shall match the crown of the existing effluent pipe, unless otherwise directed by the City.

When connecting a sewer force main to an existing manhole, the invert elevation will match the existing effluent sewer invert elevation, and the force main shall be aligned such that the flow is straight through the manhole from influent to effluent, unless otherwise approved in writing by the City. Force main connections shall be restrained, as necessary.

9.3.4 Laying Gravity Sewer Lines

Gravity sewer lines shall be laid according to the details shown on the drawings or specified herein, and according to applicable portions of ASTM D2321, Underground Installation of Flexible Thermoplastic Sewer Pipe. Ductile iron pipe shall be installed in accordance with the requirements of Section VII of the Handbook of Ductile Iron Pipes, latest Edition. The type of

bedding to be used shall be as shown on the drawings, specified herein, or as directed in writing by the Engineer.

The laying of the sewer pipe shall be commenced at the lowest point, with all bell ends upstream. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so that joint may be properly assembled without over stressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.

Each time the work on the sewer is halted for more than one hour, the ends of the pipe shall be sealed to prevent foreign material from gaining entrance to the pipe. Each time a new manhole is installed, place a sewer plug in the downstream pipe connection of the new manhole prior to installing the first section of pipe working outward from the manhole.

Trench excavation, backfill and compaction shall meet the requirements of Excavating, Backfilling and Compacting for Utilities specification contained in this document. The trench bottom shall be graded to the proposed elevation of the pipeline and the bottom shaped to fit the lower quadrant of the pipe. Holes shall be excavated at each bell so that pipe is uniformly supported along the entire length of the barrel only and not the bell. Pipe laying shall not precede backfilling by more than 100 feet without approval from the City.

9.3.5 Joining Sewer Lines

Laying instructions of the manufacturer of the pipe and fittings shall be followed explicitly. Any pipe having defective joint surfaces (bell or spigot), including gaskets, shall be rejected and replaced.

Lateral connections 6-inch or larger in diameter shall be connected to a manhole on existing VCP mains. 6-inch wyes will be allowed in new construction.

Only one repair will be allowed per tangent and will use the same material as the sewer main, except for VCP repair, where PVC fittings are to be used.

No flexible couplings will be allowed other than connections to existing VCP mains, in which case a Fernco® Strong Back 1000-Series repair coupling, or equal, may be used.

9.3.6 Lateral Installation

A lateral connection shall be provided for each platted lot or parcel, or as approved by the City

Service connections shall be extended to the property line as shown on the drawings and adequately sealed with plugs or caps prior to beginning exfiltration tests.

The Contractor shall maintain a record of service connection locations in conjunction with the "as-built plans" and, upon completion of work, shall furnish a copy of record to Engineer. The record shall include (1) location of wye branch and end of sewer connection referenced to next downstream manhole of each run, (2) offset of end of service as referenced from center line of main sewer pipe, (3) depth at end of service, and (4) distance from service end to nearest lot corner (reference lot corner shall be clearly indicated on the record). End of service pipe shall be marked with an EMS marker buried directly over end of service. Use EMS markers as manufactured by Automations Products Co., #1253 Green, Austin, Texas.

Unless otherwise indicated, service connections shall be constructed perpendicular to the sewer, and on a straight line and a constant grade of not less than 1.5 percent and not greater than 100 percent (i.e., 45 degrees from horizontal or vertical). Riser piping is not acceptable. Inverts of service connections at property lines shall be established so as to provide a minimum grade of 2 percent to the center of the lot or parcel plus 2-feet vertical with a minimum invert depth of 5-feet, unless otherwise indicated by the drawings. The maximum invert depth shall be 8-feet.

Do not connect services directly to manholes unless approved by the City. Where service lines are connected to manholes, match the invert elevation of the service lines with the crown elevation of the manholes discharge main. Provide a shaped invert from the wall of the manhole to the invert of main sewer.

When installing service connections on existing sewer mains not having wyes and tees, the Contractor may install a tee on PVC mains or install a PVC wye connection and fittings. No tapping saddles or tapping tees shall be used.

9.3.7 Infiltration

THERE WILL BE NO ALLOWABLE INFILTRATION.

9.3.8 Air Testing

Low pressure testing shall be conducted in accordance with the following procedures: Sanitary sewers tested will not be accepted by the City until the sewers meet the criteria stated. The Contractor will provide testing equipment and test supervision. The Contractor in the presence of the Engineer will conduct all tests. Generally, the sewers will be tested from manhole to manhole or from manhole to the end of the sewer if there is no manhole at the end. Service connections along the sewer main will be included in the testing.

The test procedure shall be conducted in the following manner:

- a. Clean pipe to be tested by propelling a snug fitting inflated ball through the pipe by water pressure or other adequate method. This step is important because it not only flushes out construction debris, but the water used to flush the ball through the pipe dampens the pipe wall. The rate of air loss through pipe wall permeation can be significant on dry pipes.
- b. Plug all pipe outlets with pneumatic plugs having a sealing length equal to or greater than the diameter of the pipe to be tested. The pneumatic plug shall be able to resist internal testing pressures without requiring external bracing.
- c. The groundwater level surrounding the section of sewer under testing shall be determined. If the groundwater table is above the pipe, then test pressures shall be increased by the corresponding increment (e.g., if the groundwater table is above the lowest crown of the pipe, the air pressure should be increased 0.43 times each foot of water.)
- d. Once the pipe outlet plugs are securely in place, pressurized air is introduced to the system. The air shall be fed through a single control panel with three individual hose connections as follows:
 1. From control panel to pneumatic plugs for inflation in sewer pipe;
 2. From control panel to sealed line for introducing the pressurized air;
 3. From sealed line to control panel. This line will enable continuous monitoring of the air pressure rise in the sealed line.
- e. The air shall be introduced slowly to the section of pipe under evaluation until the internal air pressure is raised to 4.0 psig greater than the hydrostatic pressure head created by the existence of groundwater that is over the pipe section.
- f. A minimum of two (2) minutes shall be provided for the air pressure to stabilize to conditions within the pipe. (This stabilization period is necessary for variations in temperature to adjust to the interior pipe conditions.) Air may be added slowly to maintain a pressure to 3.5 to 4.0 psig for at least two (2) minutes.
- g. After the stabilization period, when the pressure reaches exactly 3.5 psig, the stopwatch shall be started; and when the pressure reaches 2.5 psig, it is stopped. The portion of the line being tested shall be acceptable if the time in minutes for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than the time shown in Table 9.3.

Pipe Diameter (inches)	Time (minutes)
4	2.0
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

- h. In areas where the groundwater is above the top of the pipe, the test pressures shall be increased by 0.433 per foot of groundwater (e.g., if the groundwater is 11½ feet, the 3.5 to 2.5 pressure drop will be increased by 5 psi; the time then will be measured for a pressure drop from 8.5 to 7.5 psi.).

Alternate Pressure Test

$$T = (0.0850 \times D \times K) / 0.003$$

where:

T = minimum time in seconds the air pressure must hold while dropping from 3.5 psig to 2.5 psig

D = pipe diameter in inches

K = 0.000419DL, but not less than 1.0

L = length of line being tested

See example calculation on next page.

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Example: 10-inch sewer that is 350 feet long

$$K = 0.000419 \times D \times L$$

$$K = 0.000419 \times 10 \times 350$$

$$K = 1.4665 \text{ (use 1.47)}$$

$$T = \frac{0.0850 \times D \times K}{0.003}$$

$$T = \frac{0.0850 \times 10 \times 1.47}{0.003}$$

$$T = \frac{1.2495}{0.003}$$

$$T = 416.5 \text{ seconds}$$

$$T = 6 \text{ minutes and } 56.5 \text{ seconds}$$

The Contractor shall clean and remove all debris, silt, earth or other material from the sewer prior to testing. The Contractor shall flush the sewer with water. None of this water or debris shall be allowed to enter the existing sewer.

Test plugs will be installed within the pipe at each manhole.

If the pipe to be tested is below the groundwater table, the Contractor shall determine, in a manner suitable to the Engineer, the depth of the groundwater above the pipe invert immediately prior to testing the sewer. All gauge pressures in the test shall be increased by the amount of this backpressure due to groundwater submergence.

Air shall be added slowly to the test portion of the pipe until the internal air pressure is raised to 4.0 psig. A stabilization time of 5 minutes will be used to allow entering air to equalize with the temperature of the pipe wall.

If, at any time, prior to acceptance, a portion of the main line or any service laterals are damaged and repaired, additional air tests will be required.

9.3.9 Cleaning

At the conclusion of the work, the Contractor shall thoroughly clean the entire pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material that may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. Debris or water from the lowest outlet shall not be introduced into the City's sewage collection system. If, after this outlet cleaning obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a

heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, the Contractor shall repair them.

All water used in testing and flushing shall be furnished at the Contractor's expense.

9.3.10 Final Test and Inspection

Upon completion of the work, the sewer system or selected sections therein shall be subjected to a final test and inspection. All work in the system or sections therein being tested shall be complete, cleaned and ready for use. Tests shall be as specified herein and shall meet all requirements including but not limited to line, grade, cleanliness, infiltration, and workmanship. Deflection testing will be done on all flexible pipe at the direction of the Engineer. No pipe deflection will exceed 5%.

The Contractor will provide testing equipment and test supervision. This testing will be done using a mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices. Re-rounders are not allowed.

Inspection of mains shall be by use of a self-contained closed-circuit television (CCTV) system. These facilities shall be provided and operated by the City and scheduled through the Water Resources Engineering Division. All requests for TV inspection shall be in writing 24 hours in advance from the Contractor.

For pipes 15-inch in diameter and less, no deflections (dips/sags) will exceed $\frac{3}{4}$ -inch; and for pipes greater than 15-inch in diameter, no deflections (dips/sags) will exceed $1\frac{1}{4}$ -inch.

9.3.10.1 Sewer within street right-of-ways, paved areas, or areas subjected to frequent vehicular traffic

The City will inspect the lines with the television system on two occasions. First inspection shall be completed prior to road base construction. Second inspection shall be performed prior to final acceptance. A third or subsequent inspection if required will be charged to the Contractor at the current rates.

9.3.10.2 Non-paved areas and not subject to vehicular traffic

The City will inspect the lines with the television system on only one occasion. A second or subsequent inspection if required will be charged to the Contractor at the current rates.

END OF SECTION 9

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10.1 General

10.1.1 Scope of Work

Contractor shall furnish, deliver and install an automatic submersible sewage pump station. The station shall be complete with all needed equipment. The principle items of equipment shall include two submersible pumps; valves; internal piping; central control panel with circuit breakers; motor starters; automatic pumping level controller; lighting and all on-site improvements including slab, wet well, discharge piping including emergency by-pass, valve-vault, gravity piping, including gate valve (mechanically assisted if over 12-inch), emergency generator (for designated installations where required by the City), electrical wiring, driveway, parking area, stormwater structures, stormwater piping, fence and related items which make the station complete and operable.

These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the installation and field testing, of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these specifications or not.

To assure unity of responsibility, the pumps, accessories, and pump control system, including the RTU, coaxial cable, and antenna, shall be furnished and coordinated by the pump manufacturer. The contractor shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps, accessories and controls as specified.

The centrifugal submersible pumps shall be manufactured by WILO/EMU or ITT Flygt Corporation. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. All equipment furnished under this specification shall be new and unused. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.

10.1.2 Submittals

Copies of all materials required to establish compliance with the specification shall be submitted in accordance with the provisions of the general conditions. Submittals shall include at least the following:

- a. Shop erection drawings showing all important details of construction, dimensions and anchor bolt locations.
- b. Descriptive literature, bulletins, and/or catalogs of the equipment.

- c. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual certified tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower, except where certified witness testing is requested by the City. Curves shall be submitted on 8½ by 11-inch sheets; at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to pump capacity at minimum specified TDH for one pump running and for two pumps operating in parallel. Catalog sheets showing a family of curves will not be acceptable.
- d. Complete wiring diagrams showing in full detail all line voltage wiring and components, and control voltage wiring and components.
- e. A drawing showing layouts of the pump control panel for each pumping station shall be furnished.
- f. The total weight of the equipment including the weight of the single largest item.
- g. A complete bill of materials of all equipment.
- h. A list of the manufacturer's recommended spare parts, with the manufacturer's current price for each item. Include o-rings, seals, etc. on the list. List bearings by the bearing manufacturer's name and part number.
- i. All submittal data required by the general conditions.
- j. Complete motor data.

In the event that it is impossible to conform to certain details of the specifications due to different manufacturing techniques, describe completely all non-conforming aspects.

10.1.3 Materials and Equipment

The pumping units required under this section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done.

- a. New discharge connections shall be furnished for each pump and be rigidly and accurately anchored into position. All bolts used to mount pump base, guide rails and guide rails supports shall be drilled and epoxied per FDOT Standard Specifications. Necessary anchor bolts, nuts, and washers shall be 316 series stainless steel and be furnished by the pump manufacturer for installation by the contractor.
- b. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and all other pertinent data shall be attached to each pump.

10.1.4 Product Handling

All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

Factory assembled parts and components shall not be dismantled for shipment or installation unless permission is received in writing from the engineer.

Finished surfaces of all exposed pump openings shall be protected by wooden blanks strongly built and securely bolted thereto.

Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

Use padded straps when handling pipe and fittings so not to damage finished metal and/or coated surfaces. Any surfaces damaged shall be repaired or replaced by the Contractor at the City's discretion.

After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

Each box or package shall be properly marked to show its net weight in addition to its contents.

10.2 Products

10.2.1 Pumps

The pumps shall be totally submersible non-clog centrifugal pumps with submersible close-coupled motors designed to pump sewage. The design shall be such that the pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose, and no need for personnel to enter the wet well. Each pump shall be fitted with a 304 series stainless steel lifting chain of adequate strength and length to permit raising the pump for inspection and removal.

The impeller shall be constructed of cast iron, ASTM A48, Class 35B. The design shall permit low liquid velocities and gradual acceleration and change of flow direction of the pumped media. Impeller shall be coated with Rilsan or PVC epoxy or varnish with PVC base paint. The impeller/casing design shall result in a passage-free surface to which solid or fibrous materials cannot adhere. The overall pump design shall combine high efficiency, low required NPSH, large

sphere passage and the ability to handle high solids concentrations efficiently. All other parts shall be of close grain gray iron construction, with all parts coming into contact with sewage protected by approved sewage resistant coating. All external bolts and nuts shall be of 304 series stainless steel. The impeller shall be of a centrifugal non-clog type capable of passing solids and fibrous material of minimum 3-inch sphere size.

Each pump shall be provided with a balanced tandem mechanical seal system or cartridge. All seal faces and springs shall be immersed in oil. Both sets of faces (both upper and lower sets) are tungsten carbide or silicon carbide construction. Seal faces shall be self-aligning, positively driven, and each held by separate spring systems. The construction shall be such that no spring is exposed to the pumped media. Also acceptable is a tandem double mechanical seal running in an oil reservoir, composed of two (2) separate lapped face seals, each ring with each pair held in contact by a separate spring. The upper seal unit, between the oil sump and motor housing, shall contain one (1) stationary and one (1) rotating tungsten-carbide ring. One (1) face seal and the oil reservoir from the motor chamber shall seal the pumped liquid from the oil reservoir by the other. The seals shall require neither maintenance nor adjustment, and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces shall not be considered equal to the tandem seals specified and required.

A wear ring shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert or stainless steel ANSI 304 ring that is drive-fitted to the impeller eye.

A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connection flange to connect with a cast iron discharge connection, which shall be bolted to the floor of the sump with stainless steel anchor bolts and so designed as to receive the pump connection without the need for any bolts or nuts. Anchor bolts shall be drilled and epoxied, no redhead bolts shall be allowed. Sealing of the pumping units to the discharge connection shall be with the entire weight of the pumping unit guided by stainless steel guide rails. No portion of the pump shall bear directly on the floor of the sump and no rotary motion of the pump shall be required for sealing. The pump with its appurtenances and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

Pump motor shall be 3-Phase (unless otherwise approved by the City), NEMA-B design, squirrel-cage, induction, shell type design, housed in an air-filled (with a positive circulation system) watertight chamber. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. Motor service factor less than 1.15 may be considered on a

case-by-case basis, whereby the pump manufacturer shows this service factor to be their standard offering per published catalog information or other issued publication data; however, in no case shall it be less than 1.10. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve, from shut-off through run-out.

The stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 311°F (155°C). The stator shall be dipped and baked three (3) times in Class F varnish and shall be fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing will not be acceptable. The motor shall be capable of sustaining a minimum of ten (10) starts per hour with the liquid surface located at the top of the pump's volute, but below the motor casing, with a temperature rise not exceeding 104°F (40°C) above ambient. The motor shaft shall be series AISI 420 stainless steel of solid construction without shaft sleeves or overhang longer than 2.5 times its diameter. Overhang shall be defined as the distance from the lower bearing to the hub of the impeller. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. Each motor shall incorporate an ambient temperature compensated overheat sensing controls. The device shall be self-resetting. The power cable shall be fixed to the pump using a watertight grommet assembly. Pump motor cables shall be suitable for submersible pump applications and shall be properly sealed and PIZZMSHA approved.

10.2.2 Ductile Iron Pump Discharge Piping and Fittings

When indicated on the Plans, ductile iron pipe is an approved material for pump station discharge piping and fittings. All ductile iron pipe and fittings shall be as specified in the Technical Specification for Distribution and Transmission System Piping, with the following modifications:

For pump station wet well installations, line the interior surface of ductile iron pipe and fittings to a minimum thickness of 40 mils (DFT) with a high-solids (97% minimum) coal-tar free ceramic epoxy. Coat the exterior surface with epoxy primer to a thickness of 5 mils, and apply a top coat of epoxy to a minimum thickness of **30 mils**. Approved products include Tnemec Series 431 Perma-Shield PL or Permite Permox-CTF (interior); Tnemec Series N140 Pota-Pox Plus (primer), and Tnemec Series 435 Perma-Glaze (top coat), or approved equals. The top coat only may be field applied by an experienced applicator and allowed to cure before installation.

10.2.3 Stainless Steel Pump Discharge Piping and Fittings

When indicated on the Plans, stainless steel pipe is an approved material for 4" – 12" wet well discharge piping and above ground pipe and fittings at pump stations. Stainless steel pipe shall

be Schedule 40S T304L austenitic stainless steel in accordance with the latest revision of ASME B36.19/ASTM A312. Stainless steel pipe and fittings shall have flanged connections. Flanges shall be slip-on welded type, 150#, raised-faced, T304L stainless steel in accordance with ASTM A182. All welds shall be made by an American Welding Society (AWS) Certified Welder according to the AWS D10 (and other applicable standards) for welding stainless steel pipe and fittings.

All stainless steel pipe and fittings shall be fabricated in the USA from only high-quality stainless steel materials, free from defects, and from sources with that are ISO9001:2008 compliant.

10.2.4 Electromagnetic Flow Meter

For designated installations where required by the City (generally those stations in excess of 1 MGD average daily consumption, or where otherwise directed by the City), an electromagnetic flow meter shall be furnished and installed. The flow meter shall be McCrometer/Water Specialties Model Ultra-Mag® UM-06, with 150-lb AWWA Class-D flanges. The flow meter shall operate within a range of 0.2 – 32.0 FPS and be accurate within 0.5% of the actual flow.

The flow meter shall be installed per manufacturer's recommendations in separate vault or manhole at a determined point in the piping beyond the station discharge. The flow meter signal shall be wired back to the Pump Control Panel and integrated into the telemetry system.

10.2.5 Wet Well and Manhole Liners

Inside the wet well and in the manhole receiving the force main discharge, all exposed surfaces (including bottom of top slab) shall be lined with a protective coating manufactured by AGru, Spectrashield or Green Monster. Liners shall be shown, labeled, and dimensioned on the shop drawings submitted for approval to the Engineer.

All concrete shall be sufficiently cured to prevent gaseous formation behind the liner per the liner manufacturer's specifications. All wet well or manhole surfaces shall be thoroughly prepared, cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter to assure proper adhesion/installation of the liner.

Wet-well shall be covered with a temporary cover during construction to prevent unplanned or unauthorized entry of persons or objects.

10.2.6 Access Frames and Guides

The pumping station wet-well and valve-vault shall be furnished with the necessary aluminum access frames, complete with hinged and hasp-equipped covers, fall protection grating, stainless steel upper guide holder and level sensor cable holder. The frames shall be securely mounted above the pumps. Doors shall have safety-locking handle in open position. Doors shall have a

300 psf load rated (H20, if traffic bearing) aluminum checkered plate and shall be similar to Model "JD-AL" with stainless steel hardware manufactured by the Bilco Company, model "S2R" by Halliday Products, Electric Specialty, or model "APD 300" manufactured by US Foundry.

The wet-well shall be a minimum 8-foot diameter, the entrance opening a minimum of 36 inches x 48 inches. The wet well hatch shall be sized by the design engineer to ensure that the pumps may be passed on the guide rail through the hatch without conflict. The valve-vault shall be a minimum 7 feet wide x 8 feet 6 inches long x 5 feet 6 inches deep with a minimum 72 inches x 48 inches access opening. Shop drawings for the pumps, pump controllers, wet-well, and valve-vault and related piping, must be submitted to the City Engineer for review and approval prior to manufacture of the wet-well valve-vault or ordering of the pumps and controllers.

Guide rails (2 per pump) shall be Schedule 40, T304 tubular stainless steel pipe sized according to Table 10.1. **DO NOT** use T-shape or other beam-type rail systems.

Table 10.1 – Pump Station Guide Rail Sizing	
Pump Horsepower	Pump Rail Diameter
<10 HP	1.5" or 2"
10 HP to < 50 HP	2"
50 HP or greater	3"

Lower guide holders shall be integral with the pump discharge connection. Intermediate guide brackets shall be required on stations whose depth is equal to or greater than 20 feet. Intermediate guide brackets shall be TP 304 stainless steel.

10.2.7 Pump Control System

The pumps shall be controlled by a submersible pressure transmitter manufactured by KPSI with the following specifications:

- Part No.: 700S14ABB015.000000.000B10040A
- Pressure Range: 0.00 to 15.00 PSIG
- Excitation: 9-28 VDC
- Output: 4-20mA
- Cable Length: 30 ft.

The submersible pressure transmitter shall be mounted on a 4-inch PVC stilling well, schedule 40, and attached to the side of the wet well using pipe supports. It shall also be terminated on TB-4 in the control panel as per the electrical drawings and the face of the sensor end of the transmitter shall be located 12 inches AFF of the bottom of the wet well.

10.2.8 Wiring

The control panel shall be completely wired at the factory, except for the power feeder lines, in accordance with National Electric Code. All wiring outside the panel shall be in conduit.

10.3 Execution

10.3.1 Inspection and Testing

10.3.1.1 General

The engineer shall have the right to inspect, test, or witness tests of all materials or equipment to be furnished under these specifications, prior to their shipment to the job site. The engineer shall be notified in writing prior to initial shipment, in ample time so that the Engineer can make arrangements for inspection.

The services of a factory representative shall be furnished for 1 day and he shall have complete knowledge of proper operation and maintenance to inspect the final installations and supervise the test run of the equipment. This must be done on a Monday, Tuesday, Wednesday or Thursday; not on a Friday, Saturday or Sunday nor on a holiday or the day before a holiday. This must be closely coordinated with the City, providing a minimum of two weeks advance notice.

10.3.1.2 Pumps

After all pumps have been completely installed, and working under the direction of the manufacturer, conduct in the presence of the Engineer, such tests as are necessary to indicate that pumps conform to the specifications. Field tests shall include all pumps included under this section. The Contractor shall supply all electric power, water or wastewater, labor, equipment and incidentals required to complete the field tests.

If the pump performance does not meet the specification, corrective measure shall be taken or pumps shall be removed and replaced with pumps, which satisfy the conditions, specified. A 24-hour operating period of the pumps will be required before acceptance. During this 24-hour operating period, the contractor shall supply all power necessary.

10.3.1.3 Field Testing

Upon completion of all the mechanical work, the contractor shall conduct testing as specified herein to demonstrate that the equipment performs in accordance with all specifications.

The contractor shall perform initial testing of the equipment to ensure that the tests listed below can be satisfactorily completed.

The initial start-up shall demonstrate that all items of these specifications have been met by the equipment as installed and shall include, but not limited to, the following tests:

- a. That the quick release lift out feature functions properly and allows the pump to be raised and lowered without draining the pit.
- b. That all units have been properly installed and are in correct alignment.
- c. That the units operate without overheating or overloading any parts submerged and un-submerged and without objectionable vibration.
- d. That there are not mechanical defects in any of the parts.
- e. That the pumps can deliver the specified pressure and flow rate.
- f. That the pumps shall be capable of pumping raw unscreened sewage.
- g. That the pump sensors and controls perform satisfactorily as to sequence, the pumps correct start and stop levels, and correct high level alarm.

10.3.2 Guarantee

The contractor shall guarantee the station for 24 months from the date of acceptance that the structure and all equipment will be free from defects in design, materials and workmanship. The lift station manufacturer shall furnish replacement parts FOB factory, for any component proven defective, whether of his or of other manufacturer during the guarantee period, except for those items which are normally consumed in service such as light bulbs, oil, grease, pump seals, etc.

10.3.3 Warranty

The equipment manufacturer shall warrant the pumping units being furnished against defects in workmanship and material for a period of five (5) years or 10,000 hours, whichever occurs first, under the use indicated by these specifications and as shown in the drawing. The warranty shall be in printed form and shall apply to all units furnished, and shall be duplicated into each of the four operation and maintenance manuals submitted.

The warranty shall cover all parts and labor required to repair or replace a defective unit as follows: 100% (0 – 24 months), 50% (24 – 39 months), and 25% (40 – 60 months).

The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

10.3.4 Operating Instructions

Four (4) operating and maintenance manuals complete with spare parts lists for all equipment shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

A factory representative of all major component manufacturers, who has complete knowledge of their proper operation and maintenance, shall be provided one day to instruct representatives of the City on proper operation and maintenance. With the permission of the City, this work may be conducted in conjunction with the inspection of the installation and test run as provided under Section 9.3.1.3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the City.

10.3.5 Tools and Spare Parts

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

Check out - The manufacturer shall have his representative place the station in initial operation after all construction has been completed. This shall be done on a Monday, Tuesday, Wednesday or Thursday (not on a Friday, Saturday, Sunday or holiday or day before a holiday). The manufacturer shall furnish the City with four (4) copies of the "crank up" report. A formal inspection of the pumping station shall be scheduled on a day following the station start up but not concurrently (again not a Friday, Saturday, Sunday, Holiday or day before a Holiday). This must be closely coordinated with the City, providing a minimum of two weeks advance notice.

10.3.6 Miscellaneous

Any materials not listed in the Contract Documents (specification, construction drawings, special provisions, bid solicitation) will be per latest FDOT specifications.

All 90° and 45° bends on the entire project will be long radius bends. There is to be no 90° or 45° bend on the job site that is not long radius bends.

Pump motors will be no older than 4 months old and pump supplier will certify the date of manufacture.

All stainless steel will be 316 series unless noted otherwise.

The pump station includes everything to make the station fully operational which includes, but is not limited to, pumps, piping, valves, control panel (which must be furnished by the pump supplier), pad, 304 SS lifting chain, 304 SS guide rails, 316 SS brackets, 2 glycerin filled gauges.

10.3.6.1 Fencing

The fence and gate bolts shall be pinned to make disassembly difficult. Fencing shall be vinyl coated (green or black) with top rail. All slabs, equipment, and utilities shall be located within the fenced area at least 4 feet from the fence. A 6-foot high perimeter chain link fence shall be installed with a walk in and drive through sixteen (16) foot cantilever slide gate. This metal fencing shall conform to the current FDOT standard specification for Type "B" fencing or as detailed on the construction documents.

10.3.6.2 Driveway and Parking Areas

Concrete driveway and parking areas shall meet the current FDOT specification. Where approved by the engineer, asphalt driveway & parking area are permitted given the following requirements. Drive and parking area shall include subgrade base and wearing surface in accordance with current City Standards. Pavement grade shall be determined in relation to the drainage installations. The station's paved access road shall be at least 12-feet wide and have a slope between 2% and 12%. A paved vehicle turnaround area with a 20-foot inside turning radius to allow a two-ton truck to turn around is required. Four (4) inches of FDOT No. 57 gravel over 20 mil geotextile, or equivalent topsoil and sod, will be placed in the unpaved areas surrounding the station. Should the plans show a concrete drive and parking area, the drive and parking area will be per the plans.

10.3.6.3 Exceptions

No exceptions from these specifications will be allowed unless specifically approved in writing by the Water Resources Engineering Manager or designee.

The City will review submittal data of the pump station manufacturer to facilitate inadvertent exceptions, however, inclusion of exceptions in the submittal shall not satisfy the requirement that it be specifically approved.

END OF SECTION 10

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11.1 General Provisions

11.1.1 Scope of Work

In general, the scope of work shall be to provide and install the electrical service, electrical power distribution and controls interface for a sewage pumping station. All permits needed for the electrical construction work shall be the responsibility of the Contractor.

It is the intent of these specifications and drawings that the electrical system shall be complete, fully operational, and suitable in every way for the service required. Drawings are diagrammatic in nature and do not show in every detail all devices and incidental materials necessary to accomplish their intent. Therefore, it shall be understood that such devices and incidental materials required shall be furnished by the Contractor. The following generally describes the tasks to be included in the installation of the electrical and control systems for the pumping station:

- a. The electrical service equipment and lightning air terminal grounding shall be mounted on a pole that will be installed adjacent to the pump station. The Contractor shall provide and install the meter base, conduit (with weather-head) and wire to construct the service from the pole to the pump station control panel. The Contractor shall provide and install the lightning air terminal and #6 grounding conductor on the pole. The Contractor shall coordinate, schedule, and make payment to City Electric for City Electric's provision and mounting of the service pole. Coordination with the City and the pole installer shall be part of the work.
- b. The pole will also be the antenna mast. The Contractor shall install the antenna cable/conduit between the pump station control panel and the antenna location at the top of the pole (conduit should stop 10 feet up the pole). The cable shall be installed on the pole after the pole has been installed to avoid damage to the cable. The Contractor shall coordinate with the City concerning installation of the antenna by the City.
- c. The pump station control panel contains the main service disconnect, telecommunication RTU, and pump control equipment. The Contractor shall receive the control panel from the City or City's Vendor, and store the control panel until ready for installation. The supply and installation of the concrete pad (6 feet x 6 feet x 6 inches or larger if generator required) with imbedded conduits (service and antenna cable) shall be part of the Electrical Contractor's work. The Contractor shall install the control panel on the concrete slab.
- d. The Contractor shall provide and install the conduit and wire (including "seal-offs") between the control panel at the wet well and valve vault. The conduit and wiring shall be sized to comply with the NEC. The Contractor shall provide and install the field instrumentation (level transmitter and float switch in the wet well; and proximity

switches on the check valves). Termination of field wiring at the devices/motors and at the control panel shall be part of the work.

- e. The Contractor shall provide and install the grounding for the pump station and shall test the grounding system per the specifications.
- f. The Contractor shall provide a complete check out of the pump station (i.e. motor phase rotation, emergency power phase rotation matches normal power, field instruments provide correct input to SCADA system, etc.). The Contractor shall fill out the "startup check list" per the specification.
- g. The Contractor shall provide personnel for the start-up of the pump station (i.e. station pumping fluid). For the purpose of bidding, start-up will be 4 hours at the pump station site. Coordination of the start-up date and time with the City shall be the responsibility of the Contractor.

11.1.2 Permits and Inspections

The Contractor shall obtain all necessary permits and inspections required for the work to be performed and shall pay all charges incidental thereto. Upon completion of the work, the Contractor shall deliver to the Engineer a Certificate of Inspection and approval, from the City of Tallahassee Electrical Inspection Department or the Leon County Electrical Inspection Department, as to compliance with the National Electrical Code and the City of Tallahassee Electrical Code. A Master or Journeyman Electrician must be present during the final inspection.

In addition to the above required inspection the City of Tallahassee may retain a local Consulting Engineer, hereinafter referred to as "the Consulting Engineer" to provide construction administration, ensure adherence to these specifications and drawings, observe and perform specified measurements, perform a final inspection and submit a written report.

The Water Resources Engineering Division's decision on any questions concerning acceptability of equipment, materials or construction methods shall be construed as the decision of the City. As it is the intent of these specifications and drawings to provide for typical electrical service standards for all sewage lift stations in the City of Tallahassee or Leon County, no deviations from the plans or specifications will be allowed without advance, written approval from the Engineer.

The Contractor shall notify the City Inspector when the following items are ready for approval, inspection, performance or observation; and when practical, these services shall be accomplished with a minimum of visits to the site by the Engineer:

- a. Approval of service entrance equipment location.
- b. Inspection of the underground service and feeder conduits prior to backfilling of the trenches.

- c. Observation of final ground rod resistance measurement.
- d. Performance of phase rotation check.
- e. Final inspection.

11.1.3 Codes and Standards

The latest editions of the established standards of the following organizations shall be followed as if they were fully written herein and constitute a part of the specification requirements, except where otherwise specified:

- a. National Fire Protection Associations - National Electrical Code.
- b. Occupational Safety and Health Administration (OSHA).
- c. Federal Communications Commission (FCC).
- d. Municipal, local or other codes having jurisdiction.
- e. Utility Company Rules and Regulations.

The foregoing rules, standards, regulations, specifications, recommendations, and requirements shall be followed by the Contractor as minimum requirements. They shall not relieve the Contractor from furnishing and installing higher grades of materials and workmanship, which are specified herein or indicated on the drawings.

11.1.4 Minor Deviations

The Contractor shall note that the electrical drawings and these specifications are intended to define a typical installation as to the extent, general character and location of the work included. The Contractor shall be responsible for a complete and operable system to perform the functions desired.

Arrangements of conduit and wiring and equipment that differ materially from the obvious intent of the drawings and specifications will not be permitted except where specifically approved by the Engineer. Shop Drawings shall be furnished showing all changes. Any change resulting in a saving of labor or material shall be made in accordance with a Contract Change Order.

Any alternate proposals affecting the design or the intent of the plans and specifications shall be submitted with the bid. They shall be complete with plans, specifications and sufficient details for proper evaluation. Incomplete or partial proposals will not be given consideration.

11.1.5 Guarantee

In addition to the guarantee of equipment by the manufacturer of each piece specified herein, this Contractor shall guarantee such equipment and shall be responsible for a period of two (2)

years after final acceptance to make good any defects of materials or workmanship occurring during this period, without expense to the City. Light bulb replacement guarantee shall be limited to 30 days.

11.1.6 Qualifications

This work shall be performed by, or under the direct supervision of a Master Electrician, duly licensed to conduct business, or to practice his trade within the limits of the City of Tallahassee

11.1.7 Plans and Specifications

The plans and specifications are complementary one to the other and any item called for by one and not the other shall be supplied the same as if it were called for by both.

11.2 Basic Materials and Methods

11.2.1 Conduits

Type of Conduit to be used:

- a. All raceways shall be continuous and shall be secured to all enclosures so that an electrically continuous system ground will be maintained, when IMC or flexible conduit is used.
- b. All exposed raceways shall be racked and installed with runs parallel to or perpendicular with structural members.
- c. All raceways entering an enclosure shall have a substantial insulated bushing or insulated connector providing a smoothly rounded surface to protect the conductors, equal to Thomas and Betts Insulated Bushings.
- d. All job cut threads shall be made rust resistant by application of zinc chromate paint prior to assembly.
- e. Intermediate metal conduit (IMC) that runs in concrete or underground shall be made watertight by applying compound to the joints and shall be given two protective quick drying asphalt base paint coatings throughout the imbedded length and to a point 6 inches above final grade.
- f. Sealing fittings shall be installed in conduits where required by the NEC for Class I Division II installations and/or the drawings. The fittings shall be suitable for vertical or horizontal installation equal to O-Z Gedney type EYA, appropriately sized to fit conduits. Each fitting shall be installed as close as practicable to enclosures, and in no case, more than 18 inches from enclosures. Sealing compound shall be a type approved for the purpose, unaffected by the surrounding atmosphere or liquids, and shall have a minimum melting point of 200 °F.

- g. Conduit riser shall be clamped to service pole with standoff pipe straps to provide proper alignment into meter socket.
- h. Where not otherwise restricted by the above Paragraphs, underground conduit shall be Schedule 40 PVC.
- i. Where not otherwise restricted by the above Paragraphs, above-ground or exposed conduit shall be IMC or rigid galvanized.

11.2.2 Wiring

11.2.2.1 Type

- a. Power Wiring: The secondary wire and cable shall be 600-volt THW or THWN insulated copper conductors.
- b. Control Wiring: 120VAC control wiring shall be No. 14 AWG, THHN 600-volt insulation, 7 strand copper conductors.

11.2.2.2 Installation

- a. When pulling lubricants are used, they shall be of a type approved for the particular cable insulation.
- b. All wiring in switches, control panels, etc., shall be neatly formed, grouped and taped to present a neat orderly appearance.

11.2.2.3 Identification

- a. Conductor identification shall be by color-coded insulation and wire labels.

Power Wiring Color Codes

120/240 Volts AC System --

Phase A - Black

Phase B - Red

Phase C - Blue

Neutral - White

Ground – Green

480 Volts AC System --

Phase A - Brown

Phase B - Orange

Phase C - Yellow

Neutral - Grey

Ground - Green

- b. Control wiring shall be identified by color-coded insulation and an adhesive wire label corresponding to the wiring diagrams.

Control Wiring Color Codes --

120VAC Discrete Control Red
24VAC Discrete Control Gray
DC Discrete Control Blue
Analog Control Shielded - Pairs/Cable

The adhesive wire markers shall be pre-printed cloth wrap on style or the type written adhesive or shrink-on style.

- c. All neutral conductors shall have white or gray insulation (white preferred). All grounding conductors shall have green or green with/yellow stripe insulation.

11.2.3 Lighting

Area Lighting - Furnish and install a pole mounted, 100-watt, 120-VAC, high-pressure sodium (HPS) luminaire. The luminaire shall be per Figure 10-1 a G.E. PBS10S1A5V5AC or approved equal.

11.3 Service and Distribution

11.3.1 General

The Contractor shall install a three-phase service of the size, number of conductors, and voltage characteristics shown on the drawings. Refer to the figures at the end of this Section.

11.3.2 Location

Location of service entrance equipment shall be in accordance with the site plan, but must be approved at the job site by the Engineer prior to installation of electrical distribution and monitoring equipment.

11.3.3 Control Panel

Service entrance, metering, electrical distribution, and antenna, shall be rigidly mounted to suitable support structures as shown on the drawings.

Overhead service entrance riser poles shall be 65-foot, Class 5, CCA yellow pine service poles, or approved equal, and may be used for partial support of electrical distribution, lighting and antenna.

A 65-foot, Class 5, CCA yellow pine service pole shall be furnished and installed at underground service locations to facilitate mounting of area lighting and antenna. The light fixture and antenna shall be as specified in other sections of this specification and shall be furnished with all necessary mounting hardware. Aluminum pole cap is required. The service pole shall be paid for by the contractor.

When overhead service is required by the drawings, a suitable guy shall be installed to balance service drop conductor tension. The guy shall be composed of a seven-strand 5/16-inch galvanized steel guy with a screw type anchor, 6 inches in diameter. Anchor setting depth shall be determined in the field, as required to provide a minimum holding strength of 1,000 pounds. Minimum setting depth shall be 5 feet. Guy strand shall be attached to service pole with a galvanized steel thimble-eye angle bolt (with flat washer). Two (2) bolt-galvanized guy clamps shall be used for guy attachments to both the thimble-eye bolt and the thimble-eye anchor rod. All guying hardware shall be galvanized. Anchor and anchor rod shall be coated with asphalt paint before installation.

In all cases, service distribution support structures will be subject to approval under the provisions of the final inspection.

11.3.4 Metering

The Contractor shall install the metering equipment furnished or specified by the Electric Utility Company supplying power to the site.

The meter socket shall be installed as shown on the drawings, and in accordance with utility company regulations. When installed on a service riser pole, the meter socket shall be rigidly mounted.

11.3.5 Grounding

The Contractor shall install a complete grounding system in conformance with the National Electrical Code.

The Contractor shall install a driven ground rod, consisting of coupled 8-foot sections of 5/8-inch copper-clad steel ground rods. After notifying the City Inspector as to the time and date, ground rod installation shall be as follows:

- a. Ground rods shall be driven to a minimum depth of 32 feet, unless earth conditions prohibit reaching this depth. Under such circumstances, the Engineer may use alternate schemes of paralleled rods after prior approval.
- b. After driving 32 feet of ground rod, the Contractor shall test the ground rod for ground resistance by the fall of potential method. This shall be accomplished by utilizing a

- megger earth tester and two auxiliary reference probes driven into the earth in a straight line from the test rod at distances of 62 and 100 feet.
- c. If the ground resistance is measured at 10 ohms or less, the ground rod is satisfactory and shall have the grounding electrode conductor(s) connected to it by means of an exothermic weld connection. The service entrance grounding conductor and the service pole/antenna-grounding conductor shall be connected to the same ground rod.
 - d. If the ground resistance is greater than 10 ohms, additional ground rods must be driven until a satisfactory reading is obtained. The Contractor shall include in his bid the unit cost for installing additional 8-foot sections of ground rod. He shall be compensated on this basis, by change order, for each additional 8-foot ground rod section required, above the minimum of four (4) sections, in order to obtain the necessary 10 ohms or less ground resistance.
 - e. Should additional rod sections be required to obtain the maximum 10-ohm ground resistance, the City Inspector shall be informed and shall observe the resistance measurement after 32 feet of rod has been driven. The City Inspector will then initiate a change order request to allow the Contractor to drive the necessary additional rods at the quoted per unit price to obtain the desired ground resistance. The additional rods will be driven under the observation of the City Inspector.
 - f. The City Inspector shall observe the final ground resistance measurement. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the rod under test isolated from other grounds. A written report, in duplicate shall be made to the City Inspector giving the date, the final ground rod length, any special array of rods authorized for use, and the final ground resistance measurement.
 - g. A grounding electrode conductor shall be attached to the service pole air terminal and shall be fastened to the service pole with wire staples 4 feet o.c. minimum, and shall be protected to a height of 10 feet above ground with suitable plastic molding and clamps. This grounding conductor shall be connected to the ground rod by means of an exothermic weld.

11.4 Special Systems

11.4.1 SCADA

11.4.1.1 Antenna

The Antenna shall be a Yagi antenna, Decibel Products Model DB-499 or equivalent with the following minimum specifications:

- Antenna Gain - 12db

- Radiation Pattern - Directional
- Frequency Range - 920-960 MHz
- Power Handling - 25 Watts
- Polarization - Vertical
- Horizontal Beam Width - 60 deg. Max.
- Lighting Protection - Direct ground to mount
- Wind Rating - 150 MPH
- VSWR - 1.5:1 max (REF. 50 ohms)
- Termination - N Type

Antenna Mounting Clamps - Provide two (2) mounting clamps model DB365W or equivalent. These clamps are used in mounting a 2" mast to wood poles or masonry walls up to 14 inch thickness.

Antenna Mast - Provide a 2" non-corrosive metal piping, 10' in length, such that the antenna is mounted a minimum of 5 feet above tip of the pole and 6 inches from the tip of the mast. The 2" mast shall be grounded to station grounding system.

11.4.1.2 Coaxial Cable

a. Coaxial Cable

The transmission line shall have a solid corrugated outer conductor and polyethylene protective jacket. Type N male connectors for both ends.

- ½-inch foam-filled cable, Andrew Corporation, Model LD4-50A or equivalent
- ½-inch Super flex cable, Andrew Corporation, Model FSJ4-50 or equivalent

The length of this cable shall be determined at the site after the installation of the antenna mast or pole.

b. Coaxial Surge Protection

Provide bulkhead type protectors as means to penetrate the enclosure and "feed-through" the coaxial connection to the radio transceiver.

- Type-PolyPhaser Corporation Single channel coaxial surge protector Model IS-B50LN, or equal
- Surge - 50,000 amps minimum, IEEE 8/20 waveform (Ref. ANSI C62.1)
- Turn On Potential – 60 VDC, maximum
- Turn On Time - 7nSec. After voltage wave front reaches DC threshold (1KV/nSec waveform reference)

- Impedance – 50 ohms

11.4.1.3 Level Sensor System

To control the operation of the pumps with variations of sewage level in the wet well, a pressure transducer to measure head pressure, which correlates to level, shall be provided. The pressure transducer shall be manufactured by KPSI (Hampton, Virginia 800-328-3665) model number 700-340-4015. The transducer shall have a pressure range of 0 to 15 PSIG, operate with excitation of 9-30VDC and shall have an output of 4-20mA.

11.4.1.4 Phase Relays

Provide and install a phase loss, under voltage and phase sequence monitory/relay, SLA-230-ALE or SLA-440-ALE depending on the operating voltage of the pumping station. Phase relays shall be installed at the RTU Control Panel as shown on the Drawings.

11.4.1.5 Auxiliary High Level Switches

In addition to the liquid level sensing control system components herein specified, an additional liquid level sensor shall be provided for a high wet well alarm. The sensor shall be a float type switch (magnetic switch or encapsulated mercury switch using less than 0.9 grams of mercury). The sensor shall be watertight, encased in polypropylene or polyurethane resin for direct application in the wet well. The sensor shall be provided with sufficient conductor to reach the bottom of the wet well and terminate in the RTU Control Panel.

