

**GWINNETT COUNTY  
DEPARTMENT OF WATER RESOURCES**

**DEVELOPER PUMP STATION STANDARDS**



January 2014

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

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**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 1**

**Purpose and Policies**

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**SECTION 1 - PURPOSE AND POLICIES**

**1.1 Purpose**

**1.1.1 Authority and Title**

**1.1.1.1 Authority**

- A. These Standards and Specifications are adopted by the Gwinnett County Department of Water Resources (GCDWR) under the authority of the Code of Ordinance of Gwinnett County and the Constitution of the State of Georgia.

**1.1.1.2 Title**

- A. These regulations shall be known as “Gwinnett County Department of Water Resources Developer Pump Station Standards”, and may be referred to generally as “Developer Pump Station Standards”.

**1.1.2 Purpose and Intent**

- A. The purpose of this document is to set forth the policies, procedures, design requirements, material requirements, and construction requirements of the Gwinnett County Department of Water Resources for the design, installation, and construction of wastewater pump stations and force mains. It is intended that these Developer Pump Station Standards will provide guidance to the design engineer and contractor alike in the development of new pump stations and force mains to protect and promote the health, safety, and welfare of the general public as it relates to wastewater collection and transmission.

**1.1.3 Variance**

- A. Any variance from these Developer Pump Station Standards shall follow the procedures discussed in Section 3 and be approved in writing by the GCDWR.

**1.1.4 Amendments and Revisions**

- A. The release of these “Developer Pump Station Standards” replaces and supersedes the previous versions of the “Sanitary Sewer Pump Station and Force Main Design & Construction Manual”. The GCDWR shall amend and/or revise these “Developer Pump Station Standards” whenever it is determined to be necessary in order to improve the performance and integrity of the wastewater collection and transmission systems.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 1**

**Purpose and Policies**

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**1.2 Definitions**

ACI – American Concrete Institute

AMIS – Asset Management and Infrastructure Support

ANSI – American National Standards Institute

ASTM – American Society for Testing and Materials

AWWA – American Water Works Association

Contractor – Any individual, firm, or corporation with whom a contract is made by the developer or the GCDWR for the purpose of constructing the sanitary sewerage systems described herein.

Developer – Any individual, firm, or corporation who contracts with a contractor to construct a sanitary sewerage system.

Developer Engineer – The engineer or land surveyor who is hired by the Developer and is in responsible charge of the sanitary sewerage system design. Developer’s engineer or land surveyor shall be licensed by the Georgia State Board of Registration for Professional Engineers and Land Surveyors.

DIP – Ductile Iron Pipe

DIPRA – Ductile Iron Pipe Research Association

Discharge Manhole – A manhole on a sanitary sewer main where a force main discharges pumped flow from a wastewater pump station

Domestic Wastewater – Wastewater from sanitary fixtures such as toilets and urinals.

Force Main – A pipeline carrying wastewater flow pumped from a wastewater pump station.

GCDP&D WSR – Gwinnett County Department of Planning and Development, Water & Sewer Review.

GCDWR – Gwinnett County Department of Water Resources

GIS – Geographic Information System

GPD – Gallons per day

GPM – Gallons per minute

HDPE – High Density Polyethylene

NFPA – National Fire Protection Association

PCF – Pounds per cubic foot

PSI – Pounds per square inch

PVC – Polyvinyl chloride

Sanitary Sewer Lateral – A pipe that extends from a sanitary sewer main to the public street right-of-way or easement for the purpose of providing sewer service to a parcel.

Sanitary Sewer Main – A gravity sewer line which has one or more sanitary sewer laterals connected to it.

SCADA – Supervisory Control and Data Acquisition System

**Gwinnett County Department of Water Resources  
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**Section 1**

**Purpose and Policies**

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**1.3 Minimum Pump Station Policy**

**1.3.1 Approval of Pump Station Usage**

- A. Approval for the installation of a new pump station will only be granted by the GCDWR's AMIS Division Director through consultation with the GCDP&D. Generally, pump stations will only be permitted when gravity sewer is unavailable to the property. Unavailable shall generally be interpreted to mean more than 5,000 feet down gradient, but this distance can be increased or decreased by GCDWR Division Directors based upon actual field conditions and the size of the project involved.
- B. Generally, a pump station will not be allowed to be installed downstream from an existing pump station. GCDWR AMIS Division Director or designee may, at their discretion, require a gravity line be installed to carry flow from the existing pump station to the proposed pump station thus eliminating the existing pump station. GCDWR AMIS Division Director or designee may, at their discretion, and in conjunction with the GCDWR Operations Division Director allow the developer to move some or all of the existing equipment and reuse it. If the reuse of equipment is allowed, the developer must coordinate with the GCDWR Pump Station Operations Manager and assume complete responsibility for handling of all flows during the transition period.

**1.3.2 General Requirements**

- A. The installer of the pump station and force main must be included on the current Gwinnett County Department of Water Resources Approved Utility Contractors List. The list is available on the County Website or by contacting GCP&D WSPR.
- B. A "Construction Permit" **must** be obtained from GCP&D WSPR and a pre-construction conference **must** be held with the GCDWR Engineering & Construction (E&C) Inspector, Developer/Owner, Design Engineer, and Contractor **before any work may begin**.

**1.3.2.1 Approval**

- A. The formal review and approval process is described in detail in Section 2 – GCDWR Approval Process, of this document. At a minimum, the developer shall comply with the following requirements.
  - 1. Pump stations, force mains, and all related appurtenances must be installed in a professional manner and in accordance with all applicable building codes, construction standards, federal, state, and county regulations, etc.
  - 2. The system shall be designed by the developer's engineer (Professional Engineer registered in the State of Georgia).
  - 3. The designer shall consult with the GCDWR AMIS Division Director, or designee, during the design of the system.
  - 4. The system shall be designed with all components sized to meet the development's peak flows. The developer may elect to size the system to meet future phases of the project or may upgrade the system at a later date to serve additional phases. Any such upgraded capacity shall be reserved for the developer (subject to availability of treatment capacity) for a period of three (3) years from date of final acceptance of the system. The reserved capacity shall only include the number of lots or commercial flow quantity as identified on plan submittals approved by the GCDWR AMIS Division Director or designee. The agreement for reserved capacity shall be in writing and approved by the AMIS Division



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### Section 1

### Purpose and Policies

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Director. The developer may relinquish reserved pumping capacity at any time by notifying the GCDWR AMIS Division Director in writing.

5. Excess pump station capacity due to the difference in capacity between the developer's projected flows and the standard equipment sizes shall not be considered as belonging to the developer. Any such "extra" capacity beyond that reserved for the original developer becomes available for the GCDWR to utilize at its discretion.

#### 1.3.2.2 Location

- A. The designer shall locate the pump station to drain the largest possible sub-basin(s) associated with the proposed development. The GCDWR AMIS Division Director or designee shall have final approval of the location of the pump station.

#### 1.3.2.3 Betterment

- A. The GCDWR AMIS Division Director, or designee, will investigate the service impact associated with future Gwinnett County needs within the sub-basin, and the potential installation of additional force mains required to serve the sub-basin which drains to the pump station. If in the Division Director's or designee's opinion, a larger pump station or additional or larger force main is to be installed concurrently with the developer's project, the designer shall design and the GCDWR AMIS Division Director or designee shall review and approve the design of said betterment. Where practical, all of the force mains shall be installed in parallel and in the same trench.
- B. The extra cost associated with increasing the size of the pump station or force main **may** be paid by the County under a "County Participation Agreement". **The conditions relating to the method of payment will be negotiated by GCDWR on a case-by-case basis during the development review process.**

#### 1.3.2.4 Acceptance

- A. The developer shall furnish, install, dedicate, and provide a one (1) year warranty, from the date of acceptance, for the entire pump station / force main system to GCDWR.

### 1.4 Fees

#### 1.4.1 General

- A. A System Development Charge (SDC) and Operation and Maintenance (O&M) Charge may apply to pump station installations. This will be determined by the AMIS Division Director, or designee, prior to approval to construct a pump station and force main.
- B. Fees associated with the planning, design, installation, and operation of a new development pump station and force main will be assessed based on the provisions of the Water and Sewer System Development Charge Ordinance.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 2**

**GCDWR Approval Process**

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**SECTION 2 - GCDWR APPROVAL PROCESS**

**2.1 Project Planning Approvals**

- A. The Developer/Owner must first meet with the AMIS Division Director or designee. The AMIS Division Director or designee must give approval for the design of a pump station and/or force main in Gwinnett County. If approved, a letter of approval will be sent to the Developer/Owner and will include any associated fees that may be applicable, an invoice for fees, and the required payment terms (Fees will be determined by the AMIS Division Director or designee.). A copy of this letter will be sent (via email) to the GCDP&D Water and Sewer Review (WSR) department and GCDWR Engineering and Construction (E&C) department for information purposes. The GCDP&D WSR department will record this information in a database so that it can be referenced during final plat sign off. The GCDWR E&C department will inform the inspections department and the GCDWR Operations department that a pump station and force main is beginning to be designed and will be located in Gwinnett County.

**2.2 Pump Station and Force Main Design Submittal Process**

- A. After the Developer/Owner receives approval to plan a pump station and force main, they must hire a Professional Engineer (registered in the State of Georgia) to review the GCDWR Developer Pump Station Standards and prepare a design submittal for Gwinnett County review. Approval of pump station and force main designs involves a two-step submittal process, as follows:
- B. Technical Submittal for Development Permit
1. The first step is the technical submittal which includes a complete design of the pump station and force main. The submittal must include, but is not limited to, the following items:
    - a. Plan design of the pump station layout (including grading around the station, elevations and easements).
    - b. Force main plan and profiles including length, size and piping materials. Begin at the Pump Station 0+00. Station 0+00 shall be set at the outside wall where the force main leaves the pump station wet well (see Details PS-14 and PS-19).
    - c. The entire force main profile, beginning at the pump station, must include the discharge point, air release/vacuum valves, plug valves, elevations and stations clearly labeled (see Example pages D-1 and D-2).
    - d. A completed "Sanitary Sewer Pump Station Design Data" calculation form (see pages C-1 – C-6 and Example pages D-3 – D-8).
    - e. Pump and system curves.
  2. A total of three (3) copies of the technical submittal shall be submitted to GCDP&D for review by GCDP&D WSR, GCDWR AMIS, and GCDWR E&C.
  3. Review comments will be returned to the Developer/Owner within two weeks of the initial submittal. After all corrections have been made and approved, the Design Engineer will submit seven (7) sets of the drawings to GCDP&D WSR. The design drawings will be stamped "Approved" by the AMIS Division Director or designee and will be distributed as follows:
    - a. Two (2) copies will be returned to the submitting Engineer

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**Section 2**

**GCDWR Approval Process**

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- b. Two (2) copies will be sent to GCDWR E&C
  - c. One (1) copy to GCDWR AMIS
  - d. Two (2) copies will be retained by GCDP&D WSR.
4. The contractor for the Developer/Owner may then obtain a "Development Permit" for the pump station and force main by presenting to the GCDP&D WSR Permitting Clerk an approved set of drawings. Current permit fees will apply.
  5. The Development Permit will allow the Developer/Owner to get pricing and select equipment to be submitted as part of the Equipment Submittal. It will also allow the contractor for the Developer/Owner to mobilize and start clearing the site. However, construction of the pump station or force main will not be allowed until an equipment submittal is made and approved and a "Construction Permit" is issued.
- C. Equipment/Electrical Submittal for Construction Permit
1. Once a Development Permit for the project has been received, the Developer/Owner shall select the equipment to be used in the project and submit all necessary technical data and shop drawings on each equipment item to GCDWR for final approval.
  2. Equipment and materials used for the pump station shall be submitted in a separate package from those used for the force main.
  3. Two (2) copies of each of the pump station and force main packages shall be submitted to GCDWR AMIS Division Director or designee. These packages may be submitted concurrently or at separate times, as needed.
  4. Two (2) copies of the electrical design plans shall be submitted to GCDP&D Building Plan Review for review by the electrical department. Current review fees will apply.
  5. Upon final approval of the equipment submittal packages, GCDWR will return one (1) copy of each of the approved submittal packages to the Developer/Owner and retain the remaining one (1) copy for its records and use during the construction phase.
  6. Upon final approval of the electrical plans, GCDP&D will return one (1) copy of the authorized electrical plans to the Developer/Owner which shall be maintained as the job site copy for electrical inspections and the remaining one (1) copy shall be retained by GCDP&D for their permitting records.
  7. The contractor for the Developer/Owner may then obtain a Construction Permit for the pump station and force main by submitting stamped plans of the approved pump station, force main and electrical plans to GCDP&D WSR. Current fees will apply.
- D. See Developer/GCBOE PS & FM Current Procedures flow chart, located at the end of this section, for details on GCDWR approvals process.

**2.3 Pump Station and Force Main Design Submittal Requirements**

- A. At a minimum, the pump station and force main design submittal must include:
1. Gravity system and connection to pump station (single influent only).
  2. Force main design showing connection to existing system (Length, type, diameter, elevations, station numbers, valve locations, discharge point, existing and proposed utilities including storm drains, ground elevation and any other applicable information for force main installation.)
  3. District, land lot, address and parcel numbers of the pump station listed in the title block.
  4. Property lines, property owners, parcels, road names, pavement width, and right-of-way width.

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**Section 2**

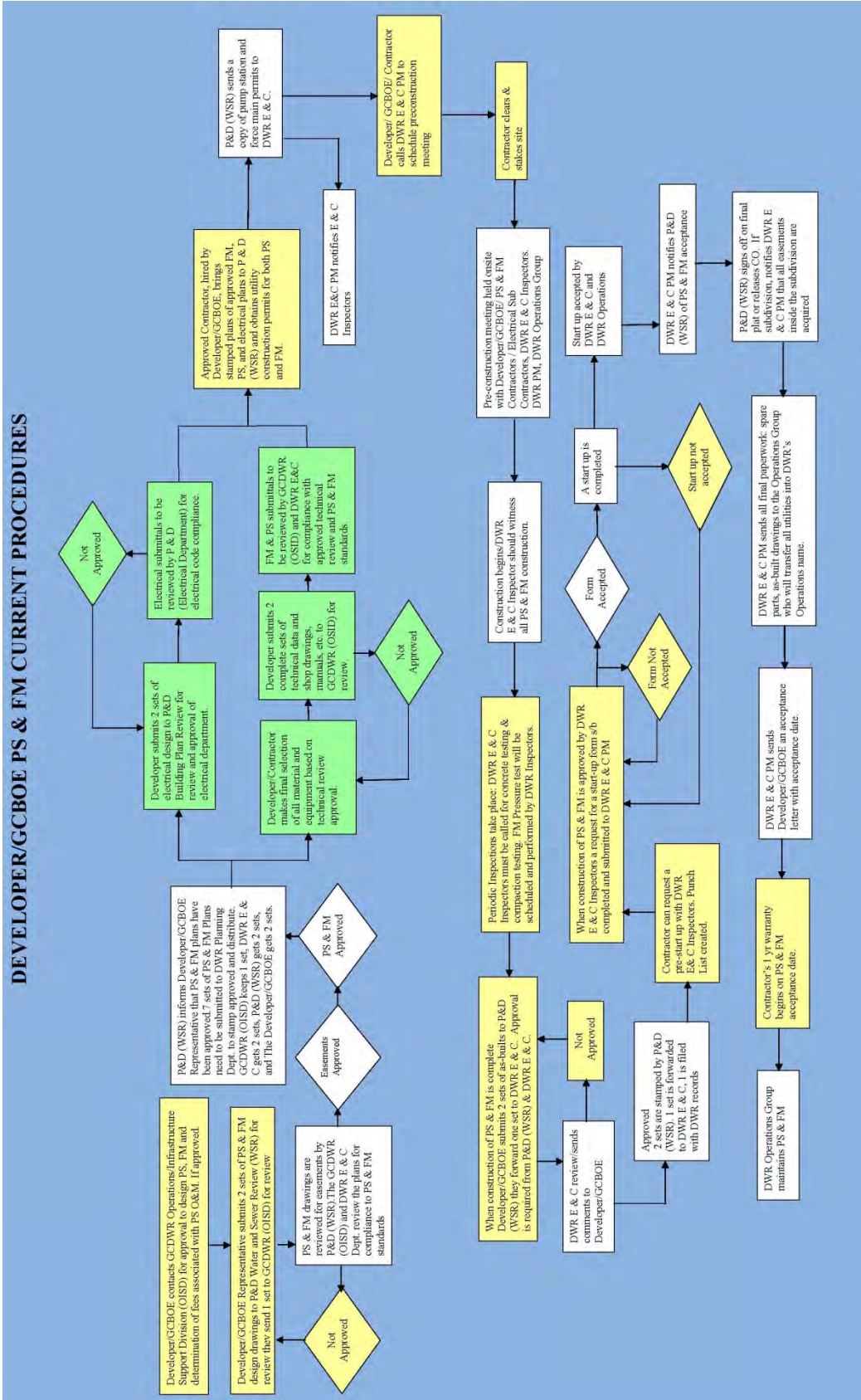
**GCDWR Approval Process**

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5. All existing and proposed utilities.
  6. Design calculations (see pages C-1 – C-6 and Example pages D-3 – D-8) included on one plan sheet.
  7. A single line electrical drawing appropriately labeled showing power distribution for the pump station shall be included on a plan sheet.
  8. Plan of the sub-basin, which drains to the pump station, to include contours and projected flow calculations for the entire sub-basin.
  9. Plans and construction details for the pump station. Include applicable PS standard drawings PS-1 - PS-35.
  10. All required easements with dimensions. A list of all easements required for the construction of the pump station and/or force main must be included on the cover sheet. The list will include easement size, property owner, land lot number, district number, and parcel number.
  11. A list of all utility owners involved with the pump station including, but not limited to, the power company, gas company, and telephone company.
  12. Specifications for pumps, valves, generator, automatic transfer switch and all other applicable equipment used on the site.
  13. Wet well elevations.
  14. Concrete mix designs.
  15. Transient analysis results. Surge analysis calculations shall be submitted along with a statement by a Professional Engineer (registered in the State of Georgia) that the surge (water hammer) for the proposed pumping station and force main will be within acceptable limits. See Section 4, paragraph 4.2.2 for allowable transient pressures.
  16. Plans shall be signed and stamped by a Professional Engineer (registered in the State of Georgia).
- B. Required easements that are not being recorded on a final plat (which includes all off-site easements) must be submitted to the GCDP&D WSR department and are required prior to plan approval.

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Section 2

## GCDWR Approval Process



**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 3**

**Change or Variance Procedures**

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**SECTION 3 - CHANGE OR VARIANCE PROCEDURES**

**3.1 General**

- A. Approved plans shall not be modified or deviated from unless approved in writing by the GCDWR AMIS Division Director or designee.
- B. Any changes to the design documents after approval has been granted by the GCDWR AMIS Division Director or designee shall require the resubmittal of the design documents incorporating and highlighting the requested changes for review and approval.
- C. Any deviations from the approved plans during construction must have approval from GCDWR E & C Inspectors prior to the deviation being made. A “REQUEST FOR EXCEPTION/CHANGE TO PUMP STATION CONSTRUCTION” form as found in these standards must be completed and submitted to the GCDWR E & C Inspectors for approval. The E & C Inspector will make sure that all appropriate approvals are received.

**3.2 Justification for Changes or Variances**

**3.2.1 Variances**

- A. Requests for variances to these standards shall be brought to the attention of GCDWR during the initial meeting with the GCDWR AMIS Division Director or designee. If the GCDWR AMIS Division Director or designee indicates GCDWR will consider the variance, the Developer/Owner shall provide the necessary justification for the variance to be considered. The justification shall include:
  - 1. Identification of the proposed variance.
  - 2. Identification of the requirements of these standards for which a variance is being requested. Identification shall include the section and paragraph number of the standard being referenced.
  - 3. Reason for the proposed variance request.
  - 4. Description of the benefits or impacts to the County’s wastewater infrastructure if the variance is allowed.
  - 5. Impact on the overall pump station and force main system.

**3.2.2 Changes**

- A. The Developer/Owner or the design engineer shall provide a detailed description of the reason for the changes to the approved plans. If the GCDWR AMIS Division Director or designee indicates GCDWR will consider the change, the Developer/Owner shall provide the necessary justification for the change to be considered. The description shall include the following:
  - 1. Identification of the proposed change.
  - 2. Reason for the proposed change.
  - 3. Impact on the overall pump station and force main system.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 3**

**Change or Variance Procedures**

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**3.3 Submittal Requirements**

**3.3.1 Variances**

- A. In order for the GCDWR AMIS Division Director or designee to make a determination on whether a variance should be allowed, the following information shall be submitted to the GCDWR AMIS Division Director or designee for review.
  - 1. Justification information identified above.
  - 2. Equipment or material data sheets for the proposed variance item, if applicable.
  - 3. Design calculation and preliminary drawings for the proposed variance item, if applicable.
  - 4. References to industry standards supporting the proposed variance, if applicable.
  - 5. Variances for the sole purpose of economic benefit for the owner/developer/contractor **WILL NOT** be considered.

**3.3.2 Changes**

- A. In order for the GCDWR AMIS Division Director or designee to decide if a change to the approved plans will be allowed, the following information shall be submitted to the GCDWR AMIS Division Director or designee for review.
  - 1. Revised plans showing the proposed change(s) highlighted for ease of comparison with the original approved plans.
  - 2. Revised design calculation for the pumping system and force main in compliance with the original submittal requirements, if applicable.
  - 3. Shop drawings and submittal data for the proposed change(s) as defined under the original submittal requirements, if applicable.
  - 4. Any other information which will show the proposed change provides a system at least equal to, if not better than the original approved plans.

**3.4 Review and Approval Process**

- A. The review and approval process for the variance or change request will follow the same procedures as the initial approval process described in Section 2. If the proposed change(s) does not impact issued permits, the submittals and reviews through the GCDP&D are not required. It is the Developer/Owner's responsibility to determine if revisions to permits will be required.
- B. If the proposed changes require revisions to approved permits, it is the Developer/Owner's responsibility to make the necessary submittals for revising the permits and obtain the required permits for construction.
- C. If the proposed variance is approved, the GCDWR AMIS Division Director or designee will issue a letter indicating the approval of the variance, to the Developer/Owner, with a copy provided to the GCDP&D WSR department.
- D. If a proposed change is approved, the GCDWR AMIS Division Director or designee will request the required number of plans be provided and will stamp the revised plans approved and distribute copies as described in Section 2. These plans shall be used for construction with a copy on site at all times.
- E. If the variance or change is not approved, the Developer/Owner shall follow the requirements of these standards and/or the previously approved plans.

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**Minimum Hydraulic Requirements**

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**SECTION 4 - MINIMUM HYDRAULIC REQUIREMENTS**

**4.1 Pump Stations**

**4.1.1 Flow Loading Calculations**

- A. Developer/Owner Engineer shall complete and submit pump station design calculations using the "Sanitary Sewer Pump Station Design Data" calculation form (see pages C-1 – C-6 and Example pages D-3 – D-8).
- B. Calculations shall be done at "Pump On", "Pump Off" and "Alarm On" levels.
- C. Flow Loading Calculations shall be based on the following:
  - 1. Average annual daily flows as listed in Table B.
  - 2. 2.5 peaking factor
- D. The maximum velocity of flow entering the pump station through the gravity sewer shall not exceed 6.0 fps. The sewer size or slope shall be adjusted as necessary to stay within this maximum limit.

**4.1.2 Wet Well Sizing Requirements**

- A. Wetwells shall be eight (8) foot diameter minimum and sized in accordance with Hydraulic Institute Standards, latest edition.
- B. The wetwell shall be sized to prevent excessive cycling of the pumps. Starts shall be limited to one start per ten minutes, when all pumps are in service, unless otherwise recommended by the engineer and/or the pump manufacturer.
- C. Based on pump design operating point, wet well shall be designed to provide available NPSH (NPSHa) with a margin of safety over the published Required NPSH (NPSHr) value based on Hydraulic Institute (HI) standards.
  - 1. Following margins of safety are suggested:
    - a.  $NPSHa > 1.3 NPSHr$ , if the design operating flow is within the pump's Preferred Operating Range (POR, 70% to 120% of the pump's best efficiency point flow)
    - b.  $NPSHa > 1.8 NPSHr$ , if the design operating flow is in the pump's Allowable Operating Range (AOR)

**4.1.3 Emergency Storage Requirements**

- A. Storage shall be provided above the high-level alarm equal to three (3) hours at design flow. Storage volume is calculated to be that volume between the high-level alarm and the lowest point of overflow (including basement elevations regardless of backflow valves in service lines). Said storage may consist of any combination of line capacity, manhole capacity and wet well volume. No corrugated metal pipe may be utilized for storage.
- B. Additional concrete storage tanks may be precast or poured-in-place. Poured-in-place concrete shall include the appropriate reinforcement as designed by a structural engineer (registered in the state of Georgia). Design calculations stamped by a structural engineer (registered in the state of Georgia) must be submitted with the plans.



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- C. The maximum number of storage vaults should be limited to two per station without prior approval from the GCDWR E&C inspector and the GCDWR AMIS Division Director or Designee.

**4.2 Force Mains**

- A. A force main shall only serve one (1) pump station. Multiple pump stations pumping through a common force main shall not be allowed without prior approval of the GCDWR AMIS Division Director or designee.

**4.2.1 Velocity Requirements**

- A. Force main velocities shall be a minimum of 2.5 fps and maximum 6 fps. Minimum size for force mains shall be 4" diameter.
- B. The minimum velocity of 2.5 fps shall be achieved with one pump operating.

**4.2.2 Operating Pressures**

- A. Force mains shall be designed for maximum allowable total dynamic head (TDH) of 250 feet. Heads greater than 250 feet are to be coordinated with GCDWR AMIS Division Director or designee.

**4.2.3 Headloss Calculations**

- A. Force main headloss shall be calculated using the Hazen Williams equation based on the following C-factor values:
  - 1. C = 130 for DIP and PVC force main piping. Note: PVC force mains are not allowed and this C value shall only be used if a pump station will be pumping through an existing PVC force main.
  - 2. C for alternate materials will require prior approval from the GCDWR AMIS Division Director or designee.

**4.2.4 Transient Analysis**

- A. A transient analysis shall be required for each force main design. The analysis should include results for operation with one pump running and with both pumps running simultaneously. Analysis shall be made under an emergency shutdown scenario and results of analysis shall be provided the AMIS Division Director or designee. The design engineer should show that the resulting transient analysis results will not exceed the working pressures of all pumps, force main and appurtenances.
- B. The analysis shall address the placement of air release/vacuum valves, as well as the need for surge relief at the pump station site.

**4.3 Downstream Gravity Sewer**

- A. An analysis of the hydraulic effects on downstream gravity sewers will be conducted by GCDWR personnel.
- B. If it is necessary to collect flow data for the existing sewer which will receive the flow from the pump station, the Developer will be required to have flow meters installed per the direction of the GCDWR AMIS Director or designee. Flow testing for the downstream analysis will be conducted by a GCDWR approved contractor.

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**SECTION 5 - PUMP STATION REQUIREMENTS**

**5.1 Pump Station**

**5.1.1 General**

- A. The pump station shall be designed and constructed in accordance with the requirements and Standard Details provided herein.
- B. The pump station shall include a standby power system and remote monitoring system as described in Section 7 – Electrical and Instrumentation Requirements.

**5.2 Wet Well**

**5.2.1 General**

- A. Wet well sizing and operating water levels shall be designed in accordance with the requirements of Section 4 – Minimum Hydraulic Requirements.
- B. Circular wet wells shall have a minimum inside diameter of 8 feet.
- C. Rectangular wet wells shall have minimum interior dimensions of 8’ by 8’ square.
- D. Wet well walls and piping shall be coated with a corrosion resistant coating system meeting the requirements of these standards.
- E. No manhole steps or ladders shall be installed in the wet well.
- F. Floats and probes shall be installed at the closest accessible location.

**5.2.2 Materials of Construction**

**5.2.2.1 Acceptable materials of construction include:**

- A. Precast concrete
- B. Cast-in-place concrete
- C. Fiber reinforced polyester (FRP).

**5.2.2.2 Precast Concrete Wet Wells**

- A. Precast concrete section shall meet the requirements of the following applicable standards.
  - 1. ASTM C478 “Standard Specification for Precast Reinforced Concrete Manhole Sections”
  - 2. ASTM C913 “Standard Specification for Precast Concrete Water and Wastewater Structures”
  - 3. ASTM C858 “Standard Specification for Underground Precast Concrete Utility Structures”
  - 4. ASTM C923 “Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals”
  - 5. ASTM C990 “Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants”
- B. Precast concrete wet wells shall consist of pre-cast reinforced concrete sections and a flat slab top section with access hatches, as required.
- C. The minimum compressive strength of the concrete for all sections shall be 4,000 psi.
- D. The maximum allowable absorption of the concrete shall not exceed 8 percent of the dry weight.

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- E. The circumferential reinforcement in the riser sections and base wall sections shall consist of one line of steel and shall be not less than 0.17 square inches per linear foot.
- F. The ends of each reinforced concrete riser section and the bottom end of the top section shall be so formed that when the risers and the top are assembled, they will make a continuous and uniform wet well.
- G. Joints of the wet well sections shall be of the tongue and groove type. Sections shall be joined using an approved preformed plastic gasket meeting the requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type 1, Rope Form. Joints shall be sealed with epoxy grout on both the internal and external walls for a smooth continuous wall.
- H. Each section of the precast wet well shall have not more than two holes for the purpose of handling and installing. These holes shall be tapered and shall be plugged with mortar after installation.

**5.2.2.3 Cast-in-Place Concrete Wet Wells**

A. Concrete

- 1. Concrete mix design shall be in accordance with ACI 318 and ACI 350.
  - a. 28-Day Strength: 4,000 PSI
  - b. Cement Content: Minimum 560 pounds per cubic yard
  - c. Air Content: 5% to 7% in accordance with ASTM C231
  - d. Water to Cement Ratio: Maximum 0.44
  - e. Slump Range: 3 to 5 inches in accordance with ASTM C143
  - f. Use of fly ash shall be approved by GCDWR E&C inspector
  - g. Use of admixtures shall be approved by GCDWR E&C inspector
- 2. Materials
  - a. Cement: Domestic Portland cement in accordance with ASTM C150, Type II.
  - b. Fine Aggregate: Washed, inert, natural sand in accordance with ASTM C33.
  - c. Coarse Aggregate: No. 57 stone in accordance with ASTM C33.
  - d. Water: Clean, potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

B. Reinforcement

- 1. Steel reinforcing bars shall be in accordance with ASTM A615, Grade 60.
- 2. Welded wire reinforcement shall be in accordance with ASTM A185.

**5.2.2.4 Fiber Reinforced Polyester Wet Wells**

A. General

- 1. Fiberglass reinforced polyester wet wells shall be manufactured from commercial grade polyester resin or vinyl ester resin, with fiberglass reinforcements. The resin system shall be suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection systems. The wet well shall be of one-piece unit construction.

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**B. Materials**

1. Resin: The resins used shall be a commercial grade unsaturated polyester resin.
2. Reinforcing Materials: The reinforcing materials shall be commercial Grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric or a combination of the above, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
3. Surfacing Material: If reinforcing materials are used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass that will provide a suitable bond with the resin and leave a resin rich surface.
4. Fillers and Additives: Fillers, when used, shall be inert to the environment and wet well construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used. The resulting reinforced plastic material must meet the requirement of this specification.

