



**CITY OF
TALLAHASSEE**

Technical Specifications
for
Water and Sewer Construction

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Tallahassee, Florida 32301

December 2023



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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 or The City of Tallahassee Flexible Pavement Design Standard Section 3 E. whichever is greater. Once the repairs have been completed, the Contractor shall warranty all repairs and restored work to the same extent as the original warranty period. Environmental Management System (EMS)

1.4 Environmental Management System (EMS)

The Contractor is required to follow all rules and regulations established by the City's EMS (Environmental Management System) documents as well as any other project requirements. The City of Tallahassee Underground Utilities and Public Infrastructure Environmental Policy Statement and a copy of the Contractor's informational brochure are available at: <https://www.talgov.com/Uploads/Public/Documents/you/emsbrochure.pdf>

END OF SECTION 1

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, nor does his presence relieve the Contractor from providing their own arborist to monitor any construction activities within the CPZ of any tree.

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 of Tallahassee's/Leon County'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/Leon 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. The Contractor is required to provide temporary construction entrances at all staging areas and points of ingress/egress from work limits. 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, Bursztynsky, and Jackson for guidance in erosion prevention control.

Any disturbed areas that will be left exposed more than 14 days, and not subject to construction traffic, shall be stabilized through the establishment of appropriate vegetative ground cover. 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 activities that may injure the tree, including, but not limited to, cut and fill activities, building pad placements, road bed construction, construction material storage, driving or parking heavy equipment, or trenching 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 said damage. Any tree-related penalties, imposed by the jurisdictional agency 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 onsite during excavation activities within the Critical Protection Zone (CPZ) of all trees to ensure proper tree impact mitigation techniques are implemented.** Tree mitigation techniques shall be in compliance with the requirements contained in the Tallahassee Land Development Code Section 5-83(g)(6)/Leon County Land Development Code Section 10-4.363.

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. Trenching and excavation and root removal shall be limited to the least extent possible or as directed on site by the Certified Arborist. All root pruning shall be done immediately upon exposure of tree roots $\frac{3}{4}$ " in diameter and larger, 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).

- b. Tree mitigation should begin prior to construction activities and tree protection barriers installed immediately after to prevent further root and soil compaction resulting from vehicular traffic, equipment storage or material stockpiling. Tree protection barriers shall be installed at the furthest extent of construction within the CPZ of each tree to be protected and remain in place until all construction activity has been completed and the Arborist has completed final evaluation.
- 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. At project completion, the Arborist shall provide documentation detailing the mitigation efforts performed and reconcile the actual tree debits and credits as part of the Landscape and urban forest compliance plan. The report should be prepared in accordance with sections 5-64 and 5-83(g)(6) and submitted to the environmental inspector seven days prior to requesting the final environmental inspection.

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, ¾-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 2pounds of nitrogen per 1,000 square feet. A fertilizer having at least 50% slow release nitrogen 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 and Chapter 12 of the Tallahassee Land Development Code 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 Jurisdictional Entity or their 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, 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 or City Construction 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

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 areas subject to regular vehicular loading such as all streets, medians, City maintained driveways, and parking lots; as well as all areas within 3-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; or easements within regular vehicular loading.

Unimproved Areas – Unimproved areas shall include easements, sidewalks, trails, vacated right-of-way, privately maintained driveways, and parking lots, 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 their own soil borings prior to submitting a bid, taking into consideration all conditions that may affect their work. The data presented in soil reports/surveys (if provided) are based on the tests performed at the specific locations and depths noted, subsurface conditions at other locations may vary significantly from those presented therein. Data provided in soil investigation surveys, reports, etc. shall not be assumed to be a guarantee of the depth, extent, or character of the material present. 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 Contract Documents 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.

4.1.2.1 Utility Restoration

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. Contractor damages to sewer mains or sewer service are required to be TV inspected after the repair at their expense. If the contractor is unable to perform their own TV inspection, the City will do this for a charge which will include a mobilization fee.

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 the Engineer's written approval 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.

In advance of days during which no trench work is to proceed, the trench shall be backfilled until the next working day. Temporary erosion controls shall be in place for the duration of the dormant period in accordance with the "Environmental Controls" Section of these specifications.

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 Manual on Uniform Traffic Control Devices. 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 payment or refunding.

4.1.5 Shoring, Sheeting and Bracing

Where sheet piling, 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. All trench excavation shall comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 CFR 1926, Subpart P, and all subsequent revisions or updates.

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 their part to issue orders, and failure to exercise their 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 Ground Water

The Contractor is responsible for the design, installation, and operation of an adequate dewatering system to dewater excavations. The Contractor shall submit a dewatering plan to the Engineer for their records before beginning construction. Contractor shall 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. Dewatering systems are required to use socks or other approved devices on discharge pipes to control turbidity in downstream receiving waters or channels.

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 improved areas (as defined herein) where the City will own and maintain the buried utility. See the City’s Flexible Pavement Standard, Latest Edition and the Pipe Trench and Asphalt Patch within Public R/W and All Improved Areas detail G01 for the exact backfill requirements over the trench section.

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 sand, A-3 and some A-2-4. When tested in accordance with the latest ASTM D422, 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, 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.

Re use of contaminated soils will NOT be allowed for trench backfill.

4.2.2 Suitable Backfill

Suitable backfill material is permissible for use in trenches in unimproved areas (as defined herein) or in improved areas subject to the requirements of City of Tallahassee Flexible Pavement Standard, latest edition. Section 3-Repair of Utility Cuts and Trenches B. of the detail and these specifications.

Suitable material shall be material obtained from the Contractor's excavations and shall be limited to select sand and plastic material in accordance with FDOT Index 505. All backfill materials shall have a maximum liquid limit of 50 and 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.

Re use of contaminated soils will NOT be allowed for trench backfill.

4.2.3 Gravel Base for Wetwell Structures

Gravel base shall be clean, washed, well-graded rounded gravel or crushed rock of 1½-inch maximum size and 1/2-inch minimum size (57 Stone). No gravel base material shall be used unless the Engineer has reviewed it. For all coarse aggregate bedding installations, the aggregate shall be completely encapsulated in geotextile filter fabric such as TenCate Mirafi N-Series or approved equal prior to setting the proposed structure.

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 ⅜-inch sieve	20 - 55%
Passing No. 4 Sieve	0 - 10%

Bedding material shall include a layer of geosynthetic fabric over the gravel.

As an alternative to placing the geosynthetic fabric, 3/8-inch nominal size aggregate may be used.

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.

Reuse of contaminated soils will NOT be allowed for trench backfill or bedding.

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 their own expense.

Pavement, driveway or sidewalk material shall be separated from other excavated materials, shall not be placed in backfill, and 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 or private street or way. Signing shall be provided in accordance with OSHA regulations, Manual on Uniform Traffic Control Devices, 2009 Edition, adopted by Sec. 316.0745, Florida Statutes, 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 sidewalk 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. 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 roadway 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 Standards and 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 and the conditions specified within the permit.

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 the end of the workday. 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 according to the FDOT Standard Plans for Roadway Construction and as specified in the Contract Documents.

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 their 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 their own expense. No act of the

City or their 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. Contractor shall provide Arborist Report to document all tree impact mitigation techniques.

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 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 Pipe Trench Construction Detail G01 and G02.

The trench shall be dry when the bottom is prepared. A continuous trough shall be excavated by hand to receive the bottom 120-degrees ($1/3$ pipe diameter) 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 as shown on Pipe Trench 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. When coarse aggregate bedding is used, the bedding shall be completely encapsulated in geotextile filter fabric such as TenCate Mirafi N-Series or approved equal prior to installing the pipe.

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, subject to liquefaction (liquid limit greater than 50), 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 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 installed and inspected, select 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 Minimum of 95% Standard Proctor. 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. If the pipe is beneath or within 5-feet of any building, compact to 100% Standard Proctor. If the pipe is near any structure compact to 100% Standard Projector for a distance of at least 3-feet.

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 Pipe Trench 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 of 95% Standard Proctor. 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 as shown in the City's "Pipe Trench and Asphalt Patch Within Public R/W and All Improved Areas" detail. Material between the bottom of the base layer and a depth 4 feet beneath the bottom of the base layer shall be **select backfill only**. Suitable backfill (as defined in Section 4.2.2) can be placed beginning at a depth of four feet below the bottom of the base layer extending to a depth of 1 foot over the top of the pipe. The pipe envelope shall be **select fill only**. The surface of the trench shall be prepared to receive subbase and base construction.

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 obtain a minimum 90% of density, as measured by Standard Proctor.

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.

4.3.2.6 Flowable Fill

Contractor shall furnish and place flowable fill as an alternative to compacted soil as approved by the Engineer. Applications for conventional flowable fill include beddings; encasements; closures for wet wells, and pipes; and general backfill for trenches, embankments and walls. Applications for cellular concrete flowable fill include beddings; encasements; closures for wet wells and pipes; and general backfill for embankments and walls.

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.

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 150 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 Unsalvageable material

Excess excavated material; the Contractor shall dispose of unsalvageable 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 Salvageable material

All material to be removed or salvaged shall be inspected by the City or their representative immediately prior to removal. The City’s decision as to salvage ability will be final. Such material that is, in the opinion of the City or their 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 their 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 or other approved methods. 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.

Cleanup and restoration of right of way and private property post installation of utility service lines (services, cleanout etc.) shall be sodded with 2" minimum of top soil. Sod shall be placed over top soil only and cut in level around the surrounding area. Placement of sod over existing sod will not be accepted. Newly installed sod shall be rolled and watered.

4.3.5.2 Sprigging

Apply 15-0-15 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 their expense and whenever necessary to assure sustained growth and vitality.

4.3.5.3 Sodding

Sod shall be placed solidly in areas shown on Plans.

Immediately before sod is placed, 15-0-15 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 their 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 15-0-15 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 their 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 water, seed, fertilizer, mulch and tack, shall be distributed over the area to be seeded as slurry. 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 under-soil. 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 their expense, maintain the grassed areas in a satisfactory condition until final acceptance of the work.

END OF SECTION 4

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.

The Contractor shall provide all materials for completing the installation and for adequate protection of the work. Refer to Section 7 Distribution and Transmission System Piping (7.2.5) for approved pressure pipe specification.

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.

The equipment used in directional boring, also known as horizontal directional drilling, shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the City or State at the discretion of the Engineer. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in directional boring operations shall be used in performing the Work.

Entry and exit points shall be as shown on the drawings, unless otherwise approved in writing by the Engineer. The Contractor shall employ licensed, professional land surveyors to locate the entry and exit points, and to establish horizontal and vertical datum for the bore and the pipe layout and fabrication areas.

Further, the Contractor's Survey Professional shall clearly mark the horizontal limits of construction such as right of way limits, easement limits, etc. It shall be the sole responsibility of the contractor to install the proposed pipe within the limits of construction. Any pipe installed outside the construction limits shall be removed at the contractor's sole expense.

The Directional Boring operation is to be operated in a manner to eliminate the discharge of water, drilling mud, and cuttings to any nearby water bodies, or to the land areas involved during the construction process. If inadvertent spills to nearby water bodies occur, the Contractor shall immediately provide environmental controls and clean up to the satisfaction of, and at no additional expense to the Owner.

Best Management Practices (BMP's) for erosion control within the Contractor's work area shall be implemented and maintained at all times during drilling and back-reaming operations to prevent siltation and turbid discharges in excess of State Water quality Standards pursuant to Rule 62-302, F.A.C. Methods shall include, but are not limited to the immediate placement of turbidity containment devices such as turbidity screen, silt containment fence, hay bales, and earthen berms, etc. to contain the drilling mud.

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 "Pipeline Design for Installation by Horizontal Directional Drilling" text (latest edition) written by the Technical Committee on Trenchless Installation of Pipeline Systems, a subsidiary of the Pipeline Division of ASCE and the 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
- Roller placement, pit location, and pipe alignment scaled drawings with degree of curvatures labeled

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
- Containment measures to be installed at drill pits prior to drilling operations
- 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

If the Contractor is planning on deviating from bid document HDD Profile, then the Contractor is required to submit additional drawings with the new HDD Profile for the Engineer's approval. The Contractor shall also submit calculations to show that the Contractor's proposed method and profile of installing the HDPE pipe is within the allowable tensile force of the pipe. The maximum tensile force shall be calculated with a 1.5 safety factor. If required to maintain the 1.5 safety factor, the Contractor shall submit plans on ballasting the HDPE pipe by filling it with water prior to install to reduce tensile force.

The Contractor shall provide details on measures to be taken to monitor and protect adjacent utilities, structures, and roadways, and provide details on monitoring equipment and provisions, including the layout of settlement points, and other monitoring points.

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 pipe with ductile iron pipe size (DIPS) outside diameters (OD) in accordance with AWWA C906. 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.

Fusible HDPE 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. The Contractor shall not proceed with pipe fusion welds under conditions non-conducive to successful connection as determined by the Engineer. 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 always be present 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 the 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 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.

During pullback, drilling fluid pressures and flow rates shall be continuously monitored and recorded by the Contractor. The pressures shall be monitored at the pump and within the annular space with a down hole pressure- sensing tool located within thirty (30) feet of the drilling head.

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.

Surface settlement or heave of utilities and other features above the HDD centerlines and within the zone influenced by the HDD construction shall be limited in values that avoid damage. The Contractor shall repair any damage resulting from settlement or heave caused by HDD activities at no additional cost to the Owner.

If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill. Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to drill activities, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer. If, during drilling operations, the Contractor experiences loss of drilling mud pressure, all drilling operations shall stop until approval to proceed is provided by the Engineer.

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 prior to over ream and product pipe pullback. The horizontal and vertical 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 20-feet below pavement, as measured from the top of pipe.

The contractor shall be considered as having completed the requirements of any directional boring when he has successfully completed the work and tested the pipe to the satisfaction of the Engineer.

At the completion of construction, the Contractor shall remove all temporary facilities installed by the Contractor. Unused soil, aggregate, and other materials shall be removed and disposed of at approved sites in accordance with all Federal, State, and Local regulations. Any damage to streets, lawns, common areas, and sidewalks shall be restored to original or better conditions. All disturbed areas shall be re-vegetated.

If, during boring, an obstruction is encountered which prevents completion of the installation in accordance with the design location and specification, and the product is left in place and taken out of service, show the failed bore path along with the final bore path on the plans. Note the failed bore path as "Failed Bore Path - Taken Out of Service" on the As-built drawings. Also show the name of the utility owner, location and length of the drill head and any drill stems not removed from the bore path.

The Contractor shall take responsibility for restoring any damage caused by heaving, settlement, separation of pavement, escaping boring fluid (frac-out) of the J&B at no cost to the City. When required by the Engineer, submit detailed plans which show how damage to any facility will be remedied. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

If conditions warrant removal of any materials installed in a failed bore path, as determined by the Engineer, it will be at no cost to the City. Promptly fill all voids by injecting all taken out of service products that have any annular space with excavatable flowable fill.

5.3.6 Field Testing

5.3.6.1 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

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 (J&B) 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 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 during these inspections.

For J&B casing installations under Railroads, FDOT, or Leon County rights-of-way, comply with the specifications and permit requirements of that Jurisdictional Entity.

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" or API 2B 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 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		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 J&B 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 or restrained DR 18 PVC sewer.

6.2.3 Carrier Pipe 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 seal.

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 J&B alignment, prior to advancing the auger and/or casing pipe. Identify and resolve any conflicts

with the proposed J&B 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 all regulatory requirements and the Contract documents.**

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 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. Only a certified welder shall perform welding operations on casing pipe.

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 J&B 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.

Contractor shall take responsibility for restoring any damage caused by heaving, settlement, separation of pavement, escaping boring fluid (frac-out) of the J&B at no cost to the City. When

required by the Engineer, submit detailed plans which show how damage to any facility will be remedied. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

If conditions warrant removal of any materials installed in a failed bore path, as determined by the Engineer, it will be at no cost to the City. Promptly fill all voids by injecting all taken out of service products that have any annular space with excavatable flowable fill.

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.

Always provide enough competent workers on the job to ensure the J&B installation is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual J&B 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 J&B 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 always present on the job site during the actual J&B 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

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

Coordinate, review, date, stamp, approve and sign all shop drawings prepared by the Contractor or agents (subcontractor, fabricator, supplier, etc.) prior to submitting them to the Engineer for review. 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 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 Requirements for Pipe and Fittings

All pipe and fittings shall be in accordance with the Buy American Act unless otherwise approved by the City. Products 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.

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 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 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, latest revision.

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, (USA-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 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 Protecto 401 or Permite Permox-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 all ductile pipe exposed or aboveground applications, coat the exterior surface with an epoxy primer to a thickness of 5 mils and apply a top coat of semi-gloss acrylic polyurethane to a minimum thickness of 5 mils DFT. Approved primer and top coat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 1095 EnduraShield (top coat) an aliphatic polyurethane 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 12-inch below-ground installation of potable and reclaimed water mains, when other approved materials are not specifically

required. For potable and reclaimed water mains larger than 12-inch, ductile iron or HDPE pressure pipe shall be used. PVC pressure pipe is an approved material for 4-inch through 30-inch below-ground installation of sewer force mains, when other approved materials are not specifically required. For sewer force mains larger than 30-inch, ductile iron or HDPE pressure pipe shall be used. PVC and HDPE pressure pipe shall not be used in aboveground applications.

All PVC pressure pipe 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., Sanderson Pipe Corp., Vulcan Plastics, 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 factory installed 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 that is damaged or displays signs of sun exposure or 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 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., WL Plastics 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 (1030*-HS-**); 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. Thrust restraint maximum working pressure shall equal that of the piping. 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) Star Pipe Stargrip Series 3000
PVC	Push-On	Diamond Plastics - Diamond Lok-21 [®] Gasket EBAA Iron Series 1900 JM Eagle - Eagle Loc 900 [™] Gasket Tyler Union TUF Grip [™] Series 3000 (PP/PVC) Star Pipe Restrainers Series 1100G2
PVC	Mechanical	EBAA Iron Megalug [®] 2000PV EBAA Iron Megalug [®] 19MJG00 Sigma One-Lok [™] D-Series SLCE (Domestic) Tyler Union TUF Grip [™] Series 2000 (TLP/PVC) Star Pipe Stargrip Series 4000
HDPE	Fusion Welded	No Restraints Required
HDPE	Mechanical	HDPE MJ Adapter w/ SS Stiffener

NOTES:

1. Concrete thrust blocks shall not be allowed unless approved in writing by the City.
2. Except for PVC Push-On joint restraints, split 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

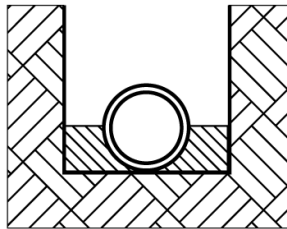
When concrete thrust blocks are required in lieu of, or in addition to, restraining gaskets and/or mechanical restraints, the thrust blocks shall be sized and installed in accordance with the Engineer of Record design.

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. A minimum Type 2 trench condition shall be used for all pressure pipe installation, unless specified otherwise.



Type 2

Flat-bottom trench.
Backfill lightly consolidated to
centerline of pipe.

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 and extend at least 12-inches the 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 shall be supported above the top of the pipe by gravel bedding to eliminate any stress on the pipe at this point.

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 on both new pipe and existing pipe as 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.

A minimum 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 shall be used between the pipe and backhoe bucket to avoid damage to the pipe. Contractor shall note the position of the painted gauge lines 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	5/8 (16)	45 - 60 (61 - 81)
4 - 24	3/4 (19)	75 - 90 (102 - 122)
30 - 36	1 (25)	100 - 120 (136 - 163)
42 - 48	1 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 run shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

If joint deflection is required to construct the distribution or transmission 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 affect 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 affect the installation as shown in plan and profile views.

If restrained joints are required, use only thrust restraints approved for PVC pipe shown in Table 7.3. 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 affect the installation as shown in plan and profile views.

All main line taps on HDPE pipe will be made through approved saddles or tapping sleeve and valve. No electro-fusion tapping tee (EFTT) shall be used.

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 3
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, 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 a minimum of 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 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

Coordinate, review, date, stamp, approve and sign all shop drawings prepared by the Contractor or agents (subcontractor, fabricator, supplier, etc.) prior to submitting them to the Engineer for review. 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 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 Requirements for Pipe and Fittings

All distribution and transmission system valves and appurtenances shall be in accordance with the Buy American Act unless otherwise approved by the City. Products shall be assembled, 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 water distribution and transmission system pressure pipe 4-inch and larger shall be cast iron or ductile iron body and bonnet, resilient wedge gate type valves with a minimum 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 mechanical joint (MJ) with the manufacturer's gaskets. Tapping valves will meet or exceed all the requirements for resilient wedge gate valves above.

All tapping sleeves for use on distribution and transmission system pressure pipe 12-inch or less in diameter shall be constructed of Type 304 stainless steel and have a mechanical joint (MJ) outlet. Tapping sleeves shall conform to AWWA and ANSI standards and shall be ANSI/NSF certified. The branch of the tapping sleeve may be either extruded or welded to the tapping sleeve. All welds on the sleeve shall be fully passivated to restore stainless steel characteristics. 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 SBR or EPDM 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 439, 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. Cast iron 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 and EJ Foundry Model 8550. Approved valve box lids include EJ Foundry Model 6800(4) and SW Services Non-Pop Lids color coded appropriately to the utility application.

8.2.4 Potable Water and Reclaimed Water Services

Standard service connection sizes shall be 1-Inch, 1.5-Inch, 2-Inch, and 4-Inch. Sizes greater than these listed will need to be approved by the City.

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 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, CI, HDPE 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 101NS, Smith-Blair #315, JCM 405, or Cascade Model CNS1. No substitutes will be allowed.

For water service taps on HDPE pipe, 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 FCP202, Romac 101N-H, Smith-Blair #315 with spring washers, or JCM 404 with stainless steel straps. No substitutes will be allowed.

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.

For water service taps on HDPE pipe, a service saddle with a double 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 FCP202, Romac 202N-H, Smith-Blair #317 with spring washers, JCM 406 with stainless steel straps. 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

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 #76101W, and Mueller B-20200. No substitutes are allowed.

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 #76102W-22, 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 high density polyethylene tubing. All joints shall be either fusion-welded or compression type.

All long side water services (up to 2” in size), across all FDOT and Leon County roadways, and City major collector roadways, shall be sleeved with HDPE pipe when the water main is outside the roadway. This applies to both open cut and directional drill installations. The HDPE casing pipe shall be color coded and labeled in accordance to Section 7.2.4, Table 7.2. The inside diameter of the sleeve shall be 2 times the nominal size of the service pipe to allow for the replacement of the service line (i.e. 2” water service shall use a 4” carrier pipe). The casing pipe shall be sealed with a skirt-type casing end seal that 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) specifically compounded synthetic rubber with stainless steel banding straps. Approved products include Calpico, Inc. – Model C; CCI Pipeline Systems – Model CSK; or approved equal.

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	BA91-314W-NL, BA94-314W-NL	EC-1	B91-213W
Mueller	H5010	B-24273N, B-24278N	H14234-1	B-24360-N
1-inch Meters				
Manufacturer	Yoke	Angle Valve	Expander	Cust. Valve
Ford	504	BA91-444W-NL, BA94-444W-NL	EC-4	B91-444W
Mueller	H5040	B-24273N, B-24278N	H14234-4	B-24360-N

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.

Approved products for meter boxes on various size meters for water and reclaimed water meter settings shall include the following components:

Table 8.4 – Approved Meter Boxes	
5/8-inch Meter Setting Non-Traffic Rating	
Manufacturer	Model
DFW Plastics	DFW1200TT.12.1*
1-inch Meter Setting Non-Traffic Rating	
Manufacturer	Model
DFW Plastics	DFW1600TT.12.1
1 1/2-inch and 2" Meter Setting Non-Traffic Rating	
Manufacturer	Model
Oldcastle Infrastructure	1730 Carson

5/8-inch Meter Setting-Traffic Rating	
Manufacturer	Model
DFW Plastics	DFW12-C-12-1
1-inch Meter Setting-Traffic Rating	
DFW Plastics	DFW65C-14-1
1 1/2-inch and 2" Meter Setting-Traffic Rating	
DFW Plastics	DFW1730C-18-1

*TriCast 1015 Lid are also approved for DFW1200TT.12 Body

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

All 1.5-inch and 2-inch potable water and reclaimed water meter settings shall be above-ground flanged meter assemblies. The Contractor shall make provisions to accept City-provided meter assemblies including transitional pipe, fittings, and an FPT Inlet x Flange Outlet Angle Ball Valve on City side of assembly. Piping, fittings, and valves shall be lead-free brass/bronze. The City shall furnish and install meter, Customer Valve, and bypass where applicable. The Contractor shall be responsible for connection of meter assembly to private service piping.

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

Table 8.4 1.5-inch and 2-inch Meter Setting Valve Connection		
Service Size (inches)	Angle Ball Valve	
	Inlet	Outlet
1.5	FPT	Flange
2	FPT	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. See section 7.2.6 for Tracer Wire detail. 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 Super Centurion 250 Model A423, M.H. 129, and EJ WaterMaster 5CD250. 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. Air valves used at potable water production wells and treatment facilities shall have a polycarbonate float. 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 position indicator, backflow actuator, and proximity/limit switch sensor with SCADA compatible output signal. Approved products include Val-Matic® - Surgebuster® Check Valve or approved equal.

8.2.9 Plug Valves

Plug valves shall be eccentric, non-lubricating type with integral plug and shafts as manufactured by DeZurik Corp., Henry Pratt, and Val-Matic.

- A. Valves shall seal bubble-tight or water drop-tight in both directions when tested according to the Leakage Test method of AWWA C517-16 with a hydrostatic pressure of 175 psi for up to 12" diameter; and 150 psi for larger than 12" diameter.
- B. Each plug valve shall be given a hydrostatic and seat test with the test results being certified.
- C. Eccentric plug valves shall be of the non-lubricated type. Port area shall be 100% of standard pipe area.
- D. Flanged valve ends shall be faced and drilled according to ANSI B 16.1, Class 125. Mechanical joint valve ends shall conform to AWWA C111.
- E. The plug valve body, bonnet and gland shall be cast iron per ASTM A126, Class B or ductile iron grade 65-45-12 per AWWA C517
- F. The integral plug and shaft shall be ductile iron grade 65-45-12 per ASTM A526, or 316 stainless steel.
- G. The entire plug and stem shall be fully vulcanized with nitrile (Buna N) rubber with a minimum peel strength of not less than 75 psi when tested according to ASTM D 429, Method B.
- H. Valve seats for sizes 3-inch and larger shall be at least 95 percent pure nickel, welded-in overlay into the cast iron or ductile iron body. The top and bottom shaft bearings shall be sintered, oil impregnated 316 stainless steel.
- I. For all plug valves used in a sewage application the interior and exterior of the valve shall be fully coated with fusion bonded epoxy (FBE) lining minimum 12 mils DFT or rubber lined with elastomer with a minimum thickness of 1/8". (IF approved by the City plug valves may be internally and externally coated with a factory applied, two-part high solids epoxy conforming to AWWA C550, 16 dry film thickness).
- J. Plug valves shall be installed side-ways with plug shaft horizontal so that the plug rotates upward when it opens, with the flow entering the seat end of the valve; unless the construction plans indicate the valve in the vertical position.
- K. Plug Valve Actuator:
 - a. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc. as indicated on the PLANS. All buried valves 4 inch and larger shall be equipped with buried service rated worm gear actuators.
 - b. Worm gears shall be constructed in accordance with AWWA C517. Buried service worm gears shall be IP68 rated for continuous submergence duty to 26ft (IP68-8). Above ground worm gears shall rated to IP67. Test certificates, signed by the ENGINEER of gear operator manufacturer, must be supplied showing full compliance to AWWA C504/C517.
 - c. Valves and actuators up to 12-inch shall be factory tested to minimum of 175 psi for up to 12" diameter; and 150 psi for larger than 12" diameter in both directions.

- d. Actuators shall be enclosed in a cast iron housing (traveling nut design only) or ductile iron housing (externally adjustable stop design), with outboard seals to protect the bearings and other internal components. The actuator worm shafts shall be supported on permanently lubricated deep groove ball bearings. The input shaft shall be stainless steel for below grade units.
- e. Fasteners shall be made of minimum 316 series stainless steel. Gears shall be efficiency optimized 3-stage for appropriately designed stage gear reduction type.
- f. Externally adjustable or traveling nut type open and closed position stops shall be provided to prevent over-travel in both the open and closed position. The adjustable closed position stop shall be used to set closing position and provide adjustments to compensate for change in pressure differential or flow direction. Gears shall be self-locking or incorporate a back winding protection to prevent undesired reverse rotation of the gear train at the extents (i.e. fully closed position) of travel when holding a residual applied torque. If required, a primary reducer shall be supplied to reduce the required input torque.
- g. Manual operators shall be provided with completely enclosed mounting brackets or adapters. The operators shall be equipped with a standard 2 inch square operating nut, or with hand wheel if for above ground service. All plug valves shall open by turning the operating nut or hand wheel counterclockwise. Orient operators with horizontal plug shafts such that the plug rotates upward upon opening.
- h. All operator components between the operating nut or hand wheel and the valve shaft including the primary gear reducer and adjustable stops shall be designed to withstand, without damage, an input torque of 300 ft. lbs. Rim pull shall be no more than 80 lbs. (to provide least amount of turns to close or open) to operate at full valve rated pressure using a 24 inch tee-wrench or hand wheel.
- i. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be 316 stainless steel.
- j. Above ground valve packing adjustment shall be accessible, adjustable and replaceable without removing the actuator off the valve and without disassembly of the actuator. Buried service actuators shall be protected from valve packing leaks via unpressurised connection to the valve.
- k. Gears shall have a two-year warranty from date of shipment and shall have a metal tag containing a serial number, ratio; number of turns shall be riveted to the gear for future identification.

Gear number of turns to open or close the valve shall not exceed the following table unless approved by the City:

Valve Size (Inches)	Turns to open or close
4	20
6	20
8	20
12	40
16	80
20	140
24	220
30	360
36	480
42	600
48	750
54" and larger	750

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 hour 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, HDPE and CI, will be located at 9:00 or 3:00 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) ⅝-inch meters per manifold on 1½-inch service lines, and a maximum of ten (10) ⅝-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, perpendicular to main. All joints shall be restrained from the main to the hydrant. Hydrant assembly shall include and be connected to main using a swivel hydrant tee (MJxSwivel Tee). 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 3
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

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, bypass pumping 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

Coordinate, review, date, stamp, approve and sign all shop drawings prepared by the Contractor or agents (subcontractor, fabricator, supplier, etc.) prior to submitting them to the Engineer for review. 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 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 Requirements for Manholes, Pipe, and Fittings

All manholes, pipe, fittings, and appurtenances shall be in accordance with the Buy America Act unless otherwise approved by the City. Products 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-inches 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 DR26 may be used, unless otherwise indicated on the drawings. For depths greater than 16 feet (as measured above), use C900 or C905 DR18 PVC. Ductile iron pipe may be used if approved by the City.

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 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 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 and 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 Protecto 401 or Permite Permox-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 5 mils. Approved primer and top coat products include Tnemec Series N140 Pota-Pox Plus (primer) and Tnemec Series 1095 EnduraShield (top coat) an aliphatic polyurethane, 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 36-inch installation of sanitary sewer collection system components, when other materials are not specifically required. For

pipes larger than 36-inch, ductile iron sewer pipe shall be used, unless otherwise approved by the Engineering Manager. 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., Sanderson Pipe Corp., Vulcan Plastics, 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 be furnished complete with all accessories, including restraints when necessary. No solvent-cement joints will be allowed.

No service saddles will be allowed for sewer collection system pipe installations or service replacement. Inserta-Tee installation will be evaluated by the City on a case-by-case basis for services made to existing sewer pipe. 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 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., WL Plastics, and Performance Pipe.

HDPE pipe for gravity sewer applications shall be iron pipe size (DIPS) 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; Trelleborg Bidco C-56 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 ADJUSTMENTS LESS THAN 2" WILL REQUIRE BRICKS CUT TO NEEDED THICKNESS AND MORTARED IN.

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.

9.2.7.8 Manhole Finishes

The interior and mating surfaces of standard manhole shall be coated with minimum of 9 mils (DFT) of a water proof coating. Approved products include Con Seal CS-55 or approved equal. This coating shall be self-priming, or applied with a primer as recommended by the manufacturer.

Water proof additives are also an approved in lieu of coatings. Approved products included Xypex or approved equivalent) and anti-microbial additive (ConBlock MIC or approved equal)

9.2.7.9 Manhole and Wetwell Linings

The entire interior of manholes, including bench and channel with force main discharge connections, air release valves manholes, or other high-corrosion applications, shall be lined with a protective coating to prevent sewer gas corrosion.

Approved lining products include:

Manufacturer	Model	Material	Application
Agru America	Sure-Grip/Ultra-Grip	HDPE	Min. 2 mm for Manhole Min. 3 mm for Pump Station
Quadex, LLC	Structure Guard	Epoxy	Min. 2 mm for Manhole Min. 3 mm for Pump Station
Raven Lining Systems	Raven 405	Epoxy	Min. 2 mm for Manhole Min. 3 mm for Pump Station

All concrete shall be sufficiently cured to prevent gaseous formation behind the liner per the liner manufacturer’s specifications. All wet well 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. 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. The flow channel in a straight through a manhole should be made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls should be formed or shaped to the full height of the crown of the outlet sewer in such a manner as to not obstruct maintenance, inspection, or flow in the sewers. 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 and maintaining the slope of the connecting sewers.

When curved flow channels are specified in manholes the slope should be increase to maintain acceptable velocities or a 0.1' drop through the flow channel can be used.

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.

9.2.8 Polymer Concrete Vaults

9.2.8.1 Structure Body and Covers

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.

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.

9.3 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 IN LIEU OF RINGS 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 remove the material to a minimum depth of 18-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. Adjustments greater than 18-inches will require a new cone or barrel section.

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. Install matching asphalt mix patch to bring the final surface flush with finished road surface. Do not use concrete collar unless approved in writing by the engineer.

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 not be higher than 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 shall not be higher than 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 5000-Series repair coupling; MAXADAPTOR One & Done; 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 3M, #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 2 percent and not greater than 100 percent (i.e., 45 degrees from horizontal or vertical). Service connections less than 2 percent must be signed and sealed by an engineer and meet the applicable flow rates. 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.

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

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.

9.3.8 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.

9.3.9 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.

9.3.9.1 Sewer within street rights-of-way, 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.

9.3.9.2 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

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 minimum of 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 array, gravity piping, including isolation valves (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 Bristol Babcock RTU, coaxial cables, and antennas, 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 Sulzer/ABS, ITT Flygt Corporation, Grundfos, KSB, or WILO/EMU per the table below.

Submersible Pump Overview Table

Horsepower	40 HP and Below	41 HP and Above
Approved Manufacturer	Sulzer/ABS	Flygt
	Flygt	KSB
	Grundfos	
	KSB	
	WILO/EMU	

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 316-series stainless steel lifting chain of adequate strength and length to permit raising the pump for inspection and removal.

Standard impellers shall be constructed of cast iron, ASTM A48, Class 35B and coated with Belzona 1341. Cutting impellers shall be constructed of hardened high chrome. The design shall permit low liquid velocities and gradual acceleration and change of flow direction of the pumped media. 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 Pump Openings

Pumps handling raw wastewater shall be capable of passing solid spheres of at least 3 inches (80 mm) in diameter. Pump suction and discharge openings shall be at least 4 inches (100 mm) in diameter. An exception to the requirement for passing solid spheres of at least 3 inches (80 mm) in diameter may be made on a case by case basis when the design includes equivalent protection from clogging or damage (i.e., grinder pumps, etc.).

10.2.3 Stainless Steel Pump Discharge Piping and Fittings

Stainless steel pipe is an approved material for discharge piping within the wet well 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 in accordance with the Buy American Act unless otherwise approved by the City. Pipe shall be fabricated from only high-quality stainless steel materials, free from defects, and from sources with that are ISO9001:2008 compliant.

10.2.4 Ductile Iron Pump Discharge Piping and Fittings

Ductile iron pipe is an approved material for above ground pipe and fittings at pump stations. All ductile iron pipe and fittings and linings shall be as specified in the Technical Specification for Distribution and Transmission System Piping (Section 7).

10.2.5 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.

10.2.6 Wet Well Liners

Inside the wet well all exposed surfaces (including bottom of top slab) shall be lined with a protective coating. Liners shall be shown, labeled, and dimensioned on the shop drawings submitted for approval to the Engineer.

Approved lining products include:

Manufacturer	Model	Material	Application
Agru America	Sure-Grip/Ultra-Grip	HDPE	Min. 2 mm for Manhole Min. 3 mm for Pump Station
Quadex, LLC	Structure Guard	Epoxy	Min. 2 mm for Manhole Min. 3 mm for Pump Station
Raven Lining Systems	Raven 405	Epoxy	Min. 2 mm for Manhole Min. 3 mm for Pump Station

All concrete shall be sufficiently cured to prevent gaseous formation behind the liner per the liner manufacturer’s specifications. All wet well 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. These linings shall be applied in strict accordance with the manufacturer’s recommendations by a certified installer.

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

10.2.7 Access Frames and Guides

The pumping station wet-well and valve-vault (if applicable) 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.

Pump Horsepower	Pump Rail Diameter
<10 HP	1.25” 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.

10.2.8 Pump Control System

The pumps shall be controlled by a level transmitter inside the wetwell. This transmitter shall be of a Radar technology type with the following specifications:

Range: 0.00 to 26.25 ft.
Excitation: 12-35 VDC
Output: Two wire 4-20mA
Cable Length: Variable from 40 to 60 ft.
Brand and model: Vega Vegapuls C21.

The level transmitter shall be mounted as per the specifications drawings. It shall also be terminated on a terminal block in the control panel as per the electrical drawings.

10.2.9 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

One hard copy and one digital copy of the 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° flanged 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 except for 90° and 45° MJ 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, 316 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. Barbed wire attachments are not to be included, unless specifically noted otherwise in 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 16-feet wide and have a slope between 2% and 12%. The road width may be reduced to a minimum of 12-feet wide with the permission of the Engineering Manager or designee. 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 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

11.1 General

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 provided by Emerson, 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 array. The conduit and wiring shall be sized to comply with the NEC. The Contractor shall provide and install the field instrumentation equipment (level transmitter and float switches 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 Utilities 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 minimal 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.

11.2.4 Battery Box

For Pump Stations where a standby power generator system is not required, furnish and install boxes and batteries with the following specifications:

- a. The battery shall be Battle Born model BB5024 50 Ah 24V LiFePO4 Deep Cycle Battery.
- b. The box shall be an 18x18x10, NEMA 3R, hinged, padlock lockable steel enclosure by nVent HOFFMAN or approved equal.

The box with the battery is to be installed as close to the control cabinet as possible. The structure to install the box on shall also be provided if not readily available. Contractor will connect the battery box to the control cabinet using a flexible ½ conduit in a way that water intrusion is avoided. Wiring and connections will be done by the City.

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

The Control Panel Cabinet size shall be as specified in the drawings according to the Pump Station type. The cabinet and subpanel shall be stainless steel painted white using the powder coating technique.

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 3/4-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 RF Antenna shall be a Yagi antenna, Decibel Products Model TY900 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.

The Cellular Antenna shall be a Laird Technologies 4G/3G Multiband Phantom[®] Antenna Model# TRA6927M3PB. The antenna shall be mounted on the control cabinet in a way that is outside and above the cabinet on its own L bracket. The antenna cable (Jumper model# 195-07-18-P3' see below) shall go through the cabinet wall to connect to the radio (MDS Orbit MCR model #MXNCL9CN4GBNNS1FIDUN1). The hole shall be sealed to avoid water penetration into the cabinet.

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 model# NM-SCF12-D01 for both ends.

- ½-inch HELIAX[®] Superflexible foam filled coaxial cable, COMMSCOPE,

Model FSJ4-50B or equivalent

- ½-inch Super flex foam filled coaxial cable, RFS, Model SCF12-50J or equivalent.

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

b. Coaxial Jumpers (Cables)

Cellular

- Jumper Cable – 3’ Coax Jumper between radio and lightning arrestor (SMA Male to SMA Male) Model# 195-18-18-P3'
- Jumper Cable – 3’ Coax Jumper between lightning arrestor and antenna (SMA Male to N Male) Model# 195-07-18-P3'

RF

- Jumper Cable – 3’ Jumper coax cable between radio and lightning arrestor (TNC Male to N Male) Model# 240-05-07-P3'

c. Coaxial Surge Protection

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

Cellular:

- Bulkhead Cellular Surge Arrestor, (SMA Female to SMA Female) Model# TW-LP-SMA-J-BHJ or equal.

RF:

- Type-PolyPhaser Corporation Single channel coaxial surge protector Model IS-B50LN, or equal

11.4.1.3 Level Sensor System

To control the operation of the pumps with variations of sewage level in the wet well, a level transmitter to measure the water level inside the wet well, shall be provided. The level transmitter shall be a radar type one, preferably manufactured by VEGA model number VEGAPULS C21 or Engineer approved equal. The transmitter shall operate with excitation of 9-30VDC and shall have an output of 4-20mA.

11.4.1.4 Pressure Transmitter

Pressure transmitter and S.S. ball valve required for all pump stations. Transmitter must be mounted at the 3 or 9 o'clock position downstream of the check valve in the tapping

boss of the tee or using a tapping saddle in the pipe that goes into the ground after the Air Release Valve.

Brand: Rosemount 2051

Transmitter Model: 2051TG3A2B21AS1M5T1

Remote Seal Model: 1299N2DD00AP1SSSG2F2FBB2

11.4.1.5 Phase Relays

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

11.4.1.6 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). 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.

11.4.1.7 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). 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.

11.4.1.8 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.

11.4.1.9 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.

11.4.1.10 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.

11.4.1.11 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.

11.4.1.12 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.

11.4.1.13 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 three (3) 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			
Black 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. All As-built drawing preparation shall be incidental to performance of the total contract and no additional compensation will be allowed unless there is a specific pay item.

Existing facilities included in the Water Utilities Engineering Geographic Information System (GIS) data 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, 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

A copy of the design files will be provided upon request from the city senior inspector.

12.3 Execution

12.3.1 As-Built Survey

During construction, the Contractor shall employ a Florida licensed Professional Surveyor and Mapper (PSM), who shall obtain field measurements during and after construction of

the actual locations, dimensions, and elevations of all constructed work; including those items of work that will become concealed or inaccessible. The survey shall be based on the horizontal control and vertical datum used to prepare the Plans, as verified by the preconstruction survey. The vertical datum and all benchmarks shall be shown on the as-built record drawings, including new benchmarks that were established for collecting as-built information.

Prior to the approval of the final payment, the Contractor's PSM shall submit to the senior inspector a complete set of as-built drawings, as specified herein. The PSM 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. The PSM shall sign and seal all copies of the as-built drawings. The contractor shall verify the information contained in the as-built is correct prior to submittal. .

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, power poles, hydrants, trees (18-inch diameter or greater), perpendicular distances from curb and gutter (or edge of pavement, when no curb and gutter are present), and property corners.

Three (3) ties are required for precise location of all proposed or newly installed 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.

Label all gravity sewer lines and sewage force mains with arrows depicting the 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,; as well as the manufacturer.

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 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-Built

12.3.5.1 As-built submission for preliminary review procedure:

Submit one (1) set of electronic files in **both AutoCad and Adobe Acrobat PDF formats** of as-built drawing for review to the senior construction inspector or designee.

Upon receiving above stated as-built material required, the assigned inspector and the Water Utilities 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 electronically submitted:

- One (1) completed digital file of the as-built drawing conforming to the specifications **in both AutoCad and in Adobe Acrobat PDF format**
- Submittal must be signed and sealed by a licensed Florida Land Surveyor
- Submittal to match the same sheet size and scale of the approved construction drawings

12.4 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 (public and private) 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

12.5 Figures

Figure 12.1 – Sample Tie Sheet for Water and Resue Construction

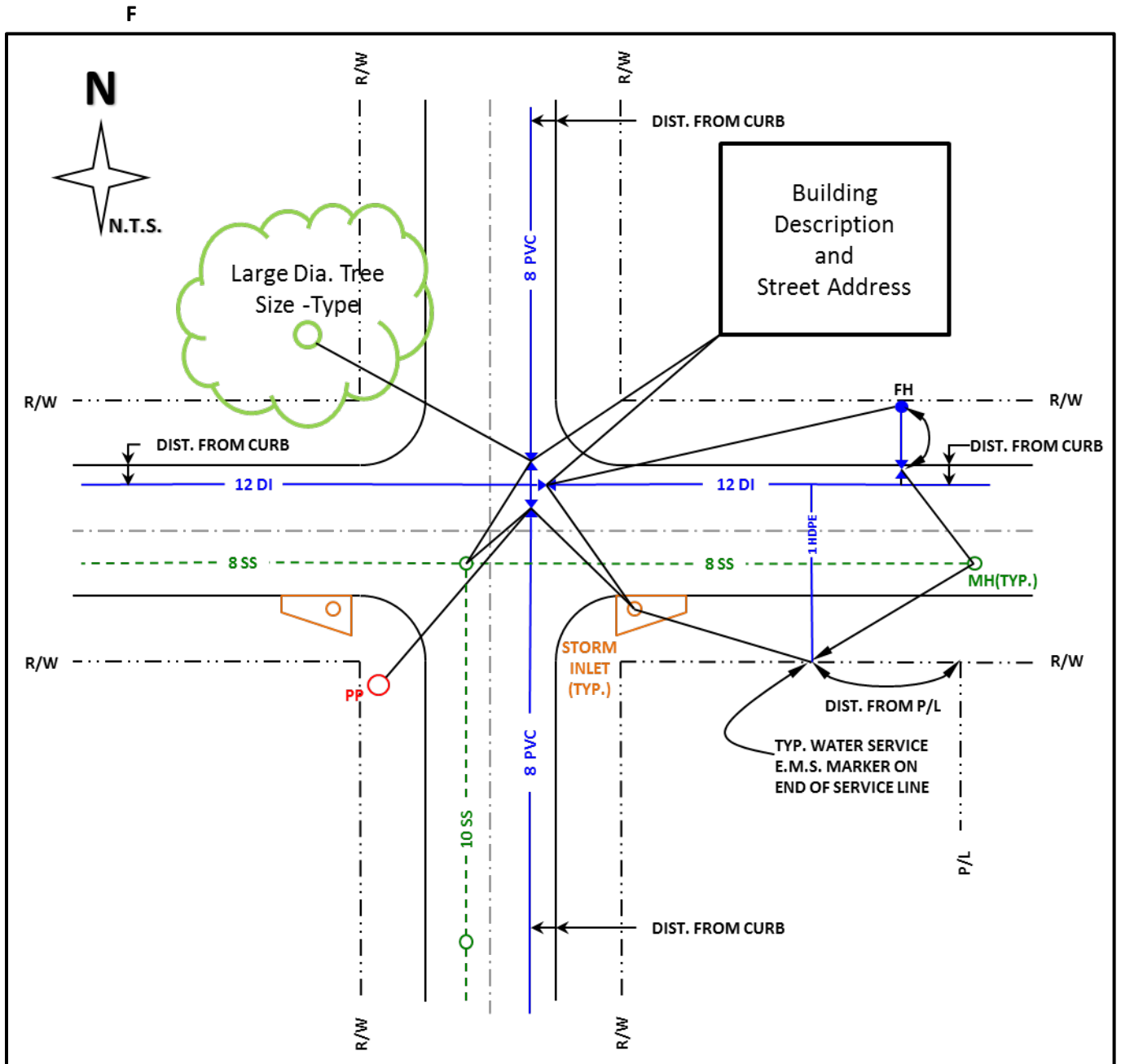


Figure 12.2 – Sample Tie Sheet for Gravity Sewer Construction

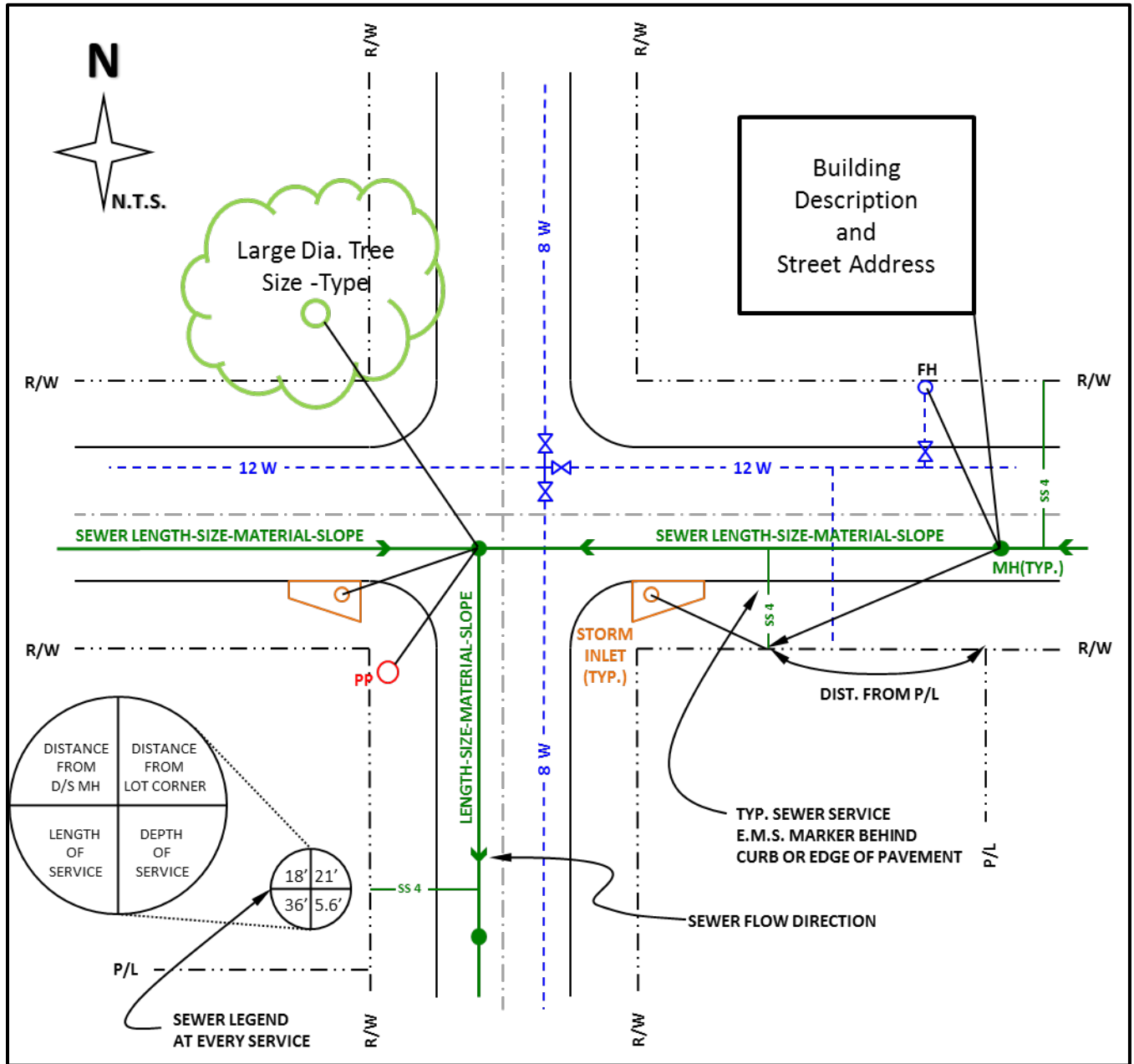
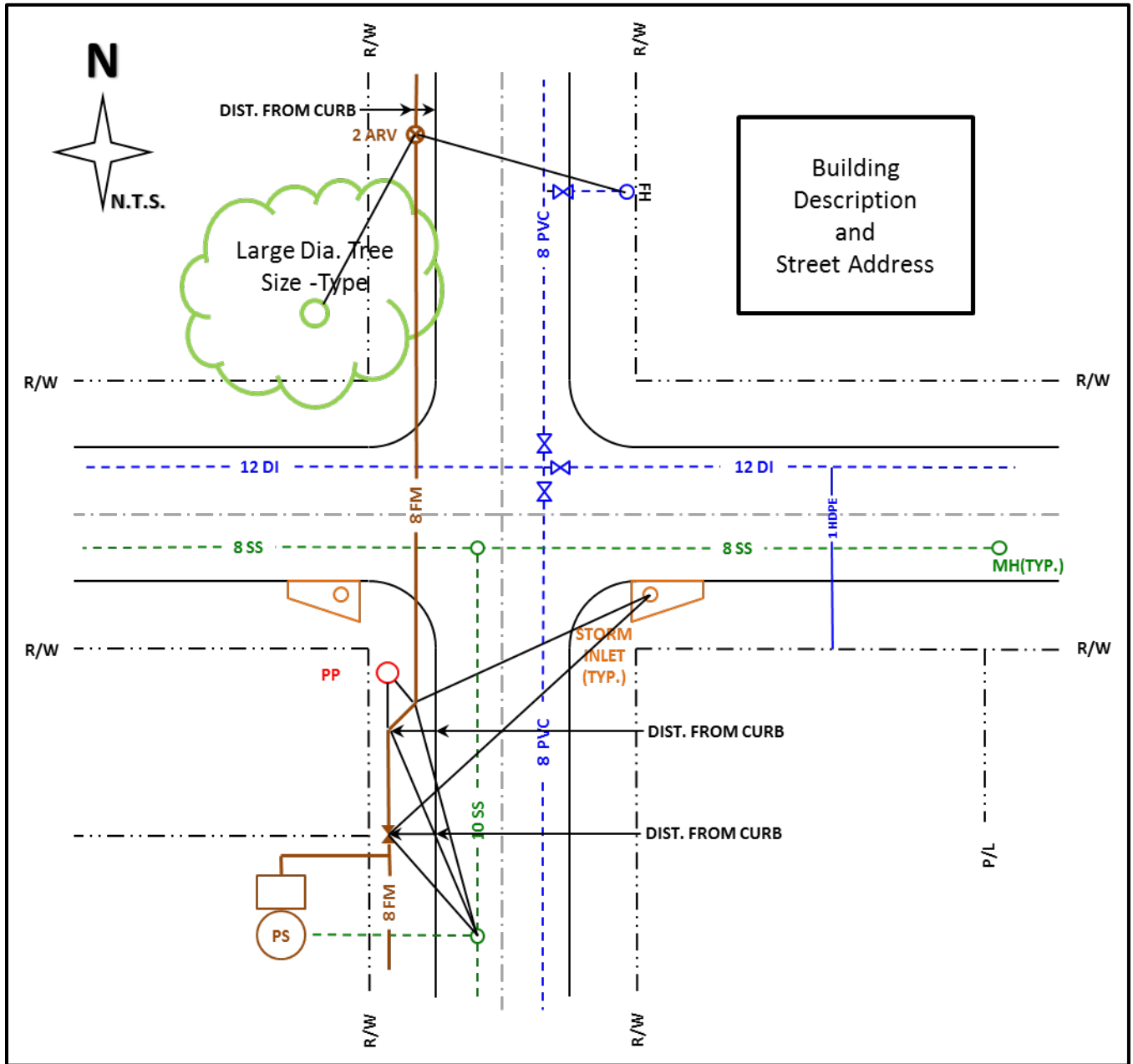


Figure 12.3 – Sample Tie Sheet for Sewer Force Main Construction



END OF SECTION

13.1 General

13.1.2 General Description of Work

- 13.1.2.1 The Contractor shall provide all labor, materials, and equipment as described herein and on the contract document drawings, including all auxiliaries and accessories required for a complete and operable electrical system.
- 13.1.2.2 The Contractor shall obtain all necessary permits and inspections required for the work to be performed and shall pay all charges incidental thereto.
- 13.1.2.3 Bidders are expected to visit the jobsite and carefully inspect the present conditions before preparing a bid. The failure of a bidder to visit the jobsite shall not relieve a bidder from full responsibility for all factors governing his work.
- 13.1.2.4 Equipment furnished as specified in other sections of these specifications or shown on other than the Electrical drawings required any wiring or electrical installation shall be governed by this Division of the Specifications.
- 13.1.2.5 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.
- 13.1.2.6 It is the intent of the 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 at no additional cost to the Owner.
- 13.1.2.7 Layout of Work and Coordination: The Contractor shall correlate final equipment locations with all other trades to ensure all trades may install equipment in available space, and provide all required coordination and supervision where work connects to or is affected by work of others.
- 13.1.2.8 The Contractor shall furnish all temporary power and lighting as required by all other trades.
- 13.1.2.9 Demonstration of Completed Electrical and Control Systems: The function of the electrical and control systems shall be demonstrated by the Owner or his representative. The contractor shall be present to verify complete and correct terminations.