11.4.1.6 Emergency Pump Control Backup Switch

An additional liquid level sensor shall be provided for controlling pump #1 whenever the RTU is malfunctioning. The sensor shall be a float type switch (magnetic switch or encapsulated mercury switch using less than 0.9 grams of mercury). The sensor shall be watertight, encased in polypropylene or polyurethane resin for direct application in the wet well. The sensor shall be provided with sufficient conductor to reach the bottom of the wet well and terminate in the RTU Control Panel. The sensor shall be positioned at about one (1) foot above the "High Level Float Switch" and connected to an Allen-Bradley timer off-delay model 700-FEB1TU22 as shown in the Drawings.

11.4.1.7 Pump Failure Check Valve Proximity Switch

The pump failure circuit for each pump shall consist of a proximity switch mounted on the pump discharge check-valve such that when the check-valve is open the contacts on the switch open providing an input to the RTU. The RTU shall be configured such that if

the pump is running (auxiliary contact from SMC) and the proximity switch is not opened within a specific amount of time, then the pump is stopped and a fault alarm is generated in the RTU.

- a. Proximity Switch – Provide and install an Automation Direct, AT1-A0-2A, 30 mm diameter, 10-30 VDC, 2-wire, sink/source, unshielded, 15 mm nominal sensing distance, normally open output, cable style, nickel-plated brass stainless steel threaded barrel type inductive proximity switch sensor mounted on the check valve's body as specified on the drawings.

11.4.1.8 Intrusion Alarm

The intrusion alarm system shall consist of normally open push type spring return limit switch activated by the RTU Control Panel door. For two-door cabinets, the switches controlled by each panel door shall be wired together in series. Intrusion switch(es) mounted inside the control cabinet shall be physically mounted such that intrusion is recognized with opening of outer door.

11.4.1.9 Emergency Power Auxiliary Contact

Provide the emergency power circuit breaker with Form C auxiliary contact (A and B contacts). The normally open contact shall be wired to the RTU.

11.4.1.10 Indicating Lights

Provide and install in the door of the control enclosures 120VAC LED type pilot lights. The lights shall have green lenses and shall be Allen-Bradley 800T-QH10(R) (G) or equal.

11.4.1.11 Testing

As part of the final inspection herein specified, the SCADA system components shall be completely tested by the system manufacturer or his representative, with the City in attendance during the test. All functions of the system shall be demonstrated to be operating properly as required by these specifications.

11.4.1.12 Licensing

The City shall accomplish proper licensing of this system with the FCC with the assistance from the manufacturer.

11.5 Start-Up

11.5.1 Procedure

The Contractor shall be responsible for placing the sewage pumping station into initial operation. A representative of the pumping station manufacturer shall be present at the start-up. The start-up shall be coordinated with the City's representative and City Inspector.

The Contractor shall complete the start-up checklist which is included as part of this specification, and furnish the City's representative with five (5) copies.

END OF TECHNICAL SPECIFICATION

(See Start-Up Checklist on following pages)

START-UP CHECK LIST (PAGE 1 OF 2)			
ITEM	OK	DEFECTIVE	COMMENT
PIPING			
Check Flanges for Leakage			
Check Valve Operation			
Check Pipe Stands			
Check Valve Alignment (Can a Valve Key Operate the Valve)			
Check Tracer Wire			
Check force main valves and boxes			
Check ARV/VRV materials (all piping should be stainless)			
Check ARV/VRV access			
Check Pressure Release Valve on Bypass Connection			
PUMPS			
Motor Rotation			
Motor Amps (Coupled to Pump)			
Excessive Leakage			
Electrical Cables			
Lifting Chains			
Pump Guides			
CONTROLS			
Motor Controls			
Motor Control Auxiliary Contacts Inputs			
Pump Fail Proximity Switches Inputs			
H-O-A "Auto" Input			
H-O-A "Hand" Input			
Pumps Run in "Hand"			
Pumps Run in "Auto"			
Motor Status Indicating Lights			
Level Control			
Level Transducer consistent with actual liquid level			
Level Transducer Signal OK (4-20ma)			
Pumps Respond to Level Control			
Wet Well Level Switch Input			
Intrusion Alarm			
Door Switch Input			

START-UP CHECK LIST (PAGE 2 OF 2)			
ITEM	OK	DEFECTIVE	COMMENT
CONTROLS (CONTINUED)			
Power/Phase Relays			
AC Power Service Input			
AC Loss of Phase Input			
Emergency Power Auxiliary Contact Input			
Emergency Power Phases Correct			
AUXILIARY EQUIPMENT			
Lighting (Interior & Exterior)			
Lighting Protection			
WET WELL			
Liner			
Wet Well Bottom Clean			
Cable Brackets			
Access Lids on Wet Well and Valve Vault			
LANDSCAPE			
Fence			
Concrete			
Plants			
WATER SERVICE			
Back Flow			
Meter			
Hose Bib			
Back Flow Cover			
VENTILATION SYSTEM			
12 VDC			
Fans run when temp switch adjusted			

PROJECT ENGINEER'S SIGNATURE _____ DATE _____

INSPECTOR'S SIGNATURE _____ DATE _____

SERVICE OPERATION SIGNATURE _____ DATE _____

ELECTRICAL MAINTENANCE SIGNATURE _____ DATE _____

12.1 General

Prepare As-Built Drawings depicting as-constructed water and sewer facilities in accordance with these specifications, as required under the Contract. THE AS-BUILT DRAWINGS MUST REFLECT THE HORIZONTAL AND VERTICAL CONFIGURATION OF THE INSTALLED FACILITIES, WITHOUT EXCEPTION. ALL EXISTING FACILITIES THAT ARE PLACED OUT OF SERVICE SHALL BE INDICATED AS SUCH ON THE AS-BUILT SURVEY. Ensure that adequate information is collected during construction to satisfy this requirement.

Exiting facilities included in the Water Resources Engineering GIS is for general information only and is not to be relied upon for as-built drawings or survey purposes.

12.2 Products

12.2.1 Digital Specifications

Unless otherwise specified, all as-built drawings will be submitted using the AutoCAD .dwg format. All as-built drawings will be drawn to scale and using the horizontal and vertical controls defined herein.

All as-built drawings will conform to the layering scheme defined herein and shall use the following predefined attribute blocks with their designated insertion points:

- T_HYD (Hydrant)
- T_SSMH (Sanitary Sewer Manhole)
- T_VALVE_WATER (Water Valve)
- T_VALVE SEWER (Sewer Valve).

Some attributes will require a value to be selected from a distinct list of translate values. The translate values are used in order to standardize these attributes. For acceptable values please refer to the "AsBuiltCode.pdf" document.

The "DIMASO" system variable value shall be set to "ON" and all dimensions used in the as-built shall be drawn using this setting for the "DIMASO" system variable.

12.2.2 Information Provided by the City

An AutoCAD file labeled "master.dwg" will be provided on request on CD from the engineering staff or the GIS-Mapping staff. This file will provide information, usage and properties regarding layering, line types and attributed blocks to be used when preparing the required water/sewer as-built drawings. Contact Water Resources Engineering and/or GIS Mapping if another CAD format is required.

A pdf document file labeled "AsBuiltCode.pdf" will be provided on request on CD from the engineering staff. This file will provide a list of coded values to be used with the attributed blocks provide in the "master.dwg" file.

An Excel file labeled "PumpStationData.xls" will be provided on request on CD from the engineering staff. This file contains a tabular listing of the required engineering data of the pump station installation. This table shall be completed in full and submitted in addition to the as-built drawings.

12.3 Execution

12.3.1 As-Built Survey

During construction, the Contractor shall employ a Registered Land Surveyor, licensed in Florida, shall keep an accurate record of the actual locations, dimensions, and elevations of the finished work; especially those items which will subsequently be concealed or inaccessible.

Prior to the approval of the final payment, the Contractor's Registered Land Surveyor shall submit to the Engineer a complete set of as-built drawings, as specified herein. The Land Surveyor shall certify on each sheet of the as-built drawings that all improvements have been constructed to the grades, elevations and locations shown on the as-built drawings and are located within the easements, rights-of-way and property boundaries shown on the record prints. Such as-built drawings shall also include a similar certification by the Contractor.

The Land Surveyor as well as the Contractor shall sign and seal all copies of the as-built drawings. All As-built drawing preparation shall be incidental to performance of the total contract and no additional compensation will be allowed.

12.3.2 Survey Controls

12.3.2.1 Horizontal Control

The horizontal datum is North American Datum 1983 (NAD83), with 1990 Florida adjustment (NAD83/90); or for Global Positioning System (GPS) survey control, the horizontal datum is NAD83, with the National Spatial Reference System (NSRS) 2007 National Readjustment (NAD83/NSRS2007), as defined by the National Geodetic Survey (NGS). The applicable State Plane Coordinate zone is Florida North - Zone 3576, FIPS 903.

12.3.2.2 Vertical Control

Vertical control datum is North American Vertical Datum 1988 (NAVD88), as defined by the NGS.

12.3.3 Survey Ties

Survey ties are the measured distances from permanent objects to the utility infrastructure (see sample tie sheets at the end of this section). Preferred permanent objects, listed in their order of preference, include the following: manholes, drainage inlets, building corners, property corners, power poles, hydrants, trees (18-inch diameter or greater), and perpendicular distances from curb and gutter (or edge of pavement, when no curb and gutter are present).

Three (3) ties are required for precise location of all proposed utility infrastructure, including valves 1½-inch diameter or larger. Ties from adjacent property corners are required for locating all service stub outs. Provide perpendicular measurements from curb to utility mains at intervals described herein.

12.3.4 Survey Data

Clearly label all roads and road names, including appropriate county or state numbers where applicable, as well as parcels, rights of way, easements, and landmarks.

All gravity sewer lines and sewage force mains are to be drawn in direction of flow.

Illustrate pressurized piping systems by depicting the application designation (water main [WM], reclaimed main [RM], sewer force main [FM], or other application designation), pipe size, and material; including 3 permanent ties, as well as vertical and horizontal locations, specifically showing the proposed and as-built elevation to +/- 0.01 feet of all fittings, appurtenances, and the top of pipe at a maximum of 50-foot intervals along the mains. Provide survey ties showing the distance from the frontage lot corners to each service.

Illustrate all valves by properly depicting the application designation (WM, RM, FM, etc.), type of valve (gate valve, ball valve, etc.), location of valve with permanent ties, the vertical and horizontal alignment of the valve, elevation of the valve operating nut; as well as the manufacturer, type of gear box, and the number of turns to open/close.

Illustrate gravity sewers systems by depicting the as-built manhole information, including top elevation; invert elevations at center of manhole and all connecting pipes; exterior drop connections; sewer pipe size, material, length, and calculated slope; sewer

lateral locations, including distance from downstream manhole to service wye; the distance from the downstream manhole to nearest lot corner, the distance from the frontage lot corners to each service lateral, and the depth below natural grade +/-0.25-feet to the invert of each service lateral.

Pumping stations shall include the completed as-built design data table, as well as all pertinent horizontal and vertical locations of the wetwell and valve vault structures (or valve arrays) and components, including all gravity sewers invert elevations, pumps, piping, fittings, valves, controls, electrical and water services, and other appurtenances and accessories.

Note any deviations from the approved Construction Plans.

12.3.5 Submission of As-Builts

12.3.5.1 As-built submission for preliminary review procedure:

Submit one (1) set of paper copies and one (1) computer disk/cd of as-built drawing for review to the Senior Engineer of the Water Resources Engineering Division.

Upon receiving above stated as-built material required, the assigned inspector and the Water Resources Engineering GIS mapping staff will review for data and formatting compliance then return to contractor/developer for revisions if found necessary within 10 business days.

12.3.5.2 As-built submission for final payment:

After the preliminary submittal has been approved to be in compliance, the following must be submitted:

- Five (5) bond copies formatted 24-inch x 36-inch/D size
- One (1) Mylar formatted 24-inchx36-inch (D size)
- One (1) computer disk/CD containing completed digital file of the as-built drawing conforming to the specifications.

12.3.6 Water Utility As-Built Layer Definitions

0: nothing is to be placed on this layer

ABANDON (WATER & SEWER): All Abandoned Gravity lines, Force Main lines, water lines, pump stations, valves and manholes located or referenced need to be placed on this layer

BUILDING: All buildings in the drawing need to be placed on this layer

BUILDINGTXT: All text associated with buildings on the drawing need to be placed on this layer

CASING: All casing and other conflict structures need to be placed on this layer

DEFPOINTS nothing is to be placed on this layer

DWG_FIELD_NOTES: All Drawing notes, reference or other notation related to the water or sewer system need to be placed on this layer

FIREHYDRANT: All fire hydrants need to be placed on this layer. i.e., the fire hydrants only and not the isolation valves for the fire hydrants these valves need to be placed on the VALVE layer

LAKE_BOUNDARY: All water bodies, watercourses and lakes to be shown on this layer

LAKE_NAMES (TEXT): All text associated with water bodies, watercourses and lakes need to be placed on this layer

LANDMARKS_(WATER & SEWER): This layer is for all structures that are used in the process of tying down water entities (Power Poles, Tel Poles, Manhole Covers, Catch Basins, Pedestals of any kind etc.). If you wish to create other layers for these structures to reside on that is permissible however the structures used for the purpose of tying down water entities need to also reside on the LANDMARKS_WATER layer

MH (MANHOLE): All manholes need to be placed on this layer using the attributed manhole block provided

MV: All layout view ports to be on this layer

PARCEL_TXT: All text associated with Parcels, needs to be placed on this layer. This includes but not limited to lot size and dimensions, parcel I.D.'s and Tax I.D.'s

PARCELS: All Parcels shown on the drawing needs to be placed on this layer

PLUG: All Plugs placed at the end of stub outs need to be placed on this layer using the attributed plug block provided

PUMP_STATION: All pump stations need to be placed on this layer using the attributed pump station block provided

ROAD_EDGE: All Road edge shown on the drawing needs to be placed on this layer

ROAD_NAME_TXT: All text associated with Roads, Street names, City/County and State route I.D.'s, etc. need to be placed on this layer

ROW (RIGHT-OF-WAY): All Right-of-Way's shown on the drawing need to be placed on this layer

ROWTXT: All text associated with the Right-of-Way's need to be placed on this layer

SUB_DIVISION_NAMES: All Subdivision names/as-built names and notes related to the Subdivision need to be placed on this layer

VALVE (WATER): All water valves shown in the drawing including fire hydrant isolation valves need to be placed on this layer

VENT: All vents need to be placed on this layer using the attributed vent block provided

WATER_INFO_TEXT: All text associated with the water portion of the drawing need to be placed on this layer

WATERTIES: All dimensions used in the process of tying down water entities need to reside on this layer

WATFITTINGS (WATER FITTINGS): All blocks or symbols for water fittings shall reside on this layer

WB (WIRE BOX): All wire boxes used for location need to be placed on this layer using the attributed plug block provided

WET_WELL: All wet wells need to be placed on this layer using the attributed wet well block provided

12.3.7 Examples for Layer and Block Use

All layers in the template drawing pertaining to pipe size and material shall be used for the corresponding pipe segments (water & sewer).

EXAMPLE (WATER): 6 inch Ductile Iron Pipe shall be placed on the "6_INCH_DUCTILE-IRON" layer.

EXAMPLE (SEWER): 6-inch Gravity shall be placed on the "GL_FLOW_6_Inch" layer.

EXAMPLE (SEWER): 6-inch Force Main shall be placed on the "FM_FLOW_6_Inch" layer.

All layers in the template drawing pertaining to valve & valve type & size shall be used for the corresponding valves (sewer) using the attributed valve block provided.

Valve Types as follows:

Valve Type	Layer	Valve Type	Layer
Air Release Valve	Valve_ARV	Ball Valve	Valve_Ball
Butterfly valve	Valve_BFV	Check Valve	Valve_Check
Gate Valve	Valve_Gate	Surge Valve	Valve_Surge
Plug Valve	Valve_Plug	Emergency Pump Bypass	Valve_EPB

EXAMPLE: 6-inch Air Release Valve shall be placed on the "Valve_ARV" layer.

12.3.8 As-Built Attribute Codes

The Contractor shall request the most current as-built attribute codes from the City.

12.3.9 Pump Station Data Table

Pump Data	Value	Wet Well Data	Value
ID		ID	
CAPACITY		TYPE	
SHUT_HEAD		BTM_ELEV	
DSGN_HEAD		LEAD_OFF_EL	
DSGEN_FLOW		LEAD_ON_EL	
HIGH_HEAD		LAG_ON_EL	
YR_INST		LAG_OFF_EL	
RATED_PWR		INIT_LEVEL	
ON_OFF		TOP_OF_SLAB_EL	
TDH		DIAMETER	
STATIC_HEAD		YR_INST	
DISCHARGE_PIPING		VOLUME_REQD*	
DISCHARGE_PIPING_MATERIAL			
PUMP_MANUFACTURER		*Submit Volume & Cycle calculations	
PUMP_MODEL_NO			
PUMP_IMPELLER_MODEL_NO			
PUMP_IMPELLER_SIZE			
PUMP_RPM			
SUPPLY_VOLTAGE			
MOTOR_HP			

Figure 12.1 – Sample Tie Sheet for Water and Resue Construction

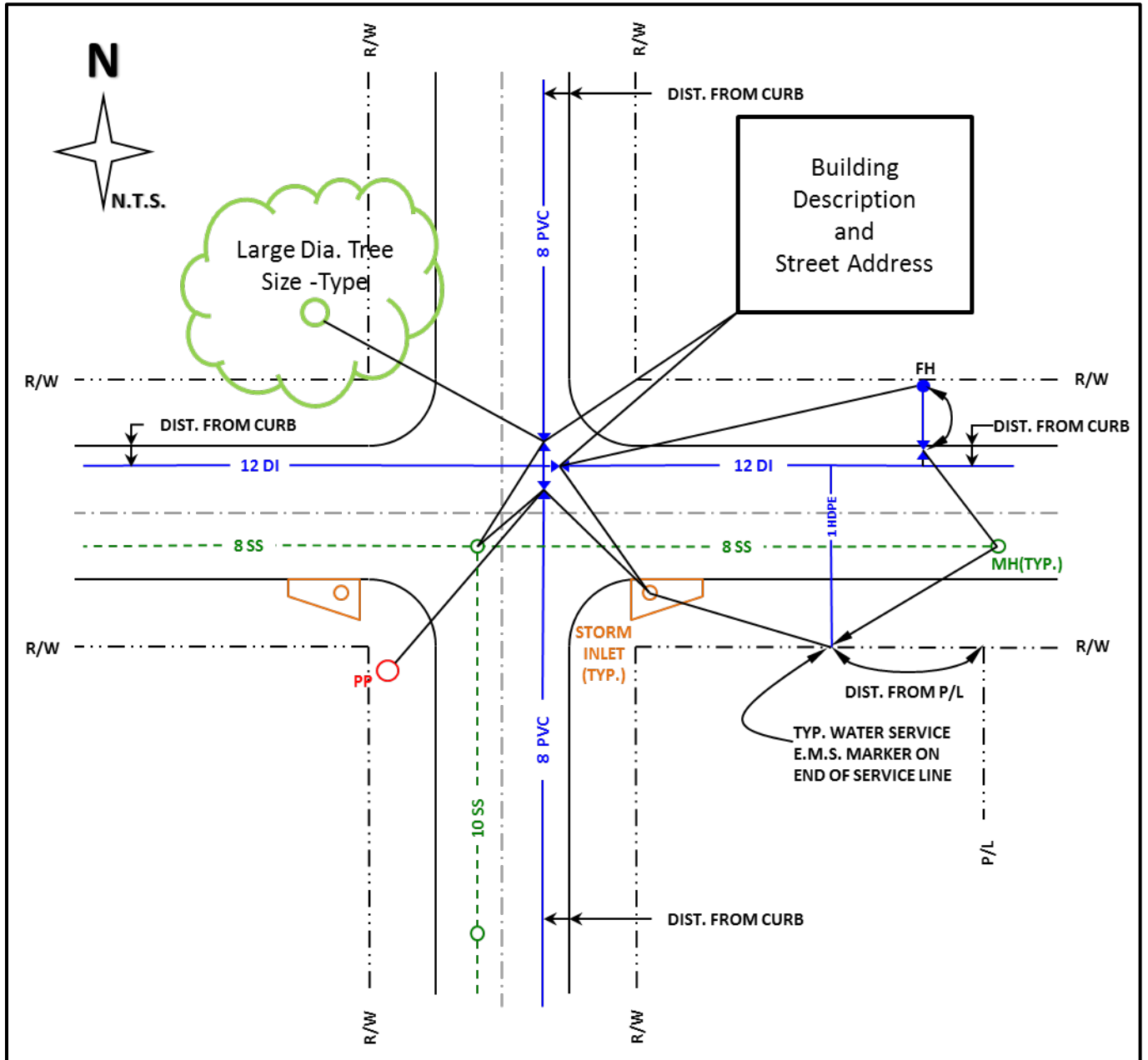


Figure 12.2 – Sample Tie Sheet for Gravity Sewer Construction

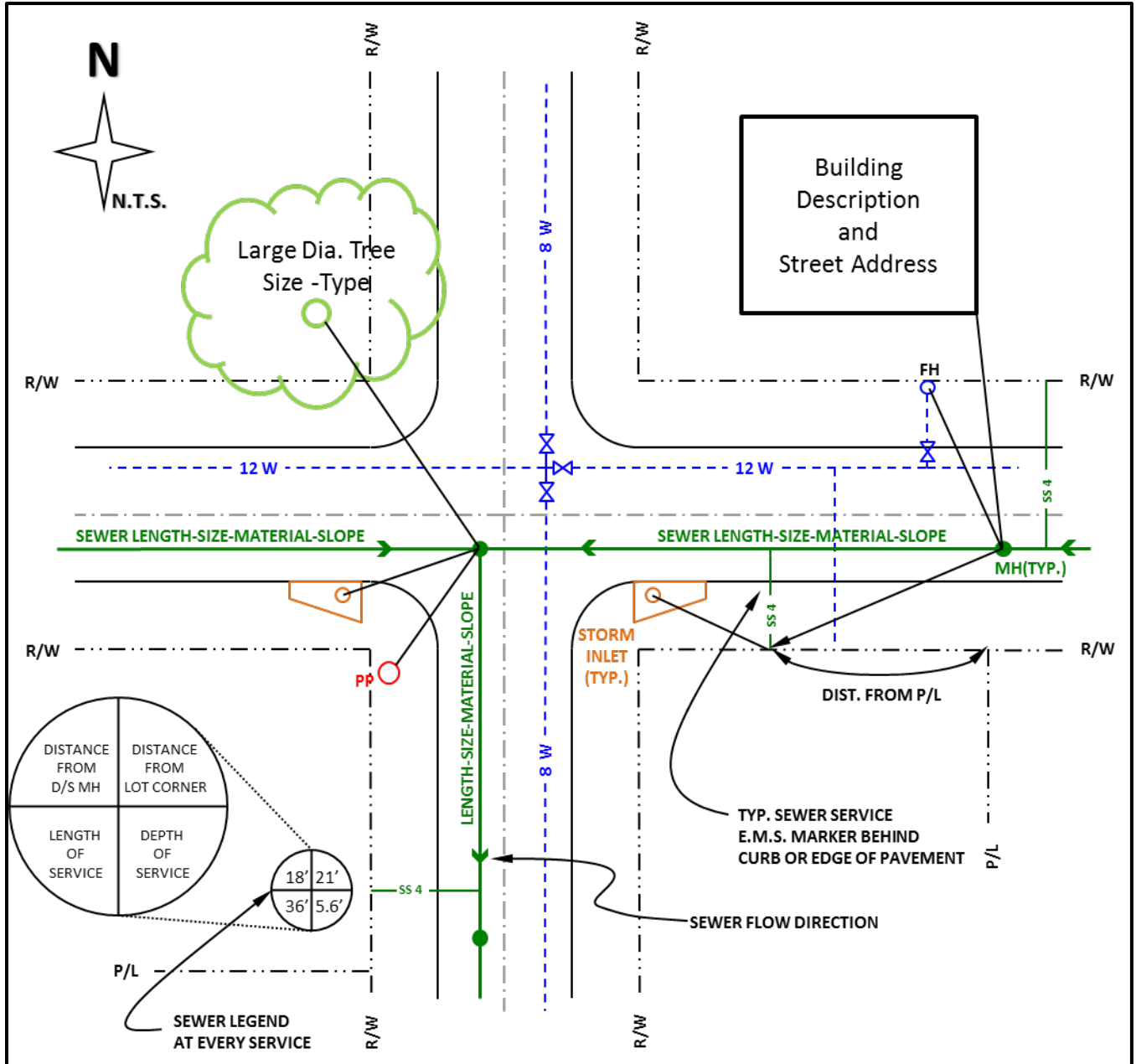
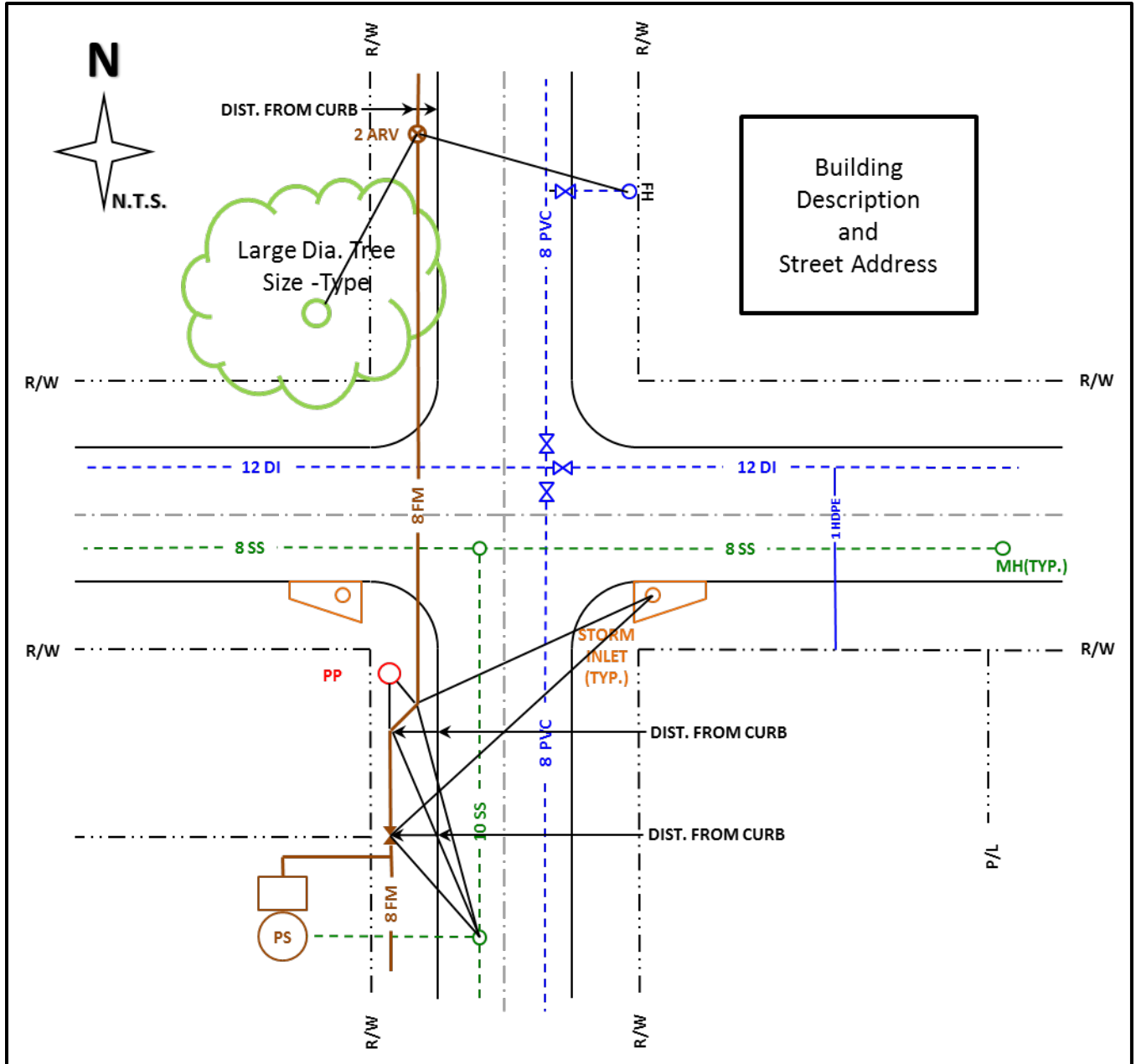


Figure 12.3 – Sample Tie Sheet for Sewer Force Main Construction



END OF SECTION

Appendix

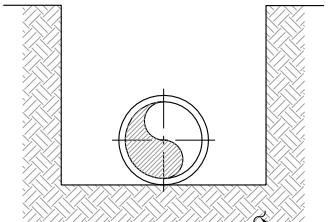
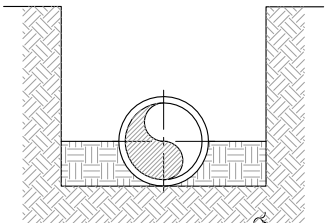
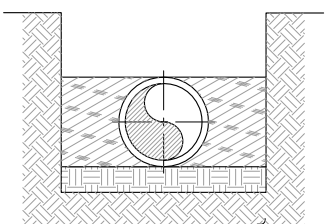
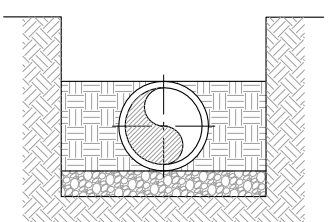
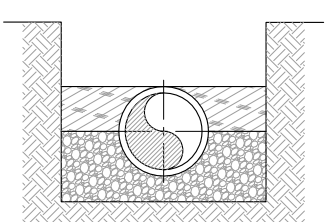
Standard Construction Details for Water and Sewer Construction

Prepared by:



Water Resources Engineering Division
408 North Adams Street
Tallahassee, Florida 32301

January 2015

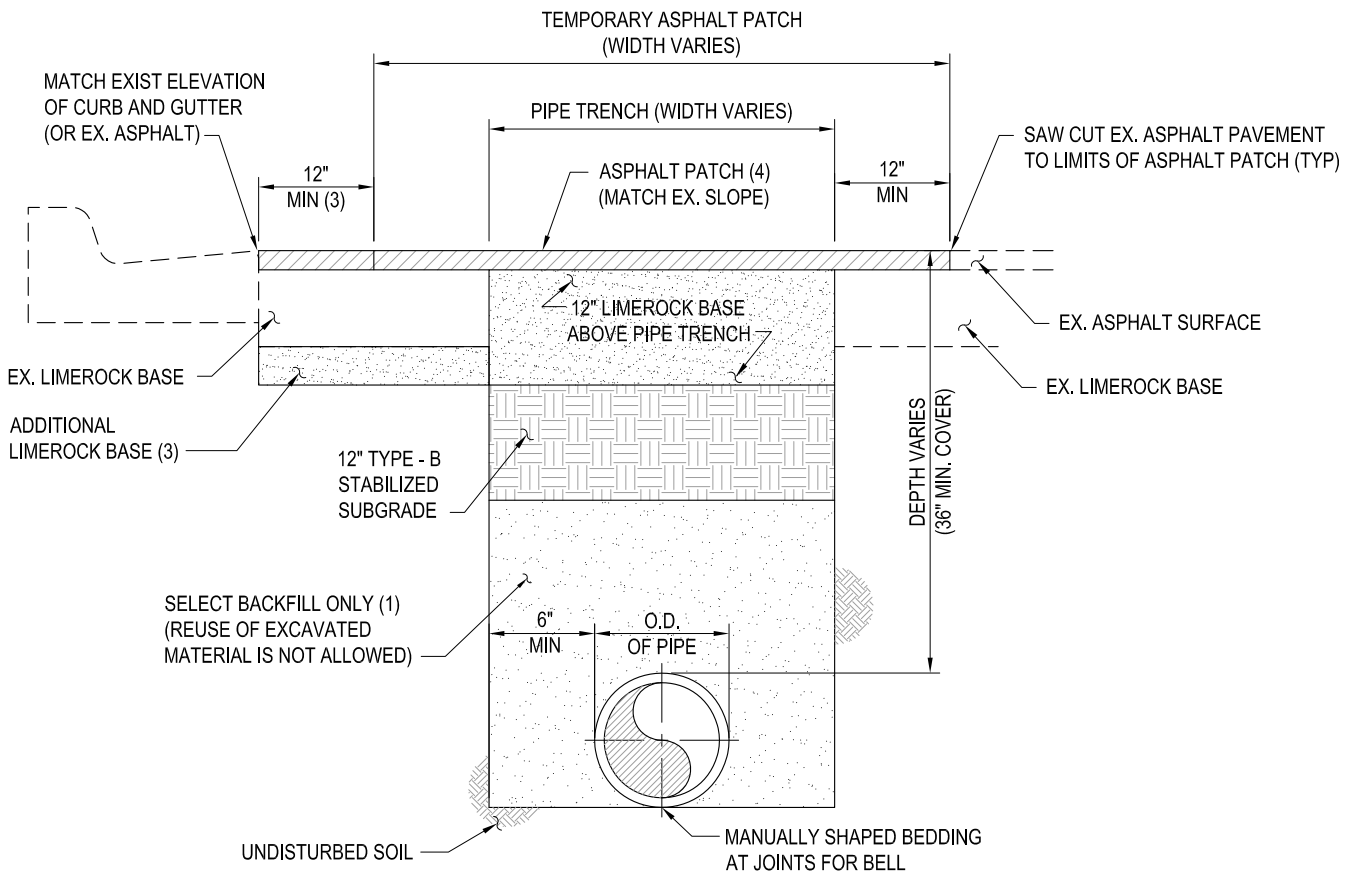
LAYING CONDITION	DESCRIPTION
 <p>TYPE 1 * <small>UNDISTURBED SOIL</small></p>	<ul style="list-style-type: none"> • FLAT-BOTTOM TRENCH (UNDISTURBED SOIL) • LOOSE BACKFILL
 <p>TYPE 2 <small>UNDISTURBED SOIL</small></p>	<ul style="list-style-type: none"> • FLAT-BOTTOM TRENCH (UNDISTURBED SOIL) • BACKFILL, LIGHTLY CONSOLIDATED TO CENTERLINE OF PIPE
 <p>TYPE 3 <small>UNDISTURBED SOIL</small></p>	<ul style="list-style-type: none"> • PIPE BEDDED IN 4" MIN SELECT MATERIAL • BACKFILL, LIGHTLY CONSOLIDATED TO TOP OF PIPE
 <p>TYPE 4 <small>UNDISTURBED SOIL</small></p>	<ul style="list-style-type: none"> • PIPE BEDDED IN SAND, GRAVEL OR CRUSHED STONE TO DEPTH OF $\frac{1}{8}$ PIPE DIAMETER, 4" MIN • BACKFILL, COMPACTED TO TOP OF PIPE (APPX. 80% STANDARD PROCTOR, AASHTO T-99)
 <p>TYPE 5 <small>UNDISTURBED SOIL</small></p>	<ul style="list-style-type: none"> • PIPE BEDDED IN COMPACTED GRANULAR MATERIAL, 4" MIN UNDER PIPE • COMPACTED GRANULAR OR SELECT MATERIAL TO TOP OF PIPE (APPX. 90% STANDARD PROCTOR, AASHTO T-99)

* FOR 14" AND LARGER PIPE, CONSIDERATION SHOULD BE GIVEN TO THE USE OF LAYING CONDITIONS OTHER THAN TYPE 1.

NOTES:

1. TRENCH BACKFILL SHALL BE "SELECT BACKFILL" MATERIAL IN ACCORDANCE WITH THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. THE TECHNICAL SPECIFICATIONS SHALL APPLY FOR ALL OTHER REQUIREMENTS NOT SUPERCEDED BY THIS DETAIL FOR ALL EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES.
3. TRENCHES WITH ASPHALT PATCHES THAT ARE CLOSER THAN 12" TO THE CURB AND GUTTER OR EDGE OF PAVEMENT SHALL HAVE CONTINUOUS 12" LIMEROCK BASE AND 2" MIN. ASPHALT PATCH TO THE CURB AND GUTTER OR EDGE OF PAVEMENT.
4. THESE SECTIONS SHALL BE IN ACCORDANCE WITH THE CITY OF TALLAHASSEE PUBLIC WORKS DEPARTMENT FLEXIBLE PAVEMENT DESIGN, CURRENT EDITION.

MINIMUM ASPHALT THICKNESS				
LOCAL STREETS	MINOR COLLECTORS	MAJOR COLLECTORS	MINOR ARTERIALS	MAJOR ARTERIALS
2.0"	2.5"	3.0"	3.5"	4.0"



**PIPE TRENCH AND ASPHALT PATCH
WITHIN PUBLIC R/W AND ALL IMPROVED AREAS**

N.T.S.

City of Tallahassee
UNDERGROUND UTILITIES WATER RESOURCES ENGINEERING DIVISION
"Setting the Standard for Excellence"
 300 S. Adams Street, B-26 - Tallahassee, FL 32301
 Phone: 850-891-4968 Fax: 850-891-6170
 www.talgov.com/you

Approved by: _____ Date Issued: **JANUARY 2015**

COMPUTER FILE: \\cityfileserver\U\U\WRE\WS\RESOURCES_STANDARDS\DESIGN_CONSTRUCTION\DOCS_Construction Details

SHEET TITLE

**PIPE TRENCH AND ASPHALT PATCH
WITHIN PUBLIC R/W AND ALL IMPROVED AREAS**

SHEET

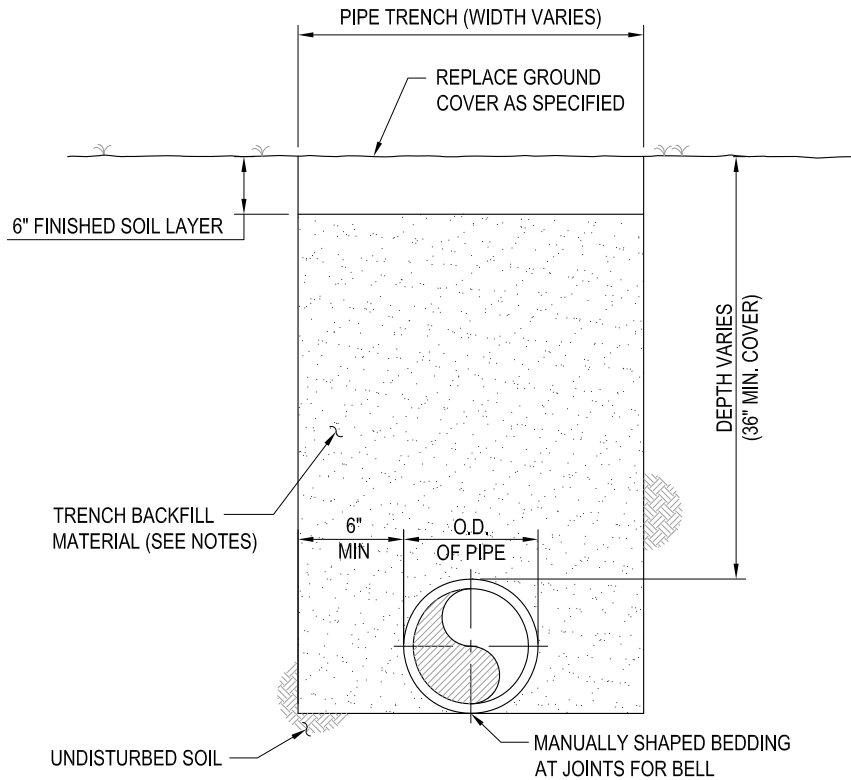
-

SCALE

N.T.S.

NOTES:

1. TRENCH BACKFILL:
 - 1.1. WITHIN PUBLIC R/W: TRENCH BACKFILL SHALL BE "SELECT BACKFILL" MATERIAL IN ACCORDANCE WITH THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
 - 1.2. OUTSIDE PUBLIC R/W: TRENCH BACKFILL SHALL BE "SUITABLE BACKFILL" MATERIAL IN ACCORDANCE WITH THE TECHNICAL SPECIFICATIONS.
2. THE TECHNICAL SPECIFICATIONS SHALL APPLY FOR ALL OTHER REQUIREMENTS NOT SUPERCEDED BY THIS DETAIL FOR ALL EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES.



PIPE TRENCH WITHIN UNIMPROVED AREAS

N.T.S.


City of Tallahassee
 UNDERGROUND UTILITIES WATER RESOURCES ENGINEERING DIVISION
"Setting the Standard for Excellence"
 300 S. Adams Street, B-26 - Tallahassee, FL 32301
 Phone: 850-891-4968 Fax: 850-891-6170
 www.tal.gov.com/you

SHEET TITLE

PIPE TRENCH WITHIN UNIMPROVED AREAS

SHEET

-

Approved by:

Date Issued:

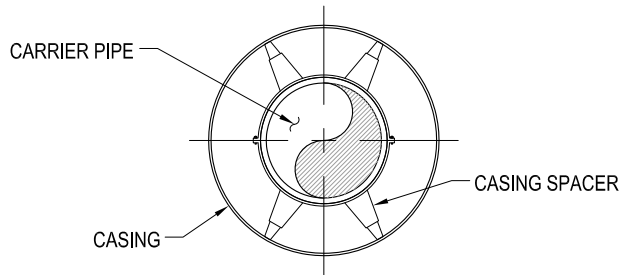
JANUARY 2015

SCALE

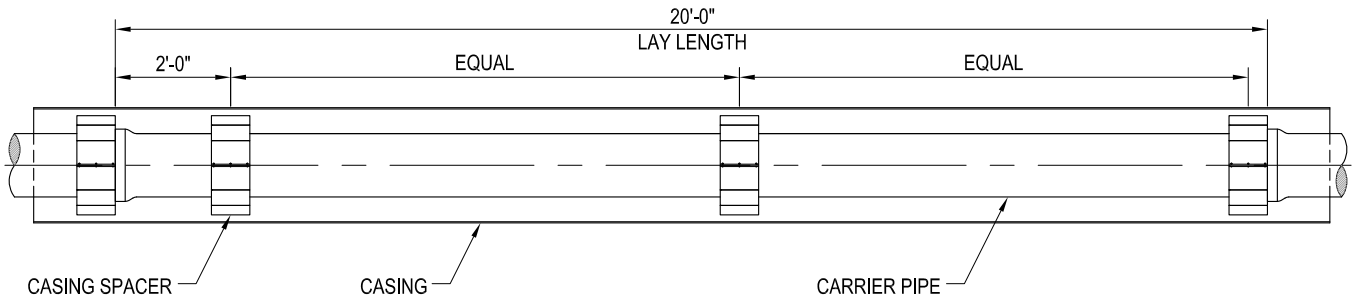
N.T.S.

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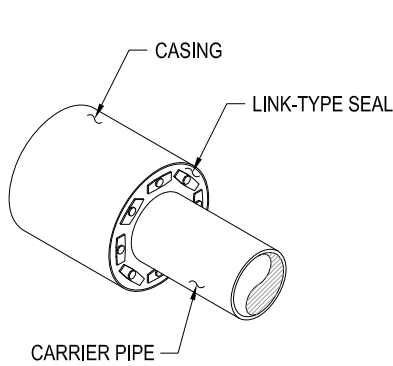
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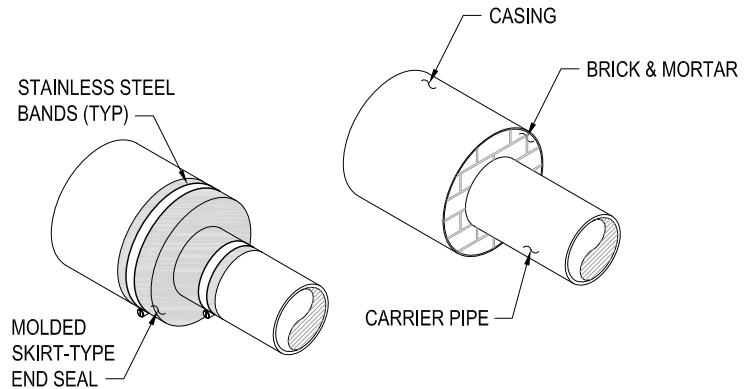
CROSS SECTION



PROFILE



LINK-TYPE CASING END SEAL



SKIRT-TYPE END SEAL OVER MASONRY PLUG

JACK & BORE

N.T.S.