**C. Fabrication**

1. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Handwork finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show. For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added for a minimum thickness of 0.125 inches.
2. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of grazing, delamination, and blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted up to 6 square feet if they are less than 3/4 inch in diameter and less than 1/16 inch deep.
3. Fiberglass Reinforced Bottom: The bottom shall be fabricated using fiberglass material as identified above. Bottom to be attached to wet well walls with fiberglass layup to comply with ASTM-D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wet well bottom per ASTM-D3299.
4. Integral Internal Fiberglass Fillet: Fiberglass wet wells may have an internal sloped fillet bottom. The fillet shall be constructed of the same fiberglass material as the wet well and shall be integral to the wet well. The fiberglass fillet shall have a 1:1 slope and shall not interfere with pump mounting in the wet well.
5. Fiberglass Reinforced Top: The fiberglass wet well top shall be fabricated using fiberglass material as identified above. Top to be attached to wet well pipe with fiberglass layup to comply with ASTM-D3299 specifications. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to wet well bottom per ASTM-D3299.
6. Installation of Stubouts: Effluent, service, or discharge lines may be factory installed. Approved methods are PVC sewer pipe, Inserta-Tee fittings, or Kor-N-Seal boots. Installation of stubouts to be fiberglass layup to comply with ASTM-D3299 specifications.
7. Defects Not Permitted:
  - a. Exposed fibers: glass fibers not wet out with resin.
  - b. Resin runs: runs of resin and sand on the surface.
  - c. Dry areas: areas with glass not wet out with resin.
  - d. Delamination: separation in the laminate.
  - e. Blisters: light colored areas larger than 1/2 inch in diameter.
  - f. Cracking: cracks caused by sharp objects.
  - g. Pits or Voids: air pockets.

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- h. Wrinkles: smooth irregularities in the surface.
- i. Sharp projection: fiber or resin projections necessitating gloves for handling.

**D. Physical Requirements**

1. Load Rating: The complete wet well shall have a minimum dynamic-load rating of 16,000 ft-lbs when tested in accordance with ASTM-D3753. To establish this rating, the complete wet well shall not leak, crack, or suffer other damage when load tested to 40,000 ft-lbs and shall not deflect vertically downward more than 1/4 inch at the point of load application when loaded to 24,000 lbs.
2. Stiffness: The wet well cylinder shall have a minimum pipe-stiffness value shown in the table below when tested in accordance with ASTM-D3753.

<b>LENGTH - FT.</b>	<b>F/AY - PSI</b>
10 to 20	2.01
21 to 30	3.02
31 to 40	5.24

**3. Physical Properties**

	<b>Hoop Direction</b>	<b>Axial Direction</b>
Tensile Strength (psi)	18,000	5,000
Tensile Modules (psi)	$0.8 \times 10^6$	$0.7 \times 10^6$
Flexural Strength (psi)	26,000	4,500
Flexural Modules (psi)		
(no ribs - 48", 60", 72") (psi)	$1.4 \times 10^6$	$0.7 \times 10^6$
(with ribs - 96", 144") (psi)	$0.7 \times 10^6$	$0.7 \times 10^6$

**5.2.3 Piping Penetrations**

- A. For precast concrete wet wells, pipe penetrations shall be sealed with one of the following methods using resilient connectors with stainless steel clamps in accordance with ASTM C923.
  1. A-Lok Products, Inc.
  2. Trelleborg Pipe Seals Milford, Inc. (Kor-N-Seal)
  3. GCDWR approved equal.
- B. For cast-in-place concrete wet wells, pipe penetrations shall be sealed with one of the following methods.
  1. Cast wall pipe into concrete when the walls are being poured.
  2. Cast in wall sleeve with link-seal and non-shrink grout on inside face.
  3. GCDWR approved equal.
- C. For fiber reinforced polyester wet wells, pipe penetrations shall be made in accordance with the paragraph 5.2.2.4 above or the manufacturer's recommended procedures.

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- D. There shall be only one (1) influent pipe connection to the wet well from the gravity sewer system. Variances from this requirement may be made in accordance with Section 3 – Change or Variance Procedures. The invert elevation of the influent pipe shall be as close to the invert of the wet well as possible. In no case shall the influent pipe invert be more than four (4) feet above the “Pump Off” elevation. The influent to the wet well should be located to avoid vortexing and direct discharge into pump suction or suction piping. The influent gravity sewer from the last manhole to the wet well shall be increased in size to the next available size above the size required for the design flows to allow for future expansion of the pump station.

**5.3 Valve Vaults**

- A. Valve vaults may be constructed of the same approved materials as the wet well.
- B. The minimum allowable interior size for valve vaults shall be 6’ x 6’ for pump stations with piping 4” and 6” in size and 8’ x 8’ for pump stations with piping 8” and larger.
- C. Valve vaults shall be provided with a minimum 4’ x 4’ double leaf aluminum access hatch meeting the requirements described in paragraph 5.4 below.
- D. No manhole steps shall be installed in valve vaults. An OSHA approved aluminum access ladder shall be installed from the access hatch to one (1) foot above the floor inside the vault and extend two (2) feet above the hatch when fully extended.

**5.4 Access Hatches**

- A. Access hatches for wet wells shall be of aluminum construction and sized per the pump manufacturers recommendation to allow adequate clearance for easy removal of the pumps.
- B. Access hatches for valve vaults shall be water tight, aluminum hatches with a minimum size indicated in paragraph 5.3 above. Hatch drain shall be piped to the wet well and include a trap.
- C. Access hatch shall be hinged with tamper proof bolts, shall have automatic hold open arm and a flush aluminum drop handle. All hardware shall be Type 316 stainless steel. Hatches shall be rated for a live load of 300 psf unless located within an area accessible by vehicle traffic, in which case the hatch shall be rated for H20 loads.
- D. All hatches shall have a recessed pad lock box to allow for secure locking of the hatch without presenting a potential trip hazard.
- E. All access hatches shall be equipped with metal safety grates with safety latches. Safety grates shall have a rated capacity of 300 psf and shall not interfere with the removal of the pumps or other equipment. Acceptable safety grate manufacturers include:
  - 1. Flygt by Xylem, Inc.
  - 2. U.S. Foundry
  - 3. Halliday Products
- F. Provide two (2) hatch keys for wet well and valve vault hatch locking devices.

**5.5 Piping and Valves**

- A. All piping from the pump discharge through the valve vault shall be flanged ductile iron pipe (DIP). No Uni-flange or Mega-flange types will be allowed.

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- B. A solid sleeve flex joint shall be used between the wet well and valve vault per Detail PS-13.
- C. Check valves used on submersible pump stations shall be Val-Matic “Swing Flex” with backflow actuator available from Charles Finch Company or Flygt “Sure Shut” swing check with backflow actuator.
- D. All pump stations shall have plug valves installed at the following locations. See Section 6 – Force Main Requirements for plug valve specifications.
  - 1. On the discharge pipe of each pump in the valve vault (No valve shall be located in the wet well).
  - 2. On the vertical bypass piping connection inside the pump station fence.
  - 3. On the force main no more than three (3) feet outside the pump station fence.
- E. A valve key for plug valves shall be provided to the GCDWR E&C inspector for each pump station.
- F. An 18” square concrete pad shall be provided around each valve cover for buried valves.

**5.6 Coatings**

- A. Wet wells are to be coated with a corrosion resistant epoxy coating before the station is accepted by the GCDWR E&C inspector.
  - 1. The coating shall be 100% solids high build epoxy coating formulated for application within a sanitary sewer environment.
  - 2. The coating thickness shall be a minimum of 100 mils in one or two multi-pass coats.
  - 3. The coating color shall be white or off-white.
  - 4. The cured epoxy resin system shall conform to the following minimum structural standards:

	<b>Strength (psi)</b>
Compressive Strength (ASTM D-695)	13,000
Flexural Strength (ASTM D-790)	13,000
Tensile Strength (ASTM D-638)	7,000
Flexural Modulus (ASTM-790)	500,000

- 5. The epoxy coating shall be mainstay DS-5 by Madewell Products Corporation, Raven 405 by Raven Lining Systems, Cor-Cote SC (Sewer Coat) by Sherwin-Williams, or approved equal.

**5.7 Acceptable Types of Pumps**

- A. The GCDWR has standardized on specific types of pumps for use at developer pump stations in an attempt to minimize the operation and maintenance costs associated with these pump stations. This standardization has resulted in the acceptance of the following two (2) types of pumps for use at pump stations.
  - 1. Submersible Pumps
  - 2. Suction Lift Pumps

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- B. The pump selected shall be the most efficient pump available at the desired station design point as recommended by the pump manufacturer.

**5.8 Submersible Pumps**

**5.8.1 Acceptable Manufacturers**

- A. Flygt by Xylem, Inc.
- B. Ebara
- C. KSB

**5.8.2 Minimum Requirements**

- A. Pass a three (3) inch diameter solid or provide alternative technologies approved by Georgia Environmental Protection Division (EPD).
- B. Maximum speed of 1,800 RPM (higher speeds may be approved through the variance request process)
- C. Electrical
  - 1. Motors shall be three phase. Acceptable motor voltages are 460V for any size motor, or 230V and 208V for motors up to 25 HP.

**5.8.3 General**

- A. Pump(s) shall be heavy-duty, electric submersible, centrifugal non-clog units capable of handling raw, unscreened sewage and wastewater and shall be fully guaranteed for this use.
- B. Pump(s) shall be designed for easy removal and reinstallation without the need for the removal of bolts, nuts, or other fasteners. The pump(s) shall automatically and firmly connect to the discharge connection, guided by no less than two parallel, non-load bearing, guide rails extending from the top of the pump station to the wet well mounted discharge connection. There shall be no need for personnel to enter the wet well.
- C. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.
- D. The entire weight of the pump/motor unit shall be borne by the pump discharge elbow. No portion of the pump/motor unit shall bear on the sump floor directly or on a sump floor mounted stand.
- E. Power and pilot cable supports shall be provided and consist of a stainless steel wire braid sleeve with attachment loops or tails to connect to cable holders on the underside of the access frame.

**5.8.4 Construction**

- A. Major pump components (pump casing, impeller, intermediate housing, motor housing) shall be minimum ASTM A-48, Class 30, cast iron with smooth surfaces devoid of blow holes or other casting irregularities.
- B. All exposed nuts or bolts shall be Type 304 stainless steel.
- C. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by manufacturers standard factory applied spray coating which shall be guaranteed to protect the pump from the pumped media.



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- D. Pump/motor unit mating surfaces, where watertight sealing is required, shall be machined and fitted with Viton rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact on four sides without the requirement of a specific bolt torque limit. Rectangular cross-sectioned rubber, paper or synthetic gaskets that require specific torque limits to achieve compression shall not be considered equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.
- E. Motor Cooling System (if Required)
1. The motor cooling jacket shall encircle the stator housing and shall provide heat dissipation for the motor regardless of whether the motor unit is submerged in the pumped media or surrounded by air.
  2. The cooling jacket shall have one fill port and one drain port.
  3. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures up to 40 °C (104 °F). Restrictions below this temperature are not acceptable.
- F. Cable and Cable Entry Seal
1. The power cable shall be suitable for the submersible pump applications and sized according to NEC and ICEA standards.
  2. The power cable shall be of sufficient length to reach from the pump to the control panel terminal block without splicing. The cable shall have enough slack such that it can be routed and secured out of the way of any equipment in the wet well.
  3. The outer jacket of the power cable shall be oil resistant.
- G. Motor
1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings and stator leads shall be insulated with moisture resistant minimum Class F insulation rated for 155°C (311 °F). The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be specifically designed for submersible pump usage and designed for continuous duty pumping media of up to 40 °C (104 °F) with an even 80°C temperature rise and capable of 15 starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing for connection of power and pilot sensor cables. The use of wire nuts or crimping type connectors is not acceptable. The motor and pump shall be produced by the same manufacturer.
  2. Motor shall have a minimum service factor of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. A performance chart shall be provided in the submittal showing curves for torque, current, power factor, input/output kW and efficiency and data on starting and no-load characteristics.
  3. The motor shall be suitable for Class 1, Division 1 environments.
  4. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
  5. 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.

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H. Bearings

1. Motor bearings shall be sealed and permanently grease lubricated with high temperature grease.
2. The minimum L10 bearing life shall be 50,000 hours at any point along the usable portion of the pump curve at maximum product speed.

I. Mechanical Seals

1. Pumps shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies.
2. Each seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide or silicon-carbide ring.
3. Seals shall operate in an oil lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate.
4. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counterclockwise direction of rotation without damage or loss of seal.
5. Should both seals fail and allow fluid to enter the stator housing, a port shall be provided to direct that fluid immediately to the stator float switch to shut down the pump and activate an alarm. Any intrusion of fluid shall not come in contact with the lower bearings.
6. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The seal lubricant chamber shall have drain and inspection plugs that are both accessible from the outside of the pump unit. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.
7. Seal lubricant shall be FDA Approved, nontoxic.

J. Pump Shaft

1. The pump shaft shall be made of 400 series stainless steel and shall be completely isolated from the pumped liquid.
2. Pump and motor shaft shall be a solid and continuous shaft. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable.

K. Impeller

1. Impeller(s) shall be minimum ASTM A-48, Class 30 cast iron, dynamically balanced, multiple vaned, enclosed or semi-open, non-clogging design having long throughlets without acute turns.
2. Impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater.
3. Impeller(s) shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing the minimum diameter solid indicated in the design criteria.

L. Wear Rings/Suction Covers

1. Enclosed Impellers
  - a. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be fitted with a Nitrile coated steel or brass ring insert that is drive fitted to the volute inlet.

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- b. The pump shall also have a stainless steel impeller wear ring heat-shrink fitted onto the suction inlet of the impeller.
- 2. Semi Open Impellers
  - a. A replaceable cast iron suction cover shall be used to provide efficient sealing between the volute and suction inlet of the impeller.
  - b. The suction cover shall be designed such that it may be adjusted to maintain working clearances and hydraulic efficiencies.
- M. Volute
  - 1. Volute(s) shall be made of minimum ASTM A-48, Class 30 cast iron, non-concentric design with smooth passages large enough to pass any size solid that may enter the impeller.
  - 2. Minimum discharge size shall be as specified in the design criteria.
- N. Protection
  - 1. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.
  - 2. A float switch shall be installed in the seal leakage chamber. When the float switch is activated, the motor shall stop and an alarm shall be activated.
  - 3. The thermal switches and seal leakage float switches shall be monitored from the pump control panel.
  - 4. The wires for the thermal switches and moisture sensor may be a part of a composite motor cable. If separate cables are provided, they shall be of adequate length to reach the control panel without splicing.

**5.8.5 Accessories**

- A. Guide Rails
  - 1. Guide rails shall be Type 316 stainless steel. Diameter shall be as specified by the pump manufacturer.
- B. Guide Rail Supports
  - 1. Upper and intermediate guide rail supports shall be Type 316 stainless steel. The pump manufacturer shall submit the recommended locations of the guide rail supports to the Engineer.
- C. Cable Holder
  - 1. Cable holder shall be Type 304 stainless steel provided.
  - 2. A minimum of one cable holder for each cable shall be provided.
- D. Pump Lifting System
  - 1. Each submersible pump shall be supplied with one (1) lifting system.
  - 2. The system shall be appropriately sized for the weight of the pump to be lifted.

**5.8.6 Spare Parts**

- A. Provide the following spare parts for submersible pump stations.
  - 1. Six (6) float switches or one (1) probe.

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2. Provide one (1) phase monitor relay and one (1) motor starter with overload block.
  3. Provide two (2) complete sets of Operation and Maintenance Manuals.
  4. Provide five (5) spare fuses for each type and rating provided.
  5. Provide five (5) spare lamps for each type provided.
  6. Provide five (5) spare relays and relay sockets for each type provided.
- B. If a submersible transducer and controller are used, a spare transducer and controller must be provided.
- C. Additional spare parts may be identified by the GCDWR E&C inspector during the review phase based on the design of the pump station.
- D. Spare parts shall be boxed and clearly labeled as to what equipment it is provided for.
- E. Spare parts shall be of the same type and quality as the parts provided in the original equipment package.

**5.8.7 Shop Testing**

- A. Certification tests shall be performed on the actual assembled pumps to be supplied. Pumps shall be tested in the Manufacturer's facility and in accordance with the latest test code of the Hydraulic Institute Level A to determine head vs. capacity and kilowatt draw required. Tests shall cover a range from shut-off to a minimum of 20% beyond the specified design performance capacity. Certification tests shall be conducted on each pump being supplied. A pump curve shall be generated showing actual flow, head, BHP, and hydraulic efficiency for each pump being supplied. A registered Professional Engineer shall certify each pump curve. Certified pump curves shall be submitted to GCDWR in accordance with Section 2- GCDWR Approval Process, of these standards.

**5.9 Suction Lift Pumps**

**5.9.1 Acceptable Manufacturers**

- A. Smith & Loveless (S&L)

**5.9.2 General**

- A. Suction lift pump stations shall be factory built and tested for mounting on top of the station wet well. The assembly shall meet the requirements of the latest specifications for the S&L Classic or Formula X Wet Well Mounted Pump Station, with the minimum requirements identified below. The station shall be constructed in one complete, factory-built assembly. It shall be sized to rest on the top of the wet well.
- B. The principal items of equipment shall include two vertical, close-coupled, motor driven, vacuum primed, non-clog pumps; valves; internal piping; central control panel with circuit breakers; motor starters and automatic pumping level controls; heater; ventilating blower; priming pumps with SONIC START® pump prime detection system and appurtenances; and all internal wiring.

**5.9.3 Minimum Requirements**

- A. Pass a three (3) inch diameter solid or provide alternative technologies approved by EPD.
- B. Maximum speed of 1,800 RPM (higher speeds may be approved through the variance request process)

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- C. Electrical
  - 1. Motors shall be three phase. Acceptable motor voltages are 460V for any size motor, or 230V and 208V for motors up to 25 HP.
- D. The supporting floor plate shall be minimum 3/8" corrosion-resistant lean duplex series 2100 stainless steel alloy, 316L stainless steel or equal. The stainless steel shall have a Pitting Resistance Equivalent Number (PRE<sub>N</sub>) of 24.0 or greater and general corrosion resistance shall be less than or equal to 0.1 mm per year in 15% H<sub>2</sub>SO<sub>4</sub> at 120 degrees F. The stainless steel surfaces shall be glass bead blast cleaned to remove surface contamination and provide a uniform finish.
- E. The pump impeller shall be of the enclosed two-port type made of close-grained cast-iron and shall be balanced. The eye of the impeller, as well as the ports, shall be large enough to permit the passage of a sphere 3" in diameter in accordance with nationally recognized codes. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel capscrew equipped with a Nylock or other suitable self-locking device. To prevent the buildup of stringy materials, grit and other foreign particles around the pump shaft, all impellers less than full diameter shall be trimmed inside the impeller shrouds. The shrouds shall remain full diameter so that close minimum clearance from shrouds to volute is maintained. Both the end of the shaft and the bore of the impeller shall be tapered to permit easy removal of the impeller from the shaft.
- F. Pump Station Control shall be in accordance with the requirements of Section 7 – Electrical and Instrumentation Requirements.
- G. Station suction piping below the top plate in the wet well shall be appropriately sized by the pump station manufacturer with a minimum diameter of 4". Piping shall be constructed of HDPE.
- H. The following accessories shall be provided:
  - 1. Pump Running Lights
  - 2. Remote Alarm Contacts
  - 3. Time Delay
  - 4. Sequential Alternation
  - 5. Pump Prime Failure
  - 6. Wet Well Fall Protection Barrier

**5.9.4 Spare Parts**

- A. Provide the following spare parts for suction lift pump stations:
  - 1. Two (2) extra sets of seals per model of pump.
  - 2. One (1) vacuum pump.
  - 3. Six (6) float switches.
  - 4. One (1) motor starter with overload block.
  - 5. Two (2) complete sets of Operation and Maintenance Manuals.
  - 6. Provide five (5) spare fuses for each type and rating provided.
  - 7. Provide five (5) spare lamps for each type provided.
  - 8. Provide five (5) spare relays and relay sockets for each type provided.
- B. If a submersible transducer and controller are used, a spare transducer and controller must be provided.

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- C. Additional spare parts may be identified by the GCDWR E&C inspector during the review phase based on the design of the pump station.
- D. Spare parts shall be boxed and clearly labeled as to what equipment it is provided for.
- E. Spare parts shall be of the same type and quality as the parts provided in the original equipment package.

**5.9.5 Shop Testing**

- A. Certification tests shall be performed on the actual assembled pumps to be supplied. Pumps shall be tested in the Manufacturer's facility and in accordance with the latest test code of the Hydraulic Institute Level A to determine head vs. capacity and kilowatt draw required. Tests shall cover a range from shut-off to a minimum of 20% beyond the specified design performance capacity. Certification tests shall be conducted on each pump being supplied. A pump curve shall be generated showing actual flow, head, BHP, and hydraulic efficiency for each pump being supplied. A registered Professional Engineer shall certify each pump curve. Certified pump curves shall be submitted to GCDWR in accordance with Section 2- GCDWR Approval Process, of these standards.

**5.10 Pressure Gauges**

- A. Pressure gauges shall be installed on the discharge piping from each pump prior to the check valve. Gauges shall be installed inside the valve vault for submersible pump stations and on the station piping for suction lift pump stations.
- B. Pressure gauges shall be minimum 2½" diameter, liquid filled, Type 316 stainless steel gauges.
- C. Range of gauge shall be approximately 2 times the normal operating pressure.
- D. Acceptable Manufacturers:
  - 1. Ametek
  - 2. Ashcroft
  - 3. Trerice
  - 4. GCDWR Approved Equal

**5.11 Diaphragm Seals**

- A. Diaphragm seals shall be Type 316 stainless steel seals with flushing connections.
- B. Acceptable Manufacturers:
  - 1. Ametek
  - 2. Ashcroft
  - 3. Trerice
  - 4. GCDWR Approved Equal

**5.12 Other Materials**

- A. Materials not covered in these specifications shall be in accordance with the approved plans.

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**SECTION 6 - FORCE MAIN REQUIREMENTS**

**6.1 General**

- A. The minimum size for force mains shall be 4-inch diameter.
- B. Force mains with multiple diameter piping must be pre-approved by GCDWR AMIS Division Director, or designee.
- C. Within the proposed development the force main shall be located in a 10' wide utility easement immediately adjacent to the proposed right-of-way. Outside of the proposed development, the force main shall either be located within the State or County Road right-of-way or a 20' wide utility easement immediately adjacent to the right-of-way if the State or County Department of Transportation will not approve locating the force main within their right-of-way.

**6.2 Acceptable Piping Materials**

- A. All force mains shall be constructed using ductile iron pipe (DIP) and fittings.
- B. The required pipe class shall be such that the "manufacturer's allowable working pressure" is either a minimum of twice the design working pressure, or one and one half times the design surge pressure, whichever is greater.

**6.2.1 Internal Lining Requirements**

- A. Force mains shall have a standard cement mortar lining except where specified otherwise below.
- B. A corrosion resistant internal lining shall be used at the following locations and/or condition. Lining shall be Protecto 401 ceramic epoxy or approved equal.
  - 1. All high points within a force main plus up to 100 feet on both sides.
  - 2. All locations where partially full conditions may exist or where the force main may be exposed to air during static or operating conditions as determined by a hydraulic model of force main, plus 40 feet on both sides.

**6.2.2 External Coating Requirements**

- A. The Developer and/or the design engineer shall conduct an assessment of the proposed route of the force main to determine if there are potential sources of external corrosion such as stray currents or corrosive soils. The results of the analysis shall be submitted to GCDWR for review and approval. If sources of potential corrosion exist, the force main shall be provided with the required means for protecting the force main from corrosion.
- B. At a minimum, force mains shall have the manufacturer's standard coal tar coating and the top quarter of the pipe shall be painted green.

**6.3 Isolation Valves**

**6.3.1 Locations**

- A. Isolation valves shall be provided at a maximum spacing of every 2,500 feet and as directed by the GCDWR AMIS Division Director or designee.

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**6.3.2 Types**

- A. Isolation valves shall be plug valves conforming to the requirements shown below. Plug valves shall be non-lubricated, resilient-seated, eccentric valves. Plug valves shall conform to the latest revision of ANSI/AWWA C517-05. All materials shall be new. Plug valve body and cover shall be composed of cast iron in conformance with either ASTM A126 Class B or ASTM A48 Class 40. All buried valves shall have mechanical joint ends conforming to ANSI/AWWA C111/A21.11, and all exposed valves measuring 4 inches in diameter and larger shall have Class 125 flat face flanged ends, at a minimum, conforming to ANSI B16.1 or ANSI/AWWA C110/A21.10. At a minimum, valves measuring 4 inches to 12 inches in diameter shall have 175 psig bodies, and valves measuring 14 inches and greater in diameter shall have 150 psig bodies. For specific installation locations where the Total Dynamic Head (TDH) plus the surge pressure exceeds the minimum pressure ratings above, Class 250 flat face flanged ends and a 400 psi (for 3-inch to 12-inch valves) or 300 psi (for 14-inch and greater valves) valve body shall be provided. Plug valves with 175 psi bodies and Class 125 flat face flanges shall have the following face-to-face dimensions.

<b>Nominal Valve Diameter (inches)</b>	<b>Lay Length (inches)</b>
4	9.0
6	10.5
8	11.5
10	13.0
12	14.0

- B. Plug shall be a solid one-piece casting composed of cast iron covered with a resilient elastomer; two-piece plugs or plugs with internal cavities shall NOT be acceptable. Plug face shall be covered with either EPDM or Neoprene; plug facings composed of natural rubber, Viton, or Nitrile shall NOT be acceptable. Seats shall be composed of either 95 percent nickel alloy or Type 316 stainless steel; seats composed of thermosetting epoxy or fusion bonded nylon shall NOT be acceptable. Screwed-in seats shall NOT be acceptable.
- C. Plug valves shall have a minimum % port area of 67% using the nominal pipe diameter as the basis of measurement. Port area shall be the minimum cross-sectional area within the valve perpendicular to the flow, expressed in square inches; valves shall have a port area exceeding the following minimum requirements.



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Nominal Valve Diameter (inches)	Port Area (Square inches)
4	11.00
6	24.50
8	42.50
10	64.50
12	89.50
14	118.50
16	158.50
18	193.50
20	238.50
24	309.50
30	494.50
36	712.50

- D. Radial shaft bearings shall be permanently lubricated, sleeve-type, sintered, oil-impregnated bearings composed of either Type 316 stainless steel in accordance with ASTM A-743, Grade CF-8M, or oil-impregnated bronze in accordance with ASTM B-127. Non-metallic radial thrust bearings shall NOT be acceptable. Thrust bearings/washers shall be composed of Type 316 stainless steel, Teflon, Nylon 11, or Nylatron. Shaft seals shall be either the U-cup type or multiple V-ring type and shall be composed of either EPDM or Neoprene; shaft seals shall be self-adjusting and repackable without removing the bonnet or actuator from the valve or removing the valve from the line. Plug valve and connecting pipe shall have the capability to be pigged without the use of special equipment.
- E. Plug valves and operators shall be installed according to the manufacturer's recommendations for conveying fluids with high solids concentrations. For horizontal installations, the plug valve shall be installed so that the plug face is pointing upwards when the valve is open and the plug face is facing the pump when the valve is closed. For vertical installations, the plug valve shall be installed so that the plug face is pointing to the side when the valve is open and the plug face is pointing upwards when the valve is closed. All plug valves shall be installed horizontally with right angle operators pointing up to allow operation from grade.
- F. Above-ground valves 6 inches in diameter and smaller shall have manual lever operators, unless otherwise specified or noted on the Drawings. Above-ground valves 8 inches in diameter and larger shall be manually hand wheel operated through totally enclosed worm gear actuators, unless otherwise specified or shown on the Drawings. Manual operators for plug valves mounted above 6 feet from the operating floor shall be equipped with worm gear chain wheel actuators. All buried valves shall be provided with totally enclosed worm gear actuators, 2-inch square AWWA operating nuts, and valve boxes. Buried valve operators shall be

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extended to within 6-inches of grade. All valves shall be provided with mechanical travel stops for the open and closed positions and shall rotate 90 degrees from fully open to fully shut. Gear actuators shall be designed to produce the required operating torque with a maximum rim pull of 80 pounds on a hand wheel / chain wheel and with a maximum input of 150 foot-pounds on 2-inch operating nuts. Actuator components between the input and the open and closed position stops shall be designed to withstand, without damage, a rim pull of 200 pounds for hand wheels / chain wheels and an input torque of 300 foot-pounds for 2-inch operating nuts.

- G. Valves shall be either directly cast with or provided with a corrosion-resistant nameplate stating, at a minimum, the valve serial number, manufacturer, size, maximum shutoff pressure, and design pressure rating. The seat end shall be clearly indicated on the valve exterior relative to half of the body containing the plug/seat interface.
- H. Plug valve manufacturer shall submit certified Shop Drawings showing the principal dimensions, construction, and materials used for all parts of the valve and actuator; certified Shop Drawings shall clearly indicate the minimum dimensions encountered within the valve port when the plug valve is fully open. Plug valve manufacturer shall certify that the plug valve(s) furnished are capable of operating in continuous duty service under the pressure and flow conditions at each installation location. Prior to valve shipment, plug valve manufacturer shall provide a written affidavit to the engineer attesting that the plug valve(s) furnished comply with the requirements of the GCDWR specifications, comply with the applicable portions of ANSI/AWWA C517-05, and match what is shown on the Shop Drawings. Each valve shall be hydrostatically tested and tested for bubble tightness at the factory after the operator has been mounted and adjusted, and manufacturer shall provide written certification of test conformance to the engineer prior to valve shipment.
- I. All internal and external ferrous components and surfaces of the valves, with the exception of stainless steel and finished or bearing surfaces, shall be shop painted with two (2) coats (10 mils minimum dry film thickness) of the manufacturer's premium epoxy for corrosion resistance. Damaged surfaces shall be repaired in accordance with the manufacturer's recommendations.
- J. Valves shall be manufactured by DeZurik, Val-Matic, Henry Pratt, or approved equal.
- K. Plug valves shall be installed so that the flow is against the face of the plug in the closed position and so that the plug rotates to the top of the pipeline in the open position.

**6.4 Air/Vacuum Valves**

**6.4.1 Locations**

- A. Force mains shall have an air release or combination air release/vacuum valve at each high point or as required by the GCDWR AMIS Division Director or designee.
- B. Location and sizing of air release or combination air release/vacuum valves shall be determined by hydraulic modeling of the force main and verified by the valve manufacturer.
- C. Force mains shall be designed to minimize the number of air release/vacuum valves. The force main bury depth shall be varied up to a maximum depth of 10 feet where deemed necessary to eliminate air release valves.

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- D. One spare air release/vacuum valve shall be provided for every five (5) air release/vacuum valves installed. If applicable, a minimum of one (1) spare valve shall be provided per force main.

**6.4.2 Types**

- A. Air release and or combination air/vacuum valves shall be Vent-O-Mat series RGX and be installed per Detail PS-10.
- B. Air release valve manholes shall be installed such that the air release valve can be worked on and removed without the need to pull off the top of the manhole.

**6.5 Sampling Assemblies**

- A. A minimum of one sampling tap shall be included on all force mains at a location designated by the GCDWR AMIS Division Director or designee. If the force main is longer than 5,000 feet, the GCDWR AMIS Division Director or designee may require additional sampling taps be provided.
- B. Sampling taps shall be located in an air release/vacuum valve vault along the force main and be installed per Detail PS-34 included with these Standards. The GCDWR AMIS Division Director or designee shall approve the final location of all sampling taps.

**6.6 Thrust Restraint**

- A. All fittings, valves, and dead-ends shall have two (2) forms of thrust restraint.
- A. All pipe joints shall be restrained as required.
- B. Acceptable thrust restraint includes restrained joint glands, field lock gaskets, threaded rods, and concrete blocking.
- C. Sanitary sewage force mains shall be restrained, as required, using restrained joint type gaskets. The design engineer shall be responsible for calculating the length of pipe from each fitting that requires restrained joints. Calculations shall be submitted to GCDWR.