13.1.3 Scope of Work

13.1.3.1 General

In general, the scope of work includes the supply and installation of a Stand-by Generator System at a Wastewater Pumping Station. The Generator System shall consist of the Generator, Automatic Transfer Switch (ATS), Main Breaker in an enclosure with an operator/handle that can be locked in the open position, and

the modifications of the existing power service/distribution system to integrate the new equipment. The work shall include the supply and installation of the concrete foundation/pad for the generator, and the supply and installation of mounting materials for the ATS, Main Breaker, and conduits and cable tray. The work shall include the modification of the existing power and control systems (SCADA) to facilitate the installation of the new equipment and the final operation and control/monitoring of the Pump Station.

Coordination with the Electric Power Utility (City of Tallahassee) concerning modifications to the electrical service is part of the contractor's work. Coordination with the owner for scheduling of outages of the Pump Station is also part of the work.

The Contractor shall receive and off-load the equipment, store the equipment prior to installation, and install the equipment at the existing Pump Station site.

13.1.3.2 Work by Contractor

The scope of work to be performed by the contractor shall be to provide and install the electrical and controls equipment, conduit, and wiring as indicated to provide a complete and operable system. Modification and/or additions to the existing support structure at the ATS location shall be part of the work (in coordination with the Owner).

The contractor's scope of work also includes the supply and installation of the concrete foundation/pad (including site prep and rebar) for the generator, and for the "walk/maintenance" slab at the ATS. The thickness of the new slab shall be as defined in the City Standard or no less than 6 inches.

Equipment provided by the Contractor shall include.

- Generator (fuel for testing, enclosure, etc.)
- Automatic Transfer Switch (ATS)
- Main Breaker – NEMA 4X enclosure – Lockable Operator
- Surge Protection Device (SPD) at the Main Breaker
- Breaker(s) for "small load" power distribution
- Conduit, wiring, termination materials
- Grounding system for new equipment

13.1.3.3 Check-Out and Start-Up

The scope of work includes check-out and start-up work. This work shall include generator testing and functional testing. Timing of this work shall be coordinated with the owner.

13.1.3.4 Generator Load Testing

The generator shall be load tested per the specification. The fuel for the testing shall be supplied by the Contractor and/or coordinated with the Owner. If applicable, the fuel tank shall be left full after the completion of the testing.

13.1.4 Submittals

13.1.4.1 Manufacturers' data in the form of "cut sheets" and engineering drawings of the equipment and materials shall be submitted to the Engineer for review before delivery to work site. Review of the submittal by the Engineer is to check for general conformance to the design intent and shall not relieve the Contractor of the responsibility for the correctness of all dimensions and the correct fitting of all parts of the work.

13.1.4.2 The entire Electrical Submittal shall be complete and delivered in one (1) package. An incomplete submittal will be returned to the Contractor without review.

13.1.4.3 The submittal shall be thoroughly checked by the Contractor for accuracy and compliance with the contract requirements. The submittal shall be dated and shall be accompanied by a statement from the contractor that they have been checked for conformity to the specifications and drawings. Submittals not so checked and noted will be returned without review.

13.1.4.4 Substitutions: Requests for substitutions shall be per General Conditions set forth in this specification and must be received in the Owner's office a minimum of ten days prior to bid, including credits and test and performance data to determine if equipment meets all specifications and requirements. Substitutions will not be reviewed if submitted with bid. All substituted equipment that cannot meet space requirements shall be replaced at the Contractor's expense.

13.1.4.5 Any alternate proposals affecting the design or 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.

13.1.5 Guarantees

13.1.6.1 In addition to the guarantee of equipment by the manufacturer, the Contractor shall also guarantee such equipment and shall be responsible for a period of two years after final acceptance to make good any defects of the materials or workmanship occurring during this period, without expense to the Owner. Light bulb replacement guarantee shall be limited to thirty days.

13.2 Basic Materials and Methods

13.2.1 Execution

13.2.1.1 Supervision

The electrical work shall be supervised by a licensed journeyman or master electrician who shall be on the job site at all times while work is in progress.

13.2.1.2 Workmen

All electrical work shall be performed by persons skilled in the trade.

13.2.1.3 Quality of Work

All electrical work shall be done neatly and in keeping with good practice and conventions of the trade.

13.2.1.4 Corrosion Preventative Procedures

All metallic materials shall be protected against corrosion. All hardware made of ferrous metals (including all nuts, bolts, washers, etc.) but not of corrosion resistant steel, shall be hot dip galvanized after fabrication, except where equivalent protective treatment is specifically approved by the Engineer. Aluminum shall not be used in contact with the earth, and were connected to dissimilar metal, shall be protected to dissimilar metal by approved fittings and treatment. Steel conduits or piping installed underground or in concrete shall have two complete coats of an approved quick drying asphalt base paint applied throughout the imbedded length to six inches (6") above the ground line or concrete surface.

13.2.1.5 Cleaning

The interior and exterior of all equipment shall be thoroughly cleaned at the completion of installation.

13.2.1.6 Painting

All painting shall be done as recommended by the equipment manufacturer/vendor/supplier.

13.2.1.7 The Contractor shall test all wiring for shorts and proper grounding before energizing.

13.2.1.8 Layout of Work and Coordination

Contractor shall coordinate all work and equipment locations with all other trades to ensure all trades may install equipment in available space and within schedule.

13.2.2 Codes and Standards

13.2.2.1 The latest editions of the established codes, standards and ordinances 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:

- Occupational Safety and Health Administration (O.S.H.A.)
- Life Safety Code C NFPA 101
- Underwriters Laboratories, Inc. Publications
- National Fire Protection Associate (NFPA)
- American National Standards Institute (ANSI)
- National Electrical Code, NFPA 70 (NEC)
- Institute of Electrical and Electronic Engineers (IEEE)
- National Electrical Manufacturer's Association (NEMA)
- International Power Cable Engineer's Association (IPCEA)
- National Electrical Safety Code (HESC)
- The Southern Standard Building Code (SBCCI)
- Federal Communications Commission (F.C.C.)
- Municipal, local or other codes having jurisdiction
- City of Tallahassee Technical Specifications for Water and Sewer Construction

13.2.2.2 The foregoing documents 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.

13.2.3 Products

13.2.3.1 Equipment and Materials

13.2.3.1.1 The Contractor shall furnish materials or equipment specified by manufacturers named or approved equal.

13.2.3.1.2 The materials furnished shall be new, undamaged and packed in the original manufacturer's packing.

13.2.3.1.3 Equipment and materials shall at all times during construction be protected from mechanical and water damage.

13.2.3.1.4 Damaged materials and equipment shall be replaced by the Contractor at no cost to the Owner.

13.2.3.2 Equipment and Materials Standards

13.2.3.2.1 The design and fabrication of electrical equipment and materials furnished shall comply with the latest edition and revisions of the following codes and standards:

- The American National Standards Institute (ANSI)
- The American Society of Mechanical Engineers (ASME)
- The American Society for Testing and Materials (ASTM)
- The Institute of Electrical and Electronic Engineers (IEEE)
- The National Electrical Manufacturers Association (NEMA)

- The Occupational Safety and Health Administration (OSHA)
- The Underwriters Laboratories (UL)
- The National Fire Protection Association (NFPA)
- The National Electrical Code (NEC)

13.2.3.3 Equipment Ratings

13.2.3.3.1 The horsepower and wattage of equipment shown on the drawings are estimated.

13.2.3.3.2 Conduit, wire, disconnects, fuses, and circuit breakers shall be sized to suit the horsepower and wattage of equipment actually furnished.

13.2.3.3.3 In no case shall conduit, wire, disconnects, fuses, and circuit breakers be sized smaller than shown on the drawings.

13.2.3.4 Nameplates

13.2.3.4.1 Provide laminated plastic nameplates for each panelboard, automatic transfer switch, disconnect switches, equipment enclosures and any other major pieces of equipment.

13.2.3.4.2 Nameplates shall be made of .125 inch thick laminated plastic with a black matte outer finish and white inner core.

13.2.3.4.3 Nameplates shall have square corners and be a minimum of 1.0 x 2.5 inches with 0.25 inch high block style engraved letter.

13.2.3.4.4 Attach nameplates to equipment, aligned with structural features of equipment, with two #4 stainless steel bolts, nuts and lock-washers.

13.3 Grounding

13.3.1 GENERAL

13.3.1.1 Scope of Work

13.3.1.1.1 The work required under this section of the specifications consists of the installation of the complete grounding system for the project. Provide all materials required for the grounding system under this section of the specifications.

13.3.1.1.2 The grounding system shall include grounding conductors and ground rods for the modification to the Electrical Service and connection of the Generator equipment to the grounding system. The grounding conductors and ground rods shall be connected by exothermic weld connections. Supply and installation of equipment grounds with the wire/cabling is part of the work and grounding system.

13.3.1.2 Related Work

13.3.1.2.1 Coordinate installation of grounding system with all work required under the project specifications and drawings.

13.3.1.2.2 Ensure grounding of Generator and Automatic Transfer Switch complies with requirements of NEC 250.30 for separately derived systems.

13.3.1.3 Application

13.3.1.3.1 Equipment grounding conductors shall be used to establish grounding of the entire system.

13.3.1.3.2 Equipment grounding shall not be by metallic raceway alone.

13.3.1.3.3 Table 250-66 of the NEC (2017) shall be used to size all grounding electrode conductors.

13.3.1.3.4 Table 250-122 of the NEC (2017) shall be used to size equipment grounding conductors.

13.3.2 PRODUCTS

13.3.2.1 Ground Rods

13.3.2.1.1 Ground rods shall be 5/8" x 10', sectional type coupled together to obtain length required, unless indicated otherwise.

13.3.2.1.2 Construction shall be a solid steel core with a heavy uniform covering of electrolytic copper.

13.3.2.1.3 Threads, on sectional rods, shall be rolled (not cut) into the composite metal after the copper covering has been applied.

13.3.2.1.4 Copper covering shall be work hardened by drawing rods.

13.3.2.1.5 Rod couplings shall be of a corrosion resistant alloy.

13.3.2.2 Grounding Electrode Conductor and Connections

13.3.2.2.1 All grounding electrode conductors shall be stranded copper.

13.3.2.2.2 Conductor connections shall be by exothermic weld (Cadweld or equal).

13.3.2.3 Equipment Grounding Conductors

13.3.2.3.1 Equipment grounding conductors shall be Green with THHN or XHHN insulation. See Section 16100 paragraph 2.3 and reference to The City of Tallahassee - Technical Specifications for Water and Sewer Construction (Section 11 - November 2019 or latest edition) for Wiring.

13.3.3 EXECUTION

13.3.3.1 Installation

13.3.3.1.1 Ground all non-current carrying metal parts of the electrical system to provide a low impedance path for ground fault current.

13.3.3.1.2 The neutral conductor(s) of the incoming electrical service shall be grounded to the ground rod system, metal piping system, and structural steel using Table 250-94 of the NEC for conductor sizing. Grounding conductors shall be run in rigid non-metallic conduit.

13.3.3.1.3 Separate bus bars shall be provided for branch circuit neutrals and equipment grounding conductors. These bars will be joined together at only one point with a bonding jumper at the service and shall be isolated throughout the system.

13.3.3.2 Testing

13.3.3.2.1 The Contractor shall test the ground rod for ground resistance by the Fall of Potential method.

13.3.3.2.2 Ground resistance shall be measured at 10 ohms or less. If ground resistance is greater than 10 ohms, additional ground rods shall be driven and the ground system retested.

13.3.3.2.3 Records of the ground resistance test shall be submitted to the Engineer.

13.4 Transient Voltage Surge Suppression / Surge Protection Devices

13.4.1 GENERAL

13.4.1.1 This Section includes transient voltage surge suppressors / surge protection devices for low-voltage power (< 600 Volts) equipment. The Contractor and/or Supplier shall take note of the Electrical Service's voltage and configuration.

13.4.1.2. The location of the Device (TVSS/SPD) is at the load side of the Main Breaker/Service Disconnect. The attachment, wiring, and support of the Device on the Main enclosure is to be included in the work.

13.4.1.3 Product Data: For each type of product indicated. Include operating voltage, rated capacities, operating temperature, shipping and installed weights, and items per Section 2: Products.

13.4.1.3.2 Product Certifications: Signed by manufacturers of transient voltage suppression devices, certifying that products furnished comply with the following testing and labeling requirements:

13.4.1.3.2.1 UL 1449, 4th Edition and UL1283 Listing and classifications.

13.4.1.3.2.2 Manufacturer shall provide independent test data showing single pulse surge current capacity, in accordance with NEMA LS-1 guidelines.

13.4.1.3.3 Field Test Reports. Written reports of tests specified in Part 3 of this Section. Include the following:

13.4.1.3.3.1 Test results that comply with requirements

13.4.1.3.4 Maintenance Data: Transient voltage suppression devices to include installation instructions, operation and maintenance manuals.

13.4.1.3.5 Warranties: Special warranties specified in this Section.

13.4.1.4 QUALITY ASSURANCE

13.4.1.4.1 Product must be made by a company engaged in the manufacture of such devices in the USA for a minimum of ten years.

13.4.1.4.2 Source Limitations: Obtain suppression devices from a single manufacturer.

13.4.1.4.3 Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered by the engineer/architect if submitted more than 14 days prior to bid. Samples may be required for approval. .

13.4.1.4.4 Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

13.4.1.4.5 IEEE Compliance: Comply with ANSI/IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits" and test devices in accordance with ANSI/IEEE C62.45, "IEEE Guide for Surge Suppressor Testing".

13.4.1.4.6 NEMA Compliance: Comply with NEMA LS-1 "Low Voltage Surge Protective Devices".

13.4.1.4.7 UL Compliance: Listed to UL 1449 "Transient Voltage Surge Suppressors" and UL1283 "Electromagnetic Filters". Shall be UL listed.

13.4.1.5 PROJECT CONDITIONS

13.4.1.5.1 Placing into Service: Do not energize or connect service entrance equipment or panelboards to their sources until the surge protective devices are installed and connected. Do not single phase, hi-pot or megger Service Entrance Equipment without disconnecting the surge protective device, as damage may result from these procedures to the surge protective device.

13.4.1.5.2 Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

13.4.1.5.2.1 Notify Owner not less than two days in advance of proposed utility interruptions.

13.4.1.5.2.2 Do not proceed with utility interruptions without Owner's written permission.

13.4.1.5.3 Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:

13.4.1.5.3.1 Maximum Continuous Operating Voltage: Not less than 125 % of nominal system operating voltage for 120/240 Single Phase or 120/208 VAC Wye systems, Not less than 115 % for 277/480 VAC Wye or 480 VAC Delta systems.

13.4.1.5.3.2 Operating Temperature: -40 to +185 degrees F (-40 to +85 degrees C)

13.4.1.5.3.3 Humidity: 0 to 95 %, noncondensing.

13.4.1.5.3.4 Altitude: Less than 20,000 feet (6,000 m) above sea level.

13.4.1.6 COORDINATION

13.4.1.6.1 Coordinate location of field mounted surge suppressors to allow adequate clearances for maintenance, clearance per NEC and all local electrical codes.

13.4.1.7 WARRANTY

13.4.1.7.1 General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

13.4.1.7.2 Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within ten years (120 months) from date of Substantial Completion, or 126 months from date of manufacture. Warranty shall include parts and labor.

13.4.2 PRODUCTS

13.4.2.1 MANUFACTURERS

13.4.2.1.1 Manufacturers: Subject to compliance with requirements of this specification listed herein, provide products by one of the following manufacturers:

13.4.2.1.1.1 Square D / Schneider Electric

13.4.2.1.1.2 APT / ASCO

13.4.2.1.1.3 Siemens

13.4.2.1.1.4 Surge Suppression (SSI) / Advantage

13.4.2.1.2 This specification is performance based, and any other vendors who desire approval to bid this project shall provide written documentation of any deviations from this specification, which shall be included in product submittal 14 days prior to bid.

13.4.2.2 **HARDWIRED TYPE SUPPRESSORS**

13.4.2.2.1 Surge Protective Device Description: With the following features and accessories:

13.4.2.2.1.1 LED indicator lights for power and protective status.

13.4.2.2.1.2 Utilizing metal oxide varistor technology.

13.4.2.2.1.3 Integral EMI/RFI Filter providing up to 54 dB of attenuation from 20 kHz to 100 MHz.

13.4.2.2.1.4 Internal surge fuses rated at 200 KA interrupting capacity.

13.4.2.2.1.5 Including thermal protection for each component, which is continuously monitored.

13.4.2.2.1.6 Internal surge module easily replaceable.

13.4.2.2.1.7 Integral Form C Contacts for remote indication of suppression status via connection to building management system (BMS provided by others).

13.4.2.2.1.8 Integral Audible Alarm with silence switch.

13.4.2.2.1.9 NEMA 3R style enclosure suitable for indoor or outdoor installation.

13.4.2.2.2 Single Impulse Surge Current Capacity shall be as follows:

System Configuration	Line to Neutral	Line to Ground	Line to Line	Neutral to Ground
120/240 Volt Single Phase	100 KA	100 KA	100 KA	100 KA
120/208 Volt Three Phase Wye	100 KA	100 KA	100 KA	100 KA
120/240 Volt High Leg Delta	100 KA	100 KA	100 KA	100 KA
277/480 Volt Three Phase Wye	100 KA	100 KA	100 KA	100 KA
480 Volt Three Phase Delta	N/A	100 KA	100 KA	N/A
347/600 Volt Three Phase Wye	100 KA	100 KA	100 KA	100 KA
600 Volt Three Phase Delta	N/A	100 KA	100 KA	N/A

13.4.2.2.3 UL 1449 (6KV, 500 Amp) let-through voltages as follows:

Mode	120/240 Volt Single Phase	120/208 Volt Wye	120/240 Volt High Leg Delta	277/480 Volt Wye	480 Volt Delta	347/600 Volt Wye	600 Volt Delta
L-N	460 V	460 V	460 V / 632 V	873 V	N/a	1,084 V	N/a
L-G	480 V	480 V	480 V / 664 V	857 V	1,330 V	1,132 V	1,777 V
N-G	512 V	512 V	512 V	774 V	N/a	979 V	N/a
L-L	763 V	763 V	935 V	1,523 V	1,317 V	1,936 V	1,837 V

13.4.2.2.4 The system for this project is 480/277 volt Wye (3-phase, 4-wire).

13.4.3 EXECUTION

13.4.3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

13.4.3.1.1 Install devices at service entrance, distribution panels, and panelboards as indicated on electrical one-line drawings.

13.4.3.1.2 Provide multi-pole, 100 Amp breaker as a dedicated disconnect for the suppressor at Service Entrance location, unless otherwise indicated on drawings.

13.4.3.1.3 Install devices per manufacturer’s instructions with conductors between suppressor and points of attachment as short and as straight as possible. Do not mount internal to switchgear to facilitate ease of future maintenance and/or replacement.

13.4.3.1.4 Provide multi-pole, 30 Amp breaker as a dedicated disconnect for the suppressor at panelboard locations, unless otherwise indicated on drawings.

13.4.3.2 CONNECTIONS

13.4.3.2.1 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

13.4.3.3 FIELD QUALITY CONTROL

13.4.3.3.1 Testing: Perform the following field quality control testing:

13.4.3.3.1.1 After installing the surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.

13.4.3.3.1.2 Complete start-up checks and voltage verifications according to manufacturer's written instructions.

13.4.3.3.1.3 Perform visual and mechanical inspection on each unit. Certify that units are installed per manufacturer's recommendations.

13.4.3.3.2 Repair or replace malfunctioning units. Retest after repairs or replacements are made.

13.5 Standby Power Generator Systems

13.5.1 GENERAL

13.5.1. Description of Work:

13.5.1.1 Extent of standby power generator system work is indicated by drawings and schedules. The system application is for a Waste Water Pumping Station.

13.5.1.2 Types of standby power generator system equipment required for project include the following:

Diesel engine-driven Generators with Automatic Transfer Switch (ATS)

Natural gas engine driven Generators with Automatic Transfer Switch (ATS)

13.5.1.3 Concrete and grout for engine-generator pads, foundations, frames, etc. are specified on the drawings or in other sections of this specification and are part of the work.

13.5.1.4 Fuel tanks, piping and associated accessories required for installation of engine-generator units pertaining to fuel oil systems, including piping and storage tank is work of this section.

13.5.1.3 Quality Assurance:

13.5.1.3.1 Manufacturer's Qualifications: Firms regularly engaged in manufacture of engine-driven standby generator systems, of types,

ratings, and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years. The complete generator system (including ATS) shall be supplied via the Manufacturer's authorized distributor.

13.5.1.3.2 Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects utilizing panelboards similar to those required for this project.

13.5.1.3.3 Codes and Standards:

13.5.1.3.3.1 NEC Compliance: Comply applicable requirements of NEC Articles 700, 701, and 702 pertaining to emergency and standby systems.

13.5.1.3.3.2 UL Compliance: Comply with applicable requirements of UL 1008, "Automatic Transfer Switches". Provide standby power generator system components, including automatic transfer switches, which are UL listed and labeled.

13.5.1.3.3.3 ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG 2, "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators".

13.5.1.3.3.4 The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142

13.5.1.4 Submittals:

13.5.1.4.1 Product Data: Submit manufacturer's data on engine-driven electric generator systems and components. Include manufacturer's standard product warranty (for not less than two-year period) for

replacement of materials and equipment used in standby engine-driven generator systems.

13.5.1.4.2 Shop Drawings: Submit layout drawings of engine-driven generator units and accessories including piping, remote start-stop stations, and instruments, showing generator set units and their spatial relationship to associated equipment. Allow clearance space for removal of engine generator elements for maintenance purposes.

13.5.1.4.3 Minimally, Engine-Generator submittals shall include the following information:

- A. Factory published specification sheet.
- B. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.
- C. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
- D. Weights of all equipment.
- E. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
- F. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.
- G. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.
- H. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
- I. Generator resistances, reactances and time constants.
- J. Generator locked rotor motor starting curves.
- K. Manufacturer's documentation showing maximum expected transient voltage and frequency dips, and recovery time during operation of the generator set at the specified site conditions with the specified loads.
- L. Manufacturer's and dealer's written warranty.

13.5.2 PRODUCTS

13.5.2.1 Acceptable Manufacturers:

13.5.2.1.1 Manufacturers: Subject to compliance with requirements, provide standby generator systems of one of the following (for each type of electric generator unit):

Caterpillar Tractor Co.

Cummins, Inc.

13.5.2.2 Engine:

13.5.2.2.1 Engine: The engine shall be a turbocharged water-cooled inline or Vee-type four-stroke cycle compression ignition diesel. The engine shall be 6 or more cylinders. It shall meet specifications when operating on Number 2 domestic burner oil. The engine shall be equipped with fuel, lube oil, and intake air filters, lube oil cooler, fuel transfer pump, and unit mounted instruments, including a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge. Normal operating speed shall not exceed 1800 RPM.

The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified kW / bHP rating. Emissions requirements / certifications of this package: EPA ESE

13.5.2.2.2 Governor: The engine governor shall be an electronic Engine Control Module (ECM) with 24-volt DC Electric Actuator. The ECM shall be enclosed in an environmentally sealed, die-cast aluminum housing which isolates and protects electronic components from moisture and dirt contamination. Speed droop shall be adjustable from 0 (isochronous) to 10%, from no load to full rated load. Steady state frequency regulation shall be +/- 6 RPM. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included. The ECM shall adjust fuel delivery according to exhaust smoke, altitude and cold mode limits. In the event of a DC power loss, the forward acting actuator will move to the minimum fuel position.

13.5.2.3 Mounting and Enclosure: The units shall be mounted on a structural steel subbase and shall be provided with suitable spring-type vibration isolators. The enclosure shall be weather resistant for outdoor installation and shall provide sound attenuation to 75 dba at 7 meters. Hinged access doors with latches shall be provided for the engine and

control panel as needed.

Engine starting batteries, battery rack, and charger shall fit inside the housing and alongside the engine.

Housing shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line is to have a high quality valve located inside the enclosure, near the fluid source.

The housing shall be equipped on the inside with a switch operated explosion proof light and a 120 volt, single phase, weatherproof convenience receptacle for easy access by maintenance personnel.

13.5.2.2.4 Safety Devices: Safety shut-offs for high water temperature, low oil pressure, overspeed, and engine overcrank shall be provided.

15.5.2.3 Generator:

13.5.2.3.1 The generator for the facility shall be rated for continuous standby service.

13.5.2.3.2 Type: The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G2 of ISO 8528. The excitation system shall enable the alternator to sustain 300% (250% for 50Hz) of rated current based on the 125C (Class H) or 105C (Class F) rise rating for ten seconds during a fault condition and shall improve the immunity of the voltage regulator to non-linear distorting loads. The excitation system shall be of brushless construction and be independent of main stator windings (either permanent magnet or auxiliary windings).

13.5.2.3.3 Regulator: The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed. Voltage regulation shall be selectable to be either volts per hertz or by load adjustment module.

13.5.2.3.4 Motor Starting: Provide locked rotor motor starting capability of "standard" skVA at 30% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.

13.5.2.4 Cooling System:

13.5.2.4.1 Radiator: A radiator with blower type fan shall be sized to maintain safe operation at 100°F. ambient temperature. Total air flow restriction from the radiator shall not exceed 0.5" H₂O at both inlet and

outlet. Contractor shall provide duct work with flexible connecting section between radiator and discharge louver frame as indicated on the drawings.

13.5.2.4.2 The engine cooling system shall be pretreated by the engine supplier for the inhibition of internal corrosion.

13.5.2.5 Fuel System for diesel driven generators:

13.5.2.5.1 Fuel Storage Tank: The fuel storage tank shall be a double wall type mounted integral to the generator skid. Auxilliary Storage tanks, gauges, and valves (if any) shall be supplied and installed by the Contractor as shown on the drawings, as required and in accordance with appropriate local codes and regulations (UL 142). All fuel oil piping extended to the engine shall be of black iron. Fuel tank shall have fuel capacity to operate the generator for 48 hours.

13.5.2.5.1.1 The fuel storage tank shall be equipped with a level switch capable of providing a discrete input (dry contact) to the SCADA System to indicate low level in the tank.

13.5.2.5.1.2 The fuel storage tank shall be equipped with release (leak) detection per 62-762.501 F.A.C. and 62-762.601 F.A.C. The leak detection shall be alarmed as part of the Generator Control Panel.

13.5.2.5.2 Contractor shall include cost of fuel for testing and start-up. Tank shall be left full at completion of job.

13.5.2.5.3 Filter/Separator: In addition to the standard fuel filters provided by the engine manufacturer. There shall also be installed a primary fuel-water separator in the fuel inlet line to the engine.

13.5.2.6 Exhaust System:

13.5.2.6.1 Exhaust Silencer: A critical type silencer, muffler companion flanges, and flexible stainless steel exhaust fitting properly sized and coordinated with the generator building shall be furnished and installed according to the manufacturer's recommendation. Mounting shall be provided by the Contractor as shown on the drawings. The silencer shall be mounted so that its weight is not supported by the engine, nor will exhaust system growth, due to thermal expansion, be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine manufacturer.

- 13.5.2.7 Automatic Starting System:
- 13.5.2.7.1 Starting Motor: A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
 - 13.5.2.7.2 Automatic Control: Fully automatic generator set start-stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, and overcrank. Controls shall include a 30 second single cranking cycle limit with lockout.
 - 13.5.2.7.3 Jacket Water Heater: A unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 90°F. The heater shall be 120 volt, single phase, 60 hertz. Vee-type engines of 12 cylinders or more shall have one heater per each bank of cylinders.
 - 13.5.2.7.4 Batteries: A lead-acid storage battery set of the heavy duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 172 ampere hours. Necessary cable and clamps shall be provided.
 - 13.5.2.7.5 Battery Trays: battery trays shall be provided for each battery and shall conform to NEC 480-7(b). They shall be constructed of fiberglass to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil over battery electrolyte shall be contained within the tray to prevent a direct path to ground.
 - 13.5.2.7.6 Battery Charger: A current limiting battery charger shall be furnished to automatically recharge batteries. The charger shall be dual charge rate with automatic switching to the boost rate when required. The battery charger shall be mounted on the genset package or inside the genset enclosure/room.
- 13.5.2.8 Mainline Circuit Breaker:
- 13.5.2.8.1 Type: A main line, molded case circuit breaker mounted upon and sized to the output of the generator (adjustable trip settings) shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during overload and short circuit conditions.
 - 13.5.2.8.2 The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protections. The circuit breaker shall meet

standards established by Underwriter's Laboratories, National Electric Manufacturer's Association, and National Electrical Code.

13.5.2.8.3 Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protections.

13.5.2.8.4 Circuit breaker shall have battery voltage operated shunt trip wired to safety shutdowns to open the breaker.

13.5.2.9 Generator Control Panel:

13.5.2.9.1 Type: A fully solid-state, microprocessor based, generator/skid mounted, NEMA 3R type vibration isolated 14 gauge steel electronic modular control panel (EMCP) shall be provided. The control panel shall provide all operating, monitoring, and control functions of the generator set. Panel shall contain, but not be limited to, the following equipment:

Frequency meter, LED, 46-65 Hz.

Voltmeter, 2% accuracy and voltmeter selector switch (4 position) line-to-line.

Ammeter, 2% accuracy and ammeter phase selector switch.

Automatic starting controls as specified.

Voltage level adjustment rheostat.

Dry contacts for remote alarms wired to terminal strips.

Individual fault indicator lights for low oil pressure, high water temperature, overspeed and overcrank.

Four position function switch marked "auto", "manual", "off/reset", and "stop".

Running time meter, oil pressure and water temperature gauges.

Auxiliary relay 3PDT for activating accessory items.

Hinged, solid protective cover with provision for padlock.

Control circuit breaker.

Shutdown solenoid circuit breaker.

13.5.2.9.2 Alarms and Shutdowns

The control shall monitor and provide alarm indication and subsequent shutdown or the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:

Engine Alarm/Shutdown:

- A. Low oil pressure alarm/shutdown
- B. High coolant temperature alarm/shutdown
- C. Loss of coolant shutdown
- D. Overspeed shutdown

- E. Overcrank shutdown
- F. Emergency stop shutdown
- G. Low coolant temperature alarm
- H. Low battery voltage alarm
- I. High battery voltage alarm
- J. Control switch not in auto position alarm
- K. Battery charger failure alarm

Generator Alarm/Shutdown:

- A. Generator phase sequence
- B. Generator over voltage
- C. Generator under voltage
- D. Generator over frequency
- E. Generator under frequency
- F. Generator reverse power (real and reactive)
- G. Generator overcurrent

Voltage Regulator Alarm/Shutdown:

- A. Loss of excitation alarm/shutdown
- B. Instantaneous over excitation alarm/shutdown
- C. Time over excitation alarm/shutdown
- D. Rotating diode failure
- E. Loss of sensing
- F. Loss of PMG

13.5.2.9.3 Communications and Inputs/Outputs

13.5.2.9.3.1 Programmable Digital Inputs

The Controller shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

13.5.2.9.3.2 Programmable Relay Outputs

The control shall include the ability to operate programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (2) Form C (Normally Open & Normally Closed) contacts.

13.5.2.9.3.3 Programmable Discrete Outputs

The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

- 13.5.2.10 Scheduled Oil Sampling:
- 13.5.2.10.1 In order to forecast and minimize engine failure, the supplier of the equipment must provide an oil sampling analysis kit which operating personnel shall utilize for scheduled sampling.
- 13.5.2.10.2 Schedule oil sampling shall be of the atomic absorption spectrophotometry method as opposed to the spectrographic analysis method and shall be accurate to within a fraction of one part per million for the following elements:
- Iron.
 - Chromium.
 - Copper.
 - Aluminum.
 - Silicon.
 - Lead.
- 13.5.2.10.3 In addition, the sample shall be tested for the presence of water, fuel dilution, and anti-freeze.
- 13.5.2.10.4 All equipment needed to take oil samples shall be provided in a kit at the time of acceptance and shall include the following:
- Sample extraction gun (1)
 - Bottles (10)
 - Postage paid mailers (10)
 - Written instructions (1)
- 13.5.2.10.5 IMMEDIATE notification shall be provided to the Owner when analysis shows any critical reading. If readings are normal, a report showing that the equipment is operating within established parameters shall be provided.
- 13.5.2.10.6 This scheduled oil sampling shall be made available, at additional cost, to the Owner beyond the mandatory starter kit specified previously and shall be optional for the Owner to continue this service after the starter kit has been depleted.
- 13.5.2.11 System Service Contract:
- 13.5.2.11.1 The supplier of the standby power system must provide a copy of and make available to the Owner his standard service contract with, at the owner's option, may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specification sheets, and wiring or outline drawings, etc. submitted for approval to the designing engineer. The contract shall be for the complete services rendered over a period of one year.

13.5.3 EXECUTION

13.5.3.1 Manufacturer and Delivery

13.5.3.1.1 The engine, including engine block, oil pan, and cylinder heads, generator and all major items of auxiliary equipment shall be manufactured in the U.S. by manufacturers currently engaged in the production of such equipment. The engine and generator must be of the same manufacturer without exception.

13.5.3.1.2 The unit shall be shipped to the jobsite by an authorized dealer having a parts and service facility within a 150 mile radius of the jobsite. In addition, and in order not to penalize the Owner for unnecessary or prolonged periods of time for service or repairs to have no less than sixty percent (60%) of all engine replacement parts in his stock at all times. Certified proof of this requirement shall be available from the supplier and a personal inspection of the supplier's facilities shall be made by the designing engineer or his appointed representative to substantiate claims made by the generator set supplier.

13.5.3.1.3 The automatic transfer switch (ATS) shall be supplied by the generator set manufacturer in order to maintain a single source of system responsibility and coordination.

13.5.3.2 Start-Up and Instructions:

13.5.3.2.1 On completion of the installation, start-up shall be performed by the engine manufacturer's trained dealer service representative.

13.5.3.2.2 Provide full load test utilizing portable test bank for four (4) hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle and automatic shutdown and return to normal power. All equipment needed for the test shall be provided by the genset dealer representative/supplier.

13.5.3.2.3 Operating and maintenance instruction manuals shall be supplied and procedures explained to operating personnel.

13.5.3.3 Warranty:

13.5.3.3.1 Equipment furnished under this section shall be guaranteed against defective parts and workmanship under terms of the manufacturer's and dealer's standard warranty. But, in no event shall it be for a period of less than two (2) years from date of initial start-up of the system and shall include labor and travel time for necessary repairs at the jobsite. Running hours shall not be a limiting factor for the system warranty.

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

13.6 Transfer Switches

13.6.1 GENERAL

- 13.6.1.2 Description of Work
- 13.6.1.2.1 Extent of transfer switch work, including associated control devices, is indicated by drawings and schedules and as specified herein. The intent is for the ATS to be supplied with the generator as a system.
- 13.6.1.2.2 Types of transfer switches required for the project include the following:
- Automatic Transfer Switch (ATS) – Time Delay from Neutral Position Transition
- 13.6.1.2.3 Refer to other specification sections for wires/cables, electrical raceways, boxes and fittings, which are required in conjunction with transfer switch work; not work of this section.
- 13.6.1.2.4 Grout for transfer switch pads (if needed) shall be Set Grout (Masterflow -928 or Engineer approved alternate).
- 13.6.1.2.5 Coordination of the operation of the ATS with the Pump Station control system shall include relays and/or contact closure to provide status inputs for the control system (SCADA). The contractor shall coordinate this control scheme and interface with the Owner.
- Status inputs required:
- ATS transfer to Generator (ATS position status)
 - Generator Running (run status from generator thru ATS)
 - Generator Fuel Low (low level switch)
- 13.6.1.2.6 ATS and Generator controls shall be provided and set-up such that the ATS and Generator can be monitored from the SCADA control system (Station 21 – coordinate with Owner).
- 13.6.1.3 Submittals:
- 13.6.1.3.1 Product Data: Submit manufacturer's data and installation instructions for electrical power transfer switches.
- 13.6.1.3.2 Shop Drawings: Submit layout drawings of electrical power transfer switches showing accurately scaled equipment locations and spatial relationships to associated electrical equipment in proximity.

13.6.1.4 Quality Assurance:

13.6.1.4.1 Manufacturer's Qualifications: Firms regularly engaged in manufacture of electrical power transfer switches, of types, ratings, and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.

13.6.1.4.2 Installer's Qualifications: Firm with at least 3 years of successful installation experience on project utilizing electrical power transfer switches similar to that required for this project.

13.6.1.4.3 Codes and Standards:

Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of electrical power transfer switches.

The automatic transfer switch shall conform to the requirements of:

- A. UL 1008: Underwriters Laboratories standard for automatic transfer switches
- B. CSA: C22.2 No. 178 certified at 600 VAC
- C. IEC: 947-6-1 certified at 480 VAC
- D. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
- E. NFPA 99: Essential electrical systems for health care facilities
- F. NFPA 101: Life safety code
- G. NFPA 110: Standard for emergency and standby power systems
- H. IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings
- I. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
- J. NEMA ICS10: AC automatic transfer switch equipment (supersedes ICS2-447)
- K. UL 50/508: Enclosures
- L. ICS 6: Enclosures
- M. ANSI C33.76: Enclosures
- N. NEMA 250: Enclosures
- O. IEEE 472: (ANSI C37.90A): Ringing wave immunity
- P. EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)

- Q. EN61000-4-2: (Level 4): ESD immunity test Class B:
- R. EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity test
- S. EN61000-4-4: Electrical fast transient/burst immunity test
- T. EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50 μ s, 5 & 8 kV)
- U. EN61000-4-6: (ENV50141): Conducted immunity test
- V. EN61000-4-11: Voltage dips and interruption immunity
- W. IEE-693-2005: Seismic certified at high level with 2.5 amplification factor
- X. IBC-2003: At $I_p=1.5$ for z/h less than or equal to 1 (in accordance with ICC-ES-AC156)

13.6.1.5 Delivery, Storage and Handling:

- 13.6.1.5.1 Deliver transfer switches and associated devices in factory-fabricated type containers or wrappings, which properly protect equipment from damage.
- 13.6.1.5.2 Store transfer switches and associated devices in original packaging, and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- 13.6.1.5.3 Handle transfer switches and associated devices carefully to prevent physical damage to equipment. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

13.6.2 PRODUCTS

13.6.2.1 Acceptable Manufacturers:

- 13.6.2.1.1 Manufacturers: Subject to compliance with requirements, provide transfer switches of one of the following or approved equal:
Transfer Switch shall be supplied by the generator vendor as a package.

13.6.2.2 Transfer Switches:

- 13.6.2.2.1 General: Except as otherwise indicated, provide manufacturer's standard design, materials, and components as indicated by published product information, designed and constructed as recommended by manufacturer for duty indicated, and as required for a complete installation.

The ATS shall be configured for a delayed transition – Time Delay from Neutral Switch Position to Emergency and Time Delay from Neutral Switch Position to Normal on Retransfer.

In general, the ATS shall comply with the following:

- A. The automatic transfer switch shall be of double throw construction operated by a reliable solenoid driven mechanism. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
- B. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- C. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 600 Amps.
- D. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Minimum UL listed withstand and close into fault ratings shall be as follows:

<u>Size (Amps)</u>	<u>Coordinated Breaker</u>	<u>Current Limiting Fuse</u>
40 - 225	30,000	200,000
260 to 600	50,000	200,000
800	65,000	200,000
1000 - 1200	85,000	200,000
1600 - 3000	100,000	200,000

(all values at 480V RMS symmetrical, less than 20% power factor)

- E. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
- F. All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.

- G. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
 - H. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
 - I. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to NEMA temperature rise standards.
 - J. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
 - K. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
 - L. Unless specified otherwise on the drawings, the switch shall be mounted in a NEMA 1 enclosure.
- 13.6.2.2.2 Automatic Transfer Switches and auxiliary equipment factory fabricated and of types, sizes, ratings and electrical characteristics, for services indicated, which are electrically operated. Mechanically held, and electrically and mechanically interlocked shall be provided.
- 13.6.2.2.3 Transferring the Load from normal to emergency source shall be automatic when normal line voltage drops below 80 percent of rated value. The load shall automatically transfer back to normal source when voltage is restored to greater than 90 percent of rated value. All transfers shall have adjustable time delay controls.
- 13.6.2.2.4 Not used.
- 13.6.2.2.5 Controls and Contacts shall consist of: a limiting device which opens that starting circuit after 45 seconds on "Engine Fail to Start" an adjustable time delay to prevent excessive transfer and retransfer operations, a signal circuit (N.O. and N.C.) contacts and relays for starting stand-by engine-generator unit an adjustable time delay on retransfer of load to normal source to provide a 5-minute cool down period for the generator set. All time settings and adjustments shall be accessible via an operator interface at the ATS.
- Test switch for manual simulation of power outages including standby unit operation and load transfer.

Time Delays

A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.

A time delay shall be provided on transfer to emergency, adjustable from 0 to 59 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.

A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.

A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

A cooldown time delay shall be provided on shutdown of engine generator, adjustable 0 to 59 minutes 59 seconds.

A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.
5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert shall become active.

The controller shall also include a time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds in 1 second increments.

An engine generator exercising timer shall be provided to configure weekly, bi-weekly or monthly automatic testing of an engine generator set with or without load for 30 minutes fixed. It shall be capable of being configured to indicate a day of the week, and the time the testing should occur.

All adjustable time delays shall be field adjustable without the use of special tools.

Adjustable timers for Time Delay from Neutral Switch Position to Emergency Position and for Time Delay from Neutral Switch Position to Normal Position on Retransfer.

In general, the controls of the ATS shall conform to the following:

- A. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:
 1. Easy-to-view Display Screen (vendor's std.), and with LED indicators.
 2. Control panel shall display voltage and frequency of both sources.
 3. The user shall be able to view the last 16 recorded events.
 4. Capability for external communication and network interface.
 5. Adjustments to all settings shall be made from the front of the panel without opening the door.
- B. The transfer switch shall be equipped with a microprocessor-based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.
- C. All programmable and control functions shall be pass code protected and accessible through the keypad.
- D. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.
- E. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.
- F. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.
- G. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.

- 13.6.2.2.6 ARC Barriers shall be provided between poles for non-inductive loads. For inductive loads, equip poles with magnetic blowouts and ARC barriers.
- 13.6.2.2.7 Copper Lugs shall be provided for terminating the number and sizes of cables as indicated on the drawings and schedules.
- 13.6.2.2.8 Enclosure shall be NEMA 4X stainless steel with swing out service panel and door locks. If vendor elects to paint the enclosure, coat enclosure with manufacturer's standard color acrylic enamel finish over a corrosion - resisting primer.

13.6.3 EXECUTION

- 13.6.3.1 Examination:
 - 13.6.3.1.1 Examine areas and conditions under which transfer switches are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- 13.6.3.2 Installation of Transfer Switch Equipment:
 - 13.6.3.2.1 Install transfer switches, including associated control devices as indicated in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that transfer switches comply with requirements. Comply with applicable requirements of NEC and NFPA pertaining to writing practices and installation of electrical power transfer switches.
 - 13.6.3.2.2 Coordinate with other electrical work including raceways and electrical boxes and fittings, as necessary to interface installation of transfer switch work with other work.
 - 13.6.3.2.3 Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
- 13.6.3.3 Grounding:
 - 13.6.3.3.1 Provide equipment grounding connections for transfer switch units as indicated. Tighten connectors to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.
- 13.6.3.4 Field Quality Control:

13.6.3.4.1 Test transfer switches, by means of simulated power outage; automatic start-up by remove-automatic starting, transfer of load, and automatic shutdown. Prior to these tests, adjust transfer switch timers for proper system coordination.

Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of transfer switches with requirements. Where possible, correct malfunctioning units as site and retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Initial testing and retesting, where necessary, at no cost to Owner.

13.6.3.5 Personnel Training:

13.6.3.5.1 Operating Personnel Training: Train Owner's personnel in procedures for starting-up, testing and operating transfer switches and auxiliary equipment.

END OF SECTION 13



**CITY OF
TALLAHASSEE**

Appendix

Standard Construction Details for
Water and Sewer Construction

Prepared by:

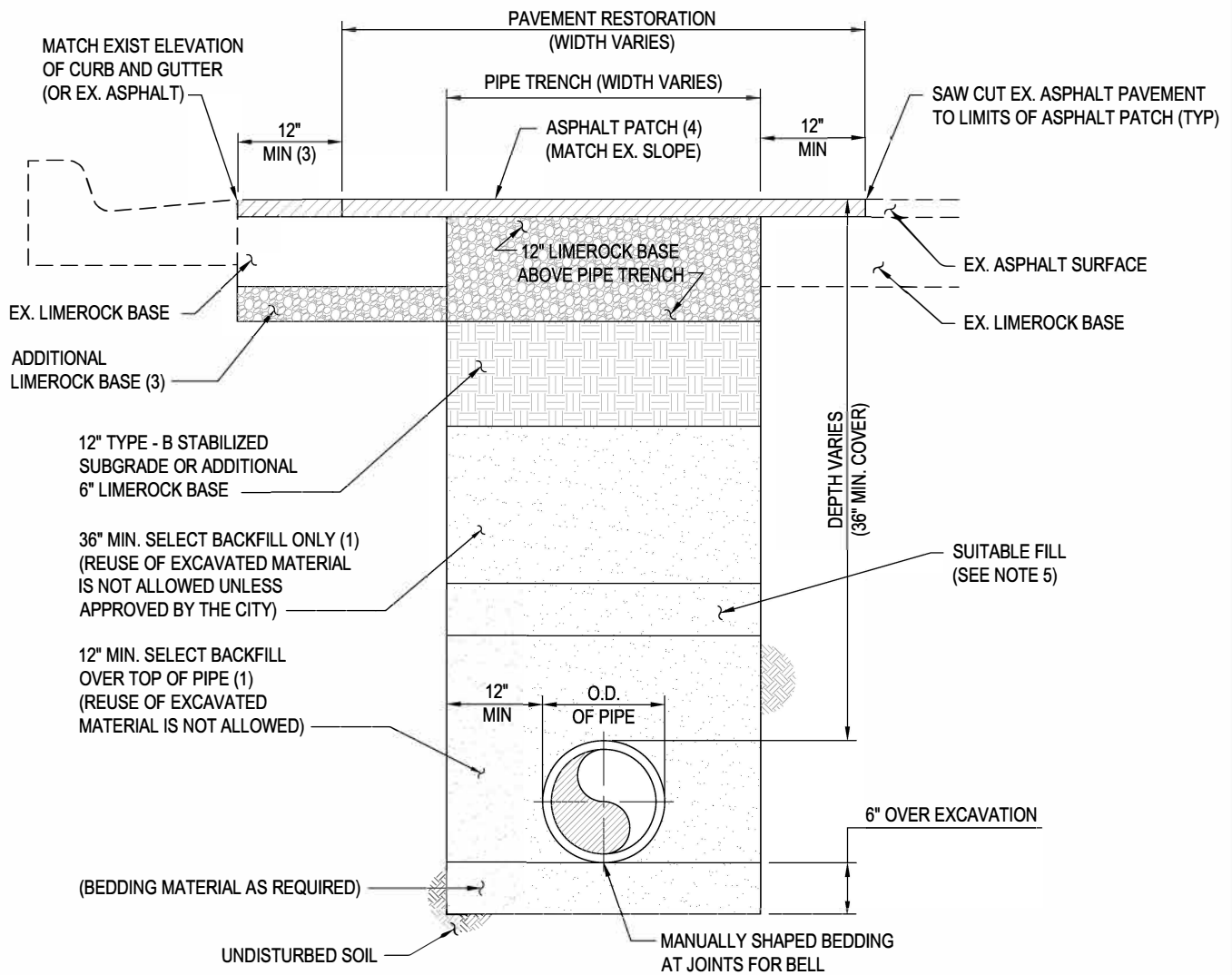
Underground Utilities & Public Infrastructure
Water Utility Engineering Division
408 North Adams Street
Tallahassee, Florida 32301

December 2023

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 INFRASTRUCTURE DEPARTMENT FLEXIBLE PAVEMENT DESIGN, CURRENT EDITION.
5. SUITABLE FILLS LIMITED TO SELECT SAND AND PLASTIC MATERIAL IN ACCORDANCE WITH F.D.O.T. INDEX 120-001.
6. NO ORGANIC MATERIALS AND PARTICLES EXCEEDING 4" IN DIAMETER WILL BE PERMITTED.
7. TACK COAT TO BE APPLIED TO ALL CUT SURFACES.