SHEET TITLE

JACK & BORE

SHEET

-

Approved by:

Date Issued:

JANUARY 2015

SCALE

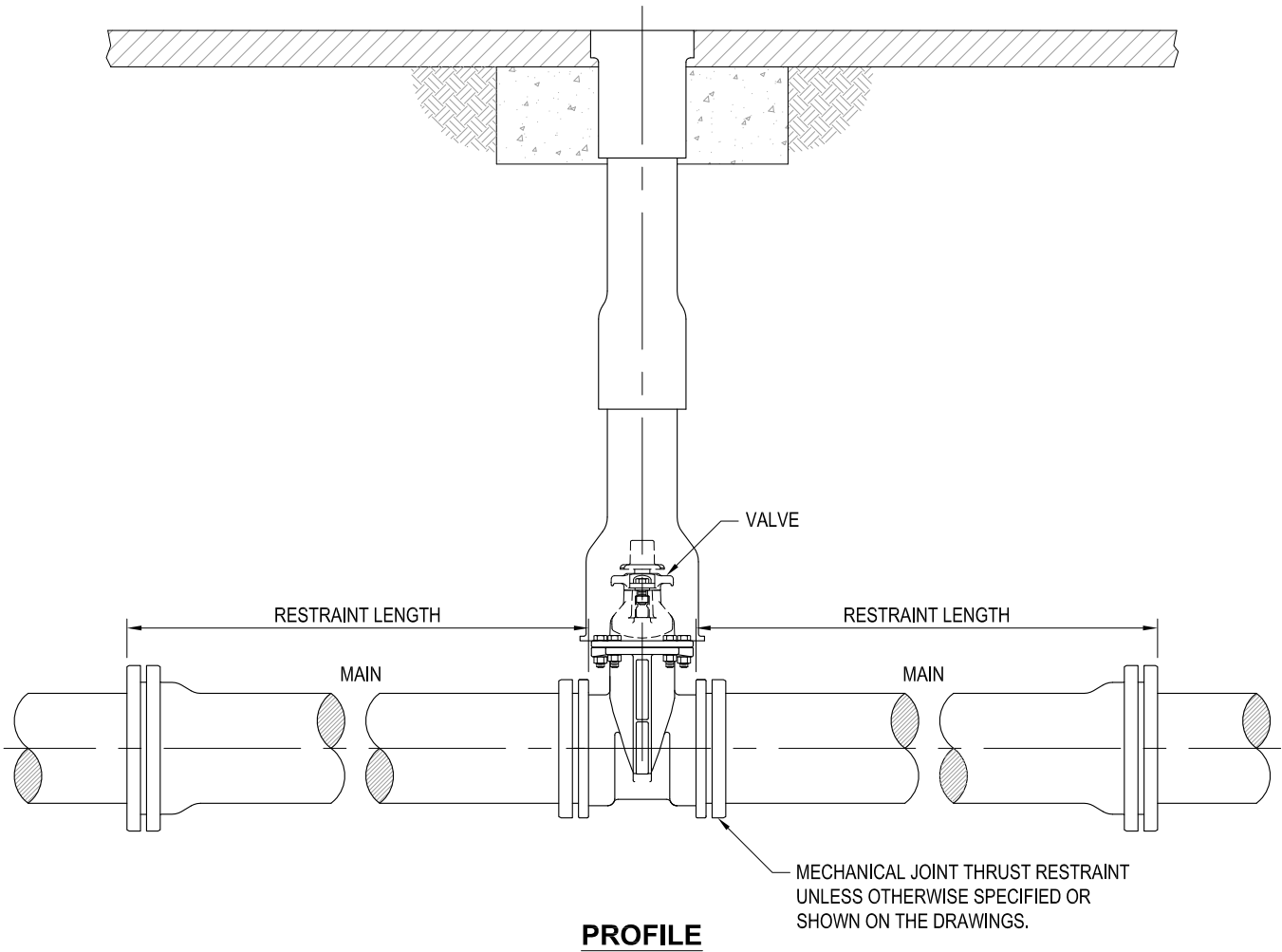
N.T.S.

RESTRAINT LENGTH FOR DEAD ENDS AND VALVES (IN FEET)

PIPE DIAMETER (INCHES)	DUCTILE IRON (FEET)	PVC (FEET)
4	31	45
6	44	63
8	58	82
10	69	98
12	81	115
14	92	131
16	103	147

THRUST RESTRAINT NOTE FOR VALVES:

1. SEE THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION FOR DESIGN PARAMETERS.
2. VALVES REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH ON BOTH SIDES OF THE VALVE.



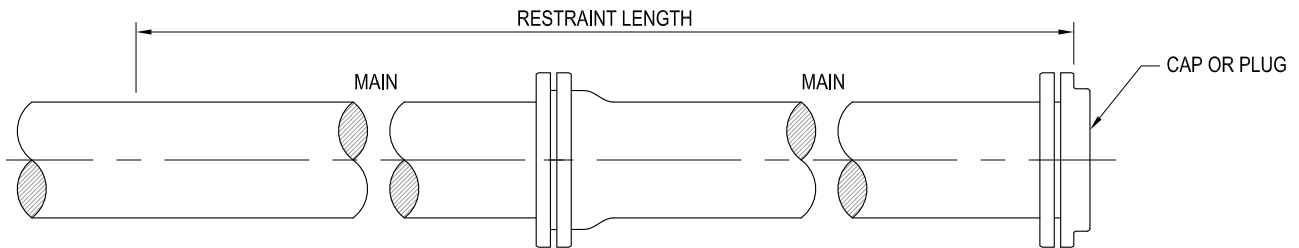
RESTRAINT LENGTHS FOR VALVES
N.T.S.

RESTRAINT LENGTH FOR DEAD ENDS AND VALVES (IN FEET)

PIPE DIAMETER (INCHES)	DUCTILE IRON (FEET)	PVC (FEET)
4	31	45
6	44	63
8	58	82
10	69	98
12	81	115
14	92	131
16	103	147

THRUST RESTRAINT NOTE FOR DEAD ENDS:

1. SEE THE CITY OF TALLHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION FOR DESIGN PARAMETERS.
2. CAPS AND PLUGS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH EXTENDING FROM THE DEAD END.



PLAN

RESTRAINT LENGTHS FOR DEAD ENDS

N.T.S.



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SHEET TITLE

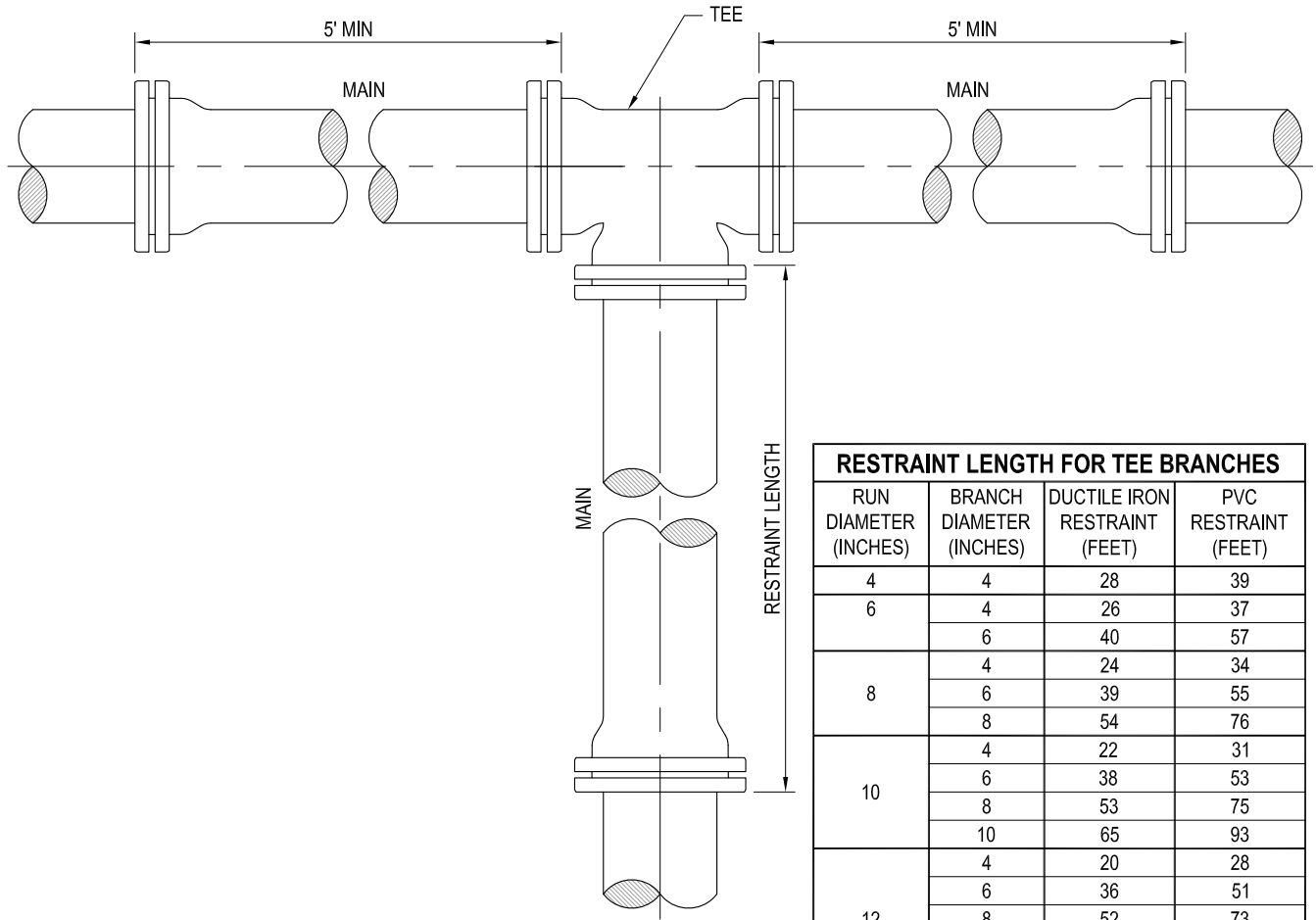
**THRUST RESTRAINT
FOR DEAD ENDS**

SHEET

-

SCALE

N.T.S.



PLAN

RESTRAINT LENGTH FOR TEE BRANCHES			
RUN DIAMETER (INCHES)	BRANCH DIAMETER (INCHES)	DUCTILE IRON RESTRAINT (FEET)	PVC RESTRAINT (FEET)
4	4	28	39
	6	26	37
6	4	40	57
	6	24	34
	8	39	55
8	4	54	76
	6	22	31
	8	38	53
10	4	65	93
	6	53	75
	8	20	28
12	6	36	51
	8	52	73
	10	64	91
	12	77	110
14	4	18	25
	6	35	49
	8	50	72
	10	63	90
	12	76	109
16	14	88	126
	4	16	22
	6	33	47
	8	49	70
	10	62	89
16	12	75	108
	14	87	125
	16	99	142

THRUST RESTRAINT NOTES FOR TEES:

1. SEE THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION FOR DESIGN PARAMETERS.
2. TEES REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH ALONG THE BRANCH PIPE.
3. BRANCH RESTRAINT LENGTH FOR TEES ASSUMES A 5 FOOT RUN LENGTH ON EACH SIDE OF THE TEE. SHORTER RUN LENGTHS MAY REQUIRE ADDITIONAL THRUST RESTRAINT.

RESTRAINT LENGTHS FOR TEES

N.T.S.

SHEET TITLE

THRUST RESTRAINT FOR TEES

SHEET

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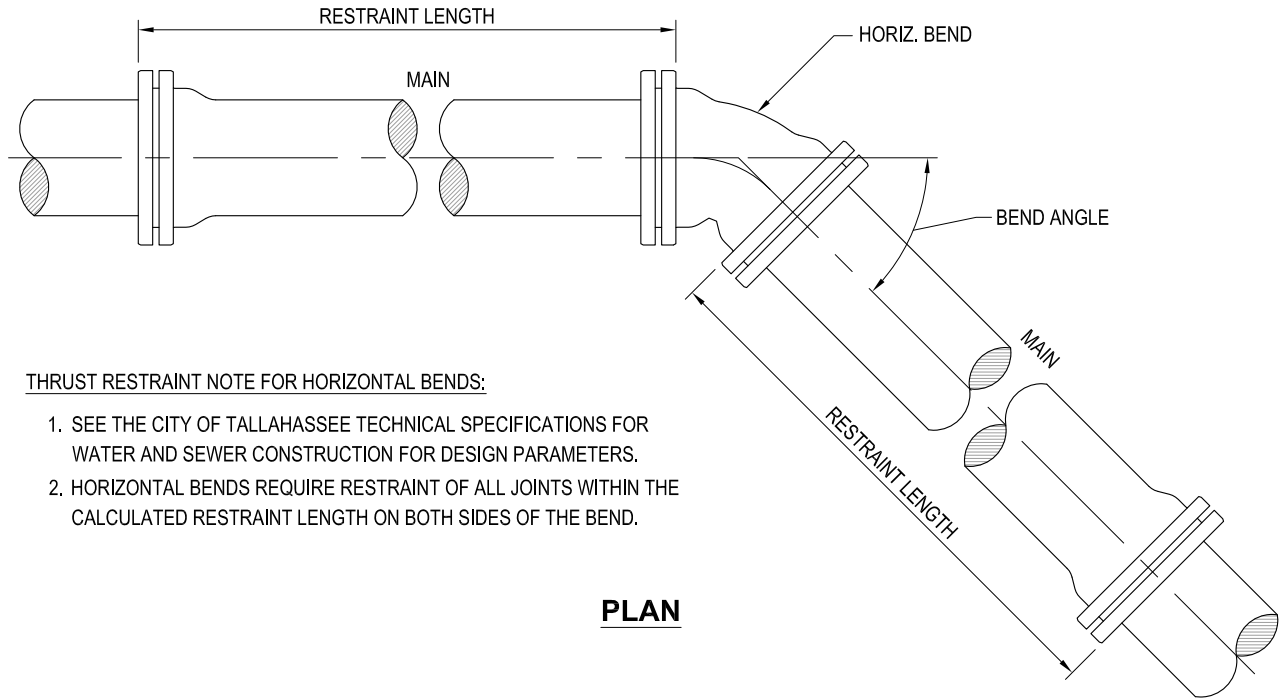
SCALE

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RESTRAINT LENGTH FOR HORIZONTAL BENDS (IN FEET)								
PIPE DIAMETER (INCHES)	DUCTILE IRON				PVC			
	BEND				BEND			
	11.25°	22.5°	45°	90°	11.25°	22.5°	45°	90°
4	2	4	8	18	3	5	9	22
6	3	5	11	25	3	6	13	30
8	4	7	14	33	4	8	17	39
10	4	8	16	39	5	10	20	47
12	5	9	19	46	6	11	23	55
14	6	11	22	52	7	13	26	62
16	6	12	24	58	7	14	29	69



THRUST RESTRAINT NOTE FOR HORIZONTAL BENDS:

1. SEE THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION FOR DESIGN PARAMETERS.
2. HORIZONTAL BENDS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH ON BOTH SIDES OF THE BEND.

PLAN

RESTRAINT LENGTHS FOR HORIZONTAL BENDS

N.T.S.

SHEET TITLE

**THRUST RESTRAINT
FOR HORIZONTAL BENDS**

SHEET

-

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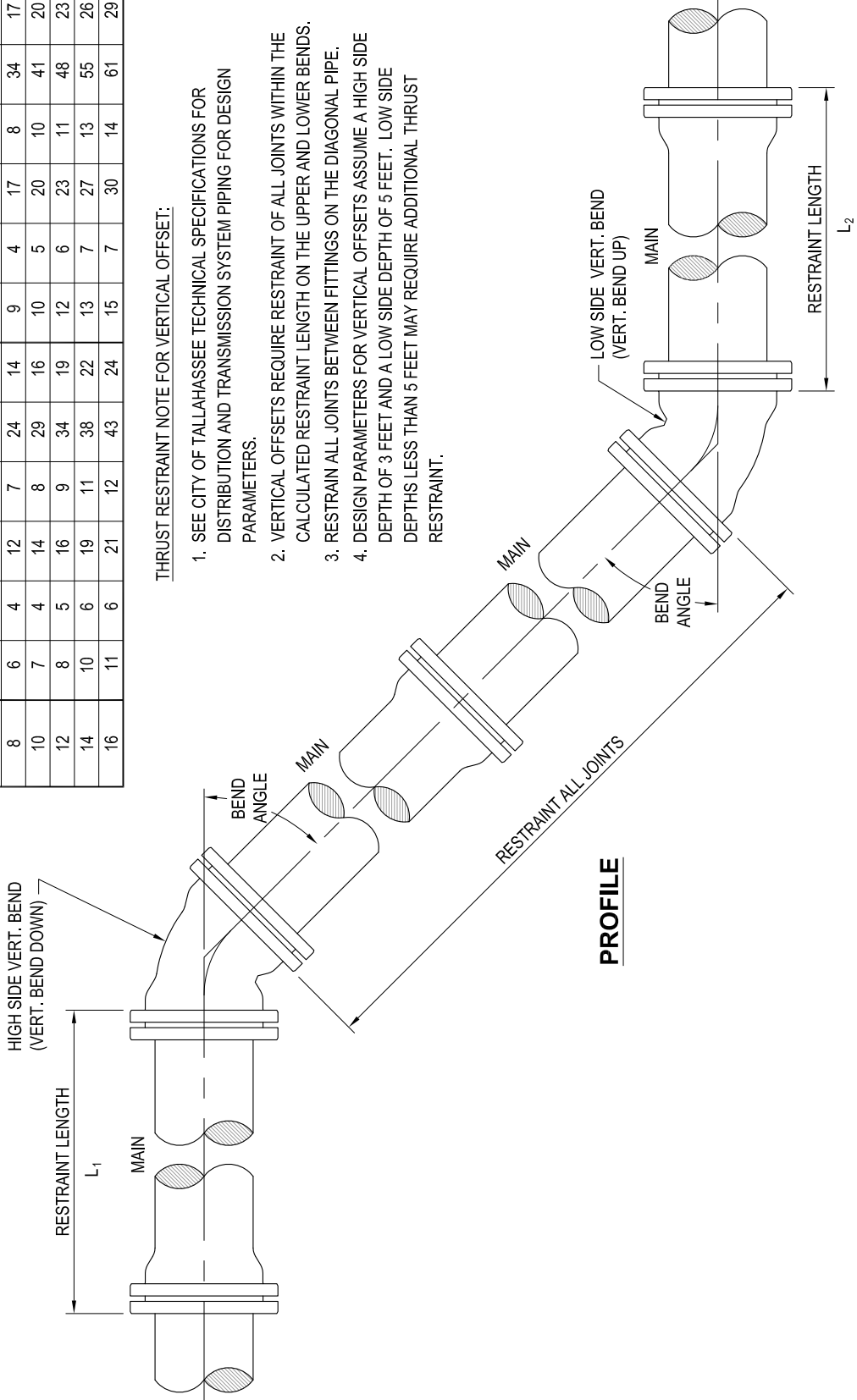
COMPUTER FILE

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RESTRAINT LENGTH FOR VERTICAL OFFSETS (IN FEET)												
PIPE DIAMETER (INCHES)	DUCTILE IRON						PVC					
	11.25°		22.5°		45°		11.25°		22.5°		45°	
	L ₁	L ₂	L ₁	L ₂	L ₁	L ₂	L ₁	L ₂	L ₁	L ₂	L ₁	L ₂
4	4	2	7	4	13	8	5	3	9	5	19	9
6	5	3	9	5	19	11	7	3	13	6	26	13
8	6	4	12	7	24	14	9	4	17	8	34	17
10	7	4	14	8	29	16	10	5	20	10	41	20
12	8	5	16	9	34	19	12	6	23	11	48	23
14	10	6	19	11	38	22	13	7	27	13	55	26
16	11	6	21	12	43	24	15	7	30	14	61	29


THRUST RESTRAINT NOTE FOR VERTICAL OFFSET:

1. SEE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR DISTRIBUTION AND TRANSMISSION SYSTEM PIPING FOR DESIGN PARAMETERS.
2. VERTICAL OFFSETS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH ON THE UPPER AND LOWER BENDS.
3. RESTRAIN ALL JOINTS BETWEEN FITTINGS ON THE DIAGONAL PIPE.
4. DESIGN PARAMETERS FOR VERTICAL OFFSETS ASSUME A HIGH SIDE DEPTH OF 3 FEET AND A LOW SIDE DEPTH OF 5 FEET. LOW SIDE DEPTHS LESS THAN 5 FEET MAY REQUIRE ADDITIONAL THRUST RESTRAINT.



RESTRAINT LENGTHS FOR VERTICAL BENDS

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SHEET TITLE

THRUST RESTRAINT FOR VERTICAL BENDS

SHEET

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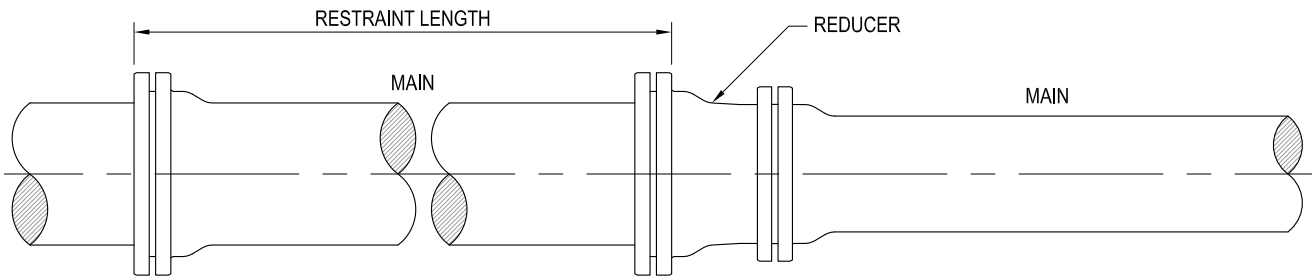
SCALE

N.T.S.

RESTRAINT LENGTH FOR REDUCERS			
LARGE PIPE DIAMETER (INCHES)	SMALL PIPE DIAMETER (INCHES)	DUCTILE IRON RESTRAINT (FEET)	PVC RESTRAINT (FEET)
6	4	23	32
8	4	41	59
	6	24	35
10	4	56	80
	6	42	60
	8	23	33
12	4	70	100
	6	59	84
	8	43	61
	10	24	34
14	4	83	118
	6	73	105
	8	60	85
	10	44	62
16	12	24	34
	4	95	136
	6	87	124
	8	75	108
	10	61	88
	12	44	63
	14	24	34

THRUST RESTRAINT NOTE FOR REDUCERS:

1. SEE THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION FOR DESIGN PARAMETERS.
2. REDUCERS REQUIRE RESTRAINT OF ALL JOINTS WITHIN THE CALCULATED RESTRAINT LENGTH, EXTENDING FROM THE REDUCER ON THE SIDE OF THE LARGER PIPE.



PLAN

RESTRAINT LENGTHS FOR REDUCERS

N.T.S.

SHEET TITLE

THRUST RESTRAINT FOR REDUCERS

SHEET

-

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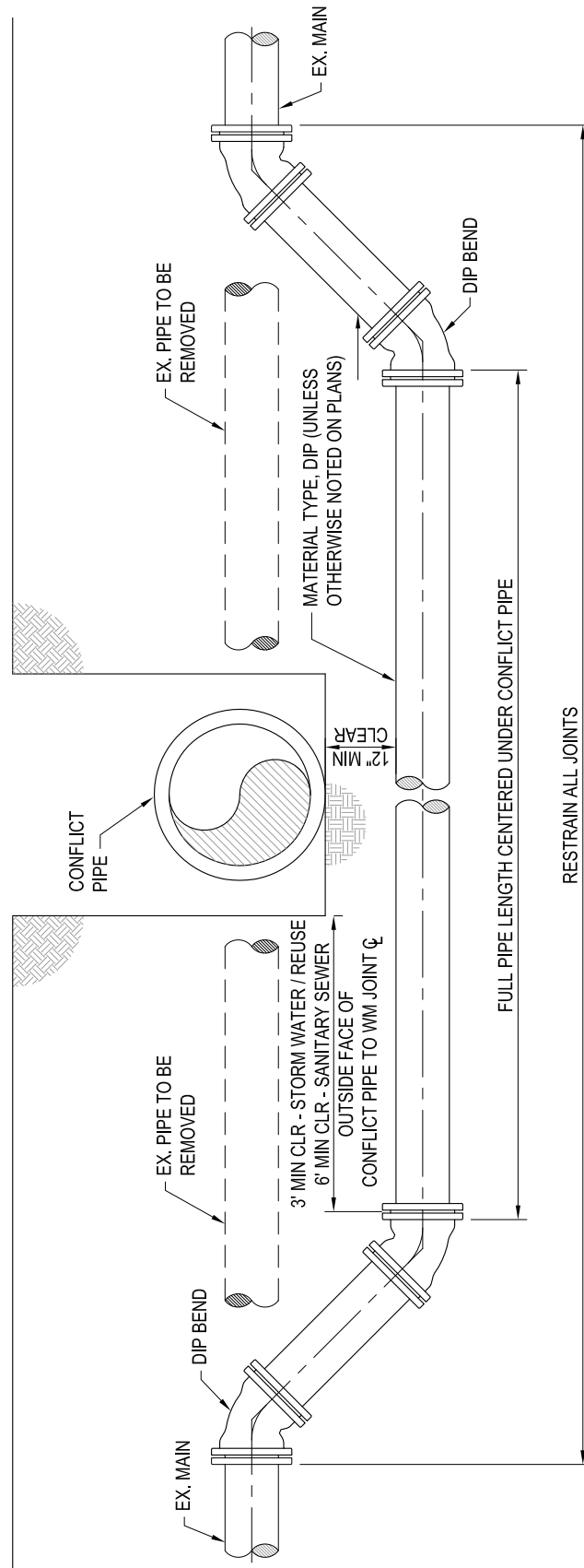
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NOTES:

1. RESTRAINT LENGTHS FOR VERTICAL OFFSETS SHALL BE IN ACCORDANCE WITH THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.



STANDARD MAIN LOWERING

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SHEET TITLE

STANDARD MAIN LOWERING

SHEET

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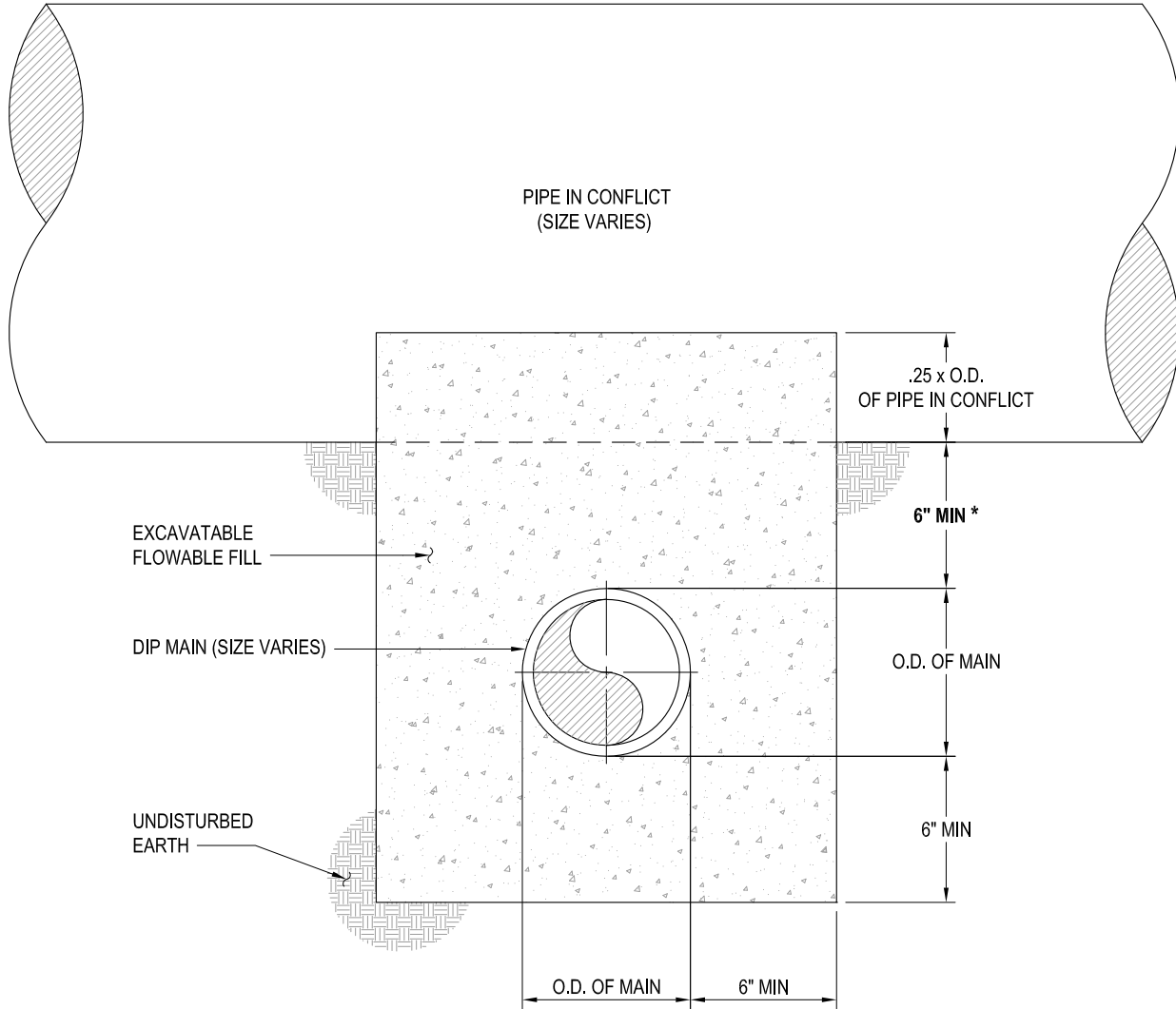
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NOTES:

1. PIPE ENCASEMENT TO EXTEND A MINIMUM OF 24" BEYOND PIPE IN CONFLICT (BOTH DIRECTIONS)



* CONTRACTOR SHALL NOTIFY CITY IF SEPARATION IS LESS THAN 6"

**PIPE ENCASEMENT FOR CROSSINGS
w/ LESS THAN 12" VERTICAL SEPARATION**

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SHEET TITLE

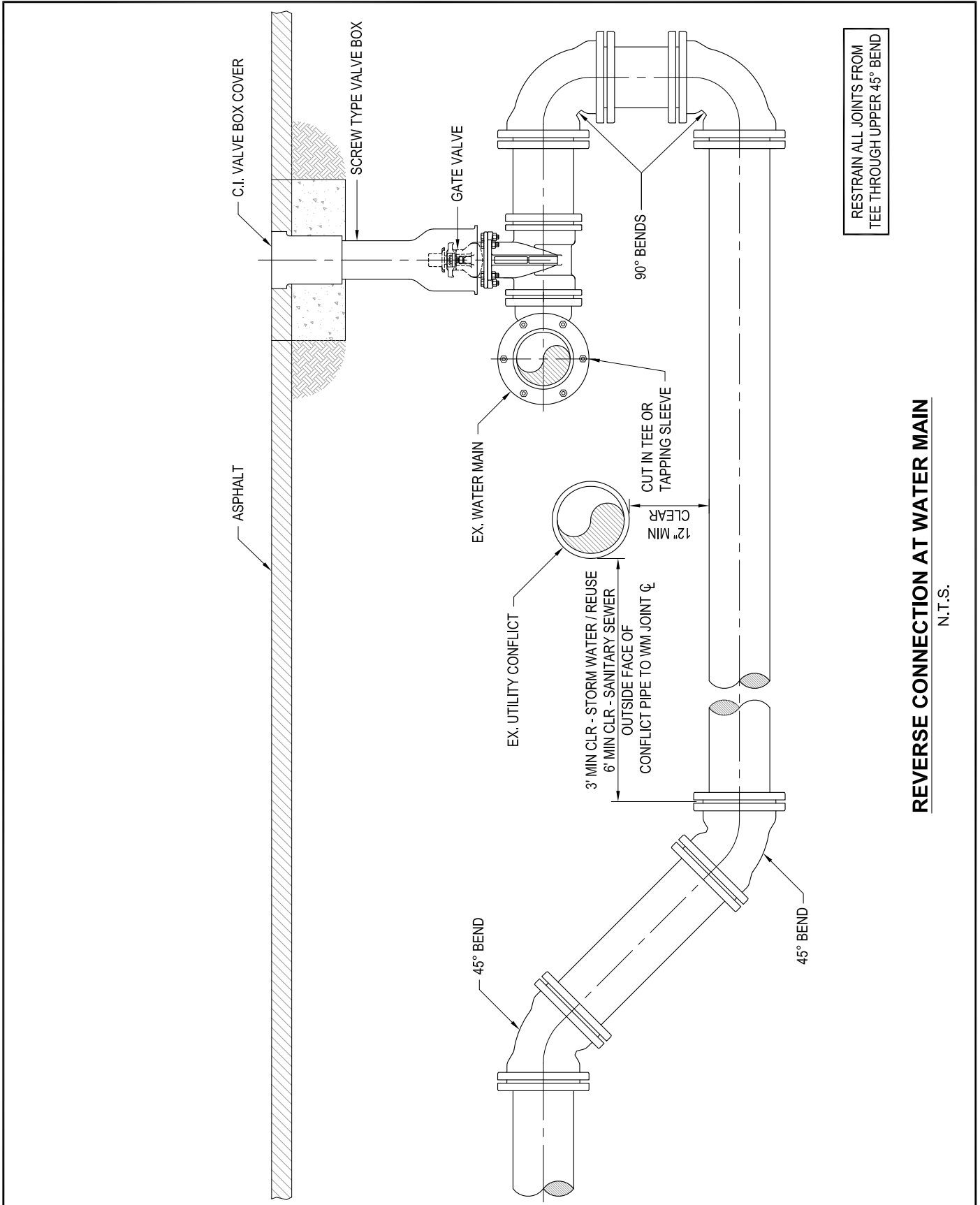
**PIPE ENCASEMENT FOR CROSSING
w/ LESS THAN 12" VERTICAL SEPARATION**

SHEET

-


SCALE

N.T.S.



RESTRAIN ALL JOINTS FROM TEE THROUGH UPPER 45° BEND

REVERSE CONNECTION AT WATER MAIN
N.T.S.

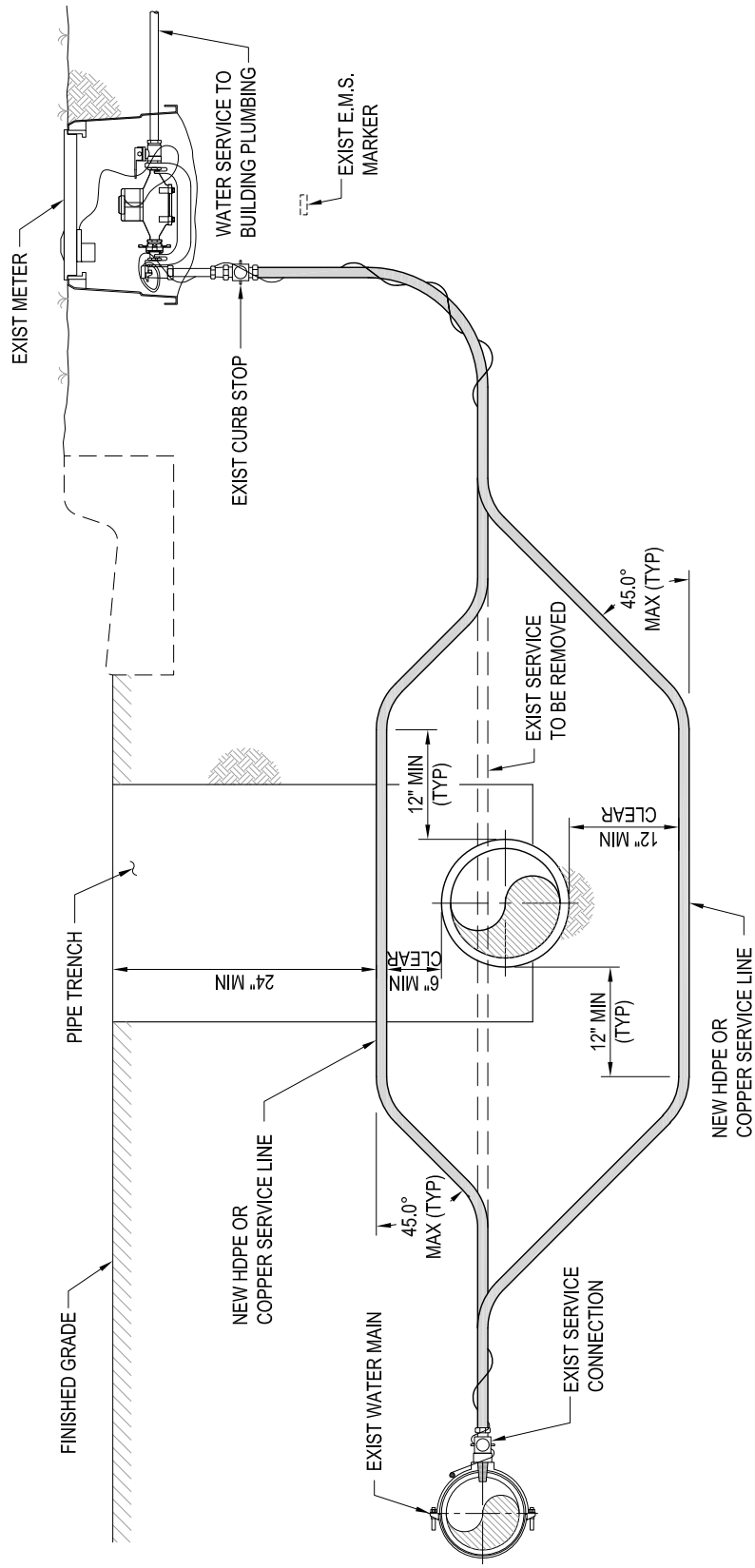
 <p>City of Tallahassee UNDERGROUND UTILITIES "Setting the Standard for Excellence"</p>	<p>WATER RESOURCES ENGINEERING DIVISION 300 S. Adams Street, B-26 - Tallahassee, FL 32301 Phone: 850-891-4968 Fax: 850-891-6170 www.telgov.com/you</p>
	<p>Approved by: _____ Date Issued: JANUARY 2015</p>
<p>COMPUTER FILE \\cityfileserver\U\U\WRE\WS\RESOURCES\STANDARDS\DESIGN_CONSTRUCTION\DOCS_Construction Details</p>	

<p>SHEET TITLE</p> <p>REVERSE CONNECTION AT WATER MAIN</p>

<p>SHEET</p> <p>•</p>
<p>SCALE</p> <p>N.T.S.</p>

NOTES:

1. IF NEW PIPE TRENCH OCCURS WITHIN IMPROVED AREAS, EXIST WATER SERVICE IS TO BE REPLACED FROM EXIST WATER MAIN SERVICE CONNECTION TO EXIST CURB STOP AT METER.
2. A MINIMUM OF 10 GAUGE SOLID COPPER WIRE (BLUE) WILL RUN FROM MAIN TO METER; CONNECT TO EXISTING TRACER WIRE AT MAIN. WRAP AROUND CORPORATION STOP, WRAP AROUND AND SECURE TO SERVICE TUBING; THEN EXTEND UP INTO METER BOX AT ANGLE VALVE. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.



PROFILE

**ADJUSTMENT OF EXIST WATER SERVICE
(NEW PIPE TRENCH WITHIN IMPROVED AREAS)**
N.T.S.


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SHEET TITLE

**ADJUSTMENT OF EXIST WATER SERVICE
(NEW PIPE TRENCH WITHIN IMPROVED AREAS)**

SHEET

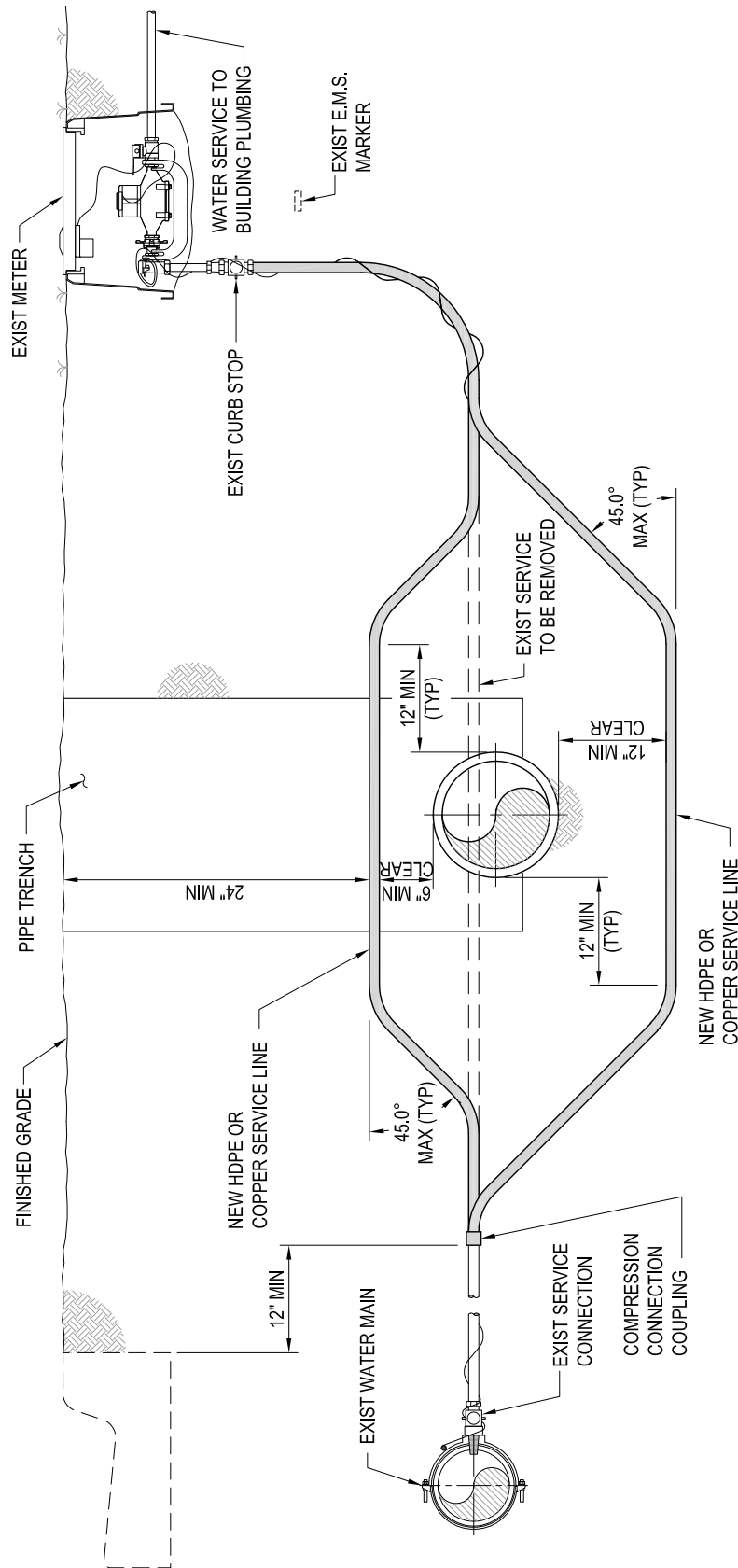
-

SCALE

N.T.S.


NOTES:

1. IF NEW PIPE TRENCH OCCURS WITHIN UNIMPROVED AREAS, EXIST WATER SERVICE IS TO BE REPLACED FROM 12" BEHIND THE BACK SIDE OF CURB OR 12" OFF THE EDGE OF PAVEMENT TO EXIST CURB STOP AT METER.
2. A MINIMUM OF 10 GAUGE SOLID COPPER WIRE (BLUE) WILL RUN FROM MAIN TO METER; CONNECT TO EXISTING TRACER WIRE AT MAIN; WRAP AROUND CORPORATION STOP; WRAP AROUND AND SECURE TO SERVICE TUBING, THEN EXTEND UP INTO METER BOX AT ANGLE VALVE. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.



PROFILE

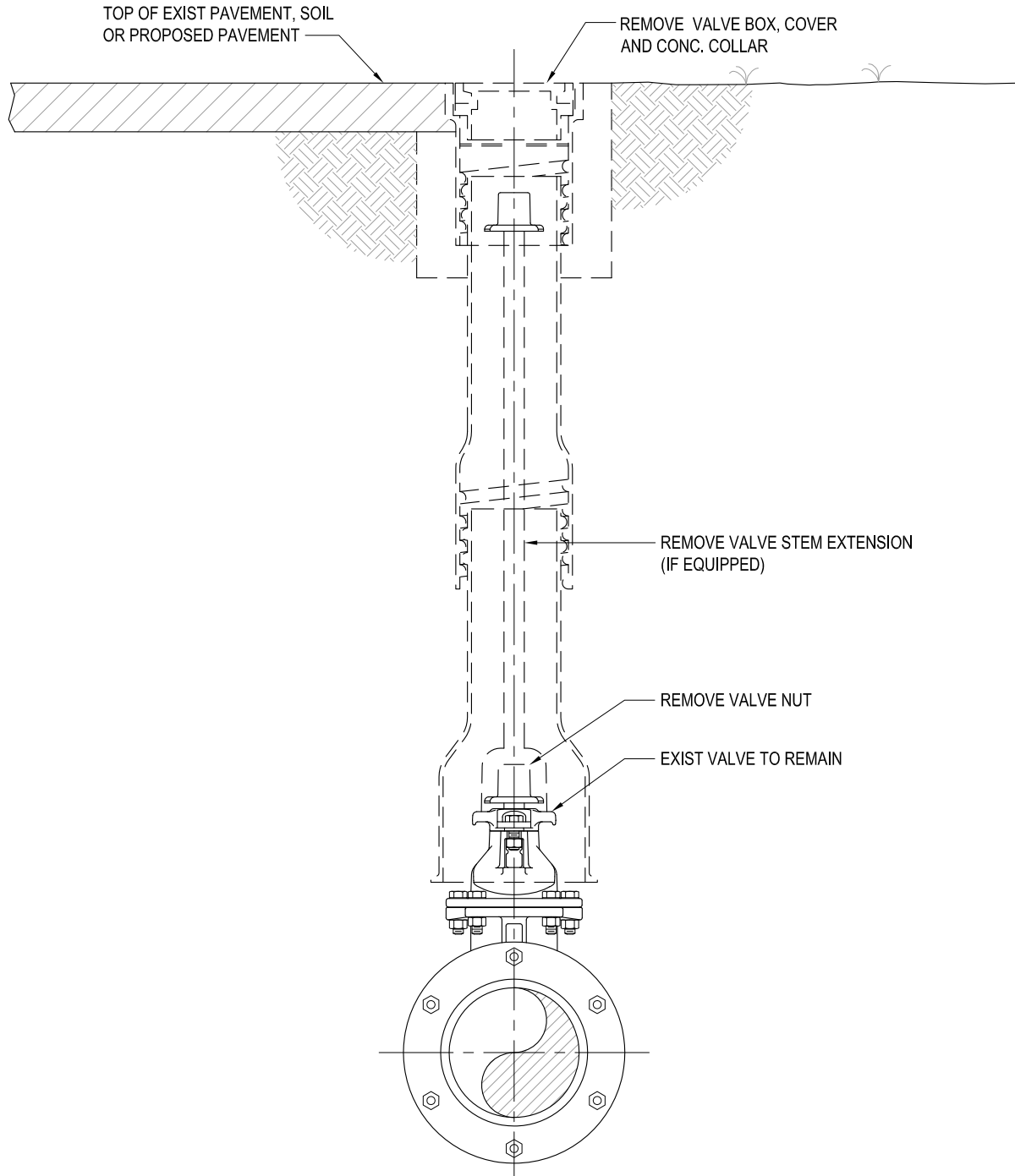
**ADJUSTMENT OF EXIST WATER SERVICE
(NEW PIPE TRENCH WITHIN UNIMPROVED AREAS)**
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SHEET TITLE	SHEET
ADJUSTMENT OF EXIST WATER SERVICE (NEW PIPE TRENCH WITHIN UNIMPROVED AREAS)	-
SCALE	N.T.S.