**6.7 Discharge Manholes**

**6.7.1 Acceptable Materials**

**6.7.1.1 Existing Manholes**

- A. When a proposed force main will discharge into an existing manhole on a gravity sewer, the existing manhole shall have a corrosion resistant lining installed in it or be replaced with a composite manhole.
- B. An existing precast concrete manhole shall be lined with an epoxy or FRP coating capable of resisting corrosion caused by hydrogen sulfide gases and other constituents found in wastewater.
- C. An existing brick manhole shall be lined with a structural FRP coating capable of resisting corrosion caused by hydrogen sulfide gases and other constituents found in wastewater.
- D. Acceptable Coatings:
  - 1. Protective Liner Systems – PerpetuWall or PerpetuSeal

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2. Dural Seal – DuralSeal CA or DuraLine
3. Environmental Coatings, LLC – Sewer Shield or Flex Guard 250
4. GCDWR AMIS Division Director or designee approved equal

**6.7.1.2 New Manholes**

- A. When a new manhole is installed as the discharge manhole, the manhole shall be constructed of composite materials capable of resisting corrosion caused by hydrogen sulfide gases and other constituents found in wastewater.
- B. Composite manholes shall be manufactured by:
  1. U.S. Composite Pipe, Inc.
  2. Sewer Shield Composite, LLC
  3. GCDWR AMIS Division Director or designee approved equal

**6.8 Force Main Installation Requirements**

**6.8.1 Depth of Bury**

- A. Force mains shall be installed with a minimum cover of five (5) feet above the top of pipe.
- B. Force main installations with depth exceeding five (5) feet may be accepted for the following conditions.
  1. To maintain rising or falling slopes to eliminate the need for an air release/vacuum valve.
  2. To allow adequate depth for the proper installation of an air release/vacuum valve manhole.
- C. In no case shall the depth of cover on a force main exceed 10 feet unless pre-approved in writing by the GCDWR AMIS Division Director or designee.

**6.8.2 Trench Backfill**

- A. Force main pipe bedding shall be installed per the requirements of Details PS-30, PS-31, and PS-35 included with these standards. Bedding material shall be angular crushed stone,  $\frac{1}{4}$  inches to  $\frac{3}{4}$  inches in size with no more than 5 percent passing a No. 8 standard sieve in accordance with Class I materials as defined by ASTM D 448 Rev. A, or latest edition.
- B. Force mains located outside of paved roads shall be backfilled per the requirements of Detail PS-35 included with these standards.
- C. Force mains located under paved roads shall be backfilled per the requirements of Details PS-30 or PS-31 included with these standards, unless directed otherwise by the GDOT or GCDOT.

**6.8.3 Rising and Falling Grades**

- A. Rising and falling grades shall be maintained to minimize the need for air release/vacuum valves.
- B. Rising and falling grades shall be maintained at all times to allow entrapped air to move to the highpoint for release through the air release valve.
- C. Deeper depth of bury may be required to eliminate or locate air release/vacuum valves away from residences or public areas.

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**6.8.4 Gravity Flow Conditions**

- A. Force mains **will not** be approved to flow downhill into the receiving manhole. After the proposed force main passes over the last high point along its route a new gravity sewer line must be installed to convey the flow downhill to the existing sewer system. Exceptions to this requirement may be granted on a case by case basis if in the opinion of the GCDWR AMIS Division Director or designee there is no benefit to the County for having gravity sewer in the particular location involved.

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**Section 7**

**Electrical and Instrumentation Requirements**

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**SECTION 7 - ELECTRICAL AND INSTRUMENTATION REQUIREMENTS**

**7.1 General**

- A. The pump station shall be supplied with a single pump station control panel (PSCP) which shall house the pump starters/VFDs and protection equipment as well as the pump station control and remote telemetry equipment.
- B. All work and materials shall comply with the National Electrical code and applicable local regulations and ordinances. Where required by applicable codes, cabinet assemblies, materials and equipment shall be approved, identified, labeled or listed by Underwriters' Laboratories.
- C. The cabinet shall be designed to absorb vibrations or mechanical movement from the motor starts or other active equipment. These movements shall not cause undue vibrations in the control panel. As a minimum any size 3 or greater starters shall include additional stiffeners or other vibration dampening equipment.

**7.2 Communication Method**

- A. The Pump Station Control Panel (PSCP) shall be evaluated for AT&T cellular communication by the contractor. Using the actual location and finished floor elevation of the PSCP location, the contractor shall conduct a site survey to determine the Received Signal Strength Indicator (RSSI) (ideal value of -75 dBm to -100 dBm) on 3G Modems or most current compatible technology using the carrier AT&T. Interference with trees, construction, mountains or simply distance from the tower could be problematic. The results of the site survey shall be submitted to the GCDWR E & C Inspector who will in turn provide it to the GCDWR Pump Station SCADA Manager for determination of the feasibility of cellular communication at the pump station site. After the conclusion of the field site survey the GCDWR Pump Station SCADA Manager will make a determination if cellular communication is feasible.
  - 1. If cellular communication is determined to be feasible the contractor shall include a cellular modem, antenna, and other necessary equipment for successful communication with the PSCP. The contractor shall supply, install, and configure the equipment to achieve satisfactory cellular communication. As a minimum this equipment will include a cellular modem, antenna, antenna cable, and antenna surge suppressor.
  - 2. If cellular communication is determined to be unavailable the contractor shall include an Ethernet modem in the panel. The Ethernet modem shall be an Allen Bradley 9300-RADES or approved equal. A telephone line shall be installed from the telephone system interface to the panel.

**7.3 Power**

- A. Three-phase power shall be provided for all pumps. No phase converters or single-phase power will be allowed. The power source may be 120/208V, 120/240V, or 480/277V.
- B. A main circuit breaker shall be used, a fused main disconnect shall not be allowed on the main power feed. The main circuit breaker shall meet the following requirements:
  - 1. Be of a type that can be locked in both on and off positions.
  - 2. The switch shall be U.L. listed for service entrance.
  - 3. The enclosure shall be NEMA 4X stainless steel
  - 4. The switch must be mounted inside the fenced area of the station.

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5. Breaker shall have Long, Short, and Instantaneous (LSI) adjustment and ground fault protection as required by the NEC.

**7.4 Conduit**

- A. All conduits shall be galvanized rigid conduit with threaded couplings. No threadless couplings shall be allowed. Conduits shall have bitumastic coating for underground installation.
- B. All conduit runs shall be buried under or within in the slab. No conduit runs or junction boxes are to be installed inside or on top of wet well. Splicing of cables inside the wet well will not be permitted.
- C. Separate conduits shall be supplied for analog, discrete, communication, and power signals.

**7.5 Control Panel**

**7.5.1 General Requirements**

- A. All equipment furnished under this section shall be selected for its superior quality and intended performance. Equipment and materials used shall be subject to review and shall comply with the following requirements.
  1. Unless specified otherwise, electrical power supply to the instrumentation equipment will be unregulated 120 volts ac at the locations noted on the one-line and functional diagrams. All transmitted electronic analog instrument signals shall be 4-20 mA dc, unless noted otherwise, and shall be linear with the measured variable.
  2. Cabinet Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), state and local codes, and applicable sections of NEMA, ANSI, UL, and ICEA.
  3. PSCP shall include physical barriers inside panel to prevent accidental access between telemetry and pump control areas of the panel.
  4. Control panel shall be fabricated at the system integrator's panel shop. No field fabrication is allowed.
  5. Cabinet shall be built to UL 508 standards and bear UL listing mark stating "LISTED ENCLOSED INDUSTRIAL CONTROL CABINETS".

**7.5.2 System Responsibility**

- A. SYSTEM INTEGRATOR: All instrumentation and industrial electronic systems shall be furnished and installed under the supervision of a single systems integrator who is regularly engaged in the design and installation of such systems of similar scope and complexity. The contractor is responsible to the developer/owner for the performance of all systems. Acceptable system integrators are as follows:
  1. M/R Systems, Norcross, GA
  2. C2I, Smyrna, GA
  3. Global Control Systems, Smyrna, GA
  4. Revere Control Systems, Birmingham, AL
  5. Turbitrol, Austell, GA
  6. Sta-con, Apopka, FL
  7. Smith and Loveless, Lenexa, KS

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**7.5.3 For Pumps 30 HP or Greater**

- A. Use soft starters with 120 VAC coil control.
- B. Must have soft stop capability.
- C. Must include integral bypass contactor.
- D. Isolation contactor is not required unless specified by the engineer.
- E. Must have overload protection capability.
- F. Must display current.
- G. Soft start display shall be remotely mounted on inner door of cabinet, as shown on PS-29A

**7.5.4 Enclosure**

- A. Enclosure Type: NEMA 4X.
- B. Materials: Type 316 stainless steel.
- C. Metal Thickness: 14-gauge, minimum.
- D. Doors: Rubber-gasket with continuous hinge. Stainless steel lockable quick-release clamps.
- E. The enclosure shall have a lockable handle on the outside of each door.
- F. Cabinet shall be sized to allow access around all the instruments for ease of operation and maintenance. The Cabinet shall be designed to prevent overheating of instruments with an ambient air temperature of 100 degrees Fahrenheit with 100% humidity (noncondensing). Air conditioner units will not be allowed.
- G. Cabinet shall include a heater unit with thermostat control for protection of cabinet equipment. Heater shall be designed for an ambient air temperature of 10 degrees Fahrenheit with 100% humidity (non-condensing).
- H. Control panel shall be a 72”H x 36”W x 18”D NEMA 4x stainless steel enclosure with a single dead front door. The control panel shall be laid out as shown on the included detail PS-29A. If additional space is required to house this equipment the panel depth may be increased or a 72”H x 72”W x 18”D double door configuration may be utilized with the telemetry equipment housed in the left hand door and pump starters and protection equipment behind the right door as shown in Detail PS-29A.
- I. Factory applied white TGIC polyester urethane powder coating electrostatically applied to all outside and inside surfaces.
- J. Manufacturers: Hoffman Engineering Co., Saginaw, or Approved equal

**7.5.5 Inner Door Indicator Lights**

- A. As shown on Detail PS-29A, the following items shall be mounted on the inner door of the PSCP:
  - 1. Pump Hand-Off-Auto switch
  - 2. Pump Run Light (Red)
  - 3. Pump Failure Light (Amber)
  - 4. Pump Stop Light (Green)
  - 5. Flygt MAS unit operator interface (if applicable)



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6. Soft Start operator interface (if applicable)
7. Pump stations shall have a six digit non-resettable elapsed time meters for each pump to show individual pump running time to the 1/10th of an hour.
8. Engraved lamincoid nameplate with RTU number and station name.

**7.5.6 Control Power Transformers**

- A. Control power transformer(s) shall be installed inside the panel in the motor control section. The transformer shall be sized at 125% of the rated load and rated for machine tool service.

**7.5.7 Cabinet Wiring**

- A. Wiring within Cabinets shall meet the following requirements:
  1. Wires for AC circuits shall be 600 volt, Type THHN stranded conductor copper and shall be sized for the current to be carried, but not smaller than No. 16 AWG.
  2. Wires for analog signal circuits shall be 300 volt stranded copper and shall be twisted shielded pairs not smaller than No. 16 AWG.
  3. Wires for other DC circuits shall be 600 volt, Type THHN stranded copper not smaller than No. 16 AWG.
  4. Wiring shall be numbered and tagged at each termination on both ends.
  5. Wiring for special signals such as communications, digital data and multiplexed signals shall use manufacturer's standard cables.
  6. All control wiring shall be stranded. No solid wire shall be allowed, except that the telemetry may be 22-gauge multi-pair telephone cable.
  7. Restrain by plastic ties or wire management system.
  8. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
  9. Arrange wiring neatly, cut to proper length, and remove surplus wire.
  10. Provide abrasion protection for wire bundles that pass through holes or across edges of sheet metal.
  11. Provide wire labels at both ends of terminated wire.
  12. If cellular communications is deemed to be unavailable, provide one RJ-11 telephone jack in the control panel. Phone wire from telephone interface to jack to be gel filled direct burial cable.

**7.5.8 Compression Clamp Type Terminals**

- A. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
- B. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
- C. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
- D. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
- E. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
- F. Plastic Wire Duct Fill: Do not exceed manufacturer's recommendations.

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**7.5.9 Terminal Blocks**

- A. Provide sufficient terminations to accommodate both present and future needs. Wire spare PLC module I/O points to their Cabinet's terminal blocks. Provide 300 volt screw clamp compression, dead-front barrier type terminal blocks with current bar providing direct contact with wire between the compression screw and yoke. Provide yoke, current bar and clamping screw constructed of high strength and high conductivity metal. Use yoke that guides all strands of wire into the terminal. Use current bar providing vibration proof connection. Supply terminals that allow connection of wire without any preparation other than stripping. Rail mount individual terminals to create a complete assembly.
- B. Provide terminal constructed such that jumpers can be installed with no loss of space on terminal or rail.
- C. Size all terminal block components to allow insertion of all necessary wire sizes and types. Supply terminal blocks with marking system allowing the use of UL approved terminal blocks manufactured by Allen Bradley, Cutler Hammer, Phoenix Contacts or approved equal.

**7.5.10 Grounding**

- A. Cabinets isolated copper grounding bus for all signal and shield ground connections. This ground bus shall be grounded at a common ground point. The signal grounding system shall meet National Electrical Code requirements.
  - 1. Each analog loop shall be grounded at a single point for the loop. This single point shall be at location of the DC power supply for the loop.
  - 2. Each analog loop shall have its wire shields connected to ground at a single point for the loop.
  - 3. Discrete signals between cabinets shall be dry isolated contacts rated for 5 amps continuous at 120 V AC.

**7.5.11 Network Cables**

- A. Network cables will be as required for a complete and operational system.

**7.6 Electrical Transient Protection**

**7.6.1 General**

- A. Protect all elements of the PSCP against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems. As a minimum, provide surge suppressors at the following:
  - 1. At any connection at AC power to PSCP.
  - 2. At the radio transmission line bulkhead entrance.
  - 3. At analog or digital monitoring or controls (DI, DO and AI).
  - 4. Output of DC power supply.
  - 5. Ethernet cables.

**7.6.2 Suppressor on 120 V AC Power Supply Connections**

- A. Construction: First stage high energy metal oxide varistor and second stage bipolar silicon avalanche device separated by series impedance. Grounding wire, stud or terminal provided.

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- B. Occurrences: Suppressor tested and rated for a minimum of 50 occurrences of IEEE 587 Category B test waveform.
- C. Clamping voltages: 350 volts or less for first stage, 210 volts or less for second stage.
- D. Response: 5 nanoseconds maximum.
- E. Recovery: Automatic
- F. Continuous operation: 5 amps minimum at 130 volts AC for suppressor on power supply for one (1) 4-wire transmitter or receiver, 20 amps minimum otherwise.
- G. Temperature range: -20 degrees C to + 85 degrees C.
- H. Manufacturers: EDCO HSP-121, Phoenix Contact FSP-1, Schneider Electric TVS120LC, or approved equal.

**7.6.3 Suppressor on Analog Signal Lines**

- A. Construction: First stage high energy metal oxide varistor and second stage bipolar silicon avalanche device separated by series impedance. Grounding wire, stud or terminal provided.
- B. Test waveform: Linear 8 microsecond rise in current from zero amps to a peak current value followed by an exponential decay of current reaching for half the peak value in 20 microseconds.
- C. Surge rating: Suppressor tested and rated for a minimum of 50 occurrences of 2000 amp peak test waveform.
- D. DC clamping voltage: Twenty to forty percent above operating voltage for circuit. Clamping voltage tolerance less than plus or minus 10 percent.
- E. Response: 5 nanoseconds.
- F. Recovery: Automatic.
- G. Maximum loop resistance: 18 ohms per conductor.
- H. Temperature range: -20 degrees C to + 85 degrees C.
- I. Approved vendor EDCO PC-642 or SRA-64 Series or equal.

**7.6.4 Main Service Surge Suppressor**

- A. A surge suppressor shall be provided at the power service entrance installed nipped to the main service disconnect switch. The surge suppressor shall meet UL 1449 as a Type 1 SPD and connected to the line side of the main disconnect. The surge suppressor shall have voltage characteristics to match the power service.
  - 1. The surge suppressor shall be in a NEMA-4X stainless steel enclosure and shall provide line to line, line to neutral, line to ground and neutral to ground protection modes as applicable for the power service.
  - 2. The surge suppressor shall be provided with an integral disconnect separate from the main breaker. Minimum surge current rating shall be 1KA per mode, 200KA per phase per NEMA LS-1. The surge suppression system shall be duty cycle tested to survive 20KV, 20KA, IEEE C62.41 category surge current with less than 5% degradation of clamping voltage. The surge suppressor shall have minimum repetitive surge capacity of 6500

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impulses per mode. Status indicating lights and form 'C' dry alarm contacts shall be provided. An event counter display shall be provided.

3. The surge suppressor shall be U.L. listed and labeled under UL1449 and UL1283. Acceptable manufacturers are Liebert, Current Technology, or Innovative Technology.

**7.6.5 Phase Monitor**

- A. A phase monitor shall be provided in the pump control panel. The pump operation shall be inhibited when an open phase/phase reversal condition is detected. A contact of the phase monitor shall also be wired to the PLC for remote indication of the open phase/phase reversal condition.

**7.7 Corrosion Protection**

- A. Corrosion-Inhibiting Vapor Capsule
- B. Manufacturers: Northern Instruments; Model Zerust VC, Hoffmann Engineering; Model A-HCI.

**7.8 Cabinet Fabrication**

**7.8.1 Power Distribution within Cabinets**

- A. One 120 V AC, 60-Hz feeder circuits.
- B. Make provisions for feeder circuit conduit entry.
- C. Furnish terminal board for termination of wires.
- D. Provide 120 VAC Circuit Breaker in each cabinet for incoming AC Power.

**7.8.2 Signal Distribution**

- A. Within Cabinets: 4 to 20 mA dc signals may be distributed as 1 to 5V dc.
- B. Outside Cabinets: Isolated 4 to 20 mA dc only.
- C. All signal wiring shall be twisted shielded pairs.

**7.8.3 Signal Switching**

- A. Use dry circuit type relays or switches.
- B. No interruption of 4 to 20 mA loops during switching.
- C. Switching Transients in Associated Signal Circuit:
- D. 4 to 20 mA dc Signals: 0.2 mA, maximum.
- E. 1 to 5V dc Signals: 0.05V, maximum.

**7.9 Relays**

**7.9.1 General**

- A. Relay Mounting: Plug-in type socket.
- B. Relay Enclosure: Furnish dust cover.
- C. Socket Type: Screw terminal interface with wiring.

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- D. Socket Mounting: Rail.
- E. Provide hold-down clips.

**7.9.2 Signal Switching Relay**

- A. Type: Dry circuit.
- B. Contact Arrangement: 2 Form C contacts.
- C. Contact Rating: 10 amps at 28V dc or 120V ac.
- D. Contact Material: Gold or silver.
- E. Coil Voltage: As noted or shown.
- F. Coil Power: 0.9 watts (dc), 1 .2VA (ac).
- G. Expected Mechanical Life: 10,000,000 operations.
- H. Expected Electrical Life at Rated Load: 100,000 operations.
- I. Indication Type: Neon or LED indicator lamp.
- J. Seal Type: Hermetically sealed case.
- K. Manufacturer: Potter and Brumfield; Allen Bradley, Siemens or Cutler Hammer or approved equal.

**7.9.3 Control Circuit Switching Relay, Non-latching**

- A. Type: Compact general purpose plug-in.
- B. Contact Arrangement: 2 Form C contacts.
- C. Contact Rating: 10A at 28V dc or 240V ac.
- D. Contact Material: Silver cadmium oxide alloy.
- E. Coil Voltage: As noted or shown.
- F. Coil Power: 1.8 watts (dc), 2.7VA (ac).
- G. Expected Mechanical Life: 10,000,000 operations.
- H. Expected Electrical Life at Rated Load: 100,000 operations.
- I. Indication Type: Neon or LED indicator lamp.
- J. Push-to-test button.
- K. Manufacturer and Product: Allen Bradley 700-HC14A1, or approved equal.

**7.9.4 Control Circuit Switching Relay, Latching**

- A. Type: Dual coil mechanical latching relay.
- B. Contact Arrangement: 2 Form C contacts.
- C. Contact Rating: 10A at 28V dc or 120V ac.
- D. Contact Material: Silver cadmium oxide alloy.
- E. Coil Voltage: As noted or shown.

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- F. Coil Power: 2.7 watts (dc), 5.3VA (ac).
- G. Expected Mechanical Life: 500,000 operations.
- H. Expected Electrical Life at Rated Load: 50,000 operations.
- I. Manufacturer: Potter and Brumfield, Siemens or Allen Bradley or approved equal.

**7.9.5 Power Supplies**

- A. Furnish as required power to instruments requiring external dc power, including two-wire transmitters and dc relays. Regulated dc power supplied for instrument loops shall be provided. Power supplies shall be suitable for an input voltage variation of +/- 10 percent, and the supply output shall be fused or short-circuit protected. Output voltage regulation shall be as required by the equipment supplied.
- B. Convert 120V AC, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
- C. Provide output over voltage and over current protective devices to protect instruments and power supplies from damage due to power supply or external failure.
- D. Enclosures: NEMA 1.
- E. Mount such that dissipated heat does not adversely affect other components.
- F. Supply indicating-type fuses for each dc supply line to each individual two-wire transmitter and mount so fuses can be easily seen and replaced.
- G. Include fused push-to-test circuitry for each push-to-test indicating light.
- H. Provide internal cabinet light. Light shall be 100-watt fluorescent bulb and shall be operated by a door switch.
- I. Provide service outlet with a breaker protected 120-volt, 15-amp, GFCI duplex receptacle and weatherproof enclosure on the outside of the "mini power center" box or support.

**7.10 Control Equipment**

- A. The PSCP shall include an Allen Bradley Micrologix 1200 PLC, associated I/O, and a PanelView Plus 600c local operator interface.
- B. The County will provide a standard PLC & HMI application program for the pump station PLC and HMI. Contractor will setup the software for the pump station, including configuring device ranges, IP address, motor current range, wet well level, set points and other settings, for a complete and operational PSCP.
- C. Allen Bradley Micrologix 1200 PLC (1762-L40AWA)
  - 1. 24 Digital Inputs, 120 VAC
  - 2. 16 Digital Outputs, relay outputs
- D. Analog Input Module (Allen Bradley 1762-IF4)
  - 1. Inputs 4 differential 4-20 mA
- E. Analog Input and Output Module (Allen Bradley 1762-IF2OF2)

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1. Inputs 2 differential 4-20 mA
  2. Outputs 2 single ended 4-20 mA
- F. Allen Bradley PanelView Plus 600 Color with keypad and touch screen (2711P-B6C20A)
1. Screen: 5.5 inch
  2. Combination touch and keypad
  3. Ethernet Communication
  4. RS-232 Communication
  5. Power: 120 VAC
- G. NET-ENI Communication Module: (Allen Bradley 1761-NET-ENI)
- H. Programmable Logic Controller Functional Requirements: PLC Inputs and Outputs (I/O) are shown below. Provide inputs, outputs, functions, or operations required to provide a completely operational system. Note that this list does not show the PLCs diagnostic fault detection points which are nevertheless required.
- I. Digital Inputs
1. DI-1 - Pump 1 Auto Mode (1=Auto, 0=Manual)
  2. DI-2 - Pump 1 Run (1=On, 0=Off)
  3. DI-3 - Pump 1 Fault (1=Fault Alarm, 0=Normal)
  4. DI-4 – Odor Control Run (1=On, 0=Off)
  5. DI-5 - Pump 2 Auto Mode (1=Auto, 0=Manual)
  6. DI-6 - Pump 2 Run (1=On, 0=Off)
  7. DI-7 - Pump 2 Fault (1=Fault Alarm, 0=Normal)
  8. DI-8 – Odor Control Fail (1=Fault Alarm, 0=Normal)
  9. DI-9 - Level Switch High (LSH) (0=Alarm, 1= Normal)
  10. DI-10 - Level Switch Lag Start (LSM3) (0=Alarm, 1= Normal)
  11. DI-11 - Level Switch Lead Start (LSM2) (0=Alarm, 1= Normal)
  12. DI-12 - Level Switch Pump Stop (LSM1) (0=Alarm, 1= Normal)
  13. DI-13 - Level Switch Low (LSL) (0=Alarm, 1= Normal)
  14. DI-14 - Phase Loss (0=Alarm, 1= Normal)
  15. DI-15 - Generator Auto (1=Auto, 0=Not Auto)
  16. DI-16 - Automatic Transfer Switch (0=Generator, 1=Normal)
  17. DI-17 - Generator Fault (0=Alarm, 1=Normal)
  18. DI-18 – Level Switch High High (LSHH) (0=Alarm, 1=Normal)
  19. DI-19 – Combustible Gas Alarm (0= High Alarm, 1=Normal)
  20. DI-20 – Cabinet Intrusion
  21. DI-21 – Station Intrusion [if available]
  22. DI-22 – UPS On
  23. DI-23 – UPS Fail
  24. DI-24 – Generator Run Status (1=On, 0=Off)
- J. Digital Outputs
1. DO -1 – Pump 1 Run (1= On, 0=Off)
  2. DO -2 – Pump 2 Run (1= On, 0=Off)
  3. DO -3 – Chemical Feed Pump 1 (1= On, 0=Off) [if available]
  4. DO -4 – Chemical Feed Pump 2 (1= On, 0=Off) [if available]
  5. DO -5 – Odor Control (1= On, 0=Off) [if available]
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6. DO -6 – Pole Lights (1= On, 0=Off) [if available]
7. DO -7 – Spare
8. DO -8 – Spare
9. DO -9 – Spare
10. DO -10 – Spare
11. DO -11 – Spare
12. DO -12 – Spare
13. DO -13 – Spare
14. DO -14 – Spare
15. DO -15 – Spare
16. DO -16 – Spare

**K. Analog In**

1. AI – 1 Wet Well Level
2. AI – 2 Flow Discharge [if available]
3. AI – 3 Pump 1 Motor Current
4. AI – 4 Pump 2 Motor Current
5. AI – 5 Discharge Pressure [if available]
6. AI – 6 Generator Fuel Level [if available]
7. AI – 7 Combustible Gas Level
8. AI – 8 Spare

**L. Analog Out**

1. AO – 1 Spare
2. AO – 2 Spare
3. AO – 3 Spare
4. AO – 4 Spare

- M.** The developer’s contractor shall provide all PLCs and associated equipment and cables to form a complete and functional controller with SCADA cellular monitoring, control and data logging capability as required for this project
- N.** Furnish and install all cables for interconnecting all components of the PLC inside the Cabinet. These cables shall include cables to network bridge, power supplies, central processing unit.
- O.** Furnish all network cables needed to interface all applicable PLCs with network.

**7.11 Uninterruptible Power Supply (UPS)**

- A.** Provide UPS system, sized for 15 minutes backup time under 150% Cabinet load (including all loop-powered instruments). UPS shall be installed in the PSCP.
- B.** UPS shall be ferro-resonant type and shall include contact outputs for low battery, loss of utility power, and UPS operating.
- C.** UPS shall contain a network management card capable of communicating status parameters via Ethernet using Simple Network Management Protocol (SNMP).
- D.** Manufacturers: Allen Bradley 1609-U500NHC or equal.



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**7.12 Submersible Level Transducer**

- A. Provide a submersible level transducer for measurement of the wet well depth.
- B. The transducer shall be of the solid-state head-pressure sensing type, suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions. The transducer cable shall be of adequate length to reach the control panel without splicing. The bottom diaphragm face of the sensor shall be installed at elevation recommended by the manufacturer. The sensor shall be mounted using a stainless steel cable system in a location and as shown on the Contract Documents. The level sensing equipment shall be provided with a digital indicating meter to be mounted above grade, adjacent to the wet well.
- C. The liquid levels in the wet wells shall be measured by submersible level transducers designed for hydrostatic level measurement. The system shall convert the hydrostatic pressure of a column of liquid into a level proportional signal.
- D. The system shall be as follows:
  - 1. FM approved intrinsically safe, Class I, II, III; Division 1, Groups AG; Class I, Division 1.
  - 2. Cable Probe, P.E. coated, 316 stainless steel, with mounting clamp.
  - 3. Measurement Range: specified in the respective Tower table for the pump station
  - 4. Service: Domestic sewage.
  - 5. Output: 4 to 20 mA with display at transmitter.
  - 6. Measuring Cell Tube: 316 stainless steel
  - 7. Seals: Welded sensor (elastomer-free).
  - 8. Cable Clamp: 316 stainless steel with plastic clamping jaws
  - 9. Environmental Protection: NEMA 4X, aluminum housing.
  - 10. Manufacturer: Endress & Hauser Model Deltapilot M FMB53.

**7.13 Float Switches**

- A. Provide six (6) float level switches for measurement of the wet well depth.
- B. Float switches shall be installed and connected to the following points on the Remote Telemetry Unit.
  - 1. High High Level
  - 2. High Level
  - 3. Lag Start Level
  - 4. Lead Start Level
  - 5. Pump Stop Level
  - 6. Low Level
- C. The system shall be as follows:
  - 1. Float switch shall be coated in polypropylene
  - 2. Cable shall be coated with PVC
  - 3. Float switch shall have both normally closed and normally open contacts inside the float
  - 4. Manufacturer and Model: Flygt ENM-10

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**7.14 Ethernet Switch**

- A. Provide an 8 port ethernet switch for connection between automation equipment and telemetry connection
- B. Ports – 8 RJ-45 10/100 Mbps 10/100BaseTX (auto-sensing; Full or Half Duplex)
- C. Rugged Industrial Design
- D. DIN-RAIL mounted
- E. Environmental Specifications: -40° C to 70°C
- F. Redundant Power Inputs
- G. Unmanaged Operation
- H. Status LEDs – Power On, and link/activity
- I. Manufacturer and Model: N-TRON 308TX or equal

**7.15 Cellular Modem**

- A. Digi Connect WAN 3G – AT&T (DC-WAN-T302A)
- B. Ports – 1 Rs-232 DB-9; Up to 230 Kbps throughput; Hardware and Software flow control
- C. RJ-45 10/100 Mbps 10Base-T (auto-sensing; Full or Half Duplex)
- D. USB Type A connector
- E. Network Protocols – UDP/TCP, DHCP
- F. Status LEDs – Ethernet, Power On, Cellular link/activity, signal strength bars or digital display
- G. MS Internet Explorer configurable

**7.16 Antenna**

- A. Digi (DC-ANT-DBHG) or equal
- B. Dual Band High-Gain Cellular Antenna
- C. 14” tall antenna with magnetic mount

**7.17 Coax Cable**

- A. 14” cable, 50 Ohm SMA male connector
- B. 2dbi gain low band
- C. 4dbi gain high band

**7.18 Coax Extension Cable**

- A. 3” Coax extension cable with SMA male connectors on either end
- B. 3/8” LMR400 Coax cable (50 Ohm, shielded, weatherproof coax) or equal

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**7.19 Surge Suppressor**

- A. TerraWave Gas Protector (TW-LP-SMA-J-BHJ) or equal
- B. Gas discharge tube lightning surge suppressor
- C. Up to 0 - 6 Ghz operation
- D. SMA female connections on either end
- E. 50 Ohm impedance
- F. < 0.9 bD insertion loss
- G. Operating Temperature Range -40°F to 185°F

**7.20 Combustible Gas Detector**

- A. Pump station shall include a combustible gas detector capable of detecting the presence of LEL gases.
  - 1. Instrument Function: Ambient air pollution monitor
  - 2. Instrument Description: Combustible gas catalytic detector (single-point)
  - 3. Signal Output: A contact for gas level alarm indication and a 4 to 20 mAdc analog signal.
  - 4. General: The gas detector system shall consist of a sensor, a transmitter, a relay module, and a power supply. The sensor shall be remotely mounted in the area to be monitored. Up to fifty feet of cable shall be permitted between the sensor and the transmitter. The sensor, transmitter and relay module shall share the same power supply. The gas detection system shall have the capability to detect an over-range condition. This condition shall be indicated on the transmitter LCD display and the output shall be locked at the maximum valve. All components of the system shall be approved for mounting in Class I, Division 1, Group C and D hazardous locations. All components of the system shall also be designed to meet NEMA 4X requirements. All components of the system shall also be capable of operation in an ambient temperature range of -4 to +122 degrees F.
  - 5. Sensor: The sensor shall employ the principle of catalytic oxidation. As the combustible gas and air mixture comes in contact with the sensor, the combustible gas in the mixture is burned catalytically, raising the temperature of the sensor. As the temperature of the sensor rises, so does its electrical resistance producing a change in output. When specified, the sensor shall be provided with a duct mounting kit. The kit shall allow the sensor to operate at velocities up to 60 mph.
  - 6. Transmitter: The transmitter shall be microprocessor-based. Combustible gas concentration shall be continuously indicated, on a front-panel meter, in percent of lower explosive limit (LEL) of the specified gas. The display shall be visible from a minimum of 5 feet and shall be present at all times, and will not require being turned ON or OFF. This readout shall be 3½ digit Liquid Crystal Display (LCD). The transmitter shall display a warning when the sensor is nearing the end of its useful life. Calibration shall be by means of a non-intrusive calibration system. The calibration values, and zero and span, shall be set without opening the transmitter enclosure. The transmitter shall not be affected by ambient light either natural or man-made.
  - 7. Relay Module: Dual alarm set points, fully adjustable over the calibrated range of the monitor shall be provided. Indicating lamps shall provide positive indication of normal operation, concentration above lower set point (warning), and concentration above higher

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set point (danger). Contact outputs shall be provided for unit trouble and each set point. Contacts shall be normally open and shall open when an alarm condition exists. A normally energized trouble relay shall be provided. The trouble relay shall de-energize and the contact shall open when a system fault is detected. Unless otherwise specified, the system shall be calibrated for methane gas. The warning set point shall be 20 percent lower explosive limit and danger set point shall be 25 percent lower explosive limit.