MINIMUM ASPHALT THICKNESS	
LOCAL STREETS	2.0"
MINOR COLLECTORS	2.5"
MAJOR COLLECTORS	3.0"
MINOR ARTERIALS	3.5"
MAJOR ARTERIALS	4.0"

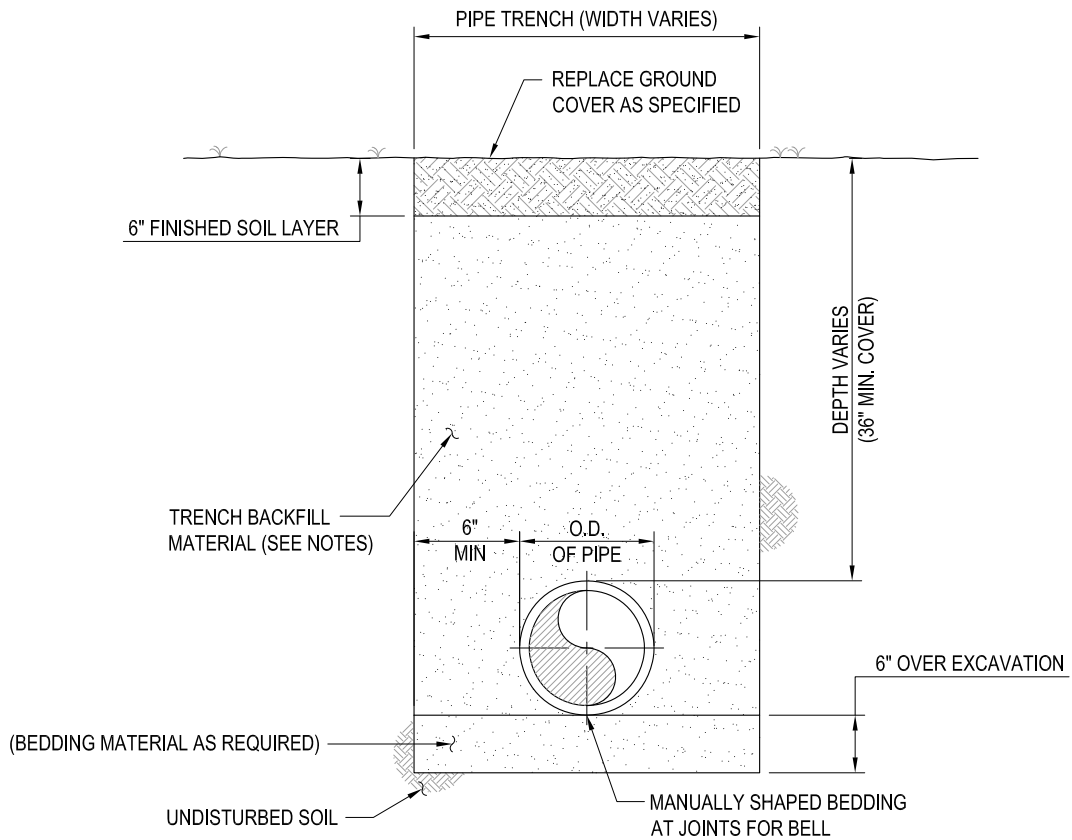


**PIPE TRENCH AND ASPHALT PATCH
WITHIN PUBLIC ROW AND ALL IMPROVED AREAS**

Date Issued: NOVEMBER 2023	SHEET G01
Approved by: WUE	
File Location: WS\PROG\1600-W&S\Specs\06-2023.	Scale: N.T.S.

NOTES:

1. TRENCH BACKFILL SHALL BE "SUITABLE FILL" 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.



Title:

PIPE TRENCH WITHIN UNIMPROVED AREAS

Date Issued:

NOVEMBER 2023

Approved by:

WUE

File Location:

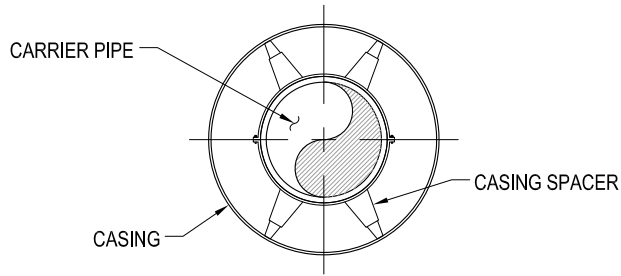
WS\PROG\1600-W&Sspecs\06-2023.

SHEET

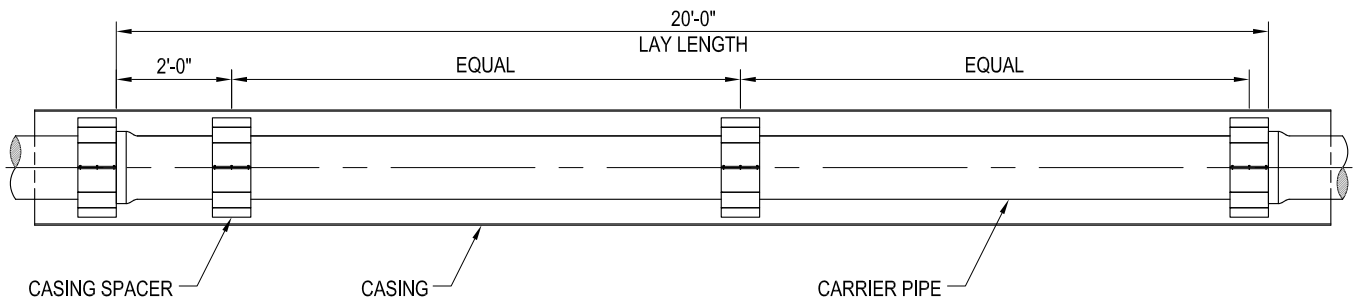
G02

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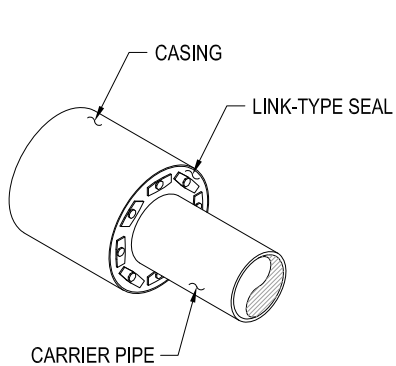
N.T.S.



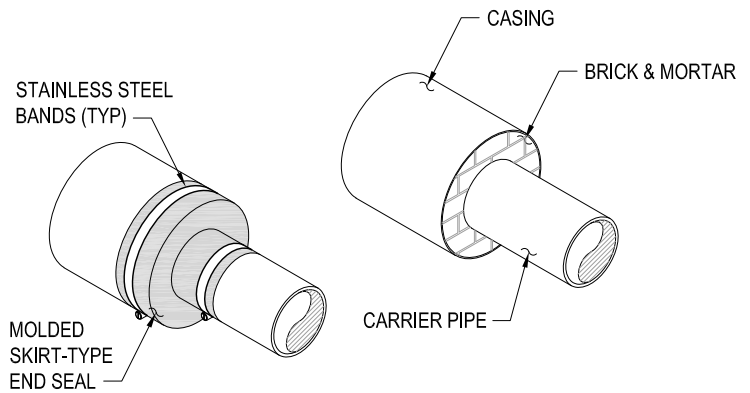
CROSS SECTION



PROFILE



LINK-TYPE CASING END SEAL



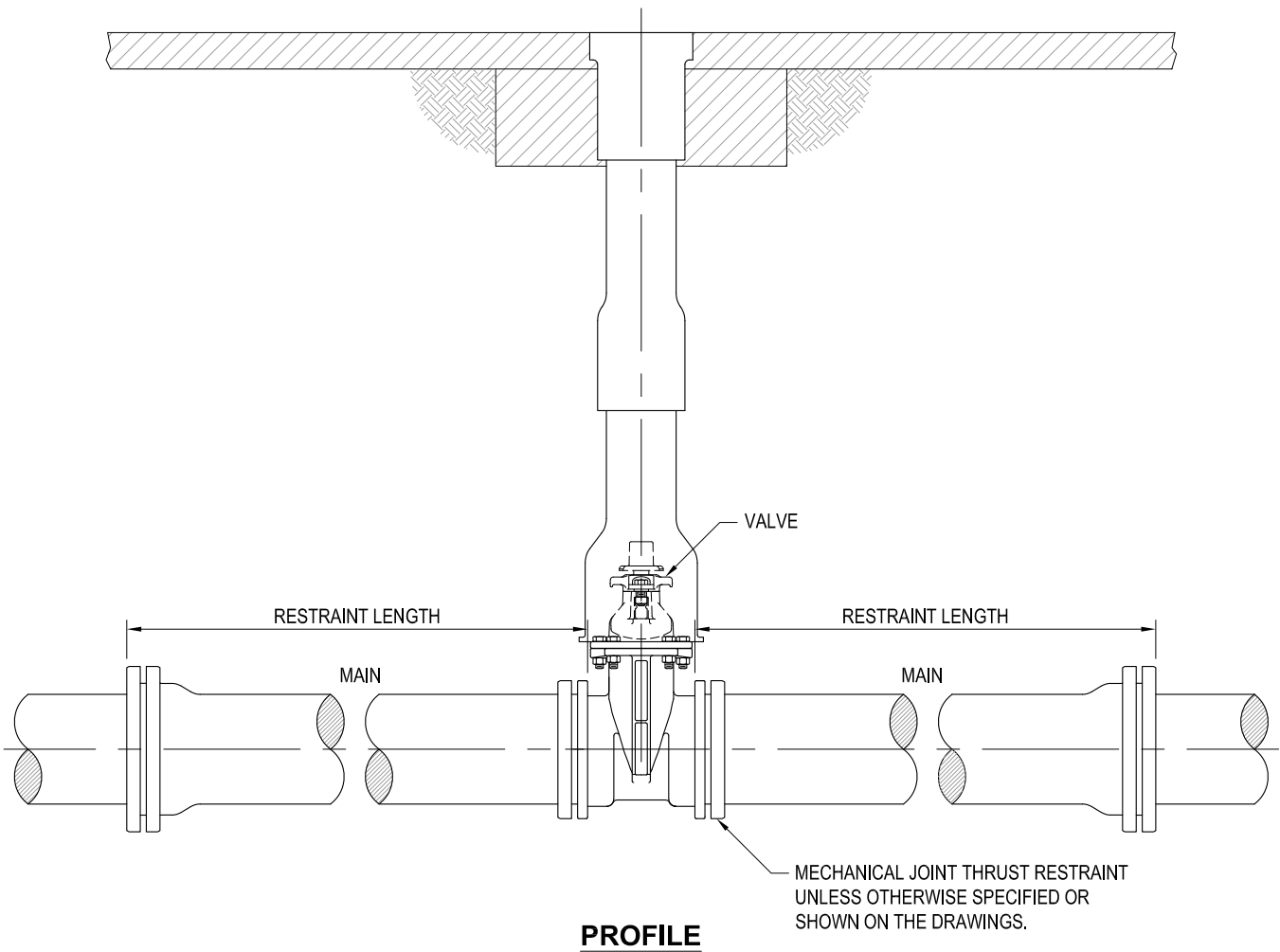
SKIRT-TYPE END SEAL OVER MASONRY PLUG

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.

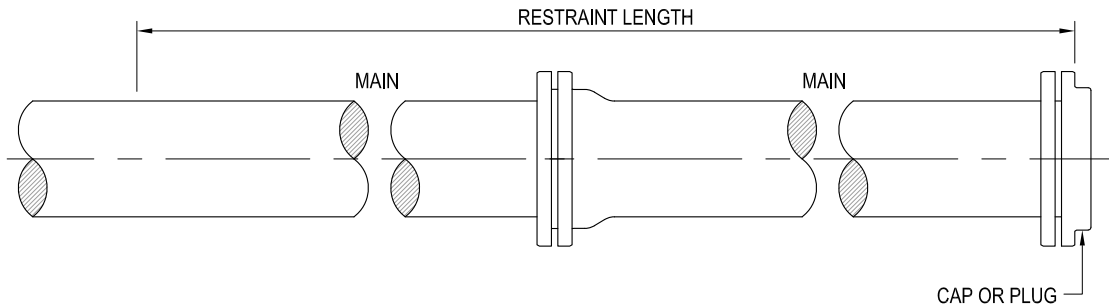


RESTRAINT LENGTH FOR DEAD ENDS AND VALVES (IN FEET)

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 TALLAHASSEE 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



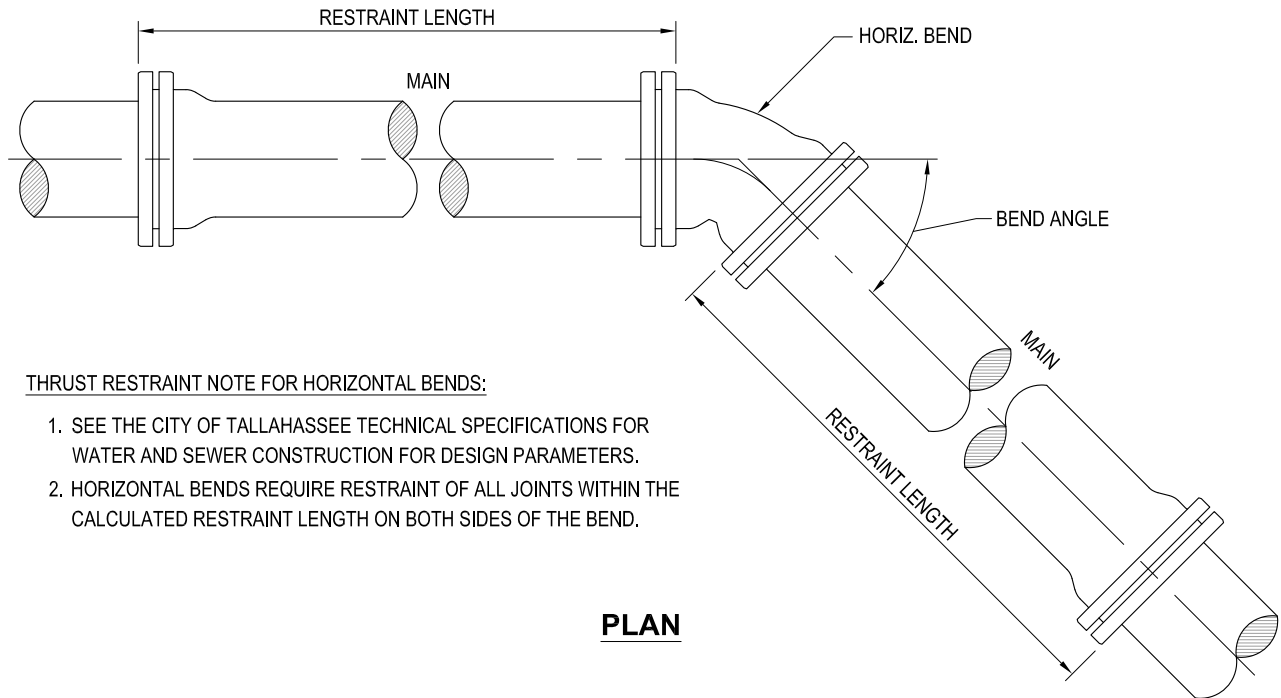
Title:

THRUST RESTRAINTS FOR DEAD ENDS

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
G05
Scale:
N.T.S.

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



Title:

THRUST RESTRAINTS FOR HORIZONTAL BENDS

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

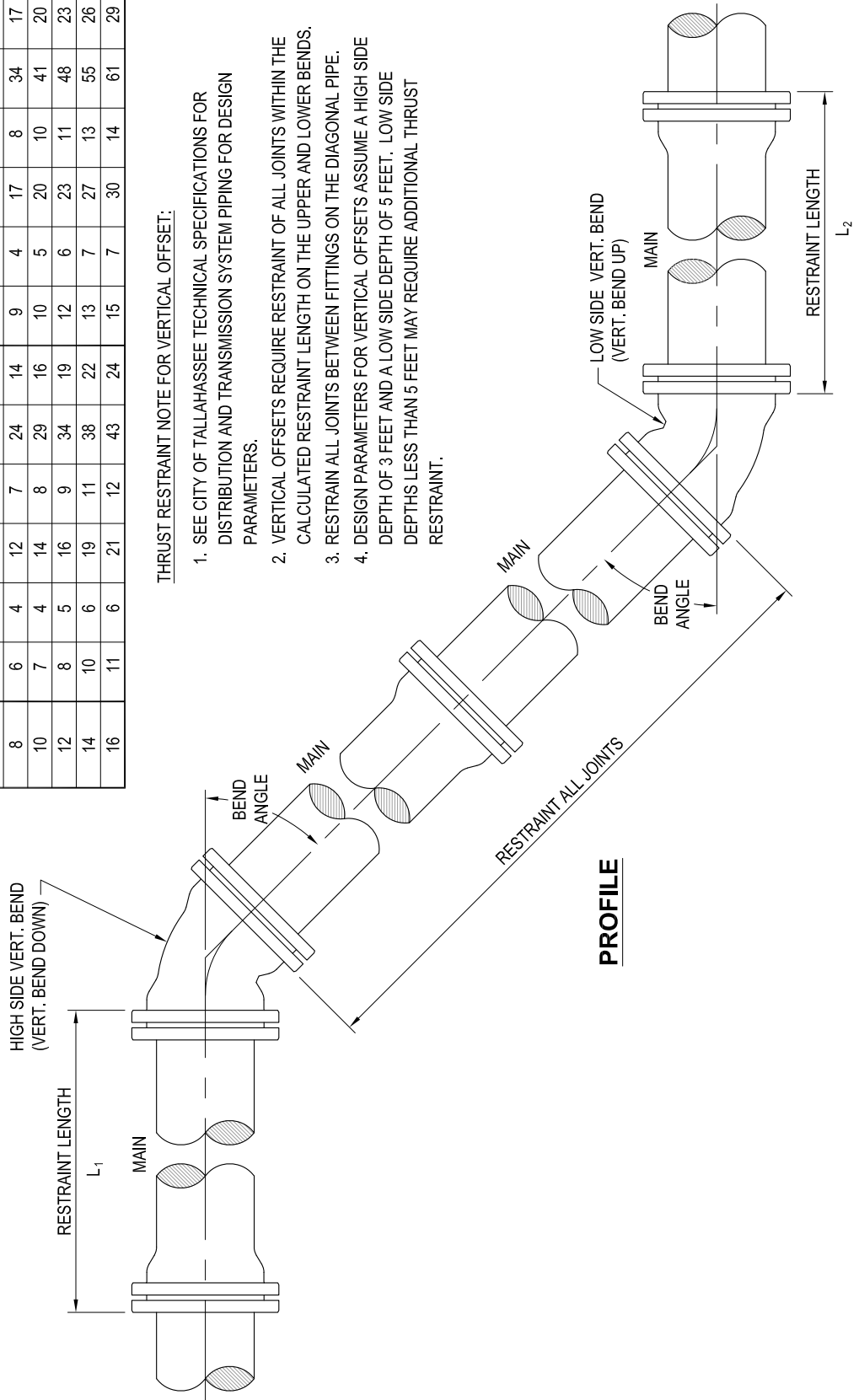
SHEET
G06
Scale:
N.T.S.

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.

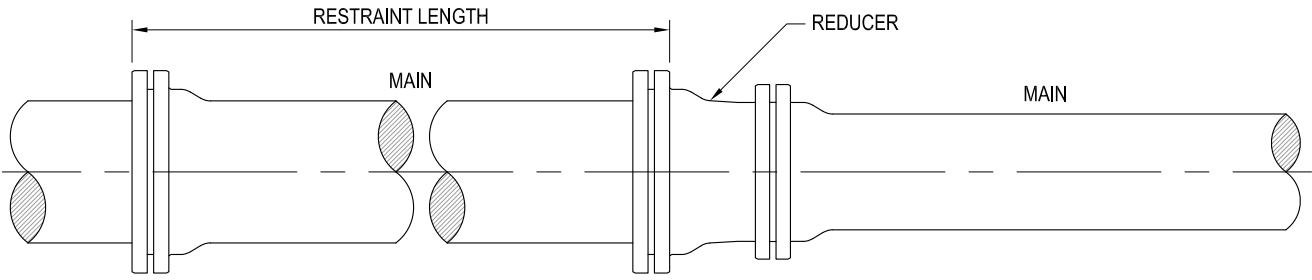


PROFILE

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.



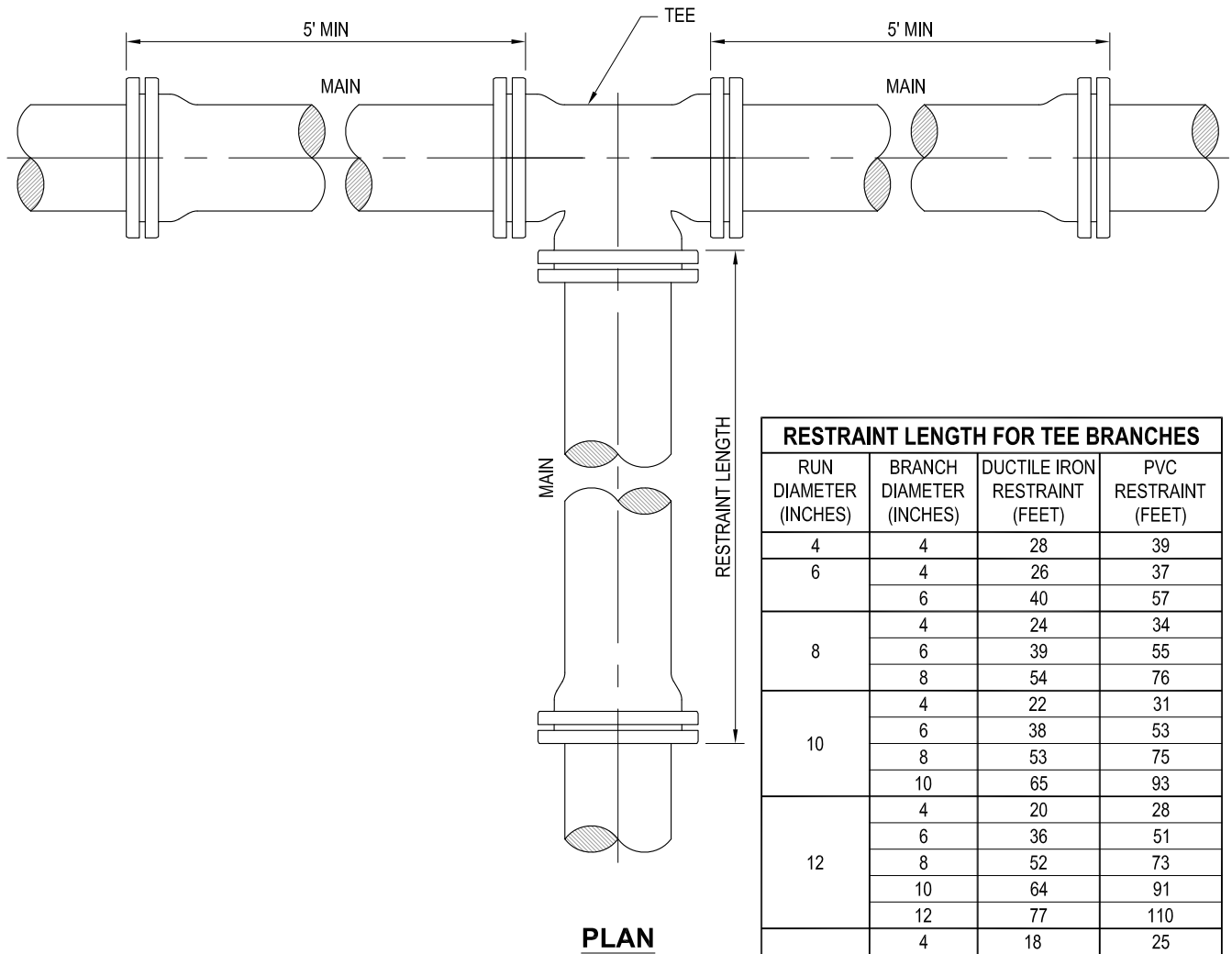
PLAN



Title: **THRUST RESTRAINTS FOR REDUCERS**

Date Issued: **NOVEMBER 2023**
 Approved by: **WUE**
 File Location: **WS\PROG\1600-W&S\Specs\06-2023.**

SHEET **G08**
 Scale: **N.T.S.**



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
8	4	40	57
	6	24	34
	8	39	55
10	8	54	76
	4	22	31
	6	38	53
	10	65	93
12	4	20	28
	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	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.



Title:

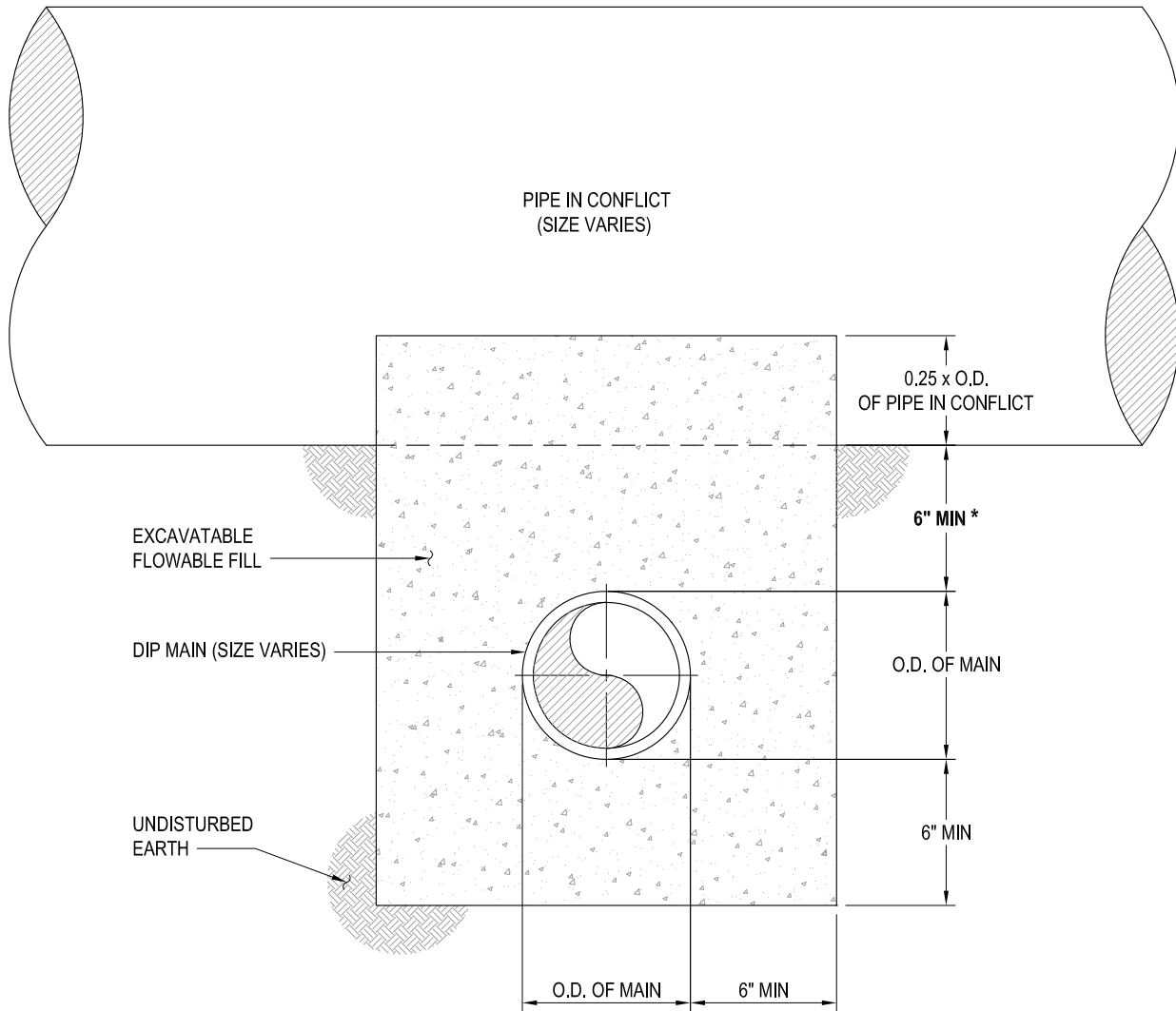
THRUST RESTRAINTS FOR TEES

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
G09
Scale:
N.T.S.

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"



Title:

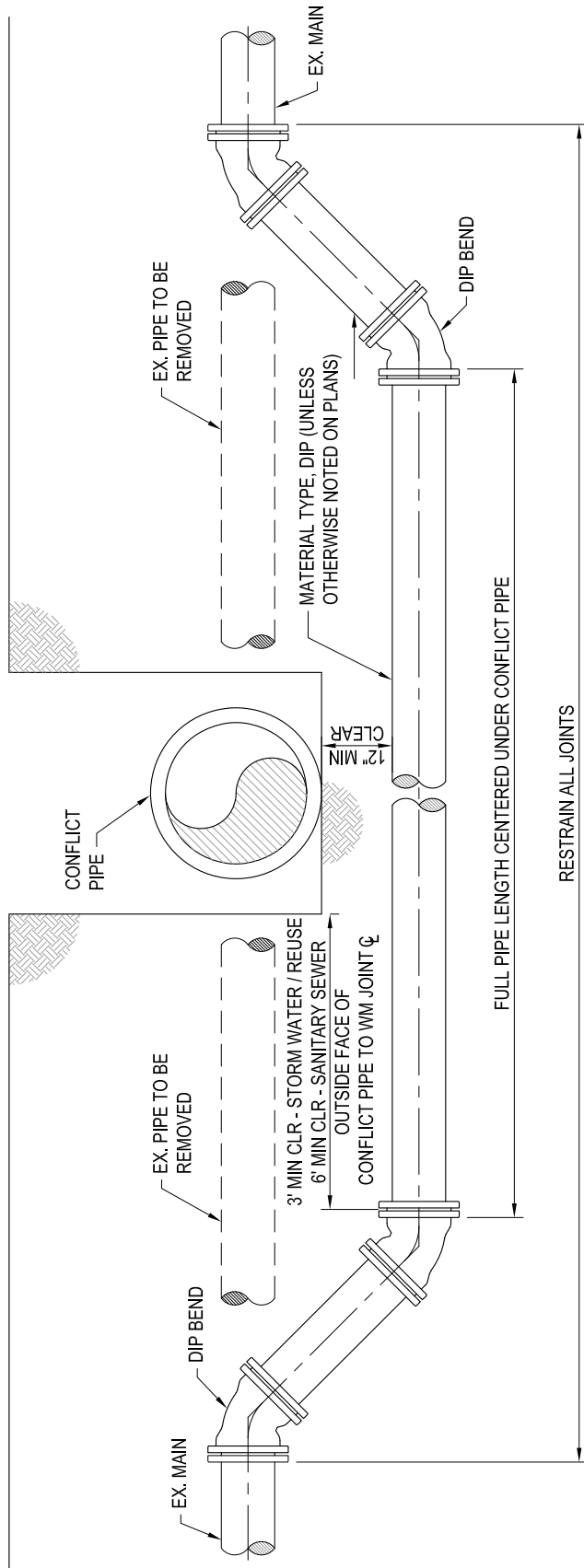
**PIPE ENCASEMENT FOR UTILITY CROSSINGS
w/ LESS THAN 12" VERTICAL SEPARATION**

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WSIPROG1600-W&Sspecs/06-2023.

SHEET
G10
Scale:
N.T.S.

NOTES:

1. RESTRAINT LENGTHS FOR VERTICAL OFFSETS SHALL BE IN ACCORDANCE WITH THE CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. ENGINEER OF RECORD SHALL DETERMINE IF AN AIR RELEASE VALVES IS REQUIRED FOR SANITARY SEWER FORCE MAIN APPLICATIONS.



CITY OF TALLAHASSEE

Title:

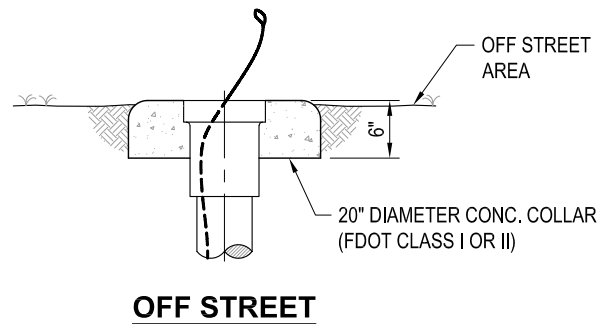
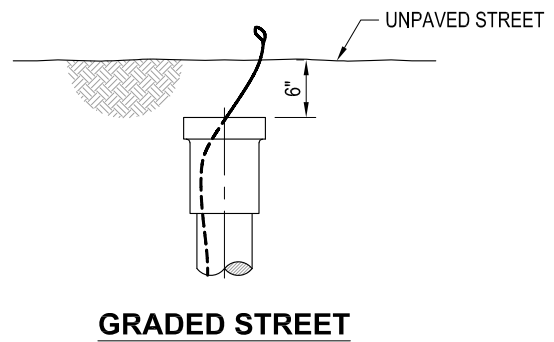
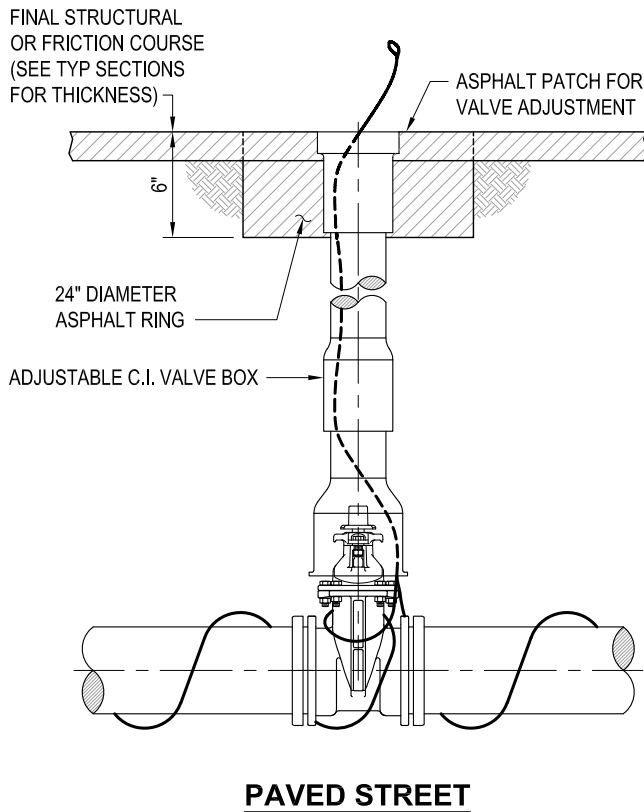
STANDARD MAIN LOWERING

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
G11
Scale:
N.T.S.

NOTES:

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 ASPHALT RING 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.



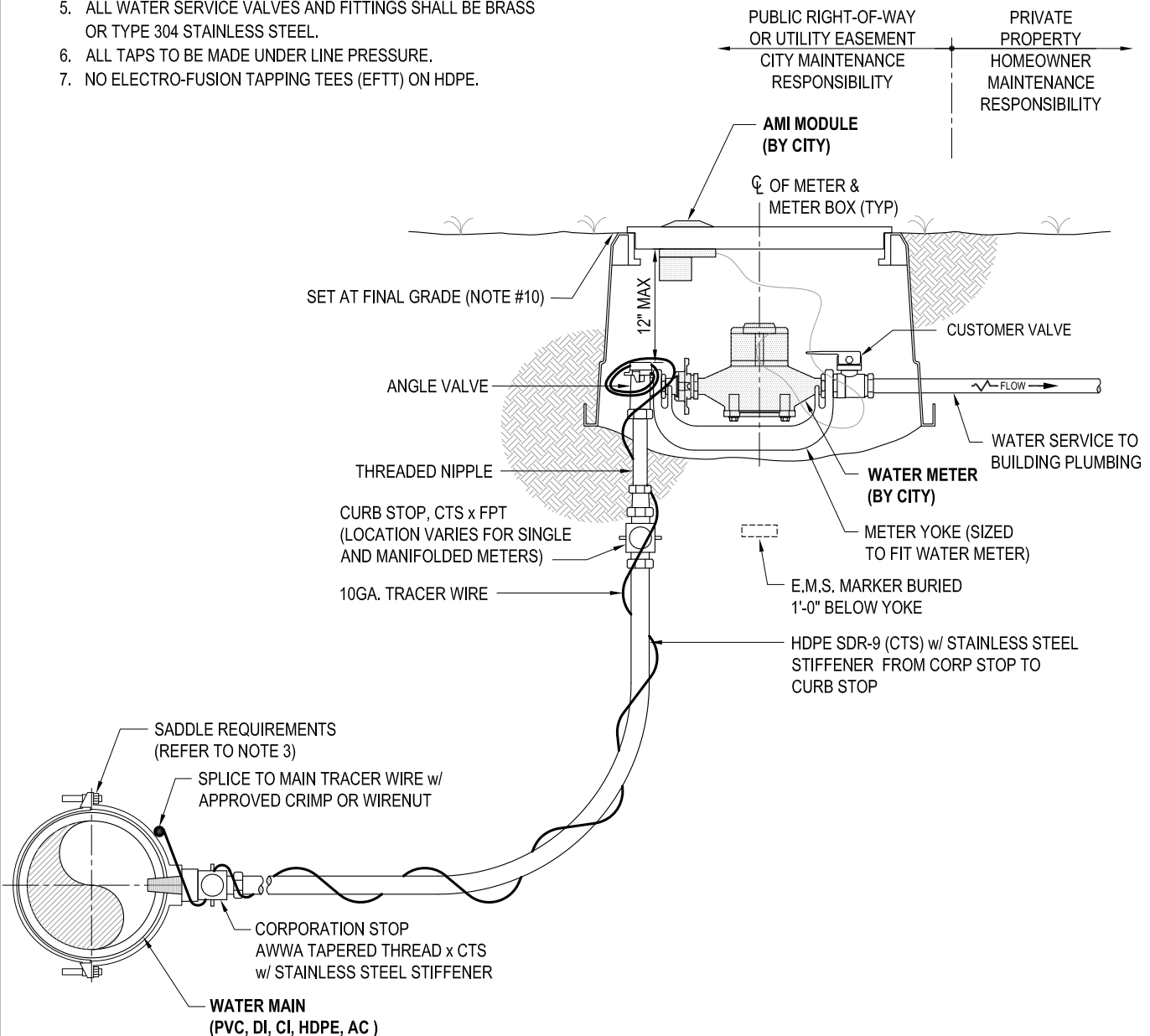
Title: **TYPICAL VALVE BOX PLACEMENT**

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
W01
Scale:
N.T.S.

NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO THE LATEST EDITION OF THE 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, HDPE, AND AC MAINS REQUIRE SADDLES (REFER TO TECHNICAL SPECIFICATIONS). DIRECT TAP ONLY ON DUCTILE PIPE. TAP AT 9 OR 3 O'CLOCK ONLY.
4. METER BOX SHALL BE TRAFFIC BEARING FOR PAVEMENT AREAS. LID SHALL BE COMPATIBLE WITH AMI SYSTEM.
5. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.
6. ALL TAPS TO BE MADE UNDER LINE PRESSURE.
7. NO ELECTRO-FUSION TAPPING TEES (EFTT) ON HDPE.
8. FOR NEW DEVELOPMENTS, THE CONTRACTOR SHALL INSTALL THE WATER SERVICE THROUGH THE CURB STOP AND PLACE AN EMS MARKER WITH ABOVE GROUND SERVICE MARKER AT THE END OF THE SERVICE LINE.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OR REPLACEMENT OF THE METER ASSEMBLY AND APPURTENANCES IF DAMAGED BY THE CONTRACTOR DURING CONSTRUCTION.
10. METER BOX AND TOP SHALL BE CLEAR OF ALL DEBRIS TO ALLOW FULL ACCESS TO BOX (I.E. NO DIRT, TRASH, OR OTHER DEBRIS PLACED ON TOP OF BOX).

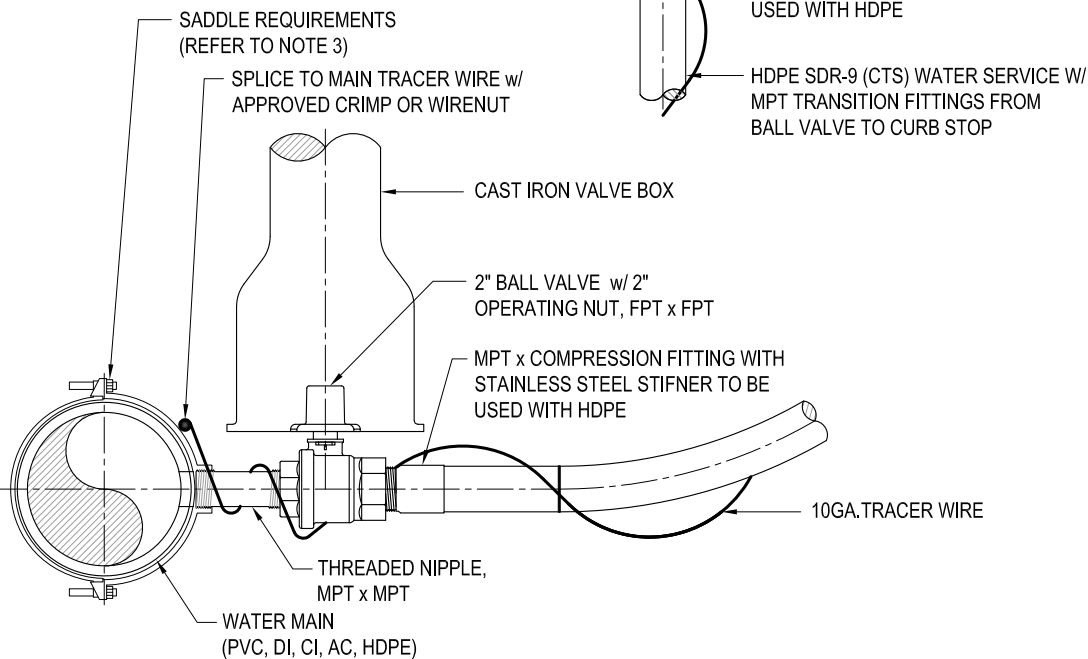
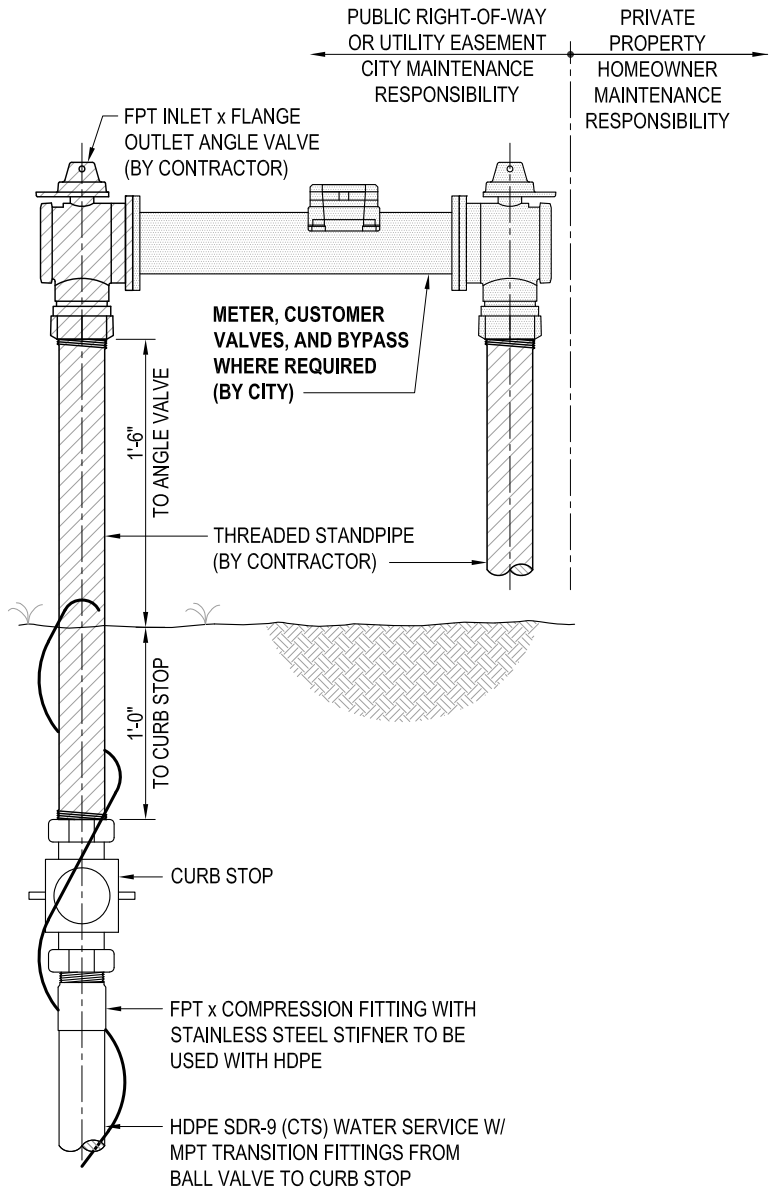


Title: **5/8" & 1" WATER SERVICE AND METER SETTING**

Date Issued: NOVEMBER 2023	SHEET W02
Approved by: WUE	
File Location: WSIPROG1600-W&Sspecs/06-2023.	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. ALL MAIN TAPS REQUIRE SADDLES (REFER TO TECHNICAL SPECIFICATIONS). TAP AT 9 OR 3 O'CLOCK ONLY.
4. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE LEAD FREE BRASS / BRONZE.
5. ALL TAPS TO BE MADE UNDER LINE PRESSURE.
6. FOR NEW DEVELOPMENTS, THE CONTRACTOR SHALL INSTALL THE WATER SERVICE THROUGH THE CURB STOP AND PLACE AN EMS MARKER WITH ABOVE GROUND SERVICE MARKER AT THE END OF THE SERVICE LINE.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OR REPLACEMENT OF THE METER ASSEMBLY AND APPURTENANCES IF DAMAGED BY THE CONTRACTOR DURING CONSTRUCTION.



Title:

1 1/2" & 2" WATER SERVICE AND METER SETTING

Date Issued:
NOVEMBER 2023

Approved by:
WUE

File Location:
WS\PROG\1600-W8\Specs\06-2023.

SHEET
W03

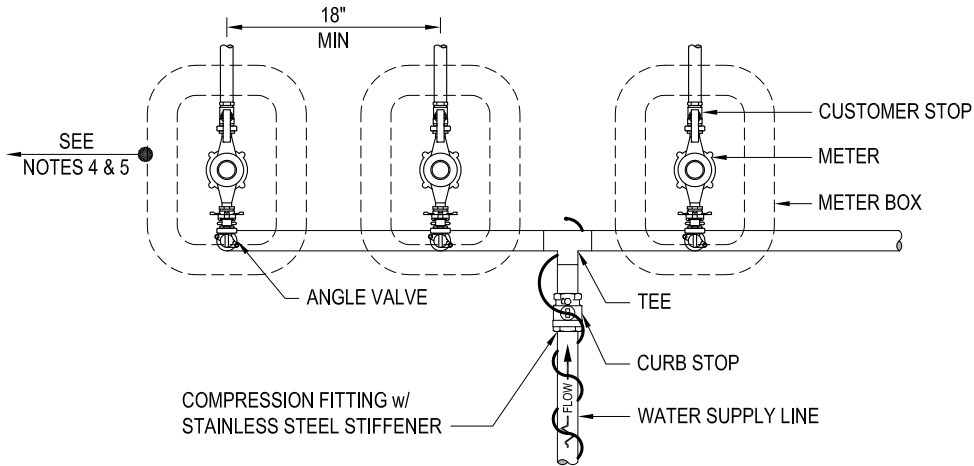
Scale:
N.T.S.

NOTES:

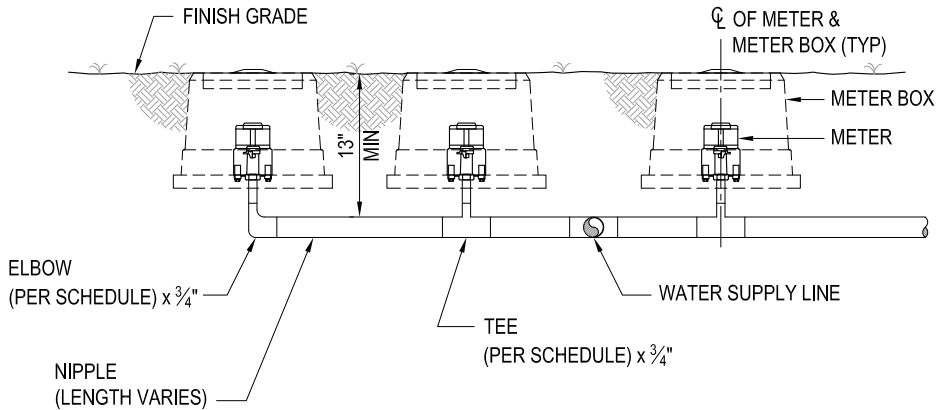
1. ALL MATERIAL FOR METER AND MANIFOLDS SHALL BE IN ACCORDANCE WITH THE BUY AMERICAN ACT.
2. ALL MANIFOLD PIPING, VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL. ON 1½" AND 2" METERS FOR ABOVE GROUND APPLICATIONS, GALVANIZED PIPE MAY BE USED.
3. 1" HDPE BLUE TUBING SDR-9 (CTS) w/ 1" MANIFOLD FOR:
UP TO (3) THREE 5/8" METERS PER MANIFOLD, MAX.
4. 1½" HDPE BLUE TUBING SDR-9 (CTS) w/ 1½" MANIFOLD FOR :
UP TO (5) FIVE 5/8" METERS PER MANIFOLD, MAX.
5. 2" HDPE BLUE TUBING SDR-9 (CTS) w/ 2" MANIFOLD FOR :
(6) SIX TO (10) TEN 5/8" METERS, (10) MAX.
6. METER SHALL BE CENTERED IN METER BOX.
7. METER BOXES SHALL BE CLEAR OF ALL STRUCTURES ON ALL SIDES, 30" MIN.
8. ENGINEER OF RECORD SHALL VERIFY AVAILABLE CITY SYSTEM PRESSURE AT THE SERVICE LOCATION AND EVALUATE POTENTIAL HEAD LOSS TO DETERMINE IF A METER MANIFOLD IS SUITABLE TO SUPPLY END USE FLOW AND PRESSURE DEMANDS.
9. FOR ALL SUBDIVISIONS, DUAL METER MANIFOLDS SHALL BE CENTERED ON PROPERTY LINE.

METERS ALLOWED PER MANIFOLD		
No. OF 5/8" METERS	SIZE OF SERVICE	CONFIGURATION
2	1" or 1½"	
3	1" or 1½"	
4	1½"	
5	1½" 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.