NOTES:

1. IN PAVEMENT: ALL CUTS AND REPAIRS TO EXIST SURFACE MUST CONFORM TO THE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. COMPACT AS REQ'D & MATCH EXIST GRADE & SURFACE CONDITIONS.



VALVE ABANDONMENT (FULL)

N.T.S.

SHEET TITLE

VALVE ABANDONMENT

SHEET

-

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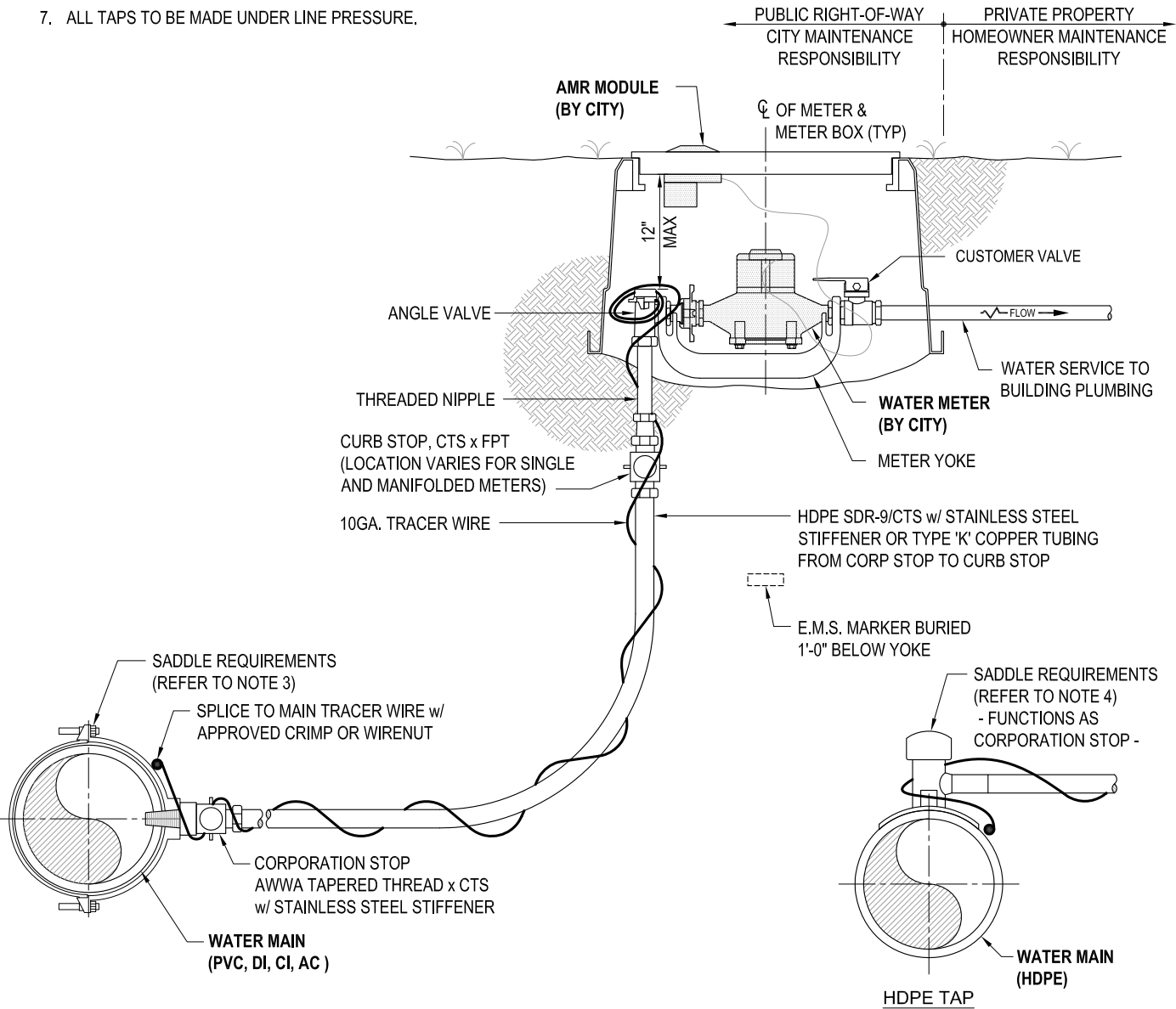
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NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. A MINIMUM OF 10 GAUGE TRACER WIRE WILL RUN FROM MAIN TO METER; CONNECT TO EXISTING TRACER WIRE AT MAIN, WRAP AROUND CORPORATION STOP, WRAP AROUND AND SECURE TO SERVICE TUBING, THEN EXTEND UP INTO METER BOX AT ANGLE VALVE. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.
3. TAPS ON PVC, CAST IRON AND AC MAINS REQUIRE SADDLES (REFER TO TECHNICAL SPECIFICATIONS), DIRECT TAP ONLY ON DUCTILE PIPE, TAP AT 9 AND 3 O'CLOCK ONLY.
4. TAPS ON HDPE MAINS REQUIRE ELECTROFUSION TAPPING TEE / SADDLE TAP AT 12 O'CLOCK.
5. METER BOX SHALL BE EITHER CDR OR QUASITE FOR PAVEMENT AREAS. LID SHALL BE COMPATIBLE WITH AMR SYSTEM.
6. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.
7. ALL TAPS TO BE MADE UNDER LINE PRESSURE.



5/8" & 1" WATER SERVICE AND METER SETTING

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SHEET TITLE

5/8" & 1" WATER SERVICE AND METER SETTING

SHEET

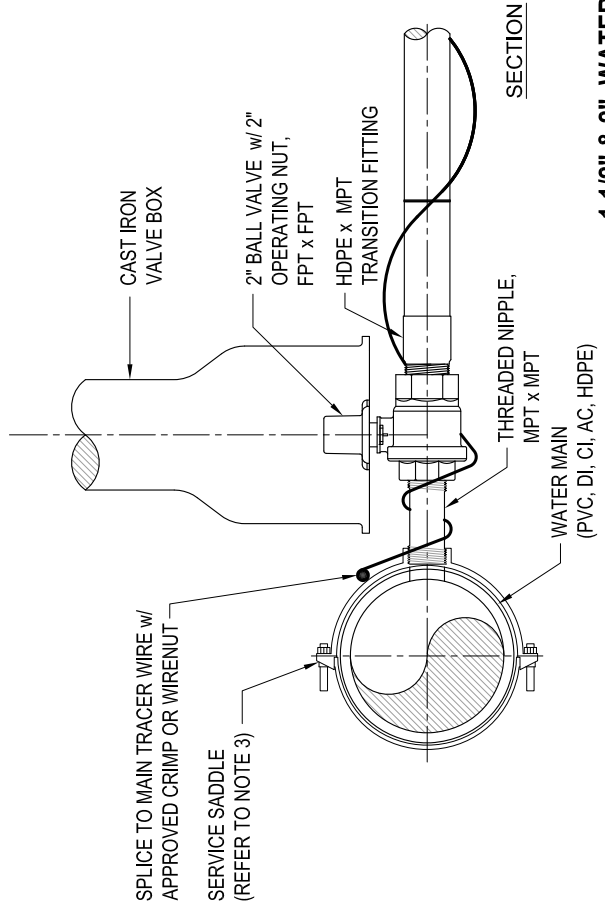
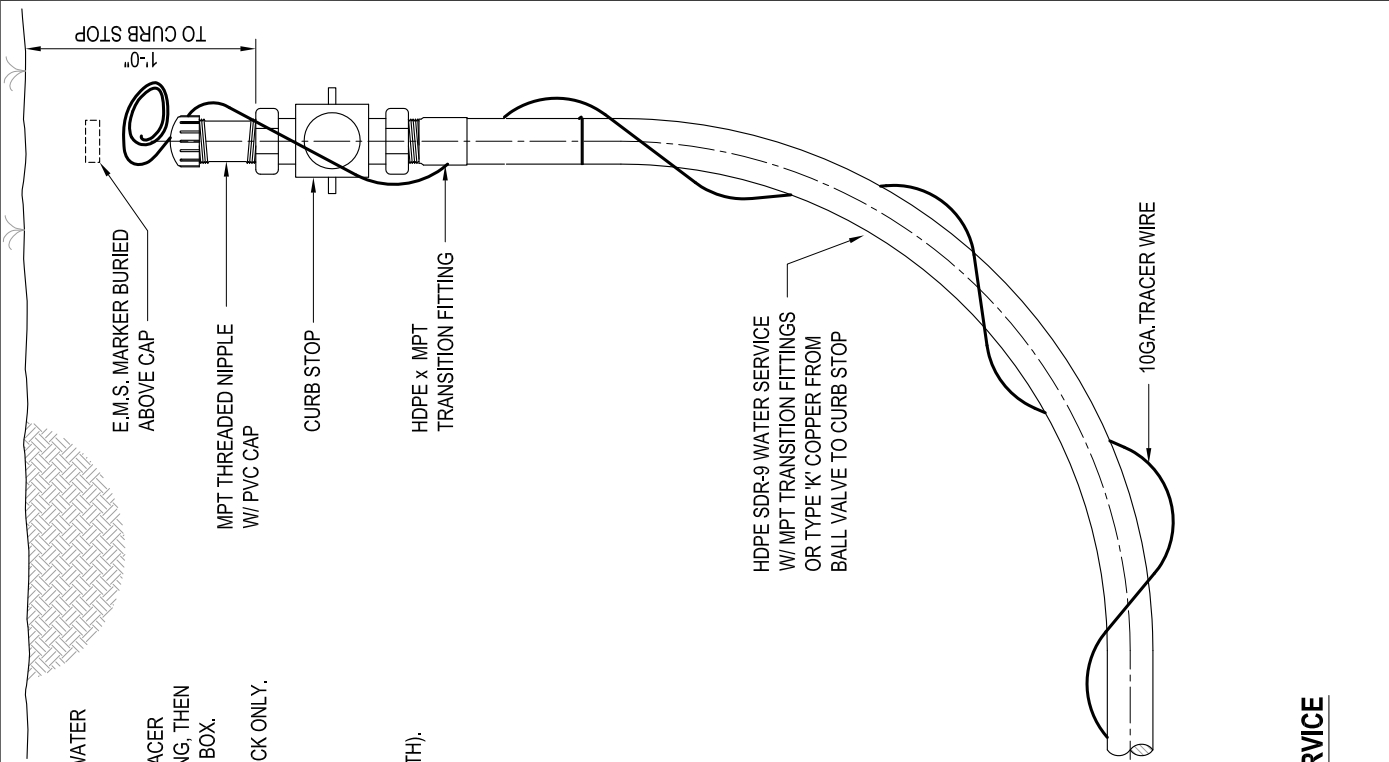
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SCALE

N.T.S.

NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. A MINIMUM OF 10 GAUGE TRACER WIRE WILL RUN FROM MAIN TO METER; CONNECT TO EXISTING TRACER WIRE AT MAIN. WRAP AROUND CORPORATION STOP, WRAP AROUND AND SECURE TO SERVICE TUBING, THEN EXTEND UP INTO METER BOX AT ANGLE VALVE. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.
3. TAPS ALL MAINS REQUIRE SADDLES (REFER TO TECHNICAL SPECIFICATIONS). TAP AT 9 AND 3 O'CLOCK ONLY.
4. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.
5. ALL TAPS TO BE MADE UNDER LINE PRESSURE.
6. BY-PASS MUST BE LOCATED INSIDE OF BOX RUNNING PARALLEL TO WATER METER (NOT UNDERNEATH).
7. BY-PASS IS NOT REQUIRED IF METER IS FOR IRRIGATION.



1 1/2" & 2" WATER SERVICE
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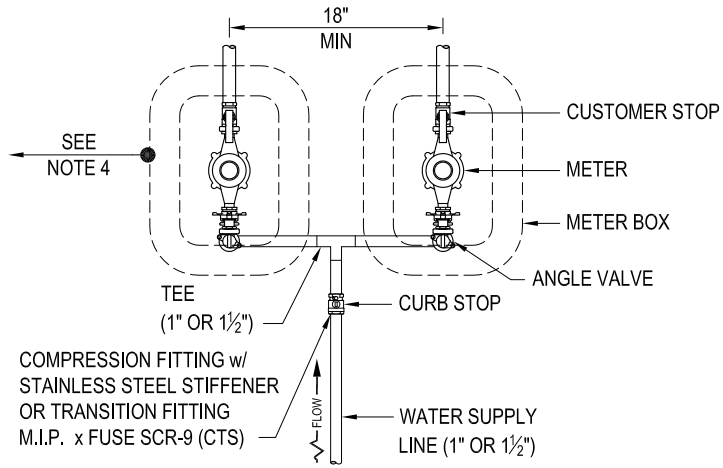
1 1/2" and 2" WATER SERVICE

SHEET

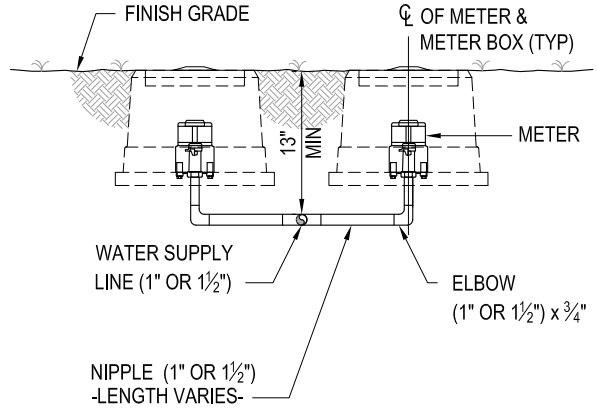
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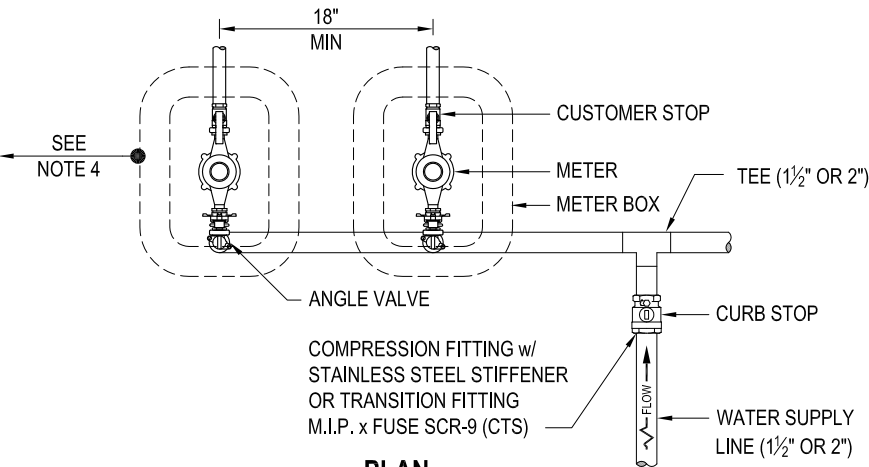
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PLAN
1" OR 1 1/2" SERVICE



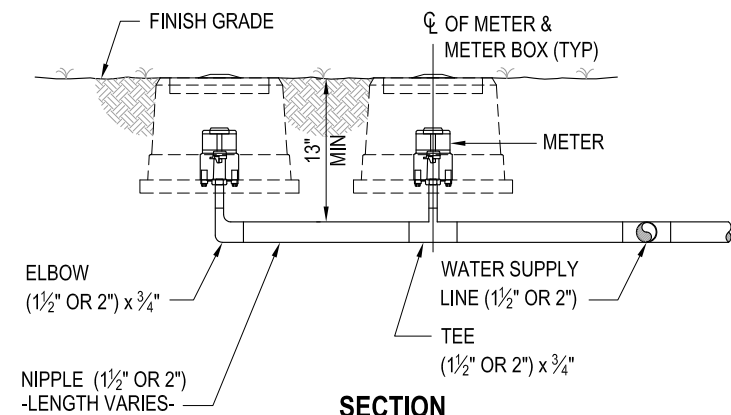
SECTION
1" OR 1 1/2" SERVICE



PLAN
1 1/2" OR 2" SERVICE

METERS ALLOWED PER MANIFOLD		
No. OF 5/8" METERS	SIZE OF SERVICE	CONFIGURATION
2	1" or 1 1/2"	
3	1" or 1 1/2"	
4	1 1/2"	
5	1 1/2" or 2"	
6	2"	
7	2"	
8	2"	
9	2"	
10	2"	

ALL METER SERVICES MUST BE BALANCED w/ NO MORE THAN (1) ONE ADDITIONAL METER EITHER SIDE OF SUPPLY LINE.



SECTION
1 1/2" OR 2" SERVICE

NOTES:

1. ALL MANIFOLD PIPING, VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.
2. ALL MATERIAL FOR METER AND MANIFOLDS MUST BE MADE IN THE U.S.A. (DOMESTIC) NO SUBSTITUTIONS.
3. 1 1/2" HDPE BLUE TUBING SDR-9 (CTS) w/ 1 1/2" MANIFOLD FOR : UP TO (5) FIVE 5/8" METERS PER MANIFOLD, MAX.
4. 2" HDPE BLUE TUBING SDR-9 (CTS) w/ 2" MANIFOLD FOR : (6) SIX TO (10) TEN 5/8" METERS, (10) MAX.
5. METER SHALL BE CENTERED IN METER BOX.
6. METER BOXES SHALL BE CLEAR OF ALL STRUCTURES ON ALL SIDES, 30" MIN.

MANIFOLDS FOR 5/8" METER
N.T.S.

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SHEET TITLE

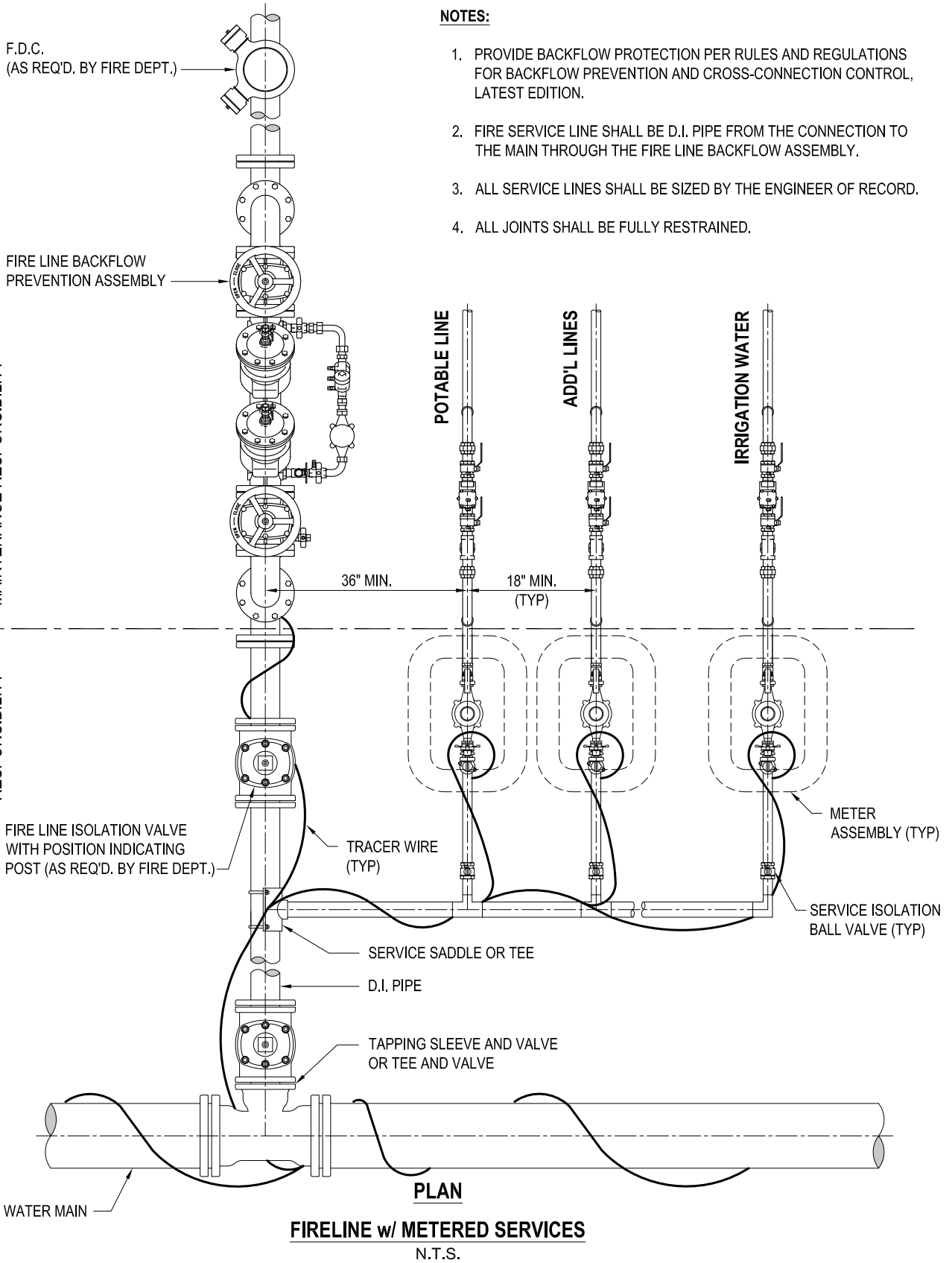
MANIFOLDS FOR 5/8" METER

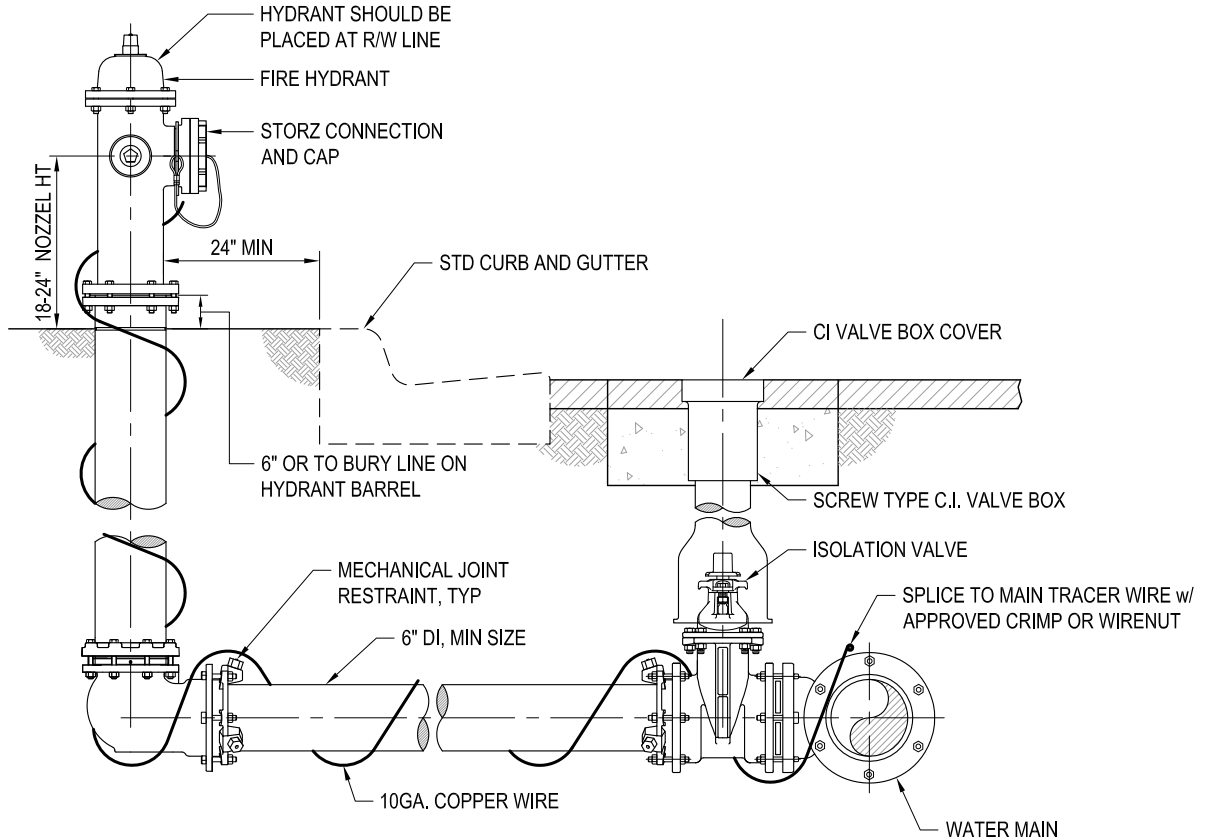
SHEET

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SCALE

N.T.S.





NOTES:

1. HYDRANT TO BE PLACED WITH PUMPER NOZZEL FACING STREET.
2. APPROVED MODELS ARE MUELLER A423, M.H. RELIANT 929, AND CLOW MEDALLION. NO SUBSTITUTES WILL BE ALLOWED.
3. VALVE OPENING 5 1/4" MINIMUM.
4. SIX INCH MJ CONNECTION TO MAIN.
5. HOSE NOZZLES: NATIONAL STANDARD THREADS WITH TWO 2 1/2" HOSE NOZZLES AND ONE STEAMER NOZZLE WITH 5" OPENING AND STORZ CONNECTION WITH CAP ON NOZZLE.
6. ALL PIPE FROM MAIN TO HYDRANT SHALL BE RESTRAINED DUCTILE IRON w/o FITTINGS.
7. FIRE HYDRANT TEE MAY BE USED IN LIEU OF MECHANICAL TEE.
8. COMPACTION WILL BE 100% STANDARD PROCTOR.
9. DEPTH OF PIPE TO HAVE 36" MINIMUM COVER.
10. HYDRANTS PAINT SHALL BE COMEX (U-10: HIGH SOLIDS, GLOSS POLYURETHANE) OVER (M-10: Universal Primer) OR APPROVED EQUAL.
11. HYDRANTS COLOR:
SAFETY YELLOW - HYDRANTS PLACED ON CITY WATER MAINS.
RED - HYDRANTS PLACED ON PRIVATE WATER MAINS.
OFF WHITE - HYDRANT PRIMER.
12. HYDRANT PLACEMENT:
CURB AND GUTTER STREET - AS NOTED PER PLANS
OPEN DITCH STREET - TOP OF BACKSLOPE OF DITCH, ON THE R/W LINE AND OR PROPERTY CORNER.
(MAX. 10' FROM DRIVING SURFACE)
13. CLEARANCES OF SEVEN AND ONE HALF FEET IN FRONT OF AND TO EACH SIDE OF HYDRANT WITH FOUR FOOT TO THE REAR SHALL BE MAINTAINED.

FIRE HYDRANT DETAIL

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SHEET TITLE

FIRE HYDRANT DETAIL

SHEET

-

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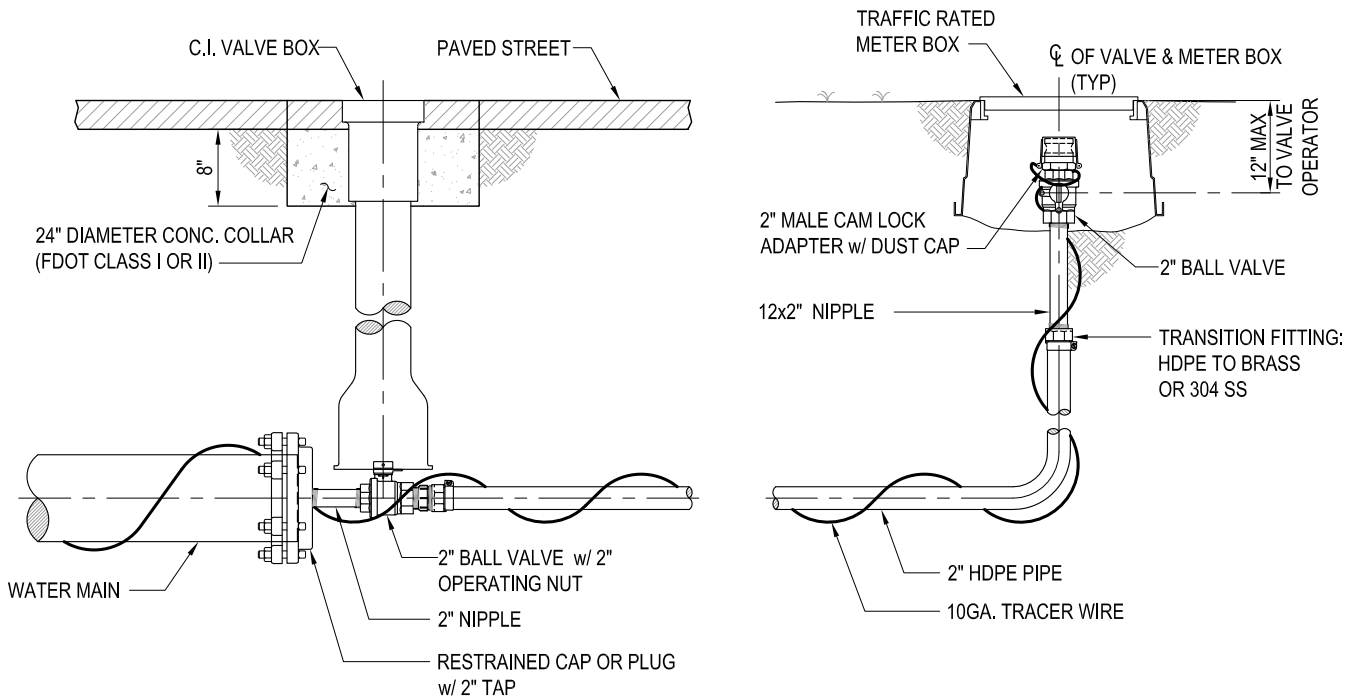
JANUARY 2015

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N.T.S.

NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. A MINIMUM OF 10 GAUGE TRACER WIRE WILL RUN FROM MAIN TO METER BOX; CONNECT TO EXISTING TRACER WIRE AT MAIN, WRAP AROUND BALL VALVE, WRAP AROUND AND SECURE TO SERVICE TUBING, THEN EXTEND UP INTO METER BOX AT BALL VALVE. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.
3. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.



MANUAL 2" WATER MAIN FLUSH STAND

N.T.S.

SHEET TITLE

MANUAL 2" WATER MAIN FLUSH STAND

SHEET

-

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Date Issued:

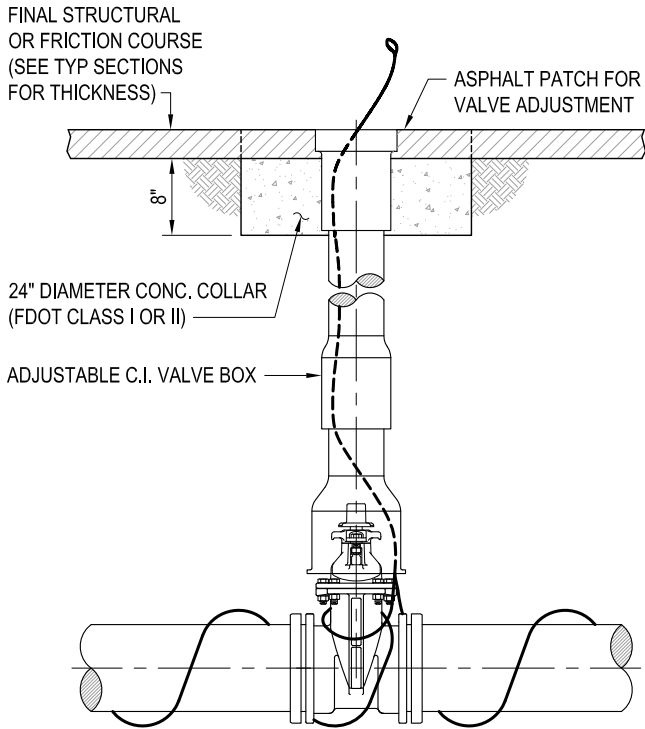
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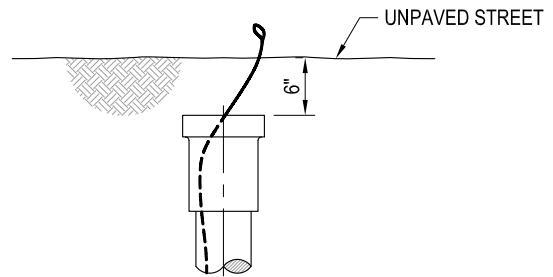
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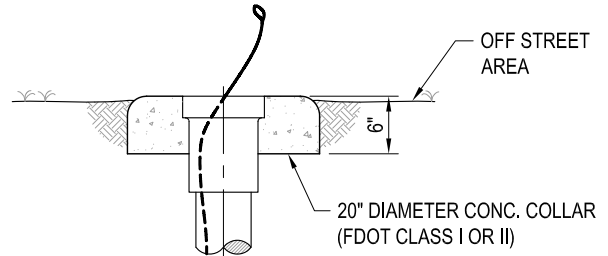
1. FOR CONSTRUCTION WITHIN ROADWAY, CONSTRUCT VALVE BOX WITH TOP 12" BELOW PROPOSED STREET GRADE. AFTER FINAL PAVING, CUT SMOOTH, CIRCULAR HOLE AROUND VALVE BOX AND ADJUST TO BE FLUSH WITH FINISH PAVEMENT. PLACE CONCRETE COLLAR AND FINISHED ASPHALT PATCH AS SHOWN TO MATCH EXISTING GRADE.
2. AT NO TIME IS VALVE BOX OR EXTENSION PIPE TO TOUCH BONNET, BODY OF VALVE, OR MAIN.
3. EXTENSION PIPE TO BE 6" C-900 PVC , DR 18 OR D.I.P.
4. WIRE SHALL NOT BE WRAPPED AROUND OPERATING NUT OR STEM FOR ANY REASON.
5. GPS LOCATION OR SWING TIES TO BE PROVIDED TO CITY BY CONTRACTOR OF ALL VALVE BOXES LOCATED BELOW FINISHED GRADE. ALL INFORMATION MUST BE KEPT CURRENT UNTIL MILLING AND RESURFACING OPERATIONS ARE COMPLETE AND VALVE BOXES ARE ADJUSTED TO FINISHED GRADE.



PAVED STREET



GRADED STREET



OFF STREET

TYPICAL VALVE BOX PLACEMENT DETAIL

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TYPICAL VALVE BOX
PLACEMENT DETAIL

SHEET

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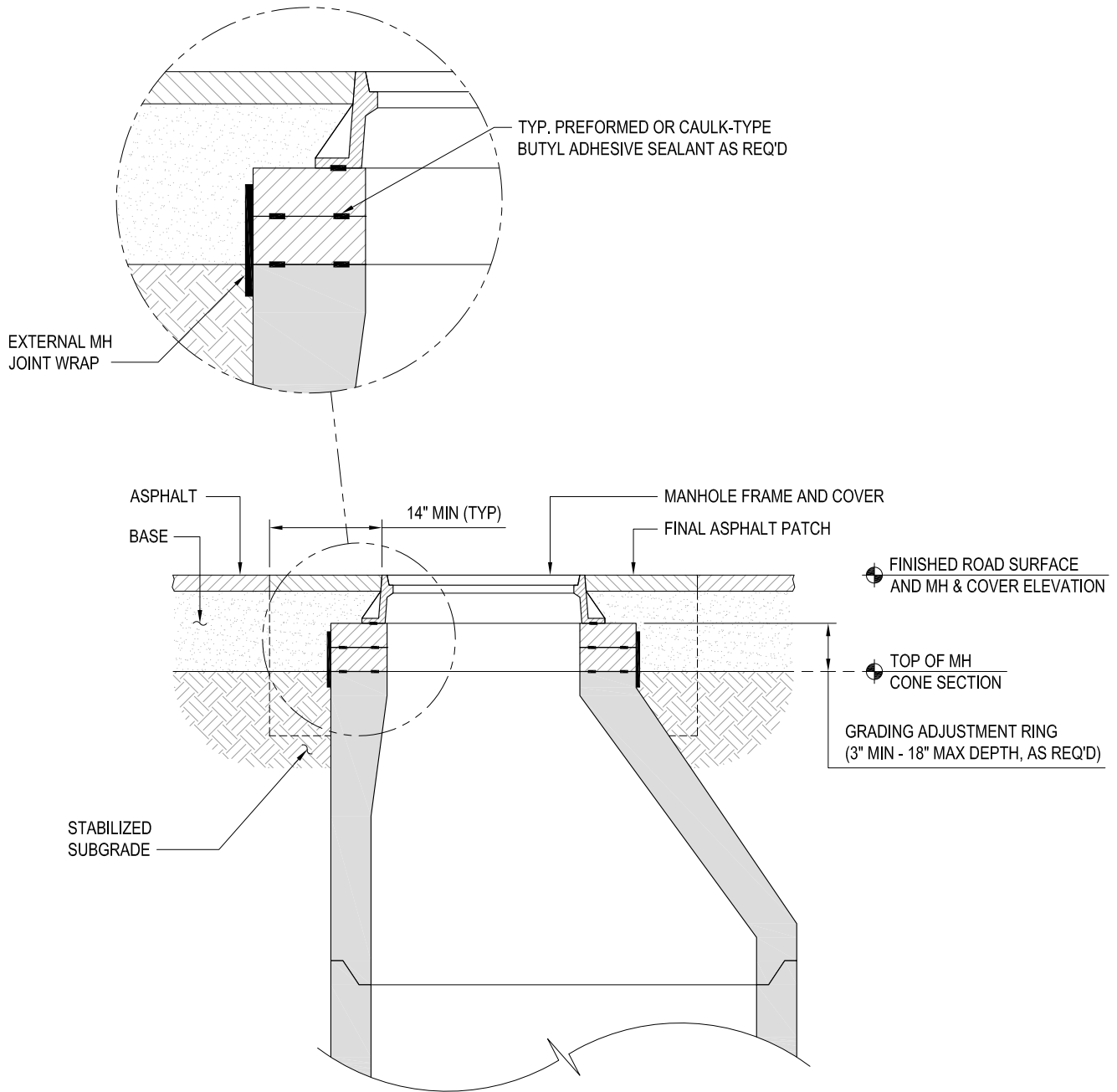
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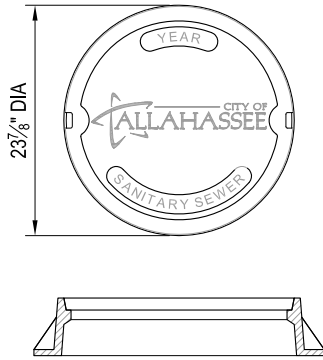
MANHOLE FRAME & COVER PLACEMENT

N.T.S.

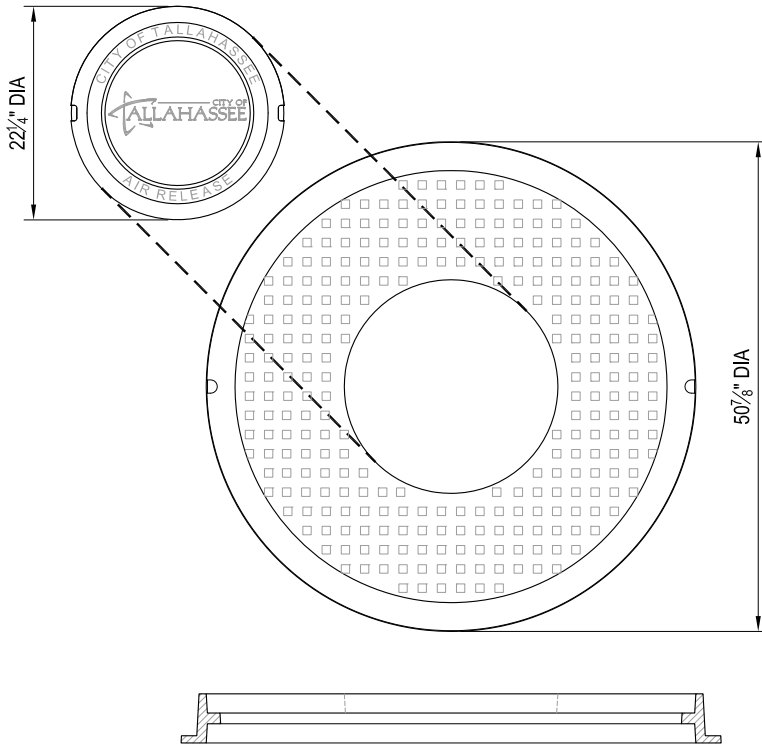
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SHEET TITLE MANHOLE FRAME & COVER PLACEMENT

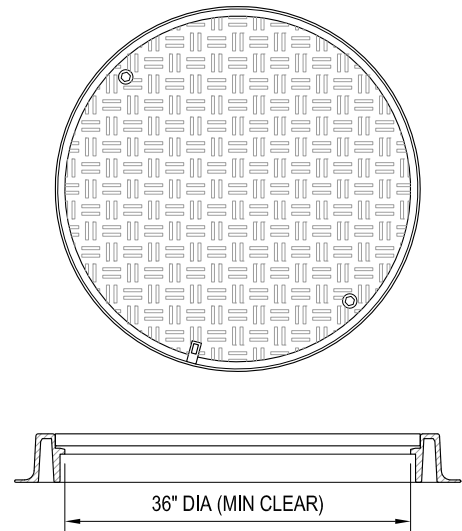
SHEET -
SCALE N.T.S.



**STANDARD SANITARY SEWER
MANHOLE COVER & FRAME**




**AIR RELEASE VALVE (ARV)
MANHOLE COVER & FRAME**



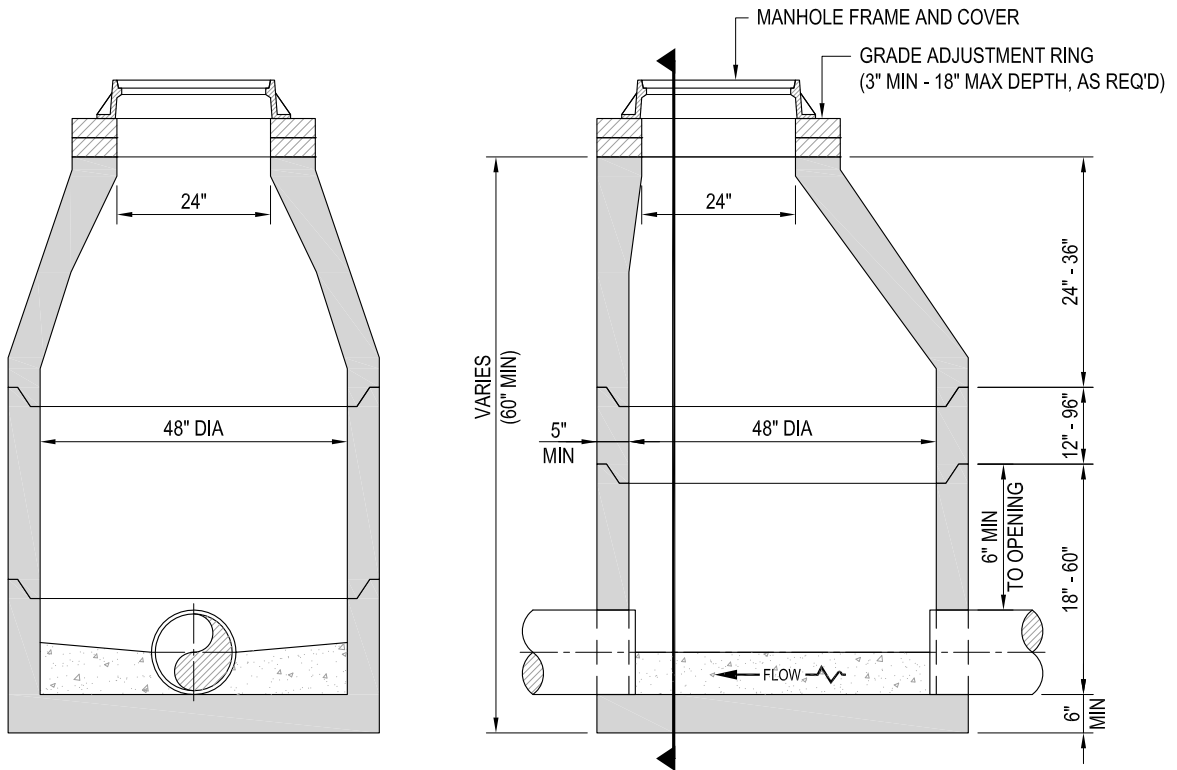
**AIR RELEASE VALVE (ARV)
COMPOSITE MANHOLE COVER & FRAME**

MANHOLE FRAMES & COVERS

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<p>SHEET TITLE</p> <p>MANHOLE FRAMES & COVERS</p>
<p>SHEET</p> <p>-</p>
<p>SCALE</p> <p>N.T.S.</p>



FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'

48"Ø MANHOLE
N.T.S.