8. Power Supply: The power supply shall accept nominal 120 V, 60 Hz power from the station power distribution. This power is not regulated, wave forms may be distorted, and significant amounts of electrical noise may be present. The power supply shall provide all necessary power for all of the components of the gas detection system.
9. Installation: The sensor shall be installed in the location accessible by the operator and in clear view of the wet well. The gas detection system shall be installed in accordance with the manufacturer's instructions and the specified functional requirements.
10. Test: The combustible gas detector shall be factory tested by the manufacturer prior to shipment. The manufacturer shall provide three certified copies of the test report. After installation, the unit shall be field tested.
11. Cable: The signal cable between the sensor and the transmitter shall be provided by the instrument manufacturer. A sufficient length of cable shall be provided for installation of a continuous run between the sensor and the electronics package.
12. Application: Unit shall be setup to indicate an alarm at 5% above normal gas levels.
13. Calibration: Instrument shall be calibrated onsite using manufacturer's recommended technique.
14. Approved Manufacturers: MSA Ultima, Sensidyne Sensalert, or equal.

**7.21 Indicating Lights**

- A. AC indicating lights shall be the push-to-test transformer type with LED lamps. They shall be heavy-duty, with NEMA rating to match enclosure type. The escutcheon and lens color shall be as specified. DC indicating lights shall be LED type. DC lamps may be tested as a group using a common lamp test button.
- B. Unless otherwise specified, indicating lights shall be equipped with colored lenses in accordance with the following schedule:

<b>Color</b>	<b>Function</b>	<b>Example</b>
Red	Run, open valve	Equipment operating, motor running
Green	Ready, closed valve	Equipment ready, end of cycle
White	Normal condition	Control power on, status OK
Amber	Abnormal condition	Failure of equipment or abnormal status, fault condition

**7.22 Generator Requirements**

- A. The standby generator shall be rated for continuous standby service for the stations full load demand. This shall include running all of the pumps with staggered startups.

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- B. The generator shall be housed in a weatherproof enclosure. Quiet site soundproofing shall be provided to reduce noise to 68 db at a distance of 7 meters for natural gas powered generators and 70 db at a distance of 7 meters for diesel powered generators.
- C. The entire standby generator set shall have a manufacturer's warranty for a minimum period of one year from the date of acceptance.
- D. Outdoor weather-protective housing with critical grade exhaust muffler shall be installed. The housing shall have hinged side access doors and a rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. Vibration isolators as recommended by the generator set manufacturer shall be provided. The generator must be mounted far enough away from obstructions to allow all doors to be opened 90°. All conduits and gas lines shall be installed underground.
- E. Generator shall be supplied with all auxiliary systems necessary for operation (i.e. - batteries, battery charger, block heater, etc.).
- F. The standby power system shall include an automatic transfer switch. Transfer switch shall be rated for 100% of full load of the main disconnect switch. Switch shall be provided with indicators for all phases of operation and be equipped with a fully programmable timer for exercising the equipment. The switch must be selectable for load or no load.
- G. Generator shall be load tested at 100% full load on site for a period of four hours using resistive load banks. Notify GCDWR E & C Inspector prior to test, and provide certification letter from the manufacturer.
- H. Two complete sets of O & M manuals and keys shall be provided for generator and automatic transfer switch.
- I. Generator control system must include a programmable control device to allow automatic start-up and test functions. Test functions can be programmed for daily, weekly or monthly testing. Connections for remote monitoring of function and failure must be provided.
- J. Pump stations are required to have continuous standby power. Generators rated 125 KW and below are to be installed to operate on natural gas. All gas piping and connecting equipment shall be installed in accordance with the Georgia State Amendments to the Standard Gas Code, latest edition. All gas supply lines must include a drip loop as well as all other equipment required for a safe and complete hook-up. If gas is unavailable, a letter of exception must be obtained from GCDWR. Contractor shall coordinate with the natural gas utility company for appropriate gas meter size based on peak gas generator consumption.
- K. Generators above 125 KW shall be diesel powered with 100 gallons minimum fuel storage capacity or 24-hour operating time, whichever is greater. Fuel storage shall be accomplished by the use of corrosion-resistant double wall sub-base fuel tank only, no underground storage will be allowed. A leak detection device shall be provided in the interstitial space for sensing fuel leakage. The device contact shall be connected to the generator control panel terminals for telemetry.
- L. Generators can be obtained from the following manufacturers/representatives:
  - 1. Cummins-Onan
  - 2. Kohler

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 7**

**Electrical and Instrumentation Requirements**

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- 3. Caterpillar
- 4. Generac
- M. Transfer switches shall be in NEMA-4 enclosures obtained from the manufacturer of the generator.
- N. Transfer switches shall be configured to switch back when power is restored to the station. The switches shall be provided with three phase voltage and frequency sensors with adjustable settings. Exercise clock shall be provided as a configurable function. The control shall provide time delay functions for “Engine Start”, “Normal to Emergency Transfer”, “Retransfer Emergency to normal”, “Genset Stop”, and “Programmed Transition”. Transfer switch position shall be monitored by the PLC.
- O. A generator ground grid must be provided as per Detail PS-21.
- P. Diesel engine generator set must be bermed and drained as shown on Detail PS-22. Berm must be designed to contain 110% of fuel tank volume. Berm volume calculations must be shown on pump station submittal drawings.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 8**

**National Fire Protection Association (NFPA) Requirements**

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**SECTION 8 - NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)  
REQUIREMENTS**

**8.1 Applicable Requirements**

- A. The design and construction of the pump station shall comply with all requirements of NFPA 820 – Fire Protection in Wastewater Treatment and Collection Facilities.
- B. At a minimum, the design engineer shall identify all areas with hazardous classifications on the submittal plans and any equipment within those areas requiring special features for being located in a hazardous area.

**8.2 Interpretation of Code**

- A. When there is a question as to whether a portion of the code is applicable, the GCDWR AMIS Division Director or designee shall have the final judgment as to the meaning of the code. The Developer/Owner and Engineer shall comply with the interpretation of the code as instructed by GCDWR.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 9**

**Site Layout Requirements**

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**SECTION 9 - SITE LAYOUT REQUIREMENTS**

**9.1 Minimum Site Dimensions**

- A. Pads for duplex, submersible pump stations with 50 hp pumps or smaller and all wet well mounted pump stations shall be 31'x41' minimum in size.
- B. Pads for duplex, submersible pump stations with pumps greater than 50 hp shall be 51'x51' minimum in size.
- C. Triplex pump station pad sizes must be submitted for approval by GCDWR AMIS Division Director or designee.
- D. The minimum site dimensions shall be in accordance with the requirements of Standard Details PS-12, PS-12A, and PS-17.
- E. Pump Station pad size for pump stations requiring special equipment or cranes to remove the pumps shall be submitted for approval by GCDWR AMIS Division Director or designee.
- F. A buffer shall be placed around each pump station site. The buffer will extend 60 feet outside the fenced-in station. This buffer is required in residential subdivisions and shall be indicated on the final plat. In addition, a permanent easement, dedicated to Gwinnett County, shall be provided to include the required fenced-in area, with an additional 5 feet extending beyond the fence and turnaround area.

**9.2 Site Access**

- A. A minimum access easement of 30' wide is required for access to the pump station. This easement can be combined with the 20' wide sewer easement or other utility easement.
- B. Station access road is to be paved with 15 foot minimum width. Access road slope shall not exceed 8%.
- C. A turnaround shall be required. **For access roads less than 50' a turnaround will be determined on a case-by-case basis.**
- D. Access roads for smaller submersible pump stations and wet well mounted pump stations shall require a minimum turnaround 20' off the fence and 30' deep with a 15' radius to the driveway. (See Details PS-12 and PS-17.)
- E. Access roads for large submersible pump stations shall require a minimum turnaround 40' off the fence and 40' deep with a 15' radius to the driveway. (See Detail PS-12A)
- F. Concrete or asphalt is acceptable for driveway and turnaround.

**9.3 Site Utilities**

- A. Site plan to show all existing and proposed utilities. All utility meters must be properly mounted outside of fenced station. If gas is required, gas pipe must be buried underground.
- B. Water meters and backflow devices shall be set at the right-of-way.
- C. A copper potable water service with an acceptable double check valve backflow RPZ prevention device must be provided.



**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 9**

**Site Layout Requirements**

- D. A frost-proof yard hydrant must be installed with 50' of 3/4" nylon reinforced garden hose with brass nozzle provided.
- E. Install a 120 V high-pressure sodium security light on a 20' breakdown pole with automatic eye and pole lowering winch. Pole must be painted architectural brown (see Detail PS-4).

**9.4 Site Grading and Drainage**

- A. Site plan to show finished grade contour lines (2' intervals) in and around pump station and access road. Spot elevations shall be provided on station pad to show proper drainage (no storm runoff/drainage will be allowed to enter the pad site and wet well). Storm runoff/drainage will need to be diverted away from the pump station during construction. Provide a 14' gate on 4" diameter posts (see Details PS-12, PS-12A and PS-17). On all design plans and as-builts, show a separate pump station site plan detail with access road and turnaround and a separate proposed structural vault detail.
- B. Earth slopes around the pump station created by "fill" that are steeper than 3 to 1 must be stabilized with "rip-rap".
- C. Backfill shall be placed and compacted in 8-inch lifts (maximum) in horizontal layers 8 inches (maximum) in depth. All fill shall be compacted minimum to 95% of maximum dry density at not less than 2% below nor more than 2% above the optimum moisture content as determined by ASTM D698. A minimum of two compaction tests taken at every five feet of backfill around the wet well is required. **A certified letter of compaction and/or subgrade suitability** shall be provided to GCDWR E&C Inspector prior to pouring the station pad.

**9.5 Pump Station Pad and Fencing**

- A. A minimum 4-inch thick, reinforced concrete pad shall have 0.5% fall away from station in all directions. Concrete must extend 6" past fence post all the way around fence. Appropriately sized reinforcing steel shall be used in the slab. Asphalt is not acceptable for the pad (see Detail PS-23).
- B. The contractor shall notify the GCDWR E&C Inspector 48 hours prior to pouring the station's concrete pad. The GCDWR E&C Inspector must be on site during the concrete pour. (See Details PS-12, PS-12A and PS-17.)
- C. Fenced areas for duplex, submersible pump stations with 50 hp pumps or smaller and all wet well mounted pump stations shall be 30'x40' minimum in size.
- D. Fenced areas for duplex, submersible pump stations with pumps greater than 50 hp shall be 50'x50' minimum in size.
- E. Triplex pump station fenced areas must be submitted for approval by GCDWR AMIS Division Director or designee. (See Details PS-12, PS-12A and PS-17.)
- F. Fences are to be installed using 8-foot high #4 chain link wire with top rails and bottom tension wires, 3 strands of barbed wire at the top on angled extension arms, posts in 3' of concrete spaced 10' apart and PVC fence slats (color: architectural brown). (See Details PS-5, PS-12, PS-12A and PS-17.)

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 10 Construction Observation, Start-up, Testing, and Record Documents**

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**SECTION 10 - CONSTRUCTION OBSERVATION, START-UP, TESTING, AND  
RECORD DOCUMENTS**

**10.1 General**

- A. Contractor is responsible for installation and maintenance of all erosion control measures until expiration of one-year warranty period. Contractor shall remove silt fence and other non-permanent erosion control measures at that time or before if directed by County.
- B. GCDP&D WSR may "sign-off" on the final subdivision plat without the pump station being complete under the following conditions:
  - 1. The Developer/Owner has made reasonable and diligent effort to design, order, and complete the station.
  - 2. A hold shall be placed upon certificates of occupancy and/or building permits.
  - 3. The Developer/Owner must present a "cash" bond equal to the value of the incomplete work or a letter of credit equal to twice the value of the incomplete work as determined by GCDWR AMIS Division Director or designee.
  - 4. All associated fees have been collected.
- C. A partial acceptance of the pump station may allow some use of the station prior to final acceptance. All conditions must have prior approval of the GCDWR AMIS Division Director and the Field Operations Division Director. Under no circumstances will the station be allowed to accept flow prior to the installation of the phone line.

**10.2 Construction Observation**

- A. The GCDWR E&C Inspector will coordinate with the Developer/Owner's contractor to review the construction and installation of the pump station and force main. Reviews and approvals of items of work by the GCDWR E&C Inspector are for general conformance with the requirements of these standards and the approved plans. In no way does the review and approval of an item of work relieve the contractor of his responsibility to comply with all building codes, safety standards, and environmental regulations.
- B. Items of work to be reviewed by GCDWR during the construction of the pump station and force main include:
  - 1. Wet well and generator subgrade compaction testing.
  - 2. Backfill compaction testing.
  - 3. Pipe restraints.
  - 4. Duct bank installation.
  - 5. Driveway and pad subgrade.
  - 6. Concrete reinforcement placement.
  - 7. Concrete strength testing.
- C. Contractor must notify GCDWR E&C Inspectors a minimum of 24 hours in advance of the activities to be inspected.
- D. GCDWR E&C Inspectors are responsible for approval of items reviewed. Results of compaction testing, if required, must meet minimum specifications.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 10 Construction Observation, Start-up, Testing, and Record Documents**

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**10.3 Start-up**

- A. The required force main tests must be complete and accepted by GCDWR E&C Inspectors prior to scheduling a start-up (See Testing below).
- B. To schedule a start-up, call the GCDWR E&C Inspector a minimum of 24-hours in advance. See Detail PS-2 for start-up check sheet and specifications for detail requirements. Pre-start-up check sheet must be signed, completed and received by GCDWR E&C Inspector 24 hours before start-up. The check sheet can be faxed to the GCDWR E&C Inspector.
- C. All utilities must be working (i.e., water, electric, telephone and gas, if applicable). No station will be accepted without a phone line. All utility information shall be brought to the start-up. Required information includes account numbers, phone numbers and any letters or tests performed which require written documentation (i.e., letter of compaction, 4-hour load bank test on generator, etc.).
- D. The following personnel shall be on site during start-up:
  - 1. General contractor or developer
  - 2. Electrical contractor
  - 3. Pump manufacturer
  - 4. Generator manufacturer
  - 5. GCDWR E&C Inspector
  - 6. GCDWR pump station personnel
  - 7. Design engineer
  - 8. Electrical engineer.
- E. A demonstration that the submersible pumps can be removed and installed in the wet well without special equipment or manipulation must be performed at the time of start-up.
- F. A demonstration that the generator is capable of providing the required power with all installed pumps operating simultaneously must be performed at the time of start-up.
- G. A letter from the pump manufacturer stating the pumps are ready to be started and operated is required prior to operating the pumps.
- H. All spare parts and O&M manuals shall be brought to the start-up, as well as O&M manuals for pumps and generator. Keys for the generator shall be left in the transfer switch.
- I. A drawdown test performed by the design engineer shall be required at start-up. Water for testing will be provided at Contractor's expense. This may require refilling the wet well several times.

**10.4 Testing**

**10.4.1 Force Main**

- A. Prior to acceptance of the force main, the Developer/Owner shall test the force main in accordance with the requirements of these Standards.
- B. Force mains shall be subjected to a minimum test pressure equal to 150 percent of the total dynamic head or 100 psi (whichever is greater) for a minimum of two hours. The test shall be performed using potable water. (Use of a fire Hydrant requires a fire hydrant meter to be rented from Gwinnett County Department of Water Resources). The entire force main pressure test

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 10 Construction Observation, Start-up, Testing, and Record Documents**

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must be witnessed and approved by the GCDWR E & C Inspector. The test will be performed from the check valve vault to the discharge manhole. No leakage will be allowed

- C. To schedule a test the contractor shall notify the GCDWR E & C Inspector at a minimum of 24 hours in advance. The inspector shall determine the test pressure and gauge location. The contractor shall remove, valve off, or otherwise protect any equipment that might be damaged by the pressures used in the test. All piping shall be securely anchored prior to the test. Pipe laid in trenches shall be backfilled. Joints, fittings, and valves may be left exposed to be examined during the test.
- D. Before applying the test pressure, all air shall be expelled from the pipe through installed air release valves. The approval of the force main installation and pressure test by the GCDWR E & C Inspector shall become a part of the overall pump station/force main system approval.
- E. The contractor shall bear the complete cost of the test including temporary plugging and blocking, water usage and the repair of all leaks.
- F. If a section of the force main fails the pressure test the contractor will be required to pay a re-inspection fee as determined by GCDWR E & C Inspectors prior to each additional retest required.

**10.4.2 Pump Station**

- A. Prior to acceptance of the pump station, the Developer/Owner shall conduct performance tests on all pumps and equipment provided in accordance with the requirements of these Standards.
- B. No testing of the pumps will be permitted until the force main has been tested and accepted by the GCDWR E&C Inspector.
- C. The following personnel shall be present on site during pertinent testing:
  - 1. General contractor or developer
  - 2. Electrical contractor
  - 3. Pump manufacturer
  - 4. Generator manufacturer
  - 5. GCDWR E&C Inspector
  - 6. GCDWR pump station personnel
  - 7. Design engineer
  - 8. Electrical engineer.
  - 9. Telemetry integrator
- D. Tests to Conduct include:
  - 1. Pump drawdown test.
  - 2. Automatic switchover to backup power.
  - 3. Generator load bank test.
  - 4. Remote Telemetry Unit Operation
  - 5. Remote Telemetry Unit Communication Test
- E. Pump station will be accepted when proven to meet the design flow and head requirements and all components operate properly for a minimum of 4 weeks, as determined by GCDWR pump station personnel.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 10 Construction Observation, Start-up, Testing, and Record Documents**

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**10.4.3 Remote Telemetry Unit**

- A. All elements of the RTU hardware shall be tested to demonstrate that the total system satisfies all of the requirements of this specification. The System Integrator (SI) shall coordinate all tests with GCDWR. The SI shall notify the GCDWR AMIS Division Director or designee two weeks in advance of any tests.
- B. As a minimum, the testing shall include the following:
  - 1. Functional onsite acceptance test
- C. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and upon the systems or subsections producing the correct result (effect), the specific test requirement will have been satisfied. Each of the inputs or conditions shall be tested:
  - 1. Digital Inputs
  - 2. Digital Outputs
  - 3. Analog Inputs (minimum scale, midscale and maximum scale)
  - 4. Power Faults
  - 5. Communication Faults
- D. All tests shall be conducted in accordance with, and documented on, prior engineer-approved procedures, forms and checklists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.
- E. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.
- F. Provide all special testing materials and equipment.
- G. Functional Onsite Acceptance Test :
  - 1. Tests shall be witnessed by GCDWR and System Integrator.
  - 2. Tests shall demonstrate specified functions, both hardware and software, to the satisfaction of the GCDWR.

**10.5 Record Documents**

- A. The contractor shall maintain on the project site an updated set of record drawings. These drawings must be the latest revision and match that of the project inspector.
- B. The Developer/Owner's engineer shall submit as-built drawings upon completion of construction and acceptance of the station by the GCDWR. Surveying shall be performed by the engineer to assure elevations and placement of appurtenances on as-builts are correct.
- C. Three(3) sets of Pump station and force main as-built plans must be submitted to GCDP&D WSR prior to scheduling a start-up. As-built plans must be approved by both the GCDP&D WSR and GCDWR E&C prior to conducting a start-up. An exception to this procedure can only be made if approval is given by the AMIS Division Director or designee. Allow two weeks for review.
- D. Pump station and force main as-built plans must include an original signed and dated stamp of a Professional Engineer (registered in the State of Georgia). Updated design calculations must also be submitted with as-builts.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Section 10 Construction Observation, Start-up, Testing, and Record Documents**

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- E. Pump station and force main as-built drawings must reflect the structures as they are actually installed. The as-builts should be completed from the approved construction drawings with redlines of construction changes, as well as notations of all variances from the approved plans.
- F. As-built drawings should include GPS coordinates for valves, fittings, and other above grade appurtenances and elevation of top of force main at least every 100 feet or as directed by GCDWR E&C Inspector.
- G. A single line electrical drawing showing power distribution for the station must be included in the as-built drawings.
- H. If any changes were made to the force main route, wet well depth or pumps after the submitted plans were approved, new design calculations must be submitted with the as-built plans.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**

**PUMP STATION STANDARD DRAWINGS  
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**Appendix**

**Standard Details**

**DESIGN CALCULATIONS**

NOTES:

A PRECONSTRUCTION CONFERENCE MUST BE HELD WITH THE GWINNETT COUNTY DEPARTMENT OF PUBLIC UTILITIES AND THE CONTRACTOR OF RECORD BEFORE ANY WORK MAY BEGIN.

DESIGN CRITERIA:

SEE TABLE A.1 – GWINNETT COUNTY GRAVITY SEWER DESIGN FLOW CALCULATION GUIDELINES

PEAK FACTOR = 2.5  
 DESIGN FLOWS \_\_\_\_\_ AVERAGE \_\_\_\_\_ PEAK  
 STATIC HEAD \_\_\_\_\_ FT  
 PUMP DESIGN TDH \_\_\_\_\_ GPM @ \_\_\_\_\_ FT

FORCE MAIN DIAMETER \_\_\_\_\_  
 FORCE MAIN VELOCITY (2.5 F.P.S. MIN.) \_\_\_\_\_  
 HIGH ALARM ELEVATION \_\_\_\_\_  
 LOWEST OVERFLOW ELEVATION \_\_\_\_\_  
 STORAGE VOLUME \_\_\_\_\_  
 STORAGE TIME AT DESIGN FLOW \_\_\_\_\_

PUMPS:

MANUFACTURER \_\_\_\_\_  
 MODEL \_\_\_\_\_  
 \_\_\_\_\_ DIA. IMPELLER  
 \_\_\_\_\_ DIA. SUCTION  
 \_\_\_\_\_ DIA. DISCHARGE  
 \_\_\_\_\_ H.P.  
 \_\_\_\_\_ V, \_\_\_\_\_  $\phi$ , \_\_\_\_\_ WIRE, \_\_\_\_\_ CYCLE  
 WETWELL VOLUME: \_\_\_\_\_ GAL.  
 PUMP CYCLE TIME: \_\_\_\_\_ AT MINIMUM ADF  
 \_\_\_\_\_ AT MINIMUM PEAK FLOW

GENERATOR:

MANUFACTURER \_\_\_\_\_  
 MODEL \_\_\_\_\_  
 RATING \_\_\_\_\_ KW \_\_\_\_\_ V \_\_\_\_\_ FUEL

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**


JOB TITLE  PUMP STATION STANDARD DRAWING	SHEET TITLE  PUMP STATION DATA  DETAIL NO. PS-1	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
		FILE NO:	SCALE: N.T.S.		



# Gwinnett County Department of Water Resources Developer Pump Station Standards

Appendix

Standard Details



**WINNETT COUNTY**  
Department of Water Resources  
(678) 376-6700

**WINNETT COUNTY PUMP STATION  
START-UP CHECK LIST**

Pump Station Name \_\_\_\_\_ Requested Start-up Date \_\_\_\_\_

General Contractor/Developer \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

\_\_\_\_\_ A Forcemain Test must be completed and accepted.

\_\_\_\_\_ A pump draw down test must be completed and accepted.

\_\_\_\_\_ A certified letter of compaction from a licensed Geotechnical Engineer must be completed and accepted.

\_\_\_\_\_ The General Contractor/Developer, Electrical Contractor, Pump Manufacturer, Generator Manufacturer, GCDWR E&C Inspector, GCDWR Pump Station Personnel, Design Engineer and Electrical Engineer must be scheduled to be on site at Start-up.

\_\_\_\_\_ All utilities (i.e. - electric, water, telephone and gas, if applicable) must be installed and working at Start-up.

\_\_\_\_\_ Submersible pumps will need to be pulled out of the wetwell at Start-up. (The General Contractor is responsible for this.)

\_\_\_\_\_ Pumps must be able to run off the main power source, as well as off the generator.

\_\_\_\_\_ All spare part, O & M Manuals and applicable paperwork should be brought to Start-up. (i.e. - 4-Hour load bank test, letter of compaction, utility names and account numbers, etc.)

THESE ITEMS MUST BE COMPLETE PRIOR TO SCHEDULING A START-UP.

When this check off list is complete, it will need to be faxed to The Pump Station Department for Gwinnett County Department of Water Resources. (Fax: 678-376-6729) Jean Evans (Phone: 678-376-7073).

The desired Start-up date should be listed along with a contact name and phone number. If all the items are complete, you will be contacted with a Start-up date and time. Note: If any items that are checked are not complete upon arrival, the Pump Station Start-up will need to be rescheduled and a fee could be assessed for additional trips.

Signature: \_\_\_\_\_ Date \_\_\_\_\_

684 WINDER HIGHWAY • LAWRENCEVILLE, GEORGIA 30045-5012

<b>WINNETT COUNTY DEPARTMENT OF WATER RESOURCES</b>				
JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY DATE
PUMP STATION STANDARD DRAWING	PUMP STATION START-UP CHECK LIST	CKD BY:		
		APPD. BY:		
		DATE: 12-01-11		
	DETAIL NO. PS-2	FILE NO:	SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

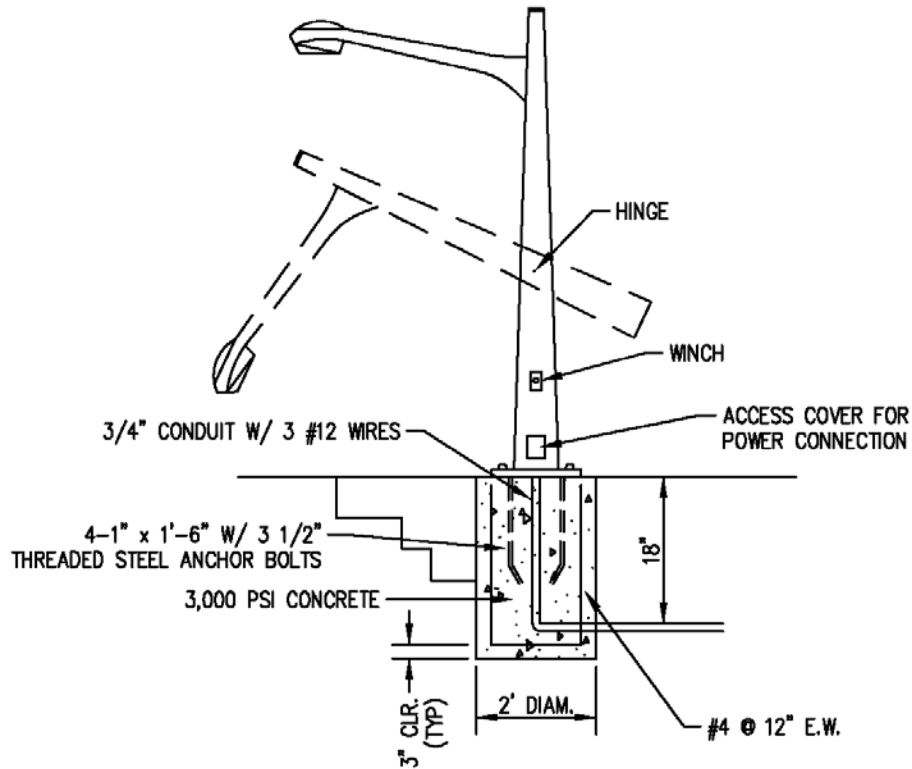
**Appendix**

**Standard Details**

**NOTE**

EXTERIOR HINGED LIGHT POLE WITH 150 WATT HIGH PRESSURE SODIUM LUMINAIRE, 120 VOLT BALLAST, PHOTOELECTRIC CONTROL, WITH HEAT AND IMPACT RESISTANT ACRYLIC LENS. POLE IS TO BE ARCHITECTURAL BROWN AND IS TO BE SUPPLIED WITH LOWERING WINCH.