PLAN



SECTION

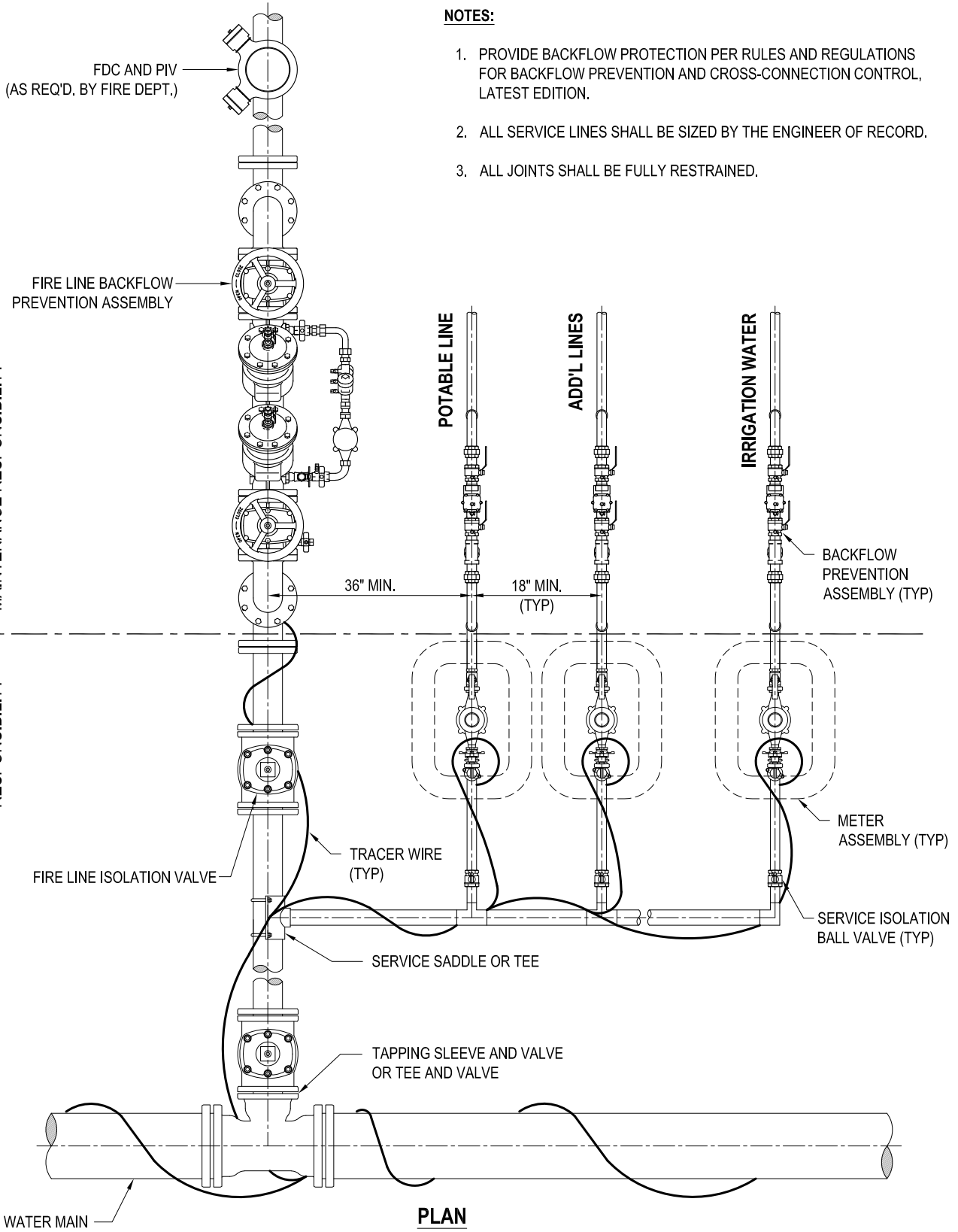


Title:

MANIFOLDS FOR 5/8" METER

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W8\Specs\06-2023.

SHEET
W04
Scale:
N.T.S.



NOTES:

1. PROVIDE BACKFLOW PROTECTION PER RULES AND REGULATIONS FOR BACKFLOW PREVENTION AND CROSS-CONNECTION CONTROL, LATEST EDITION.
2. ALL SERVICE LINES SHALL BE SIZED BY THE ENGINEER OF RECORD.
3. ALL JOINTS SHALL BE FULLY RESTRAINED.

PLAN

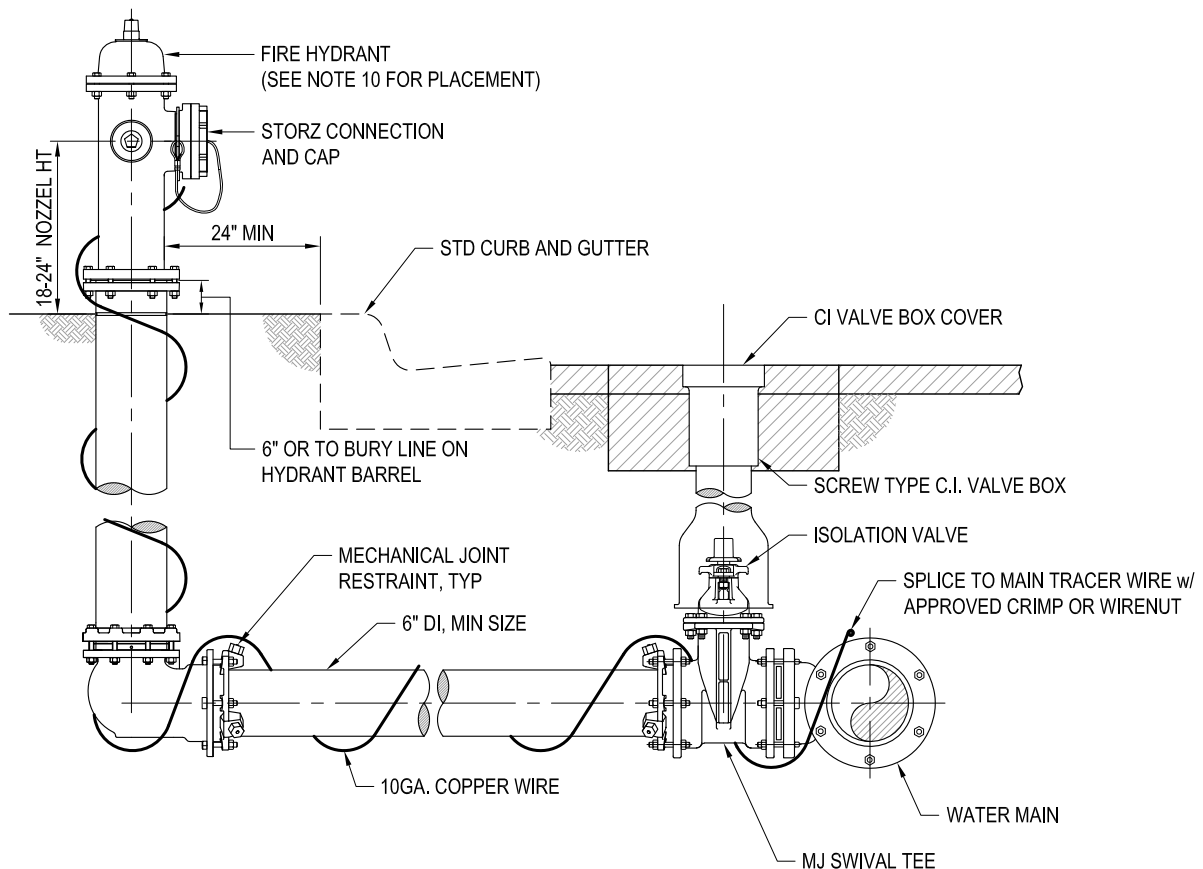


Title: **FIRELINE w/ METERED SERVICE**

Date Issued: NOVEMBER 2023	SHEET W05
Approved by: WUE	
File Location: WS\PROG\1600-W&S\Specs\06-2023.	Scale: N.T.S.

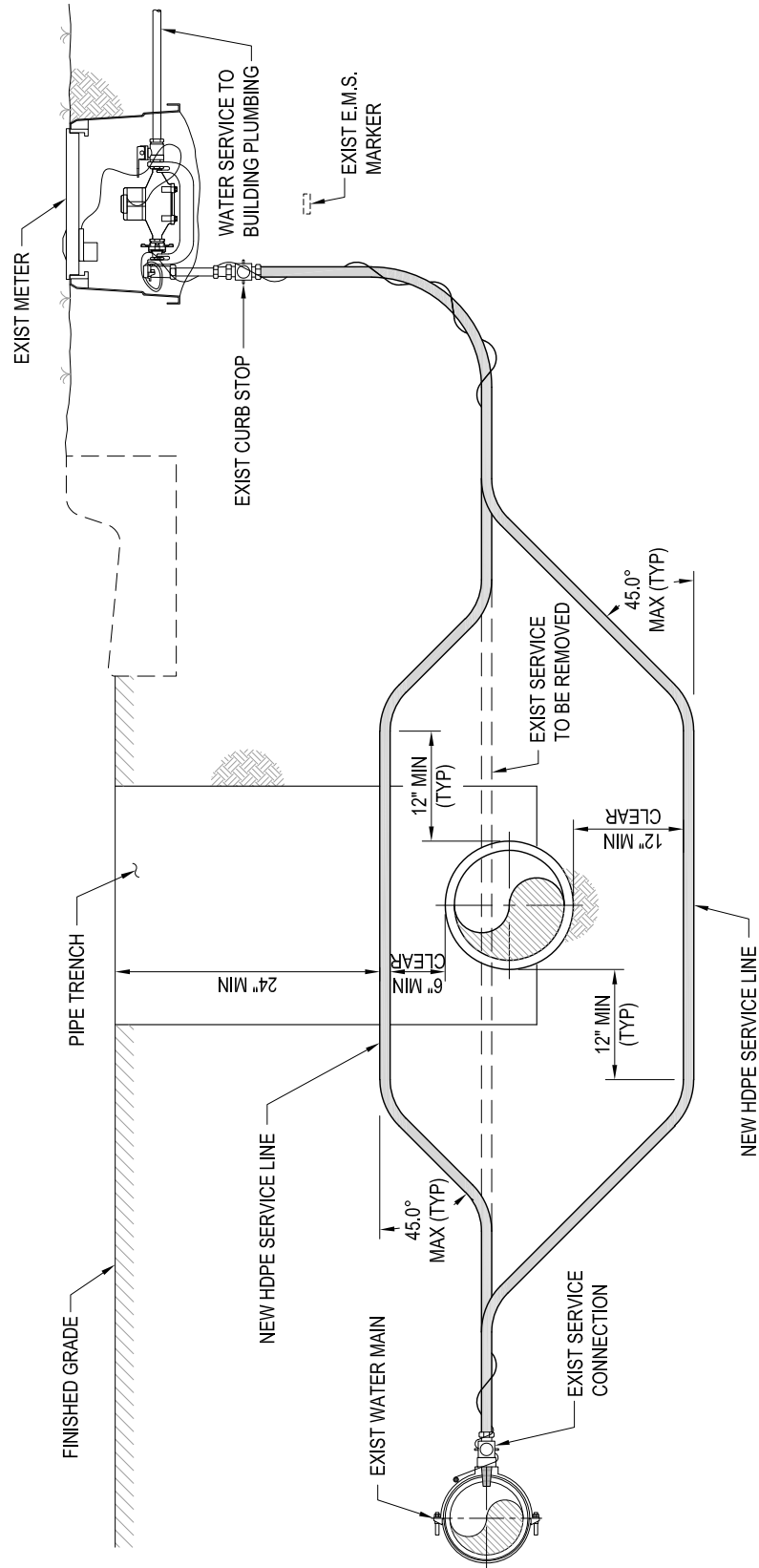
NOTES:

1. HYDRANT TO BE PLACED WITH PUMPER NOZZLE FACING STREET.
2. VALVE OPENING 5 1/4" MINIMUM.
3. SIX INCH MJ CONNECTION TO MAIN.
4. 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.
5. ALL PIPE FROM MAIN TO HYDRANT SHALL BE RESTRAINED DUCTILE IRON w/o FITTINGS.
6. COMPACTION WILL BE 100% STANDARD PROCTOR.
7. DEPTH OF PIPE TO HAVE 36" MINIMUM COVER.
8. HYDRANTS PAINT SHALL BE COMEX (U-10: HIGH SOLIDS, GLOSS POLYURETHANE) OVER (M-10: UNIVERSAL PRIMER) OR APPROVED EQUAL.
9. HYDRANTS COLOR:
SAFETY YELLOW - HYDRANTS PLACED ON CITY WATER MAINS.
RED - HYDRANTS PLACED ON PRIVATE WATER MAINS.
OFF WHITE - HYDRANT PRIMER.
10. 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)
11. 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.



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



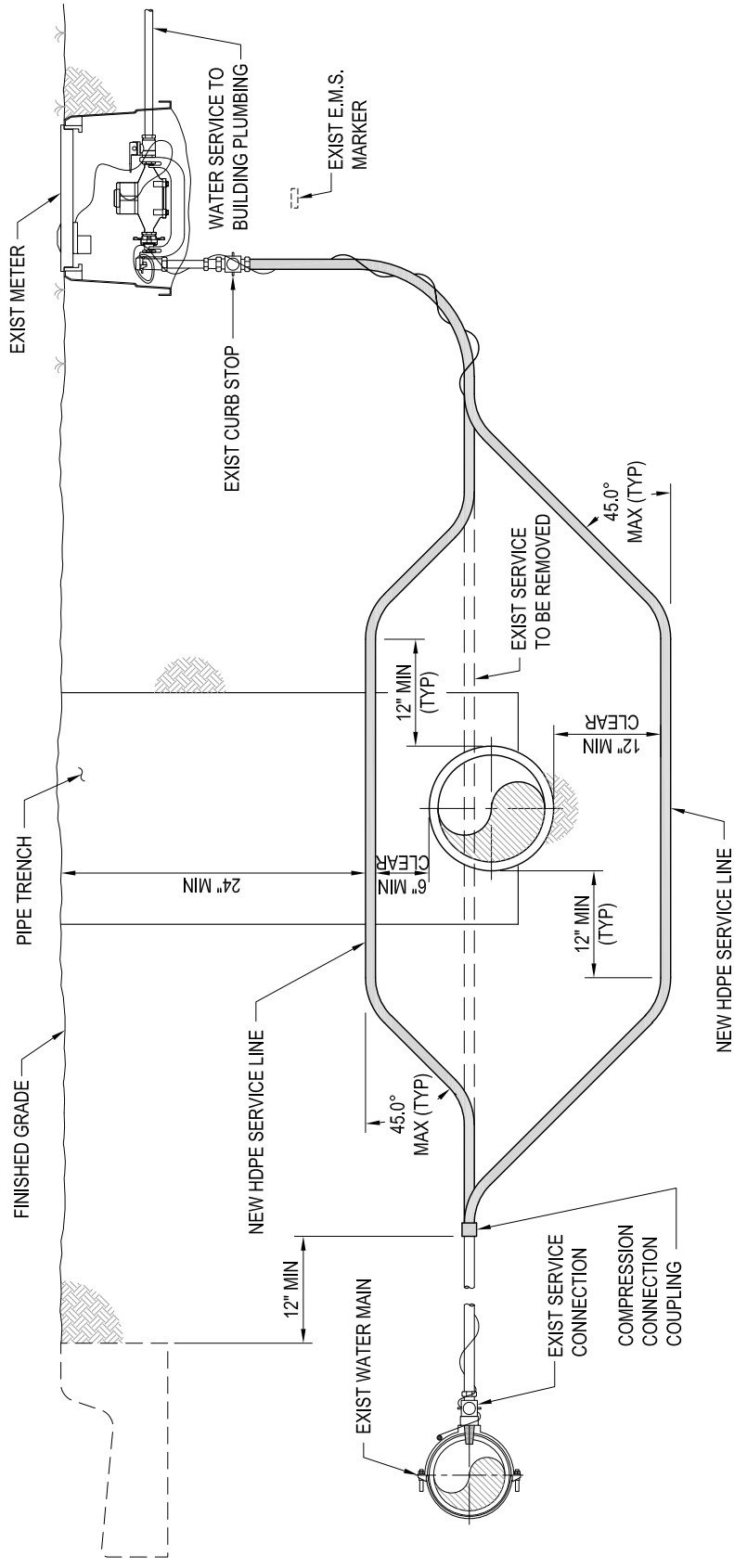
Title: **WATER SERVICE ADJUSTMENT (IMPROVED AREAS)**

Date Issued: **NOVEMBER 2023**
 Approved by: **WUE**
 File Location: **WS\PROG\1600-W8\Specs\06-2023.**

SHEET **W07**
 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



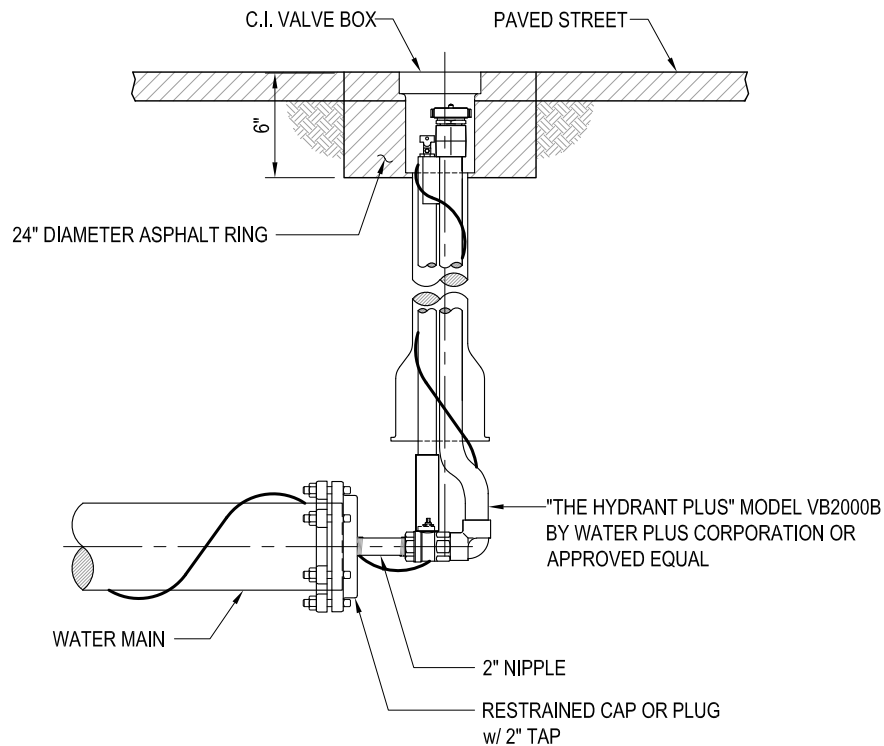
Title: **WATER SERVICE ADJUSTMENT (UNIMPROVED AREAS)**

Date Issued: **NOVEMBER 2023**
 Approved by: **WUE**
 File Location: **WSIPROG1600-W8Specs/06-2023.**

SHEET **W08**
 Scale: **N.T.S.**

NOTES:

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 ASPHALT RING 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. 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.
5. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
6. 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. WIRE SHALL NOT BE WRAPPED AROUND OPERATING NUT OR STEM FOR ANY REASON.
7. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.



Title:

MANUAL 2" WATER FLUSH STAND

Date Issued:

NOVEMBER 2023

Approved by:

WUE

File Location:

WS\PROG\1600-W&Specs\06-2023.

SHEET

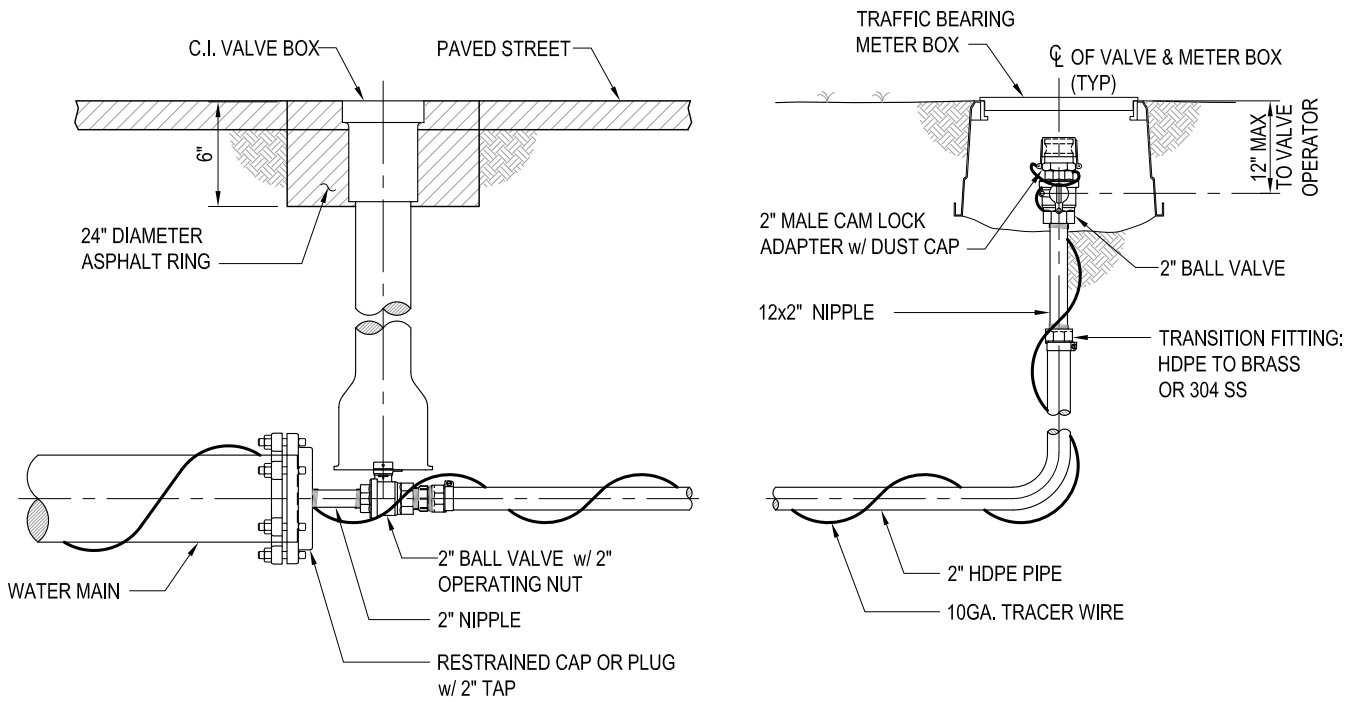
W09

Scale:

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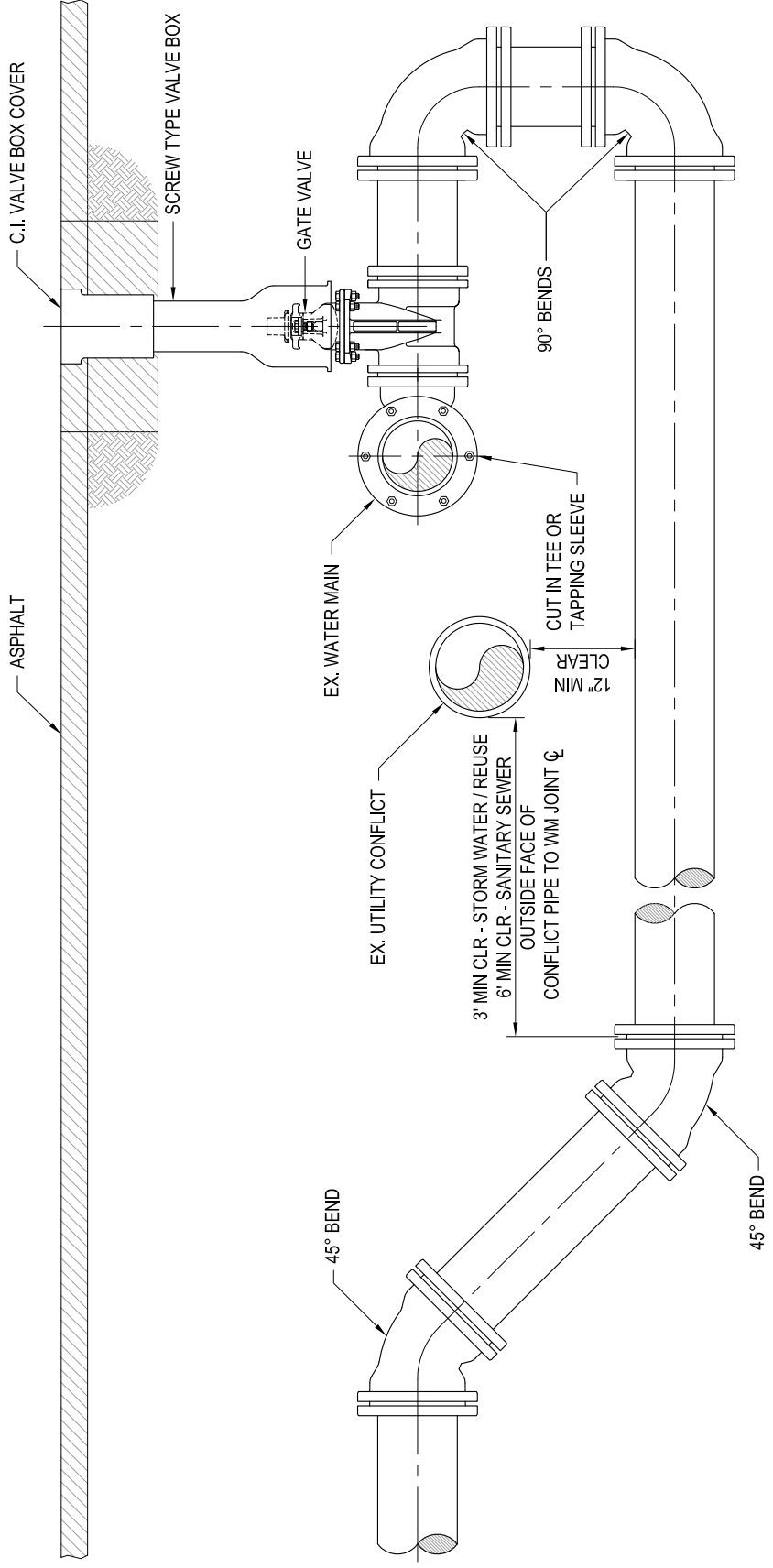
NOTES:

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 ASPHALT RING 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. 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.
5. ALL CONSTRUCTION SHALL CONFORM TO CITY OF TALLAHASSEE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
6. 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. WIRE SHALL NOT BE WRAPPED AROUND OPERATING NUT OR STEM FOR ANY REASON.
7. ALL WATER SERVICE VALVES AND FITTINGS SHALL BE BRASS OR TYPE 304 STAINLESS STEEL.



Title: **OPTIONAL MANUAL 2" WATER FLUSH STAND**

Date Issued: NOVEMBER 2023	SHEET W10
Approved by: WUE	
File Location: WSIPROG1600-W&Sspecs/06-2023.	Scale: N.T.S.



RESTRAIN ALL JOINTS FROM TEE THROUGH UPPER 45° BEND



Title:

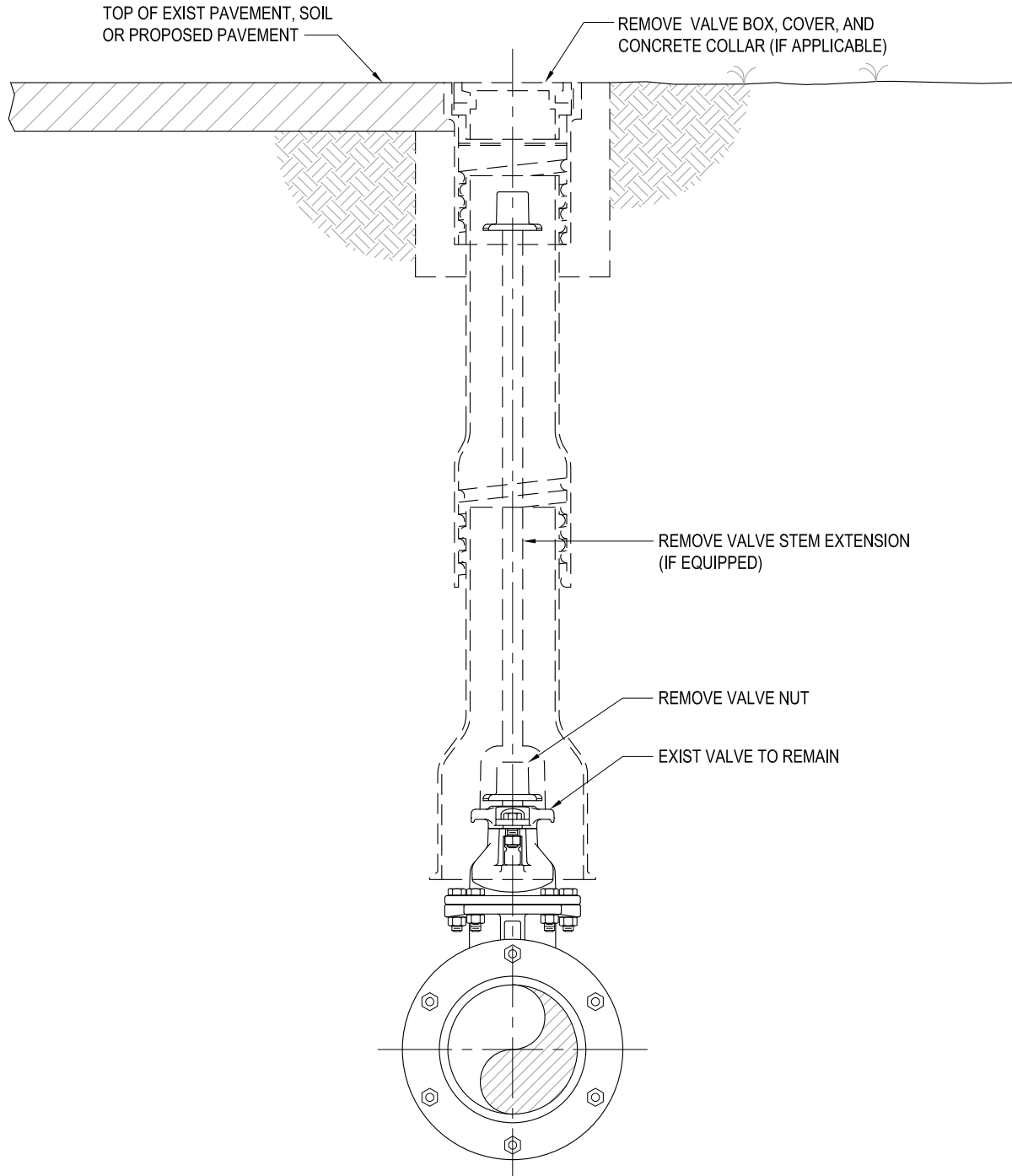
REVERSE CONNECTION AT WATER MAIN

Date Issued:
NOVEMBER 2023
 Approved by:
WUE
 File Location:
 WSPROG1600-W&Sspecs/06-2023.

SHEET
W11
 Scale:
 N.T.S.

NOTES:

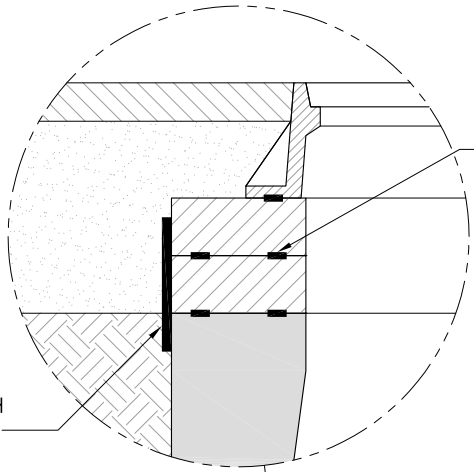
1. IN PAVEMENT: ALL CUTS AND REPAIRS TO EXIST SURFACE MUST CONFORM TO THE TECHNICAL SPECIFICATIONS FOR WATER AND SEWER CONSTRUCTION.
2. COMPACT AS REQUIRED AND MATCH EXIST GRADE AND SURFACE CONDITIONS.



Title: **VALVE PLACED OUT OF SERVICE**

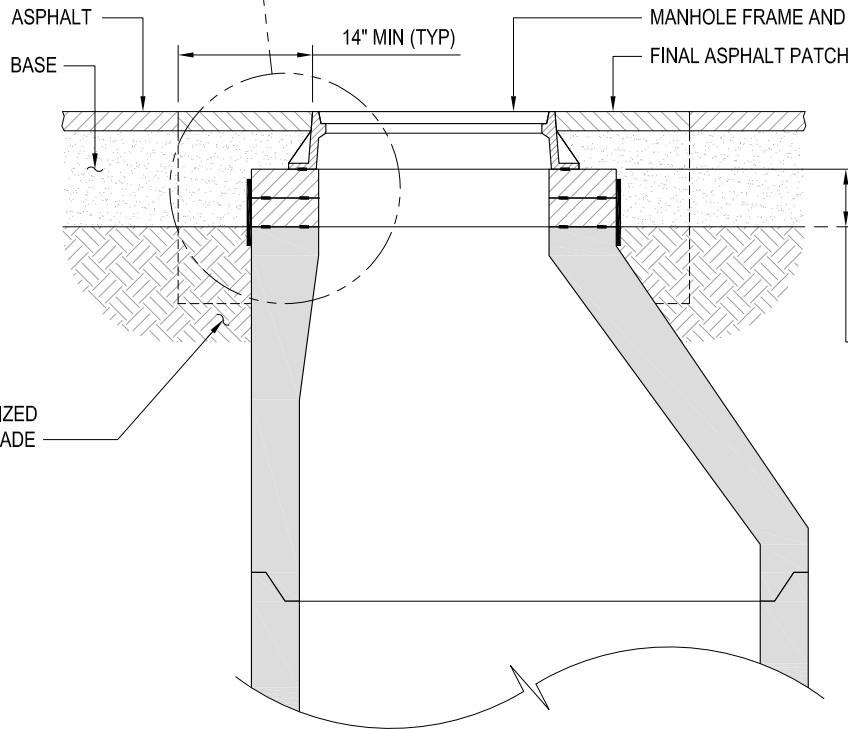
Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WSIPROG1600-W&Sspecs/06-2023.

SHEET
W12
Scale:
N.T.S.



TYP. PREFORMED OR CAULK-TYPE BUTYL ADHESIVE SEALANT AS REQ'D

EXTERNAL MH JOINT WRAP



FINISHED ROAD SURFACE AND MH & COVER ELEVATION

TOP OF MH CONE SECTION

GRADING ADJUSTMENT RING (3" MIN - 18" MAX DEPTH, AS REQ'D)

STABILIZED SUBGRADE



Title:

MANHOLE FRAME & COVER PLACEMENT

Date Issued:
NOVEMBER 2023

Approved by:
WUE

File Location:
WSIPROG1600-W&Sspecs/06-2023.

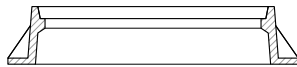
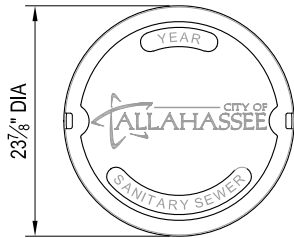
SHEET

S01

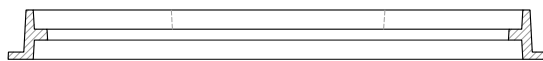
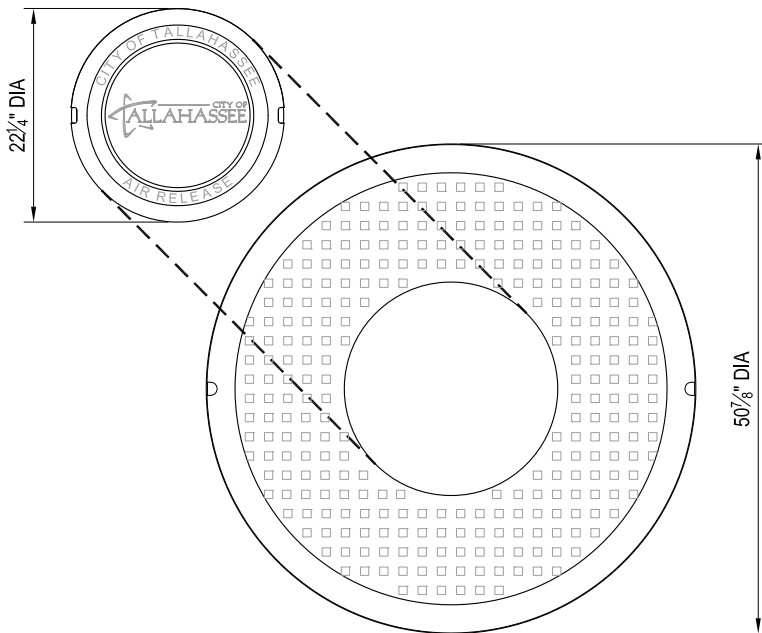
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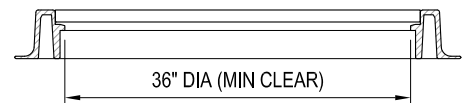
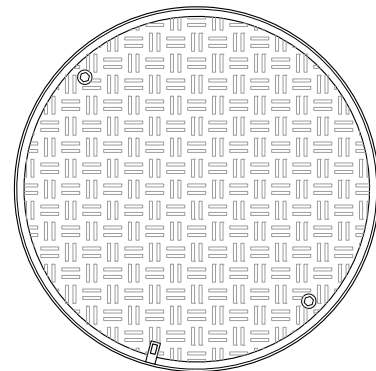
1. ALL MANHOLE COVERS IN ROADWAYS SHALL BE TRAFFIC BEARING (H-20 OR GREATER).



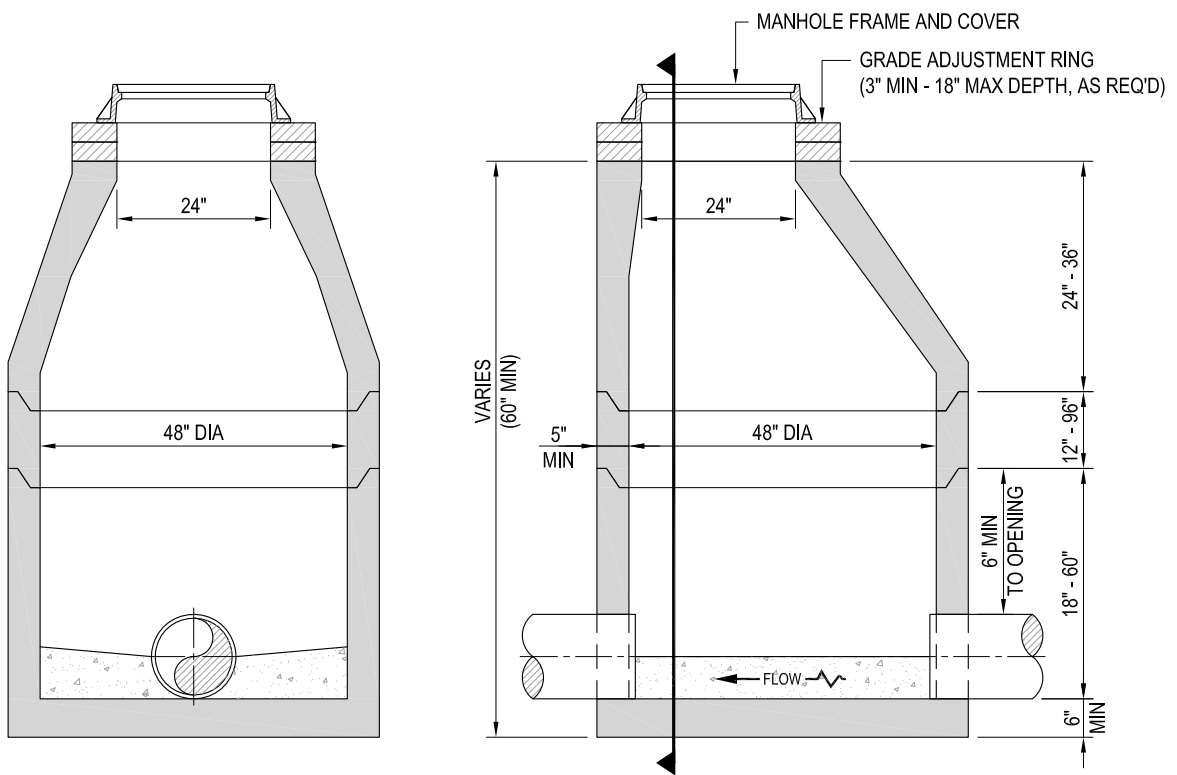
**STANDARD SANITARY SEWER
MANHOLE COVER & FRAME**



**AIR RELEASE VALVE (ARV)
MANHOLE COVER & FRAME**



**AIR RELEASE VALVE (ARV)
COMPOSITE MANHOLE COVER & FRAME**



Title:

**48-INCH MANHOLE
FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'**

Date Issued:
NOVEMBER 2023

Approved by:
WUE

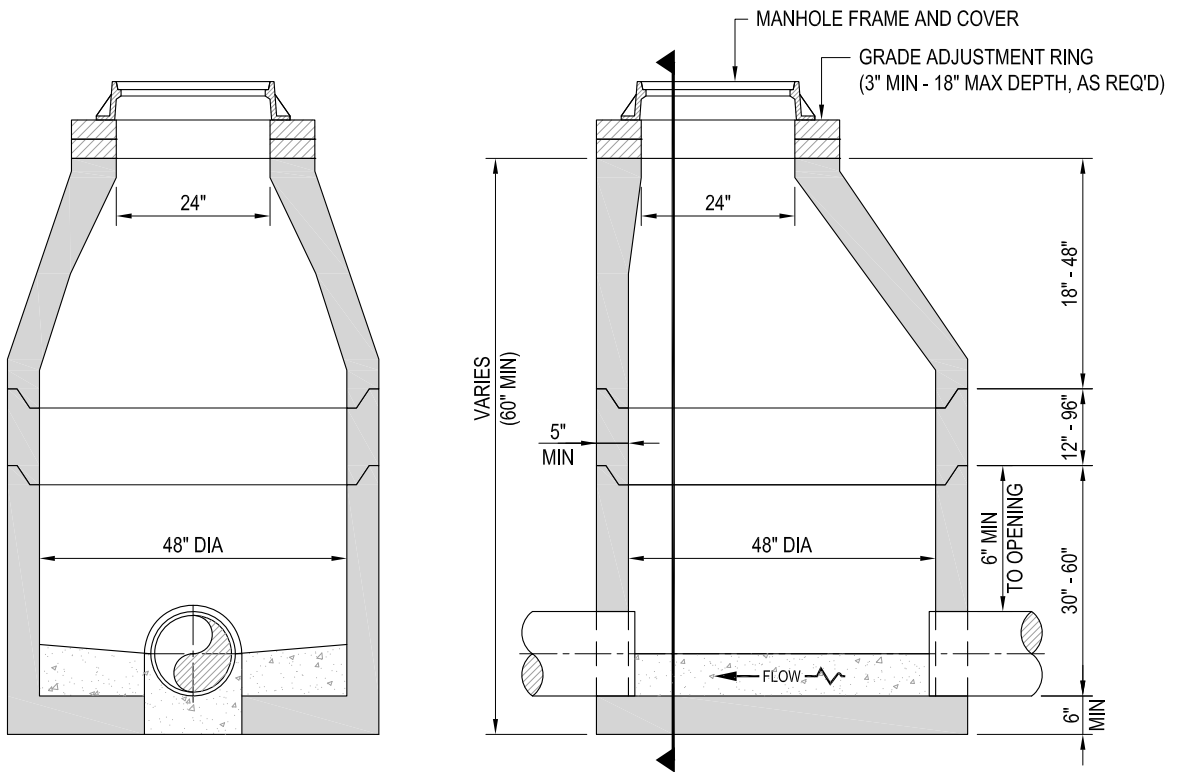
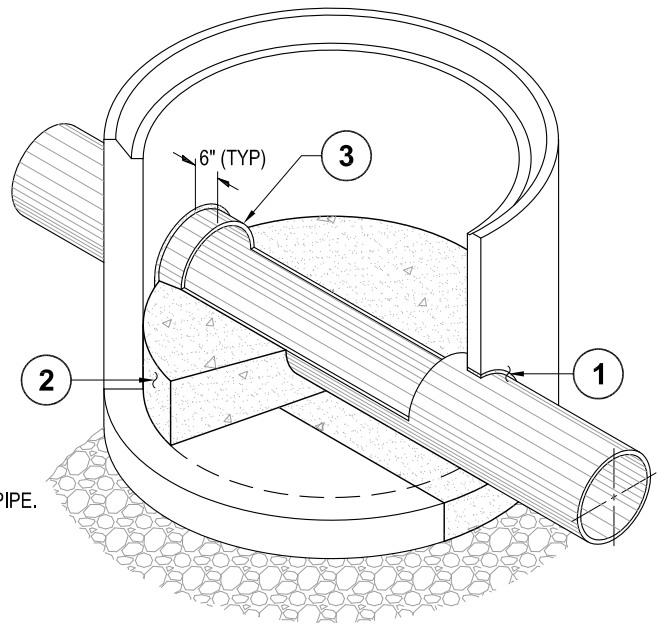
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
S03

Scale:
N.T.S.

INSTALLATION NOTES:

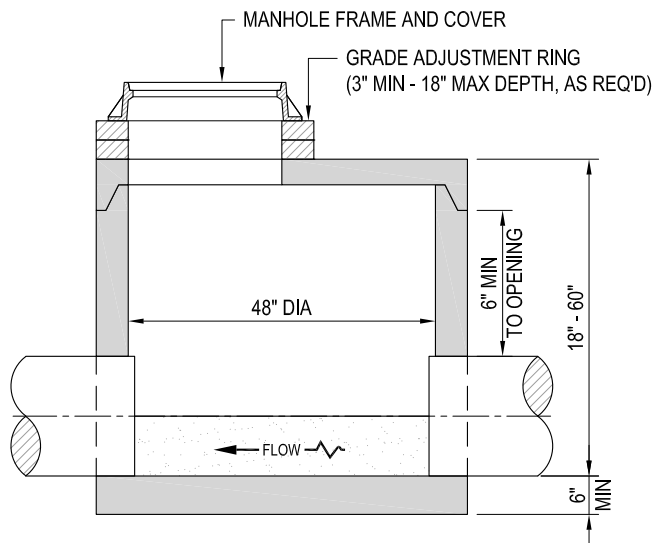
1. **INSTALL MANHOLE**
FILL DOGHOUSE OPENINGS w/ CONC. (FDOT CLASS I OR II)
2. **FORM MANHOLE BENCH**
FORM BENCH w/ CONC. (FDOT CLASS I OR II) TO SPRINGLINE (.5D) OF PIPE.
SEE MANHOLE BENCH DETAIL FOR SLOPE REQUIREMENTS.
3. **CUT EXIST PIPE**
CUT EXIST PIPE TO MATCH SPRINGLINE (.5D) OF PIPE.



Title: **48-INCH SADDLE MANHOLE
FOR PIPE DIA 15" AND LESS
AND DEPTHS MORE THAN 5'**

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
S04
Scale:
N.T.S.



Title:

**48-INCH MANHOLE w/ TOP SLAB
FOR PIPE DIA 15" AND LESS
AND DEPTH LESS THAN 5'**

Date Issued:

NOVEMBER 2023

Approved by:

WUE

File Location:

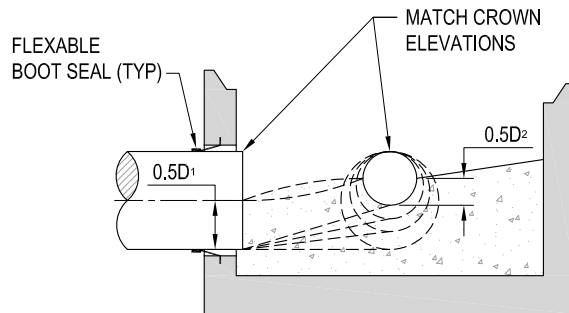
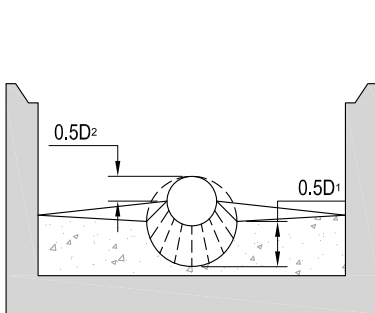
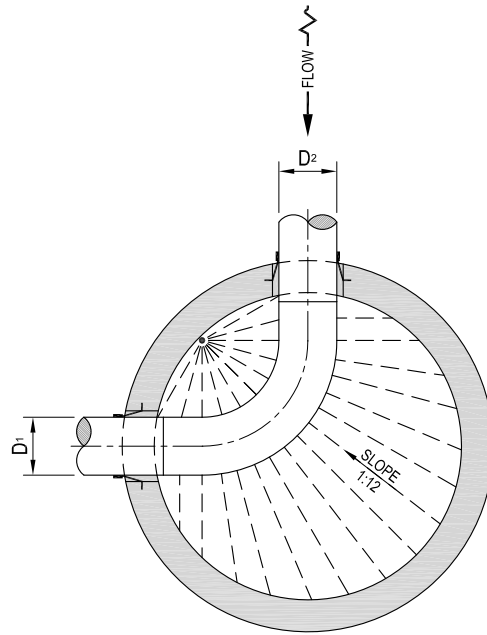
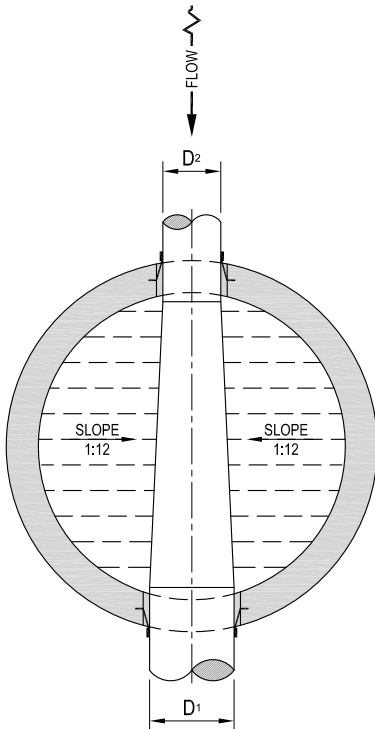
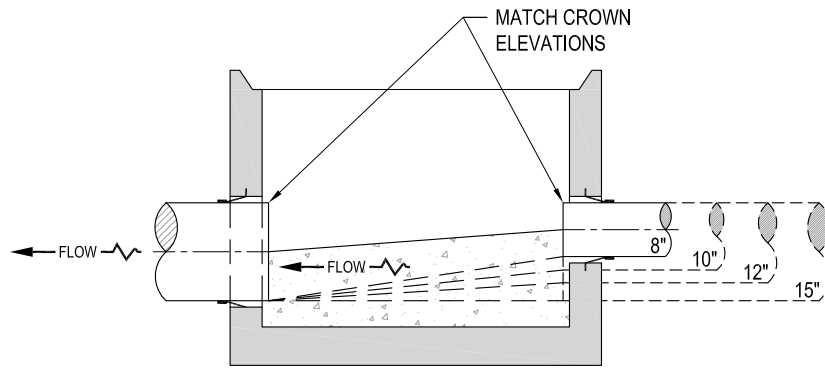
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SHEET

S05

Scale:

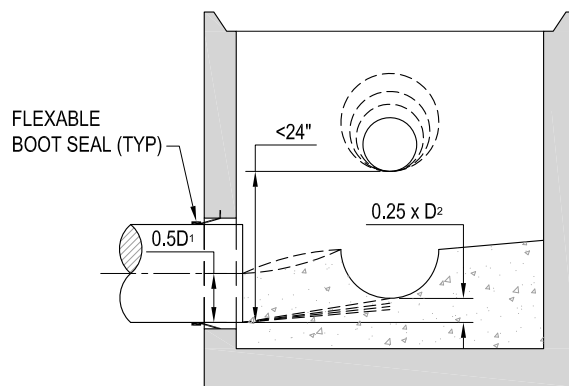
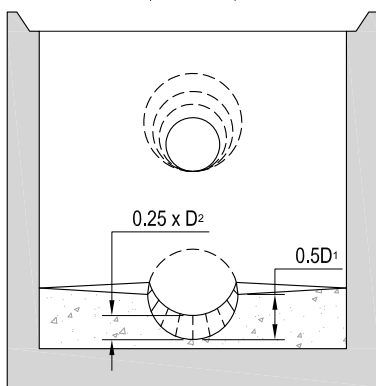
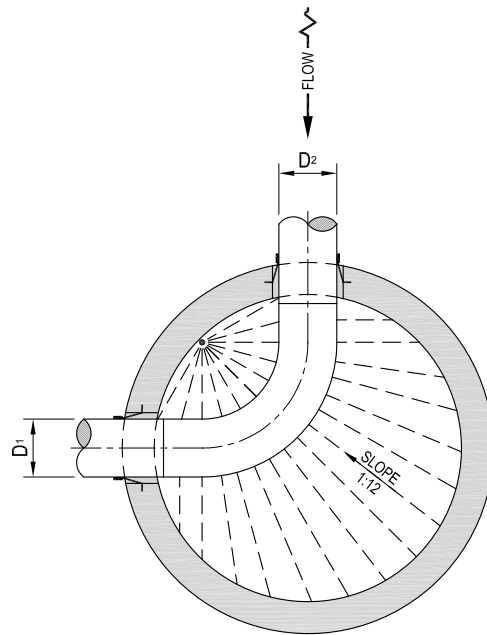
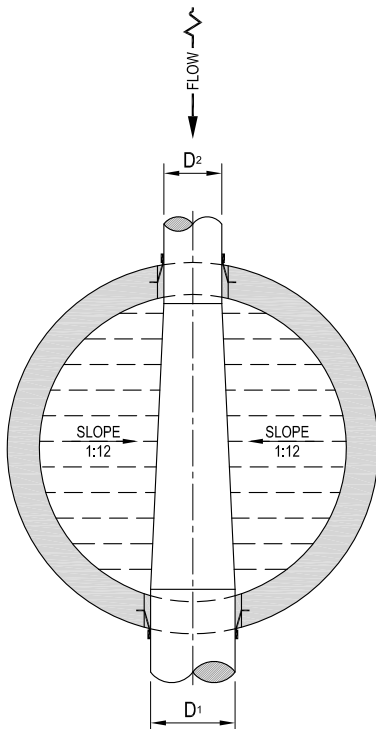
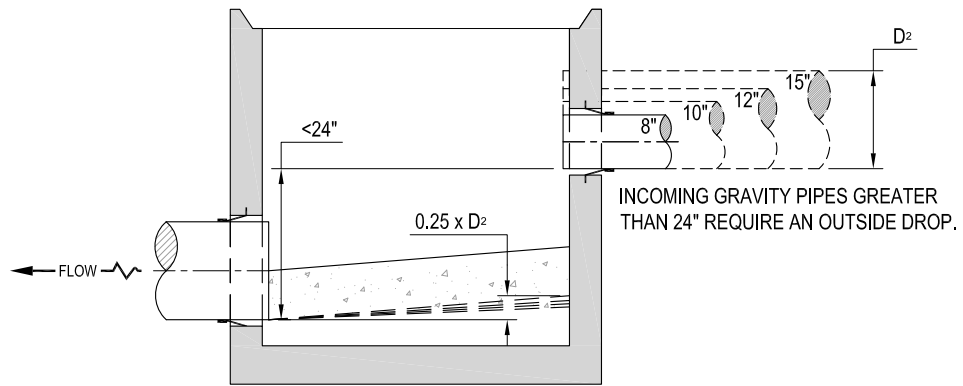
N.T.S.