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SHEET TITLE

48"Ø MANHOLE
FOR PIPE DIA. 15" AND LESS
AND DEPTHS MORE THAN 5'

SHEET

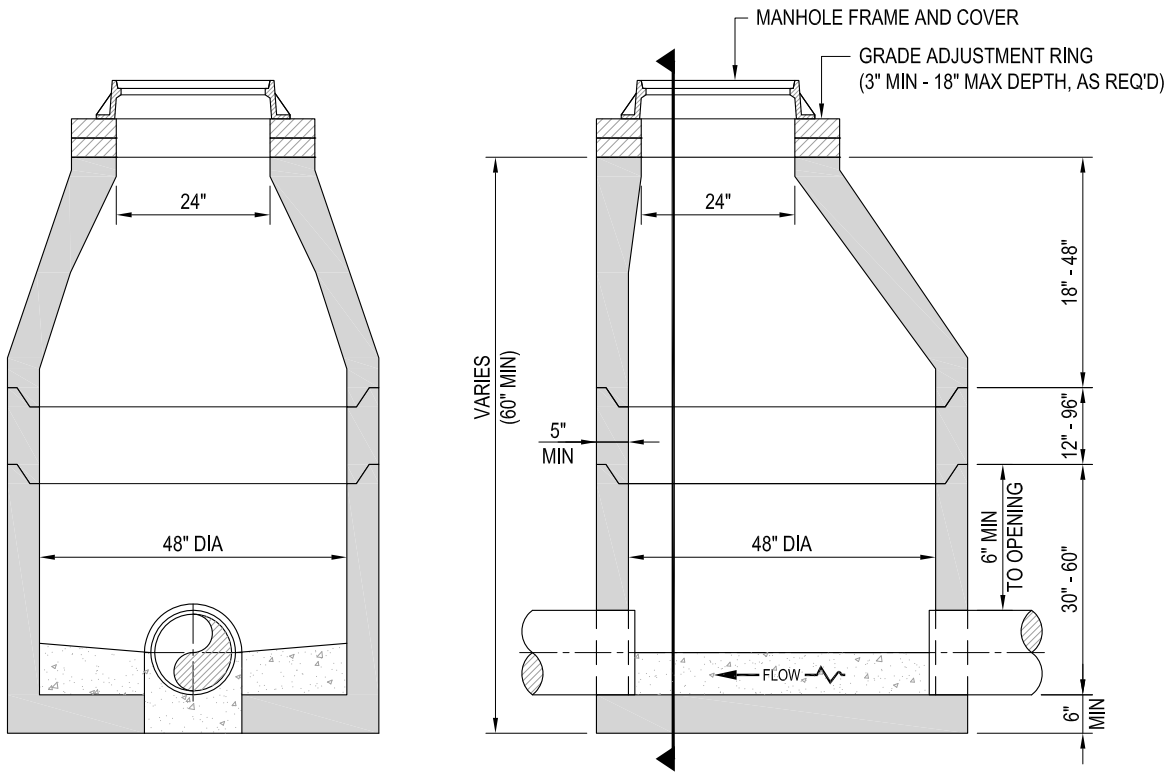
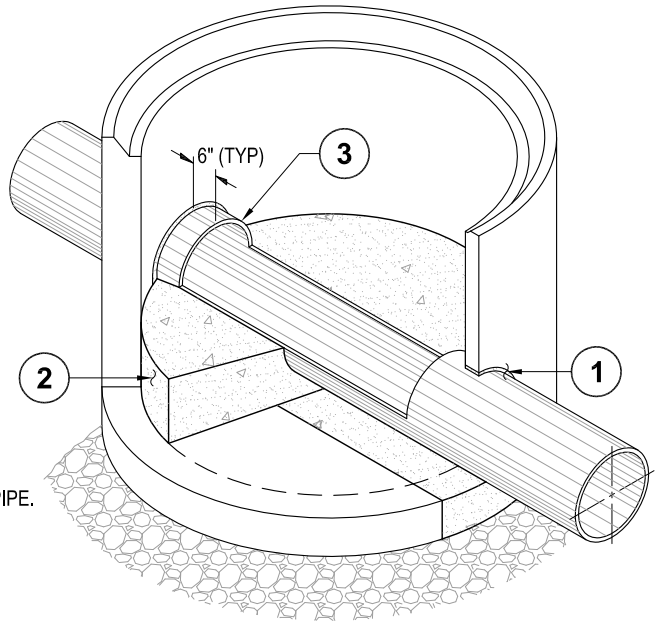
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SCALE

N.T.S.

INSTALLATION NOTES:

1. **INSTALL MANHOLE**
FILL DOGHOUSE OPENINGS w/ CONC. (FDOT CLASS I OR II)
2. **FORM MANHOLE BENCH**
FORM BENCH w/ CONC. (FDOT CLASS I OR II) TO SPRINGLINE (.5D) OF PIPE.
SEE MANHOLE BENCH DETAIL FOR SLOPE REQUIREMENTS.
3. **CUT EXIST PIPE**
CUT EXIST PIPE TO MATCH SPRINGLINE (.5D) OF PIPE.



FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'

48"Ø SADDLE MANHOLE
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SHEET TITLE

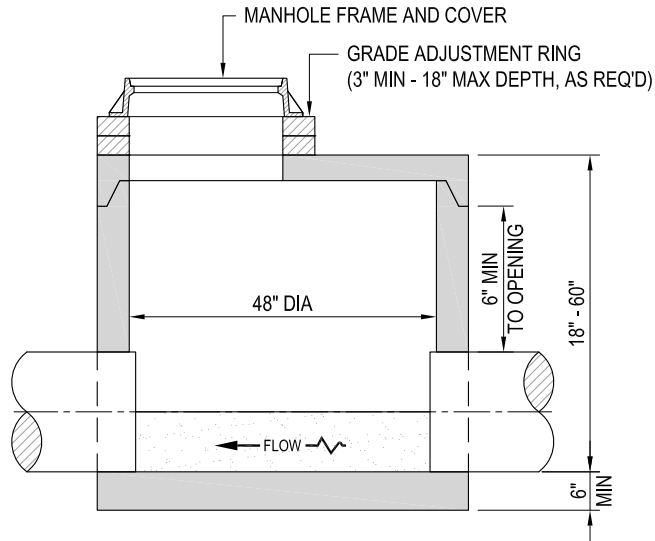
**48"Ø SADDLE MANHOLE
FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'**

SHEET

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FOR PIPE DIA 15" AND LESS

48"Ø MANHOLE w/ TOPSLAB

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SHEET TITLE

48"Ø MANHOLE w/ TOP SLAB
FOR PIPE DIA 15" AND LESS

SHEET

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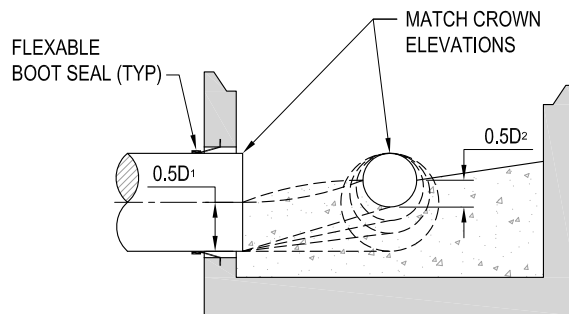
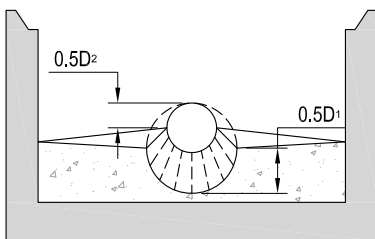
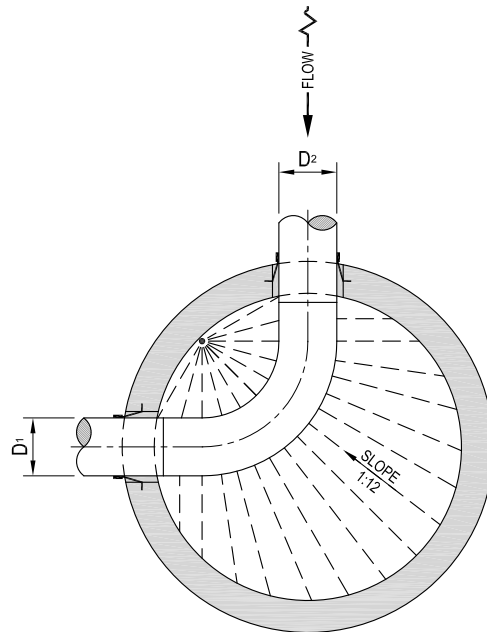
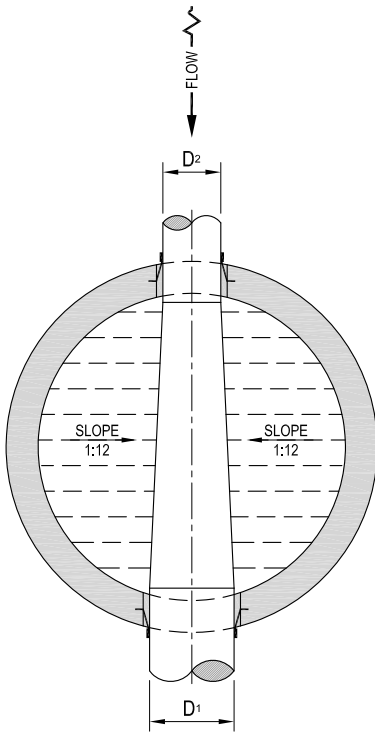
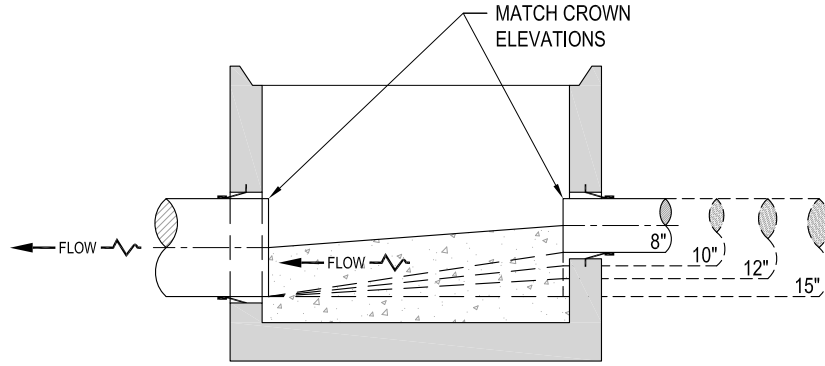
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MANHOLE BENCH w/ MATCHING CROWNS

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SHEET TITLE

**MANHOLE BENCH
 w/ MATCHING CROWNS**

SHEET

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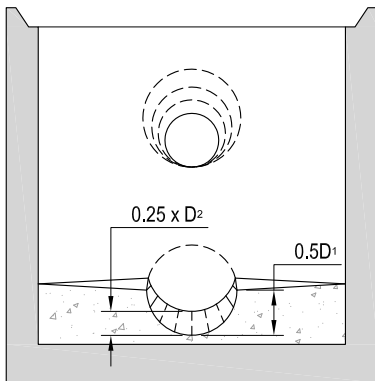
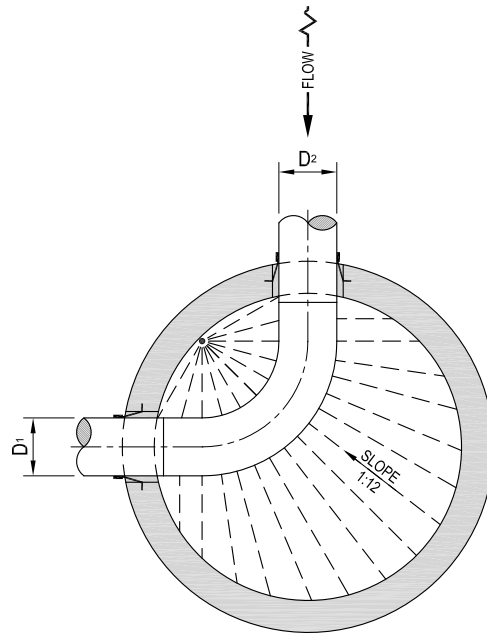
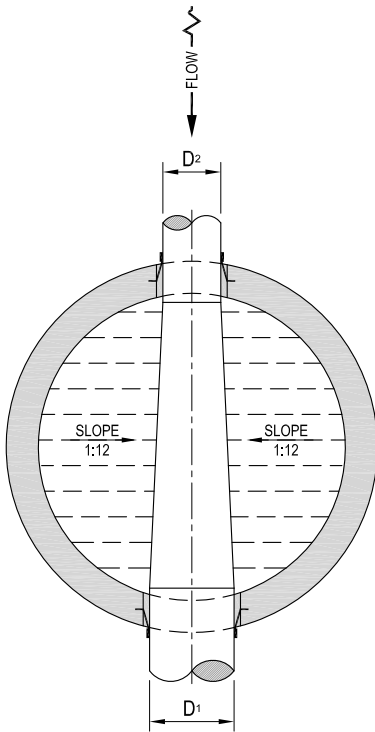
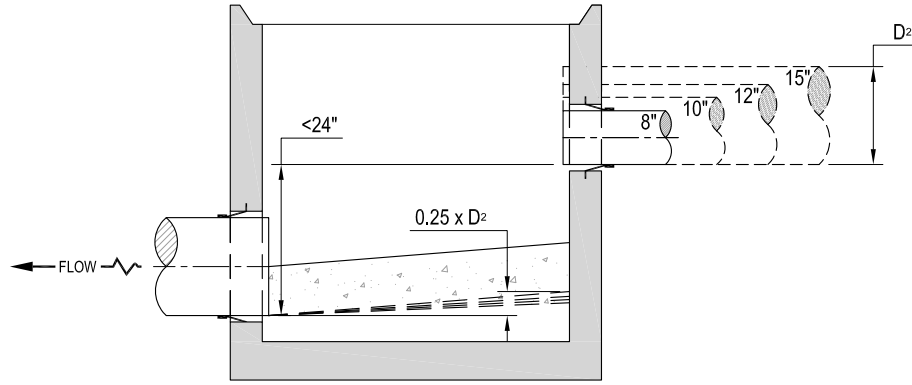
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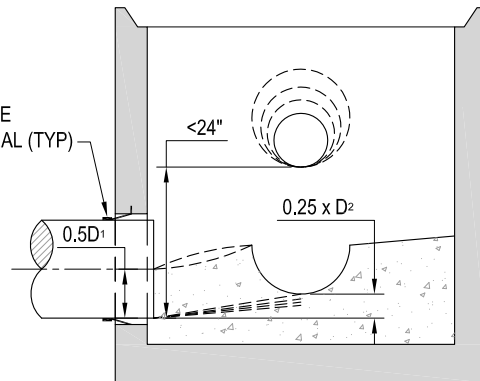
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FLEXIBLE BOOT SEAL (TYP)



MANHOLE BENCH w/ OFFSET CROWNS

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SHEET TITLE

MANHOLE BENCH
w/ OFFSET CROWNS

SHEET

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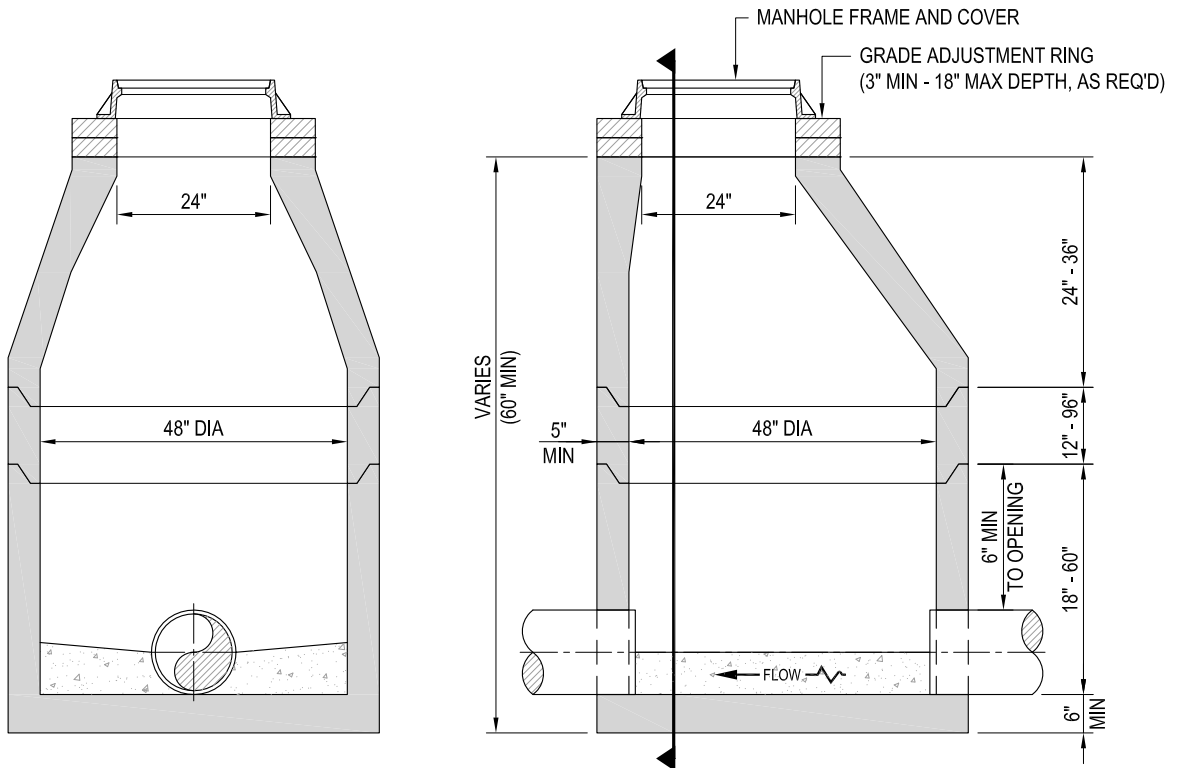
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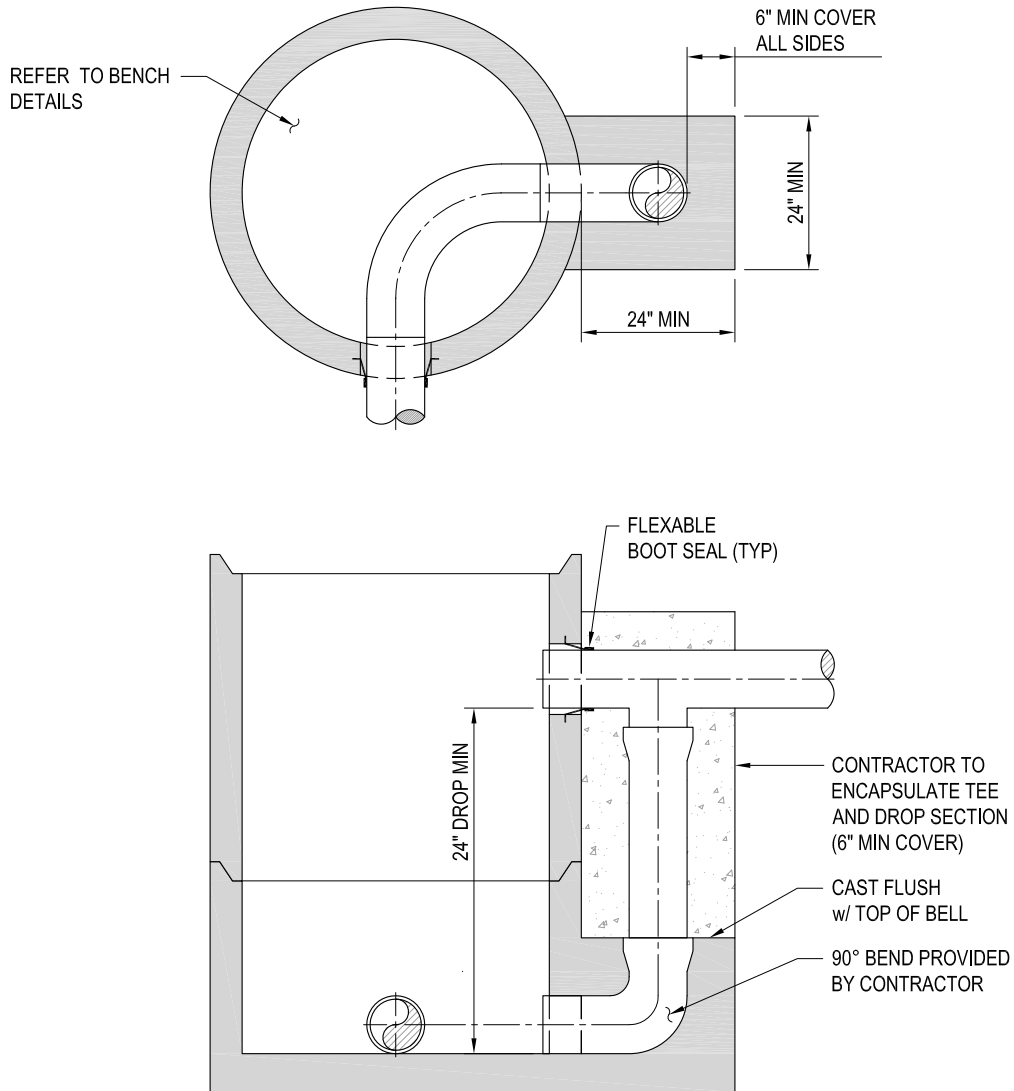


FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'

48"Ø MANHOLE
N.T.S.

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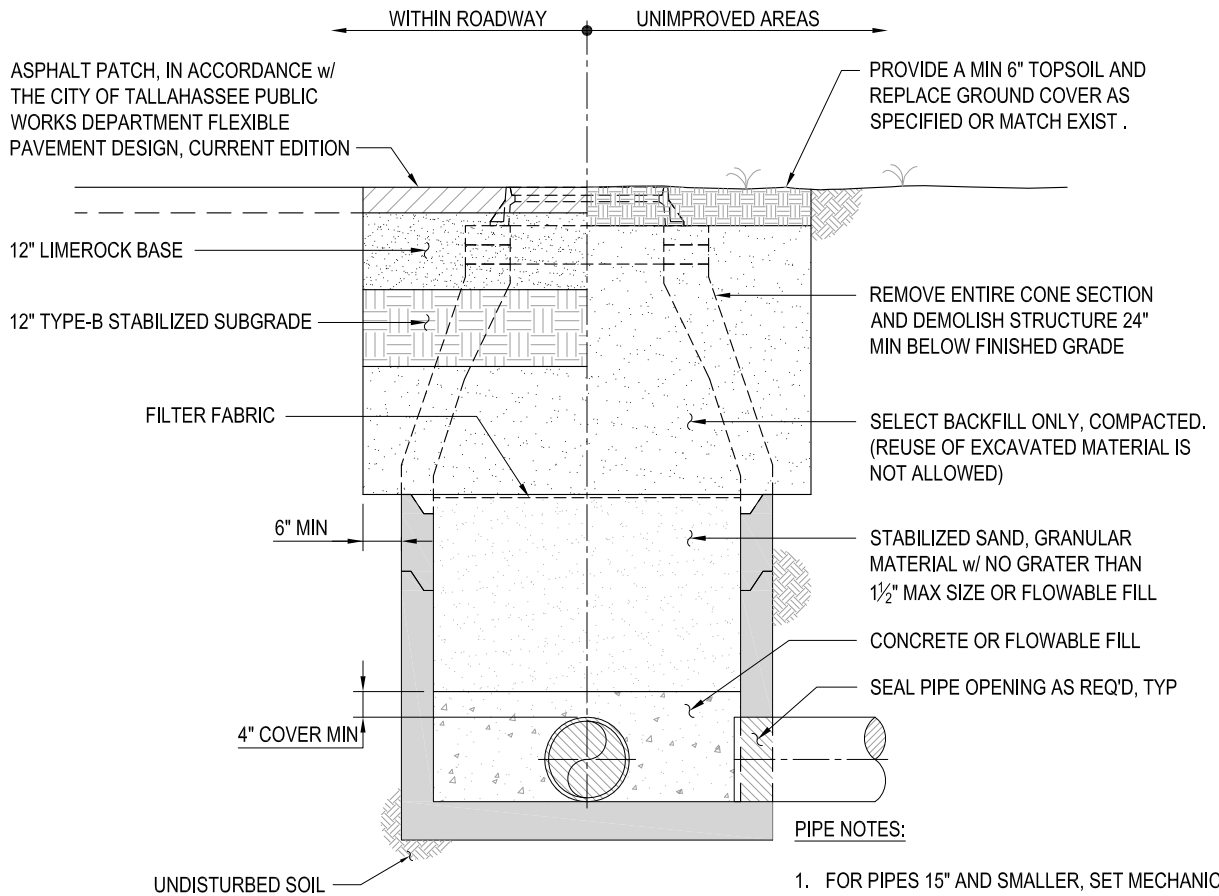
SHEET TITLE	48"Ø MANHOLE FOR PIPE DIA. 15" AND LESS AND DEPTHS MORE THAN 5'
SHEET	-
SCALE	N.T.S.



DROP MANHOLE
N.T.S.

NOTES:

1. THE TECHNICAL SPECIFICATIONS SHALL APPLY FOR ALL OTHER REQUIREMENTS NOT SUPERCEDED BY THIS DETAIL FOR ALL EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES.
2. IF SEWER LINE WHICH IS TO BE ABANDONED IN PLACE EXTENDS UNDER EXISTING OR PROPOSED STRUCTURE, THE ENTIRE SEWER LINE TO THE NEXT MANHOLE SHALL BE GROUTED OR SLURRY (FLOWABLE FILL) FILLED.
3. IF SEWER LINE IS NOT LOCATED UNDER STRUCTURE, ABANDON EXISTING SEWER LINE IN PLACE BY PLUGGING BOTH ENDS OF LINE AND GROUTING AROUND PLUGS.
4. CONTRACTOR SHALL RECORD AND CERTIFY QUANTITIES OF GROUT OR SLURRY (FLOWABLE FILL) PUMPED.
5. ALL SALVAGED MATERIAL BECOMES PROPERTY OF COT UNDERGROUND UTILITY DEPARTMENT.

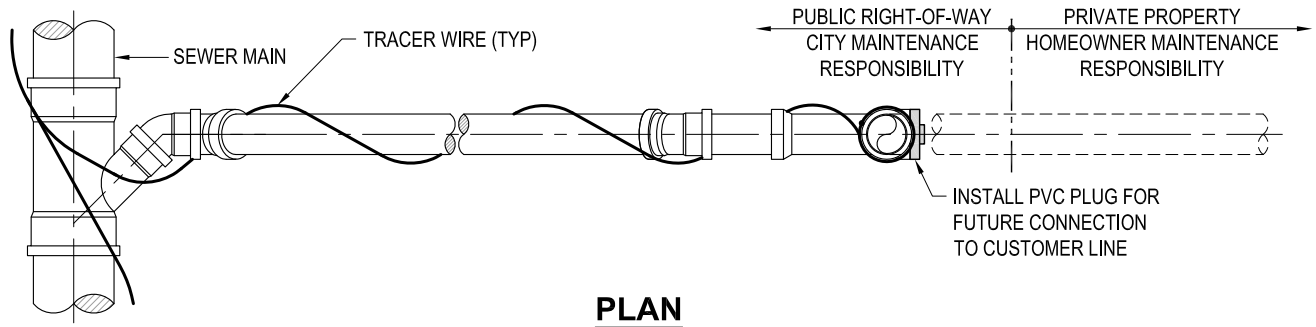


SANITARY SEWER MANHOLE ABANDONMENT

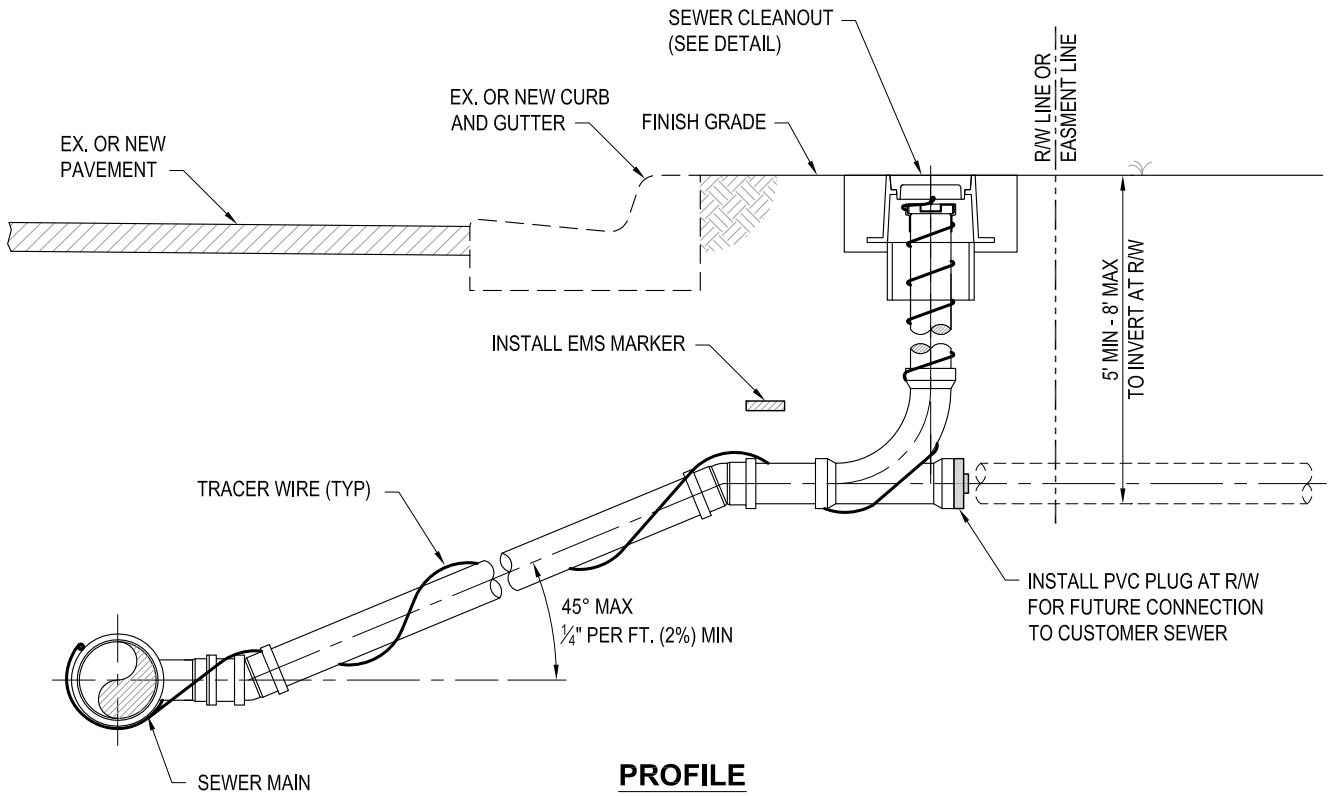
N.T.S.

- PIPE NOTES:**
1. FOR PIPES 15" AND SMALLER, SET MECHANICAL PLUGS INTO ALL PIPES ENTERING MANHOLE.
 2. FOR PIPES LARGER THAN 15", PROVIDE MASONRY BULKHEAD IN LIEU OF MECHANICAL PLUG.

SHEET TITLE	SHEET
SANITARY SEWER MANHOLE ABANDONMENT	-
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Date Issued: JANUARY 2015	N.T.S.
COMPUTER FILE	



PLAN



PROFILE

SANITARY SEWER LATERAL

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SANITARY SEWER LATERAL

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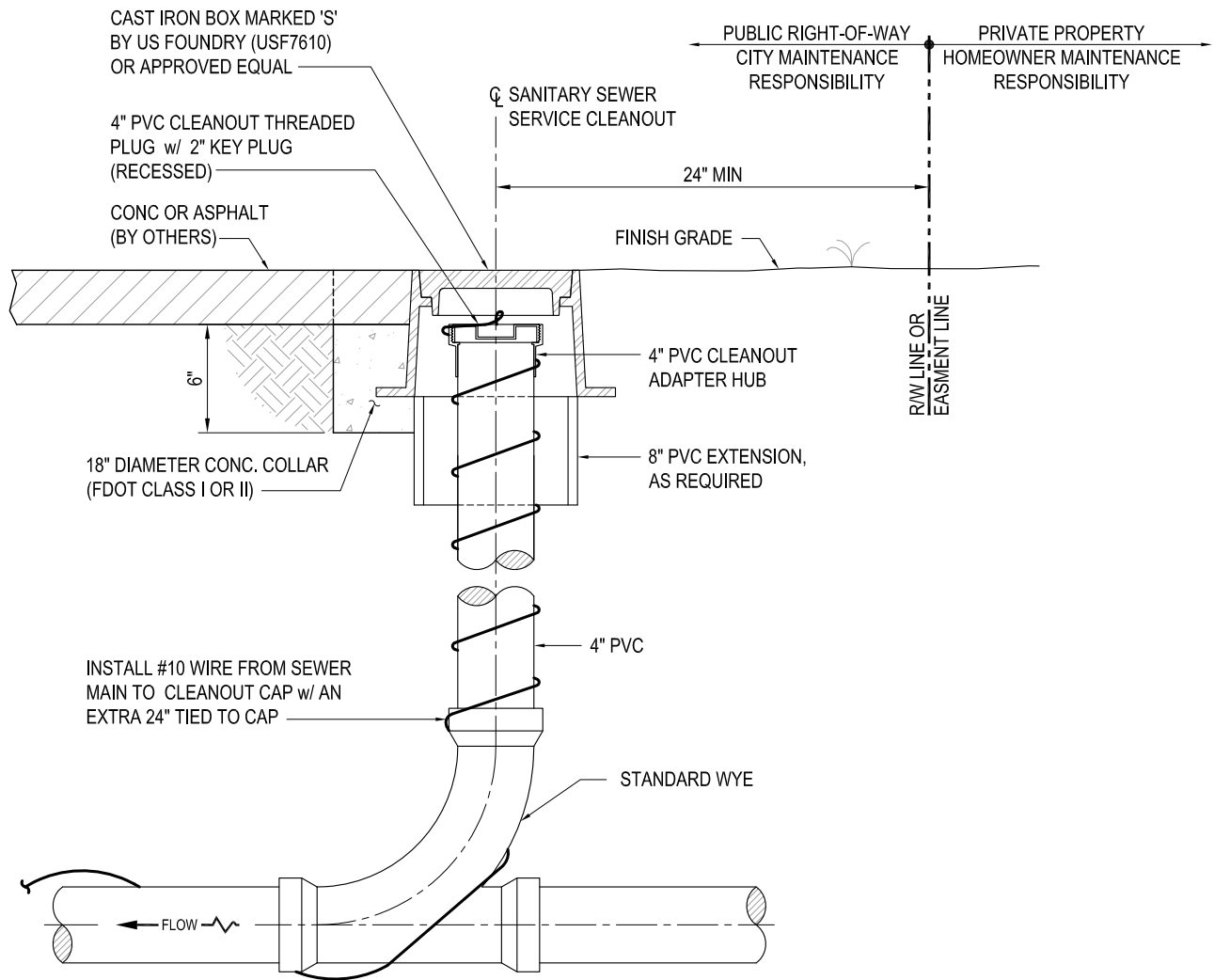
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SANITARY SEWER CLEANOUT

N.T.S.

SHEET TITLE

SANITARY SEWER CLEANOUT

SHEET

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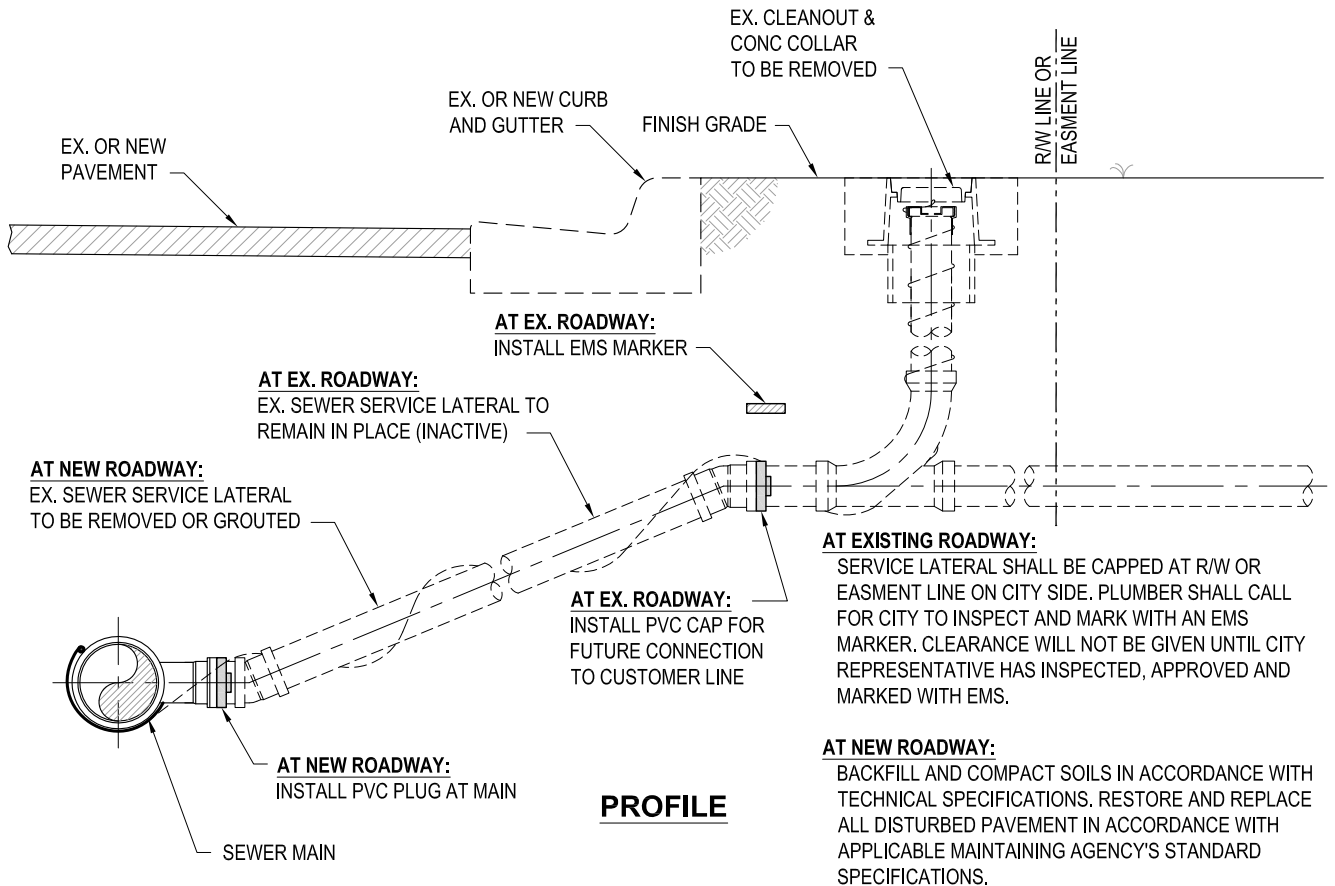
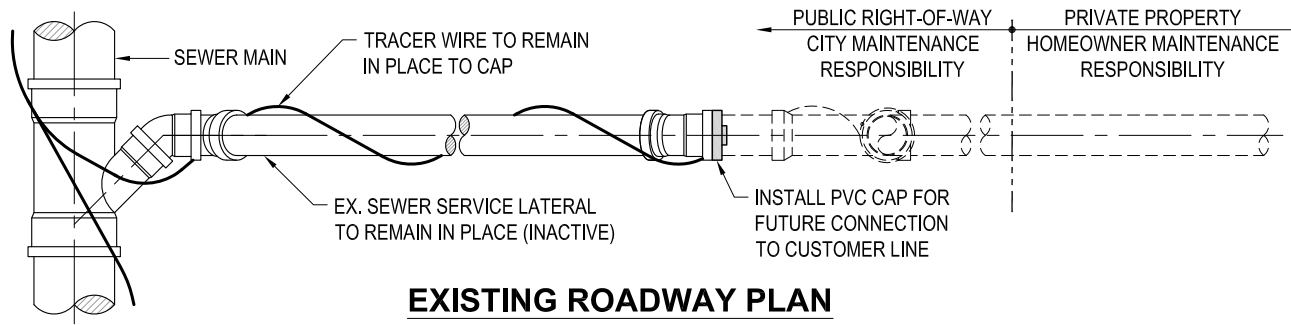
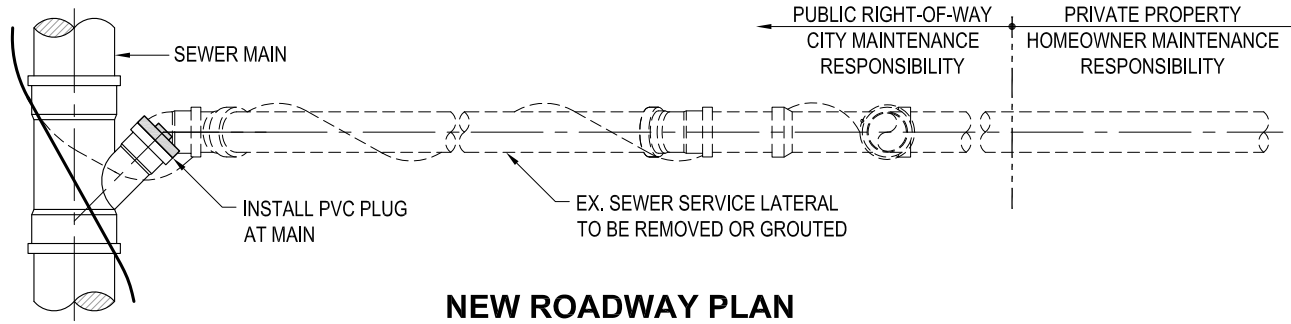
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**SANITARY SEWER LATERAL DISCONNECTION
(WITHIN IMPROVED AREAS)**

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**SANITARY SEWER LATERAL DISCONNECTION
(WITHIN IMPROVED AREAS)**

SHEET

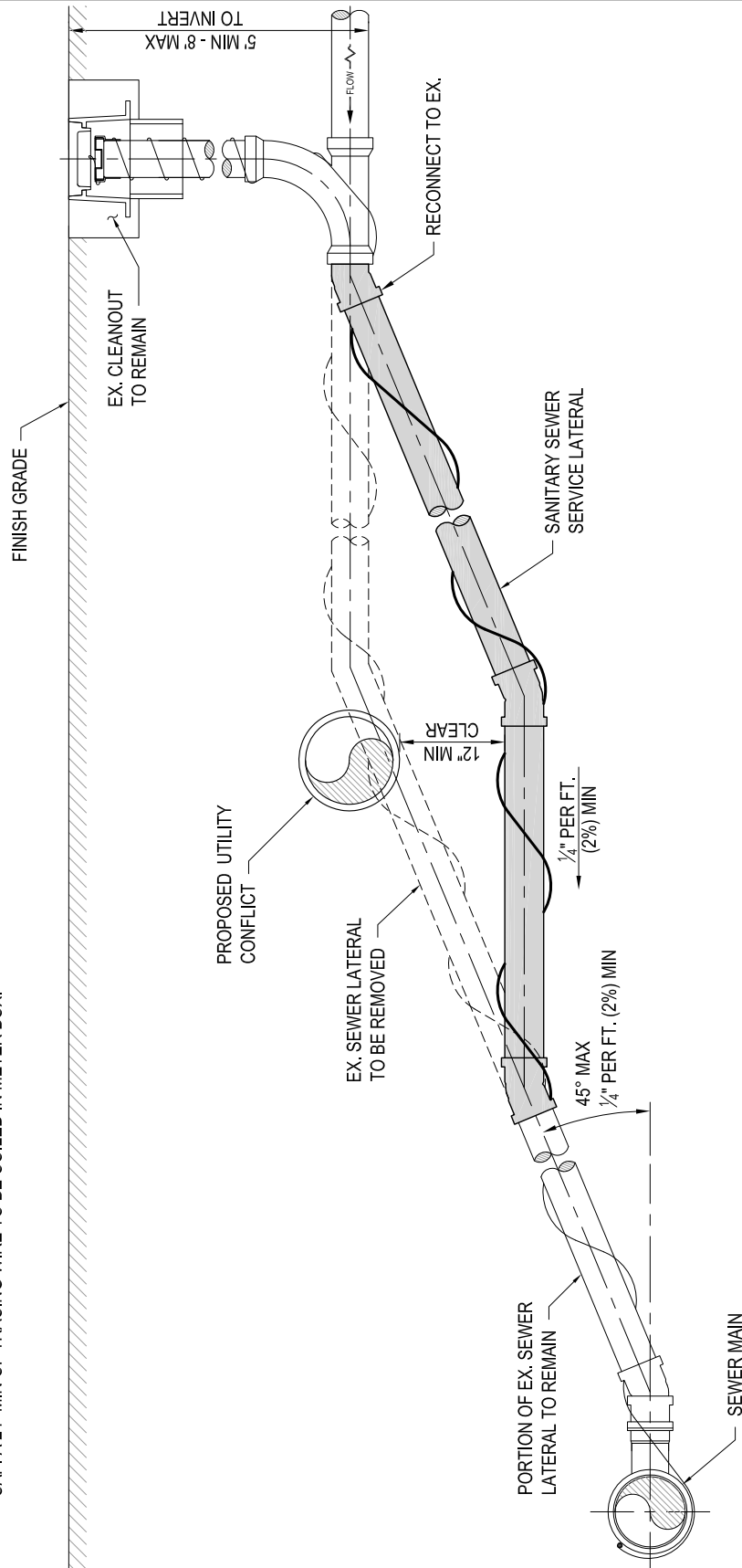
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SCALE

N.T.S.