- LUMINAIRE      ———→      GE PART # M2RR-15S1A2A-MN4
- BRACKET        ———→      GE PART # RBSU2H6DB
- POLE            ———→      GE PART # ASHS202T-6.4-11DB



NOTE: BREAK DOWN POLE TO BE LOCATED INSIDE FENCE

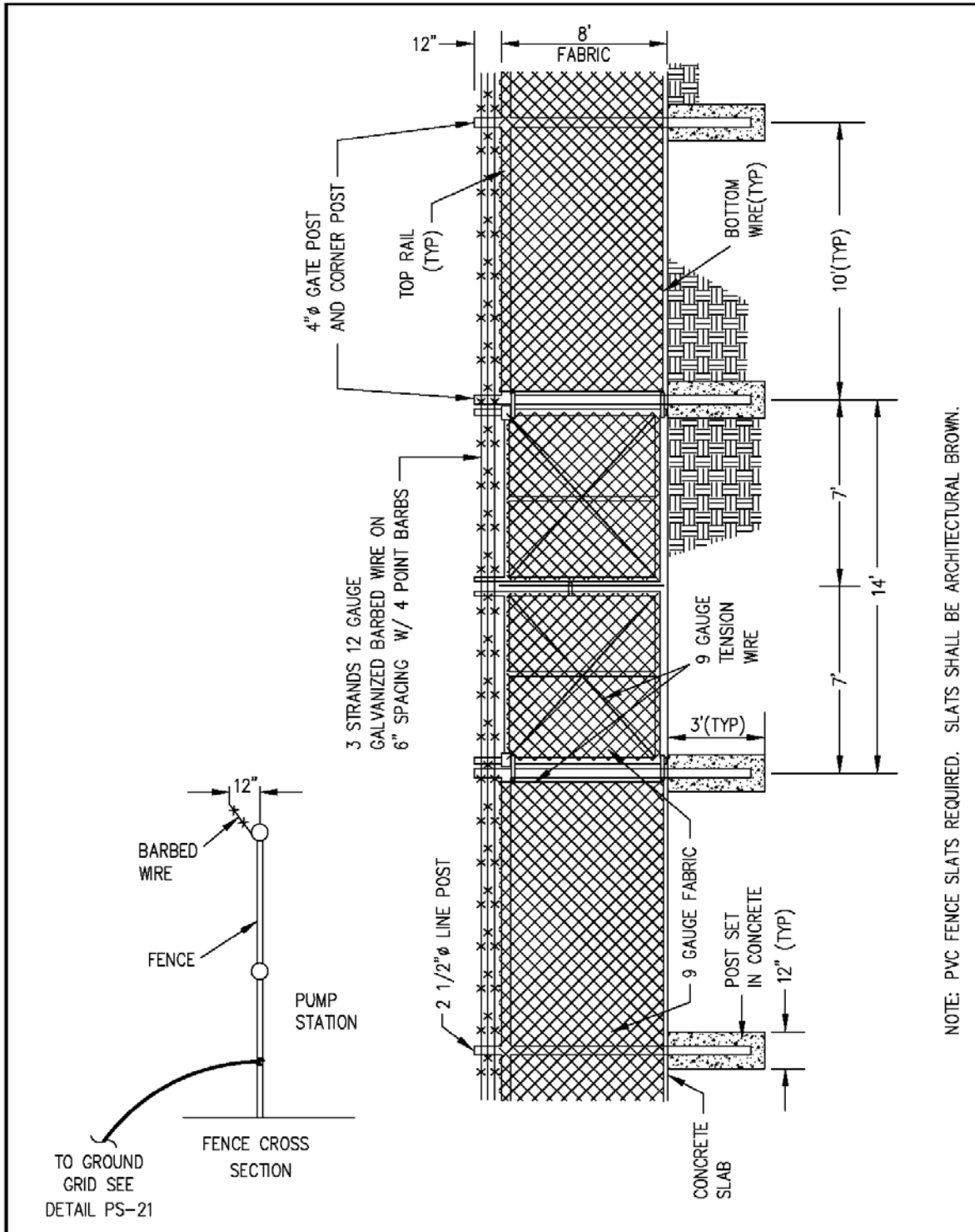
HIGH PRESSURE SODIUM SECURITY LIGHT ON 20' BREAK DOWN POLE

<b>GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES</b>					
JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	YARD LIGHT	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		DETAIL NO. PS-4	FILE NO:	SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

Appendix

Standard Details



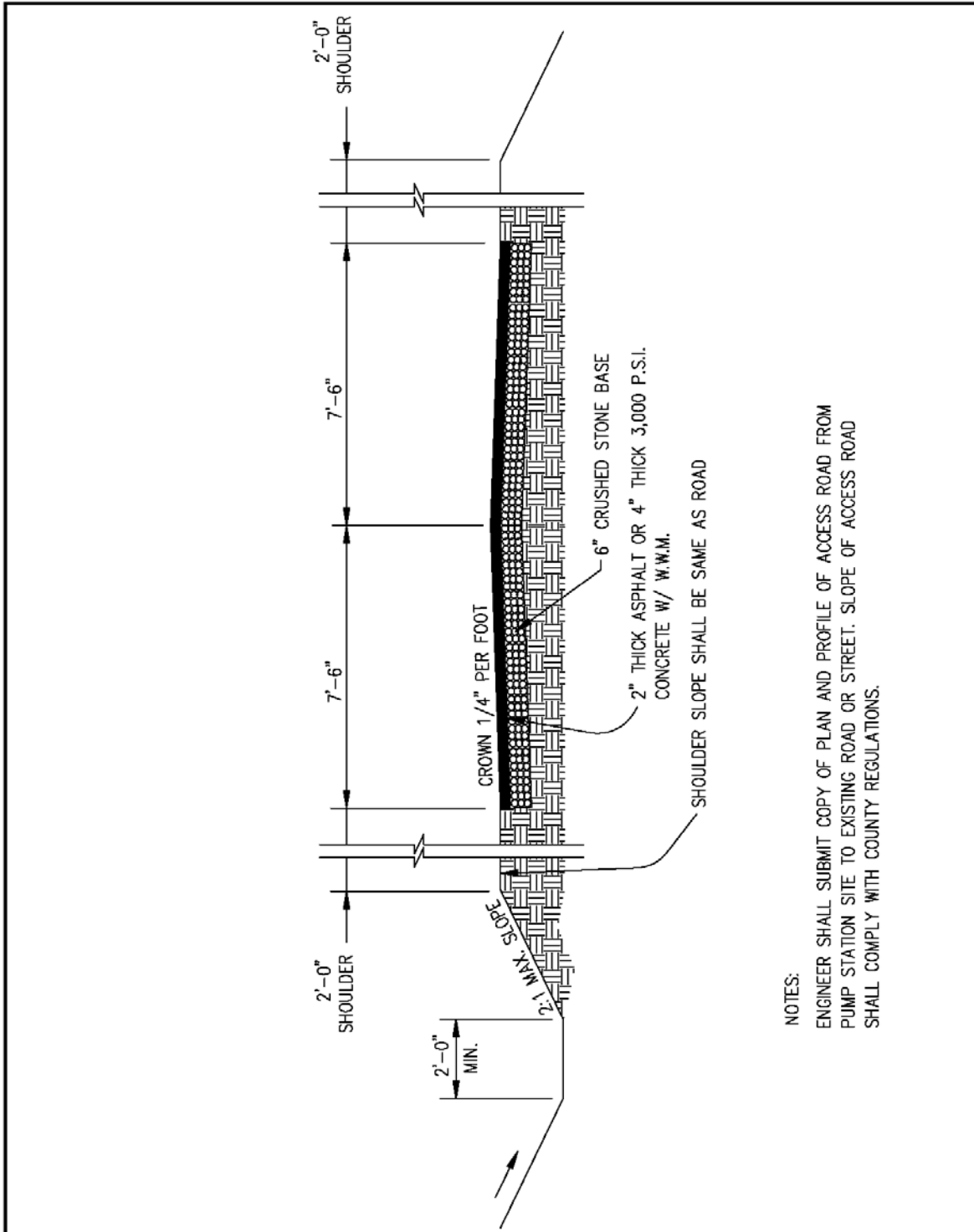
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	FENCE/GATES	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:		SCALE: N.T.S.	
	DETAIL NO. PS-5				

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

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Standard Details



NOTES:  
ENGINEER SHALL SUBMIT COPY OF PLAN AND PROFILE OF ACCESS ROAD FROM PUMP STATION SITE TO EXISTING ROAD OR STREET. SLOPE OF ACCESS ROAD SHALL COMPLY WITH COUNTY REGULATIONS.

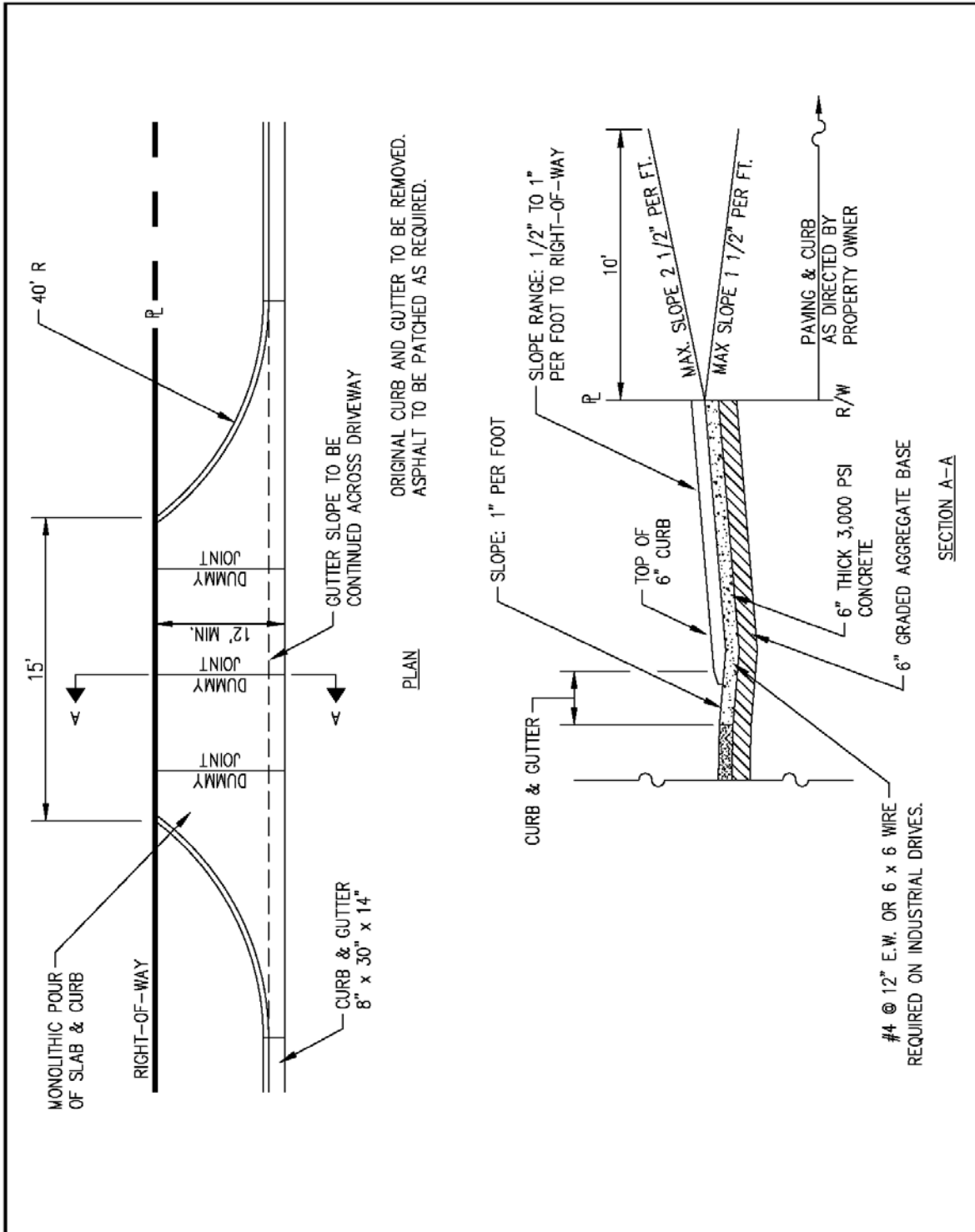
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	ACCESS ROAD SECTION	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		
	DETAIL NO. PS-6				

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

Appendix

Standard Details



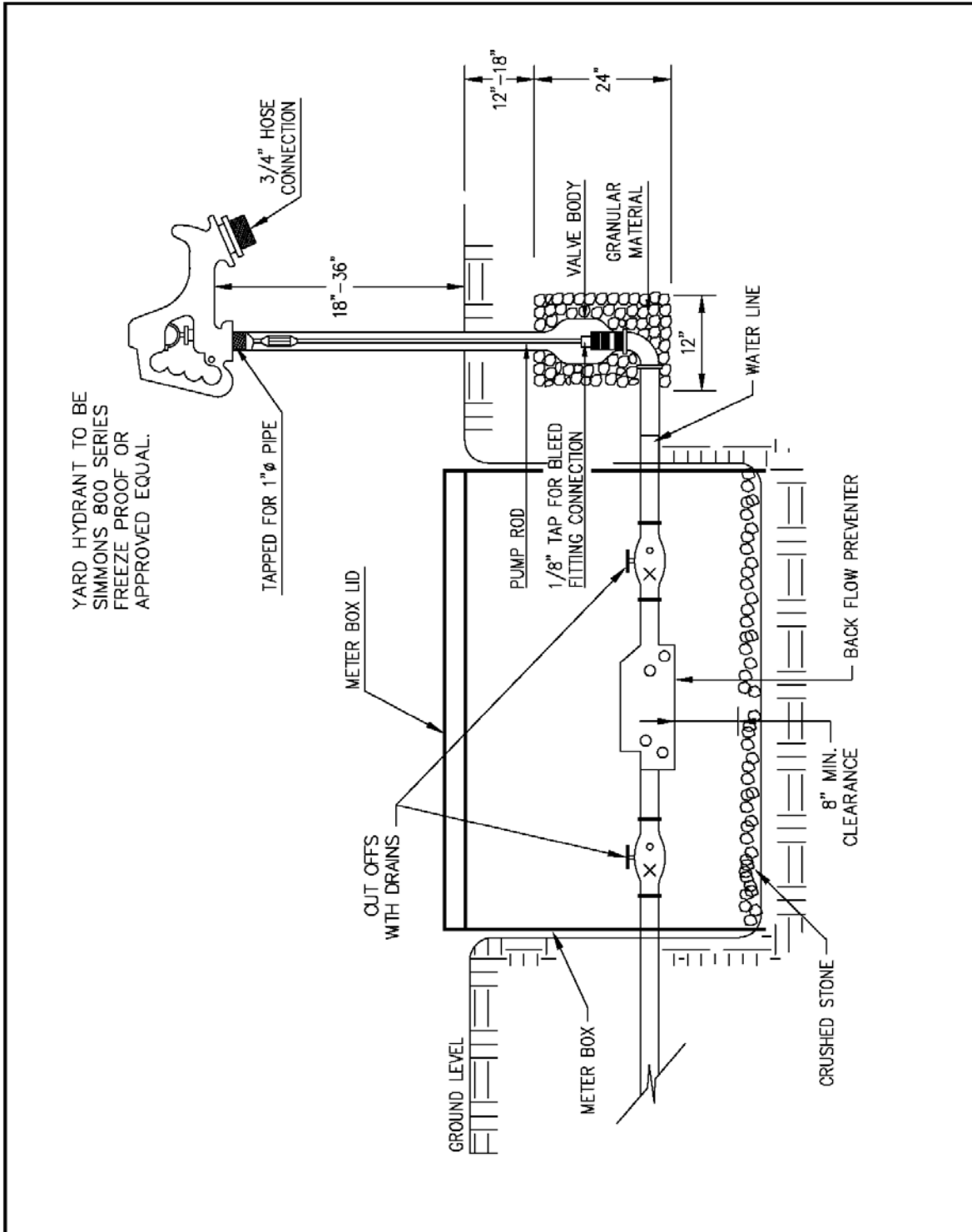
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE PUMP STATION STANDARD DRAWING	SHEET TITLE ACCESS ROAD ENTRANCE DETAIL NO. PS-7	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

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Standard Details



**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	HOSE BIBB & BACK FLOW PREVENTER	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
	DETAIL NO. PS-8	FILE NO:	SCALE: N.T.S.		

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**

MINIMUM CONTAMINANT PROTECTION

NEW CONSTRUCTION AND RETROFIT INSTALLATIONS  
SERVICE METER SIZES: THRU 1-INCH (RESIDENTIAL ONLY)  
DUAL CHECK (DUC) BACKFLOW PREVENTER (BEP)

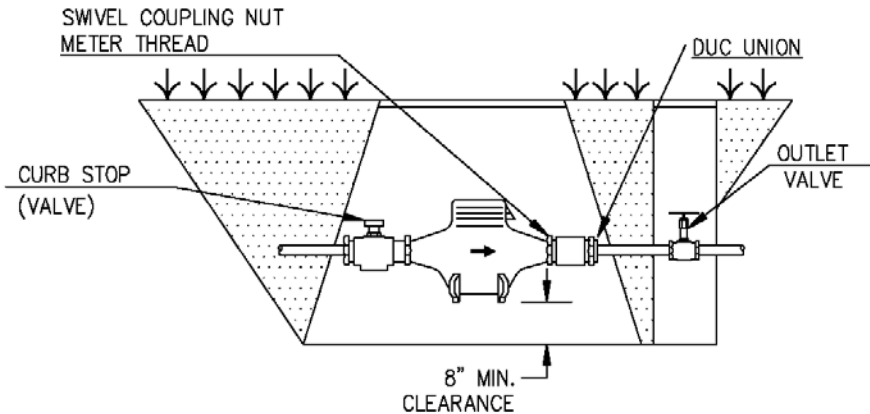
SPECIFICATIONS: THE CUSTOMER/OWNER SHALL PROVIDE A DUAL CHECK (DUC) BACKFLOW PREVENTER (BFP) IN A SIZE TO MATCH THE REQUIRED SERVICE METER. THE DUC FOR A 3/4-INCH METER SHALL HAVE A MINIMUM CAPACITY OF 25 GPM AND IT SHALL BE BRONZE-BODIED AND INCLUDE A FEMALE SWIVEL UNION WITH (NHF) METER THREAD THAT ATTACHES DIRECTLY TO THE OUTLET SIDE OF THE METER, AND A FEMALE UNION ADAPTOR 3/4 OF 1 INCH ON THE DISCHARGE SIDE WITH THE UNION NUT DRILLED TO ACCEPT A TAMPER PROOF LOCKING WIRE. THE DEVICE SHALL BE EMBOSSED, OR HAVE A BRASS IDENTIFICATION TAG ATTACHED TO THE VALVE BODY BY CORROSION RESISTANT MECHANICAL FASTENERS, TO DISPLAY THE FOLLOWING:

1. NAME OR MANUFACTURE OR TRADEMARK.
2. TYPE, SIZE AND MODEL NUMBER OF THE DEVICE.
3. MAXIMUM RATED WORKING PRESSURE AND TEMPERATURE.
4. DIRECTION OF FLOW THROUGH THE DEVICE.
5. DATE OF MANUFACTURE OR SERIAL NUMBER.

THE DUC-BFP SHALL HAVE BEEN TESTED BY A NATIONALLY RECOGNIZED LABORATORY IN ACCORDANCE WITH ASSE STANDARD 1024, AND BEAR THE ASSE SEAL.

INSTALLATION INSTRUCTIONS: THE DUC-DFP SHALL NOT BE BURIED IN EARTH BUT MAY BE INSTALLED BELOW GROUND AS IN THE WATER SYSTEM'S METER BOX ATTACHED TO THE METER OUTLET OR IN AN ADJACENT SIMILAR ENCLOSURE. A POSITIVE SHUT OFF VALVE SHALL BE NEAR BOTH THE INLET AND OUTLET SIDES. WHEN THE DEVICE IS ATTACHED DIRECTLY TO THE METER, THE WATER SYSTEM'S CURB STOP (VALVE) MAY BE USED FOR THE INLET SIDE VALVE. (SEE BELOW.)

TYPICAL METER BOX INSTALLATION



NOTE: ASSEMBLY MUST BE CENTERED IN METER BOX

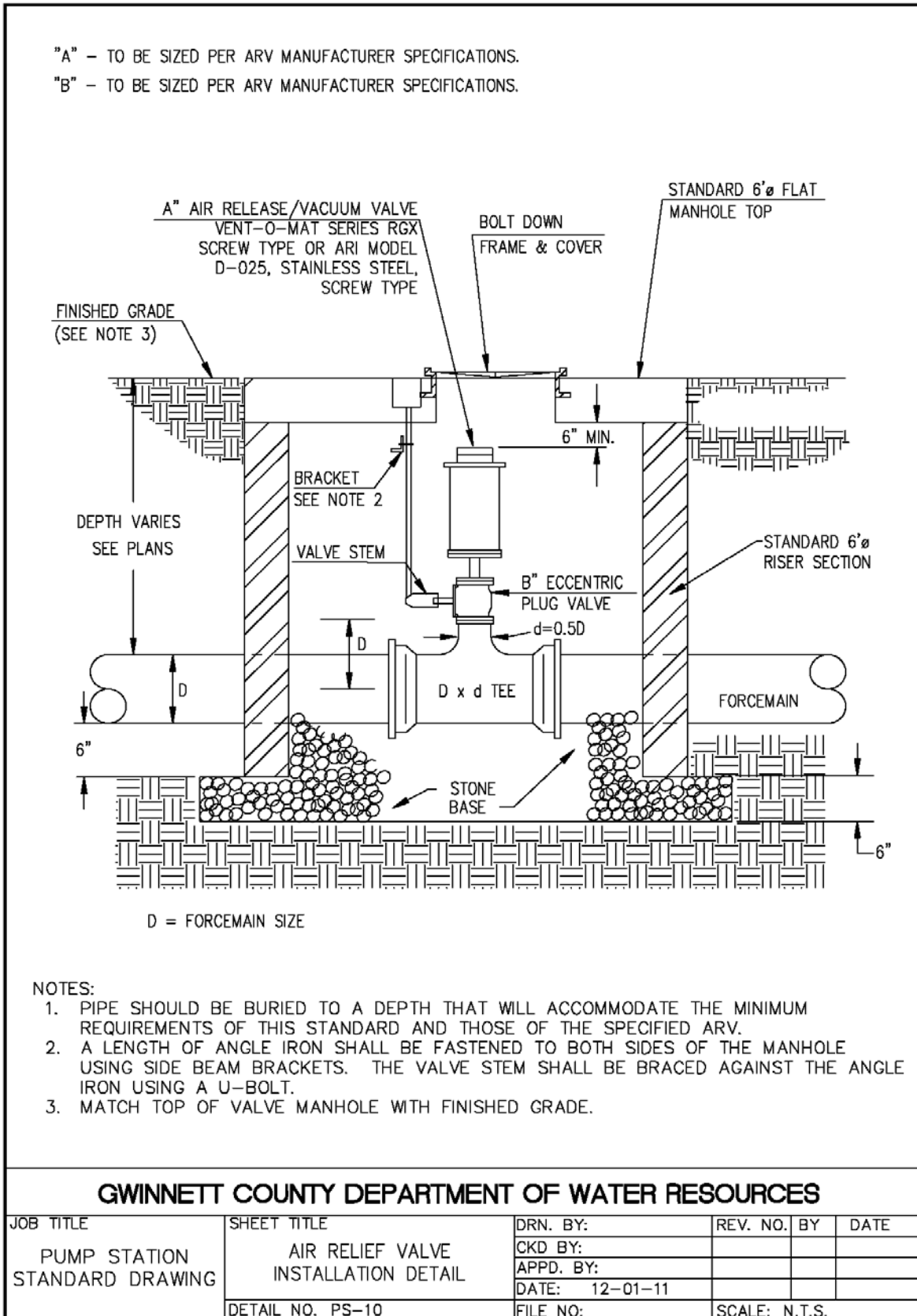
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	TYPICAL METER BOX INSTALLATION	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:		SCALE: N.T.S.	
	DETAIL NO. PS-9				

**Gwinnett County Department of Water Resources  
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**Standard Details**

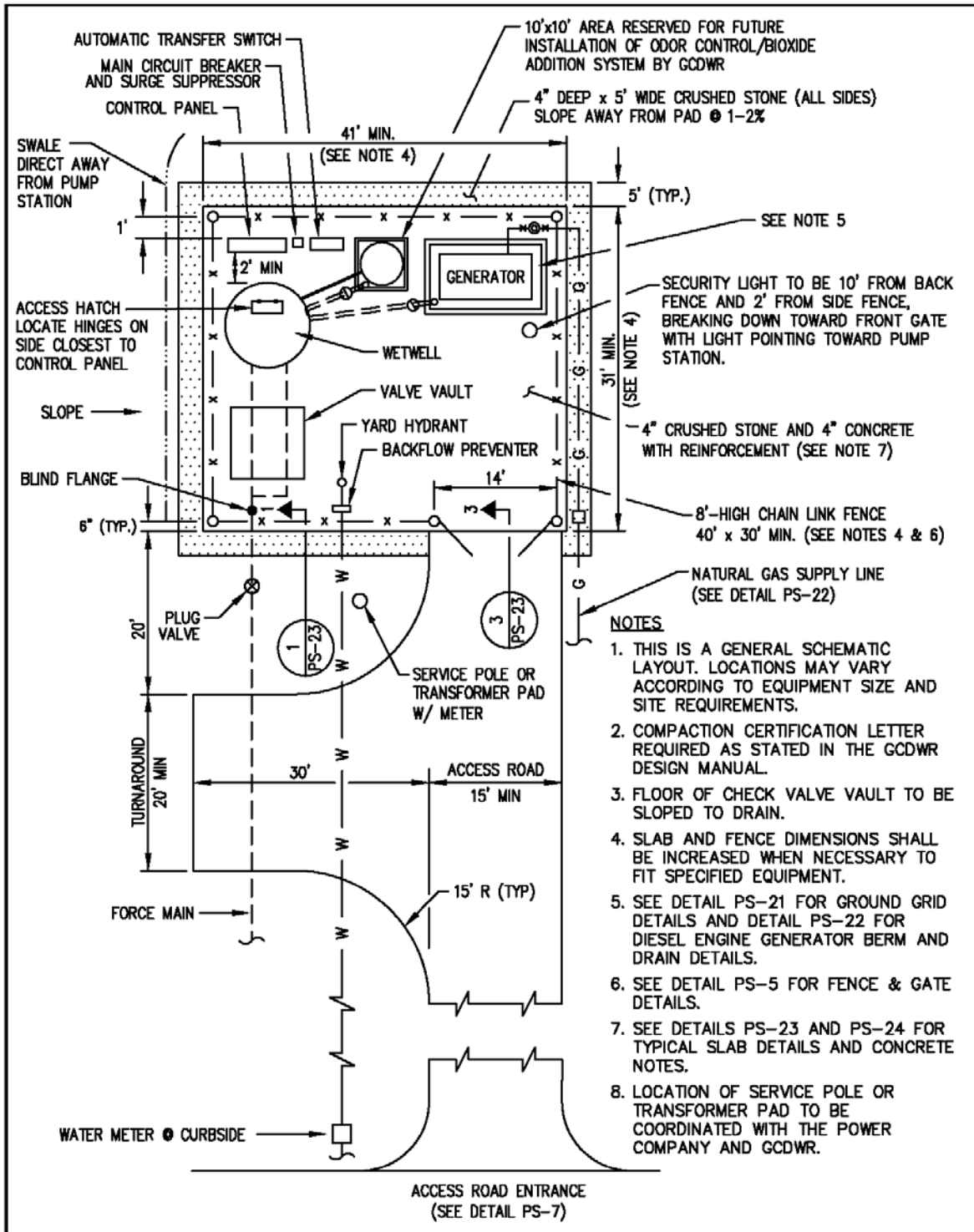




# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



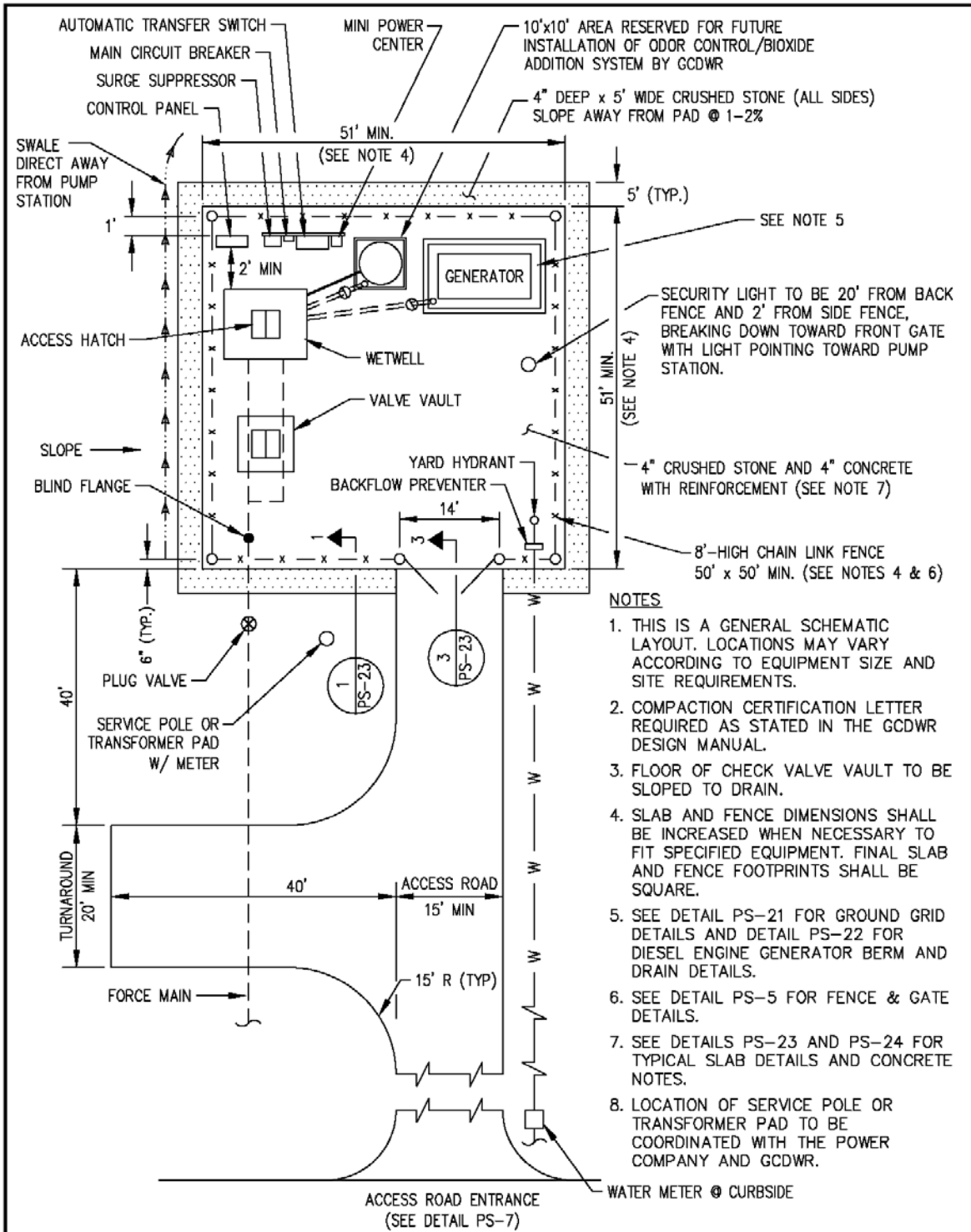
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	SUBMERSIBLE PUMP STATION SITE LAYOUT	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:			SCALE: N.T.S.
DETAIL NO. PS-12					