Title: **MANHOLE BENCH
w/ MATCHING CROWNS**

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG\1600-W&S\Specs\06-2023.

SHEET
S06
Scale:
N.T.S.



Title:

MANHOLE BENCH
w/ OFFSET CROWNS

Date Issued:

NOVEMBER 2023

Approved by:

WUE

File Location:

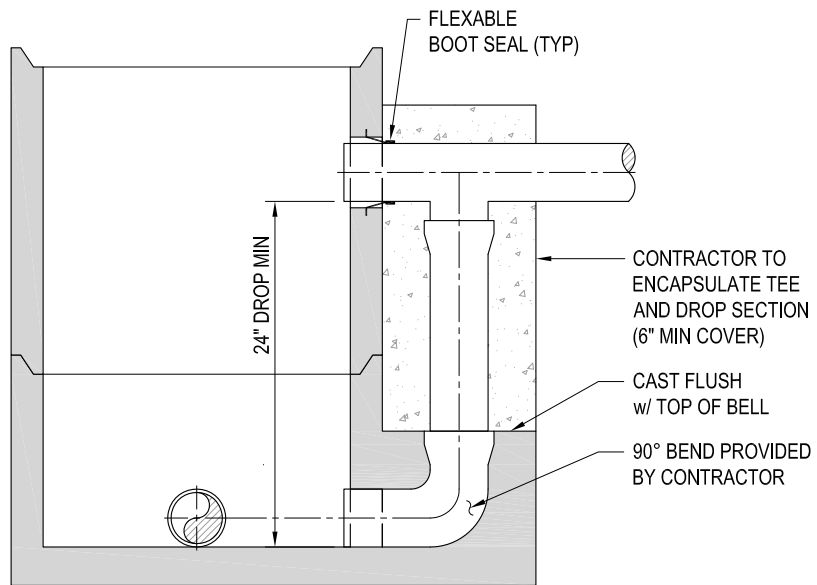
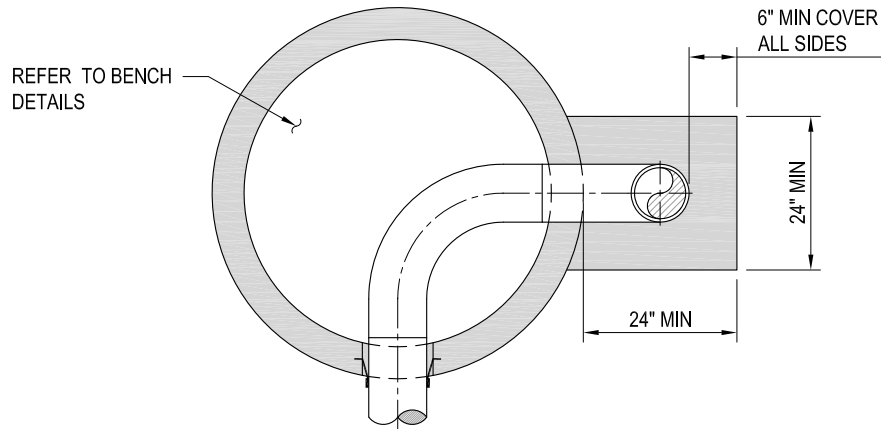
WS\PROG\1600-W&S\Specs\06-2023.

SHEET

S07

Scale:

N.T.S.



Title:

**DROP MANHOLE
w/ PARTIAL PRECAST ENCASEMENT**

Date Issued:

NOVEMBER 2023

Approved by:

WUE

File Location:

WSIPROG1600-W&Sspecs/06-2023.

SHEET

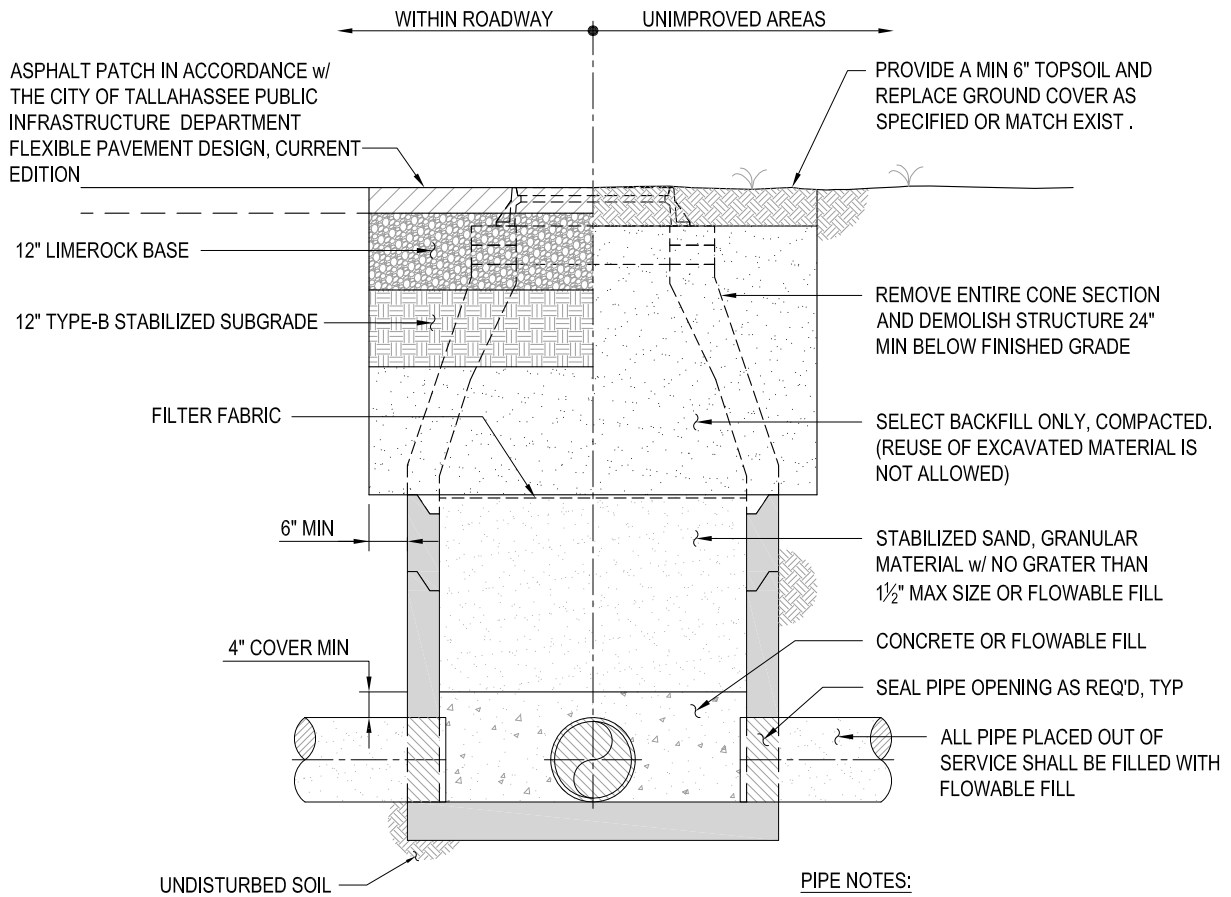
S08

Scale:

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 PLACED OUT OF SERVICE EXTENDS UNDER EXISTING OR PROPOSED STRUCTURE, THE ENTIRE SEWER LINE TO THE NEXT MANHOLE SHALL BE GROUTED OR SLURRY (FLOWABLE FILL) FILLED.
3. CONTRACTOR SHALL RECORD AND CERTIFY QUANTITIES OF GROUT OR SLURRY (FLOWABLE FILL) PUMPED.
4. RING AND COVER BECOMES PROPERTY OF COT UNDERGROUND UTILITIES DEPARTMENT.



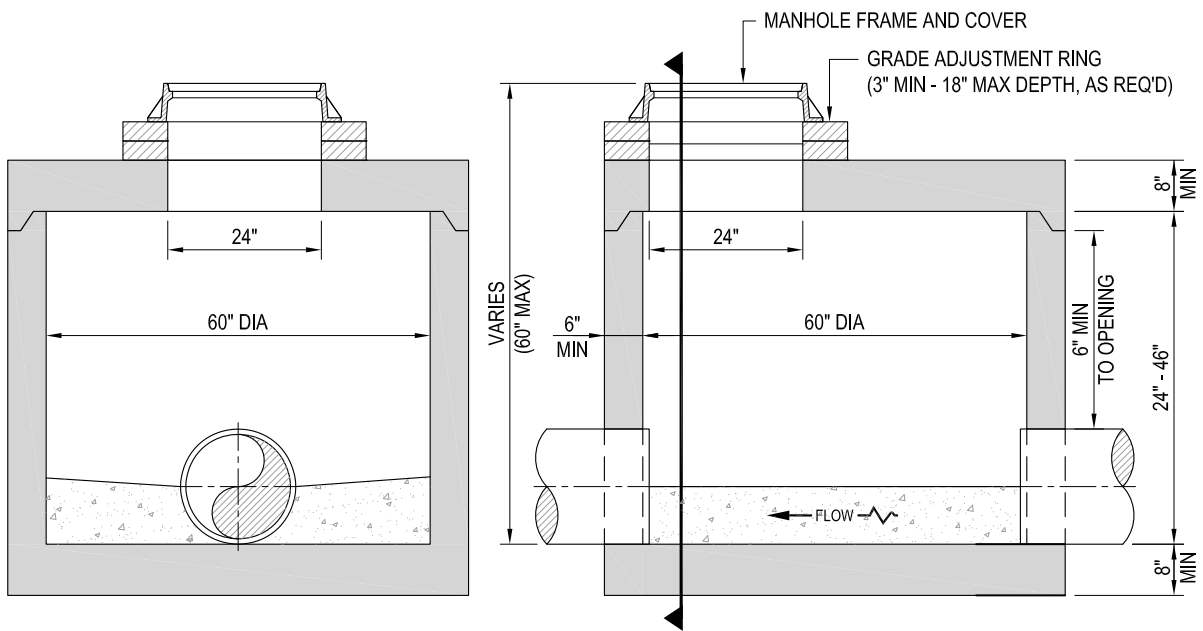
- PIPE NOTES:**
1. FOR PIPES 15" AND SMALLER, SET MECHANICAL PLUGS INTO ALL PIPES ENTERING MANHOLE.
 2. FOR PIPES LARGER THAN 15", PROVIDE MASONRY BULKHEAD IN LIEU OF MECHANICAL PLUG.



Title: **PLACING SANITARY SEWER MANHOLE OUT OF SERVICE**

Date Issued: **NOVEMBER 2023**
 Approved by: **WUE**
 File Location: **WS\PROG\1600-W&S\Specs\06-2023.**

SHEET **S09**
 Scale: **N.T.S.**



Title:

**60-INCH MANHOLE w/ TOP SLAB
FOR PIPE DIA. 18" TO 24"
AND DEPTHS UP TO 5'**

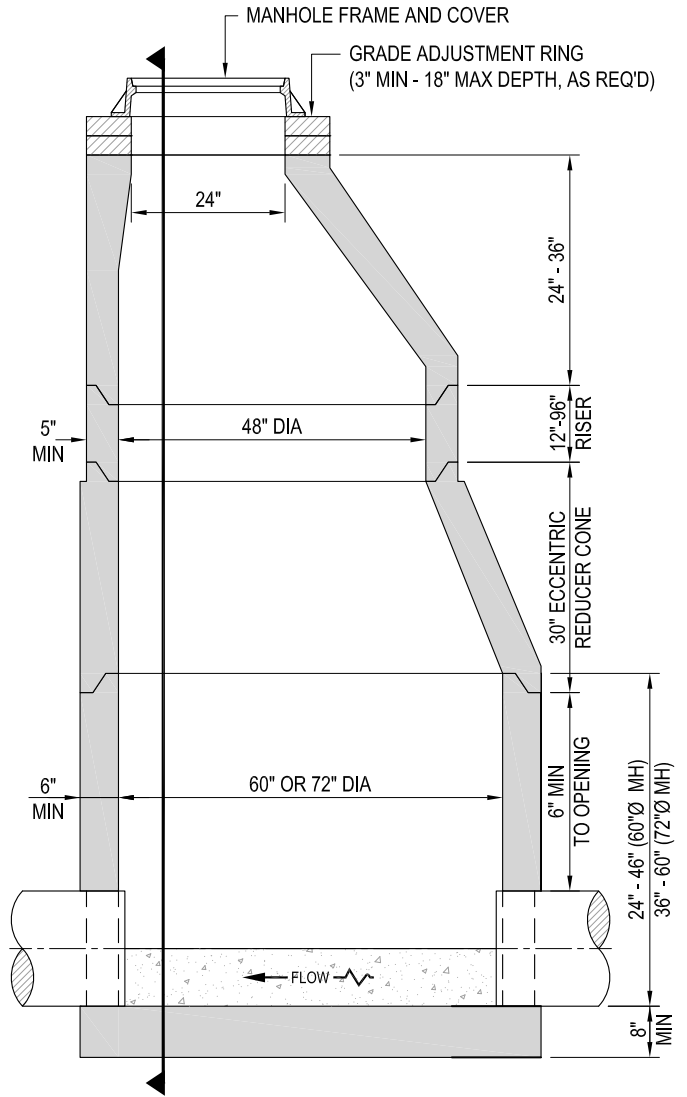
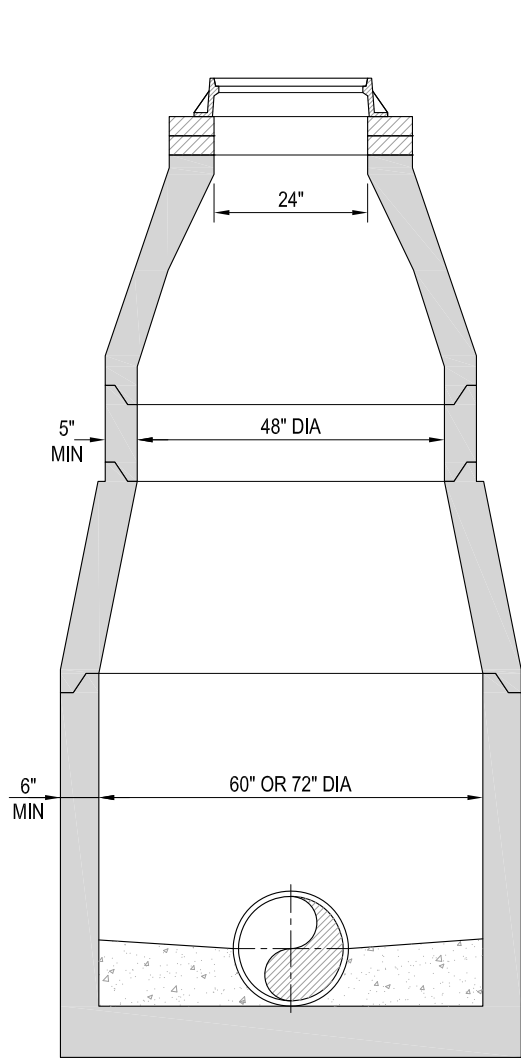
Date Issued:
NOVEMBER 2023

Approved by:
WUE

File Location:
WSIPROG1600-W&Sspecs/06-2023.

SHEET
S10

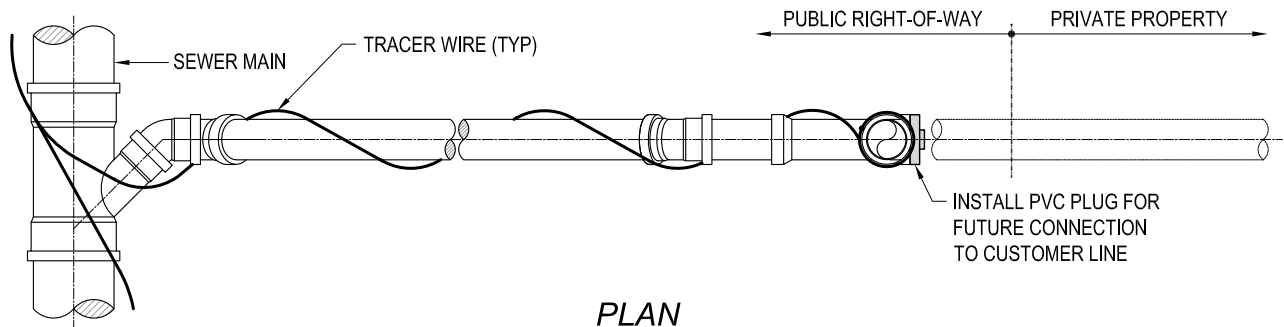
Scale:
N.T.S.



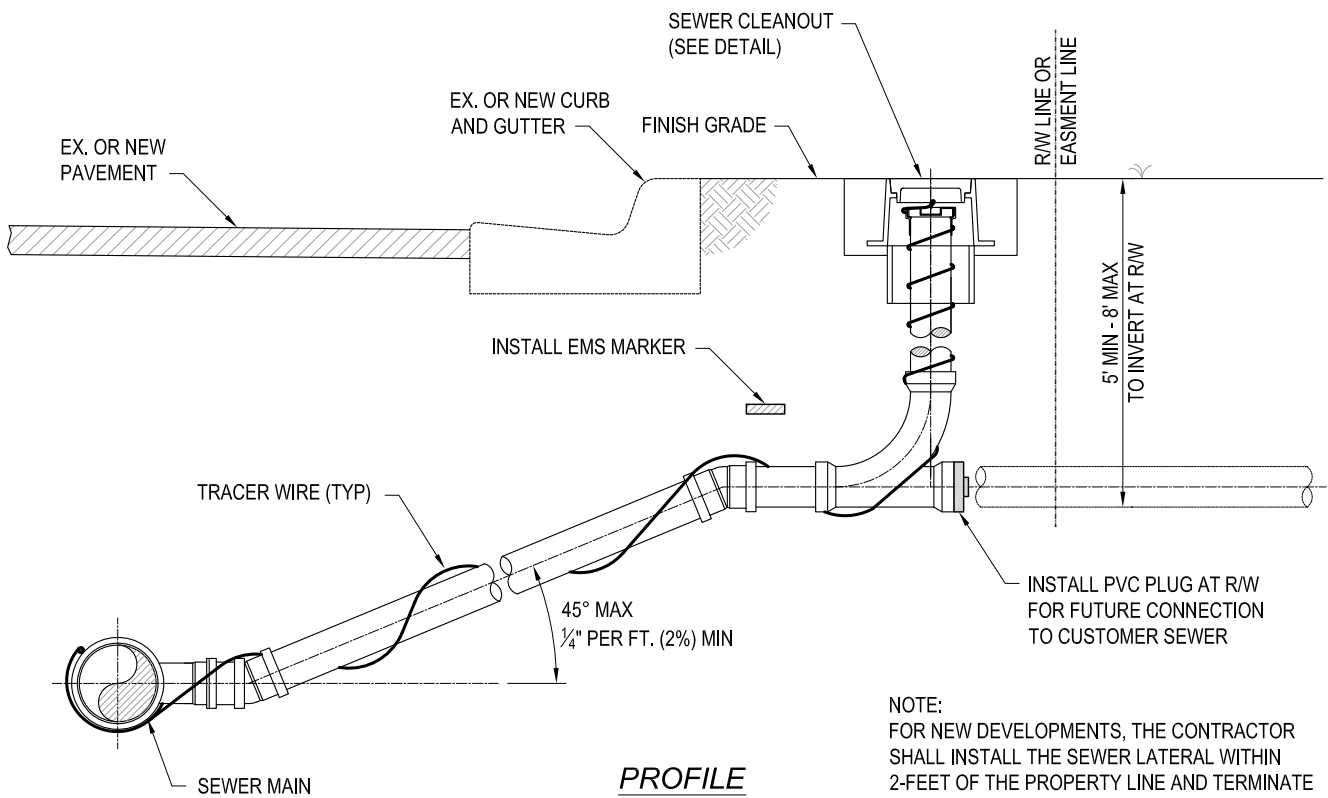
Title: 60-INCH MANHOLE - FOR PIPE DIA 18" TO 24"
 72-INCH MANHOLE - FOR PIPE DIA GREATER THAN 24"
 AND DEPTHS MORE THAN 5'

Date Issued: NOVEMBER 2023
 Approved by: WUE
 File Location: WSPROG1600-W&Sspecs/06-2023.

SHEET S11
 Scale: N.T.S.



PLAN



PROFILE

NOTE:
 FOR NEW DEVELOPMENTS, THE CONTRACTOR SHALL INSTALL THE SEWER LATERAL WITHIN 2-FEET OF THE PROPERTY LINE AND TERMINATE WITH A STUB AND CAP WITH EMS MARKER. PLUMBER WILL INSTALL THE REQUIRED WYE AND CLEANOUT UPON CONNECTION.

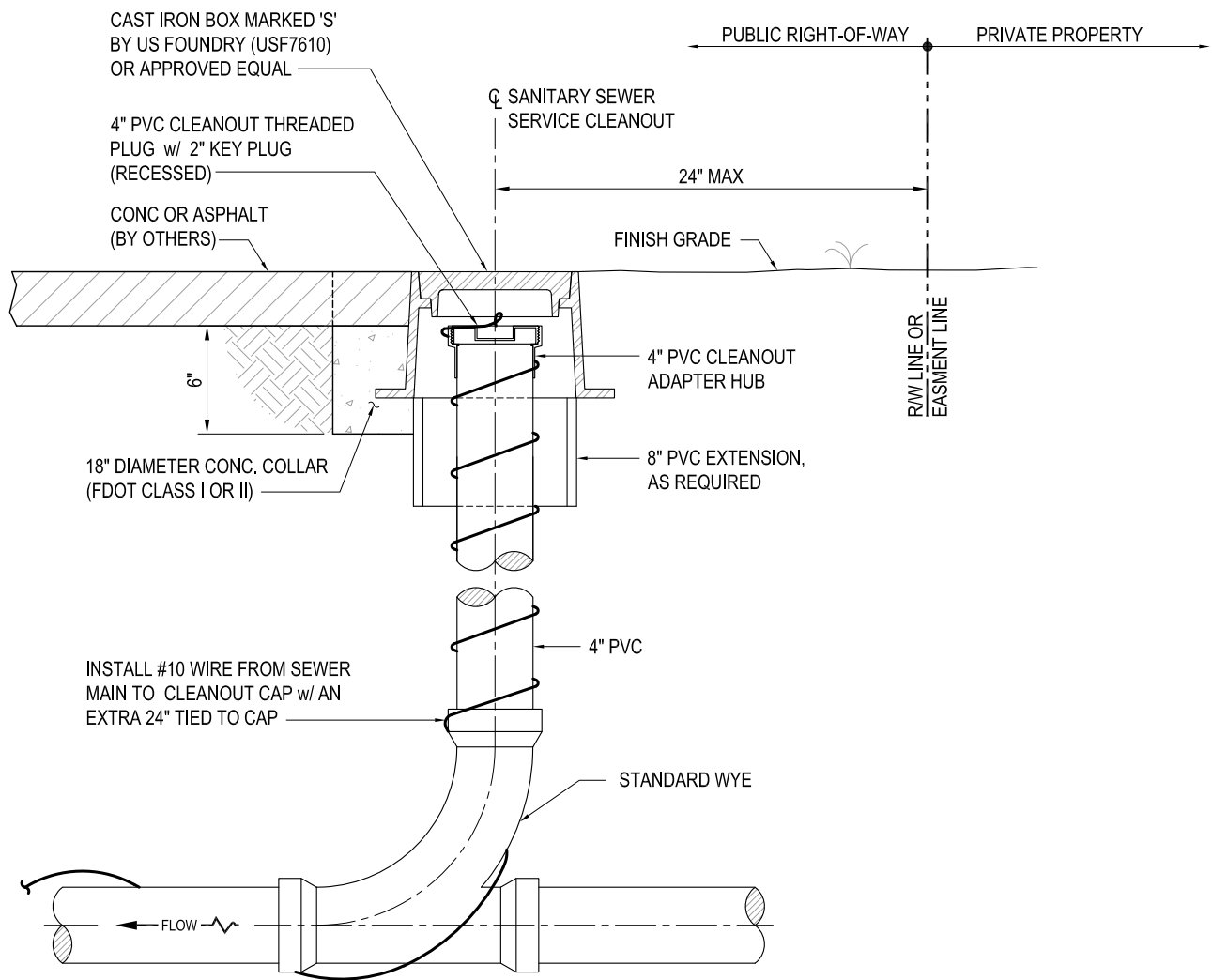


Title:

SANITARY SEWER LATERAL

Date Issued:
NOVEMBER 2023
 Approved by:
WUE
 File Location:
 WSPROG1600-W&Sspecs/06-2023.

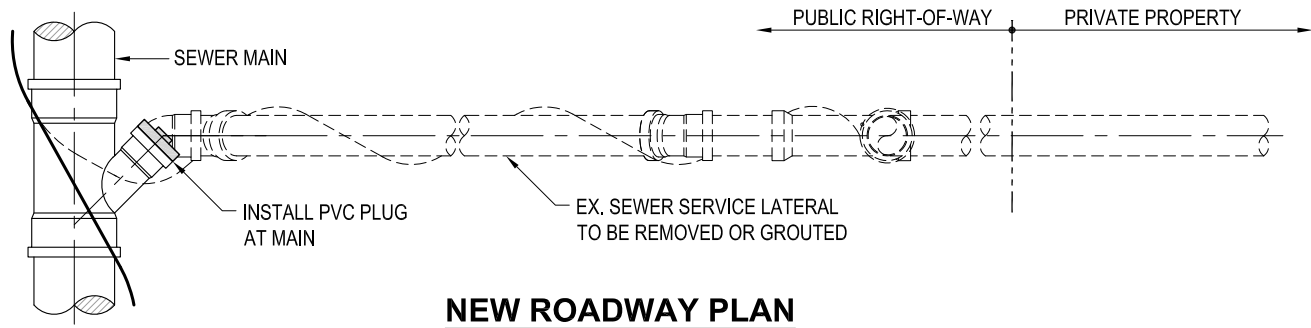
SHEET
S12
 Scale:
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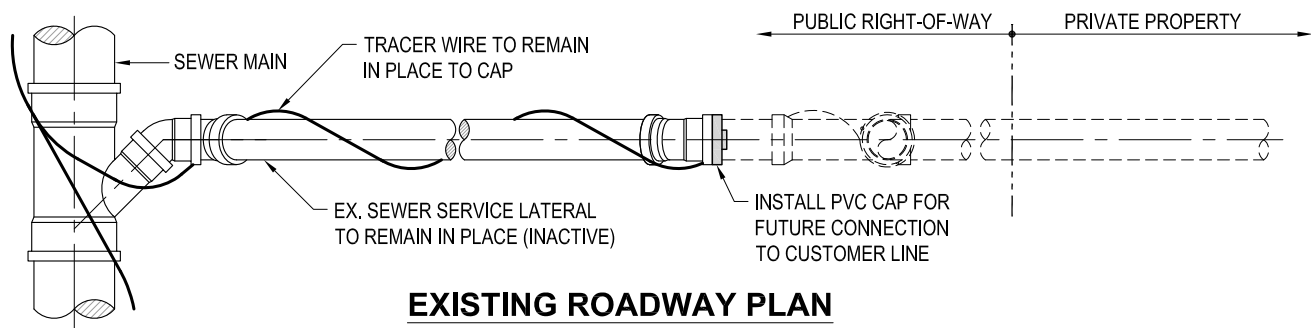
Title:

SANITARY SEWER CLEANOUT

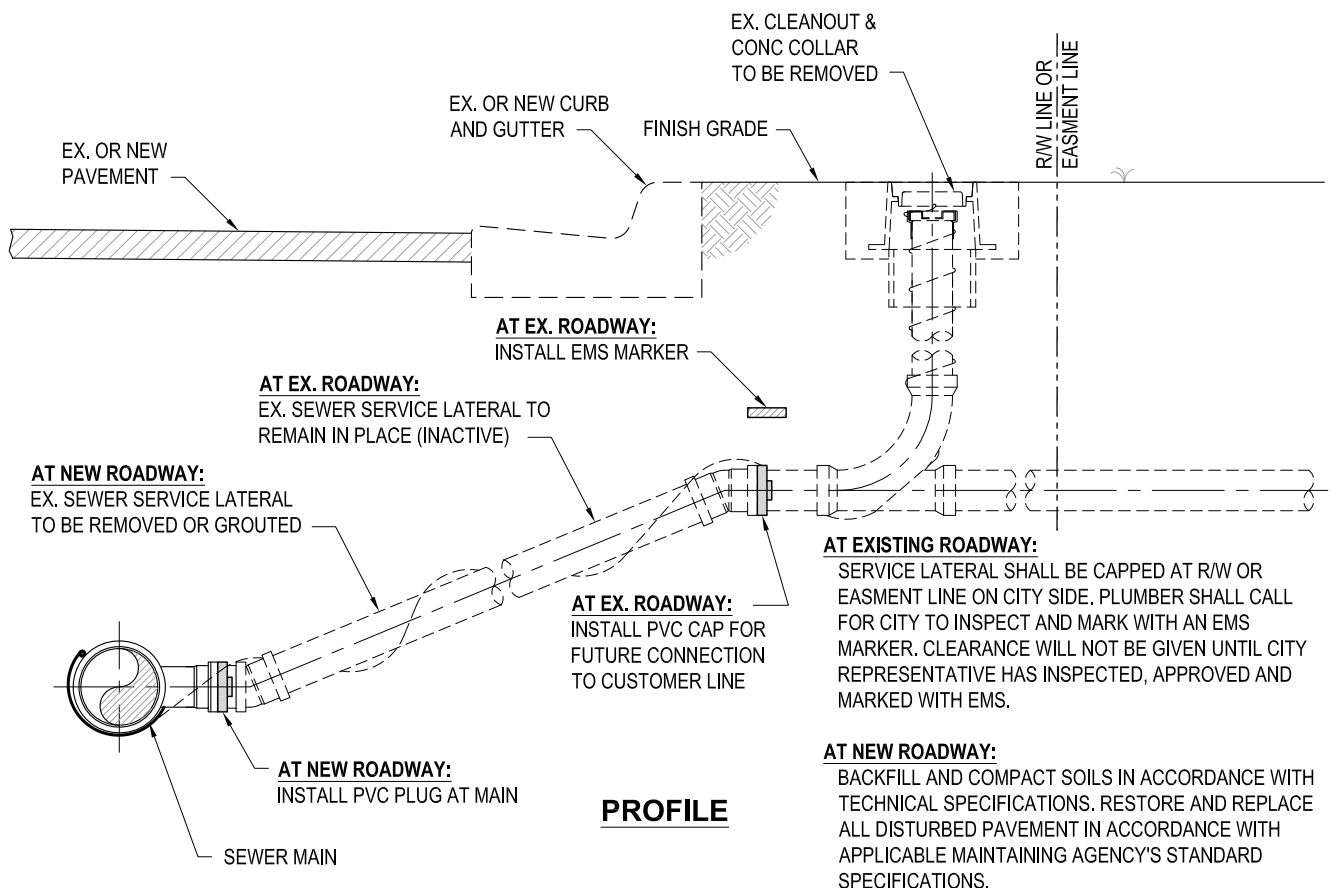
Date Issued: NOVEMBER 2023	SHEET S13
Approved by: WUE	
File Location: WS\PROG\1600-W&S\Specs\06-2023.	Scale: N.T.S.



NEW ROADWAY PLAN



EXISTING ROADWAY PLAN

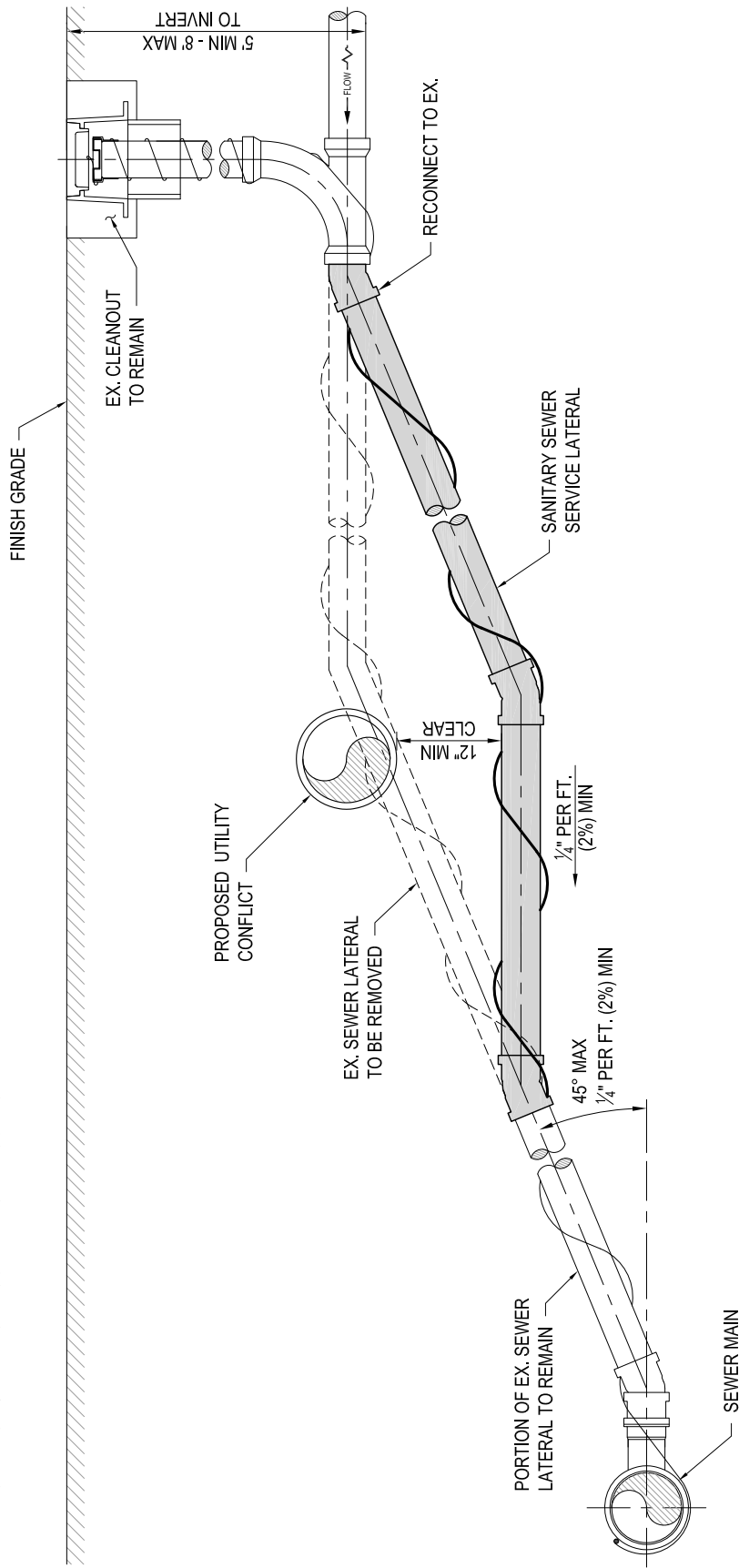


Title: **SANITARY SEWER LATERAL DISCONNECTION WITHIN IMPROVED AREAS**

Date Issued: NOVEMBER 2023	SHEET S14
Approved by: WUE	
File Location: WS\PROG\1600-W&S\Specs\06-2023.	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 WITH TWO WRAPS PER JOINT; CONNECT TO EXISTING TRACER WIRE AT MAIN AND EXTEND UP TO CLEANOUT CAP. A 24" MIN OF TRACING WIRE TO BE COILED IN CLEANOUT BOX.



PROFILE



Title:

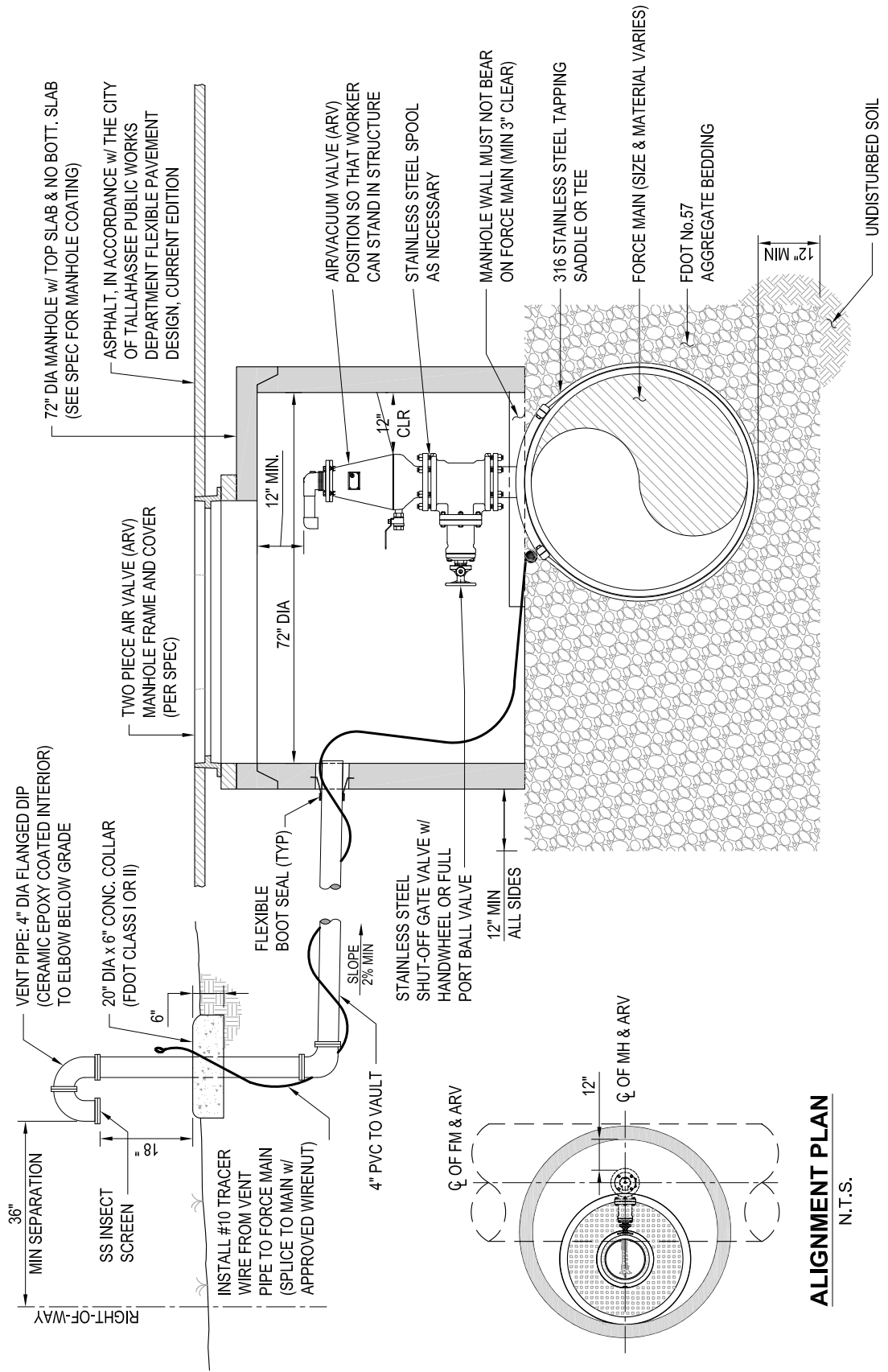
**ADJUSTMENT OF EXISTING
SANITARY SEWER LATERAL**

Date Issued: NOVEMBER 2023
Approved by: WUE
File Location: WS\PROG\1600-W&S\Specs\06-2023.

SHEET S15
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.



ALIGNMENT PLAN
N.T.S.



Title:

**FORCE MAIN AIR VALVE AND VAULT
WITHIN VEHICLE TRAVEL LANE**

Date Issued:	NOVEMBER 2023
Approved by:	WUE
File Location:	WS\PROG\1600-W\Specs\06-2023.

SHEET	S16
Scale:	N.T.S.

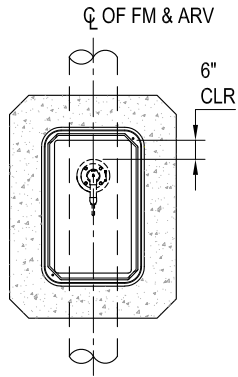


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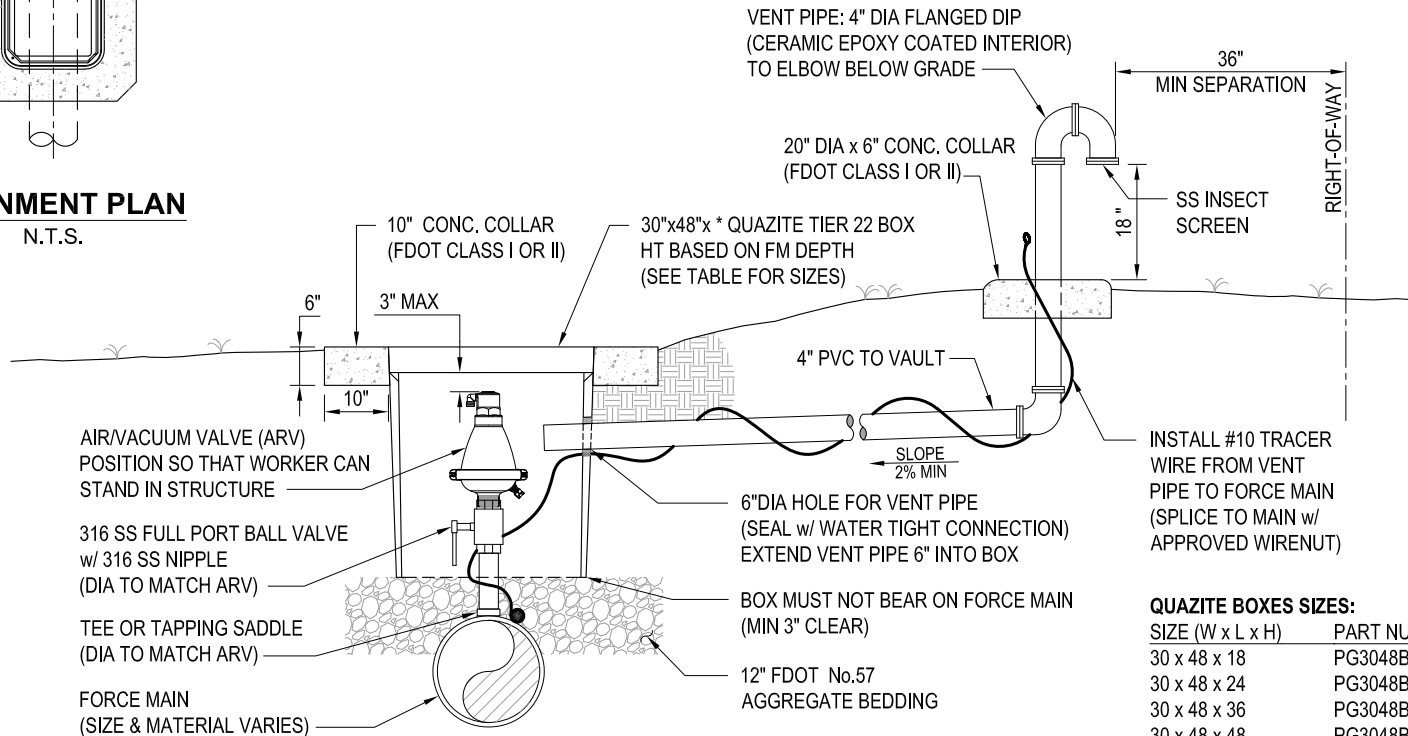
**FORCE MAIN AIR VALVE AND VAULT
OUTSIDE VEHICLE TRAVEL LANE**

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.



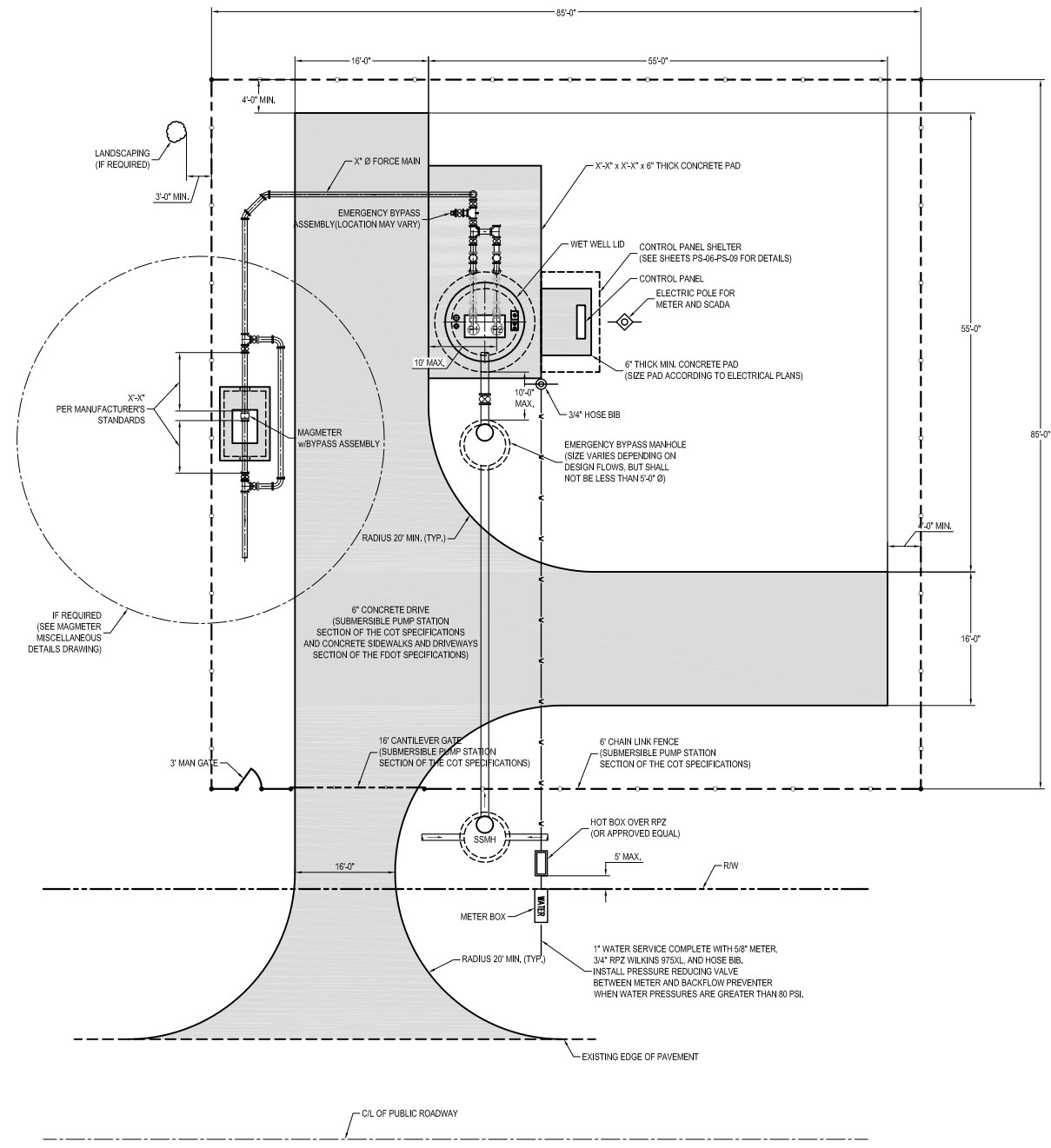
ALIGNMENT PLAN
N.T.S.



QUAZITE BOXES SIZES:

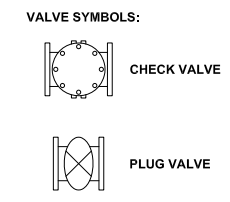
SIZE (W x L x H)	PART NUMBER
30 x 48 x 18	PG3048BA18
30 x 48 x 24	PG3048BA24
30 x 48 x 36	PG3048BA36
30 x 48 x 48	PG3048BA48

* 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.