NOTES:

1. THE SEWER LATERAL ADJUSTMENT MUST BE CONSTRUCTED UNDER THE PROPOSED UTILITY CONFLICT. IF THIS CAN NOT BE ACCOMPLISHED, THE PROPOSED CONFLICT MUST BE ADJUSTED LOWER.
2. BENDS GREATER THAN 22½° ARE NOT PERMITTED.
3. A MINIMUM OF 10 GAUGE TRACER WIRE (GREEN) WILL RUN FROM MAIN TO CLEANOUT; CONNECT TO EXISTING TRACER WIRE AT MAIN. WRAP AROUND CORPORATION WYE, THEN EXTEND UP TO CLEANOUT CAP. A 24" MIN OF TRACING WIRE TO BE COILED IN METER BOX.



PROFILE

ADJUSTMENT OF EXIST SANITARY SEWER LATERAL
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SHEET TITLE

**ADJUSTMENT OF
EXIST SEWER SERVICE LATERAL**

SHEET

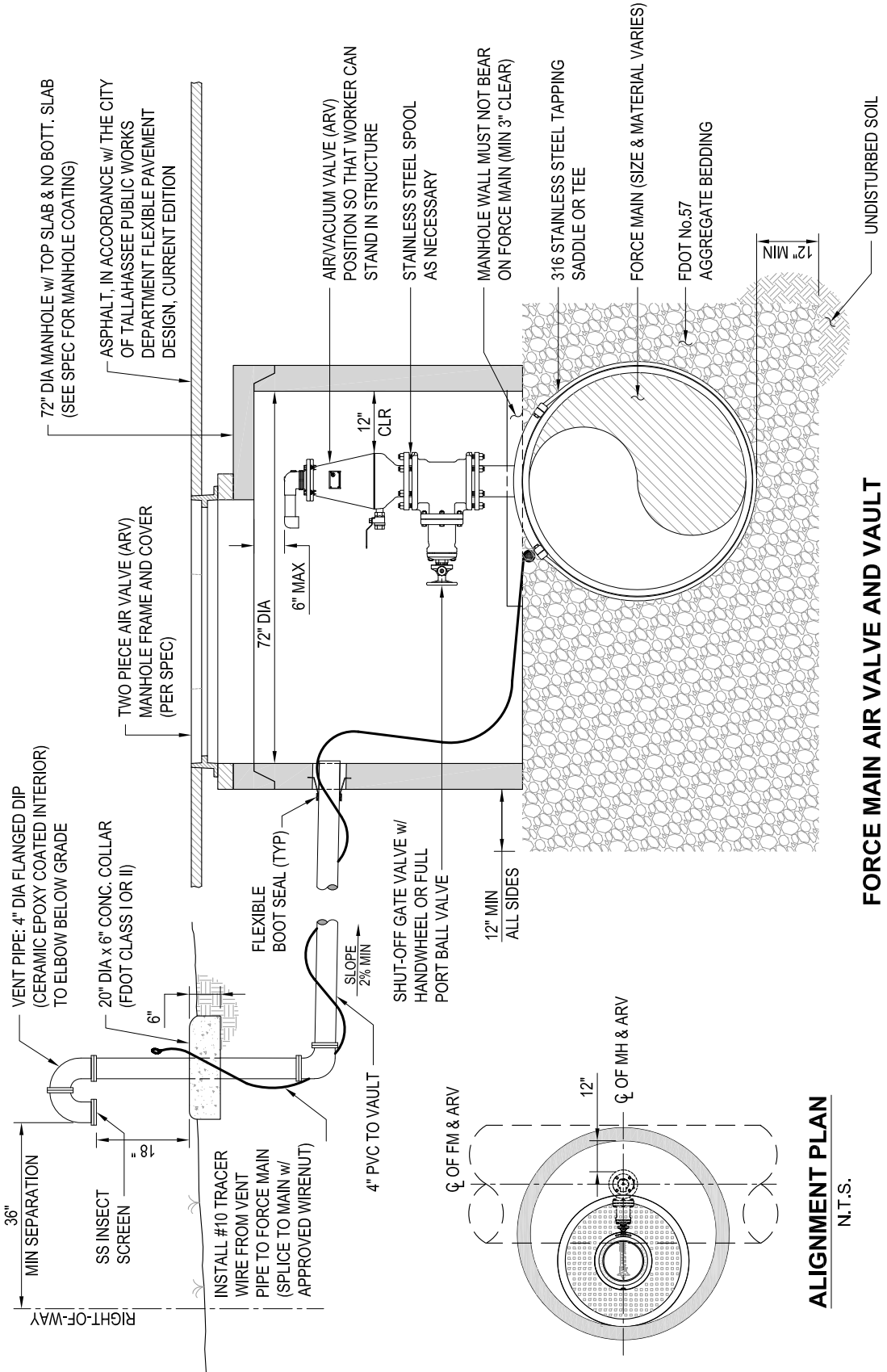
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SCALE

N.T.S.

NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. ALL MATERIALS WITHIN VAULT SHALL BE TYPE 316 STAINLESS STEEL (SS).
3. DESIGNER SHALL ENSURE THAT SUFFICIENT HEAD ROOM IS AVAILABLE TO ACCOMMODATE INSTALLATION. FOR INSTANCES W/ INSUFFICIENT HEAD ROOM, CONSULT CITY ENGINEER.



FORCE MAIN AIR VALVE AND VAULT WITHIN VEHICLE TRAVEL LANE

N.T.S.

ALIGNMENT PLAN

N.T.S.

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SHEET TITLE

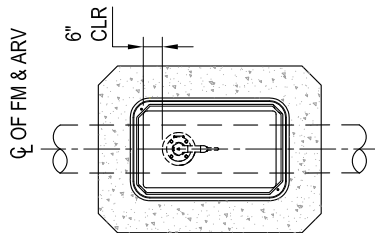
FORCE MAIN AIR VALVE AND VAULT WITHIN VEHICLE TRAVEL LANE

SHEET

SCALE
 N.T.S.

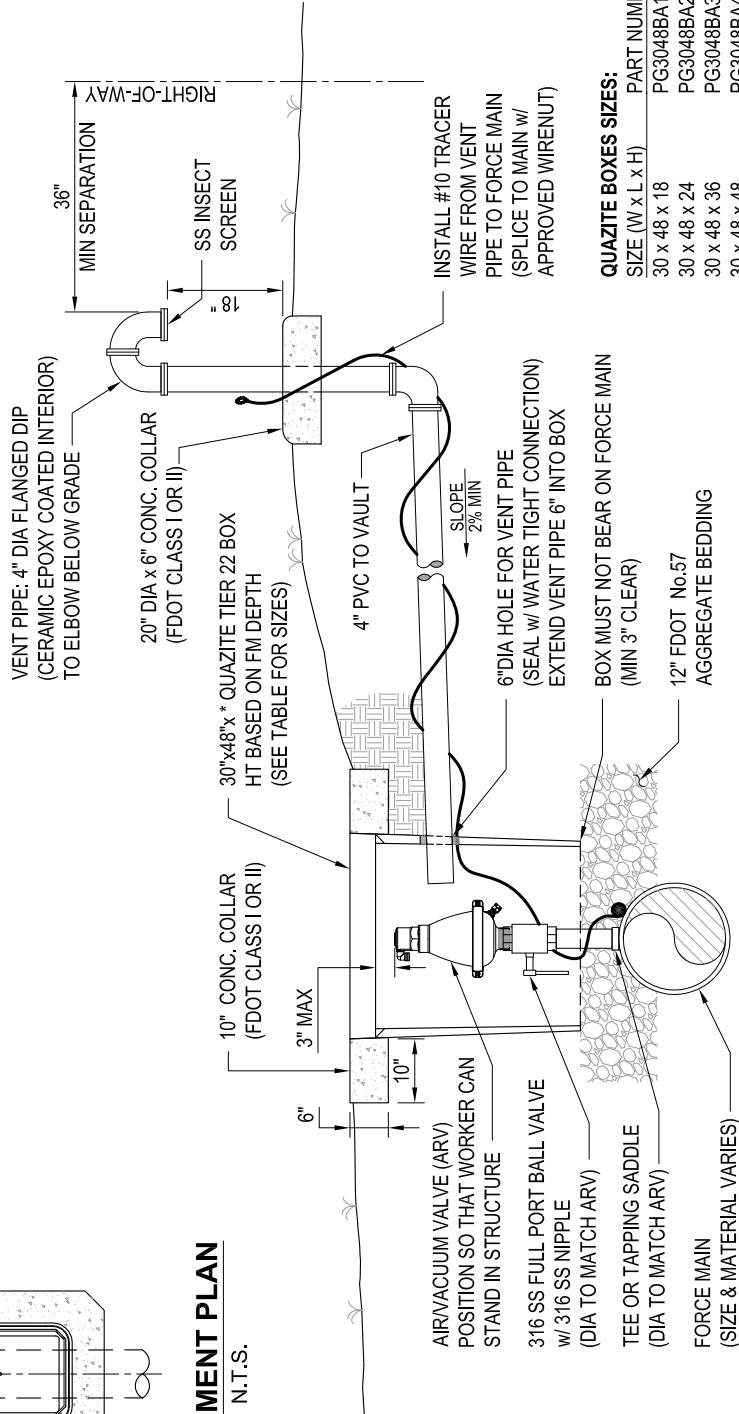
NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. ALL MATERIALS WITHIN VAULT SHALL BE TYPE 316 STAINLESS STEEL (SS).
3. ALL QUAZITE BOXES AND COVERS SHALL BE TEIR 22 (STATIC DESIGN LOAD OF 22,500 LBS. [100,085 N] OVER A 10 [254] X 10 [254] AREA AND MUST PASS A MINIMUM STATIC TEST LOAD OF 33,750 LBS. [150,128 N]).
4. DESIGNER SHALL ENSURE THAT SUFFICIENT HEAD ROOM IS AVAILABLE TO ACCOMMODATE INSTALLATION. FOR INSTANCES W/ INSUFFICIENT HEAD ROOM, CONSULT CITY ENGINEER.
5. FOR INSTALLATIONS w/o VENT TUBE, CONSULT CITY ENGINEER.



ALIGNMENT PLAN

N.T.S.



QUAZITE BOXES SIZES:

SIZE (W x L x H)	PART NUMBER
30 x 48 x 18	PG3048BA18
30 x 48 x 24	PG3048BA24
30 x 48 x 36	PG3048BA36
30 x 48 x 48	PG3048BA48

* IF REQUIRED, QUAZITE BOXES MAY BE STACKED. A MIN BOX SIZE OF 48" x 48" SHALL BE USED. BOXES SHALL BE WRAPPED WITH MANHOLE WRAP.

**FORCE MAIN AIR VALVE AND VAULT
OUTSIDE VEHICLE TRAVEL LANE**

N.T.S.

City of Tallahassee
UNDERGROUND UTILITIES
 "Setting the Standard for Excellence"

WATER RESOURCES ENGINEERING DIVISION
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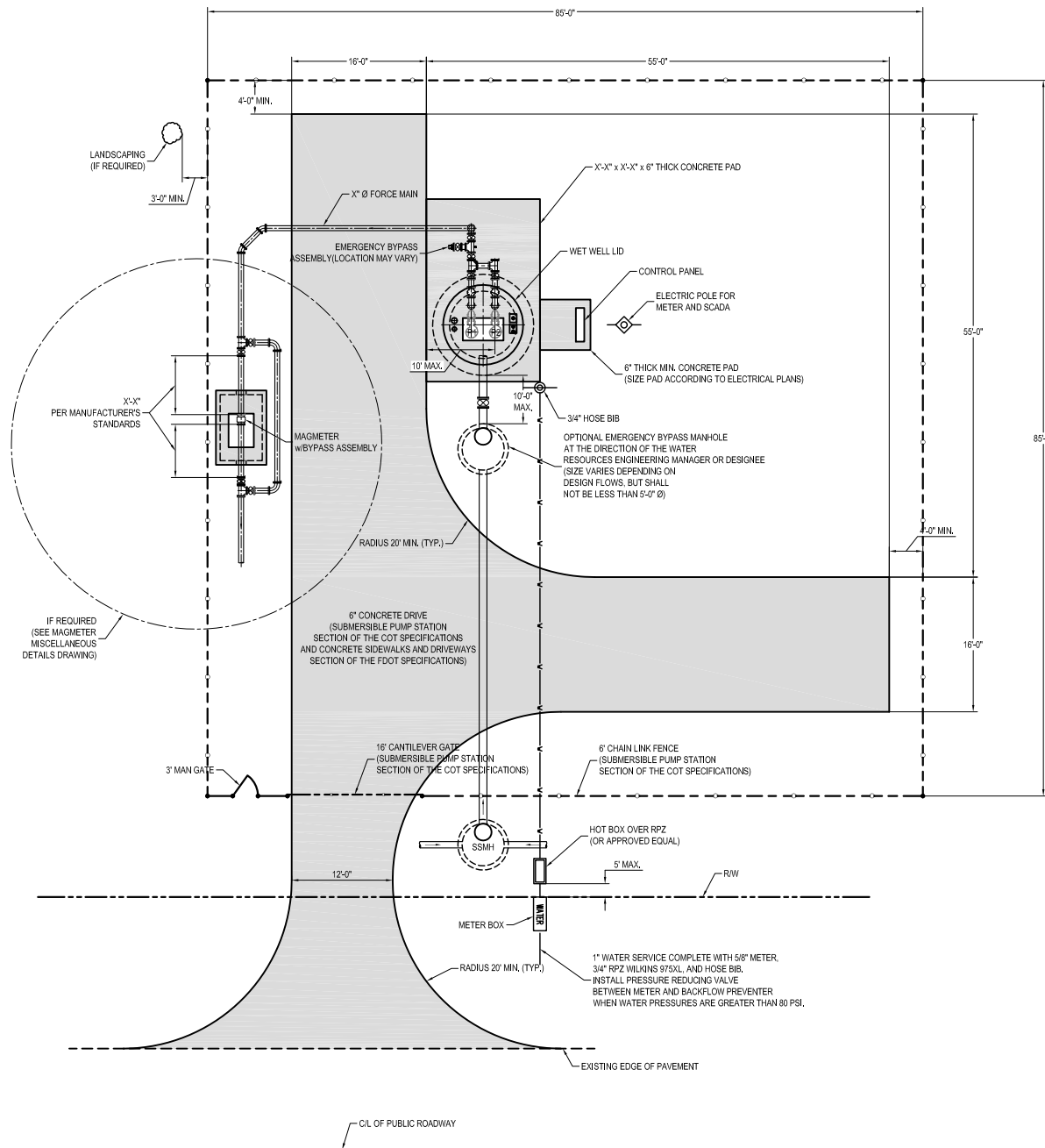
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**FORCE MAIN
AIR VALVE AND VAULT
OUTSIDE VEHICLE TRAVEL LANE**

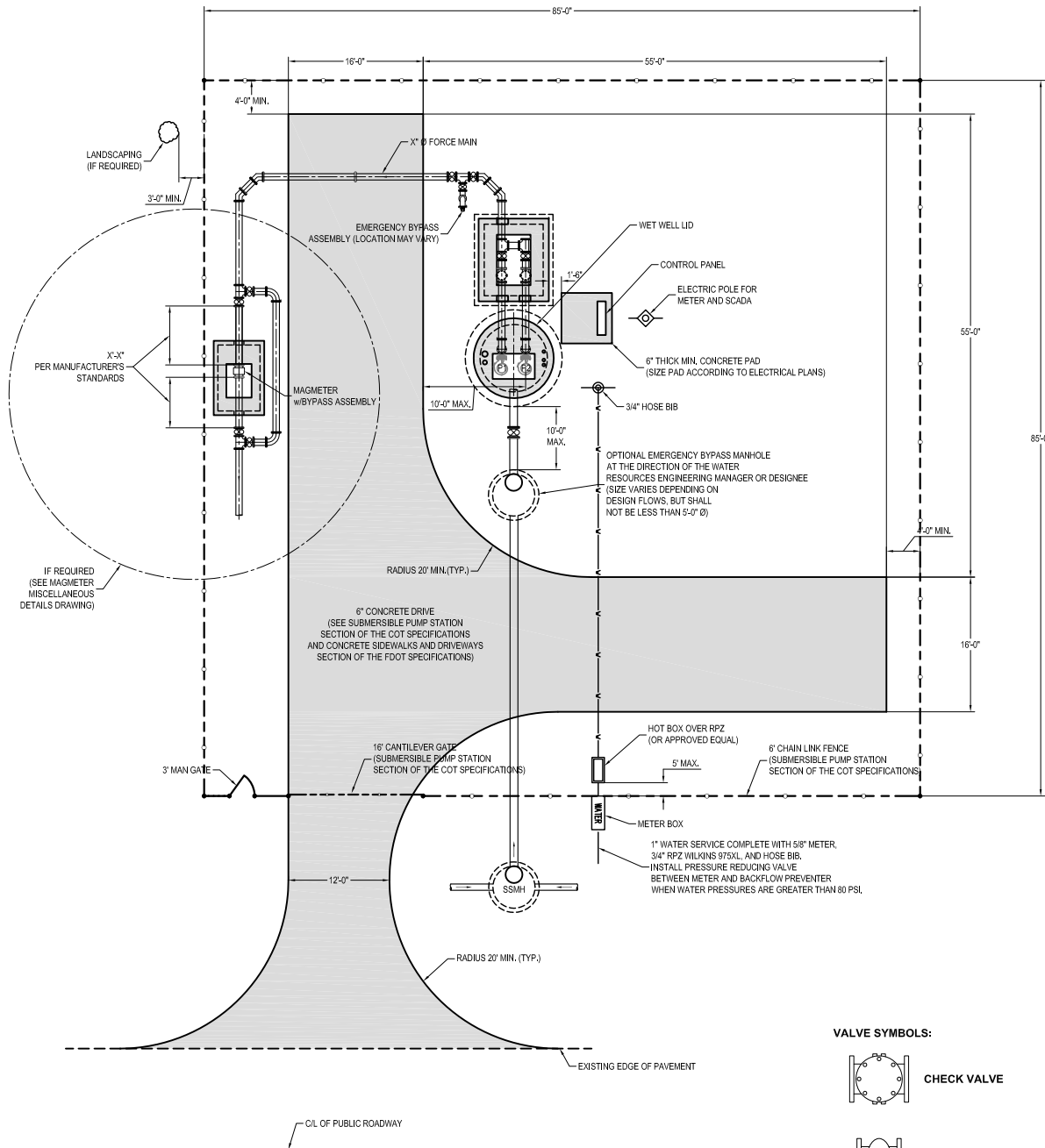
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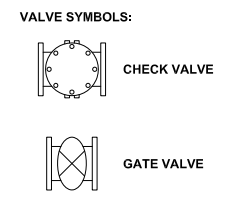
N.T.S.



PUMP STATION WITH ABOVE GROUND VALVES

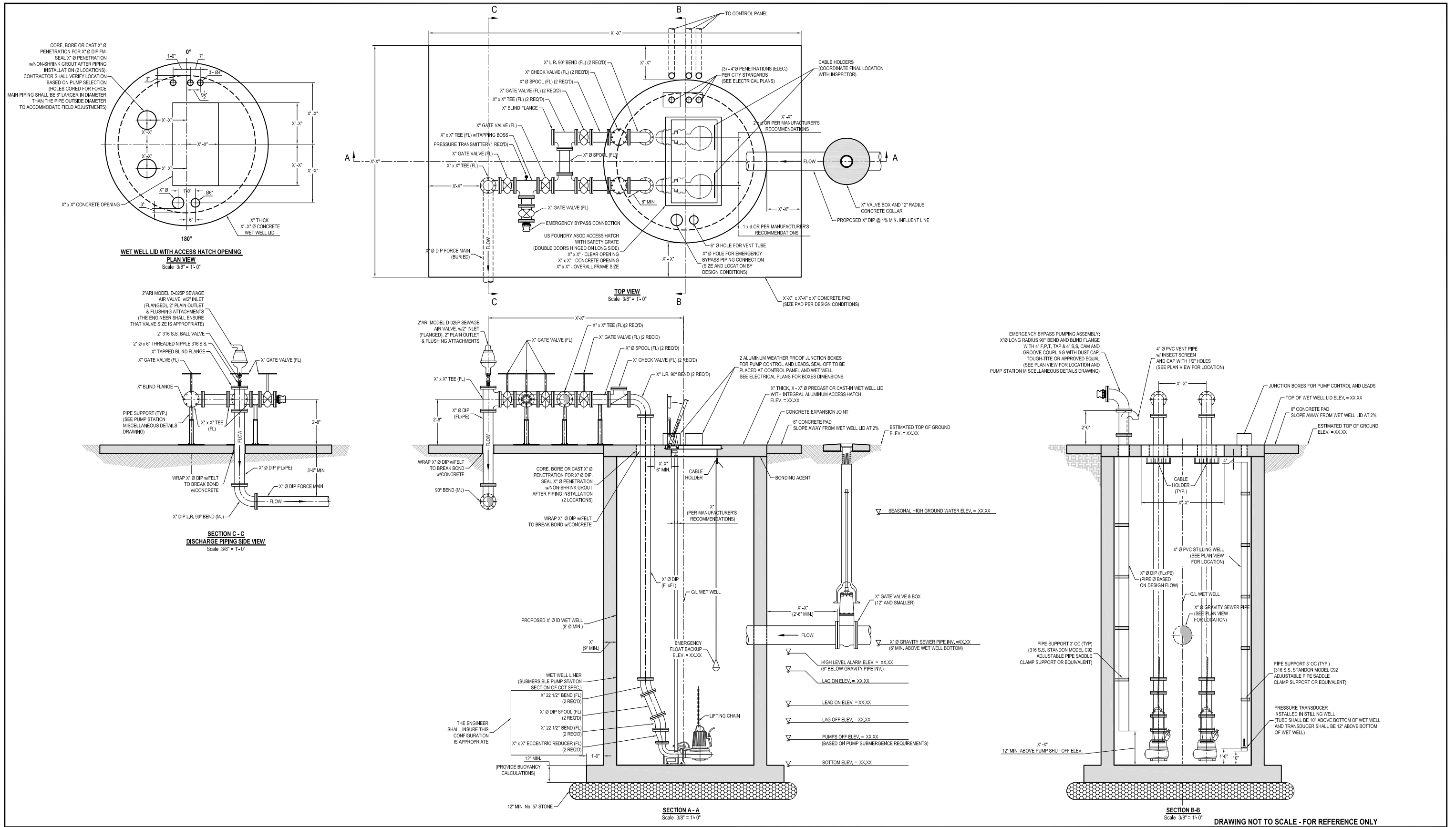



**PUMP STATION WITH UNDERGROUND VALVE VAULTS
(ENGINEER MAY USE THIS ALTERNATE ONLY WITH
APPROVAL FROM THE WATER RESOURCES ENGINEERING MANAGER)**

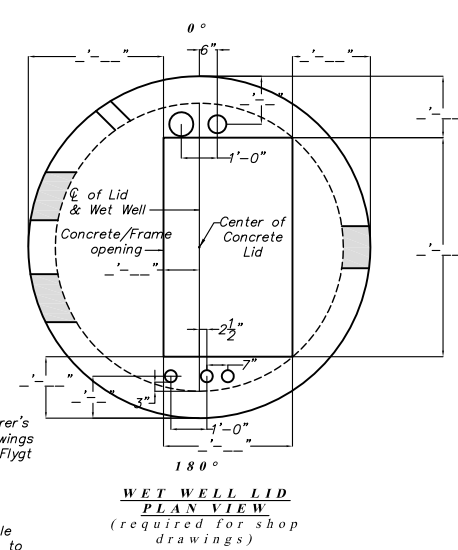
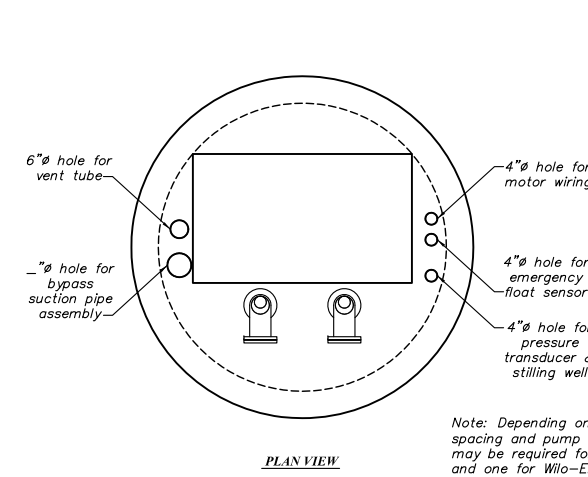
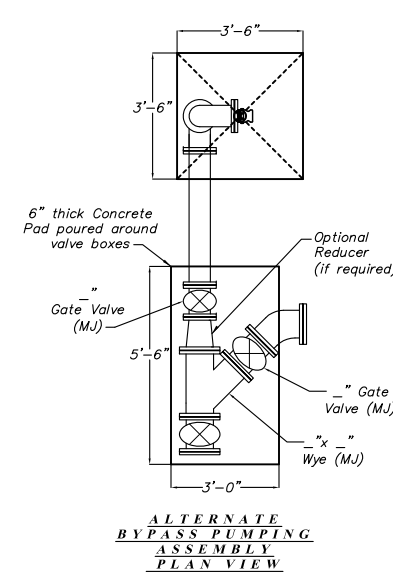
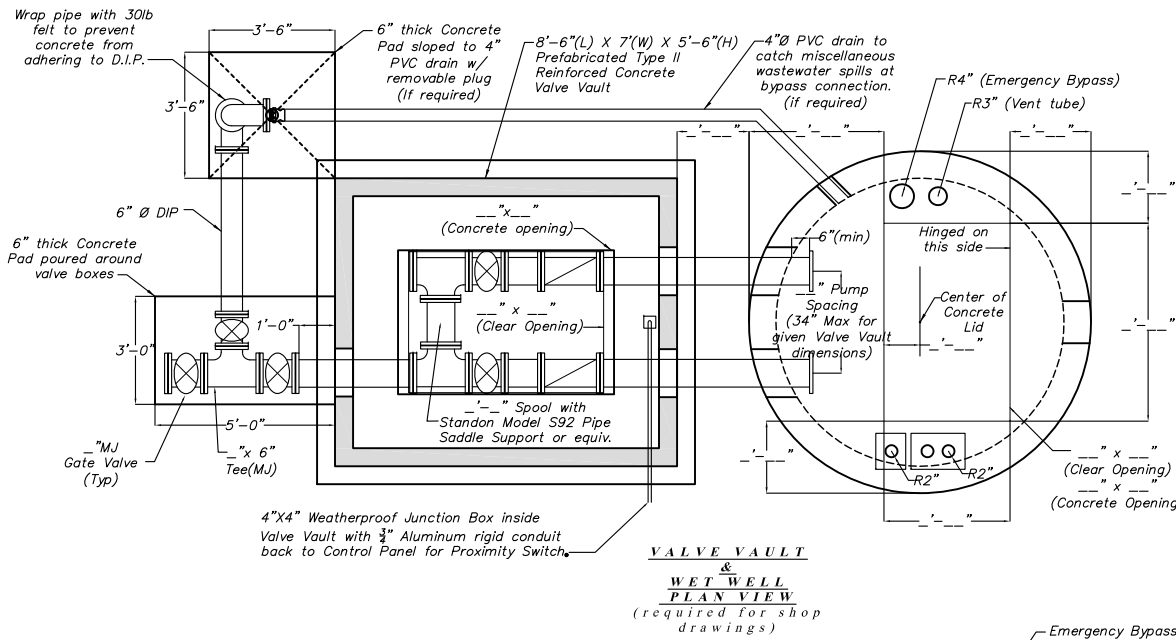


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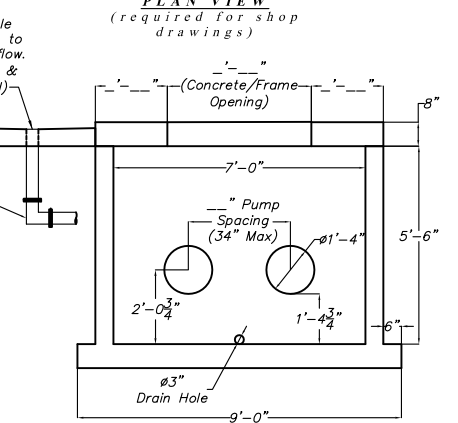
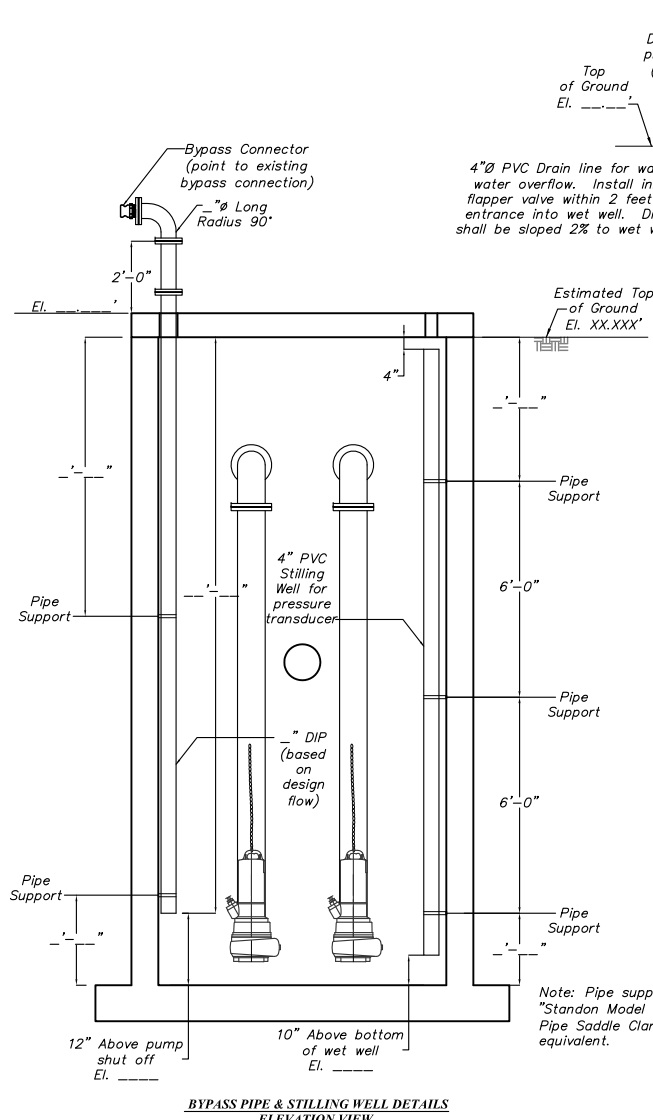
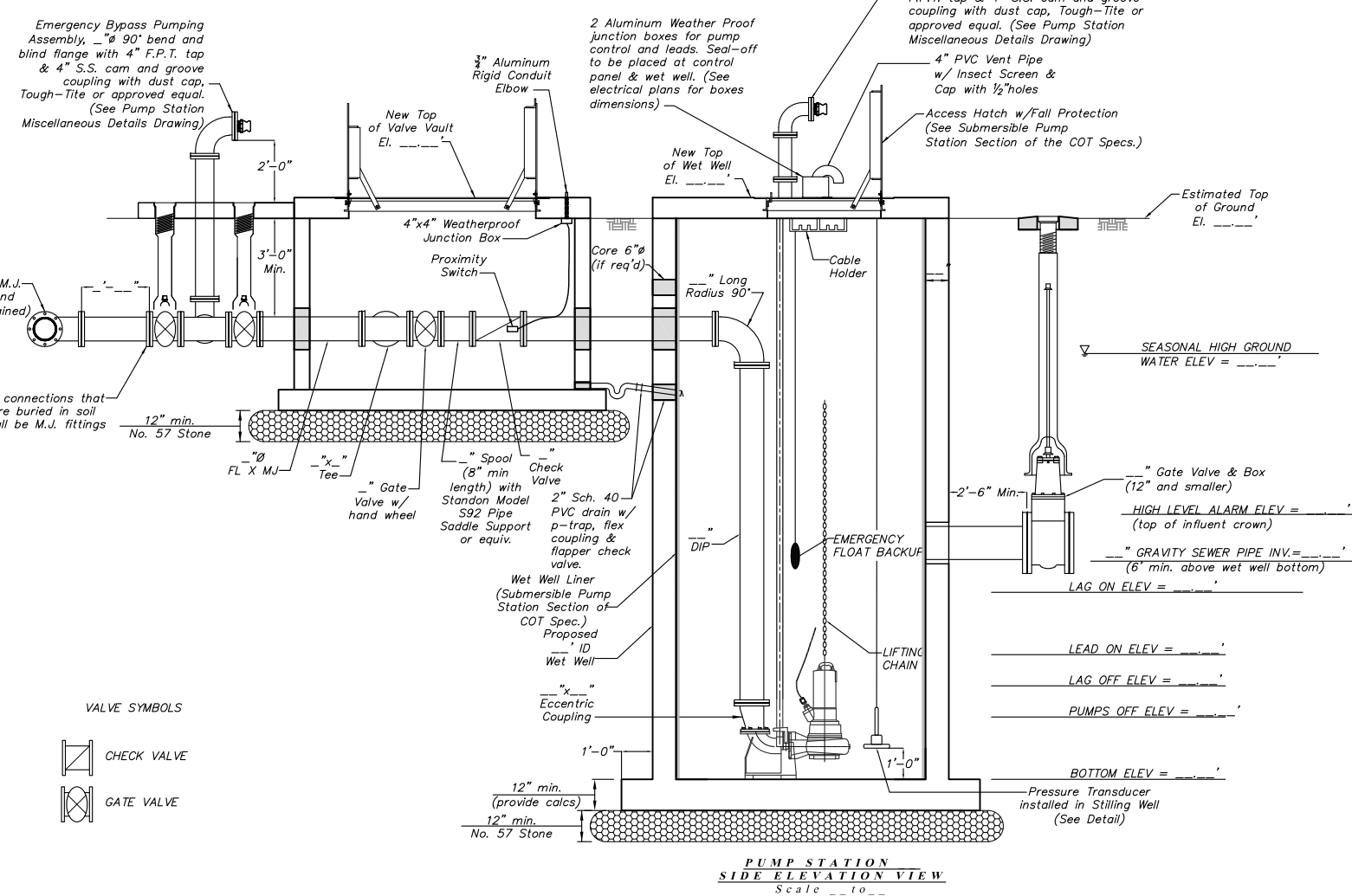
PUMP STATION No. XX DESIGN DETAILS		
PUMP MANUFACTURER	FLYGT	WLO-EMU
PUMP DUTY POINT (GPM)		
TDH AT DUTY POINT (FT)		
DESIGN DUTY POINT (FT) (ALL PUMPS)		
STATIC HEAD (FT)		
PUMP MODEL NO.		
PUMP CURVE NO. (IF AVAILABLE)		
EXPLOSION PROOF (YES/NO)		
PUMP IMPELLER SIZE - CAST IRON		
INLET / DISCHARGE SIZE (IN)		
SUPPLY VOLTAGE		
PUMP RPM		
HORSEPOWER		
FORCEMAIN SIZE (IN)		
TOTAL FORCEMAIN LENGTH (FT)		
EQUIVALENT FORCEMAIN LENGTH (FT)		
FORCEMAIN ELEVATION AT POINT OF DISCHARGE / HIGH POINT (FT)		
WET WELL SIZE (FT)		
WET WELL DEPTH (FT)		
WET WELL TYPE (DUPLEX / TRIPLEX)		



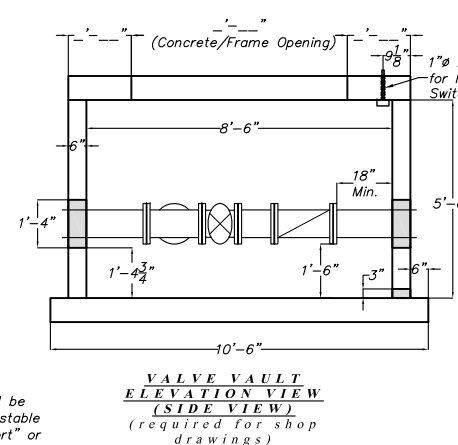
 <p>City of Tallahassee UNDERGROUND UTILITIES "Setting the Standard for Excellence"</p> <p>WATER RESOURCES ENGINEERING DIVISION 300 S. Adams Street, B-26 ~ Tallahassee, FL 32301 Phone: 850-891-4968 Fax: 850-891-6170 www.talgov.com/you</p>	<p>PROJECT TITLE</p> <p align="center">- CITY OF TALLAHASSEE - PUMP STATION STANDARDS</p> <p>SHEET TITLE</p> <p align="center">PUMP STATION WITH ABOVE GROUND VALVES</p>	<p>Approved by:</p> <p>Date Issued: JANUARY 2015</p> <p>COMPUTER FILE \\cityfiles\server\UUI\WREWS\RESOURCES_STANDARDS\DESIGN_CONSTRUCTION\DOCS\Construction Details</p> <p>SHEET</p> <p align="center">-</p> <p>SCALE</p> <p align="center">N.T.S.</p>
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Note: Depending on pump manufacturer's spacing and pump locations, two drawings may be required for plans. One for Flygt and one for Wilo-EMU.



Note: Depending on pump manufacturer's spacing and force main size, the valve vault may have to be re-sized. CHECK TO MAKE SURE MINIMUM CLEARANCES ARE MET!



ENGINEER MAY USE THIS ALTERNATE ONLY WITH APPROVAL FROM THE WATER RESOURCES ENGINEERING MANAGER. DRAWING NOT TO SCALE - FOR REFERENCE ONLY.

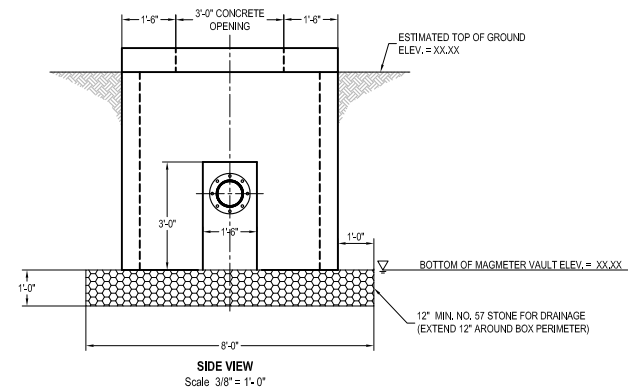
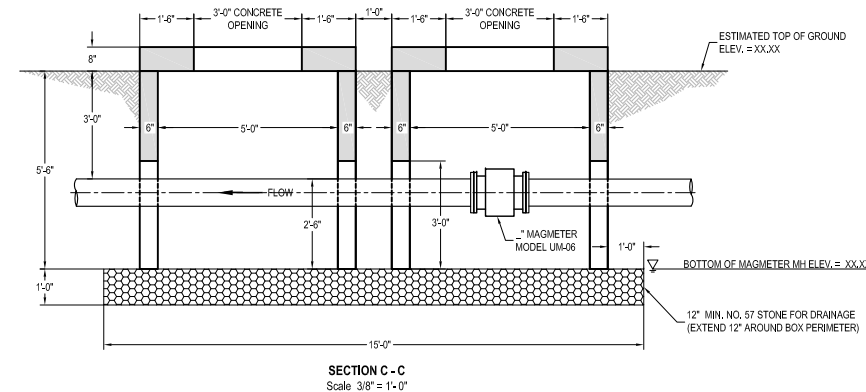
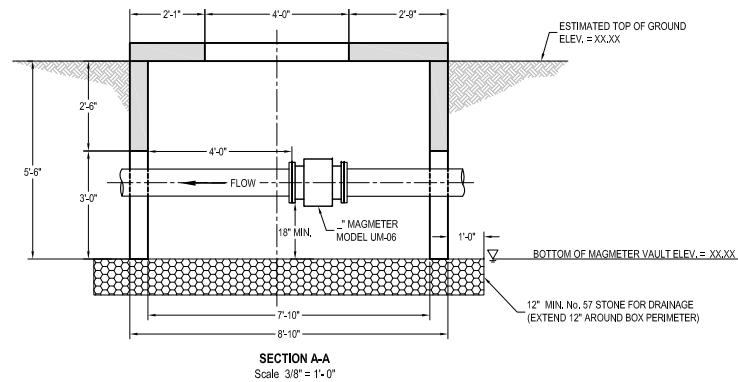
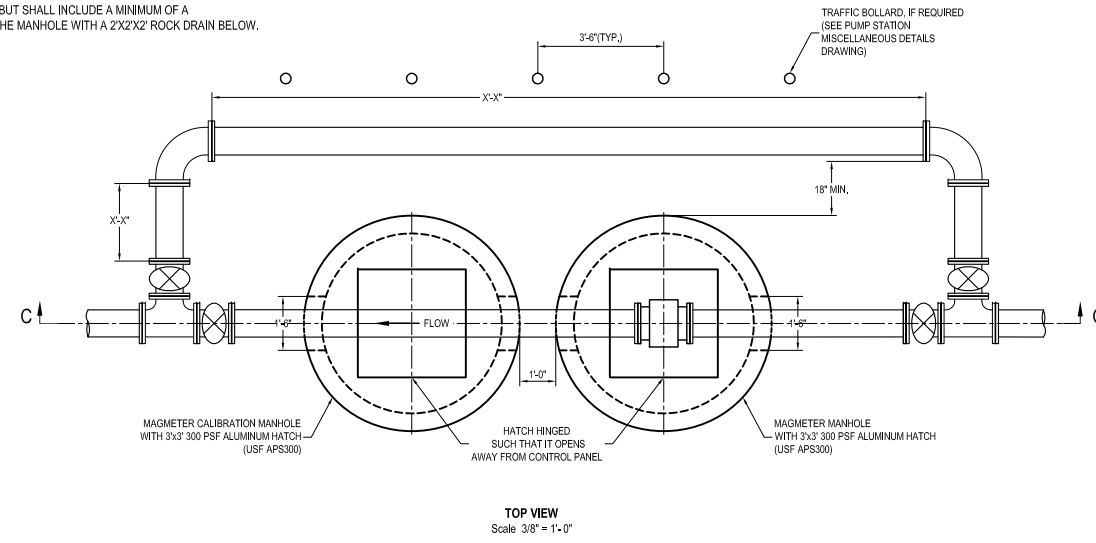
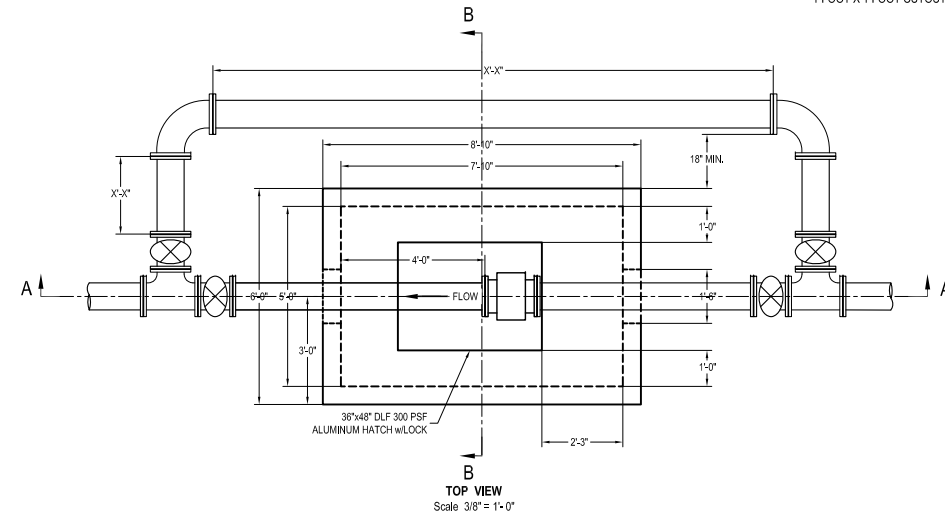


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PROJECT TITLE	- CITY OF TALLAHASSEE - PUMP STATION STANDARDS
SHEET TITLE	PUMP STATION WITH UNDERGROUND VALVES

Approved by:		SHEET	-
Date Issued:	JANUARY 2015	SCALE	N.T.S.
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NOTE: THE MAG METER MANHOLE DETAILS SHOWN ARE FOR EXISTING FORCE MAINS. IF THE MAG METER IS TO BE INSTALLED ON A NEW FORCE MAIN THEN A STANDARD MANHOLE MAY BE SUBSTITUTED IN LIEU OF A STRADDLE BUT SHALL INCLUDE A MINIMUM OF A 1 FOOT X 1 FOOT CUTOUT IN THE BOTTOM OF THE MANHOLE WITH A 2X2X2' ROCK DRAIN BELOW.