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



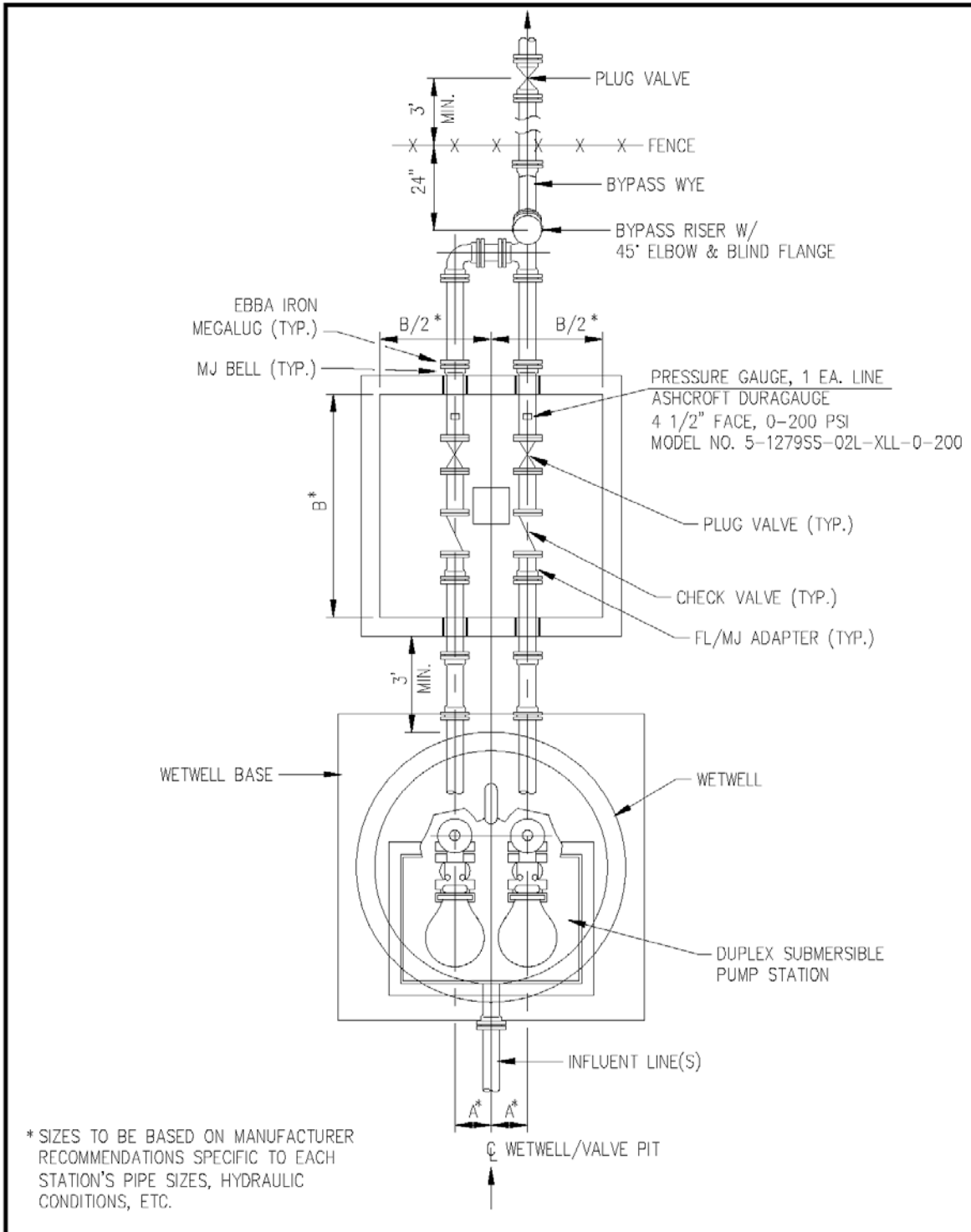
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO. BY	DATE
PUMP STATION STANDARD DRAWING	LARGE SUBMERSIBLE PUMP STATION SITE LAYOUT	CKD BY:		
	DETAIL NO. PS-12A	APPD. BY:		
		DATE: 12-01-11		
		FILE NO:	SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**

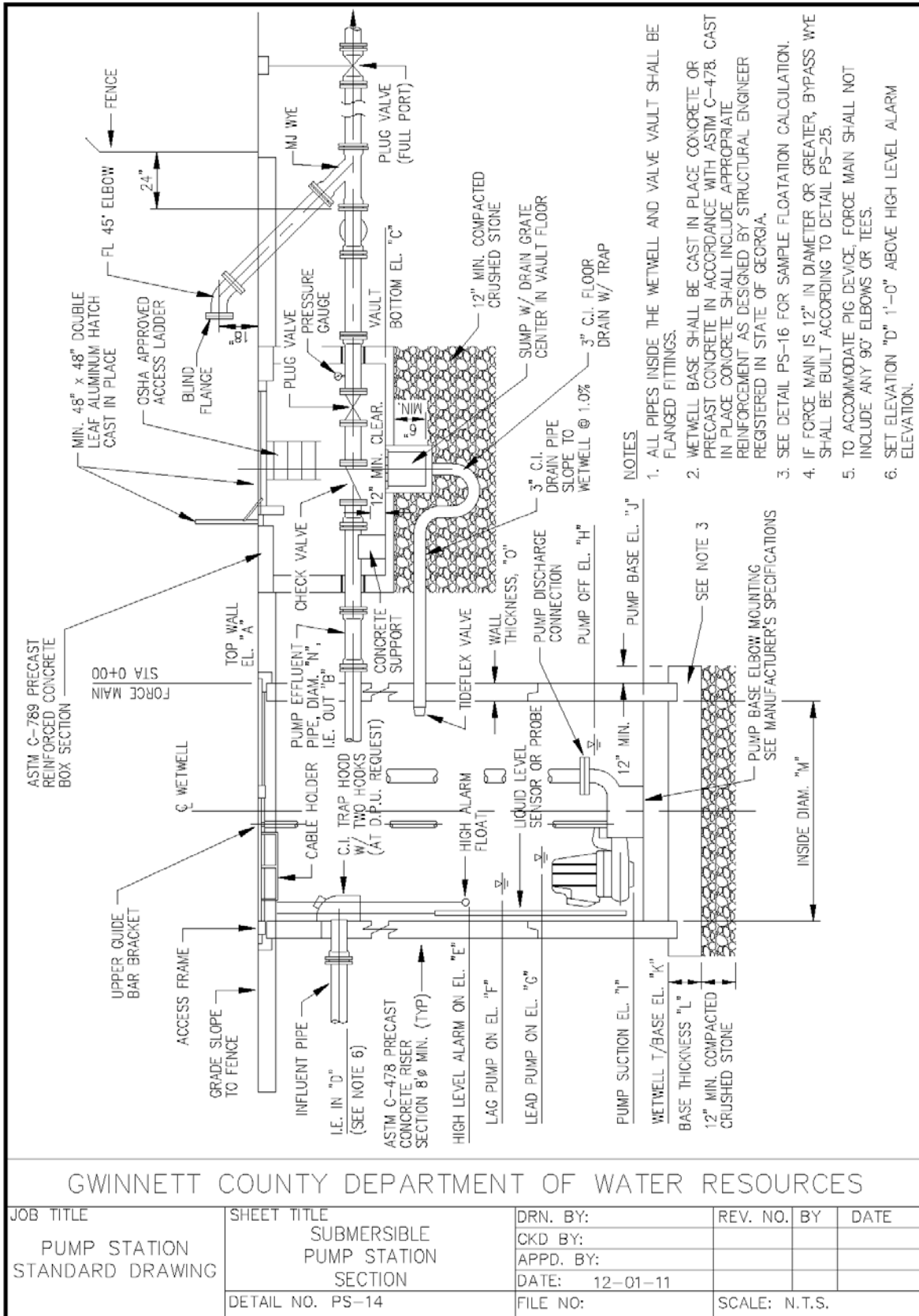


GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES					
JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	SUBMERSIBLE PUMP STATION PLAN  DETAIL NO. PS-13	CKD BY:			
		APPD. BY:			
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		FILE NO:			SCALE: N.T.S.

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



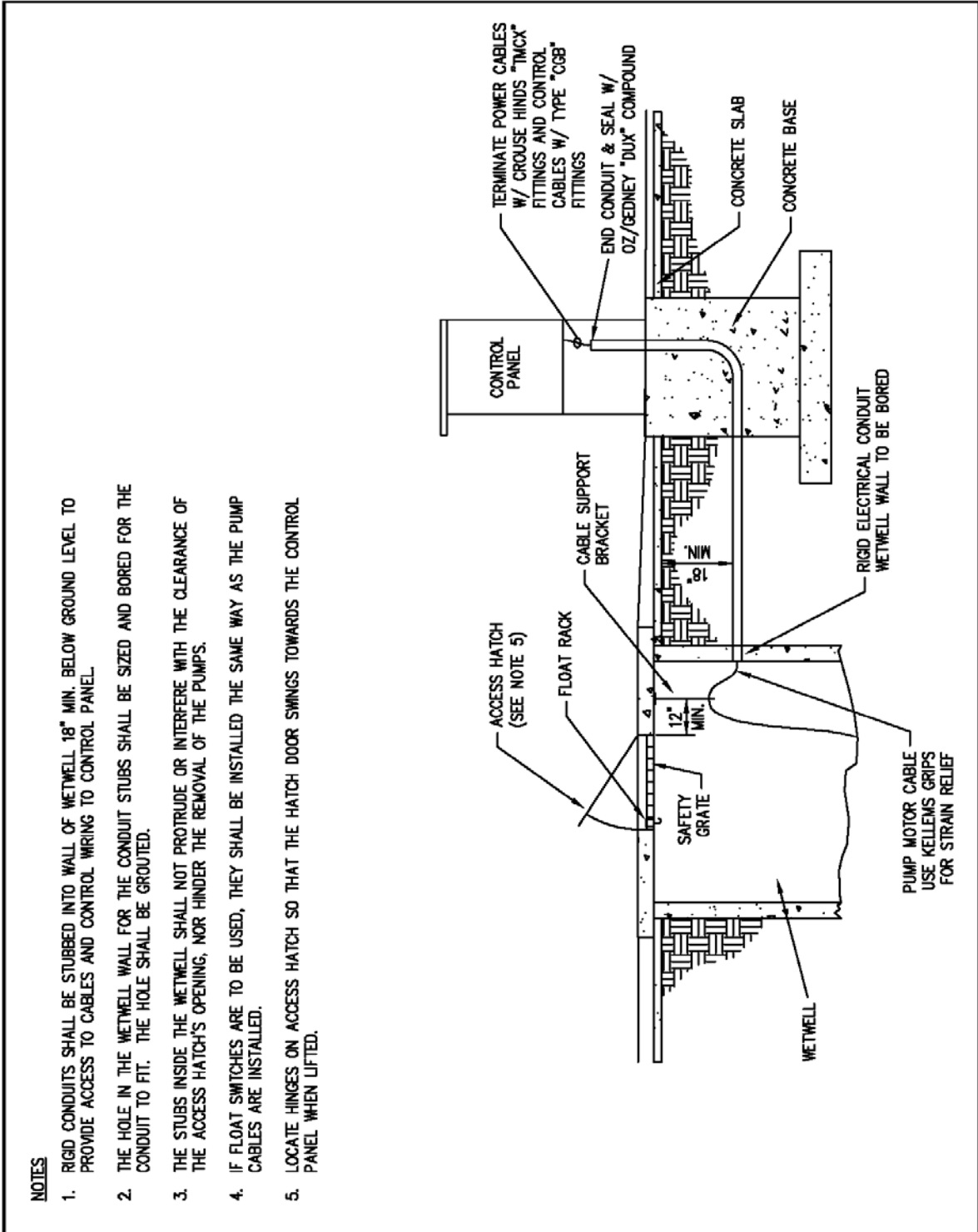
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

<b>JOB TITLE</b> PUMP STATION STANDARD DRAWING	<b>SHEET TITLE</b> SUBMERSIBLE PUMP STATION SECTION DETAIL NO. PS-14	<b>DRN. BY:</b> CKD BY: APPD. BY: DATE: 12-01-11 <b>FILE NO:</b>	<b>REV. NO. BY DATE</b>  SCALE: N.T.S.
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**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**



**NOTES**

1. RIGID CONDUITS SHALL BE STUBBED INTO WALL OF WETWELL 18" MIN. BELOW GROUND LEVEL TO PROVIDE ACCESS TO CABLES AND CONTROL WIRING TO CONTROL PANEL.
2. THE HOLE IN THE WETWELL WALL FOR THE CONDUIT STUBS SHALL BE SIZED AND BORED FOR THE CONDUIT TO FIT. THE HOLE SHALL BE GROUTED.
3. THE STUBS INSIDE THE WETWELL SHALL NOT PROTRUDE OR INTERFERE WITH THE CLEARANCE OF THE ACCESS HATCH'S OPENING, NOR HINDER THE REMOVAL OF THE PUMPS.
4. IF FLOAT SWITCHES ARE TO BE USED, THEY SHALL BE INSTALLED THE SAME WAY AS THE PUMP CABLES ARE INSTALLED.
5. LOCATE HINGES ON ACCESS HATCH SO THAT THE HATCH DOOR SWINGS TOWARDS THE CONTROL PANEL WHEN LIFTED.

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE  PUMP STATION STANDARD DRAWING	SHEET TITLE  SUBMERSIBLE PUMP CABLE  DETAIL NO. PS-15	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details

THE FOLLOWING CALCULATIONS ARE BASED ON THE WETWELL CONFIGURATION SHOWN TO THE RIGHT. (SEE DETAILS PS-14 AND PS-19 FOR DESCRIPTIONS OF THE PARAMETERS INDICATED.)

**ASSUMPTIONS**

1. FRICTION BETWEEN THE SOIL AND WALLS IS IGNORED.
2. STRUCTURE WEIGHT IS BASED ON THE WEIGHT OF THE WETWELL RISER AND BASE SECTIONS AND PUMP BASE FILL ONLY. WEIGHT OF PUMPS, PIPING, TOP, ETC. ARE IGNORED.
3. MATERIAL SPECIFIC WEIGHTS:  
WATER = 62.4 PCF  
CONCRETE = 150 PCF  
SOIL = 100 PCF
4. WETWELL IS ADJACENT TO FLOODPLAIN.

**STRUCTURE**

VOLUME OF RISER SECTIONS:  $V_R = (\text{AREA OF OUTSIDE WALL} - \text{AREA OF INSIDE WALL}) \times \text{HEIGHT OF RISERS}$   
 $= (\pi/4) \times [(M + 2 \times 0/12)^2 - M^2] \times (A - K)$   
 $= (3.14/4) \times [(8 + 2 \times 10/12)^2 - 8^2] \times (922.68 - 896.68) = 601.0 \text{ CF}$

VOLUME OF BASE SECTION:  $V_B = \text{AREA OF BASE} \times \text{BASE THICKNESS}$   
 $= (\pi/4) \times [M + 2 \times (12 + 0)/12]^2 \times L/12$   
 $= (3.14/4) \times [8 + 2 \times (12 + 10)/12]^2 \times 12/12 = 106.8 \text{ CF}$

VOLUME OF FILL:  $V_F = \text{AREA OF INSIDE DIAM.} \times \text{FILL DEPTH}$   
 $= (\pi/4) \times M^2 \times (J - K)$   
 $= (3.14/4) \times 8^2 \times (897.68 - 896.68) = 50.2 \text{ CF}$

WEIGHT OF CONCRETE:  $W_c = (V_R + V_B + V_F) \times \gamma_c = (601.0 + 106.8 + 50.2) \times 150 = 113,700 \text{ LBS}$

**SOIL**

VOLUME OF SOIL OVER BASE:  $V_s = (\text{AREA OF BASE} - \text{AREA OF OUTSIDE WALL}) \times \text{HEIGHT OF RISERS}$   
 $= (\pi/4) \times [(M + 2 \times (12 + 0)/12)^2 - (M + 2 \times 0/12)^2] \times (A - K)$   
 $= (3.14/4) \times [(8 + 2 \times (12 + 10)/12)^2 - (8 + 2 \times 10/12)^2] \times (922.68 - 896.68)$   
 $= 870.8 \text{ CF}$

WEIGHT OF SOIL OVER BASE:  $W_s = V_s \times \gamma_s = 870.8 \times 100 = 87,080 \text{ LBS}$

**WATER**

VOLUME OF WATER DISPLACED:  $V_w = \text{AREA OF OUTSIDE WALL} \times \text{HEIGHT OF RISERS} + \text{VOLUME OF BASE}$   
 $= (\pi/4) \times (M + 2 \times 0/12)^2 \times (A - K) + V_B$   
 $= (3.14/4) \times (8 + 2 \times 10/12)^2 \times (922.68 - 896.68) + 106.8 = 2,014.0 \text{ CF}$

WEIGHT OF WATER DISPLACED:  $W_w = V_w \times \gamma_w = 2,014.0 \times 62.4 = 125,674 \text{ LBS}$

**FLOATATION CHECK**

FACTOR OF SAFETY:  $F_s > 1.5$  WHERE ADJACENT TO FLOODPLAIN;  $F_s > 1.0$  ELSEWHERE  
 $F_s = \text{TOTAL WEIGHT OF STRUCTURE AND SOIL} / \text{WEIGHT OF WATER DISPLACED}$   
 $= (W_c + W_s) / W_w$   
 $= (113,700 + 87,080) / 125,674 = 1.60 \rightarrow F_s > 1.5 \therefore \text{WETWELL WILL NOT FLOAT}$

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

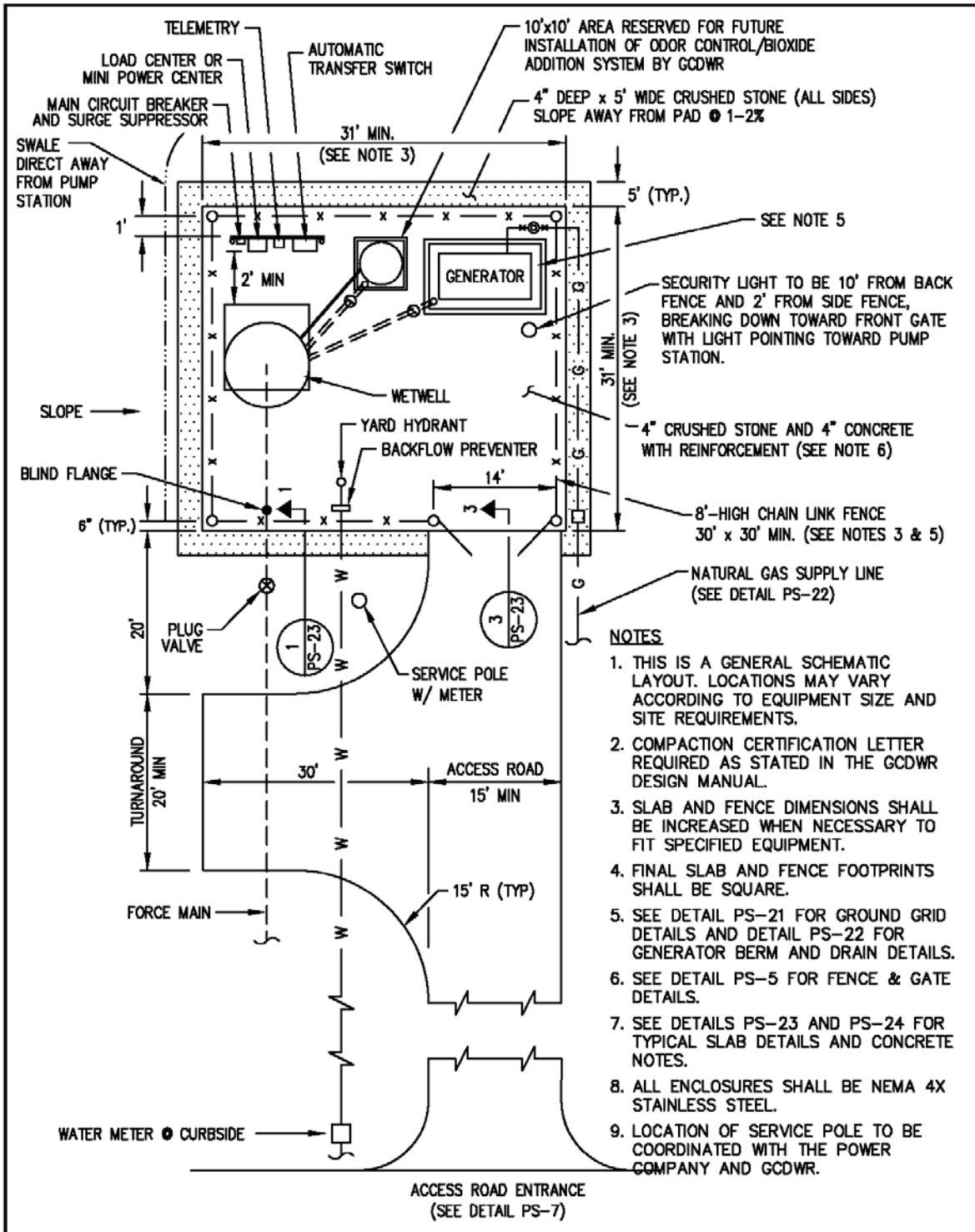
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PUMP STATION STANDARD DRAWING	PUMP STATION WETWELL SAMPLE FLOTATION CALCULATION	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
	DETAIL NO. PS-16	FILE NO:	SCALE: N.T.S.		

A-16

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**



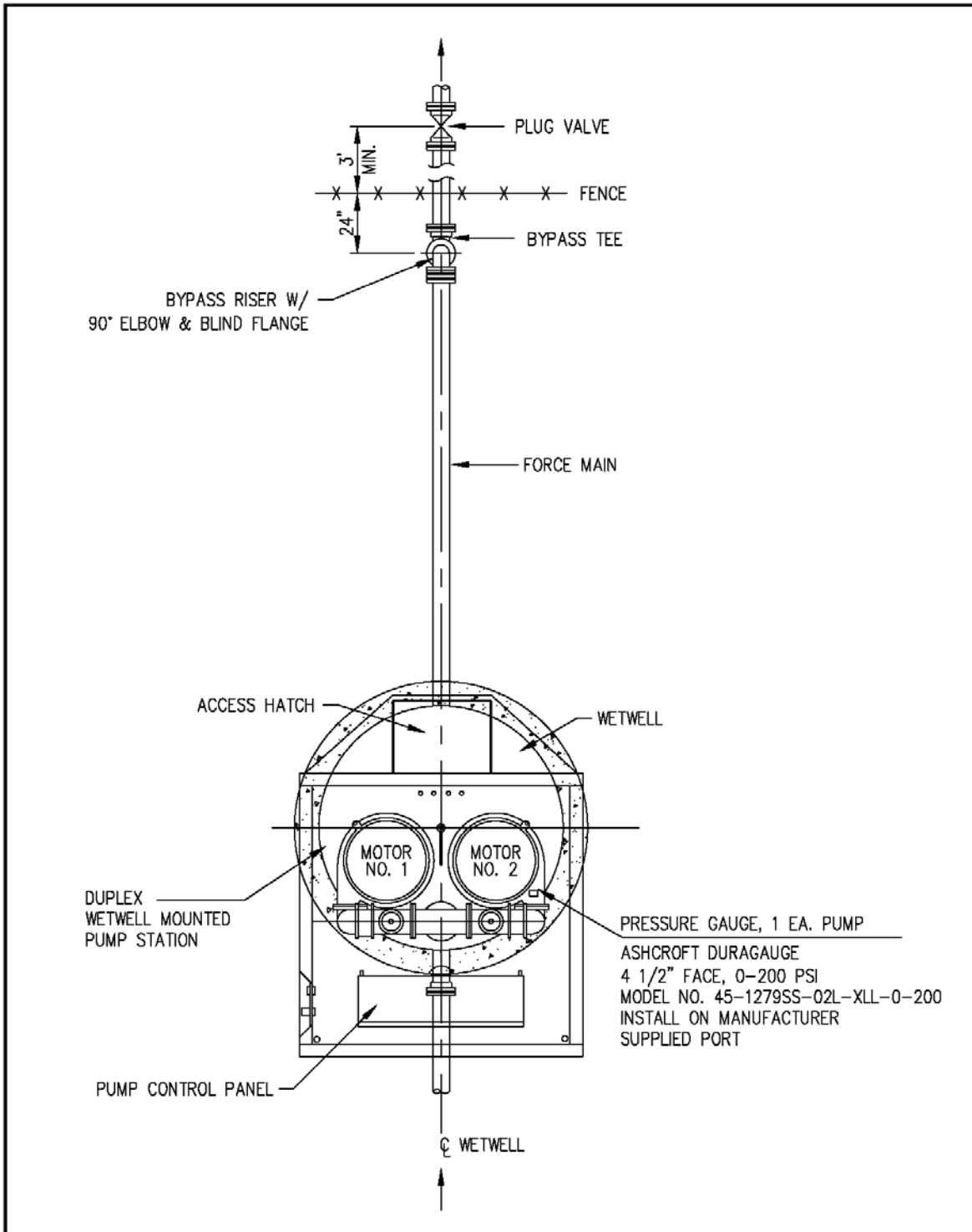
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	WETWELL MOUNTED PUMP STATION SITE LAYOUT	CKD BY:			
		APPD. BY:			
	DETAIL NO. PS-17	DATE: 12-01-11			
		FILE NO:		SCALE: N.T.S.	

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**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

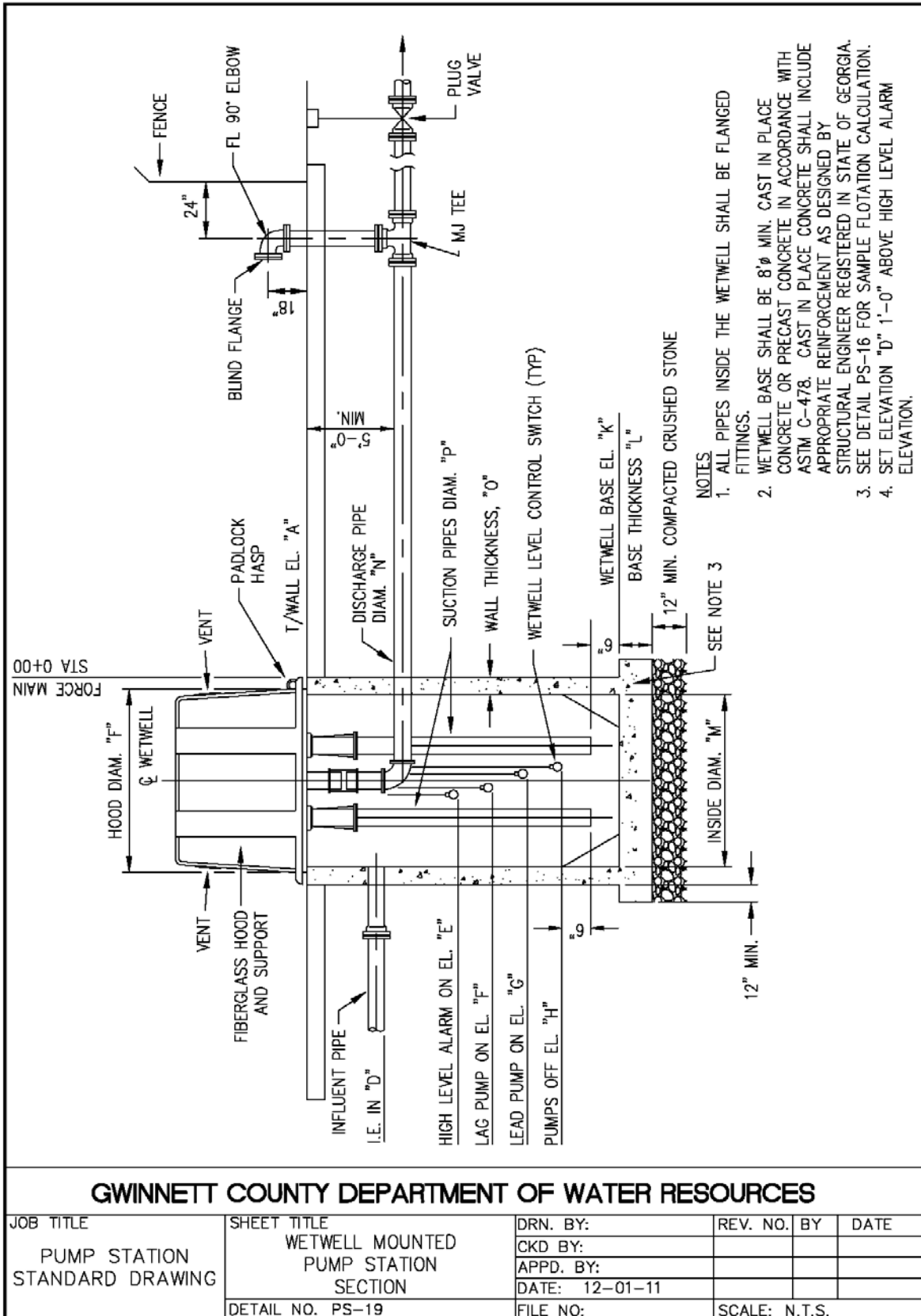
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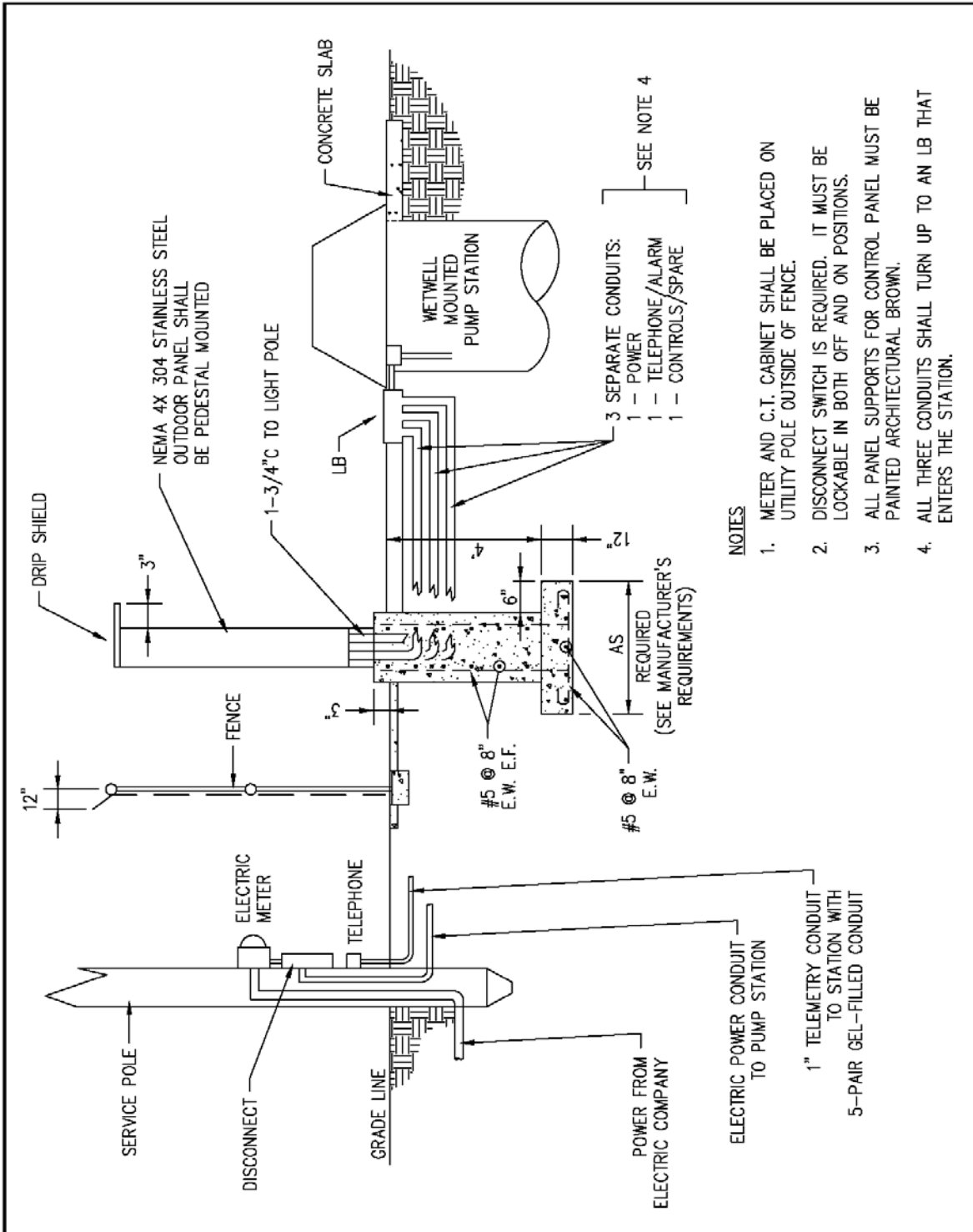
**Standard Details**



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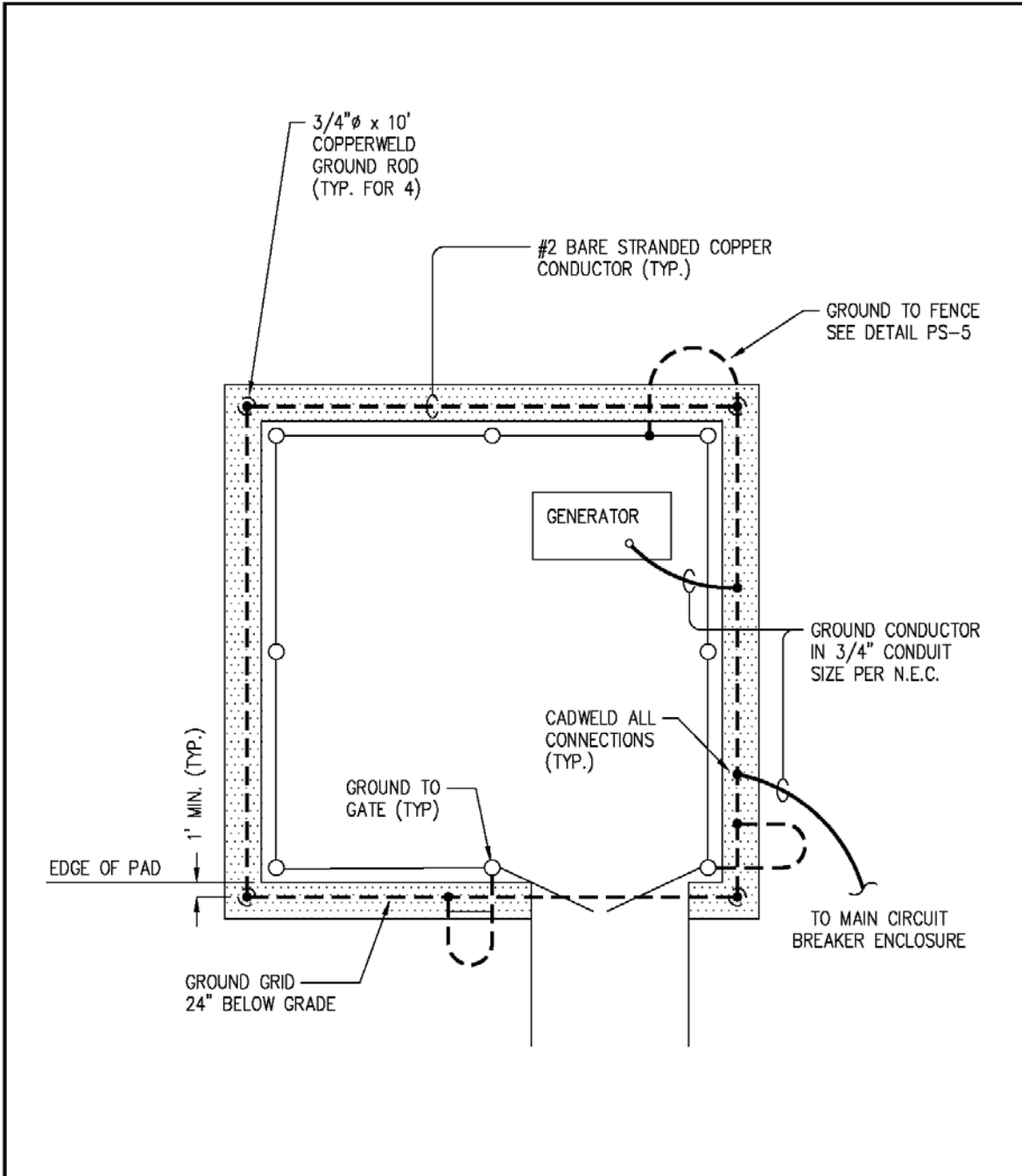
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

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	UNDERGROUND CONDUIT	APPD. BY:			
	DETAIL NO. PS-20	DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		

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Developer Pump Station Standards**

**Appendix**

**Standard Details**



NOTE: SEE DETAILS PS-12, PS-12A AND PS-17 FOR PUMP STATION LAYOUT.