PUMP STATION WITH ABOVE GROUND VALVES

PUMP STATION No. XX DESIGN DETAILS		
PUMP MANUFACTURER	FLYGT	WILO-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)		



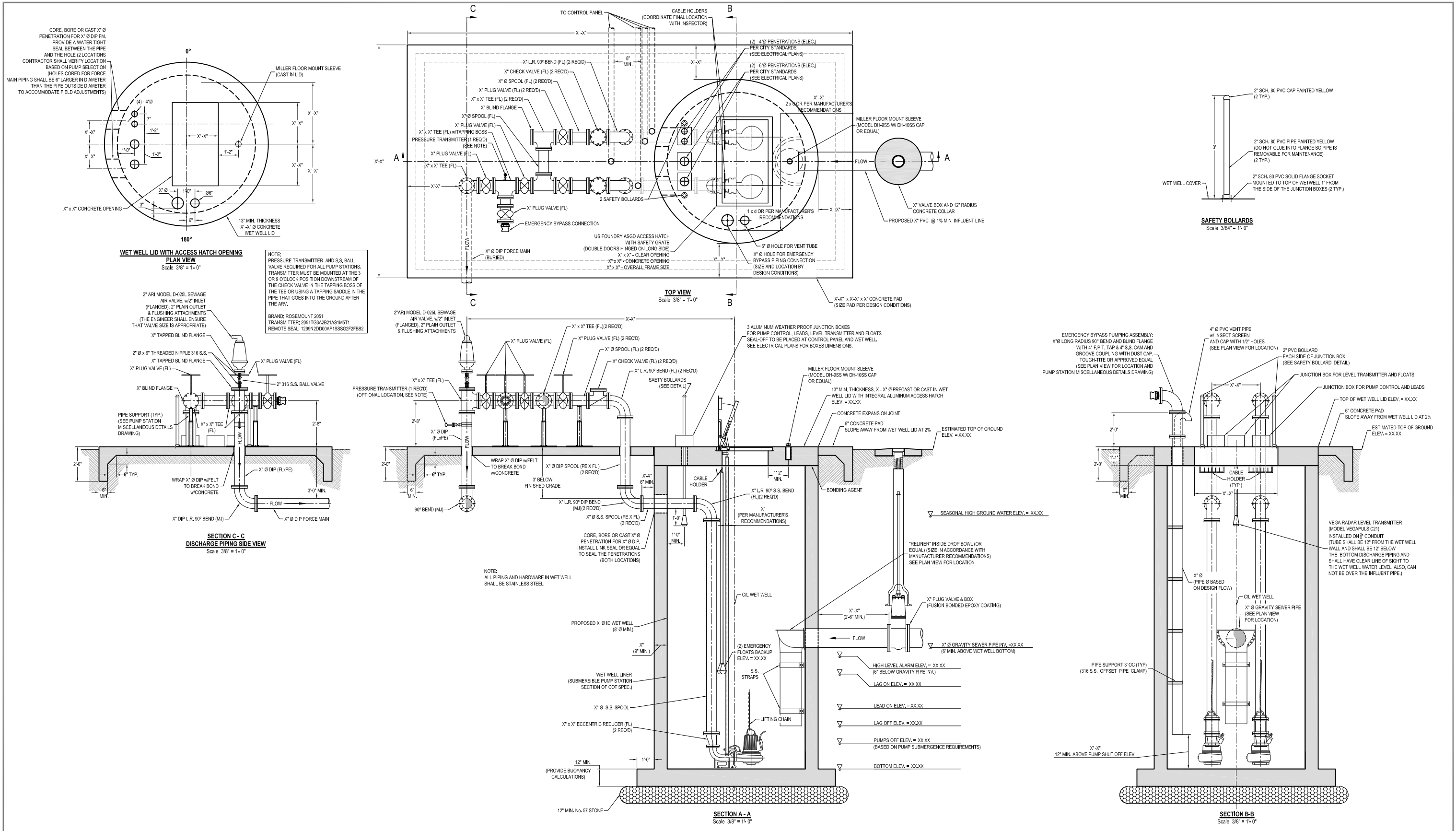
DRAWING NOT TO SCALE - FOR REFERENCE ONLY



Title:

PUMP STATION SITE PLAN LAYOUT

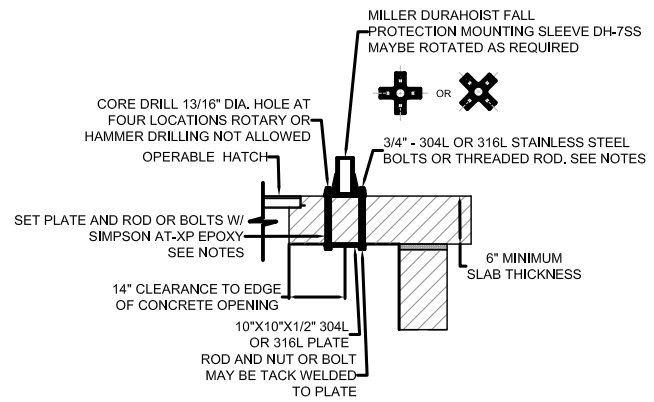
Date Issued: NOVEMBER 2023	SHEET PS01
Approved by: WUE	
File Location: WS\PROG1\600-W8\Specs\05-2023.	Scale: N.T.S.



Title:		Date Issued:	NOVEMBER 2023	SHEET:	PS02
		Approved by:	WUE		
		File Location:	WS\PROG1600-W8\Specs\05-2023	Scale:	N.T.S.

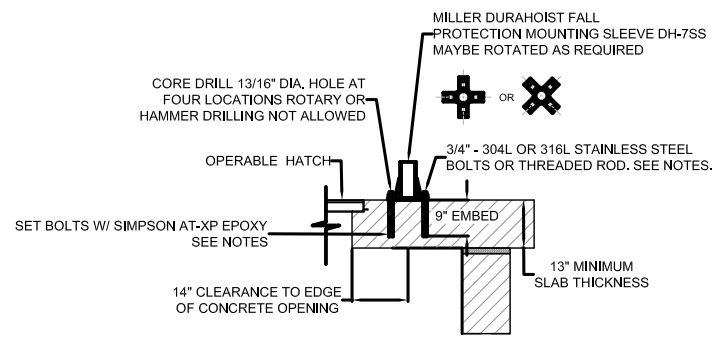
PUMP STATION w/ ABOVE THE GROUND VALVES

DRAWING NOT TO SCALE - FOR REFERENCE ONLY



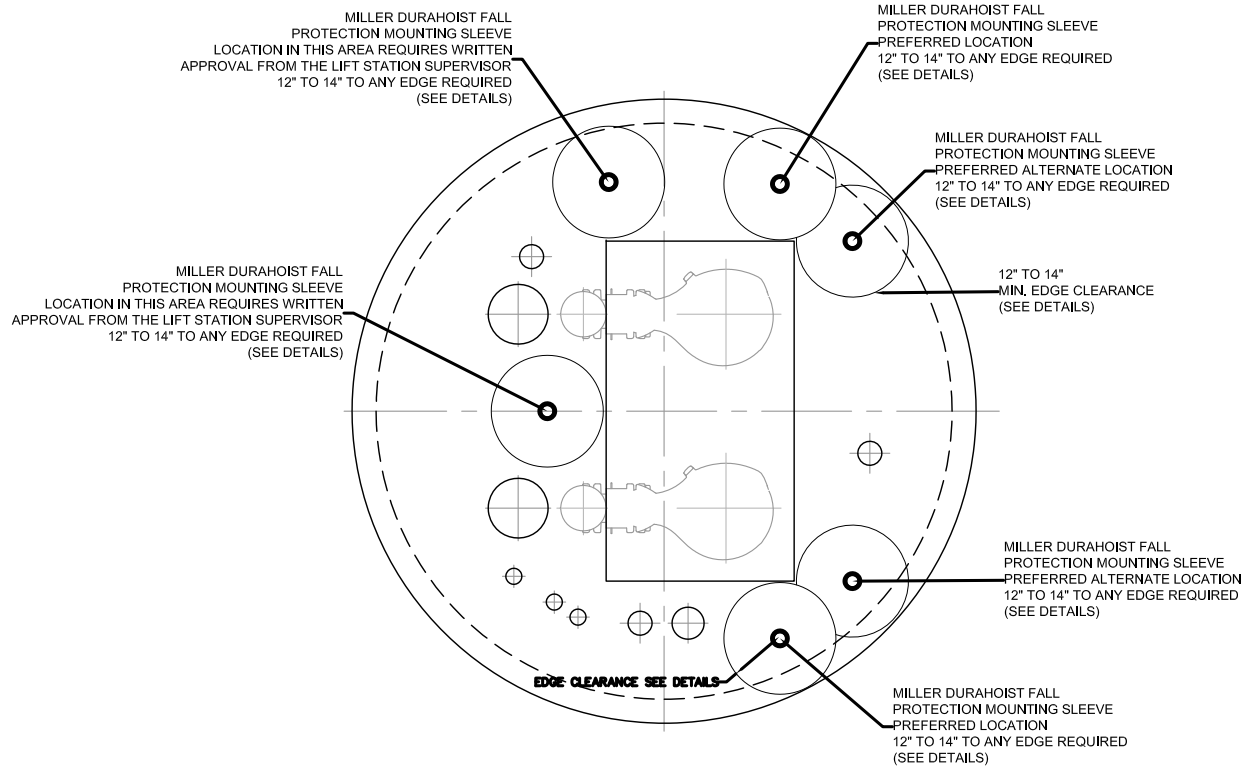
**FALL PROTECTION MOUNTING SLEEVE
SURFACE MOUNT - THIN SLAB OPTION**

SCALE 1"=2"



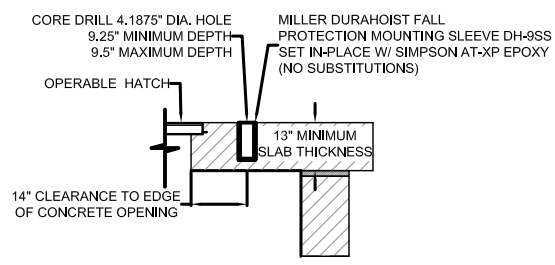
**FALL PROTECTION MOUNTING SLEEVE
SURFACE MOUNT - THICK SLAB OPTION**

SCALE 1"=2"



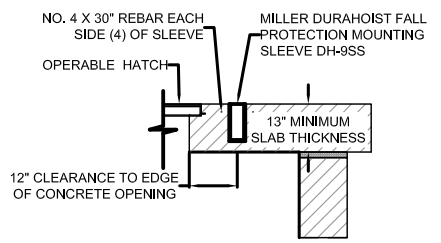
**FALL PROTECTION MOUNTING SLEEVE
ACCEPTABLE LOCATIONS**

SCALE 1"=2"



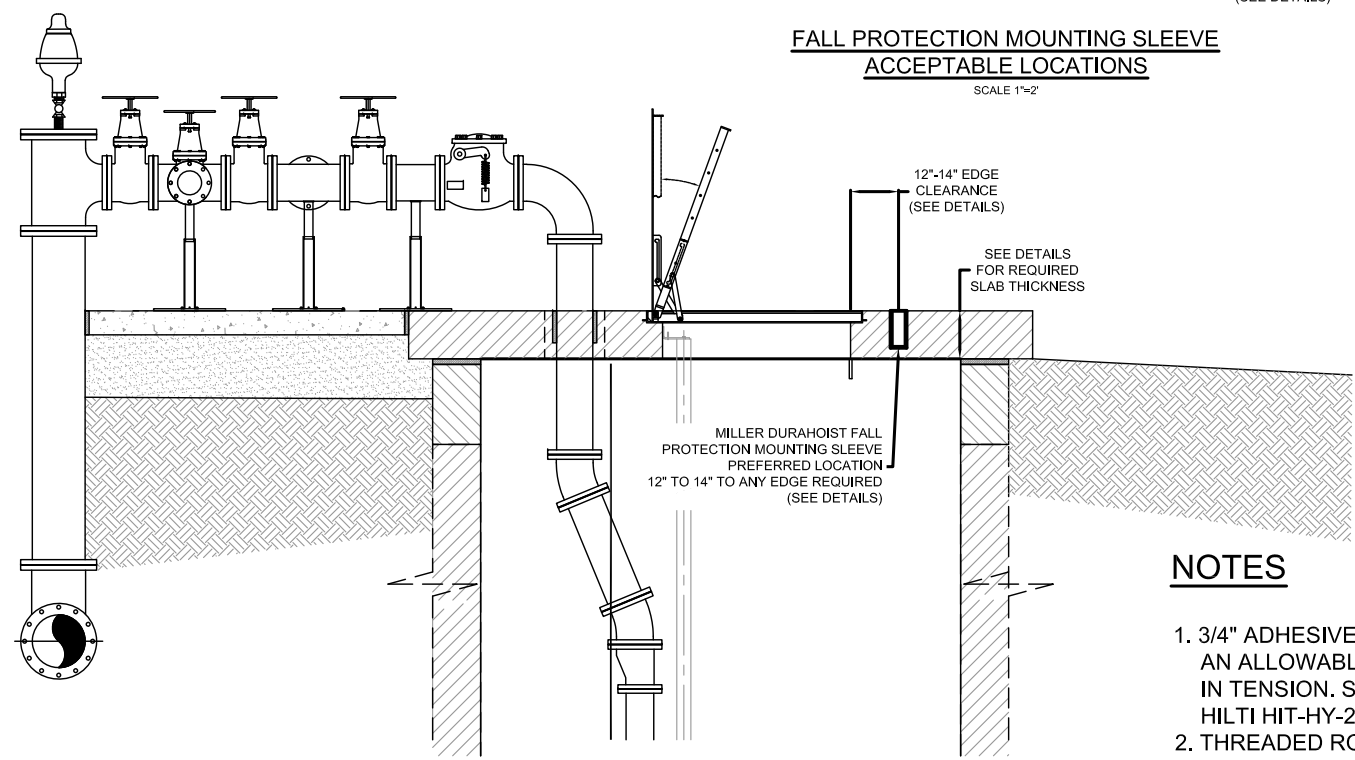
**FALL PROTECTION MOUNTING SLEEVE
RETRO FIT INSTALLATION
EPOXY OPTION**

SCALE 1"=2"



**FALL PROTECTION MOUNTING SLEEVE
NEW CONSTRUCTION CAST IN-PLACE SLEEVE**

SCALE 1"=2"



**FALL PROTECTION MOUNTING SLEEVE
EDGE LOCATION**

SCALE 1"=2"

NOTES

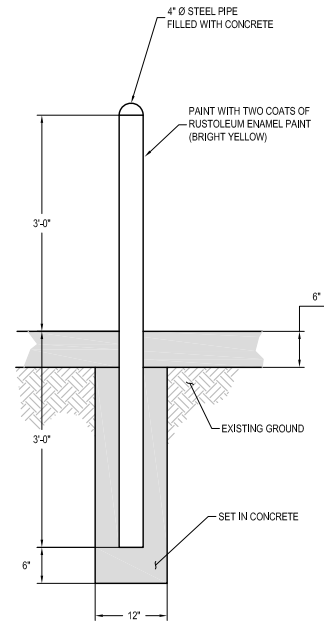
1. 3/4" ADHESIVE ANCHORS MUST HAVE AN ALLOWABLE LOAD OF 10,600 POUNDS IN TENSION. SIMPSON AT-XP OR HILTI HIT-HY-200.
2. THREADED ROD FOR ANCHORS SHALL BE STAINLESS STEEL, ASTM A193-GRADE B8 OR B8 (304 OR 316). ASTM A193-GRADE B6 IS ALSO ACCEPTABLE (410)



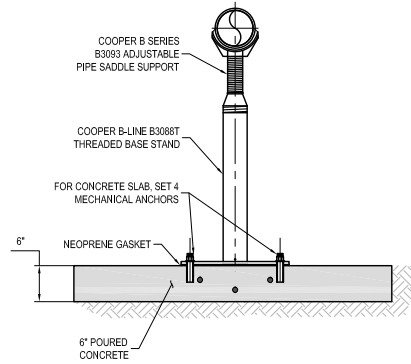
Title:

PUMP STATION FALL PROTECTION

Date Issued: NOVEMBER 2023	SHEET PS03
Approved by: WUE	
File Location: WS\PROG1600-W8\Sepacs\05-2023	Scale: N.T.S.

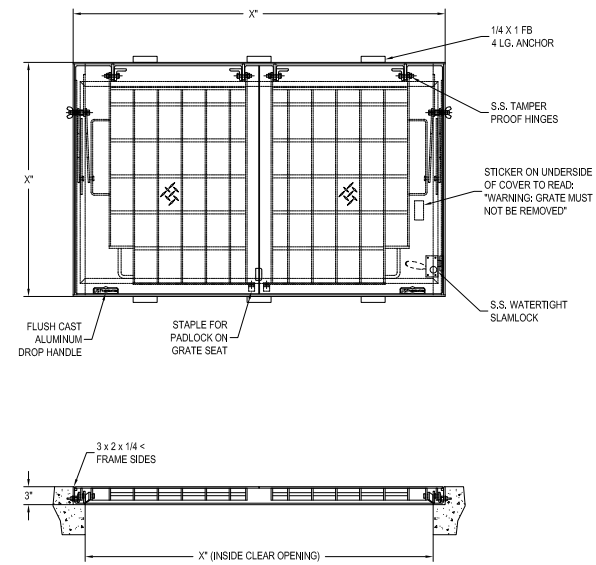


TRAFFIC BOLLARD DETAIL
(NOT TO SCALE)

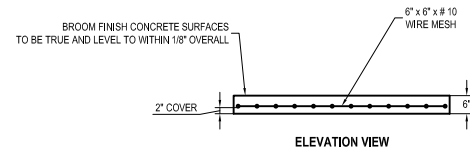
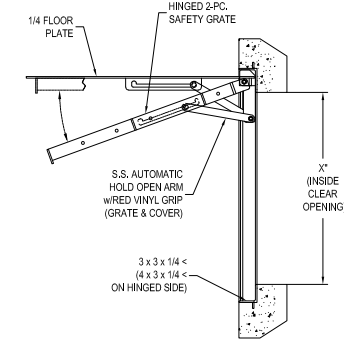


- NOTES:
- FOR PIPE SUPPORT USE COOPER B-LINE PRODUCT. USE B3088T THREADED BASE STAND WITH B3093 PIPE ADJUSTER. CONTRACTOR IS RESPONSIBLE FOR SPECIFYING AND ORDERING APPROPRIATE HEIGHT PIPE STANDS.
 - PIPE SUPPORT BASE IS 18"x18"x1/2" WITH A 4" THREADED STANDPIPE TO A 2 1/2" THREADED SUPPORT.
 - COMPACT 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.

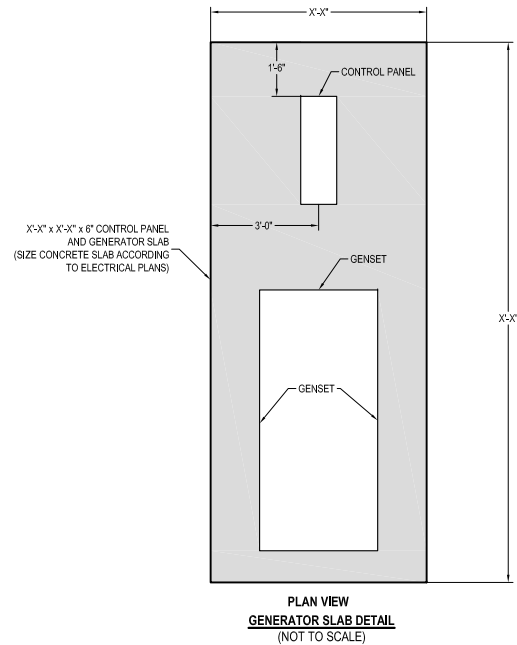
PIPE SUPPORT DETAIL
(NOT TO SCALE)



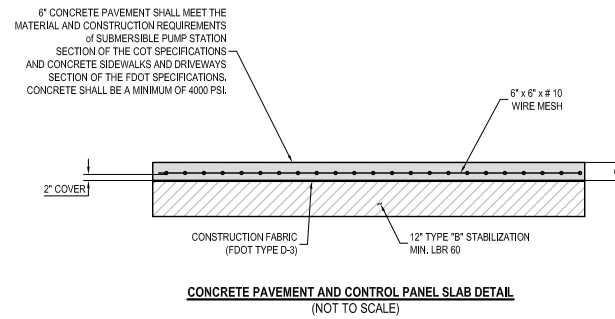
US FOUNDRY ASGD ACCESS HATCH WITH SAFETY GRATE
(NOT TO SCALE)



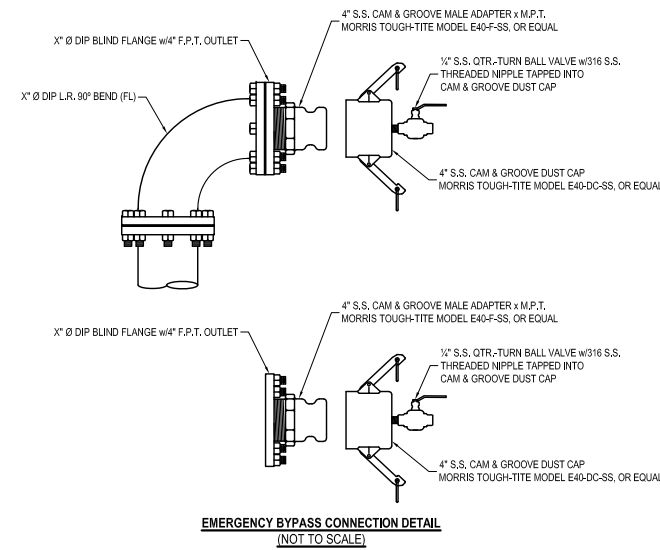
ELEVATION VIEW



**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)



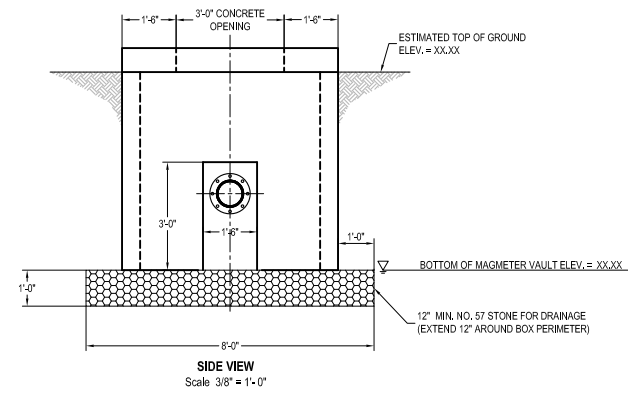
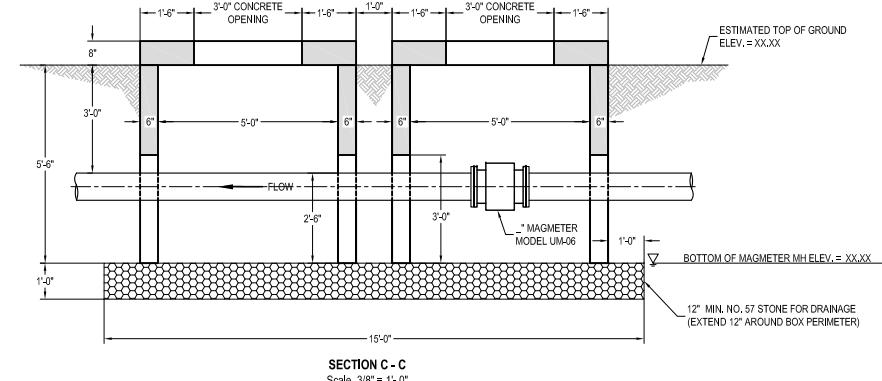
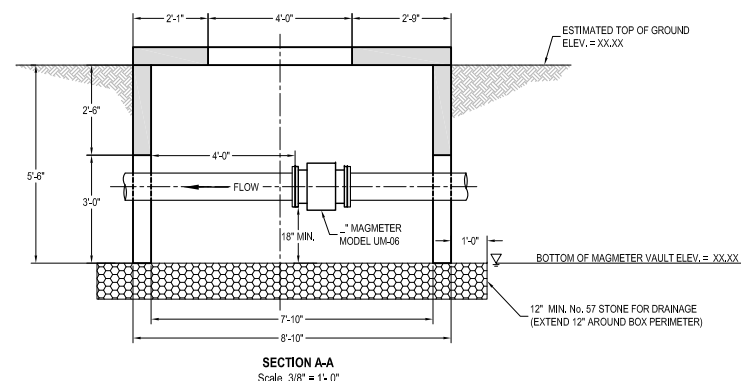
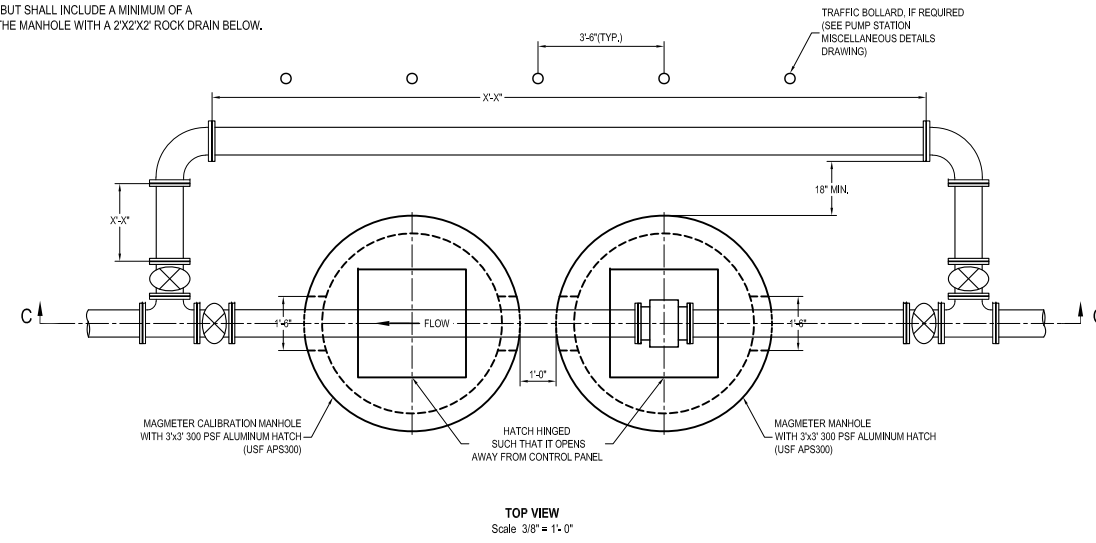
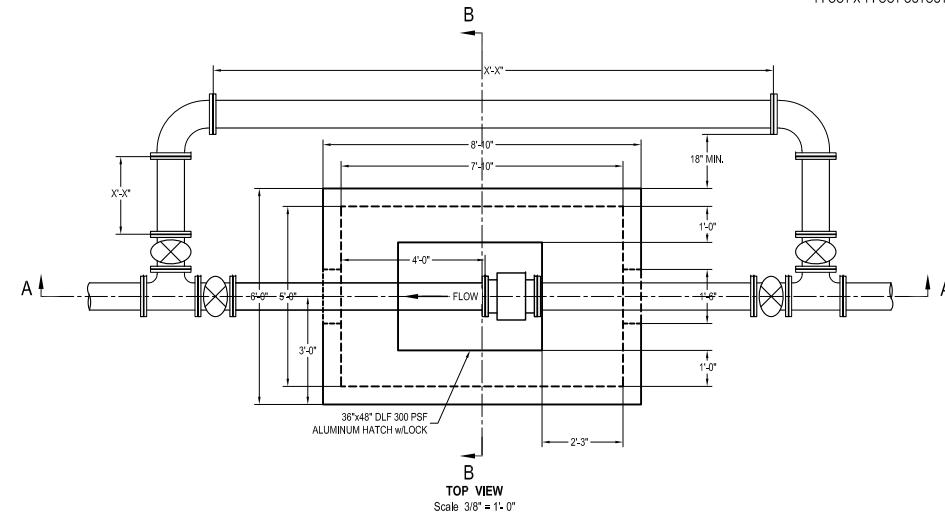
Title:

PUMP STATION MISCELLANEOUS DETAILS

Date Issued:
NOVEMBER 2023
Approved by:
WUE
File Location:
WS\PROG1600-W8\Specs\05-2023.

SHEET
PS04
Scale:
N.T.S.

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)



Title:

PUMP STATION MAGMETER DETAILS

Date Issued: NOVEMBER 2023	SHEET PS05
Approved by: WUE	
File Location: WS\PROG1600-W8\Specs\05-2023	Scale: N.T.S.

NOTES:

- 1) CONCRETE SHALL BE 3,000 PSI AT 28 DAYS MINIMUM.
- 2) REBAR SHALL BE GRADE 60.
- 3) CLIPS AND STRAPS SHALL BE BY SIMPSON STRONG TIE AS INDICATED, OR APPROVED EQUAL, INSTALLED PER MANUFACTURER. BOLTS SHALL CONFORM TO ASTM A307. NUTS SHALL CONFORM TO ASTM A563, AND WASHERS SHALL CONFORM TO ASTM F436.
- 4) TIMBER SHALL BE SOUTHERN PINE #2 OR BETTER PRESSURE TREATED FOR GROUND CONTACT.
- 5) ALL FASTENERS SHALL BE GALVANIZED OR PLATE COATED, CERTIFIED FOR USE WITH PRESSURE TREATED TIMBER
- 6) ROOFING SHALL BE 29 GAUGE CORRUGATED METAL FLORIDA APPROVAL NUMBER FL-1832.2-MASTER LOCK 90, EVERGREEN COLOR. (OR APPROVED EQUAL)
- 7) FOUNDATION DESIGNED FOR WELL COMPACTED, INORGANIC, GRANULAR (FRICTION ANGLE GREATER THAN OR EQUAL TO 32 DEGREES) OR LOW PLASTICITY CLAY (PI LESS THAN 20) SOILS, WITH AN IN SITU MOIST UNIT WEIGHT OF 90PCF OR GREATER. CONTACT ENGINEER IF SOIL CONDITIONS DO NOT MEET THESE CRITERIA.

CODE NOTES:

APPLICABLE CODES	
FLORIDA BUILDING CODE, BUILDING (FBC-B)	7TH EDITION (2020)
FLORIDA ACCESSIBILITY CODE (FACBC)	7TH EDITION (2020)
FLORIDA BUILDING CODE, MECHANICAL (FBC-M)	7TH EDITION (2020)
FLORIDA BUILDING CODE, FUEL GAS (FBC-FG)	7TH EDITION (2020)
FLORIDA BUILDING CODE, PLUMBING (FBC-P)	7TH EDITION (2020)
FLORIDA BUILDING CODE, EXISTING BUILDING (FBC-EB)	7TH EDITION (2020)
FLORIDA FIRE PREVENTION CODE (FFPC)	7TH EDITION (2020)

DESIGN DATA:

OCCUPANCY CLASS:	N/A
OCCUPANCY LOAD:	N/A
DESIGN LOADS:	15PSF LIVE LOAD
WIND LOAD	
TOTAL BUILDING AREA PER FLOOR (NEW):	N/A
SQUARE FOOTAGE OF ALTERED AREA (ALT):	N/A
BUILDING HEIGHT / NUMBER OF STORIES:	N/A
REQUIRED SPRINKLER OR ALARM SYSTEMS:	N/A
BLDG KEY PLAN IF ALT. TO A TENANT AREA:	N/A
OCCUPANCY SEPARATIONS:	N/A
NUMBER OF BEDROOMS PER BUILDING:	N/A
TOTAL NUMBER EXITS PROVIDED:	N/A
TENANT SEPARATIONS (MALLS ONLY):	N/A

WIND DESIGN CRITERIA - PER ASCE 7-16

RISK CATEGORY	II
WIND SPEED	120 MPH
ENCLOSURE CLASS.	OPEN
ROOF SLOPE	1:12
K_d	0.85
K_{zt}	1.00
K_e	1.00
G	0.85
K_c	0.85
q_h	26.63 PSF

COMPONENTS AND CLADDING -

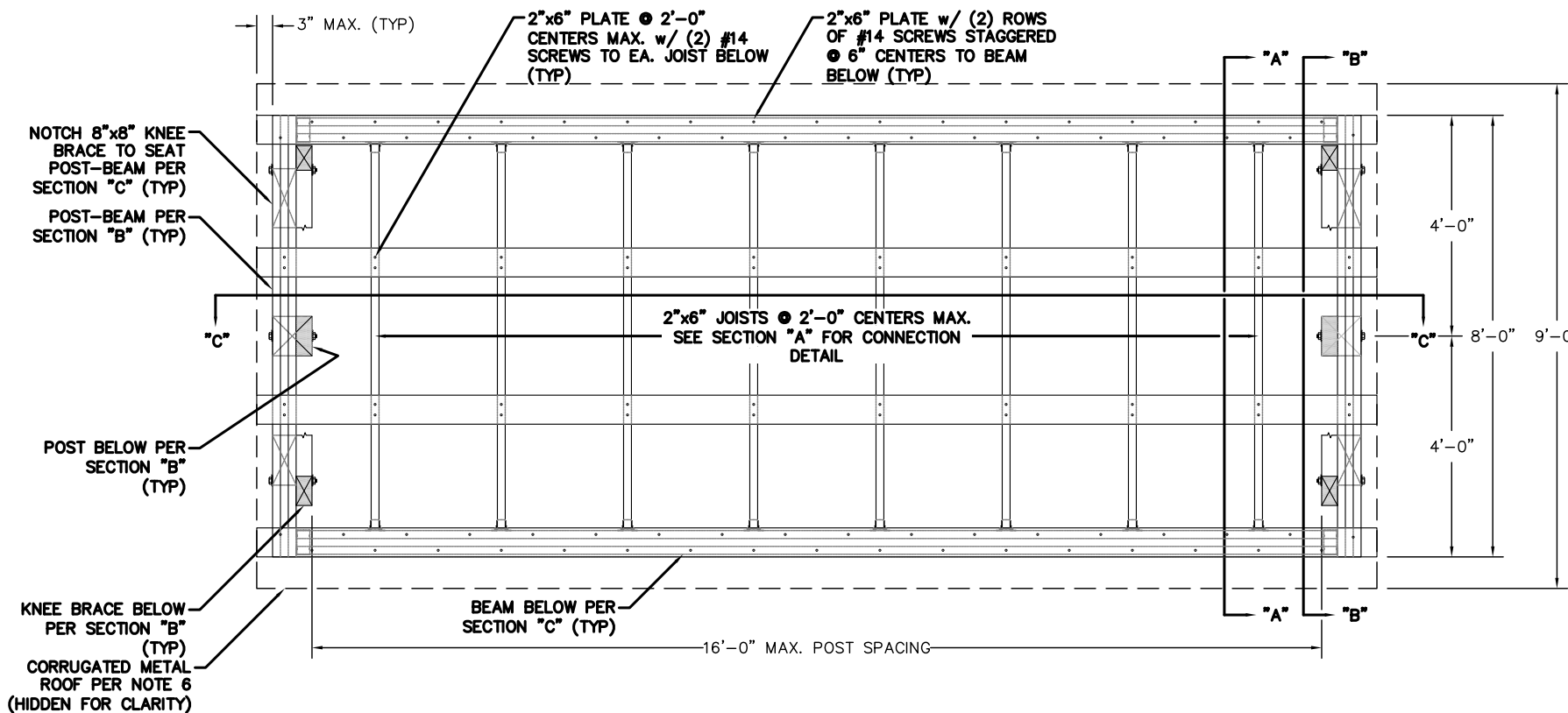
ROOF			
ZONE 1	+33.6 PSF	-53.3 PSF	
ZONE 2	+33.6 PSF	-92.8 PSF	
ZONE 3	+32.6 PSF	-137.2 PSF	

MAIN WIND FRAME RESISTING STRUCTURE

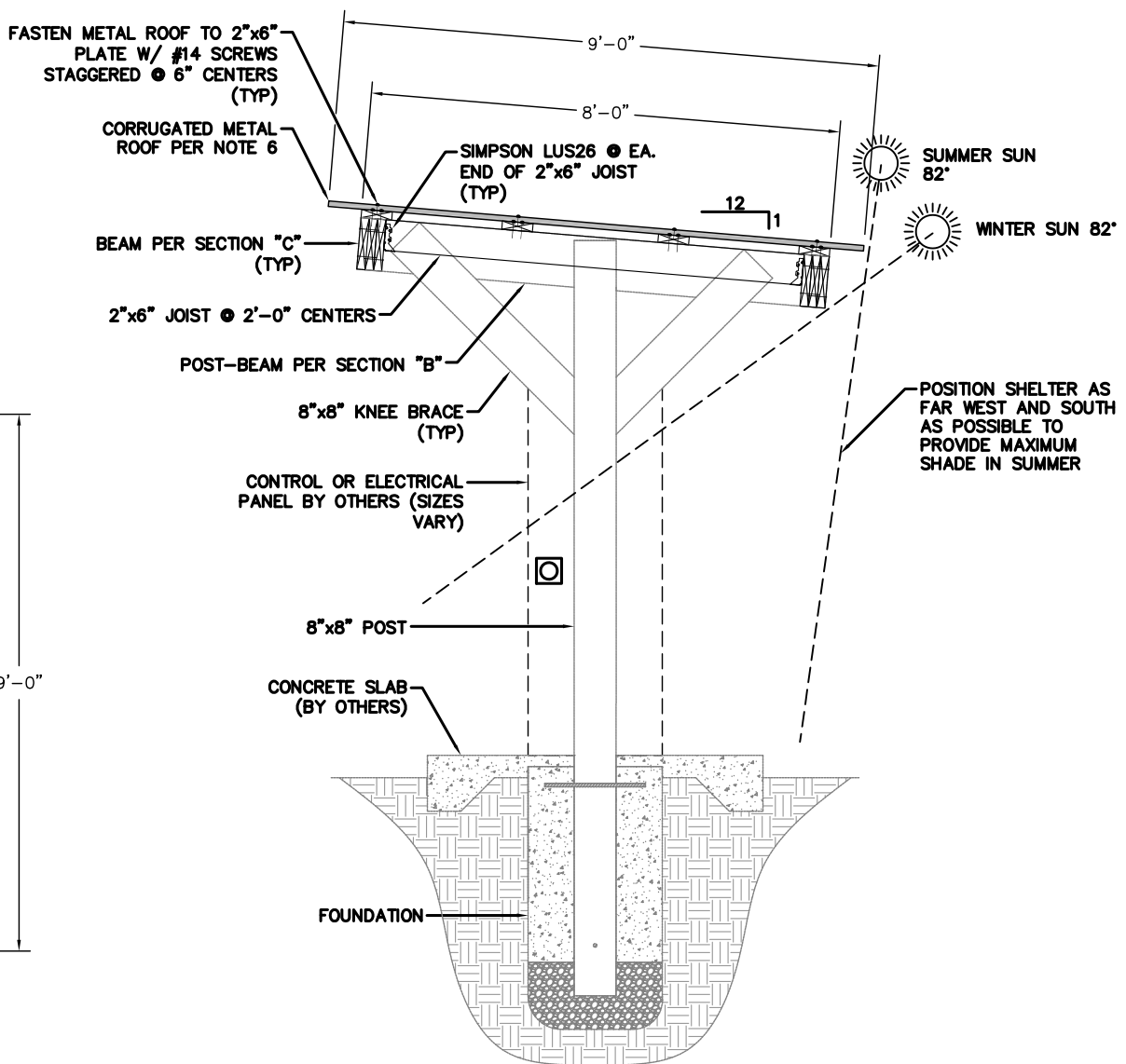
ROOF		
ZONE A	+27.2 PSF	-24.9 PSF
ZONE B	+27.2 PSF	-24.9 PSF
POSTS		
POST 1	27.2 PSF	
POST 2	27.2 PSF	

SUMMARY OF STRUCTURE QUANTITIES			
SECTION	ITEM	UNIT	QUANTITY
ROOF	METAL ROOF DECK	SQUARE FOOT	160
TIMBER (OUT TO LENGTH)	2"x6" x 10'-0"	EACH	0.0
	2"x6" x 8'-0"	EACH	0.0
	4"x12" x 16'-0"	EACH	2.0
	4"x12" x 8'-0"	EACH	2.0
	6"x6" x 12'-0"	EACH	2.0
	6"x6" x 8'-0"	EACH	2.0
CONNECTIONS	SIMPSON LUS26	EACH	16.0
	SIMPSON HUC26	EACH	4.0
	SIMPSON HUC26-3-8DS	EACH	12.0
	SIMPSON HUB26	EACH	7.2
	#5 REBAR	LINEAR FEET	2.0
FOUNDATION	CONCRETE	CUBIC FEET	12.0
	#57 GRAVEL	CUBIC FEET	4.0

ALTERNATE SUMMARY OF STRUCTURE QUANTITIES			
SECTION	ITEM	UNIT	QUANTITY
ROOF	METAL ROOF DECK	SQUARE FOOT	160
TIMBER (OUT TO LENGTH)	2"x6" x 10'-0"	EACH	0.0
	2"x6" x 8'-0"	EACH	0.0
	4"x12" x 16'-0"	EACH	0.0
	4"x12" x 8'-0"	EACH	0.0
	6"x6" x 12'-0"	EACH	0.0
	6"x6" x 8'-0"	EACH	0.0
CONNECTIONS	SIMPSON LUS26	EACH	16.0
	SIMPSON HUC26-3-8DS	EACH	4.0
	SIMPSON HUB26	EACH	12.0
	SIMPSON C26D	LINEAR FEET	7.2
	#5 REBAR	LINEAR FEET	0.0
FOUNDATION	CONCRETE	CUBIC FEET	12.0
	#57 GRAVEL	CUBIC FEET	4.0



FRAMING PLAN VIEW
SCALE: NTS



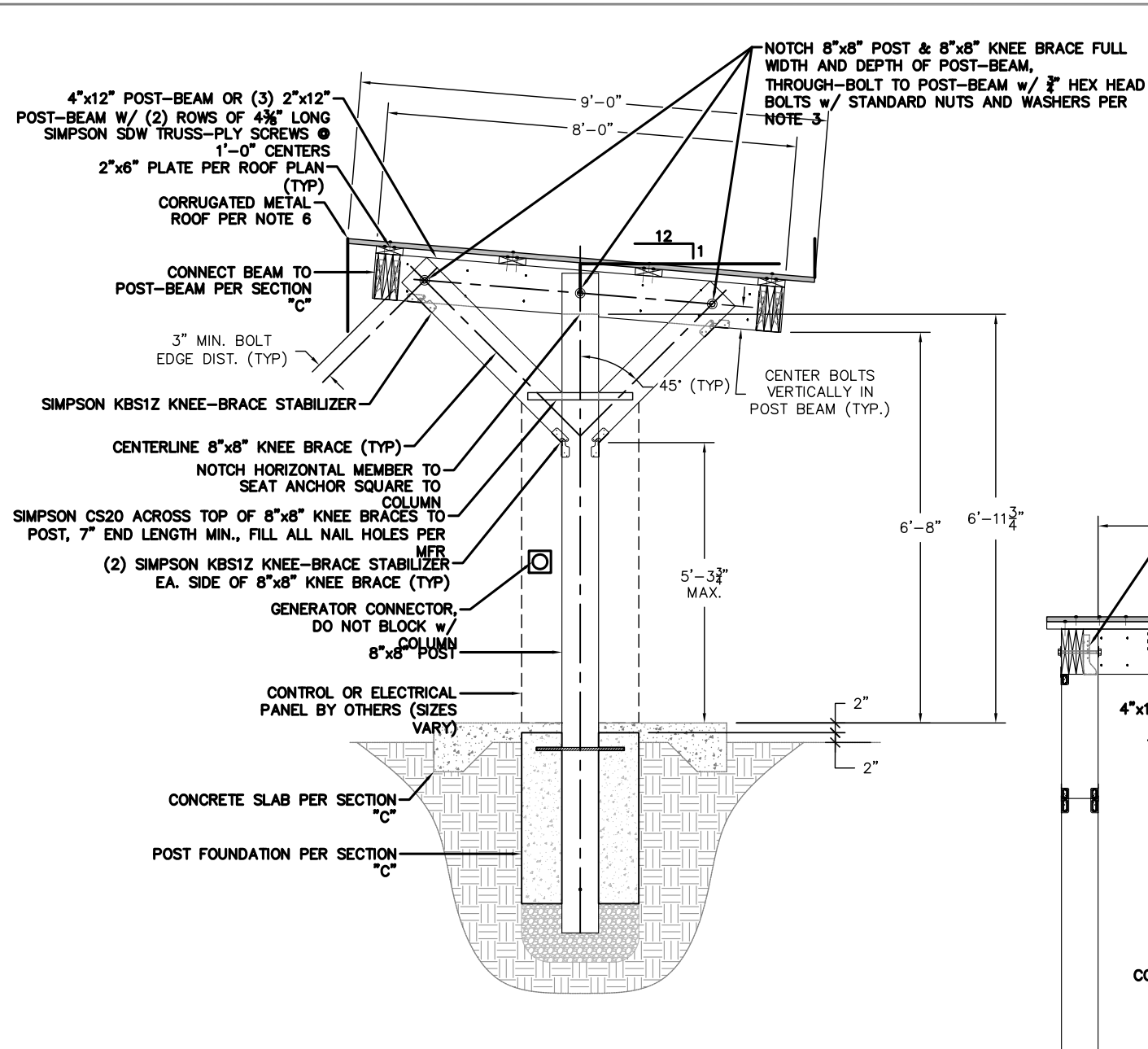
CROSS SECTION "A"
SCALE: N.T.S.

CONTROL PANEL SHELTER (16'-0" MAX. SPAN WIDTH)
- NOTES, PLAN, & SECTION -

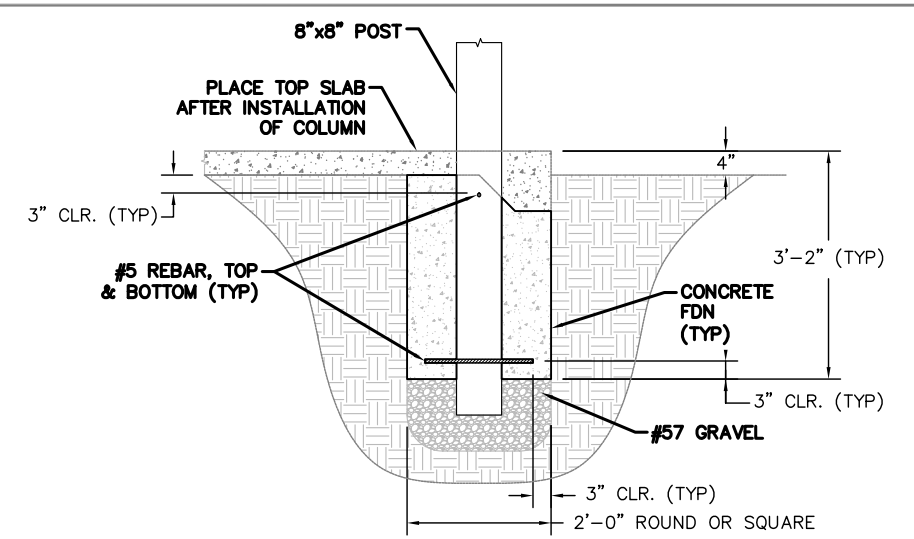


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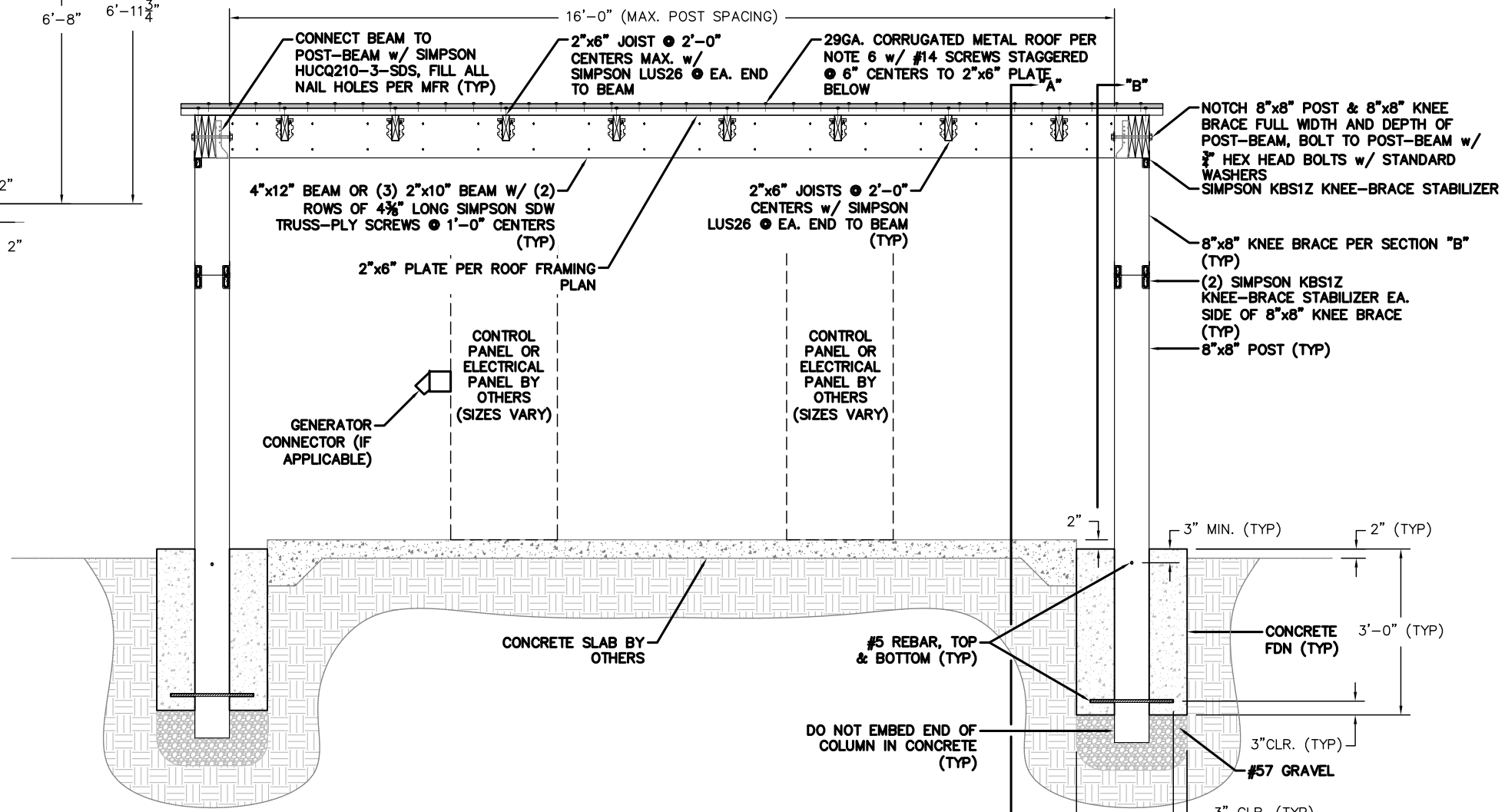
Date Issued:	NOVEMBER 2023	SHEET	PS06
Approved by:	WUE		
File Location:	WS\PROG1600-W8\Specs\05-2023	Scale:	N.T.S.



CROSS SECTION "B"
SCALE: N.T.S.



ALTERNATE FOUNDATION DETAIL
SCALE: N.T.S.



FRONT SECTION "C"
SCALE: N.T.S.

CONTROL PANEL SHELTER (16'-0" MAX. SPAN WIDTH)
- SECTION & DETAILS -



Title

Date Issued: NOVEMBER 2023	SHEET PS07
Approved by: WUE	
File Location: WS\PROG1600-W8\Sepacs\05-2023	Scale: N.T.S.