OPTION 1
MAGMETER STRADDLE VAULT DETAIL
WITH OPTIONAL BYPASS, IF REQUIRED

OPTION 2
MAGMETER STRADDLE MANHOLE DETAIL
(UP TO 8" MAGMETER)



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PROJECT TITLE

- CITY OF TALLAHASSEE -
PUMP STATION STANDARDS

SHEET TITLE

PUMP STATION
MISCELLANEOUS DETAILS

Approved by:

Date Issued: JANUARY 2015

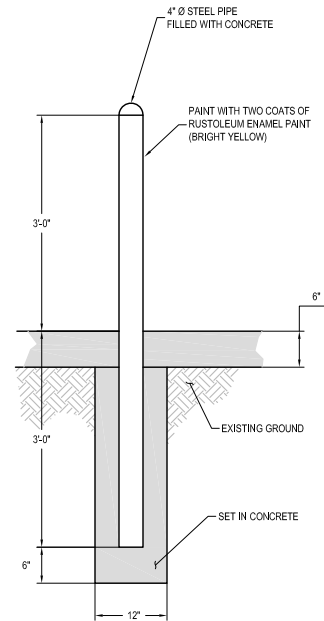
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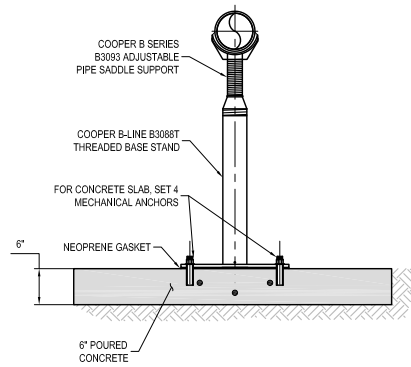
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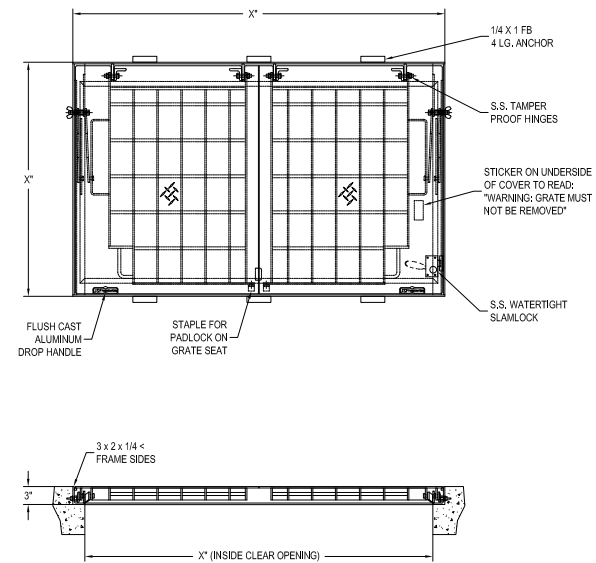


TRAFFIC BOLLARD DETAIL
(NOT TO SCALE)

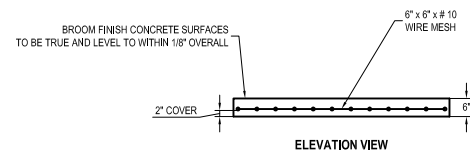


- NOTES:
1. FOR PIPE SUPPORT USE COOPER B-LINE PRODUCT. USE B3088T THREADED BASE STAND WITH B3093 PIPE ADJUSTER. CONTRACTOR IS RESPONSIBLE FOR SPECIFYING AND ORDERING APPROPRIATE HEIGHT PIPE STANDS.
 2. PIPE SUPPORT BASE IS 18"x18"x12" WITH A 4" THREADED STANDPIPE TO A 2 1/2" THREADED SUPPORT.
 3. COMPACT SUBGRADE TO ACHIEVE AT LEAST 95% OF THE SOLID MAX. DRY DENSITY AS DETERMINED BY ASTM D698. BACKFILL, IF REQUIRED, SHALL BE PLACED IN 6" MAX LIFTS.

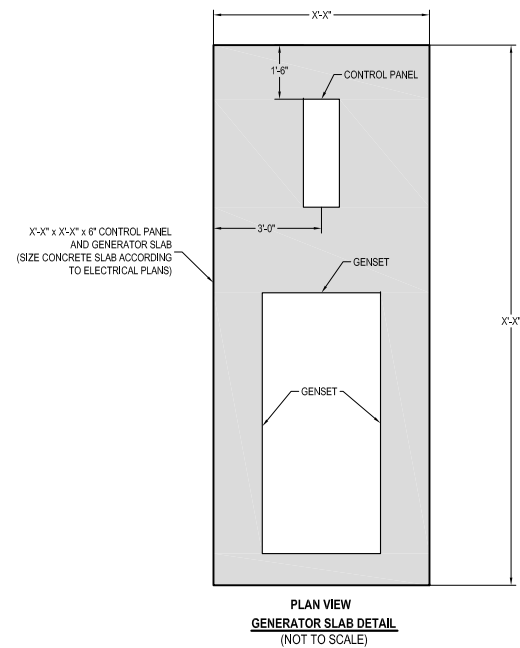
PIPE SUPPORT DETAIL
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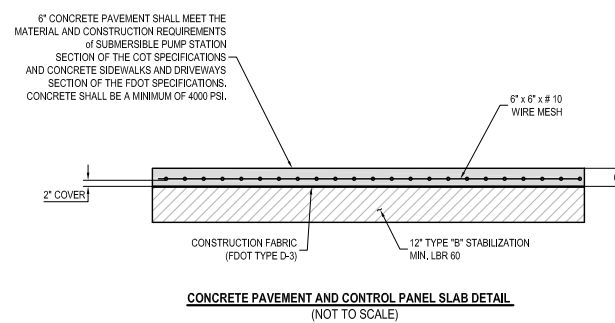
US FOUNDRY ASGD ACCESS HATCH WITH SAFETY GRATE
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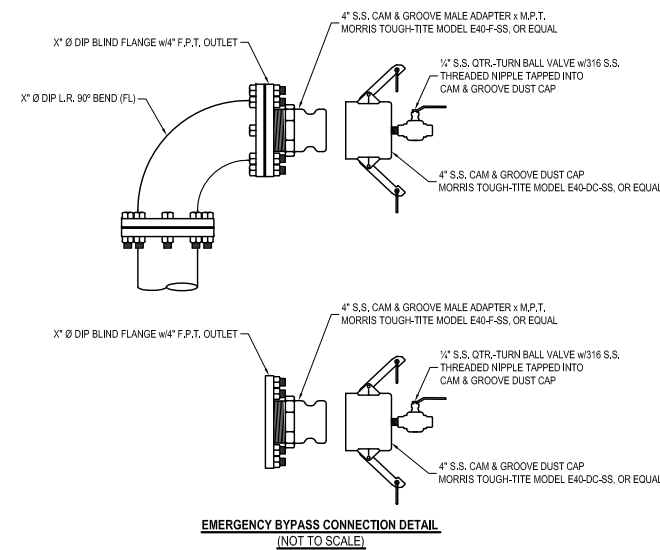
ELEVATION VIEW



PLAN VIEW
GENERATOR SLAB DETAIL
(NOT TO SCALE)



CONCRETE PAVEMENT AND CONTROL PANEL SLAB DETAIL
(NOT TO SCALE)



EMERGENCY BYPASS CONNECTION DETAIL
(NOT TO SCALE)



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PROJECT TITLE

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PUMP STATION STANDARDS

SHEET TITLE

PUMP STATION
MISCELLANEOUS DETAILS

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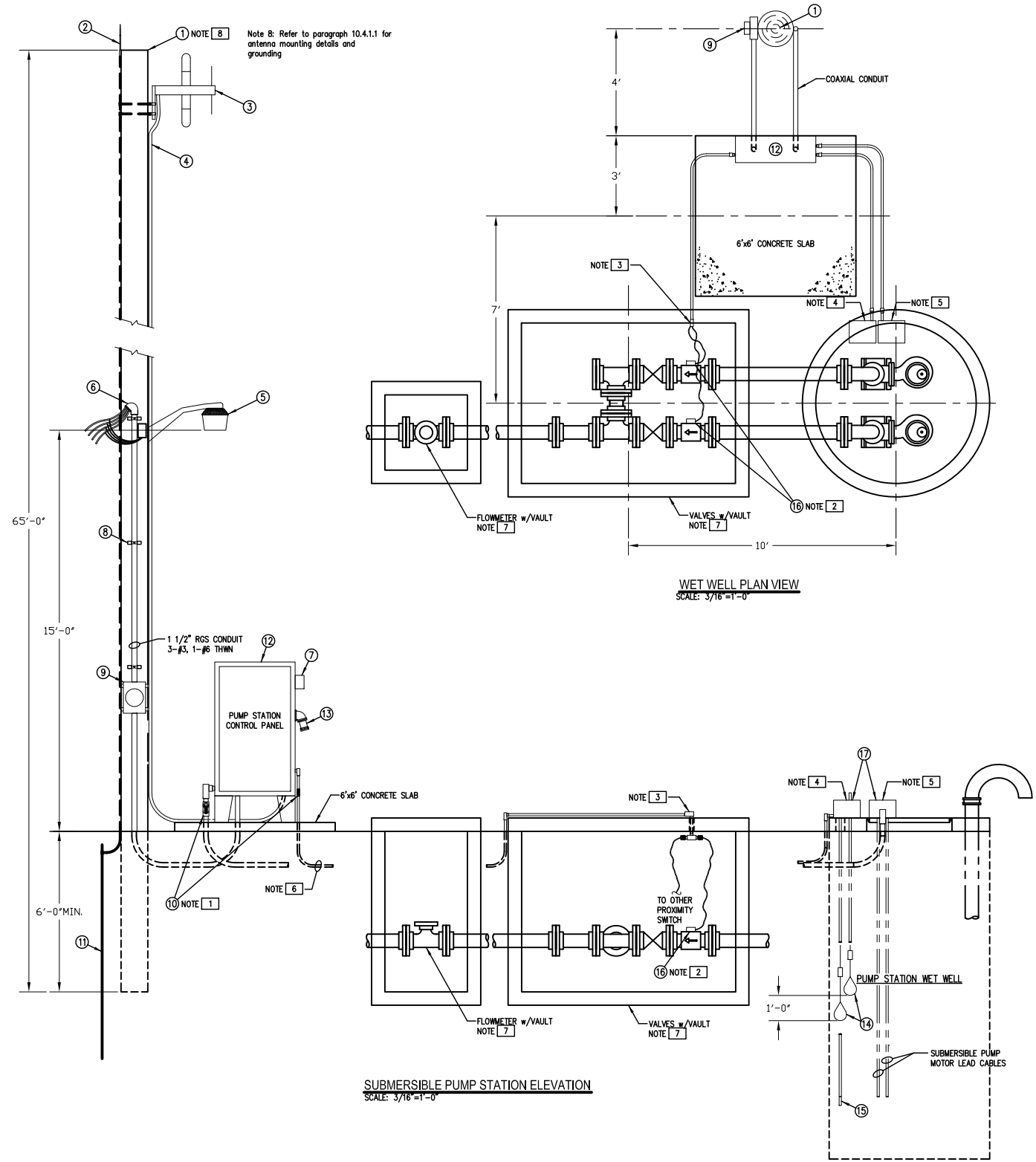
ATTACHMENT #2

NOTES:

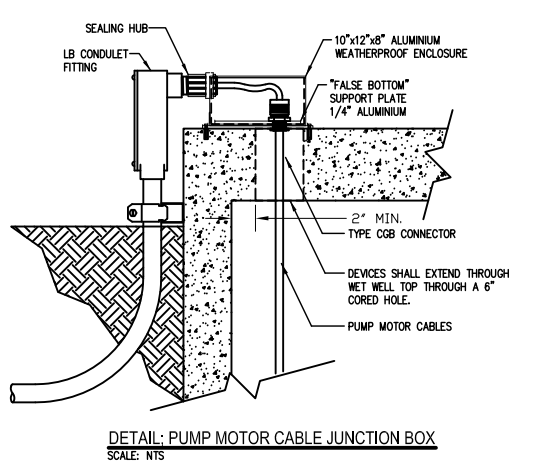
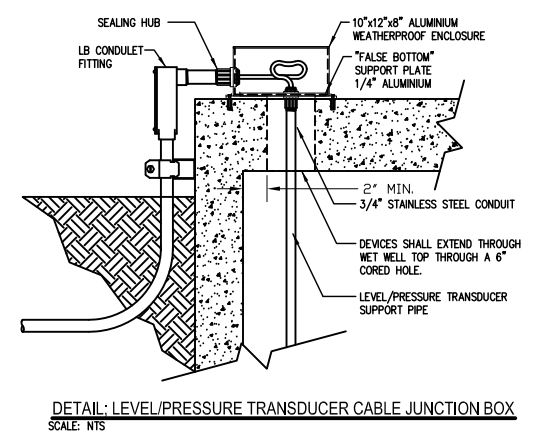
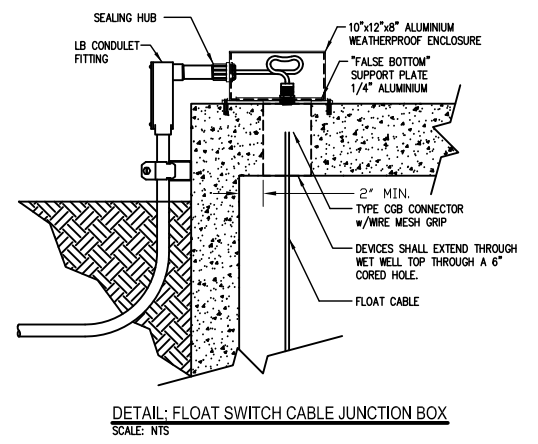
1. DRAWINGS DEPICTED ARE TYPICAL AND SHALL BE DRAWN TO SCALE IN THE PLANS AND SUBMITTED TO THE CITY BY THE ENGINEER OF RECORD. ALL DIMENSIONS SHALL BE INCLUDED THAT ARE SHOWN IN THESE STANDARDS.
2. PUMP DRAWINGS MUST BE OBTAINED FROM THE PUMP MANUFACTURER TO AID IN THE DRAFTING OF THESE PLANS.
3. HOLES CORED FOR FORCE MAIN PIPES SHALL BE 6" LARGER THAN THE PIPE OUTSIDE DIAMETER IN THE EVENT FIELD ADJUSTMENTS ARE REQUIRED. HOLES THAT ARE CORED IN THE FIELD THROUGH CONCRETE SHALL RECEIVE A HEAVY DUTY COAL TAR EPOXY COATING TO PREVENT CORROSION TO THE CONCRETE AND/OR EXPOSED REBAR AS SPECIFIED IN THE SANITARY SEWERS PRE-CAST CONCRETE MANHOLES SECTION OF COT SPECIFICATIONS.
4. INSURE THAT THE FLANGE FOR THE LONG RADIUS 90° FITTING IN THE WET WELL WILL BE A MINIMUM OF 6" FROM THE BACK WALL. THIS MAY REQUIRE SHIFTING THE PUMP MOUNTING BRACKETS FARTHER OUT FROM PUMP MANUFACTURER'S RECOMMENDED PUMP BASE LOCATION.
5. BE AWARE THAT THE DIMENSIONS GIVEN FOR THE WET WELL AND VALVE VAULT HATCHES ARE THE "CLEAR" OPENING AND THE HATCH USED MUST PROVIDE NO LESS THAN THE CLEAR OPENING GIVEN TO INSURE THE COMPONENTS CAN BE INSTALLED AND REMOVED. THE HATCH WILL BE LARGER THAN THE "CLEAR" OPENING DIMENSIONS. US FOUNDRY HATCH WAS USED FOR THIS DRAWING, OTHER MANUFACTURERS DIMENSIONS MAY VARY SLIGHTLY. FALL PROTECTION, IN THE FORM OF A GRATE, IS REQUIRED.
6. INSURE THAT THERE IS AT LEAST 3" CLEARANCE FROM ALL SIDES OF THE PUMP VOLUTE TO THE CLEAR OPENING IN THE LID.
7. DEPICTED VALVE VAULT IS SIZED TO ACCOMMODATE UP TO A 34" PUMP SPACING AND 8" PIPING IN MOST CASES. LARGER PUMPS (I.E. HIGH HEAD) MAY REQUIRE VALVE VAULT TO BE RESIZED. INDICATE EXACT PUMP SPACING AND INSURE MINIMUM CLEARANCES ARE MET.
8. IN ADDITION TO THE DETAILS SHOWN, THE FOLLOWING DETAILS MUST BE PROVIDED AS PART OF THE SUBMITTED PLANS: OVERALL SITE LAYOUT, GRADING PLAN, EROSION CONTROL PLAN, FENCING LAYOUT/DETAILS, LANDSCAPING PLAN, DETAILED PIPING LAYOUT (FORCE MAIN, VALVES, GRAVITY MAIN) WITHIN THE LIMITS OF THE PUMP STATION FENCING & DRAWN TO SCALE, DETAILED DRAWINGS OF ALL CONCRETE STRUCTURES (PLAN, PROFILE, SIDE PROFILE, ETC.) & DRAWN TO SCALE. THESE DETAILS SHALL BE SPECIFIED BY THE ENGINEER OF RECORD.
9. ALL BOLTS USED TO MOUNT PUMP BASE, GUIDE RAILS, GUIDE RAIL SUPPORTS & PIPE SUPPORTS SHALL BE DRILLED AND EPOXIED. NO REDHEADS WILL BE ALLOWED.
10. REBAR LAYOUT FOR WET WELL AND VALVE VAULT SHALL BE PROVIDED BY THE PRE-CAST CONCRETE MANUFACTURER UNLESS A SPECIAL DESIGN IS REQUIRED.
11. MAG METERS SHALL BE INSTALLED AT STATIONS DESIGNATED BY THE CITY AND AT ALL STATIONS PUMPING MORE THAN 1 MGD. MAG METER INSTALLATION MAY CONSIST OF TWO MANHOLES OR ONE RECTANGULAR BOX. FOR PROPER CALIBRATION, CONTACT THE FLOW METER MANUFACTURER FOR MINIMUM UPSTREAM AND DOWNSTREAM DISTANCES FROM THE NEAREST FITTING AND ENSURE THAT THESE ARE AVAILABLE WITHIN THE FLOW METER VAULT/MANHOLE. NO FITTING SHALL BE CLOSER THAN THE MANUFACTURER'S RECOMMENDATIONS TO THE MAG METER UPSTREAM AND DOWNSTREAM.
12. TOP OF WET WELL AND VALVE VAULT LIDS SHALL BE A MINIMUM OF ONE FOOT ABOVE THE 100 YEAR FLOOD PLAIN ELEVATION. PROVIDE CALCULATIONS AND/OR DOCUMENTATION.
13. ALL PIPES & VALVE BOXES THAT WILL HAVE CONCRETE POURED AROUND THEM SHALL BE WRAPPED WITH 30LB FELT A MINIMUM OF TWO TIMES AND SECURED IN PLACE SUCH THAT THE CONCRETE DOES NOT ADHERE TO THE PIPE OR VALVE BOX. THE 30LB FELT SHALL BE CUT FLUSH WITH THE FINISHED CONCRETE GRADE.
14. ENGINEER SHALL PROVIDE ALL CALCULATIONS, INCLUDING SYSTEM HEAD CURVES FOR ONE PUMP RUNNING, 2 PUMPS RUNNING, ETC. BUOYANCY CALCULATIONS ARE REQUIRED. IF THE PUMP STATION FORCE MAIN IS A MANIFOLDED SYSTEM, CALCULATIONS AND/OR MODELING RESULTS SHALL BE SUBMITTED SHOWING HEAD CONDITIONS AT ALL EXISTING AND PROPOSED AFFECTED PUMPING STATIONS.
15. CONTRACTOR SHALL PROVIDE A RECORD DRAWING SURVEY AND PROFILE OF THE PUMP STATION FORCE MAIN TO THE LIMITS OF NEW CONSTRUCTION IN ADDITION TO THE RECORD DRAWING REQUIREMENTS FOUND IN AS-BUILT SPECIFICATIONS SECTION OF THE COT SPECIFICATIONS.
16. CONTRACTOR IS RESPONSIBLE FOR REMOVING AND PROPERLY DISPOSING OF ALL EXISTING MECHANICAL AND ELECTRICAL EQUIPMENT THAT THE CITY DOES NOT WANT TO SALVAGE. CONTRACTOR SHALL NOTIFY CITY INSPECTOR 72 HOURS IN ADVANCE BEFORE EXISTING STATION PUMPS AND CONTROLS ARE REMOVED.
17. GRAVEL ALL AREAS INSIDE PUMP STATION FENCE WITH 4" OF FDOT No. 57 GRAVEL OVER 20 MIL PDC OR EQUIVALENT.
18. PROVIDE SOIL BORINGS TO DEPTH OF WET WELL PLUS 5 FEET (MINIMUM).
19. MAINTAIN A 2% SLOPE ACROSS THE ENTIRE PUMP STATION SITE TO PROMOTE PROPER DRAINAGE.
20. PUMP STATION SITE SHOULD BE SIZED AT A MINIMUM OF 85' X 85'. DEVIATIONS FROM THIS STANDARD SITE LAYOUT WILL NOT BE ALLOWED UNLESS APPROVED BY THE WATER RESOURCES ENGINEERING MANAGER OR DESIGNEE.
21. THE FENCE SHALL TYPICALLY BE LOCATED 6" WITHIN THE PROPERTY/EASEMENT LIMITS UNLESS LANDSCAPING IS REQUIRED.
22. LANDSCAPING SHALL BE IN ACCORDANCE WITH APPROVED PLANS AND PERMITTING DOCUMENTS. LANDSCAPING MUST BE A MINIMUM OF 3 FEET AWAY FROM THE OUTSIDE OF THE FENCE. IF LANDSCAPING IS REQUIRED, A LANDSCAPING PLAN SHALL BE PROVIDED AS PART OF THE PUMP STATION DESIGN PLANS.
23. THE ENGINEER OF RECORD SHALL PREPARE, OR HAVE PREPARED, ELECTRICAL PLANS THAT ARE SPECIFIC TO THE STATION. THE USE OF "STANDARD" DRAWINGS OR REFERENCE TO THE COT SPECIFICATIONS IS NOT PERMITTED.

 <p>City of Tallahassee UNDERGROUND UTILITIES <i>"Setting the Standard for Excellence"</i></p> <p>WATER RESOURCES ENGINEERING DIVISION 300 S. Adams Street, B-26 - Tallahassee, FL 32301 Phone: 850-891-4968 Fax: 850-891-6170 www.talgov.com/you</p>	<p align="center">SHEET TITLE</p> <p align="center">PUMP STATION STANDARD NOTES</p>	<p align="center">SHEET</p> <p align="center">-</p>
<p>Approved by:</p>	<p>Date Issued: JANUARY 2015</p>	<p align="center">SCALE</p> <p align="center">N.T.S.</p>
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BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	WOOD POLE-60" ABOVE GRADE MINIMUM (PAID FOR BY CONTRACTOR)			1
2	AIR TERMINAL - CLASS 1 SOLID COPPER AIR TERMINAL BASE	HARGER LIGHTNING PROTECTION, INC.	NO. 60 NO. 160	1
3	ANTENNA-YAGI w/MOUNTING AND GROUNDING HARDWARE	DECIBEL PRODUCTS	MODEL DB-499	1
4	ANTENNA COAXIAL CABLE	ANDREW CORP.	LD4-50A, FS34-50 or EQUIVALENT	1
5	SECURITY LIGHT - 100W, HIGH PRESSURE SODIUM, 120VAC	GENERAL ELECTRIC	PBS10S1A5V5AC	1
6	ELECTRICAL SERVICE MAST AND WEATHER HEAD			
7	SERVICE LIGHTNING ARRESTERS	ADVANCED PROTECTION TECHNOLOGIES, INC.	TE/3XF/4X	1
8	SERVICE MAST SUPPORT AND STRAP			
9	METER BASE			
10	CONDUIT SEAL-OFF FITTINGS			
11	GROUND ROD 5/8" COPPER CLAD 8' LONG			
12	PUMP STATION RTU CONTROL PANEL	SEE CNTL PANEL DWG.		
13	EMERGENCY CONNECTION	SEE CNTL PANEL DWG.		
14	FLOAT SWITCH	ANCHOR SCIENTIFIC	S40N0NC	2
15	PRESSURE TRANSDUCER LEVEL TRANSMITTER SUSPENDED ON 3/4" STAINLESS STEEL PIPE	KPSI	700-340-4015	1
16	PROXIMITY SWITCH	AUTOMATION DIRECT	ATI-A0-2A	2
17	10"x12"x8" ALUMINUM ENCLOSURE			2
18	MAGMETER	McCROMETER	ULTRA-MAG UM-XX	1



- NOTES:**
- CONDUIT SEALS SHALL BE PLACED WITHIN (18)EIGHTEEN INCHES OF THE PUMP STATION CONTROL PANEL ENCLOSURE.
 - PROXIMITY SWITCH TO BE MOUNTED ON EACH SUBMERSIBLE PUMP'S DISCHARGE PIPING CHECK VALVE TO INDICATE PUMP FAILURE IF NO FLOW OCCURS TO ACTIVATE THE SWITCH.
 - 3/4" LB CONDULET FITTING WITH GASKETED COVER MOUNTED ON TOP OF VALVE VAULT, EXTEND CONDUIT DOWN THROUGH VAULT TOP. CONTRACTOR TO USE TYPE CGB CORD GRIP CONNECTORS FOR PROXIMITY SWITCH CABLES.
 - 10"x12"x8" ALUMINUM JUNCTION BOX WITH GASKETED COVER MOUNTED ON TOP OF THE WET WELL FOR THE WET WELL LEVEL/PRESSURE TRANSDUCER AND EMERGENCY BACKUP FLOAT SWITCH. THIS ASSEMBLY WILL REQUIRE CORED HOLES TO FACILITATE INSTALLATION AND REMOVAL OF THE 3/4" STAINLESS STEEL PIPE ON WHICH PRESSURE TRANSDUCER IS SUSPENDED AND THE FLOAT SWITCH ASSEMBLY FROM THE OUTSIDE OF THE WET WELL. CONTRACTOR TO USE TYPE CGB CONNECTORS WITH WIRE MESH GRIP TO SUPPORT THE FLOAT SWITCH AND CABLE SUSPENDED IN THE WET WELL.
 - 10"x12"x8" ALUMINUM JUNCTION BOX WITH GASKETED COVER MOUNTED ON TOP OF THE WET WELL FOR THE PUMP MOTORS POWER CABLES. ASSEMBLY WILL REQUIRE 2 CORED HOLES IN TOP OF THE WET WELL LID FOR PUMP MOTOR CABLES TO CHASE THROUGH INTO WET WELL. CONTRACTOR TO USE TYPE CGB CORD CONNECTORS WITH WIRE MESH GRIP TO SUPPORT THE PUMP MOTOR CABLES.
 - CONDUIT FOR VALVE POSITION PROXIMITY SWITCHES CAN ENTER VALVE BOX THROUGH THE TOP AS SHOWN OR MAY ENTER THROUGH THE SIDE OF THE VALVE BOX DEPENDING UPON WHICH IS BEST SUITED TO SITE CONDITIONS.
 - DEVICE POSITION AND LAYOUT ARE APPROXIMATE, REFER TO CHAPTER NINE OF THE CITY OF TALLAHASSEE SPECS FOR DETAILED STRUCTURAL DRAWINGS AND PIPE LAYOUTS.
 - THE ELECTRICAL/SCADA POLE WILL BE PROVIDED AND INSTALLED BY THE CITY OF TALLAHASSEE. THE COST OF THE POLE AND INSTALLATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.



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PROJECT TITLE
**- CITY OF TALLAHASSEE -
 ELECTRICAL SPECIFICATIONS**

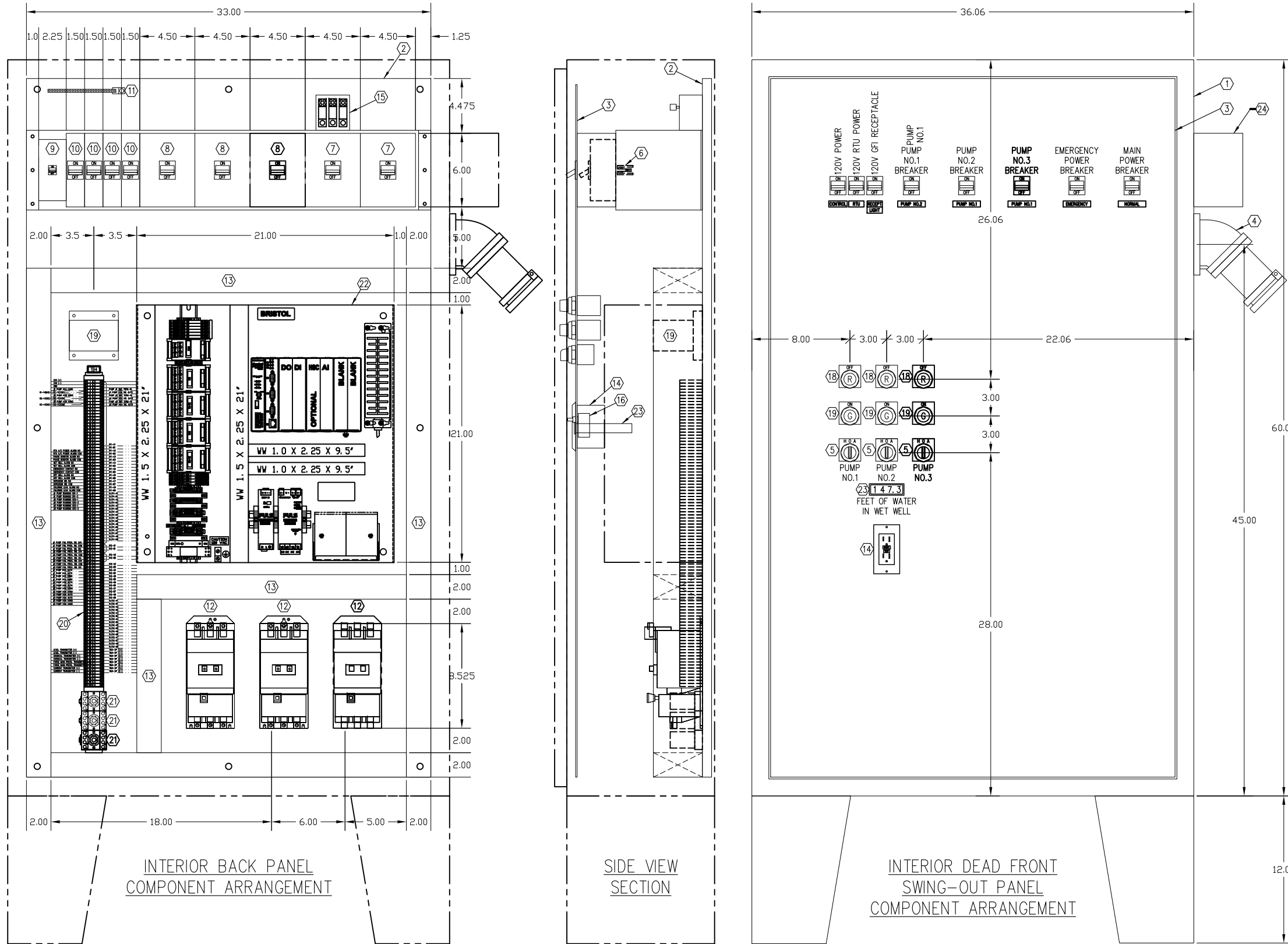
SHEET TITLE
**ELECTRICAL SITE PLAN
 DUPLEX PUMP STATION**

FIGURE
E-01

Approved by:
 Date Issued: **JANUARY 2015**

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SCALE
 N.T.S.



BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT	HOFFMAN	A-60H3612SS6LP A-FK1212SS	1
2	ENCLOSURE BACK & DEADFRONT PANELS XXX	HOFFMAN	A-60P36	2
3	DEAD FRONT SWING-OUT PANEL KIT XXX	HOFFMAN	A-NADFK	1
4	EMERGENCY POWER RECEPTACLE - 100A, 3Ø, 4 WIRE, w/45° ADAPTER & SCREW CAP	RUSSELL-STOLL	7334-72-45	1
5	3 POSITION SELECTOR SWITCH w/7/8"-Ø-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
6	WALKING BEAM MECHANICAL INTERLOCK ASSEMBLY	SQUARE-D	FA4WB	1
7	BREAKER-100A, THREE POLE	SQUARE-D	FAL34100WB	2
8	BREAKER 60A, THREE POLE	SQUARE-D	FAL34060	2
9	BREAKER 10A, THREE POLE	SQUARE-D	QOU310	1
10	BREAKER 15A, SINGLE POLE	SQUARE-D	FAL12015	4
11	EQUIPMENT GROUND BAR w/ #1-4/Ø COPPER LUG	SQUARE-D	PK15GTA-L	1
12	FULL VOLTAGE STARTER, SIZE 2, w/OL'S AND N.O.-N.C. AUXILIARY CONTACT	ALLEN-BRADLEY	509-COC 595-AB	2
13	WIREDUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	-
14	SERVICE RECEPTACLE 15A, 125VAC, G.F.I. w/COVER	LEVITON	6599-W	1
15	POWER BLOCK	ALLEN-BRADLEY	1492-PD3C141	1
16	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2RQ1-A2	1
17	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-OHTOR 800T-X527	2
18	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-OHTOC 800T-X530	2
19	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-230-ALE	1
20	TERMINAL	PHOENIX CONTACT	UK 5	-
21	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12P14V20 NR51	3
22		BRISTOL-BABCOCK	-	1
23	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
23	TRANSIENT VOLTAGE SURGE SUPPRESSOR	APT	TE/3XF/4X	1

MOTOR HP	MAIN BREAKER	EMERG. BREAKER	STARTER BREAKER	STARTER SIZE
15	100	100	80	2
10	80	80	60	2
7.5	60	60	45	1
5	60	60	30	1

DUPLEX PUMP STATION

MOTOR HP	MAIN BREAKER	EMERG. BREAKER	STARTER BREAKER	STARTER SIZE
15	150*	100*	80	2
10	100	100	60	2
7.5	80	80	45	1
5	60	60	30	1

TRIPLEX PUMP STATION

* MAIN AND EMERGENCY BREAKERS SHALL BE SAME FRAME IN ORDER TO ACCOMMODATE STOCK WALKING BEAM MECHANICAL INTERLOCK COMPONENT. (150A IS A K-FRAME BREAKER THEREFORE THE 100A EMERGENCY BREAKER MOUNTED WITH IT SHALL ALSO BE A K-FRAME BREAKER)

NOTES:

- PANEL CONSTRUCTOR AND PUMP STATION INSTALLATION CONTRACTOR SHALL COORDINATE THE CALIBRATION OF THE PANEL METER AND THE WETWELL LEVEL INSTRUMENT (PRESSURE TRANSDUCER) SUCH THAT THE PANEL METER READ OUT IS IN ENGINEERING UNITS. UNITS SHALL BE FEET TO TENTHS OF FEET (i.e. 14.6 FEET).
- BREAKERS AND GENERATOR RECEPTACLE TO BE SIZED BASED ON THE HORSEPOWER OF THE PUMP STATION'S PUMP MOTORS.

15HP OR LESS WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL DUPLEX/TRIPLEX



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PROJECT TITLE

- CITY OF TALLAHASSEE -
 ELECTRICAL SPECIFICATIONS

SHEET TITLE

ELECTRICAL - 230V, 15HP OR LESS
 PUMP STATION CONTROL PANEL LAYOUT

Approved by:

Date Issued: JANUARY 2015

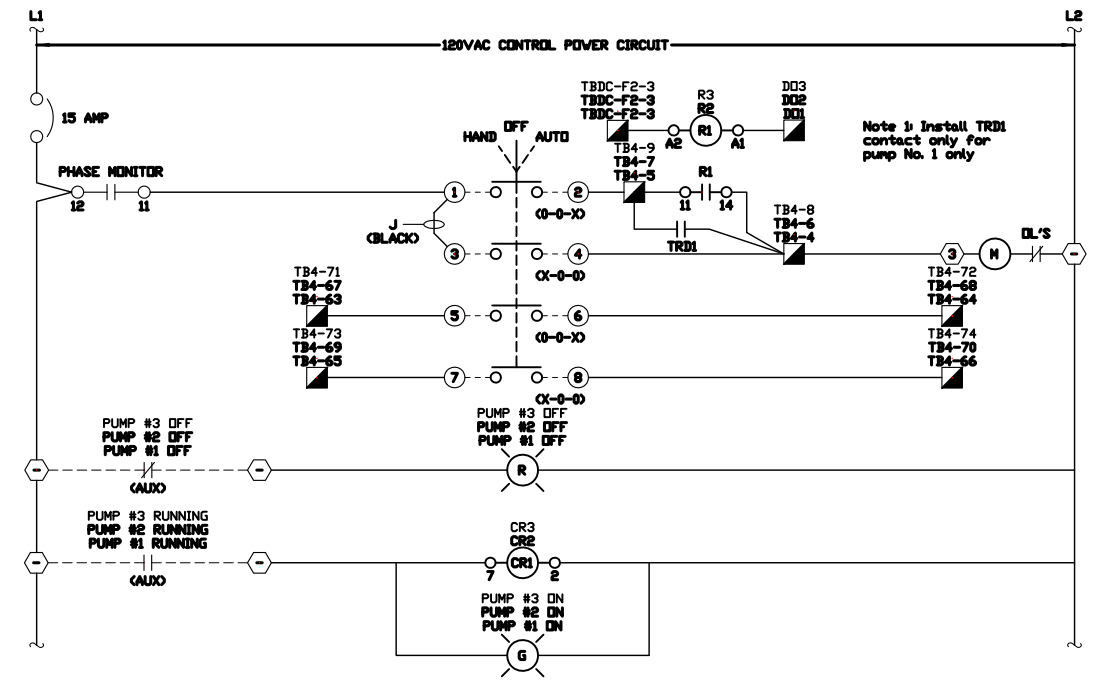
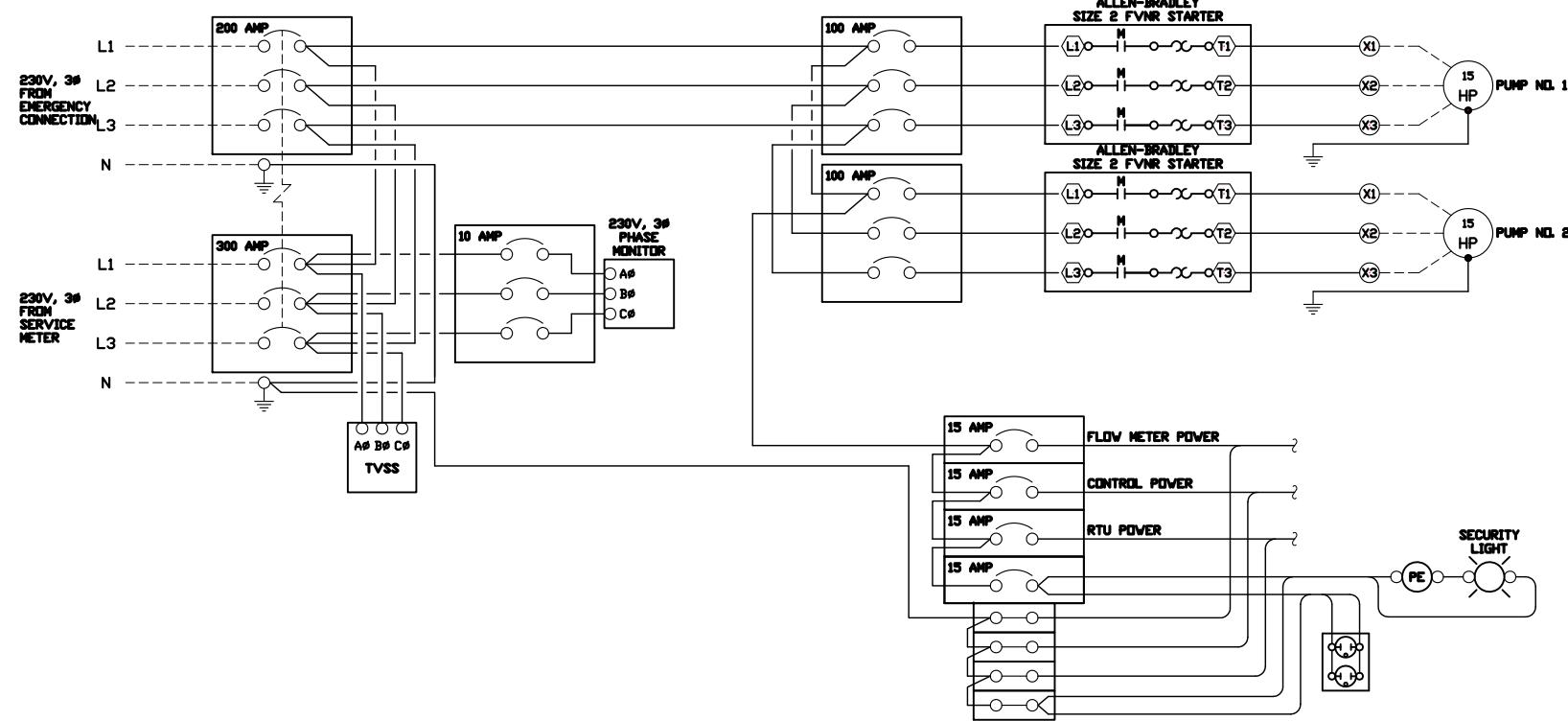
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FIGURE

E-02

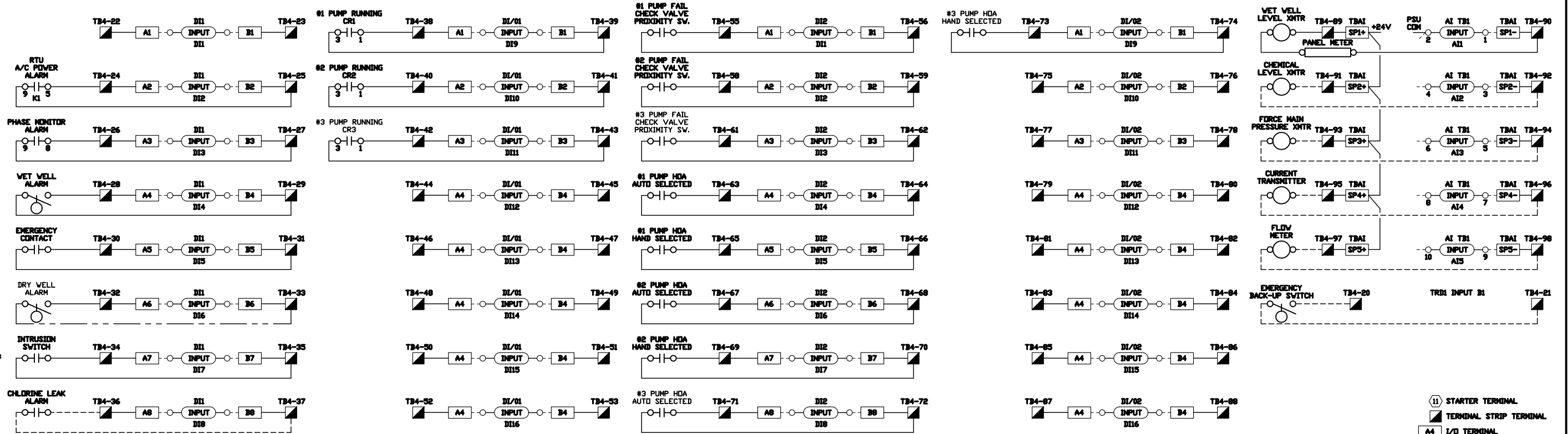
SCALE

N.T.S.