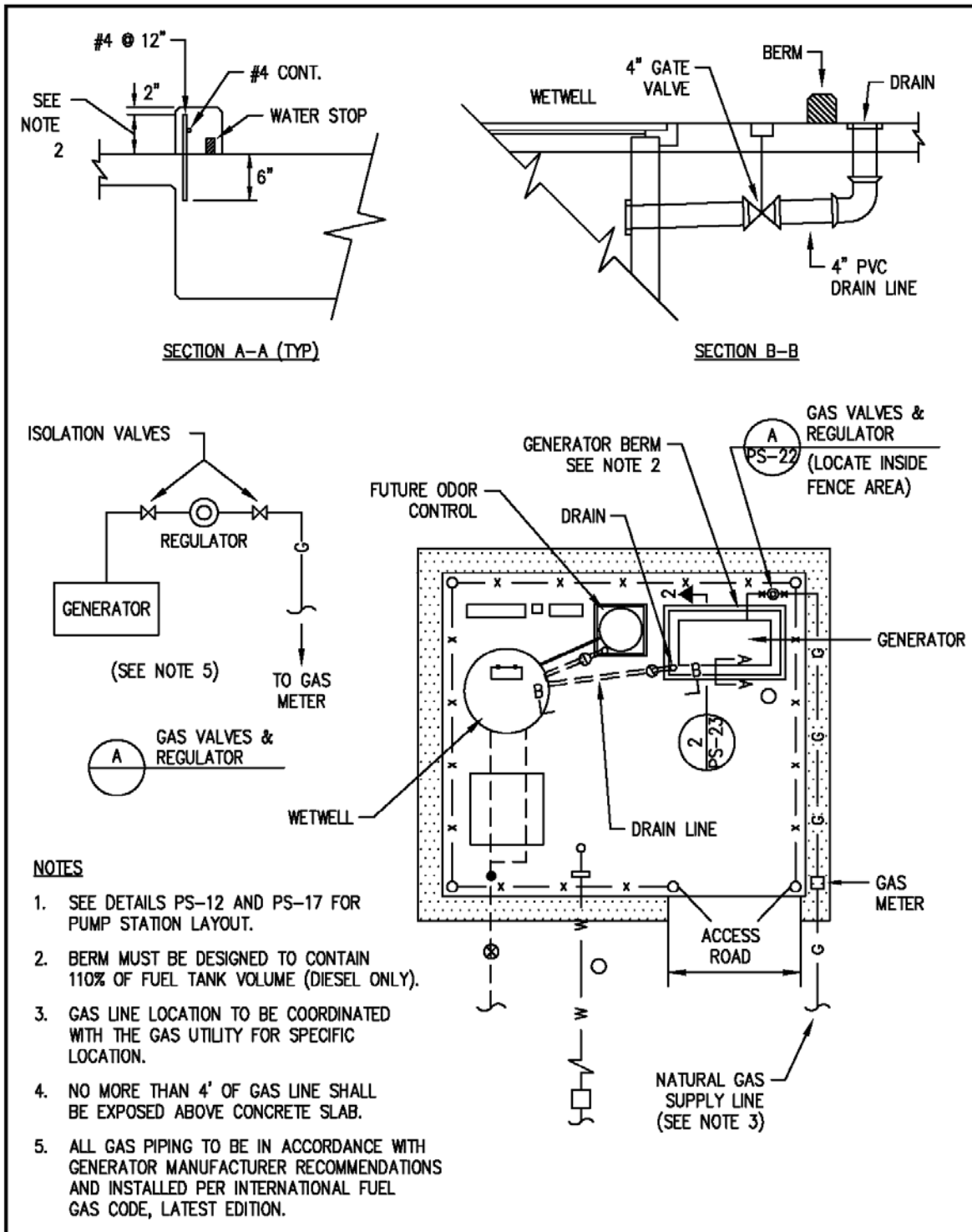
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

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		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		

**Gwinnett County Department of Water Resources  
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**Standard Details**



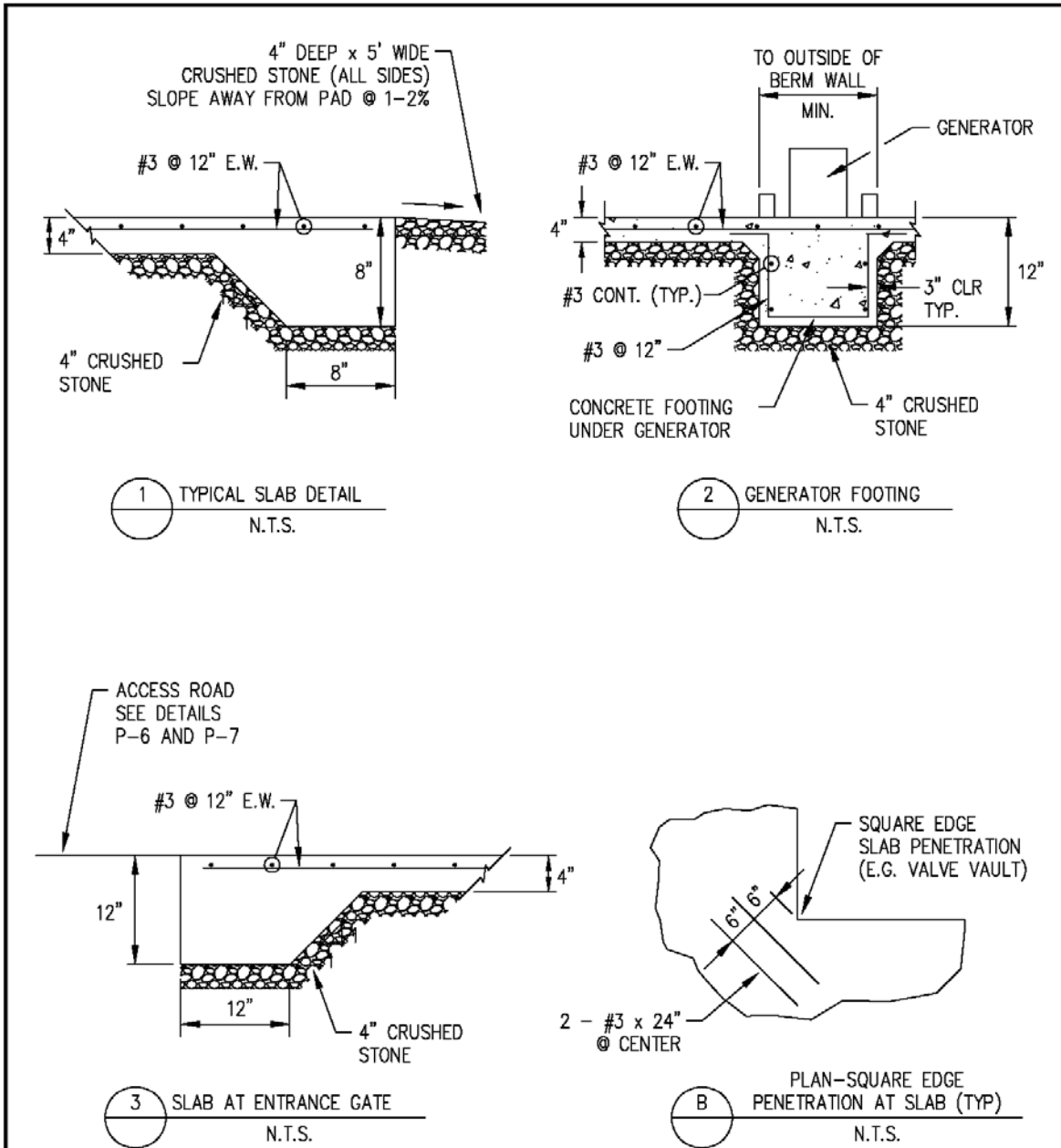
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

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		APPD. BY:		
		DATE: 12-01-11		
		FILE NO:	SCALE: N.T.S.	

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**Appendix**

**Standard Details**



NOTE: SEE DETAIL PS-24 FOR CONCRETE NOTES.

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	CONCRETE SLAB DETAILS	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		DETAIL NO. PS-23	FILE NO:	SCALE: N.T.S.	

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**Standard Details**

1. A CERTIFIED LETTER OF COMPACTION FROM A LICENSED GEOTECHNICAL ENGINEER MUST BE COMPLETED PRIOR TO PLACEMENT OF CONCRETE.
2. CONCRETE MIX SHALL BE IN ACCORDANCE WITH ASTM C94 AND POSSESS THE FOLLOWING CHARACTERISTICS:
  - (a) COMPRESSIVE STRENGTH OF AT LEAST 3,000 PSI AT 28 DAYS.
  - (b) MINIMUM AGGREGATE SIZE OF 1-INCH.
  - (c) AIR CONTENT OF  $4 \frac{1}{2}\% \pm 1 \frac{1}{2}\%$ .
  - (d) WATER-CEMENT RATIO SHALL NOT BE GREATER THAN 0.44.
  - (e) SLUMP SHALL BE  $4" \pm 1"$ .
  - (f) UNIT WEIGHT SHALL NOT BE LESS THAN 145 LB/C.F.
  - (g) ACCELERATING ADMIXTURES IN COLD WEATHER OR RETARDING ADMIXTURES IN HOT WEATHER SHALL ONLY BE USED WHEN APPROVED IN WRITING BY GCDWR.
3. CONCRETE PLACEMENT SHALL BE IN ACCORDANCE WITH ACI 301 AND ACI 304R. CONCRETE TEMPERATURE AT TIME OF PLACEMENT SHALL BE A MINIMUM OF 55°F AND A MAXIMUM OF 90°F.
4. COLD WEATHER: CONCRETE SHALL BE PLACED IN ACCORDANCE WITH ACI 306R.
5. HOT WEATHER: NO CONCRETE SHALL BE PLACED WHEN AMBIENT AIR TEMPERATURE IS GREATER THAN 85°F. CONCRETE SHALL BE PLACED IN ACCORDANCE WITH ACI 305R.
6. CURING OF CONCRETE SHALL BE IN ACCORDANCE WITH ACI 308 AND ACI 318.
7. DEFECTIVE OR IMPROPERLY PLACED CONCRETE SHALL BE REPAIRED OR REPLACED AT CONTRACTOR'S/DEVELOPER'S EXPENSE.

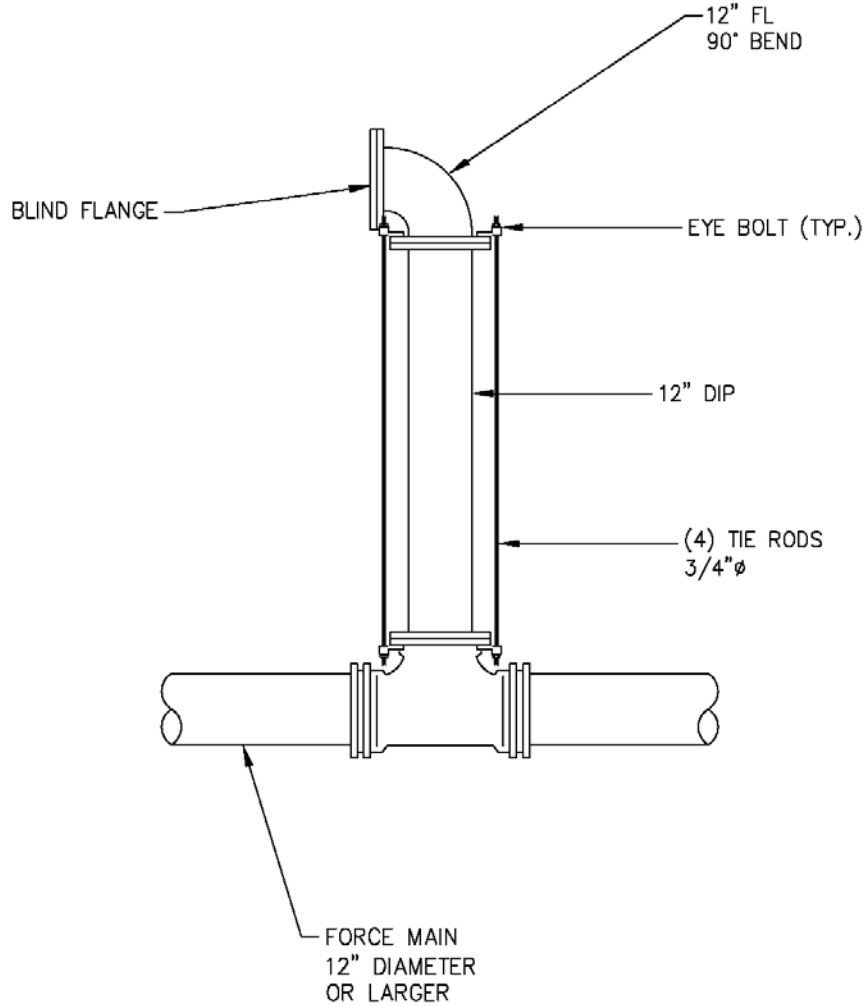
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE  PUMP STATION STANDARD DRAWING	SHEET TITLE  CONCRETE NOTES  DETAIL NO. PS-24	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:		SCALE: N.T.S.	

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**NOTES**

1. RODS TO BE MINIMUM YIELD STRENGTH OF 50,000 PSI.
2. RODS MUST HAVE A MINIMUM 6" OF THREAD ON EACH END.
3. ALL STEEL MUST BE CLEANED AND COATED WITH ROYSTON ROSKOTE, KOPPERS SUPER SERVICE BLACK OR APPROVED EQUAL.
4. ALL NUTS USED ON TIE RODS MUST HAVE A WASHER.

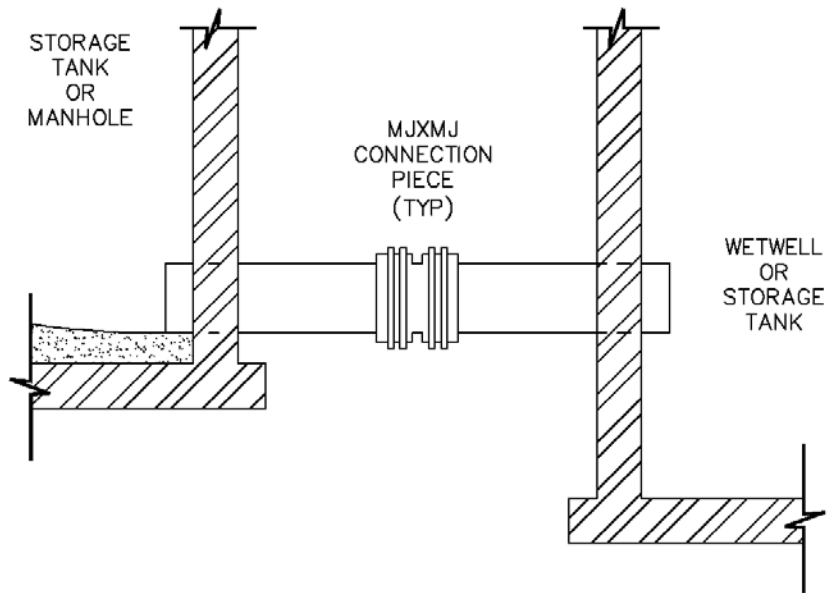
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	LARGE FORCE MAIN BYPASS TEE	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:			SCALE: N.T.S.
	DETAIL NO. PS-25				

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

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N.T.S.

\* NOTE: ALSO REQUIRED BETWEEN EMERGENCY STORAGE TANK TO EMERGENCY STORAGE TANKS OR EMERGENCY STORAGE TANK AND SYSTEM MANHOLES

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

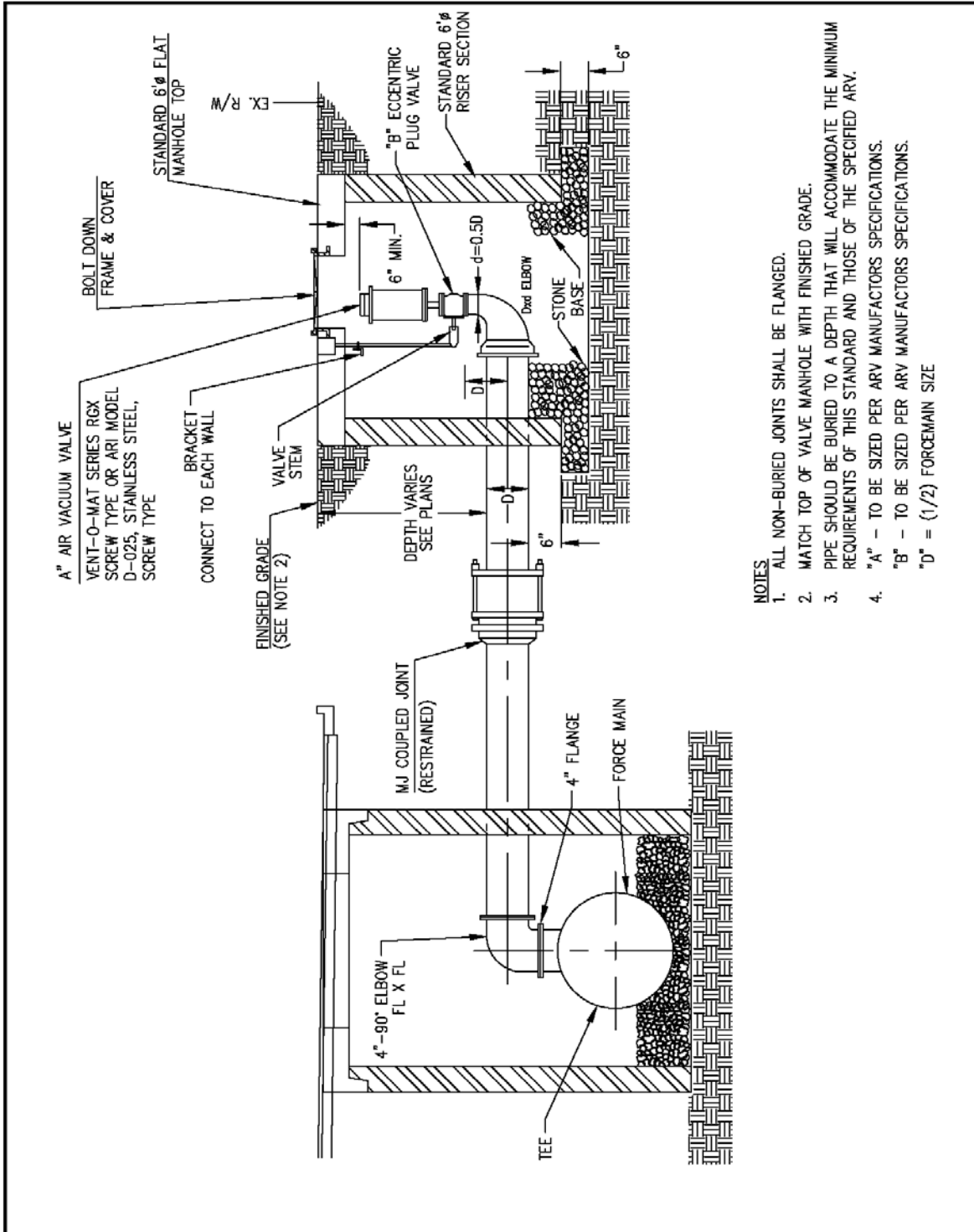
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		APPD. BY:			
		DATE: 12-01-11			
		FILE NO:	SCALE: N.T.S.		



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- NOTES**
1. ALL NON-BURIED JOINTS SHALL BE FLANGED.
  2. MATCH TOP OF VALVE MANHOLE WITH FINISHED GRADE.
  3. PIPE SHOULD BE BURIED TO A DEPTH THAT WILL ACCOMMODATE THE MINIMUM REQUIREMENTS OF THIS STANDARD AND THOSE OF THE SPECIFIED ARV.
  4. "A" - TO BE SIZED PER ARV MANUFACTURERS SPECIFICATIONS.  
 "B" - TO BE SIZED PER ARV MANUFACTURERS SPECIFICATIONS.  
 "D" = (1/2) FORCEMAIN SIZE

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	OFFSET AIR RELIEF VALVE DETAIL	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
	DETAIL NO. PS-27	FILE NO:	SCALE: N.T.S.		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details

**NOTES:**

1. Dependant on equipment size and space requirements, locate the required pump control equipment in this area or expand the panel to a 72" wide, double door panel configuration and include the items in the adjacent panel section.

A. Starters  
 B. MAS Units  
 C. Overload Protection  
 D. Main Breaker  
 E. Soft Starter  
 F. Pump CTs  
 G. Surge Protection  
 H. 120V Control Power Transformer

SIDE VIEW

BACKPLANE LAYOUT

INNER DOOR LAYOUT

PANEL FRONT LAYOUT

STARTER SIZE 5/6

STARTER SIZE 3/4

STARTER SIZE 1/2

FLYGT  
MAS UNIT

FLYGT  
MAS OIT

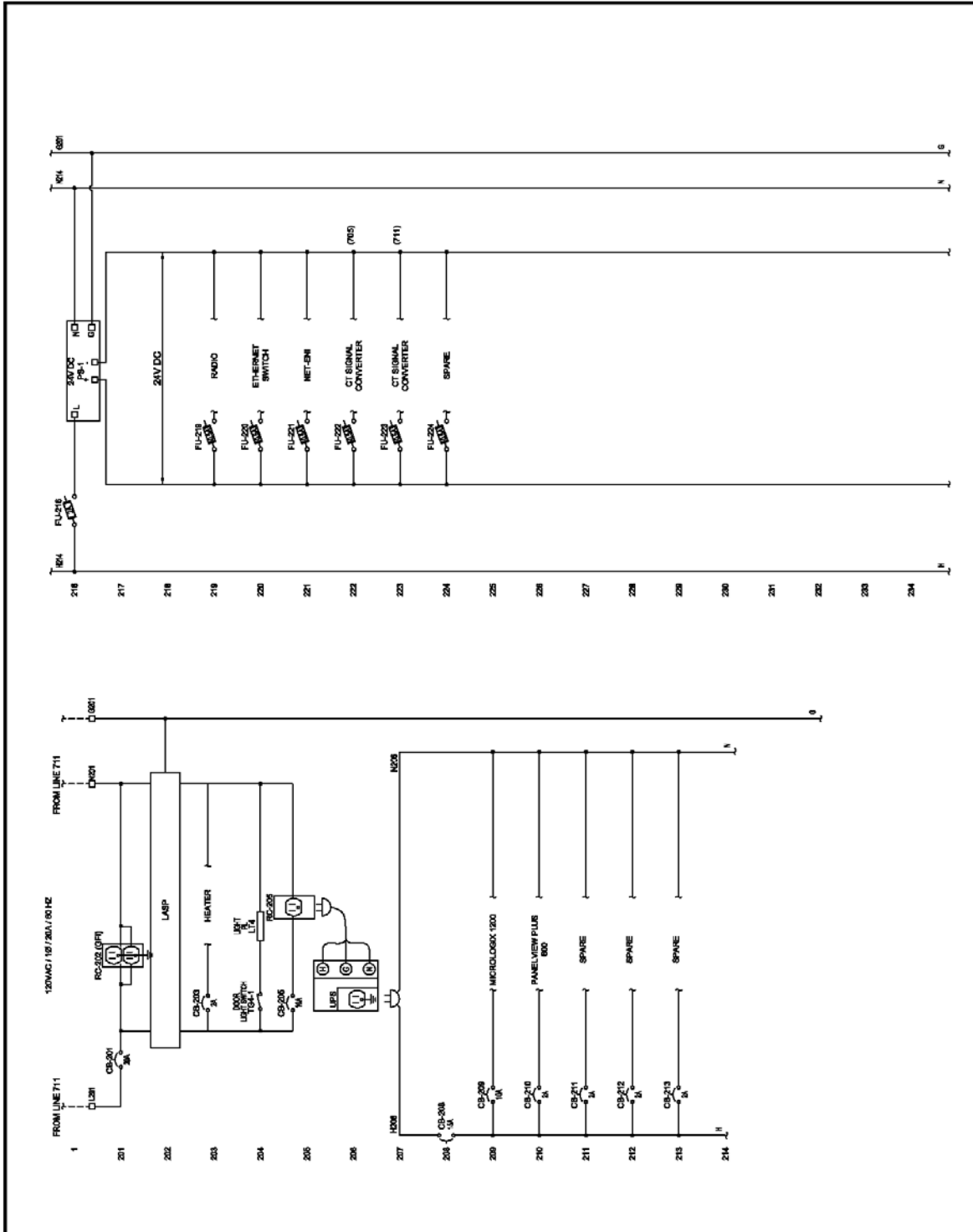
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	RTU PANEL LAYOUT TYPE 1	CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
	DETAIL NO. PS-29A	FILE NO:	SCALE: N.T.S.		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



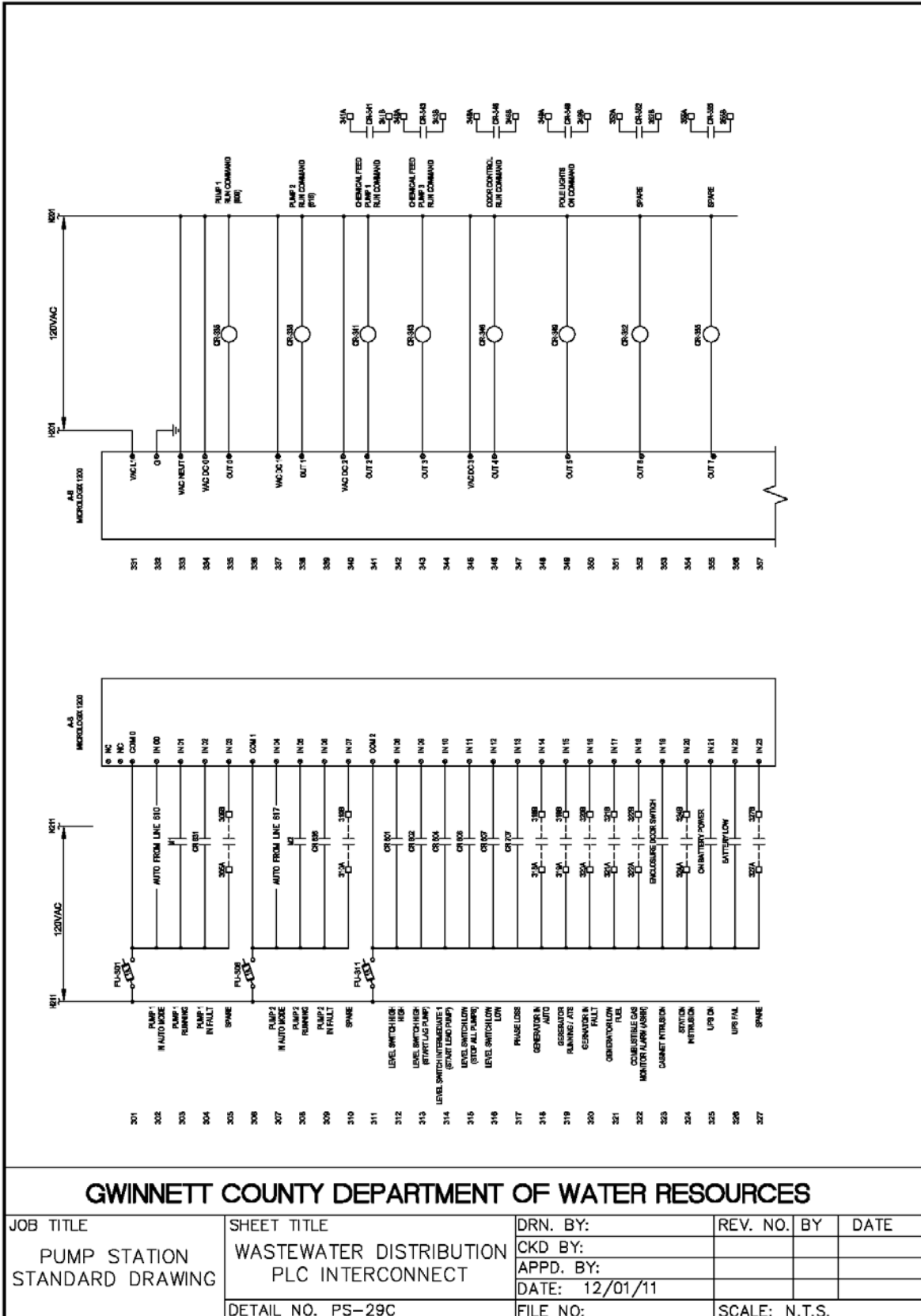
## GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	RTU PANEL ELECTRICAL SCHEMATIC	CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
DETAIL NO. PS-29B		FILE NO:	SCALE: N.T.S.		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