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. ALL PENETRATIONS 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 WATER PROOF COATING TO PREVENT CORROSION TO THE CONCRETE AND/OR EXPOSED REBAR AS SPECIFIED IN THE SANITARY SEWER PRE-CAST CONCRETE MANHOLES SECTION OF COT SPECIFICATIONS.
4. THE FLANGE FOR THE LONG RADIUS 90° FITTING IN THE WET WELL SHALL 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 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 MANUFACTURER DIMENSIONS MAY VARY SLIGHTLY. HATCH FALL PROTECTION IS REQUIRED.
6. THERE SHALL BE AT LEAST 3" CLEARANCE FROM ALL SIDES OF THE PUMP VOLUTE TO THE CLEAR OPENING IN THE LID.
7. 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.
8. ALL BOLTS USED TO MOUNT PUMP BASE, GUIDE RAILS, GUIDE RAIL SUPPORTS & PIPE SUPPORTS SHALL BE DRILLED AND EPOXIED. NO REDHEADS WILL BE ALLOWED.
9. REBAR LAYOUT FOR WET WELL SHALL BE PROVIDED BY THE PRE-CAST CONCRETE MANUFACTURER UNLESS A SPECIAL DESIGN IS REQUIRED.
10. 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.
11. TOP OF WET WELL LIDS SHALL BE A MINIMUM OF ONE FOOT ABOVE THE 100 YEAR FLOOD PLAIN ELEVATION. PROVIDE CALCULATIONS AND/OR DOCUMENTATION.
12. 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.
13. 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.
14. 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.
15. 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.
16. GRAVEL ALL AREAS INSIDE PUMP STATION FENCE WITH 4" OF FDOT No. 57 GRAVEL OVER 20 MIL PDC OR EQUIVALENT.
17. PROVIDE SOIL BORINGS TO DEPTH OF WET WELL PLUS 5 FEET (MINIMUM).
18. MAINTAIN A MIN. 2% SLOPE ACROSS THE ENTIRE PUMP STATION SITE TO PROMOTE PROPER DRAINAGE.
19. 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 UTILITY ENGINEERING MANAGER OR DESIGNEE.
20. THE FENCE SHALL TYPICALLY BE LOCATED 6" WITHIN THE PROPERTY/EASEMENT LIMITS UNLESS LANDSCAPING IS REQUIRED.
21. 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.
22. THE ENGINEER OF RECORD SHALL PREPARE, OR HAVE PREPARED, ELECTRICAL PLANS THAT ARE SPECIFIC TO THE STATION.



Title:

PUMP STATION DESIGN NOTES

...\\S\PROG\1600-W&S Specs\01-2018 Specification Update\007-Details\

Date Issued:

SHEET

Approved by:

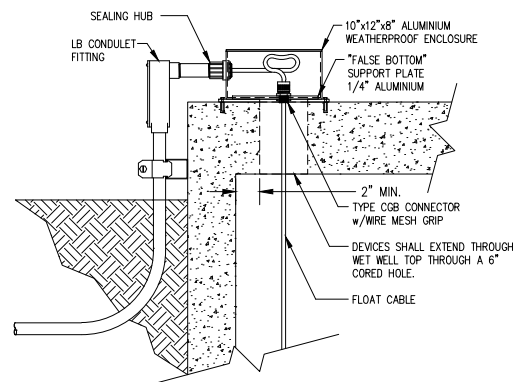
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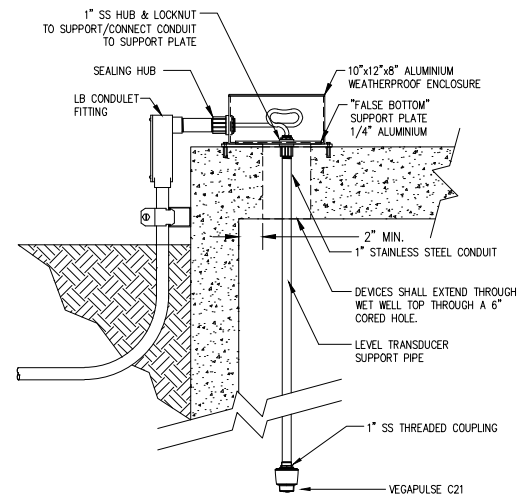
NOVEMBER 2023

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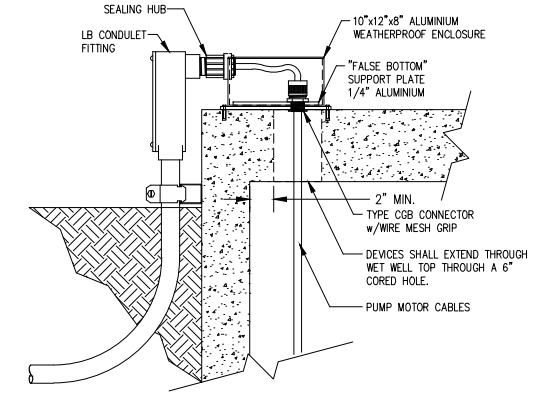
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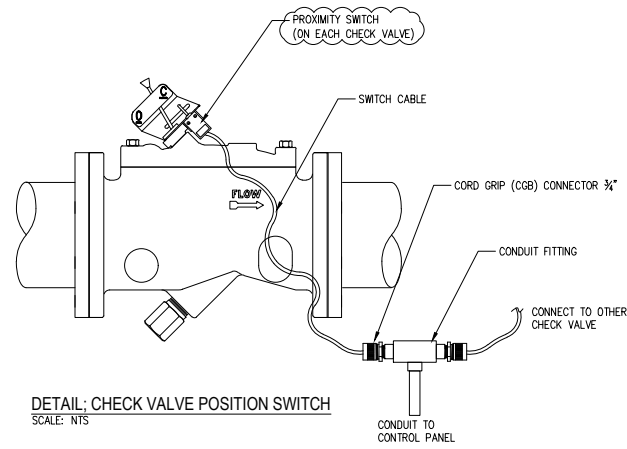
DETAIL: FLOAT SWITCH CABLE JUNCTION BOX
SCALE: NTS



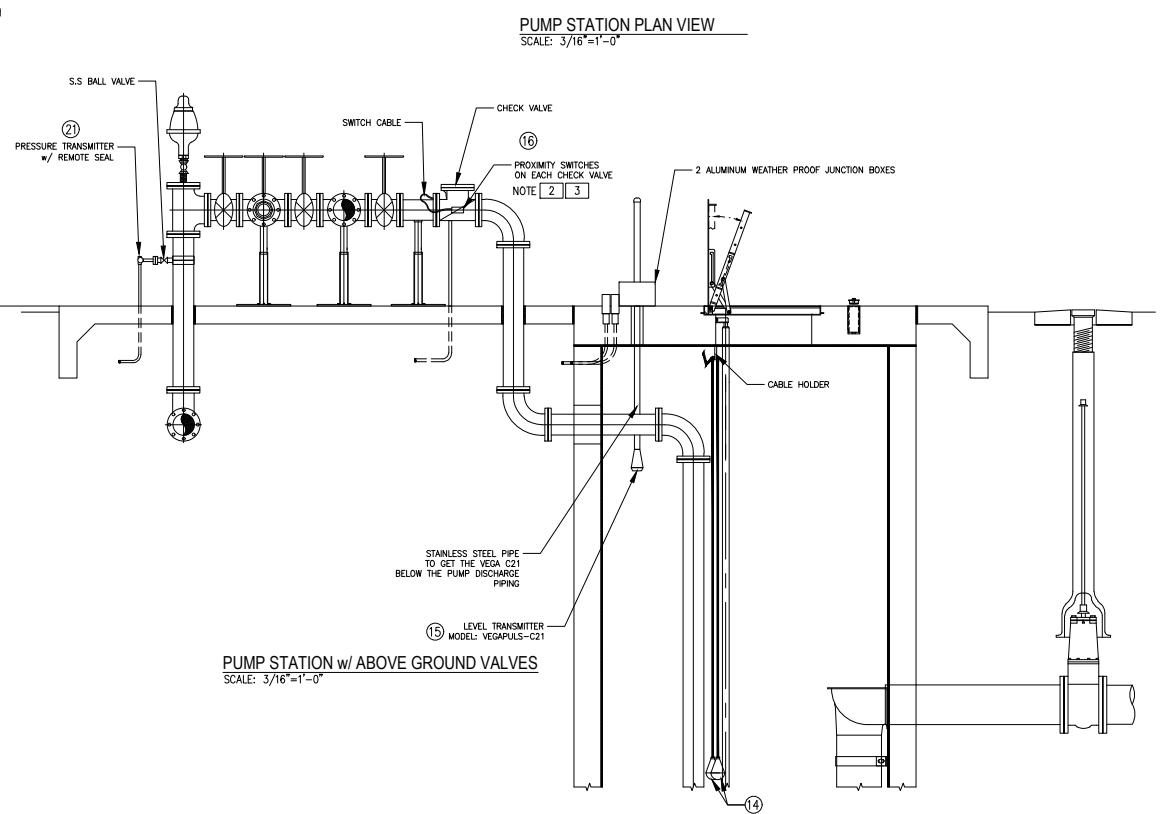
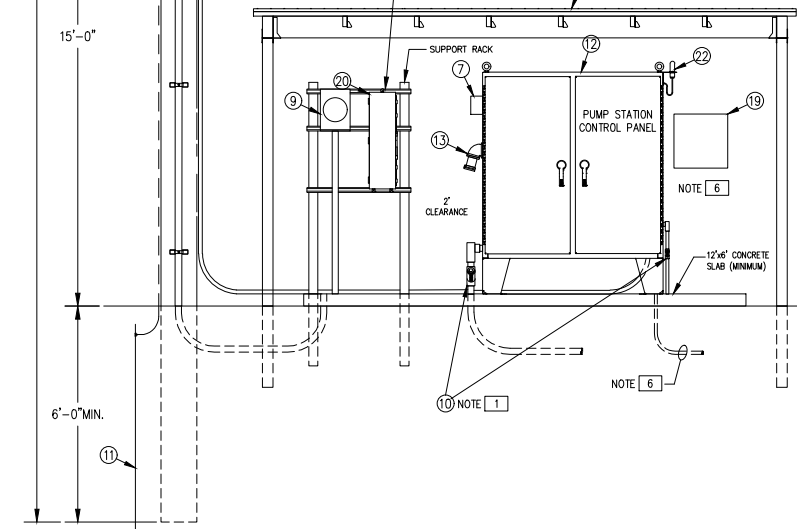
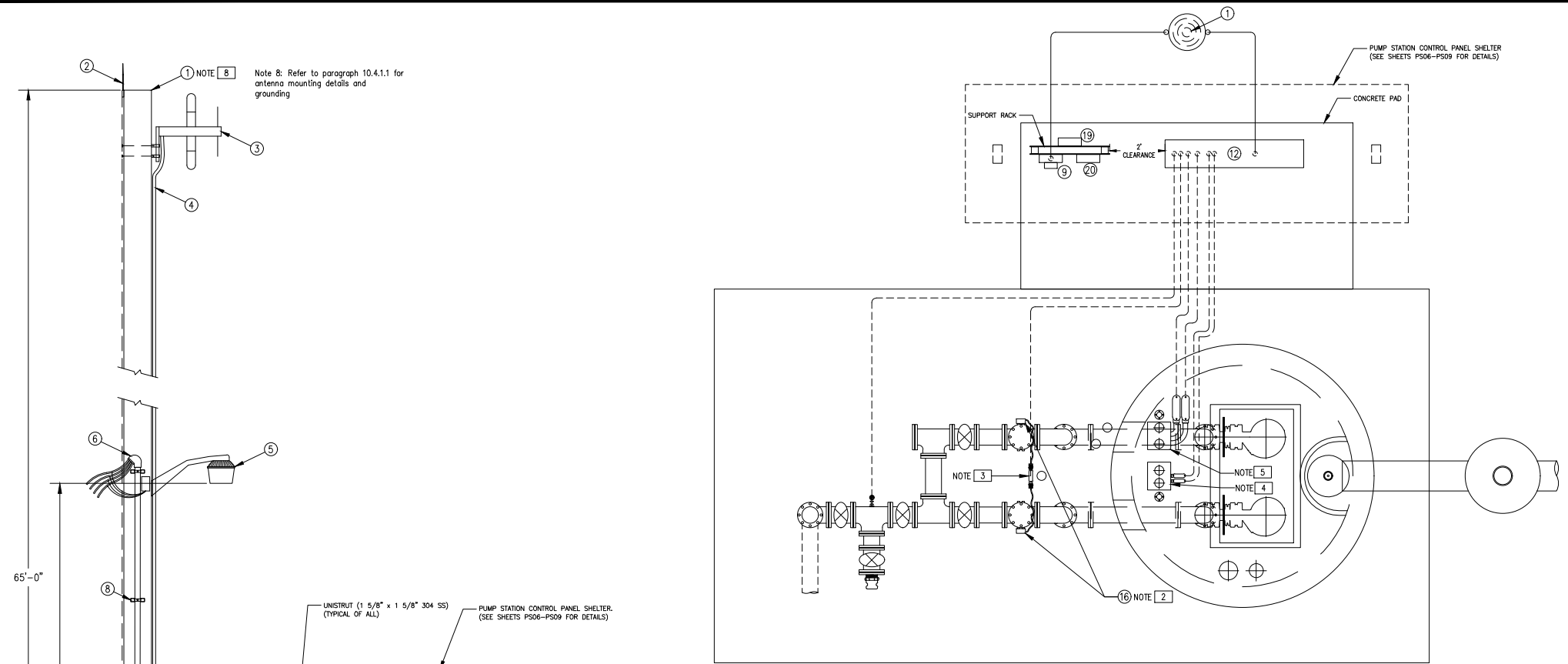
DETAIL: LEVEL TRANSMITTER MOUNTING
SCALE: NTS



DETAIL: PUMP MOTOR CABLE JUNCTION BOX
SCALE: NTS



DETAIL: CHECK VALVE POSITION SWITCH
SCALE: NTS



BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	WOOD POLE-60\"/>			
2	AIR TERMINAL - CLASS 1 SOLID COPPER AIR TERMINAL BASE	HARGER LIGHTNING PROTECTION, INC.	NO. 60 NO. 160	1
3	RF ANTENNA-YAGI w/MOUNTING AND GROUNDING HARDWARE	DECIBEL PRODUCTS	MODEL DB-499	1
4	ANTENNA COAXIAL CABLE SUPERFLEXIBLE FORM FILLED	COMMSCOPE	FSJ4-50B	1
5	SECURITY LIGHT - LED, w/ MOUNTING ARM, PHOTO CONTROL, 120VAC	RAB	YBLED60	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\"/>			
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 TRANSDUCER SUSPENDED ON 1\"/>			
16	PROXIMITY SWITCH	VAL MATIC		2
17	10\"/>			
18	MAGMETER	McCROMETER	ULTRA-MAG UM-XX	1
19	BATTERY BOX	BATTLE BORN	BB5024 50 Ah 24V LiFePO4	1
20	MAIN BREAKER	SQUARE-D		1
21	PRESSURE TRANSDUCER w/ REMOTE SEAL	ROSEMOUNT	2088C3S2ZAT1MS1T1199WD495ARTW5DA1G	1
22	CELLULAR ANTENNA 4G/3G MULTIBAN	LARID TECHNOLOGIES	TRA6927M3PB	1

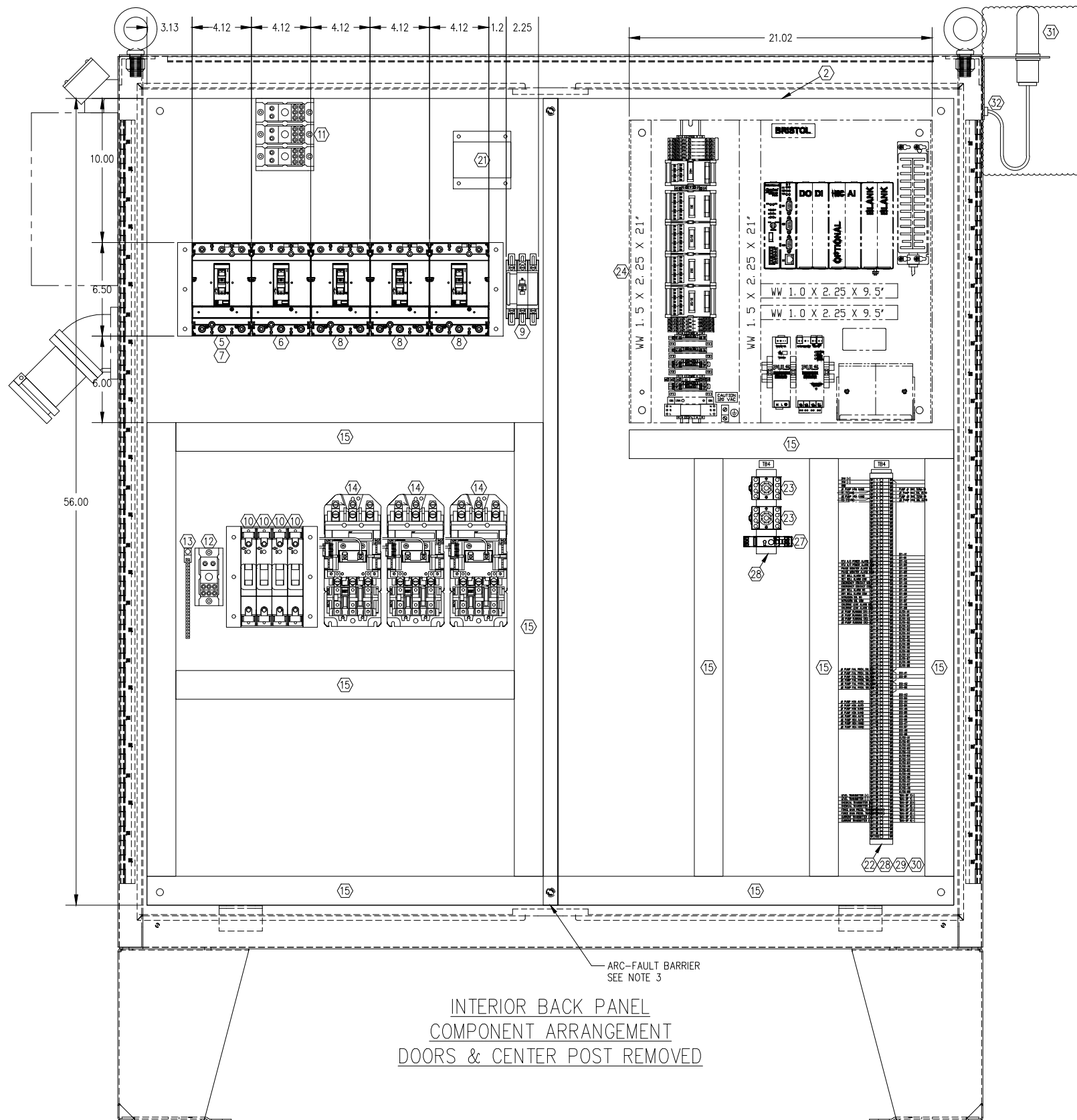
- NOTES:**
- CONDUIT SEALS SHALL BE PLACED WITHIN (18)EIGHTEEN INCHES OF THE PUMP STATION CONTROL PANEL ENCLOSURE.
 - PROXIMITY SWITCH TO BE MOUNTED ON EACH SUBMERSIBLE PUMP'S DISCHARGE PIPING CHECK VALVE TO INDICATE PUMP FAILURE IF NO FLOW OCCURS TO ACTIVATE THE SWITCH. SWITCHES SUPPLIED AS PART OF VALVE PURCHASE.
 - CONDUITS AND FITTINGS. CONTRACTOR TO USE TYPE CGB CORD GRIP CONNECTORS FOR PROXIMITY SWITCH CABLES. COORDINATE w/ VALVE INSTALLATION.
 - 10\"/>
 - 10\"/>
 - BATTERY BOX SHOWN AS INDICATED FOR CLARITY. THE INTENT IS FOR THE BATTERY TO BE MOUNTED ON THE BACK OF THE ELECTRICAL EQUIPMENT SUPPORT RACK. A SEPARATE SUPPORT RACK IS FEASIBLE IF SITE CONDITIONS DICTATE THAT.
 - 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. REFER TO PARAGRAPH 11.4.1.1 FOR ANTENNA MOUNTING DETAILS AND GROUNDING.



Title: _____

**ELECTRICAL SPECIFICATIONS
 DUPLEX PUMP STATION
 ELECTRICAL SITE PLAN**

Date Issued: 11/2023	SHEET E-01
Approved by: -	SH. 1 OF 1
File Location: -	Scale: N.T.S



INTERIOR BACK PANEL
COMPONENT ARRANGEMENT
DOORS & CENTER POST REMOVED

ARC-FAULT BARRIER
SEE NOTE 3

15HP OR LESS WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL DUPLEX/TRIPLEX

BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT, PAINTED WHITE (POWDER COAT)	HOFFMAN	A-62H60125S6LP A-FK1212SS	1
2	ENCLOSURE "BACK" PANEL	HOFFMAN	A-60P60	1
3	DEAD FRONT SWING-OUT PANEL KIT	-	-	2
4	EMERGENCY POWER RECEPTACLE - 100A, 3ø, 4 WIRE, w/45° ADAPTER & SCREW CAP	HUBBELL	HBL4100R9W AA6010055	1
5	H-FRAME MECHANICAL INTERLOCK FOR TOGGLE HANDLE	SQUARE-D	S29354	1
6	BREAKER-150A, THREE POLE	SQUARE-D	HGL36150	1
7	BREAKER-100A, THREE POLE AUXILIARY CONTACT 1A/1B ON EMERG. BKR	SQUARE-D	HGL36100 S29450	1
8	BREAKER 80A, THREE POLE	SQUARE-D	HGL36080	2
9	BREAKER 10A, THREE POLE	SQUARE-D	Q0U310	1
10	BREAKER 15A, SINGLE POLE	SQUARE-D	BDL16015	4
11	POWER BLOCK	SQUARE-D	9080LBA363206	1
12	POWER BLOCK FOR NEUTRALS	SQUARE-D	9080LBA163206	1
13	EQUIPMENT GROUND BAR w/ #1-4/0 COPPER LUG	SQUARE-D	PK15GTA-L	1
14	FULL VOLTAGE STARTER, SIZE 2, w/O.L'S AND N.O.-N.C AUXILIARY CONTACT	ALLEN-BRADLEY	509-COC 595-AB	2
15	WIREWAY DUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	2
16	SERVICE RECEPTACLE 15A, 125VAC, G.F.I. w/COVER	LEVITON	6599-W	1
17	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2RQ1-A2	1
18	3 POSITION SELECTOR SWITCH w/"H-O-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
19	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-QH10G 800T-X530	2
20	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-QH10R 800T-X527	2
21	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-230-ALA	1
22	TERMINAL	PHOENIX CONTACT	UK 5	A/R
23	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12P14V20 NR51	3
24	RTU	BRISTOL-BABCOCK	-	1
25	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
26	TRANSIENT VOLTAGE SURGE SUPPRESSOR	ASCO POWER TECH	460240HP20ACCE10	1
27	GENERAL PURPOSE TIMING RELAY	ALLEN-BRADLEY	700-FEB1TU22	1
28	35mm SYMMETRICAL DIN RAIL	PHOENIX CONTACT	NS 35/7,5 0801733	A/R
29	TERMINAL END COVER	PHOENIX CONTACT	D-UK 4/10 3003020	A/R
30	TERMINAL END CLAMP	PHOENIX CONTACT	CLIPFIX 35 3022218	A/R
31	CELLULAR ANTENNA, COAXIAL JUMPER CABLES (CELLULAR AND RF SYSTEMS)	(SEE F. 01-ANTENNA) (SEE STD-CABLES)	195-18-18-P3' 195-07-18-P3' 240-05-07-P3'	A/R
32	BULKHEAD CELLULAR SURGE ARRESTOR	(SEE STD.)	TW-LP-SMA-J-BHJ (OR EQUAL)	A/R

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

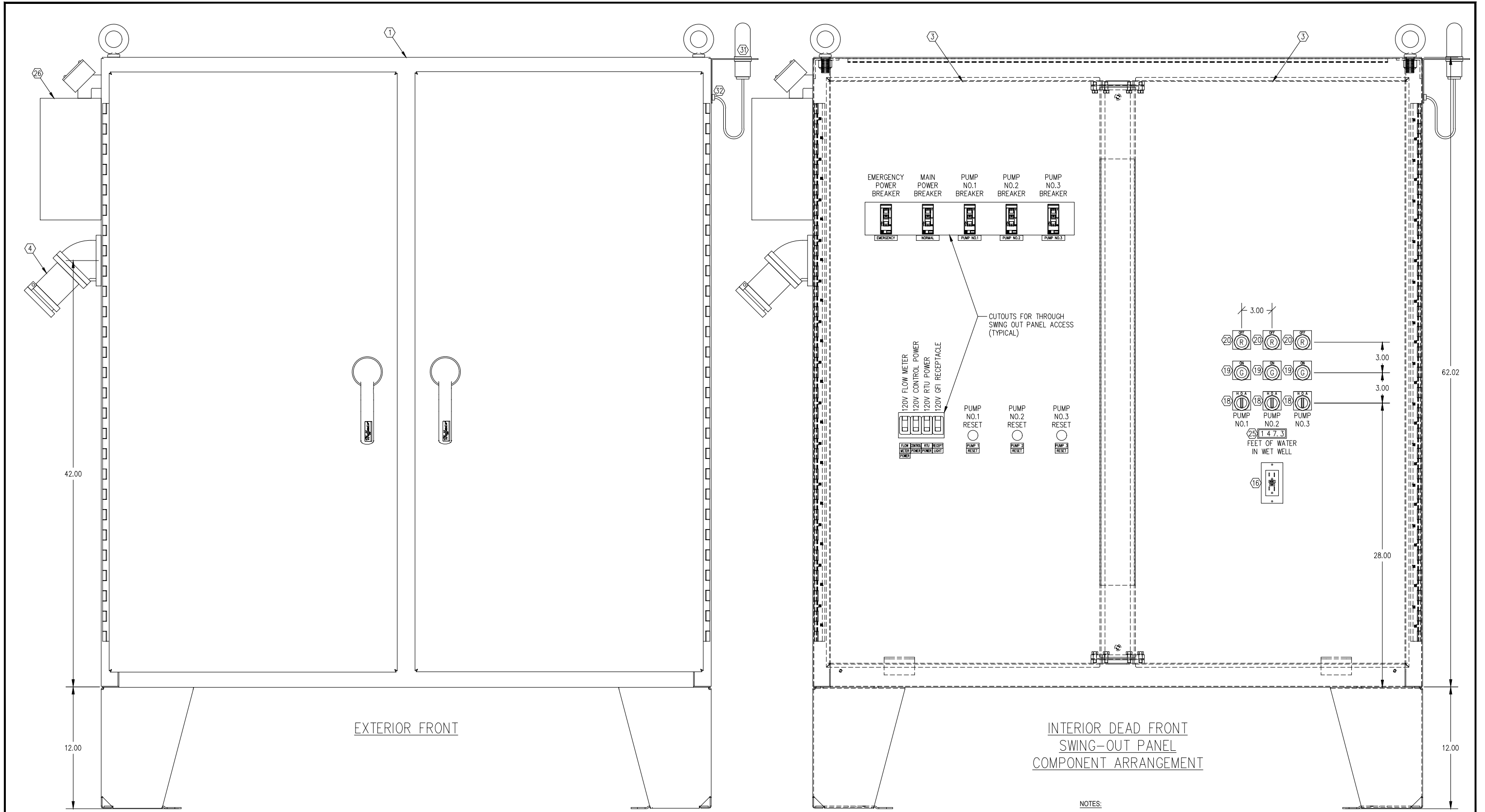
MOTOR HP	MAIN BREAKER	EMERG. BREAKER	STARTER BREAKER	STARTER SIZE
15	150*	100*	80	2
10	100	100	60	2
7.5	80	80	45	1
5	60	60	30	1

TRIPLEX PUMP STATION

* MAIN AND EMERGENCY BREAKERS SHALL BE SAME FRAME IN ORDER TO ACCOMMODATE STOCK MECHANICAL INTERLOCK COMPONENT.
(150A IS A H-FRAME BREAKER THEREFORE THE 100A EMERGENCY BREAKER MOUNTED WITH IT SHALL ALSO BE A H-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.
- PANEL CONSTRUCTOR SHALL INSTALL A METAL BARRIER BETWEEN THE CONTROL (LOW VOLTAGE) SIDE OF THE PANEL AND THE POWER (HIGH VOLTAGE) SIDE OF THE PANEL TO PROVIDE ARC-FAULT PROTECTION FOR OPERATORS AND SERVICE PERSONNEL. NOTCH THE DIVIDER TO ALLOW THE WIREWAY AT THE BOTTOM OF THE PANEL TO SPAN WIDTH OF THE BACK PANEL FOR CONTROL WIRING.



15HP OR LESS WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL DUPLEX/TRIPLEX

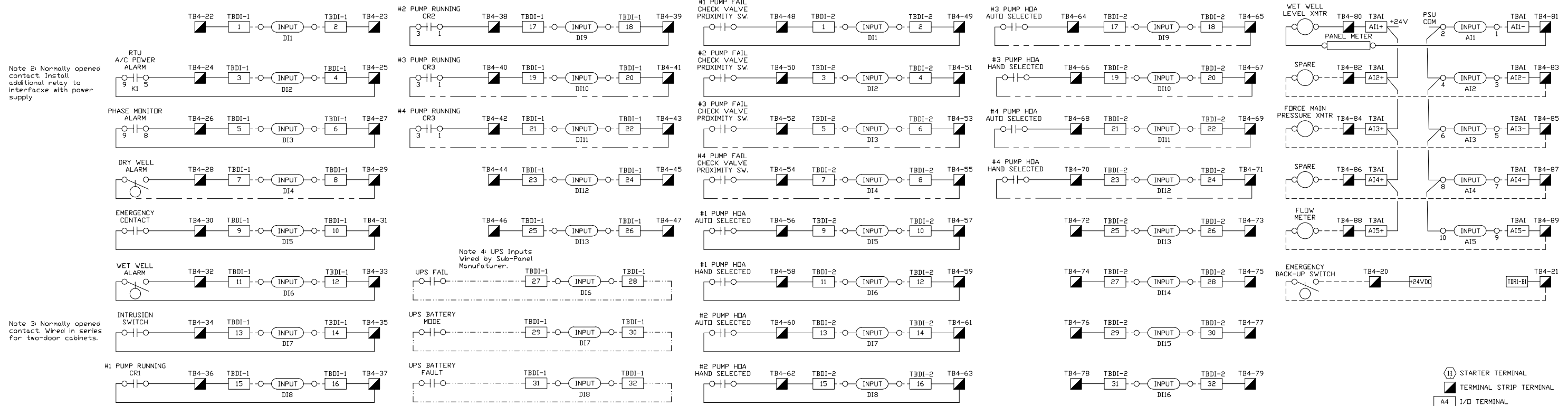
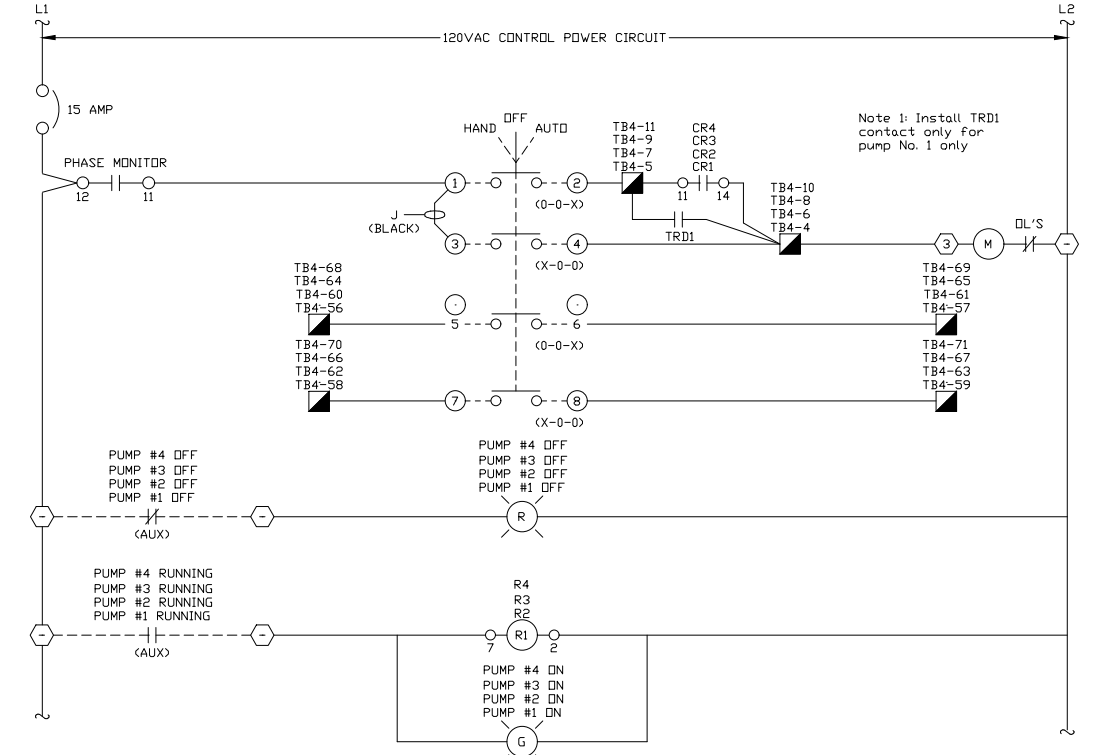
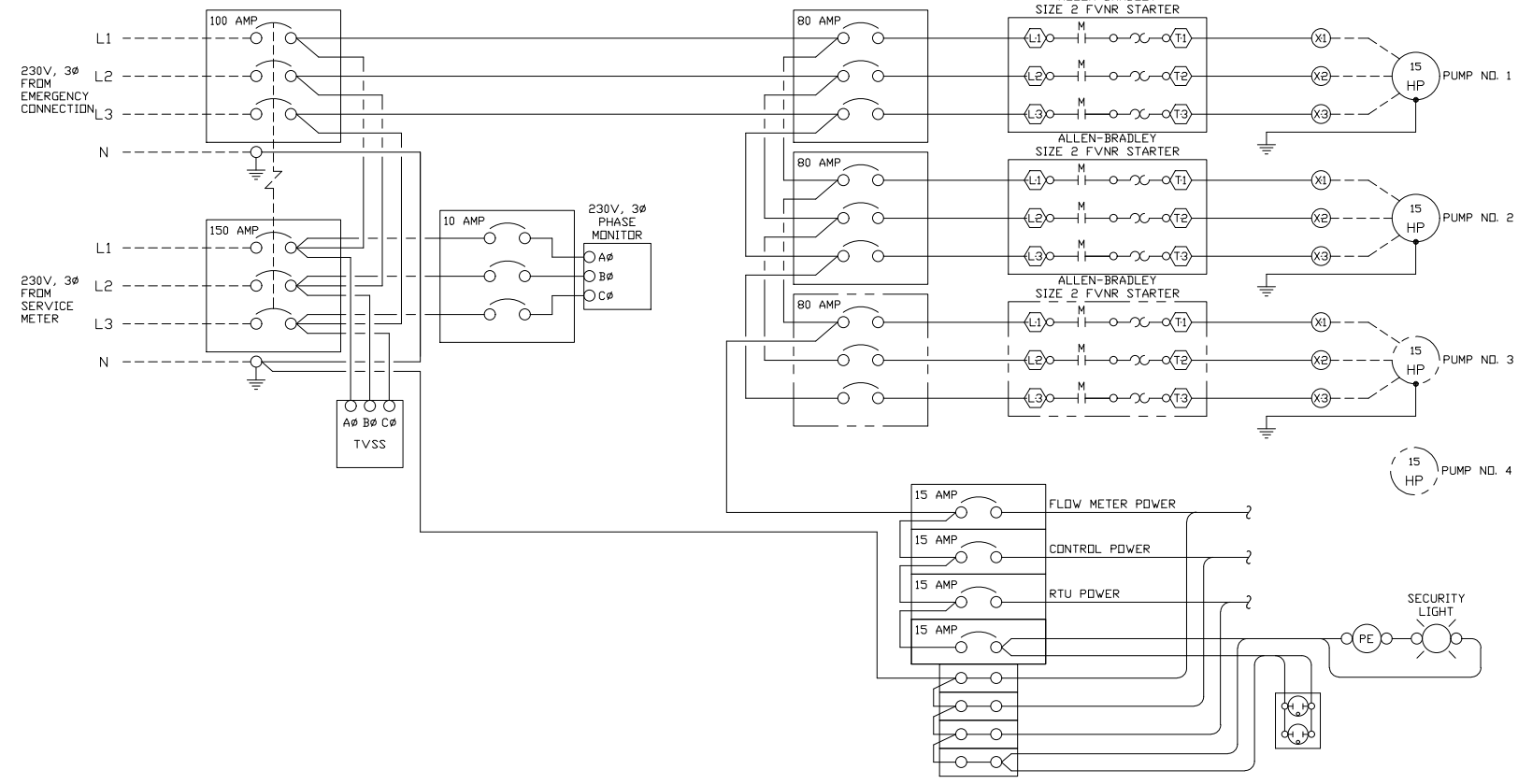
NOTES:
 1 REFERENCE DRAWING E-02A FOR BILL OF MATERIALS AND INTERNAL ARRANGEMENT OF THE ELECTRICAL COMPONENTS.



Title:

ELECTRICAL SPECIFICATIONS
 230V, 15HP OR LESS PUMP STATION
 ELECTRICAL CONTROL PANEL LAYOUT

Date Issued: 11/2023	SHEET E-02
Approved by: -	SH. 1 OF 1
File Location: -	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.

Note 4: UPS Inputs Wired by Sub-Panel Manufacturer.

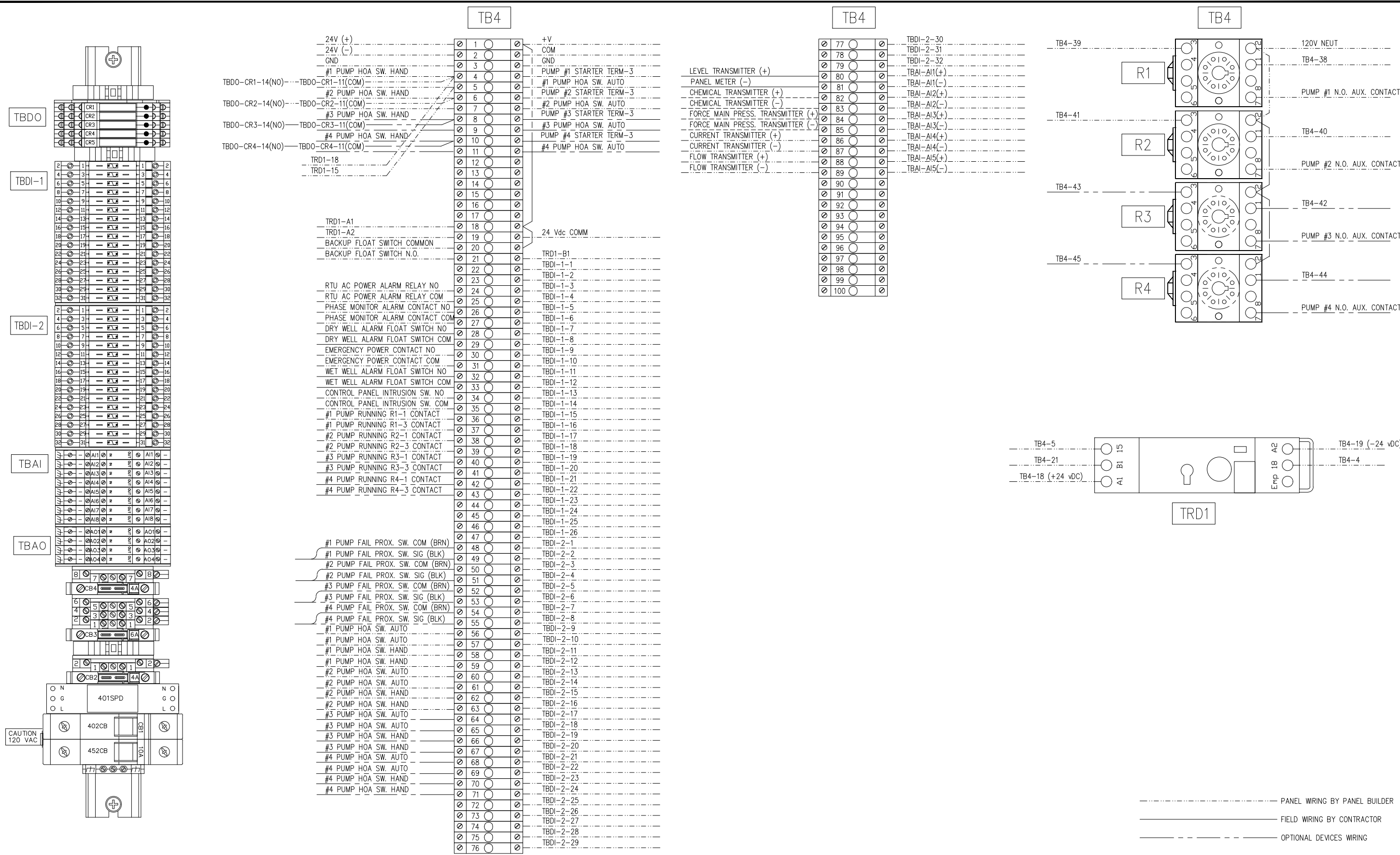
STARTER TERMINAL
 TERMINAL STRIP TERMINAL
 I/O TERMINAL



Title:

ELECTRICAL SPECIFICATIONS 230V, 15HP OR LESS SUBMERSIBLE PUMP STATION ELECTRICAL WIRING DIAGRAM

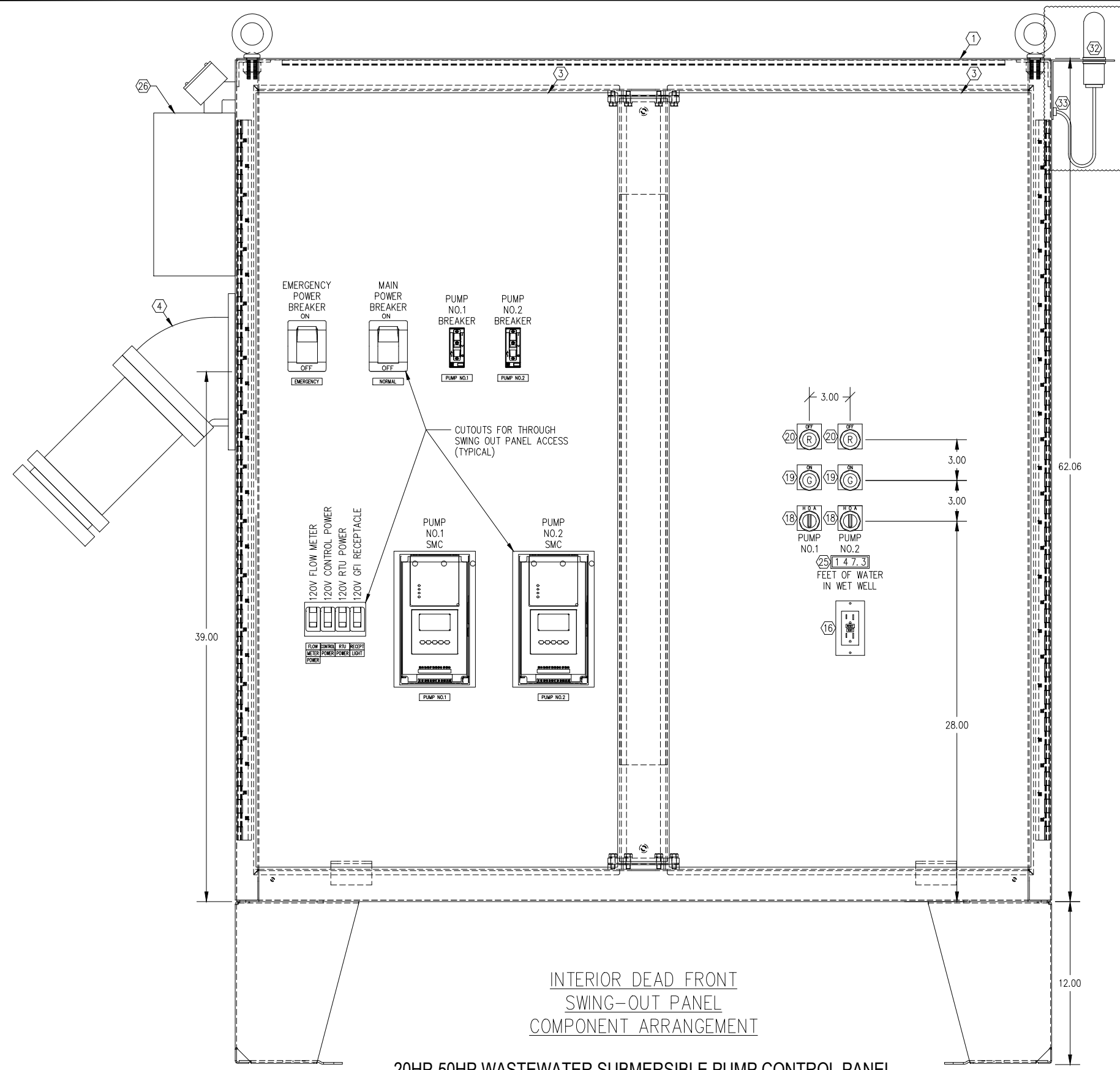
Date Issued: 11/2023	SHEET E-03
Approved by:	SH. 1 OF 1
File Location:	Scale: N.T.S



Title:

ELECTRICAL SPECIFICATIONS
230V, 15HP OR LESS PUMP STATION
ELECTRICAL INTERCONNECT DIAGRAM

Date Issued:	11/2023	SHEET
Approved by:	-	E-04
File Location:	-	SH. 1 OF 1
Scale:	-	N.T.S



20HP-50HP WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL

INTERIOR DEAD FRONT
SWING-OUT PANEL
COMPONENT ARRANGEMENT

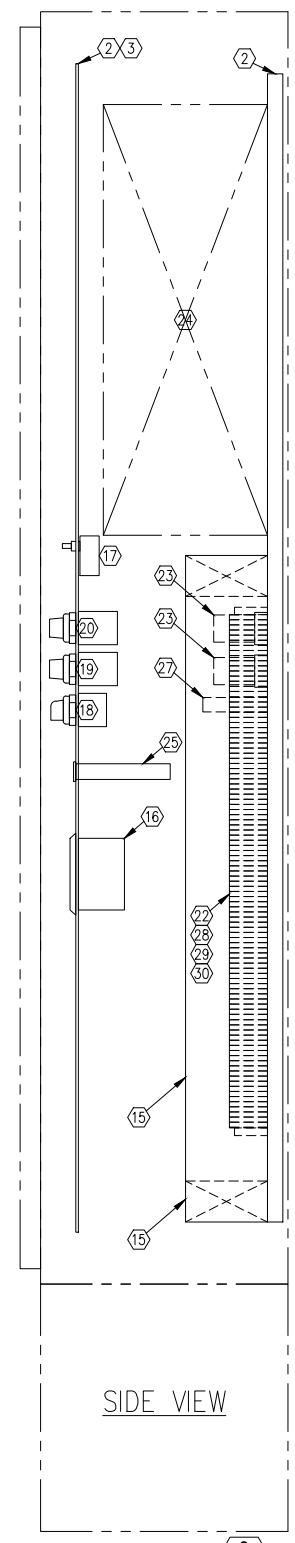
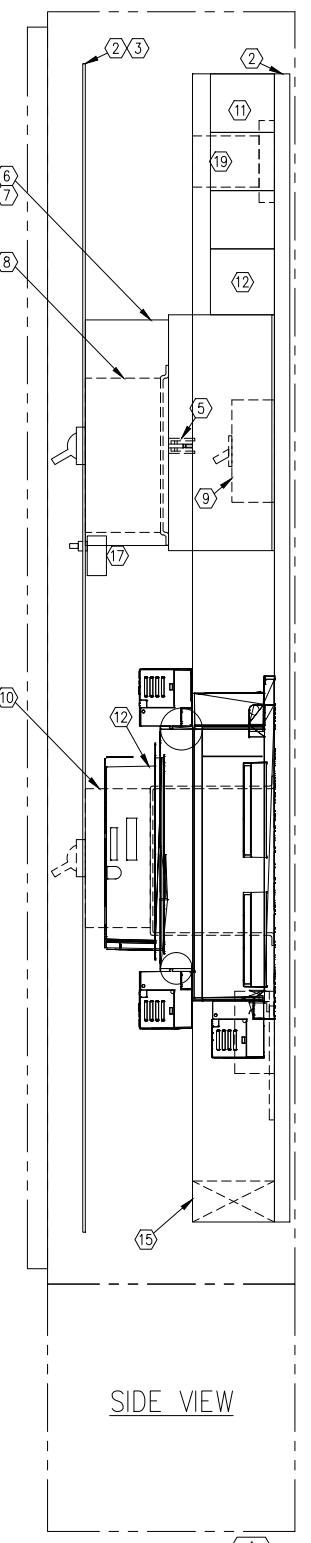
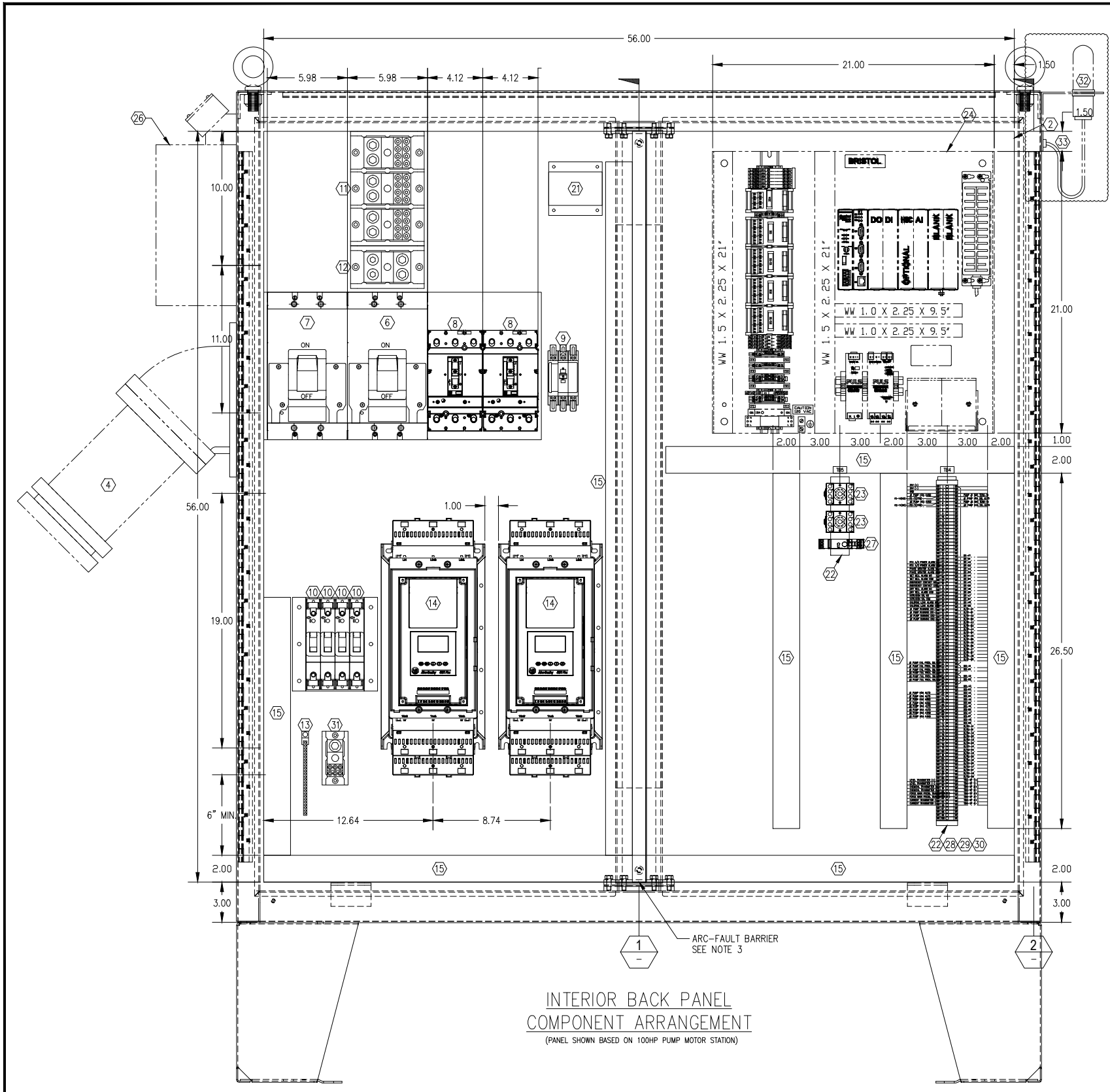
NOTES:
1 REFERENCE DRAWING E-06 FOR BILL OF MATERIALS AND INTERNAL ARRANGEMENT OF THE ELECTRICAL COMPONENTS.