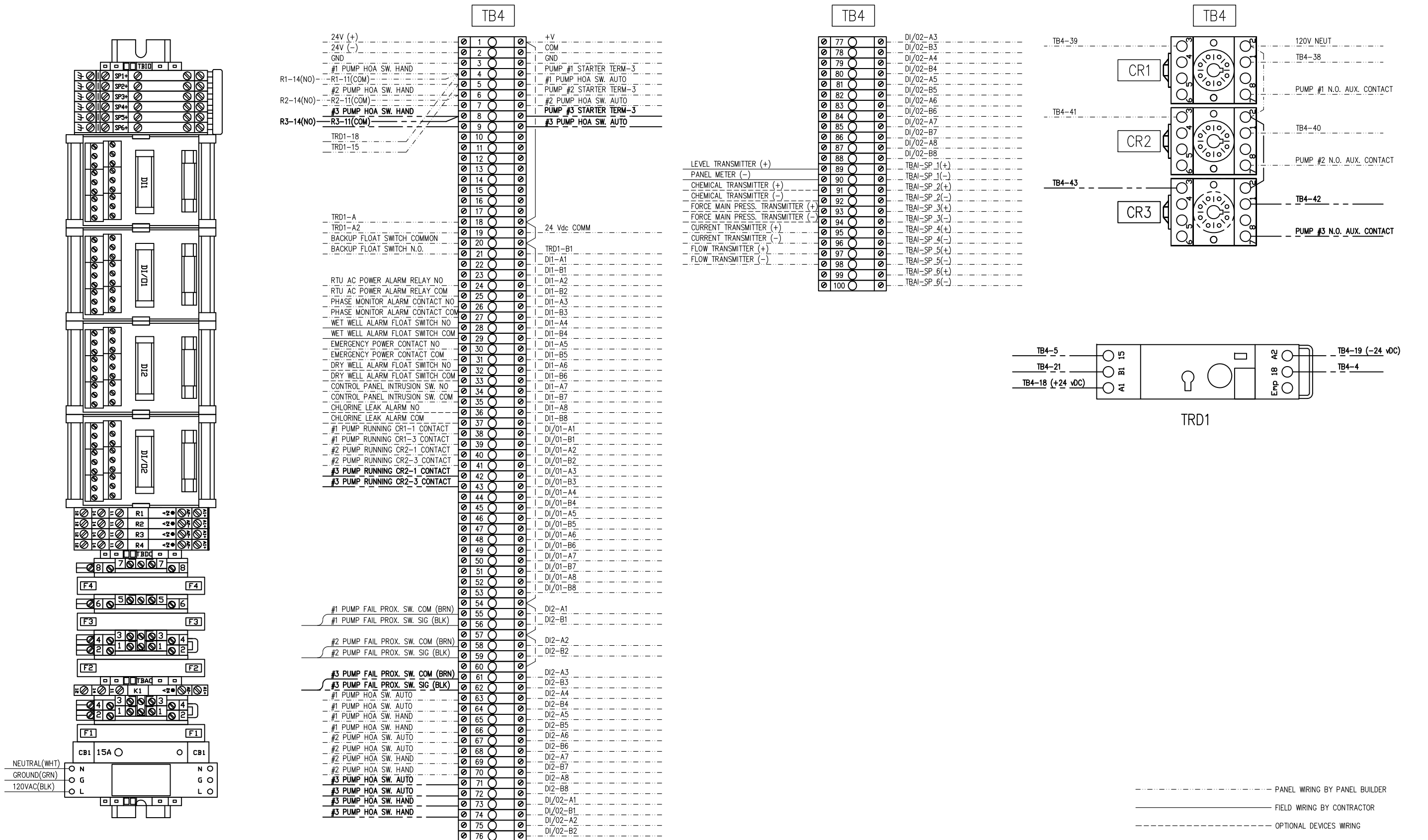


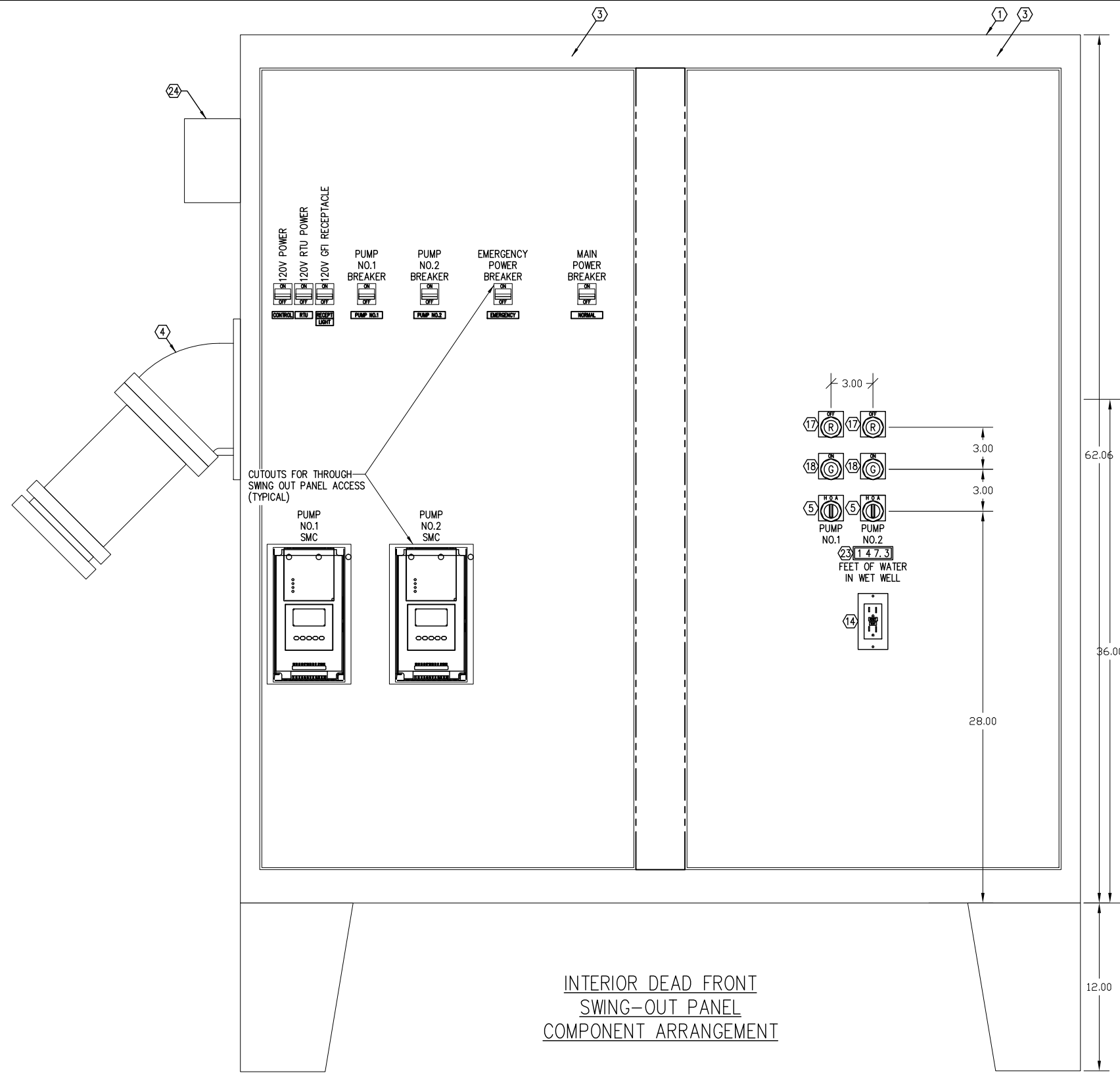
Note 2: Normally opened contact. Install additional relay to interface with power supply

Note 3: Normally opened contact. Wired in series for two-door cabinets.



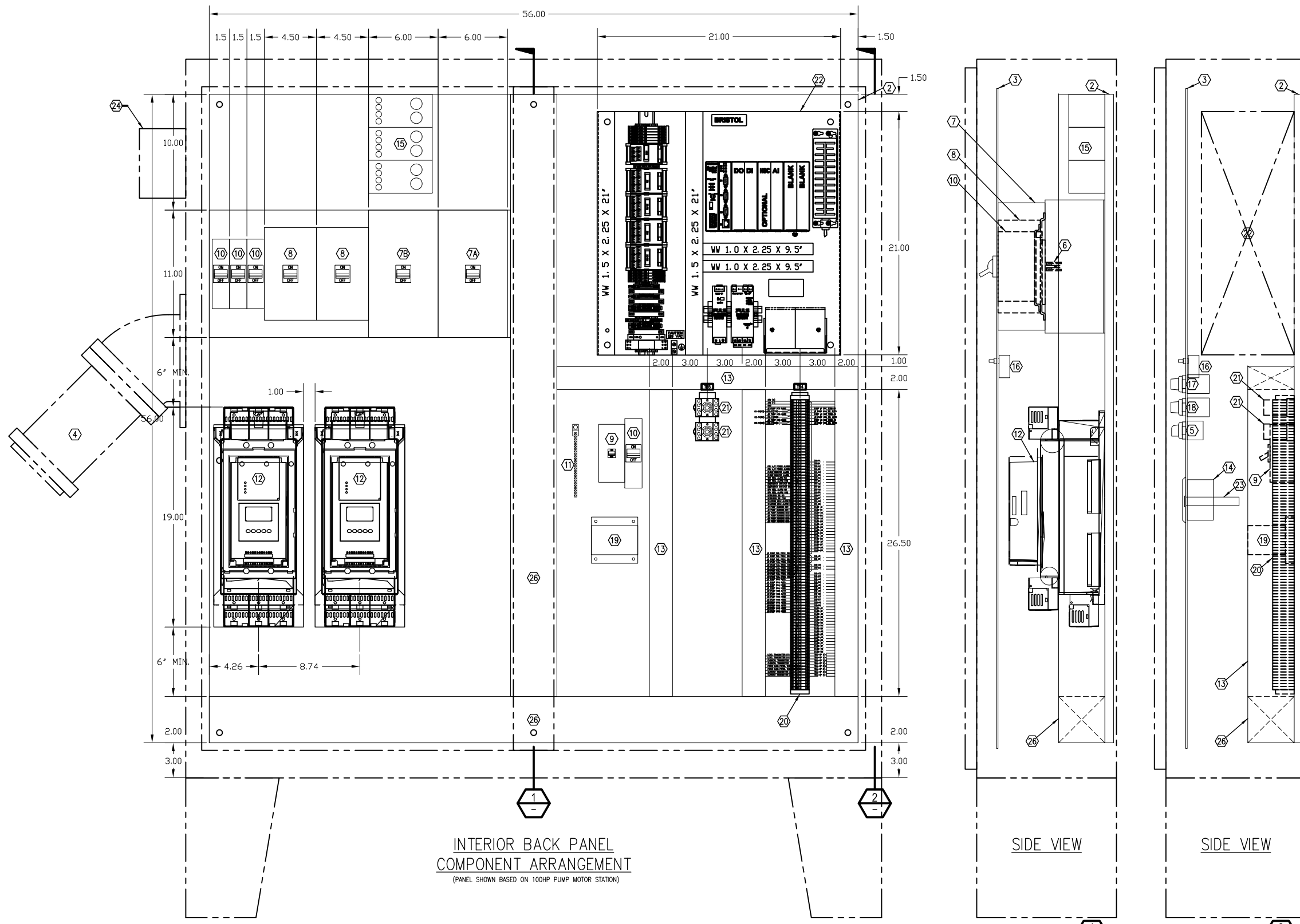
11 STARTER TERMINAL
 12 TERMINAL STRIP TERMINAL
 A4 I/O TERMINAL





20HP-50HP WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL

NOTES:
1 REFERENCE DRAWING E-06 FOR BILL OF MATERIALS AND INTERNAL ARRANGEMENT OF THE ELECTRICAL COMPONENTS.



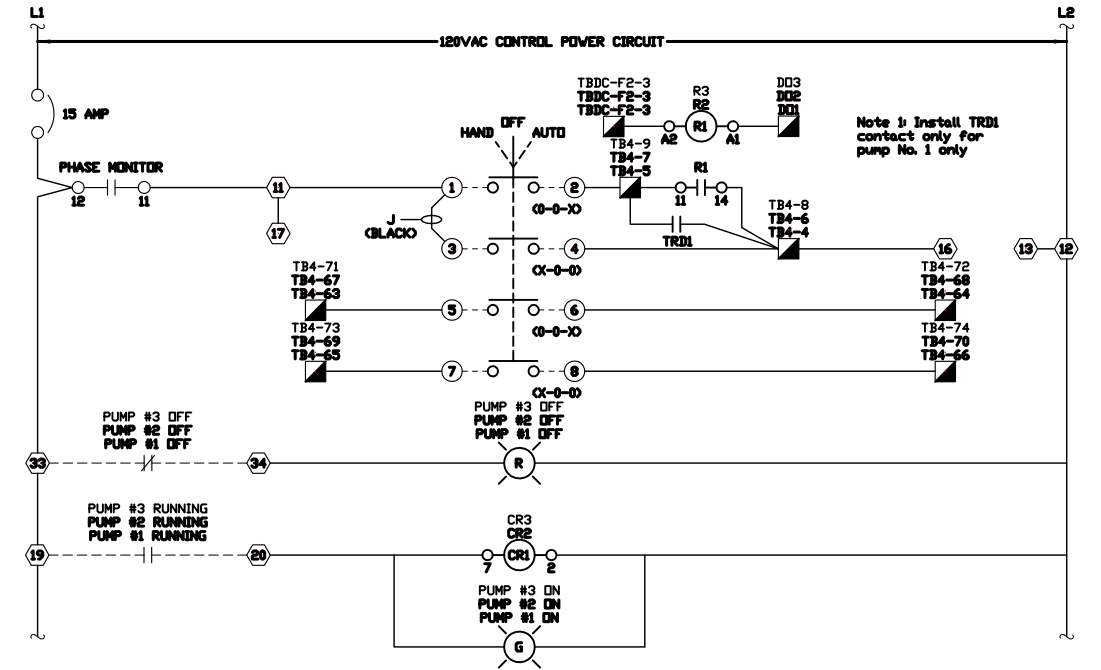
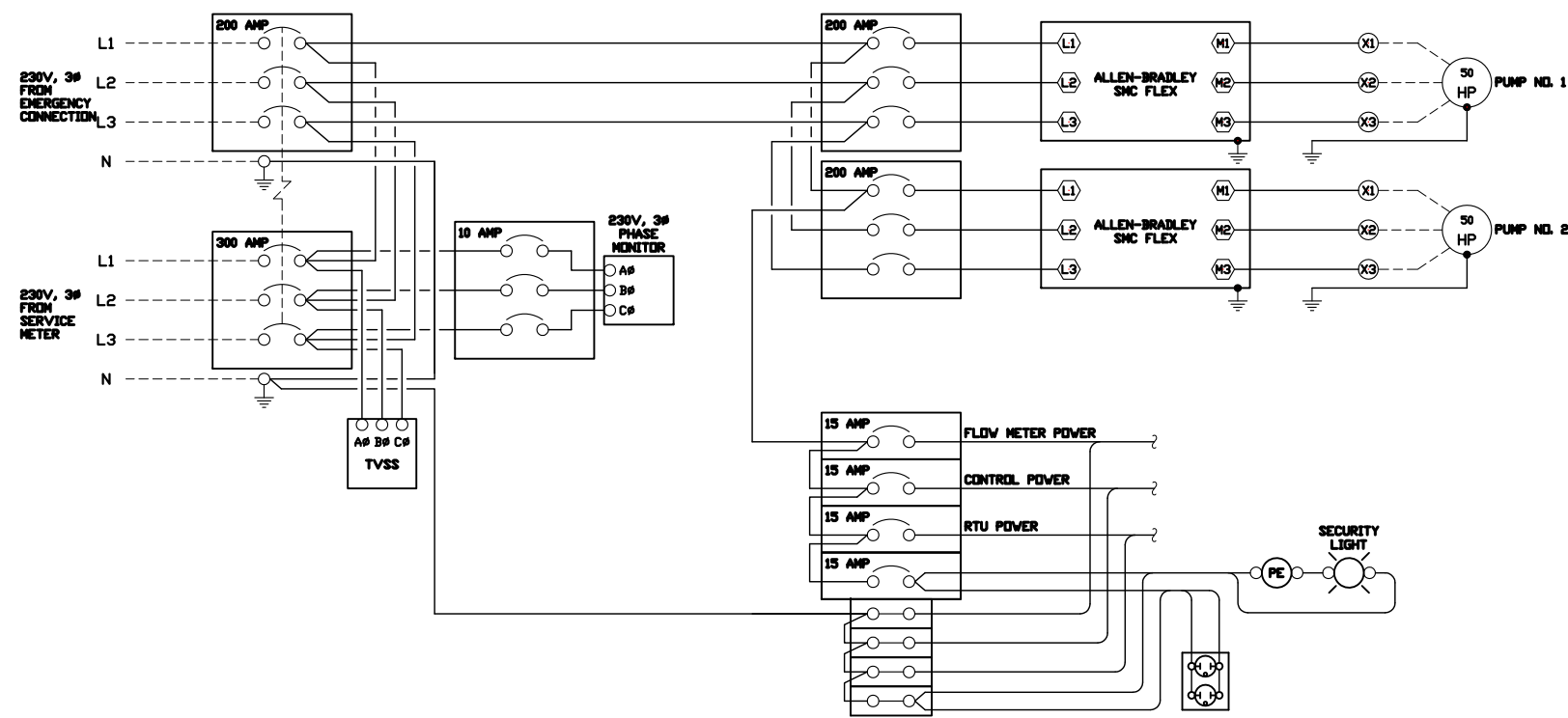
BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT	HOFFMAN	A-62H6012SSLP A-FK1212SS	1
2	ENCLOSURE BACK PANEL	HOFFMAN	A-60P60	1
3	DEAD FRONT SWING-OUT PANEL KIT	-	-	1
4	EMERGENCY POWER RECEPTACLE - 400A, 3Ø, 4 WIRE, w/45° ADAPTER & SCREW CAP	CROUSE-HINDS	AR40422	1
5	3 POSITION SELECTOR SWITCH w/"H-O-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
6	WALKING BEAM MECHANICAL INTERLOCK ASSEMBLY	SQUARE-D	LA6WB	1
7A	BREAKER-300A, THREE POLE	SQUARE-D	LAL36300WB	1
7B	BREAKER-200A, THREE POLE	SQUARE-D	LAL36200WB	1
8	AUXILIARY CONTACT 1A/1B ON EMERG. BKR	SQUARE-D	SQ-D OPTION 1212	1
9	BREAKER 200A, THREE POLE	SQUARE-D	KAL36200	2
10	BREAKER 10A, THREE POLE	SQUARE-D	QQU310	1
11	BREAKER 15A, SINGLE POLE	SQUARE-D	FAL12015	4
12	EQUIPMENT GROUND BAR w/ #1-4/0 COPPER LUG	SQUARE-D	PK15GT-A-L	1
13A	FLEX SMART MOTOR CONTROLLER (SMC), 135A, w/PUMP CONTROL	ALLEN-BRADLEY	150-F135NBDB	2
13B	LINE/LOAD LUGS	ALLEN-BRADLEY	199-LF1	4
13C	TERMINAL COVERS	ALLEN-BRADLEY	150-TC1	4
14	WIREWAY DUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	-
15	SERVICE RECEPTACLE 15A, 125VAC w/COVER	LEVITON	6599-W	1
16	POWER TERMINAL BLOCK	SQUARE-D	9080LBA365208	1
17	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2RQ1-A2	2
18	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-QHTOR 800T-X527	2
19	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-QHTOC 800T-X530	2
20	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-230-ALE	1
21	TERMINAL	PHOENIX CONTACT	UK 5	60
22	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12P14V20 NR51	2
23	RTU	BRISTOL-BABCOCK	-	1
24	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
25	TRANSIENT VOLTAGE SURGE SUPPRESSOR	APT	TE/3XF/4X	1
26	INDUSTRIAL CONTROL TRANSFORMER 2000VA 240x480-120VAC, PRI. & SEC. FUSING	SQUARE-D	9070TF2000D1	1
27	WIREWAY DUCT 4"x4" w/COVER	HOFFMAN	A-400400WH A-400CWH	-

MOTOR HP	MAIN BREAKER	EMERG. BREAKER	SMC BREAKER	SMC RATING	EMERG. RECEPT.
50	300	200	200	135A	400
40	250	200	150	108A	400
30	225	125	110	85A	100
25	200	100	100	85A	100
20	175	100	80	60A	100

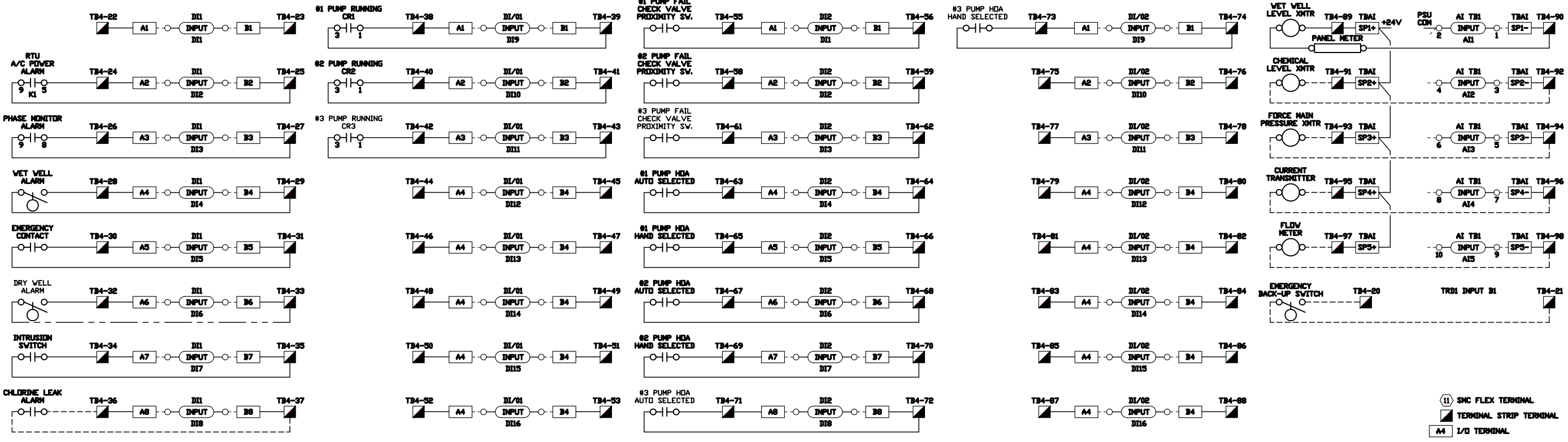
BREAKERS & GENERATOR RECEPTACLE SIZE CHART

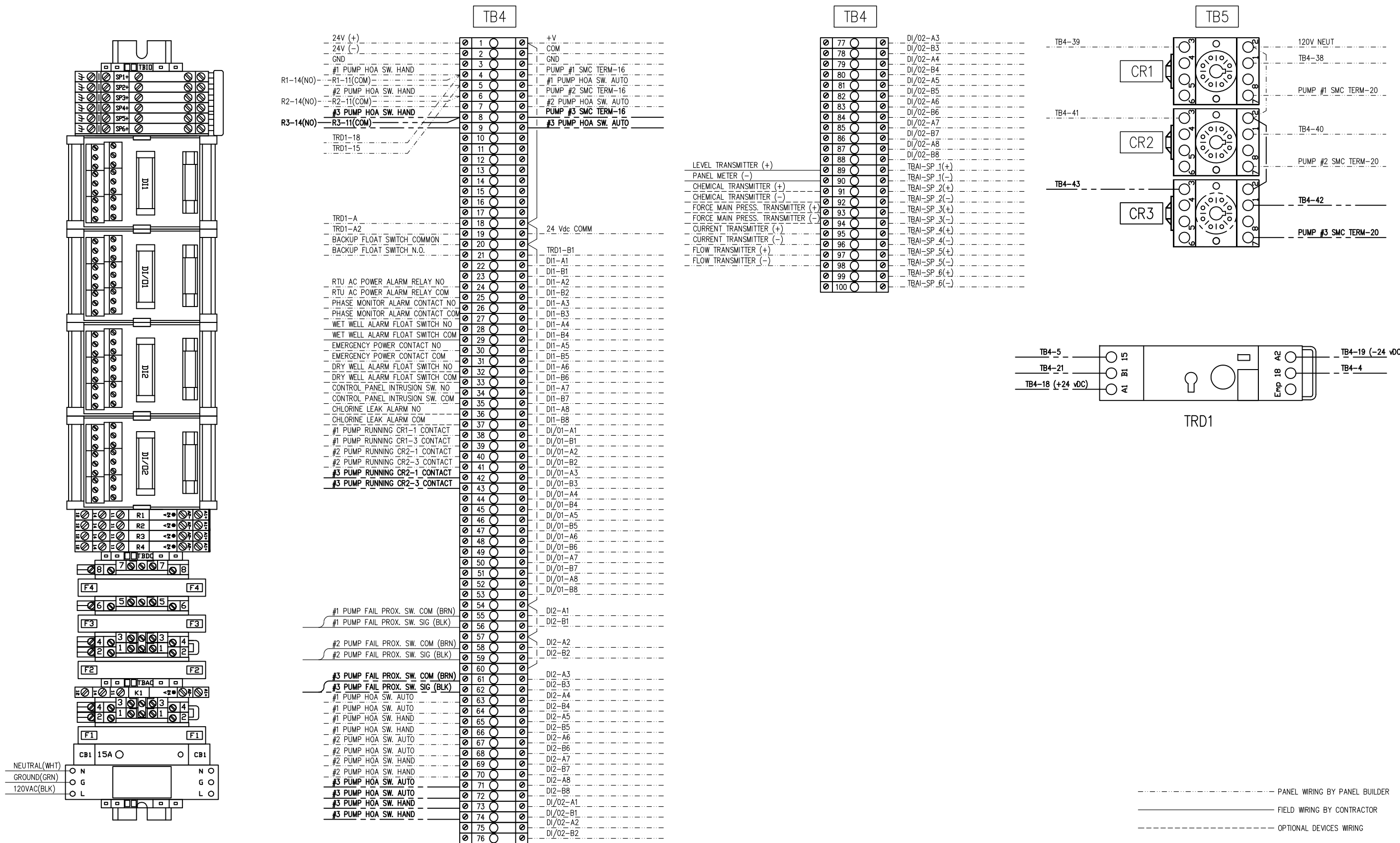
- NOTES:
- 1 PANEL CONSTRUCTOR AND PUMP STATION INSTALLATION CONTRACTOR SHALL COORDINATE THE CALIBRATION OF THE PANEL METER AND THE WETWELL LEVEL INSTRUMENT (PRESSURE TRANSDUCER) SUCH THAT THE PANEL METER READ OUT IS IN ENGINEERING UNITS. UNITS SHALL BE FEET TO TENTHS OF FEET (i.e. 14.6 FEET).
 - 2 BREAKERS AND GENERATOR RECEPTACLE TO BE SIZED BASED ON THE HORSEPOWER OF THE PUMP STATION'S PUMP MOTORS.

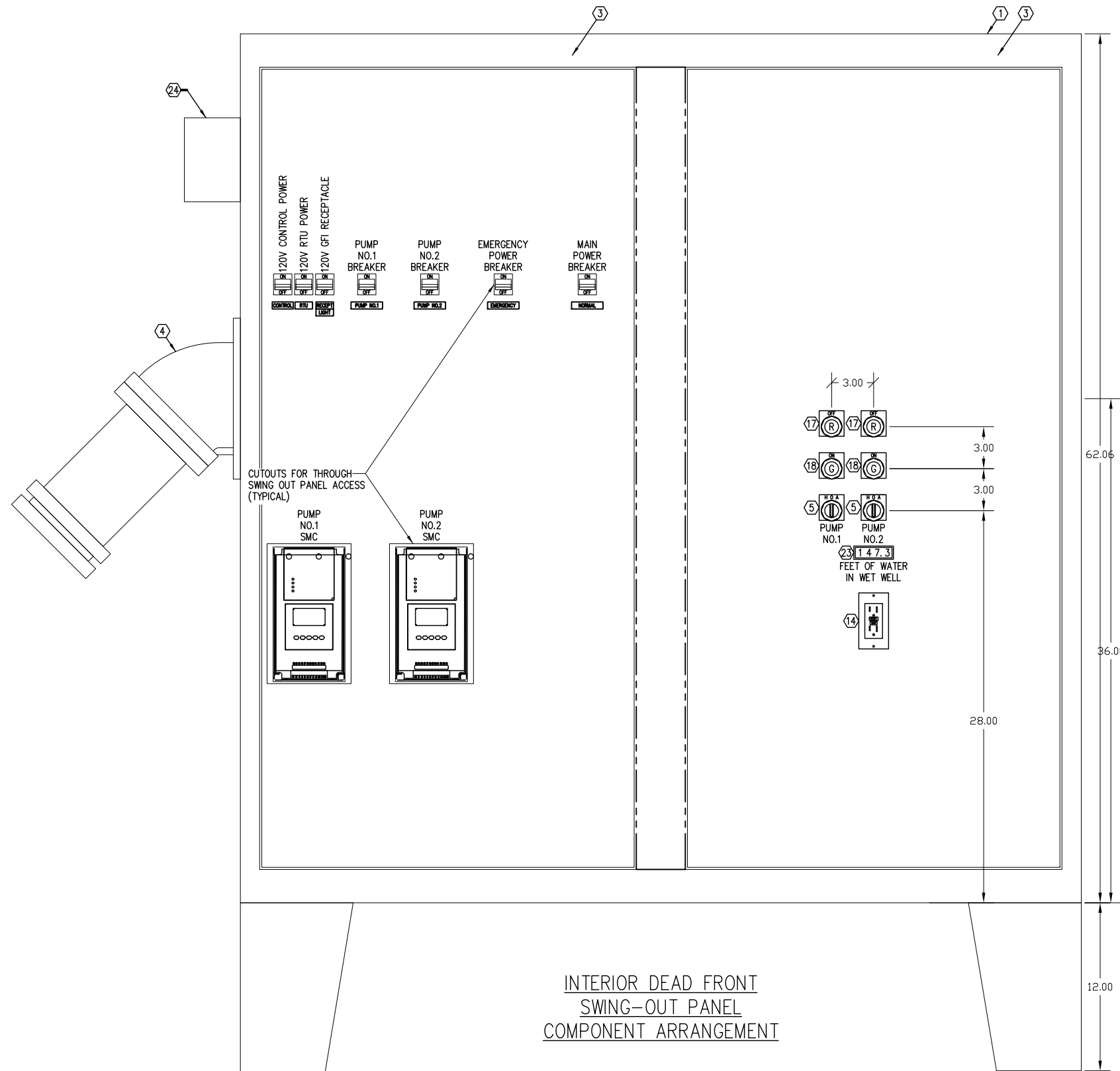
20HP-50HP WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL



Note 2: Normally opened contact. Install additional relay to interface with power supply







NOTES:
 1] REFERENCE DRAWING E-10 FOR BILL OF MATERIALS AND INTERNAL ARRANGEMENT OF THE ELECTRICAL COMPONENTS.

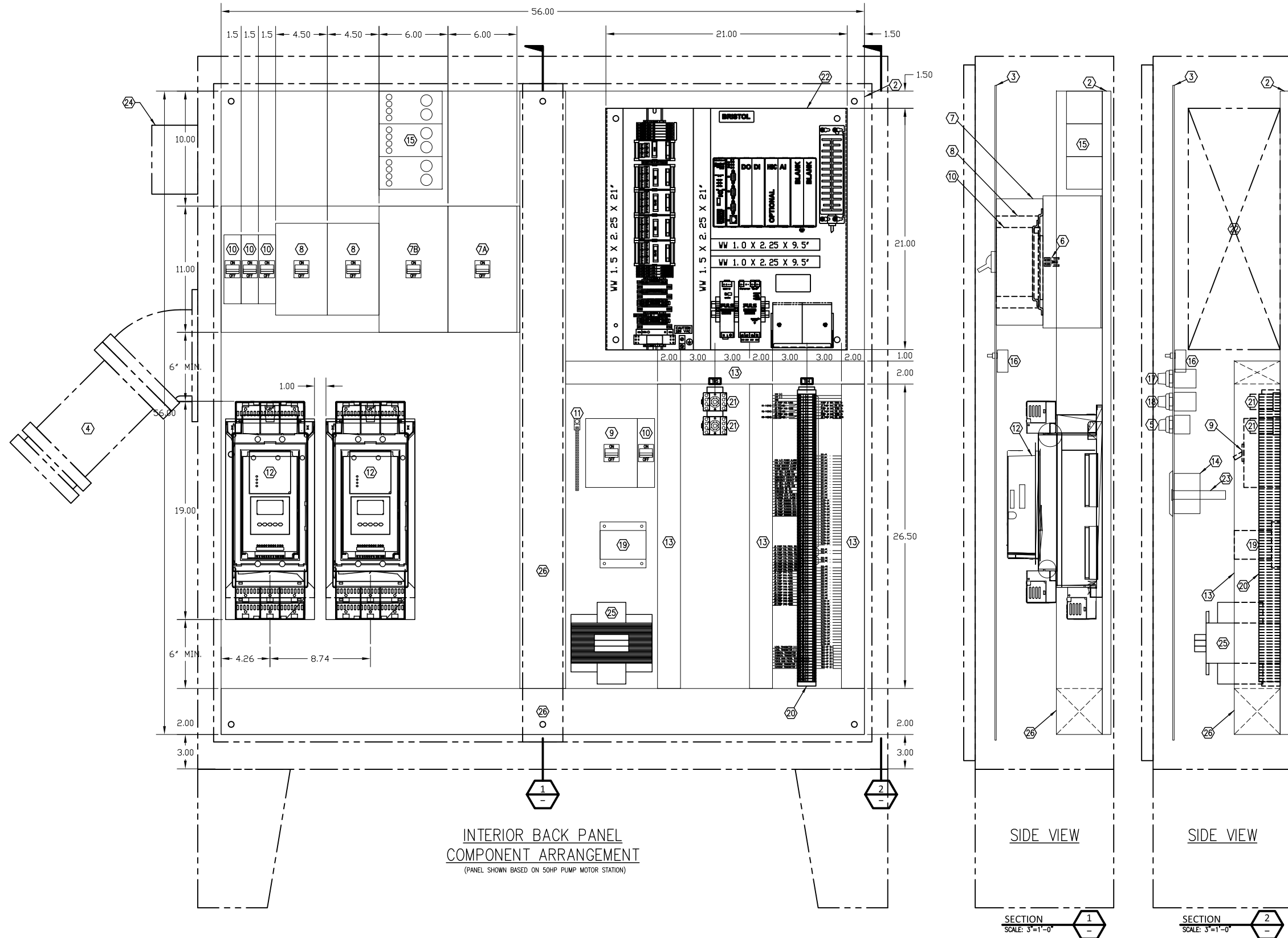
40HP-100HP (480 V) WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL



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PROJECT TITLE	- CITY OF TALLAHASSEE - ELECTRICAL SPECIFICATIONS
SHEET TITLE	ELECTRICAL - 480V, 40-100HP DUPLEX PUMP STATION PUMP STATION CONTROL PANEL LAYOUT

FIGURE	E-09
Approved by:	
Date Issued:	JANUARY 2015
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SCALE	N.T.S.



INTERIOR BACK PANEL
COMPONENT ARRANGEMENT
(PANEL SHOWN BASED ON 50HP PUMP MOTOR STATION)

SECTION 1
SCALE: 3"=1'-0"

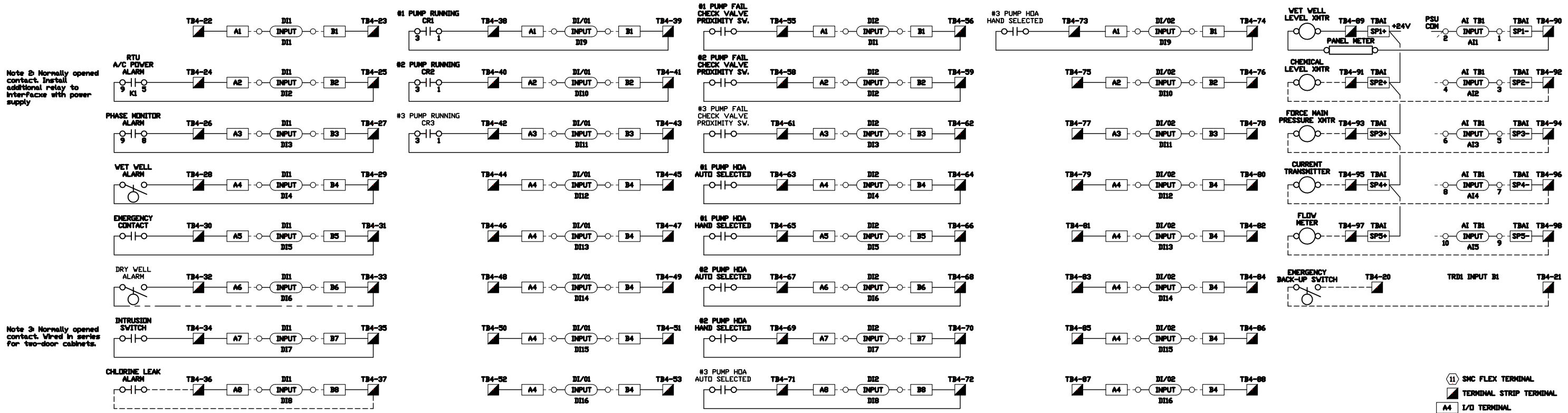
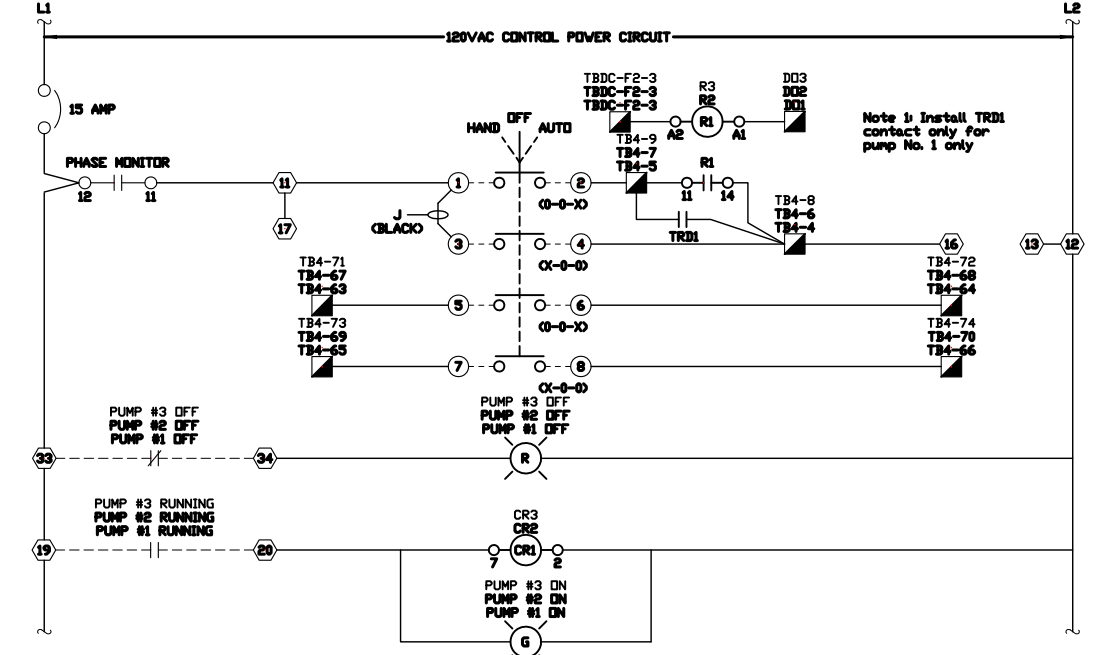
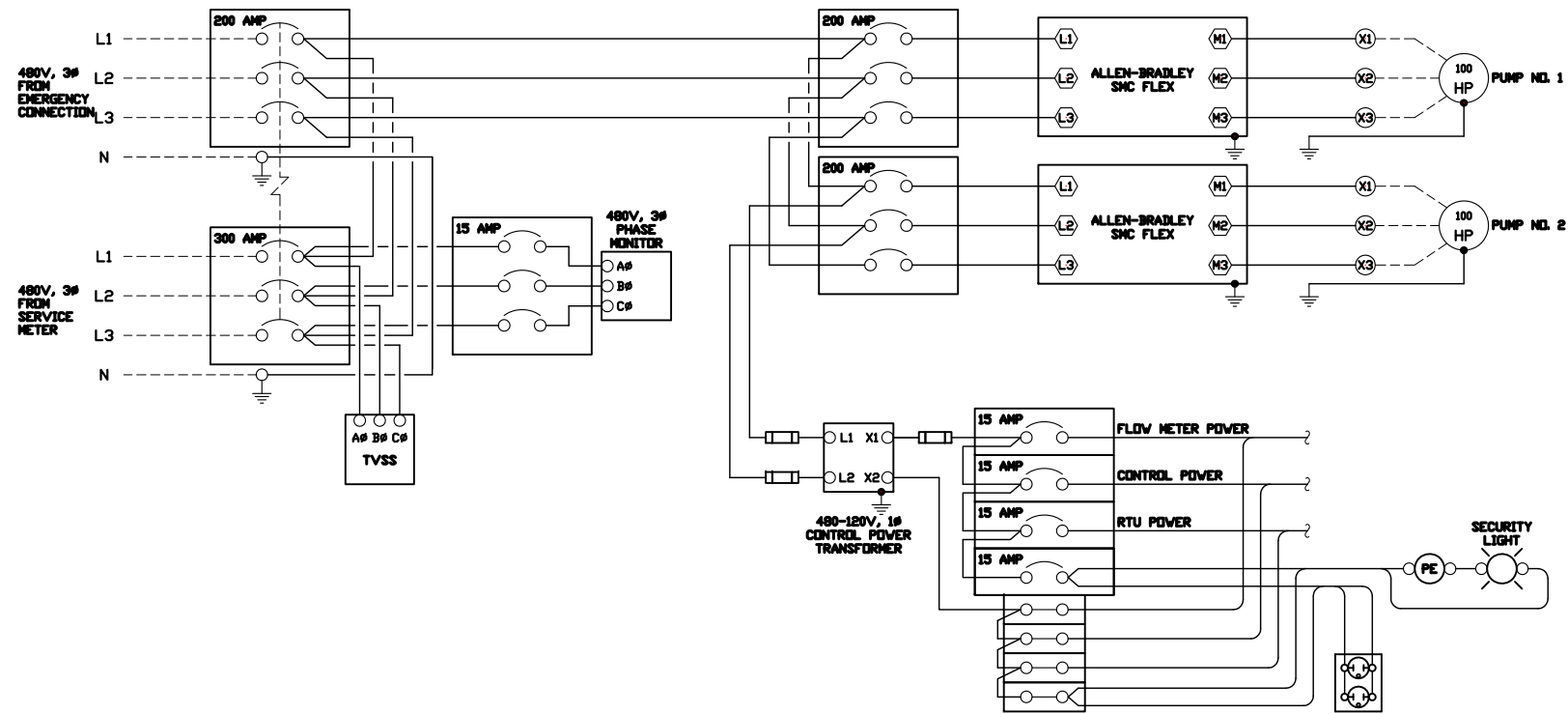
SECTION 2
SCALE: 3"=1'-0"

PUMP STATION 40-100HP (480 V) WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL

BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
①	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT	HOFFMAN	A-62H60125SLP A-FK1212SS	1
②	ENCLOSURE BACK PANEL	HOFFMAN	A-60P60	1
③	DEAD FRONT SWING-OUT PANEL KIT	-	-	1
④	EMERGENCY POWER RECEPTACLE - 400A, 3# 4 WIRE, w/45° ADAPTER & SCREW CAP	CROUSE-HINDS	AR40422	1
⑤	3 POSITION SELECTOR SWITCH w/"H-O-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
⑥	WALKING BEAM MECHANICAL INTERLOCK ASSEMBLY	SQUARE-D	LA6WB	1
⑦A	BREAKER-300A, THREE POLE	SQUARE-D	LAL36300WB	1
⑦B	BREAKER-200A, THREE POLE AUXILIARY CONTACT 1A/1B ON EMERG. BKR	SQUARE-D	LAL36200WB SQ-D OPTION 1212	1
⑧	BREAKER 200A, THREE POLE	SQUARE-D	KAL36200	2
⑨	BREAKER 15A, THREE POLE	SQUARE-D	FAL34015	1
⑩	BREAKER 15A, SINGLE POLE	SQUARE-D	FAL12015	4
⑪	EQUIPMENT GROUND BAR w/#1-4/0 COPPER LUG	SQUARE-D	PK15GTA-L	1
⑫	FLEX SMART MOTOR CONTROLLER (SMC), 135A, w/PUMP CONTROL LINE/LOAD LUGS	ALLEN-BRADLEY	150-F135NBDB	2
⑬	TERMINAL COVERS	ALLEN-BRADLEY	199-LF1 150-TC1	4
⑭	WIREWAY DUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	-
⑮	SERVICE RECEPTACLE 15A, 125VAC w/COVER	LEVITON	6599-W	1
⑯	POWER TERMINAL BLOCK	SQUARE-D	9080LBA365208	1
⑰	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2RQ1-A2	2
⑱	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-QH10R 800T-X527	2
⑲	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-QH10G 800T-X530	2
⑳	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-440-ALE	1
㉑	TERMINAL	PHOENIX CONTACT	UK 5	60
㉒	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12PT14V20 NR51	2
㉓	RTU	BRISTOL-BABCOCK	-	1
㉔	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
㉕	TRANSIENT VOLTAGE SURGE SUPPRESSOR	APT	TE/3XF/4X	1
㉖	INDUSTRIAL CONTROL TRANSFORMER 2000VA 240x480-120VAC, PRL. & SEC. FUSING	SQUARE-D	9070TF2000D1	1
㉗	WIREWAY DUCT 4"x4" w/COVER	HOFFMAN	A-400400WH A-400CWH	-

MOTOR HP	MAIN BREAKER	EMERG. BREAKER	SMC BREAKER	SMC RATING	EMERG. RECEPT.
100	300	200	200	135A	400
75	250	200	150	108A	400
60	225	125	110	85A	100
50	200	100	100	85A	100
40	175	100	80	60A	100

- NOTES:
- ① PANEL CONSTRUCTOR AND PUMP STATION INSTALLATION CONTRACTOR SHALL COORDINATE THE CALIBRATION OF THE PANEL METER AND THE WETWELL LEVEL INSTRUMENT (PRESSURE TRANSDUCER) SUCH THAT THE PANEL METER READ OUT IS IN ENGINEERING UNITS. UNITS SHALL BE FEET TO TENTHS OF FEET (i.e. 14.6 FEET).
 - ② BREAKERS AND GENERATOR RECEPTACLE TO BE SIZED BASED ON THE HORSEPOWER OF THE PUMP STATION'S PUMP MOTORS.



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PROJECT TITLE
- CITY OF TALLAHASSEE -
ELECTRICAL SPECIFICATIONS
 SHEET TITLE
ELECTRICAL - 480V, 40-100HP DUPLEX PUMP STATION
SUBMERSIBLE PUMP STATION WIRING DIAGRAM

FIGURE
E-11
 Approved by:
 Date Issued: **JANUARY 2015**
 COMPUTER FILE: \\cityfileserver\U\UWREWS\RESOURCES_STANDARD\DESIGN_CONSTRUCTION\DCS\Construction Details
 SCALE
 N.T.S.