Title:

ELECTRICAL SPECIFICATIONS
230V, 20-50HP DUPLEX PUMP STATION
ELECTRICAL CONTROL PANEL LAYOUT

Date Issued: 11/2023	SHEET E-05
Approved by: -	SH. 1 OF 1
File Location: -	Scale: N.T.S



20HP-50HP WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL

BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT PAINTED WHITE (POWDER COAT)	HOFFMAN	A-62H6012SSLP A-FK1212SS	1
2	ENCLOSURE BACK	HOFFMAN	A-60P60	1
3	DEAD FRONT SWING-OUT PANEL KIT	-	-	2
4	EMERGENCY POWER RECEPTACLE - 100A, 3Ø, 4 WIRE, w/45° ADAPTER & SCREW CAP	HUBBELL	HBL4100R9W AA6010055	1
5	WALKING BEAM MECHANICAL INTERLOCK ASSEMBLY	SQUARE-D	LA6WB	1
6	BREAKER-300A, THREE POLE	SQUARE-D	LAL36300WB	1
7	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 10A, THREE POLE	SQUARE-D	QOU310	1
10	BREAKER 15A, SINGLE POLE	SQUARE-D	BDL16015	4
11	POWER TERMINAL BLOCK	SQUARE-D	9080LBA36520B	1
12	POWER TERMINAL BLOCK	SQUARE-D	9080LBA165202	1
13	EQUIPMENT GROUND BAR w/ #1-4/0 COPPER LUG	SQUARE-D	PK15GTA-L	1
14	FLEX SMART MOTOR CONTROLLER (SMC), 135A, w/PUMP CONTROL	ALLEN-BRADLEY	150-F135NBDB	2
15	LINE/LOAD LUGS	ALLEN-BRADLEY	199-LF1	4
16	TERMINAL COVERS	ALLEN-BRADLEY	150-TC1	4
17	WIREWAY DUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	-
18	SERVICE RECEPTACLE 15A, 125VAC w/COVER	LEVITON	6599-W	1
19	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2RQ1-A2	2
20	3 POSITION SELECTOR SWITCH w/"H-O-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
21	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-QHT0G 800T-X530	2
22	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-QHT0R 800T-X527	2
23	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-230-ALA	1
24	TERMINAL	PHOENIX CONTACT	UK 5	60
25	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12P14V20 NR51	2
26	RTU	BRISTOL-BABCOCK	-	1
27	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
28	TRANSIENT VOLTAGE SURGE SUPPRESSOR	ASCO POWER TECH	460240HP20ACCE10	1
29	GENERAL PURPOSE TIMING RELAY	ALLEN-BRADLEY	700-FEB1TU22	1
30	35mm SYMMETRICAL DIN RAIL	PHOENIX CONTACT	NS 35/7,5 0801733	A/R
31	TERMINAL END COVER	PHOENIX CONTACT	D-UK 4/10 3003020	A/R
32	TERMINAL END CLAMP	PHOENIX CONTACT	CLIPFIX 35 3022218	A/R
33	POWER TERMINAL BLOCK	SQUARE-D	9080LBA163106	1
34	CELLULAR ANTENNA, COAXIAL JUMPER CABLES (CELLULAR & RF SYSTEMS)	LAIRD (SEE E-01-ANTENNA) (SEE STD.-CABLES)	195-18-18-P3' 195-07-18-P3' 240-05-07-P3'	A/R
35	BULKHEAD CELLULAR SURGE ARRESTOR	(SEE STD.)	TW-LP-SMA-J-BHJ (OR EQUAL)	A/R

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

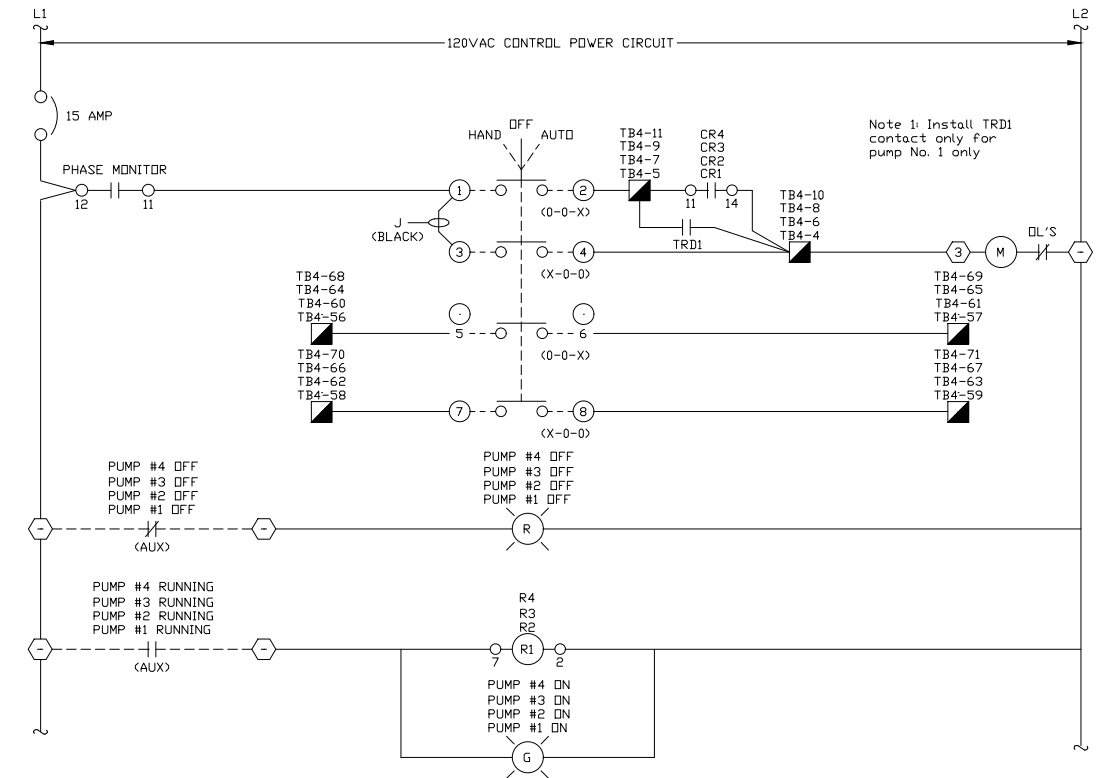
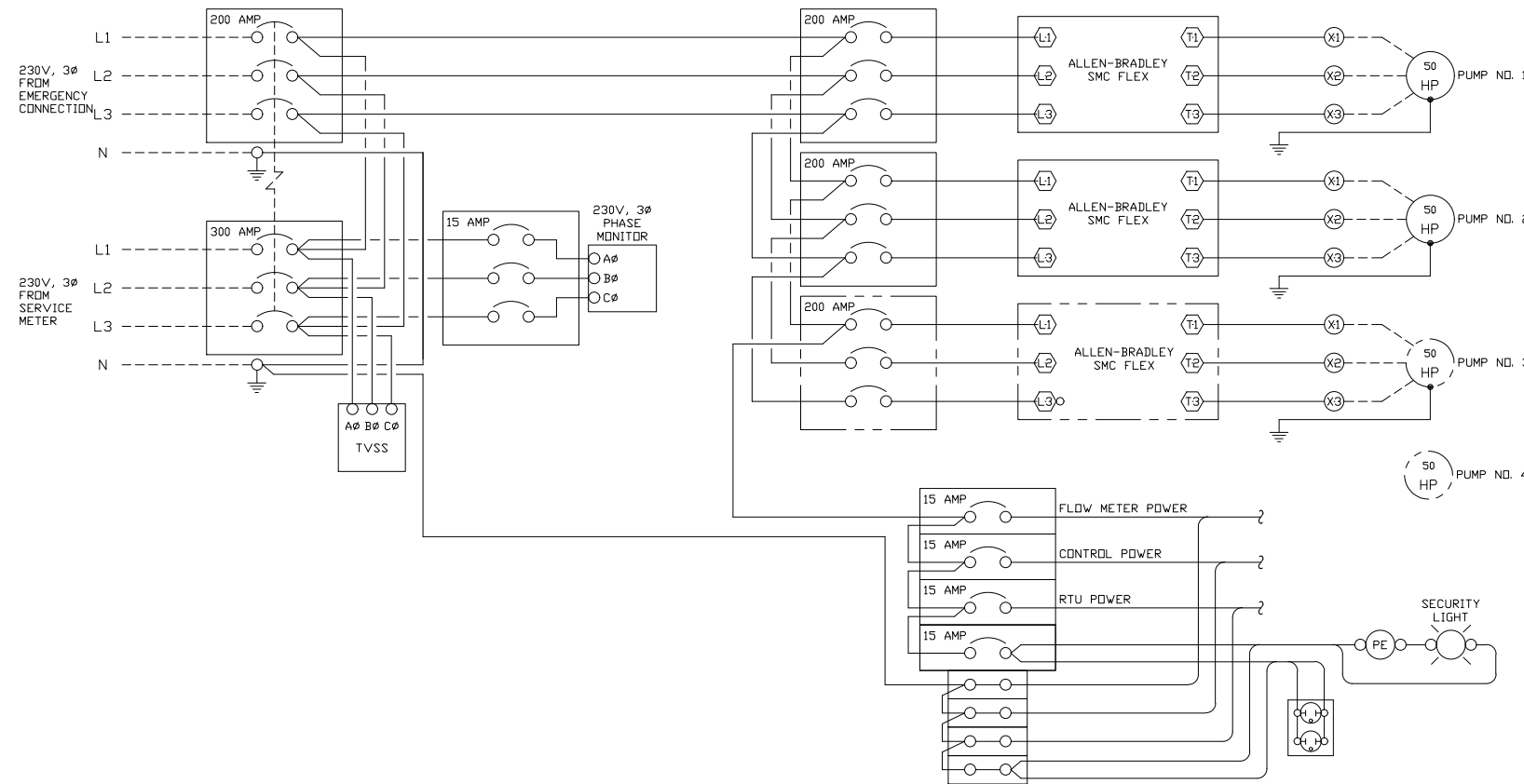
- NOTES:**
- PANEL CONSTRUCTOR AND PUMP STATION INSTALLATION CONTRACTOR SHALL COORDINATE THE CALIBRATION OF THE PANEL METER AND THE WETWELL LEVEL INSTRUMENT (PRESSURE TRANSDUCER) SUCH THAT THE PANEL METER READ OUT IS IN ENGINEERING UNITS. UNITS SHALL BE FEET TO TENTHS OF FEET (i.e. 14.6 FEET).
 - BREAKERS AND GENERATOR RECEPTACLE TO BE SIZED BASED ON THE HORSEPOWER OF THE PUMP STATION'S PUMP MOTORS.
 - PANEL CONSTRUCTOR SHALL INSTALL A METAL BARRIER BETWEEN THE CONTROL (LOW VOLTAGE) SIDE OF THE PANEL AND THE POWER (HIGH VOLTAGE) SIDE OF THE PANEL TO PROVIDE ARC-FAULT PROTECTION FOR OPERATORS AND SERVICE PERSONNEL.



Title: _____

**ELECTRICAL SPECIFICATIONS
230V, 20-50HP DUPLEX PUMP STATION
ELECTRICAL CONTROL PANEL LAYOUT**

Date Issued: 11/2023	SHEET E-06
Approved by: -	SH. 1 OF 1
File Location: -	Scale: N.T.S

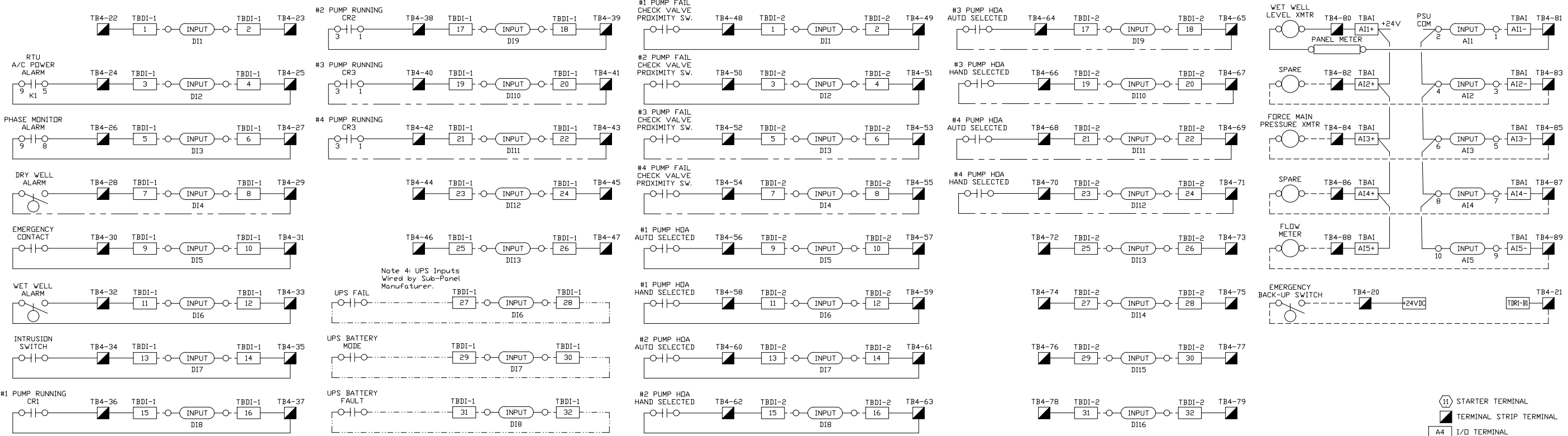


Note 2: Normally opened contact. Install additional relay to interface with power supply

Note 3: Normally opened contact. Wired in series for two-door cabinets.

Note 4: UPS Inputs Wired by Sub-Panel Manufacturer.

Note 1: Install TRD1 contact only for pump No. 1 only



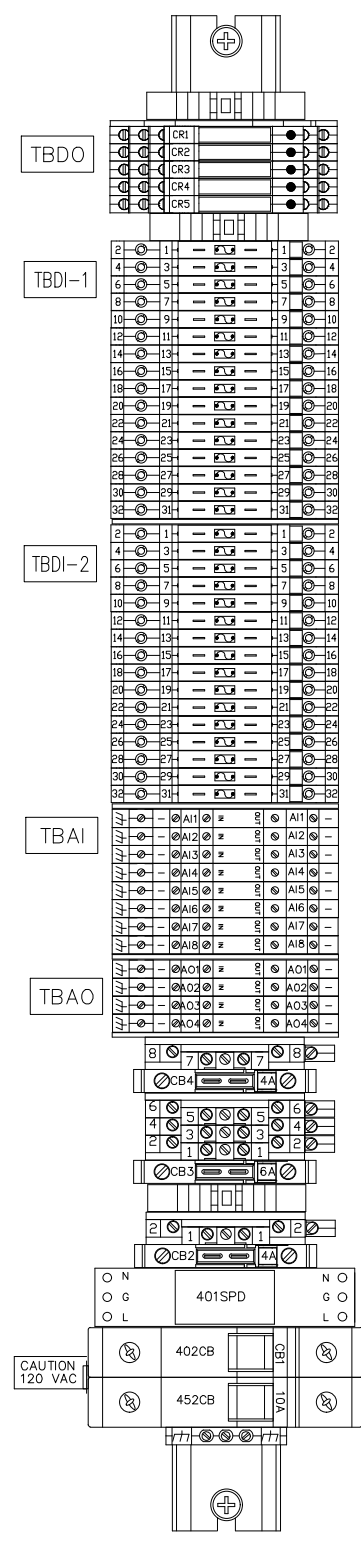
STARTER TERMINAL
 TERMINAL STRIP TERMINAL
 I/O TERMINAL



Title:

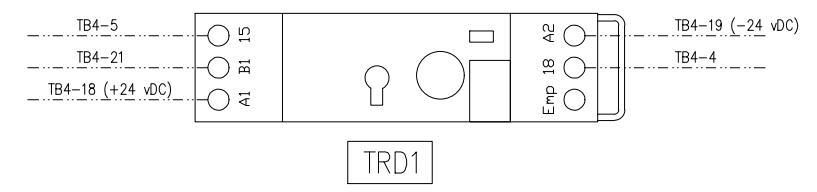
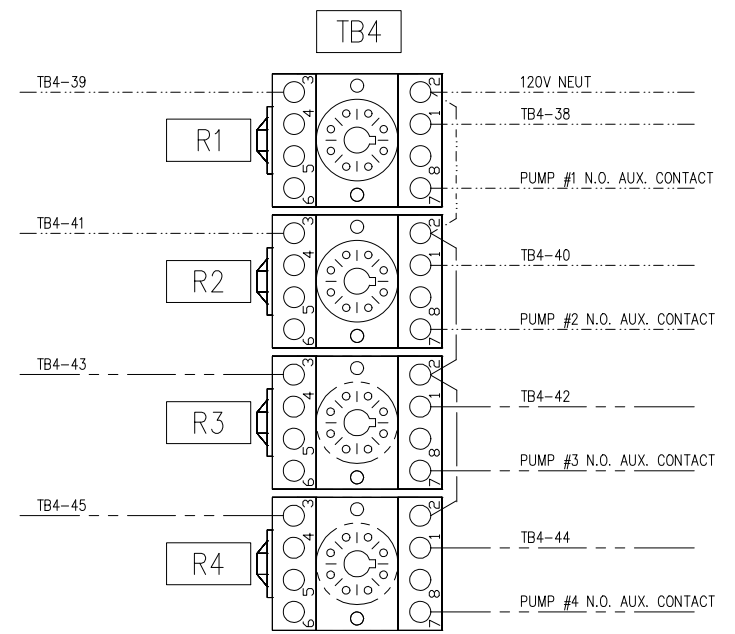
ELECTRICAL SPECIFICATIONS 230V, 20-50HP SUBMERSIBLE PUMP STATION ELECTRICAL WIRING DIAGRAM

Date Issued: 11/2023	SHEET E-07
Approved by:	SH. 1 OF 1
File Location:	Scale: N.T.S



Terminal	Description	Terminal	Description
1	24V (+)	1	+V
2	24V (-)	2	COM
3	GND	3	GND
4	#1 PUMP HOA SW. HAND	4	PUMP #1 STARTER TERM-3
5	TBDO-CR1-14(NO)---TBDO-CR1-11(COM)	5	#1 PUMP HOA SW. AUTO
6	#2 PUMP HOA SW. HAND	6	PUMP #2 STARTER TERM-3
7	TBDO-CR2-14(NO)---TBDO-CR2-11(COM)	7	#2 PUMP HOA SW. AUTO
8	#3 PUMP HOA SW. HAND	8	PUMP #3 STARTER TERM-3
9	TBDO-CR3-14(NO)---TBDO-CR3-11(COM)	9	#3 PUMP HOA SW. AUTO
10	#4 PUMP HOA SW. HAND	10	PUMP #4 STARTER TERM-3
11	TBDO-CR4-14(NO)---TBDO-CR4-11(COM)	11	#4 PUMP HOA SW. AUTO
12	TRD1-18	12	
13	TRD1-15	13	
14		14	
15		15	
16		16	
17		17	
18	TRD1-A1	18	
19	TRD1-A2	19	24 Vdc COMM
20	BACKUP FLOAT SWITCH COMMON	20	
21	BACKUP FLOAT SWITCH N.O.	21	TRD1-B1
22		22	TBDI-1-1
23	RTU AC POWER ALARM RELAY NO.	23	TBDI-1-2
24	RTU AC POWER ALARM RELAY COM	24	TBDI-1-3
25	PHASE MONITOR ALARM CONTACT NO.	25	TBDI-1-4
26	PHASE MONITOR ALARM CONTACT COM	26	TBDI-1-5
27	DRY WELL ALARM FLOAT SWITCH NO.	27	TBDI-1-6
28	DRY WELL ALARM FLOAT SWITCH COM	28	TBDI-1-7
29	EMERGENCY POWER CONTACT NO.	29	TBDI-1-8
30	EMERGENCY POWER CONTACT COM	30	TBDI-1-9
31	WET WELL ALARM FLOAT SWITCH NO.	31	TBDI-1-10
32	WET WELL ALARM FLOAT SWITCH COM	32	TBDI-1-11
33	CONTROL PANEL INTRUSION SW. NO	33	TBDI-1-12
34	CONTROL PANEL INTRUSION SW. COM	34	TBDI-1-13
35	#1 PUMP RUNNING R1-1 CONTACT	35	TBDI-1-14
36	#1 PUMP RUNNING R1-3 CONTACT	36	TBDI-1-15
37	#2 PUMP RUNNING R2-1 CONTACT	37	TBDI-1-16
38	#2 PUMP RUNNING R2-3 CONTACT	38	TBDI-1-17
39	#3 PUMP RUNNING R3-1 CONTACT	39	TBDI-1-18
40	#3 PUMP RUNNING R3-3 CONTACT	40	TBDI-1-19
41	#4 PUMP RUNNING R4-1 CONTACT	41	TBDI-1-20
42	#4 PUMP RUNNING R4-3 CONTACT	42	TBDI-1-21
43		43	TBDI-1-22
44		44	TBDI-1-23
45		45	TBDI-1-24
46		46	TBDI-1-25
47		47	TBDI-1-26
48	#1 PUMP FAIL PROX. SW. COM (BRN)	48	TBDI-2-1
49	#1 PUMP FAIL PROX. SW. SIG (BLK)	49	TBDI-2-2
50	#2 PUMP FAIL PROX. SW. COM (BRN)	50	TBDI-2-3
51	#2 PUMP FAIL PROX. SW. SIG (BLK)	51	TBDI-2-4
52	#3 PUMP FAIL PROX. SW. COM (BRN)	52	TBDI-2-5
53	#3 PUMP FAIL PROX. SW. SIG (BLK)	53	TBDI-2-6
54	#4 PUMP FAIL PROX. SW. COM (BRN)	54	TBDI-2-7
55	#4 PUMP FAIL PROX. SW. SIG (BLK)	55	TBDI-2-8
56	#1 PUMP HOA SW. AUTO	56	TBDI-2-9
57	#1 PUMP HOA SW. AUTO	57	TBDI-2-10
58	#1 PUMP HOA SW. HAND	58	TBDI-2-11
59	#1 PUMP HOA SW. HAND	59	TBDI-2-12
60	#2 PUMP HOA SW. AUTO	60	TBDI-2-13
61	#2 PUMP HOA SW. AUTO	61	TBDI-2-14
62	#2 PUMP HOA SW. HAND	62	TBDI-2-15
63	#2 PUMP HOA SW. HAND	63	TBDI-2-16
64	#3 PUMP HOA SW. AUTO	64	TBDI-2-17
65	#3 PUMP HOA SW. AUTO	65	TBDI-2-18
66	#3 PUMP HOA SW. HAND	66	TBDI-2-19
67	#3 PUMP HOA SW. HAND	67	TBDI-2-20
68	#4 PUMP HOA SW. AUTO	68	TBDI-2-21
69	#4 PUMP HOA SW. AUTO	69	TBDI-2-22
70	#4 PUMP HOA SW. HAND	70	TBDI-2-23
71	#4 PUMP HOA SW. HAND	71	TBDI-2-24
72		72	TBDI-2-25
73		73	TBDI-2-26
74		74	TBDI-2-27
75		75	TBDI-2-28
76		76	TBDI-2-29

Terminal	Description	Terminal	Description
77	LEVEL TRANSMITTER (+)	77	TBDI-2-30
78	PANEL METER (-)	78	TBDI-2-31
79	CHEMICAL TRANSMITTER (+)	79	TBDI-2-32
80	CHEMICAL TRANSMITTER (-)	80	TBAI-A1(+)
81	FORCE MAIN PRESS. TRANSMITTER (+)	81	TBAI-A1(-)
82	FORCE MAIN PRESS. TRANSMITTER (-)	82	TBAI-A2(+)
83	CURRENT TRANSMITTER (+)	83	TBAI-A2(-)
84	CURRENT TRANSMITTER (-)	84	TBAI-A3(+)
85	FLOW TRANSMITTER (+)	85	TBAI-A3(-)
86	FLOW TRANSMITTER (-)	86	TBAI-A4(+)
87		87	TBAI-A4(-)
88		88	TBAI-A5(+)
89		89	TBAI-A5(-)
90		90	
91		91	
92		92	
93		93	
94		94	
95		95	
96		96	
97		97	
98		98	
99		99	
100		100	



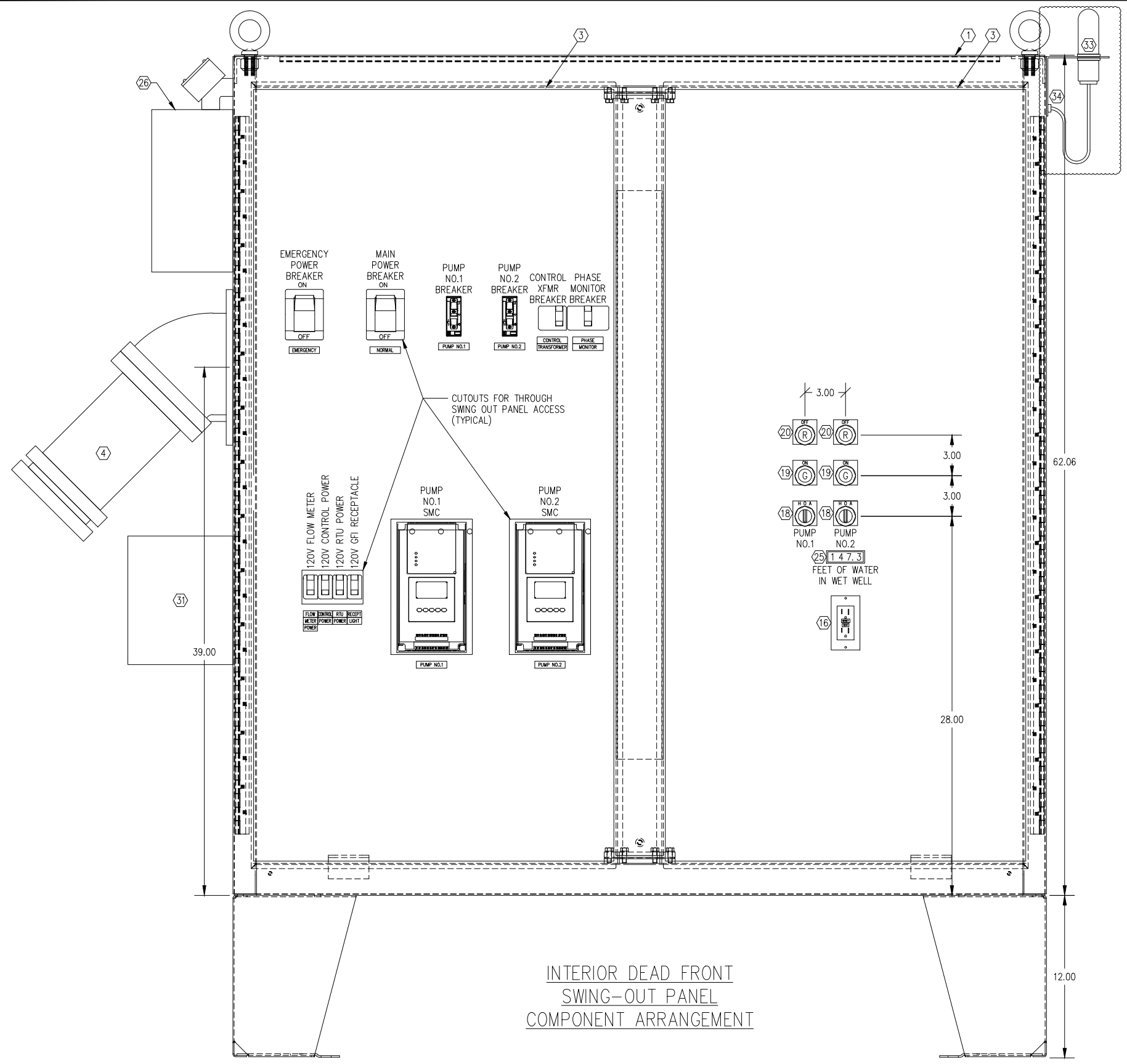
- - - - - PANEL WIRING BY PANEL BUILDER
 _____ FIELD WIRING BY CONTRACTOR
 - - - - - OPTIONAL DEVICES WIRING



Title: _____

ELECTRICAL SPECIFICATIONS
230V, 20-50HP PUMP STATION
ELECTRICAL INTERCONNECT DIAGRAM

Date Issued:	11/2023	SHEET	E-08
Approved by:	-	SH. 1 OF 1	
File Location:	-	Scale:	N.T.S



INTERIOR DEAD FRONT
SWING-OUT PANEL
COMPONENT ARRANGEMENT

40HP-100HP (480 V) WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL

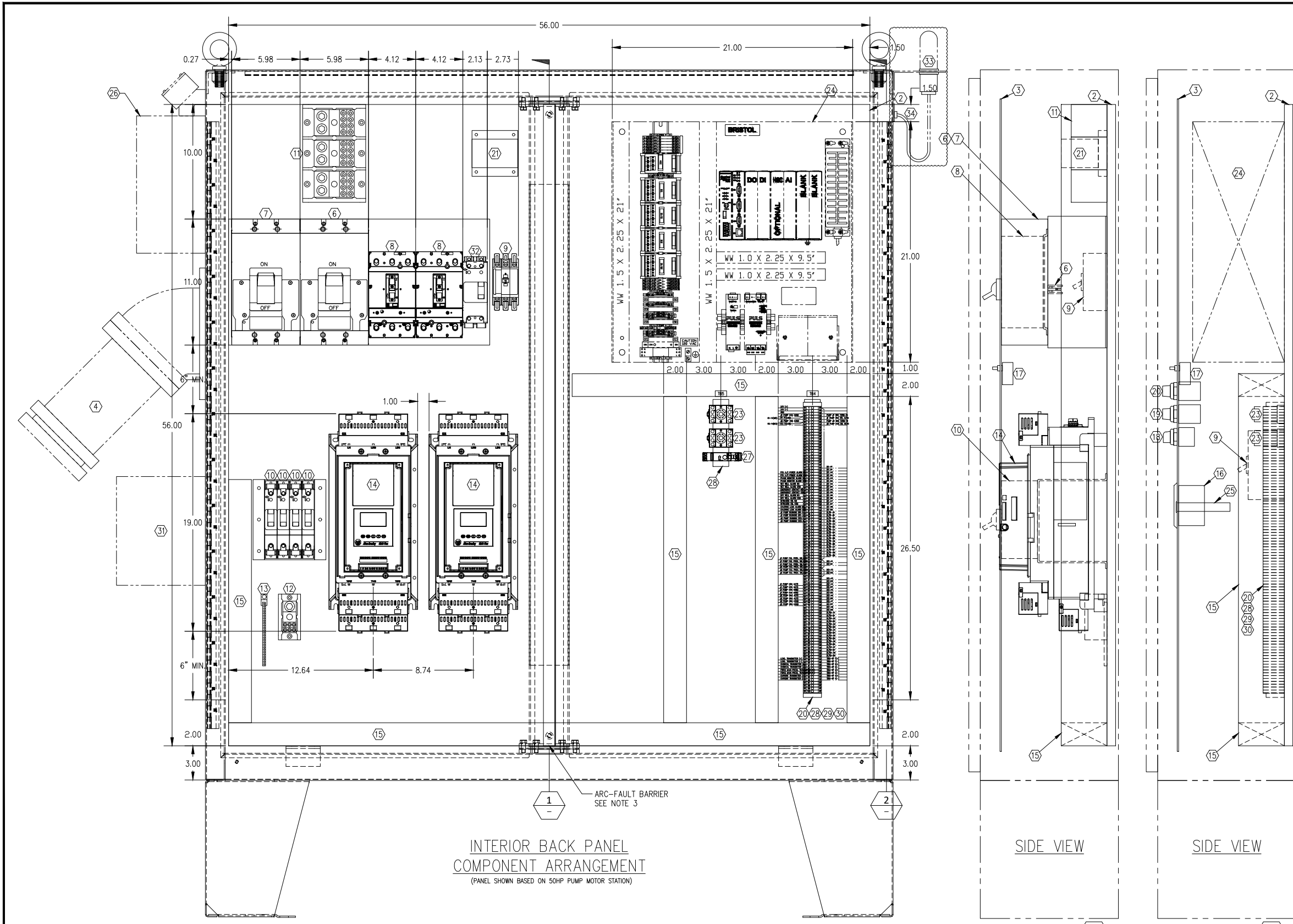
NOTES:
1 REFERENCE DRAWING E-10 FOR BILL OF MATERIALS AND INTERNAL ARRANGEMENT OF THE ELECTRICAL COMPONENTS.



Title:

ELECTRICAL SPECIFICATIONS
480V, 40-100HP DUPLEX PUMP STATION
ELECTRICAL CONTROL PANEL LAYOUT

Date Issued: 11/2023	SHEET E-09
Approved by: -	SH. 1 OF 1
File Location: -	Scale: N.T.S.



BILL OF MATERIAL				
ITEM	DESCRIPTION	MANUFACTURER	CATALOG NO.	QTY.
1	STAINLESS STEEL TYPE 4X ENCLOSURE w/FLOOR STAND KIT PAINTED WHITE (POWDER COAT)	HOFFMAN	A-62H6012SSLP A-FK1212SS	1
2	ENCLOSURE BACK PANEL	HOFFMAN	A-60P60	1
3	DEAD FRONT SWING-OUT PANEL KIT	-	-	2
4	EMERGENCY POWER RECEPTACLE - 400A, 3ø, 4 WIRE, w/45° ADAPTER & SCREW CAP	HUBBELL	HBL4100R7W AA6010055	1
5	WALKING BEAM MECHANICAL INTERLOCK ASSEMBLY	SQUARE-D	L46WB	1
6	BREAKER-300A, THREE POLE	SQUARE-D	LAL36300WB	1
7	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	JDL36200	2
9	BREAKER 10A, THREE POLE	SQUARE-D	QOU310	1
10	BREAKER 15A, SINGLE POLE	SQUARE-D	BDL16015	4
11	POWER TERMINAL BLOCK	SQUARE-D	9080LBA365208	1
12	POWER TERMINAL BLOCK	SQUARE-D	9080LBA163106	1
13	EQUIPMENT GROUND BAR w/ #4 COPPER LUG	SQUARE-D	PK15GTA-L	1
14	FLEX SMART MOTOR CONTROLLER (SMC), 135A, w/PUMP CONTROL LINE/LOAD LUGS	ALLEN-BRADLEY	150-F135NBDB 199-LF1 150-TC1	2 4 4
15	WIREWAY DUCT 2"x4" w/COVER	HOFFMAN	A-200400WH A-200CWH	-
16	SERVICE RECEPTACLE 15A, 125VAC w/COVER	LEVITON	6599-W	1
17	MICRO SWITCH - SPDT, 15A	HONEYWELL	BZ-2R01-A2	2
18	3 POSITION SELECTOR SWITCH w/"H-O-A" LEGEND PLATE	ALLEN-BRADLEY	800T-J2B 800T-X511	2
19	PILOT LIGHT - w/GREEN LENSE w/"ON" LEGEND PLATE	ALLEN-BRADLEY	800T-QHT0G 800T-X530	2
20	PILOT LIGHT - w/RED LENSE w/"OFF" LEGEND PLATE	ALLEN-BRADLEY	800T-QHT0R 800T-X527	2
21	PHASE MONITOR	DIVERSIFIED ELEC.	SLA-440-ALE	1
22	TERMINAL	PHOENIX CONTACT	UK 5	60
23	GENERAL PURPOSE DPDT 120VAC RELAY w/RELAY SOCKET	SQUARE-D	KP12P14V20 NR51	2
24	RTU	BRISTOL-BABCOCK	-	1
25	PANEL METER (see NOTE 1) LEGEND: FEET OF WATER IN WETWELL	NEWPORT	205-PA1-R-CO	1
26	TRANSIENT VOLTAGE SURGE SUPPRESSOR	ASCO POWER TECH	460227YP20ACCE10	1
27	GENERAL PURPOSE TIMING RELAY	ALLEN-BRADLEY	700-FEB1TU22	1
28	35mm SYMMETRICAL DIN RAIL	PHOENIX CONTACT	NS 35/7,5 0801733	A/R
29	TERMINAL END COVER	PHOENIX CONTACT	D-UK 4/10 3003020	A/R
30	TERMINAL END CLAMP	PHOENIX CONTACT	CLIPFIX 35 3022218	A/R
31	RESIN ENCAPSULATED TRANSFORMER 2kVA 480-120/240VAC, 1ø, NEMA 4X STAINLESS	SQUARE-D	4X2S40FSS	1
32	BREAKER 15A, DOUBLE POLE	SQUARE-D	BDL26015	1
33	CELLULAR ANTENNA, COAXIAL JUMPER CABLES (CELLULAR & RF SYSTEMS)	LAIRD (SEE E-01-ANTENNA (SEE STD.-CABLES))	195-18-18-P3' 195-07-18-P3' 240-05-07-P3'	A/R
34	BULKHEAD CELLULAR SURGE ARRESTOR	(SEE STD.)	TW-LP-SMA-J-BHU (OR EQUAL)	A/R

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

BREAKERS & GENERATOR RECEPTACLE SIZE CHART

- 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.
 - PANEL CONSTRUCTOR SHALL INSTALL A METAL BARRIER BETWEEN THE CONTROL (LOW VOLTAGE) SIDE OF THE PANEL AND THE POWER (HIGH VOLTAGE) SIDE OF THE PANEL TO PROVIDE ARC-FAULT PROTECTION FOR OPERATORS AND SERVICE PERSONNEL. NOTCH THE DIVIDER TO ALLOW THE WIREWAY AT THE BOTTOM OF THE PANEL TO SPAN WIDTH OF THE BACK PANEL FOR CONTROL WIRING.

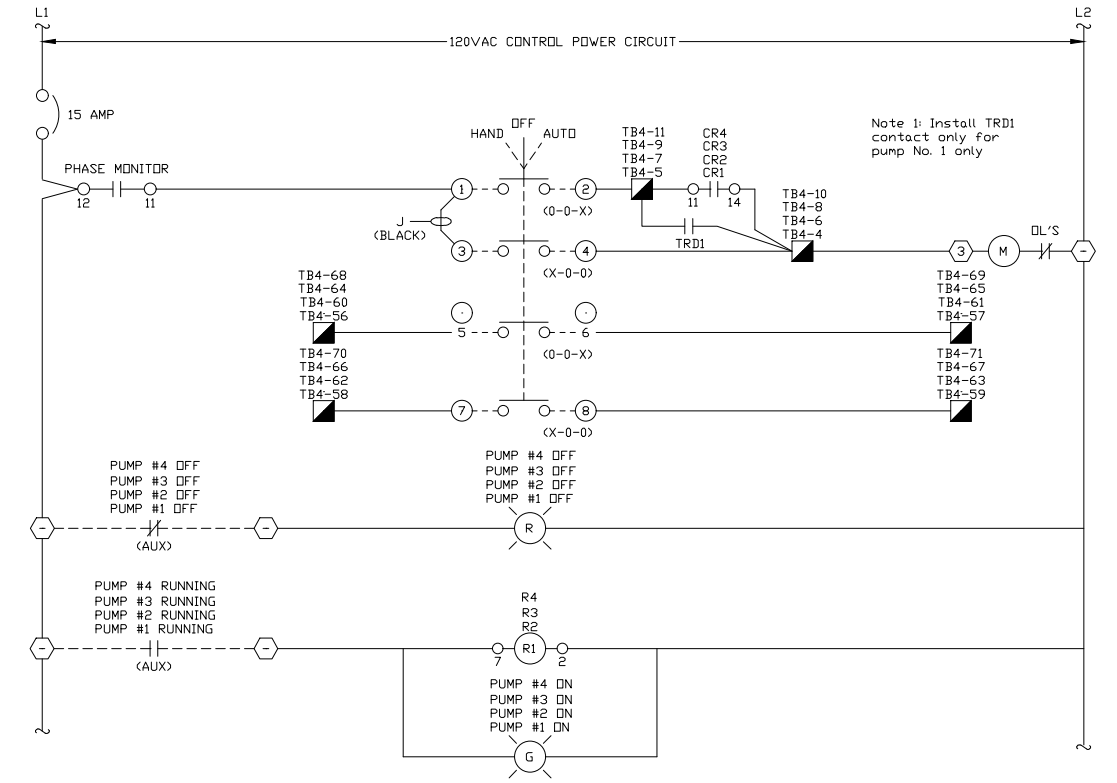
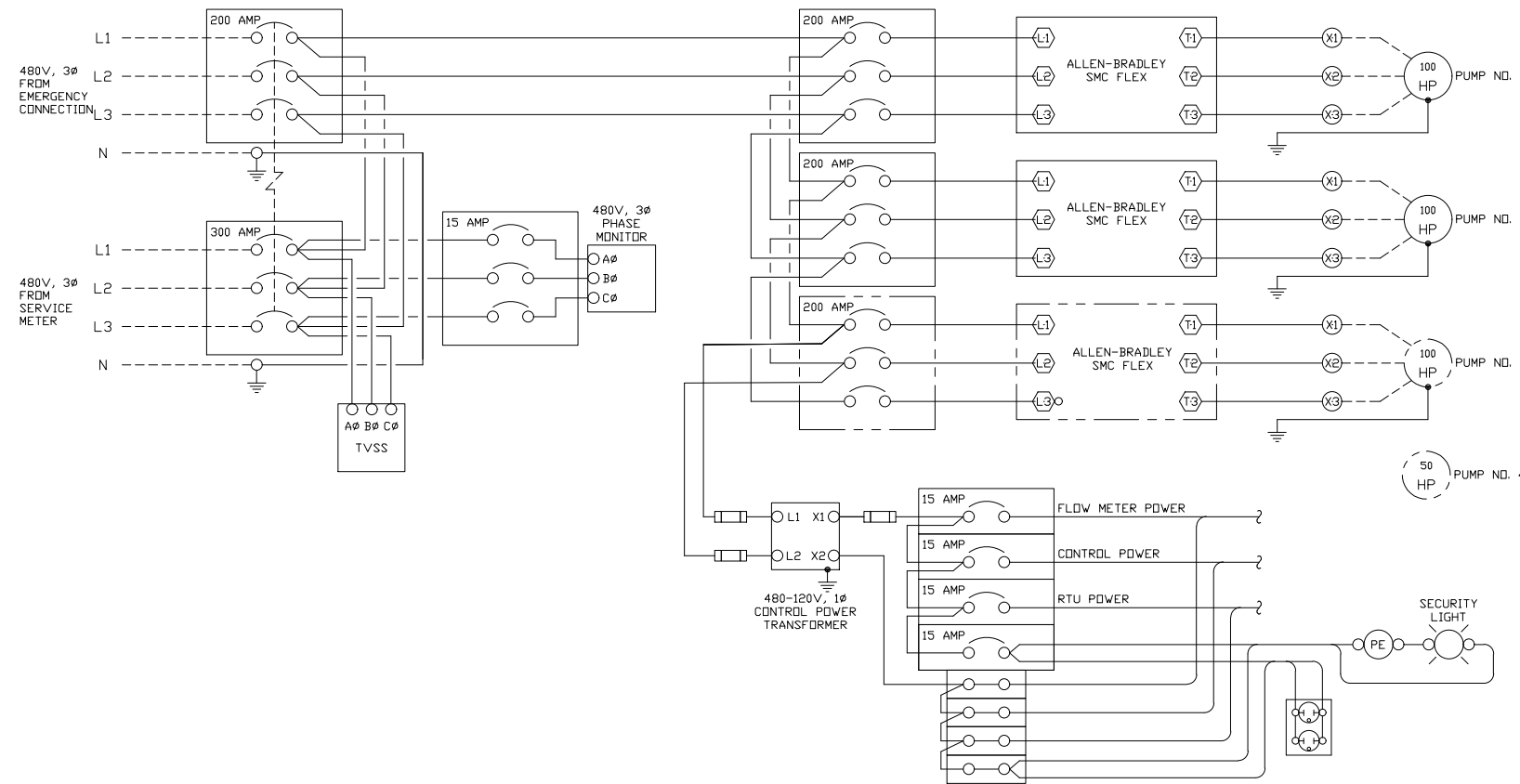
PUMP STATION 40-100HP (480 V) WASTEWATER SUBMERSIBLE PUMP CONTROL PANEL



Title: _____

ELECTRICAL SPECIFICATIONS
480V, 40-100HP DUPLEX PUMP STATION
ELECTRICAL CONTROL PANEL LAYOUT

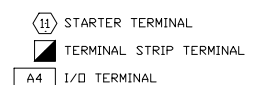
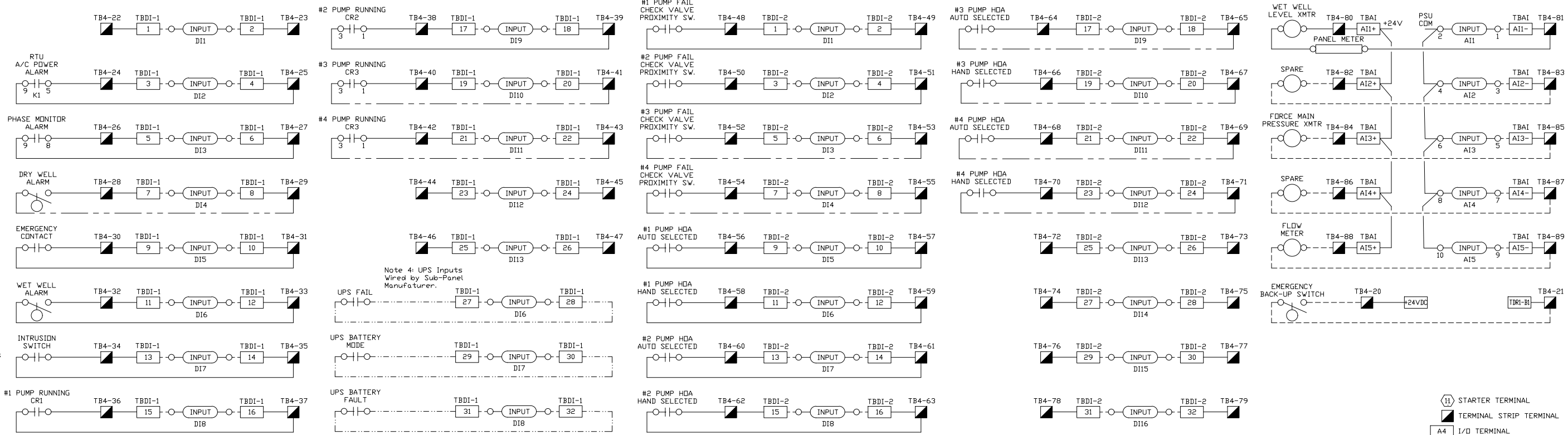
Date Issued: 11/2023	SHEET E-10
Approved by: -	SH. 1 OF 1
File Location: -	Scale: N.T.S



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.

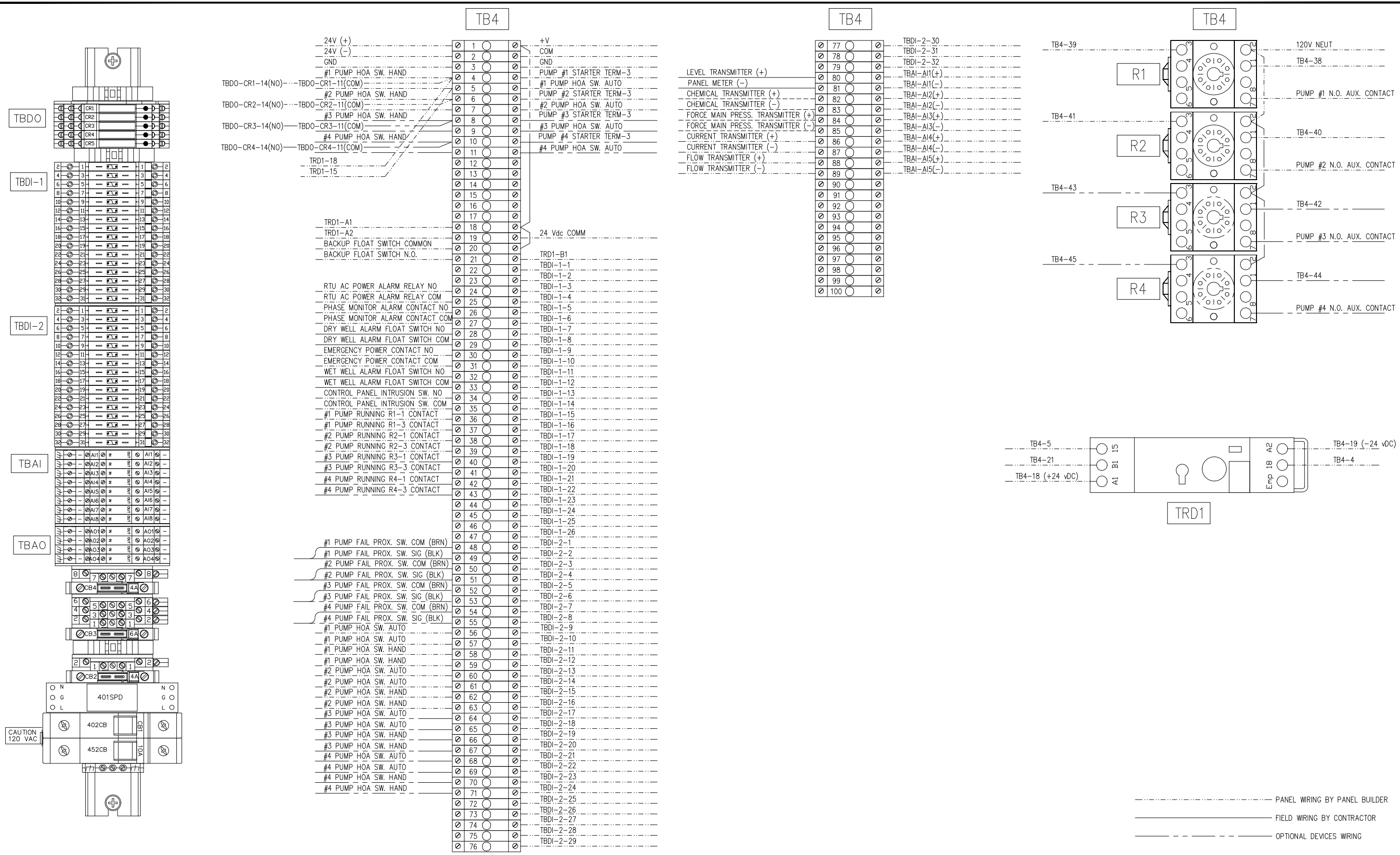
Note 4: UPS Inputs Wired by Sub-Panel Manufacturer.



Title:

ELECTRICAL SPECIFICATIONS 480V, 40-190HP PUMP STATIONS SUBMERSIBLE PUMP STATION ELECTRICAL WIRING DIAGRAM

Date Issued: 11/2023	SHEET E-11
Approved by:	SH. 1 OF 1
File Location:	Scale: N.T.S



Title:

ELECTRICAL SPECIFICATIONS
480V, 40-100HP PUMP STATIONS PUMP STATION
ELECTRICAL INTERCONNECT DIAGRAM

Date Issued:	11/2023	SHEET	E-12
Approved by:	-	SH. 1 OF 1	
File Location:	-	Scale:	N.T.S

----- PANEL WIRING BY PANEL BUILDER
 _____ FIELD WIRING BY CONTRACTOR
 - - - - - OPTIONAL DEVICES WIRING