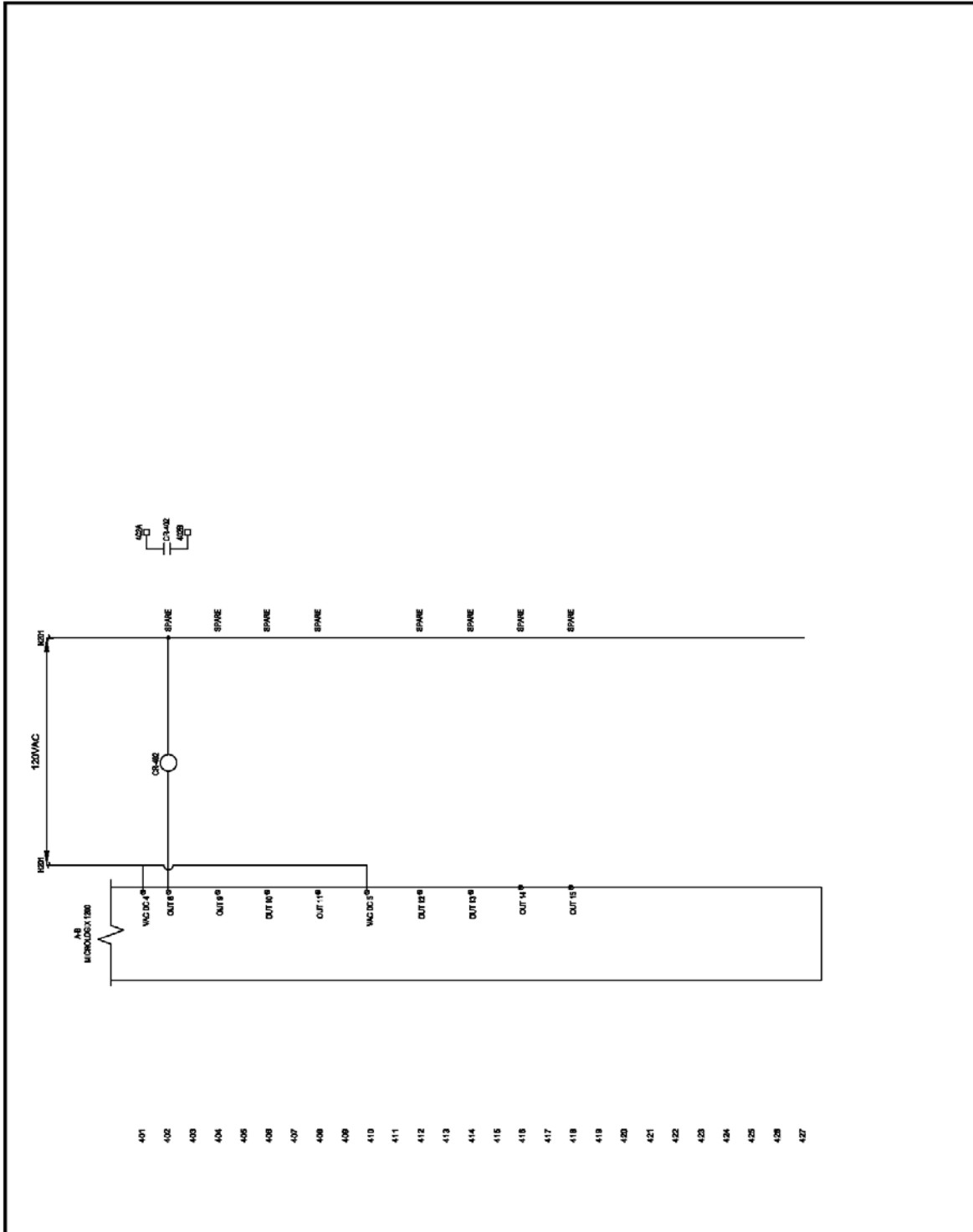
## Standard Details



# Gwinnett County Department of Water Resources Developer Pump Station Standards

Appendix

Standard Details



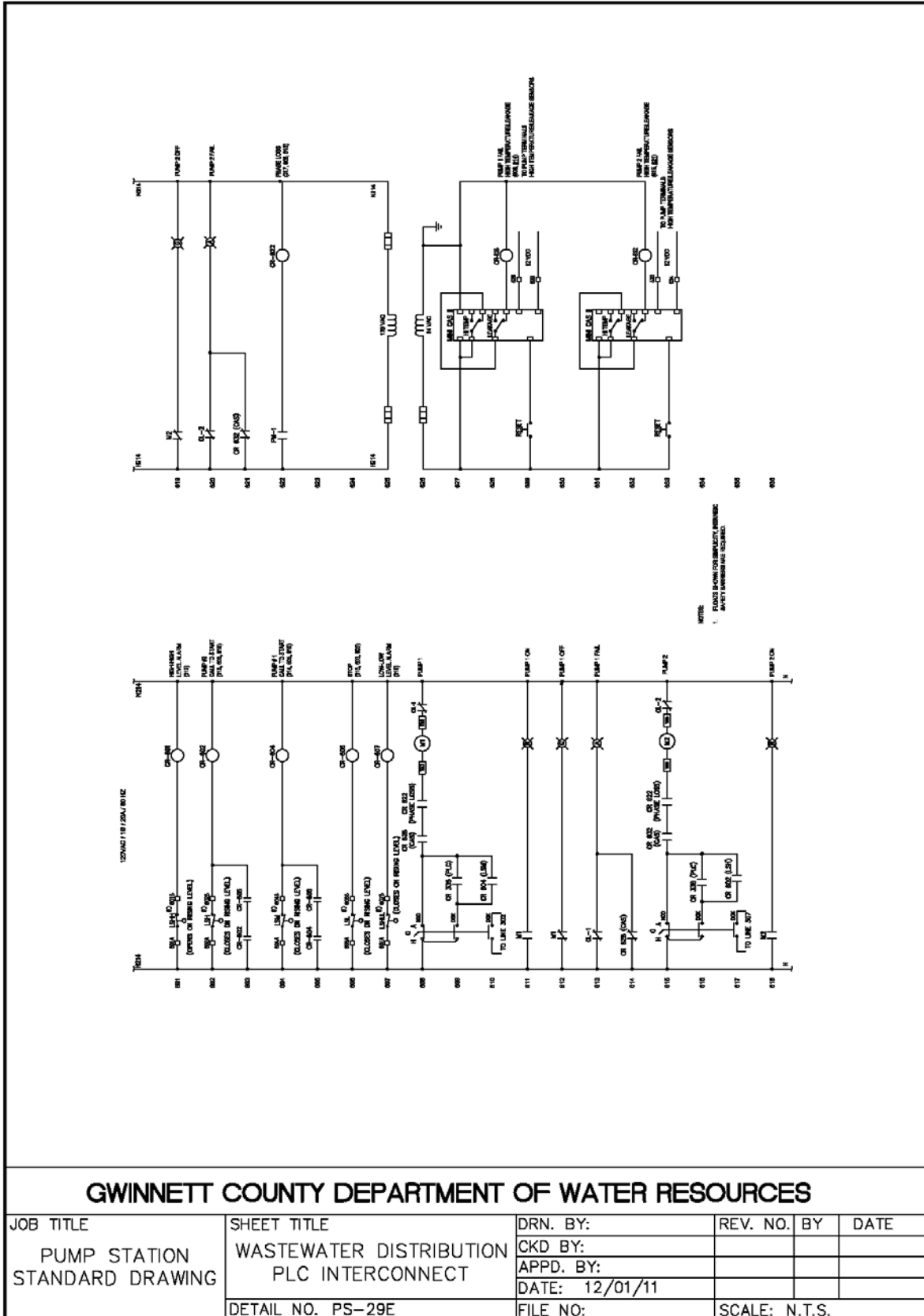
## GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE PUMP STATION STANDARD DRAWING	SHEET TITLE WASTEWATER DISTRIBUTION PLC INTERCONNECT	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
	DETAIL NO. PS-29D	FILE NO:	SCALE: N.T.S.		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

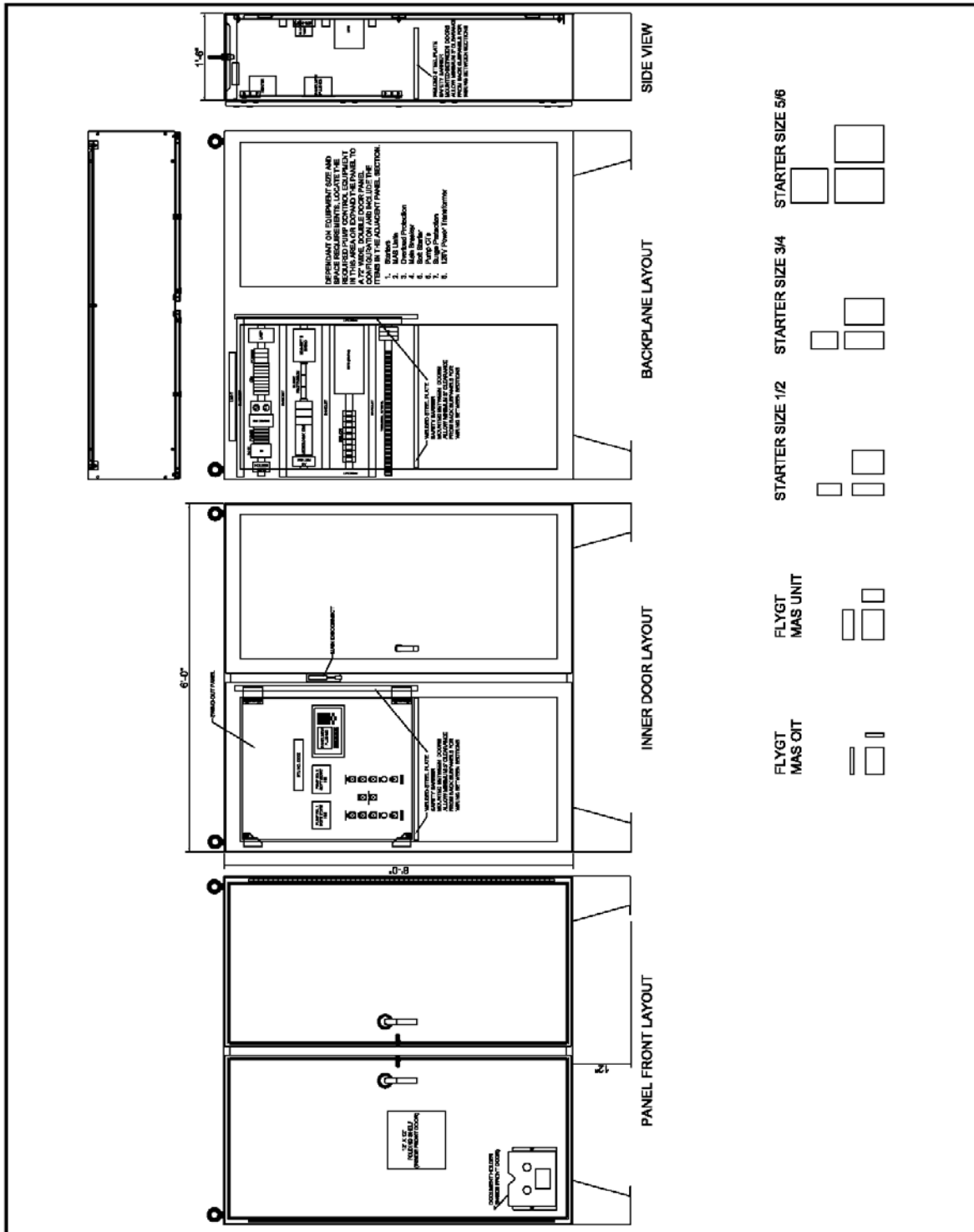
## Standard Details



# Gwinnett County Department of Water Resources Developer Pump Station Standards

Appendix

Standard Details



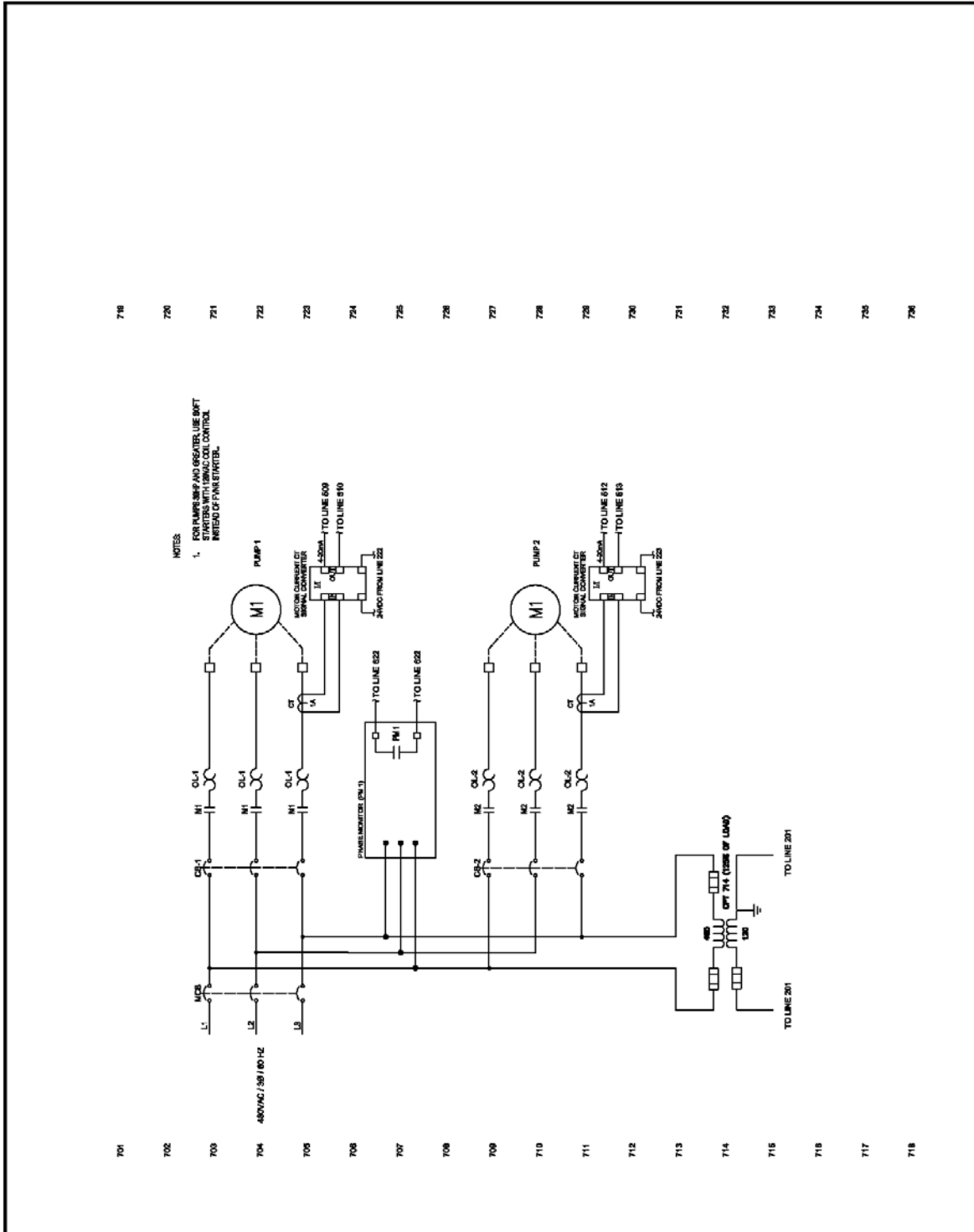
## GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE PUMP STATION STANDARD DRAWING	SHEET TITLE RTU PANEL LAYOUT TYPE 2  DETAIL NO. PS-29F	DRN. BY: CKD BY: APPD. BY: DATE: 12/01/11 FILE NO:	REV. NO. BY DATE	
		FLYGT MAS UNIT FLYGT MAS OIT STARTER SIZE 1/2    STARTER SIZE 3/4    STARTER SIZE 5/6		

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



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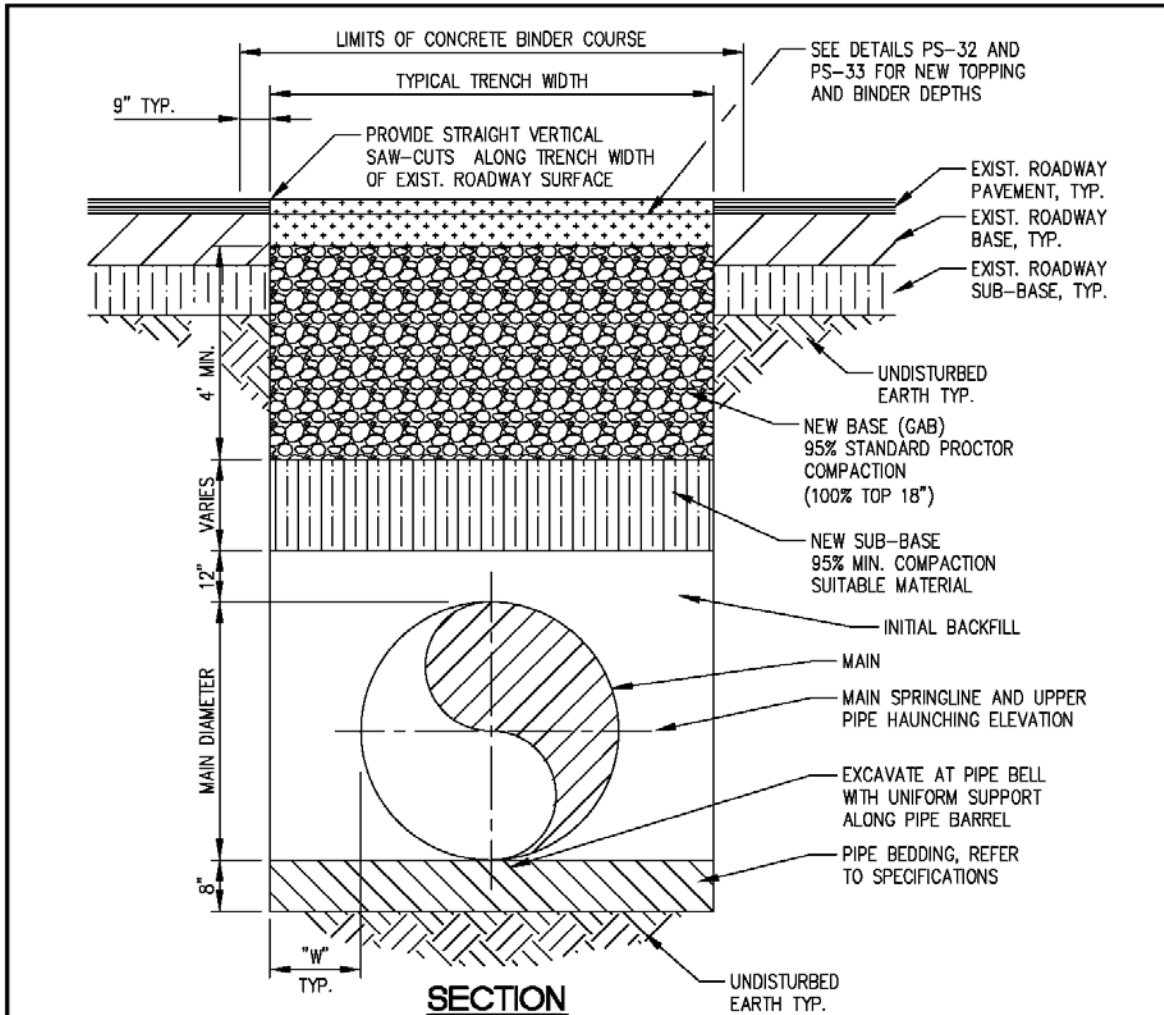
<b>GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES</b>					
JOB TITLE <b>PUMP STATION STANDARD DRAWING</b>	SHEET TITLE <b>RTU PANEL ELECTRICAL SCHEMATIC</b>	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
	DETAIL NO. PS-29G	FILE NO:			SCALE: N.T.S.



# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



MAIN DIAMETER (INCHES)	4	6	8	10	12	16	24	30	36	42	48
"W" (INCHES)	12	12	12	13	13	14	16	18	20	24	24

**NOTES**

1. ALL MATERIALS AND METHODS OF INSTALLATION SHALL COMPLY WITH THE GA DOT "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" LATEST REVISION.
2. WHERE TOP OF PIPE IS 6'-0" OR LESS BELOW TOP OF EXISTING PAVEMENT THE NEW BASE SHALL EXTEND DOWNWARD TO TOP OF INITIAL BACKFILL WITH NO SUB-BASE. WHERE TOP OF PIPE IS GREATER THEN 6'-0" BELOW TOP OF EXISTING PAVEMENT THE NEW BASE SHALL BE INSTALLED TO A DEPTH OF 4'-0".
3. TRENCH WIDTHS OF 6'-0" OR LESS, A 7 INCH 3,000 PSI CONCRETE CAP MAY BE SUBSTITUTED FOR THE BINDER COURSE LISTED. INSTALLATION OF A CONCRETE BINDER COURSE SHALL BE PROVIDED WITH A 9 INCH BENCH ON EACH SIDE OF TRENCH WIDTH AS INDICATED.
4. NEW ROADWAY PAVEMENT SHALL MATCH CROSS SLOPE AND GRADE OF EXISTING ROADWAY.
5. **THIS DETAIL APPLIES ONLY TO CUTS IN GWINNETT COUNTY ROADWAYS. CUTS IN ROADWAYS FOR STATE AND OTHER MUNICIPALITIES SHALL BE PER THE STANDARDS FOR THE APPLICABLE JURISDICTION.**

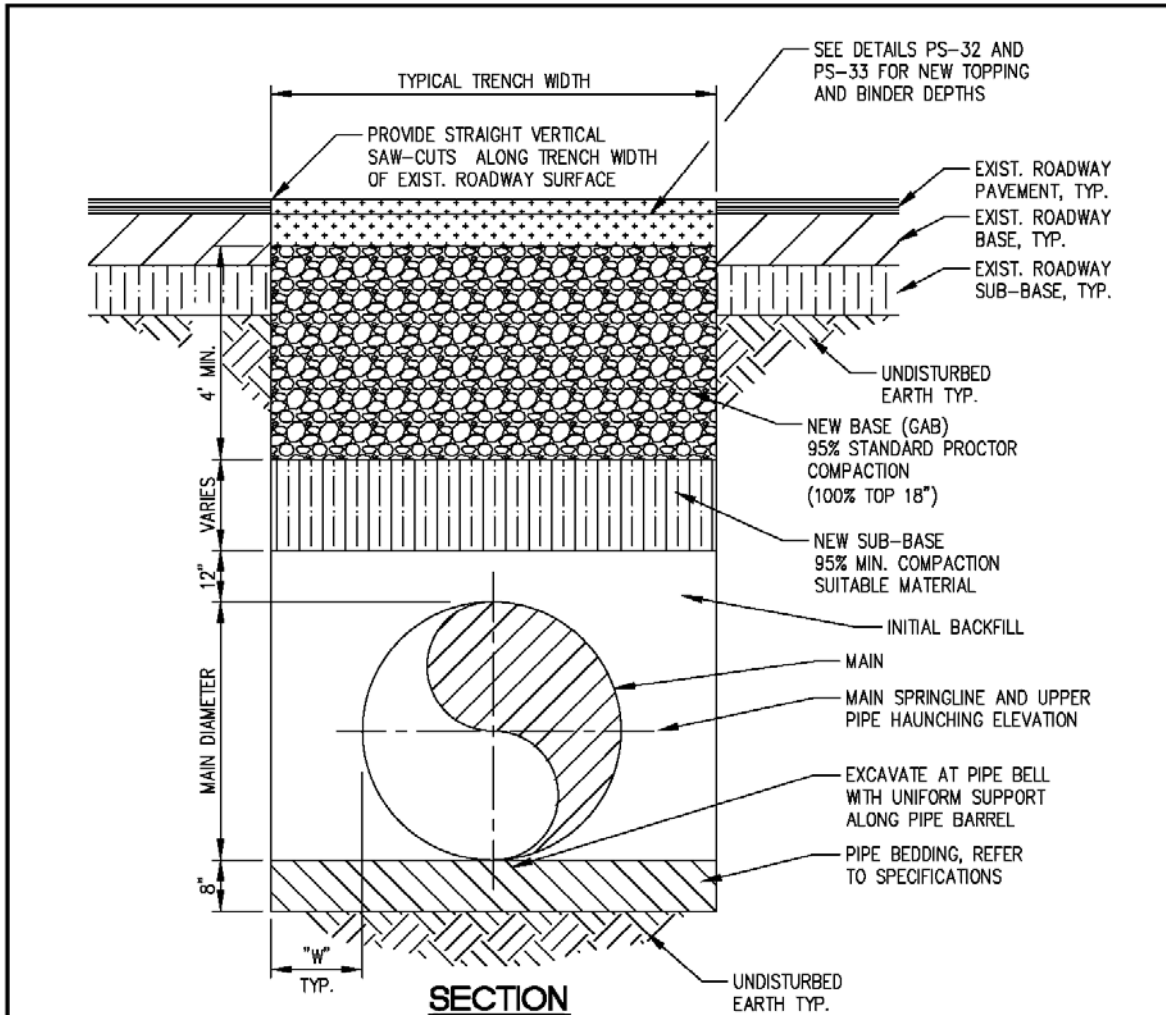
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	PERPENDICULAR ROADWAY CUTS BEDDING AND BACKFILL GWINNETT COUNTY ROADS	CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
DETAIL NO. PS-30	FILE NO:	SCALE: N.T.S.			

# Gwinnett County Department of Water Resources Developer Pump Station Standards

## Appendix

## Standard Details



MAIN DIAMETER (INCHES)	4	6	8	10	12	16	24	30	36	42	48
"W" (INCHES)	12	12	12	13	13	14	16	18	20	24	24

**NOTES**

1. ALL MATERIALS AND METHODS OF INSTALLATION SHALL COMPLY WITH THE GA DOT "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" LATEST REVISION.
2. WHERE TOP OF PIPE IS 6'-0" OR LESS BELOW TOP OF EXISTING PAVEMENT THE NEW BASE SHALL EXTEND DOWNWARD TO TOP OF INITIAL BACKFILL WITH NO SUB-BASE. WHERE TOP OF PIPE IS GREATER THEN 6'-0" BELOW TOP OF EXISTING PAVEMENT THE NEW BASE SHALL BE INSTALLED TO A DEPTH OF 4'-0".
3. NEW ROADWAY PAVEMENT SHALL MATCH CROSS SLOPE AND GRADE OF EXISTING ROADWAY.
4. **THIS DETAIL APPLIES ONLY TO CUTS IN GWINNETT COUNTY ROADWAYS. CUTS IN ROADWAYS FOR STATE AND OTHER MUNICIPALITIES SHALL BE PER THE STANDARDS FOR THE APPLICABLE JURISDICTION.**

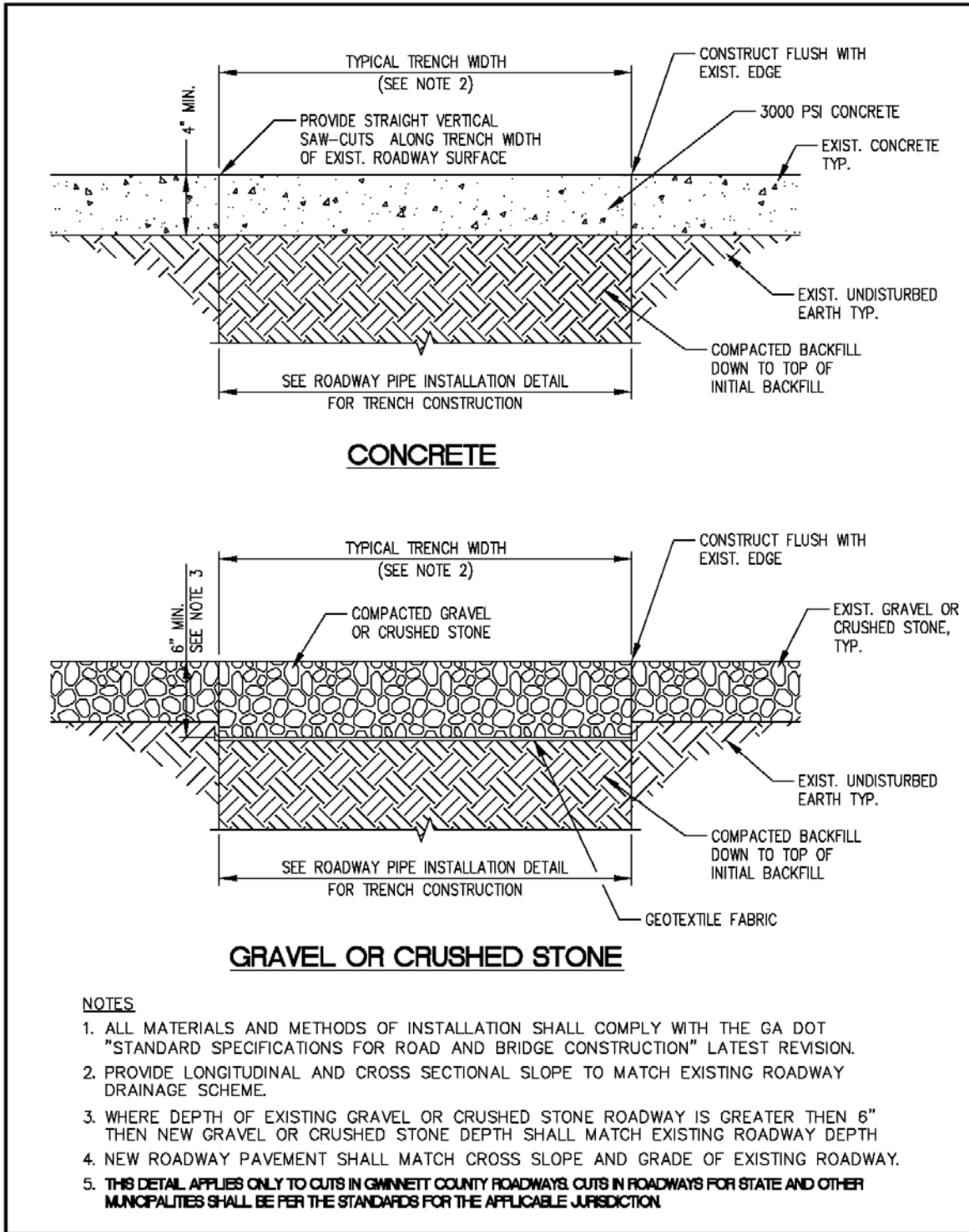
### GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	LONGITUDINAL ROADWAY CUTS BEDDING AND BACKFILL GWINNETT COUNTY ROADS	CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
		DETAIL NO. PS-31	FILE NO:	SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**

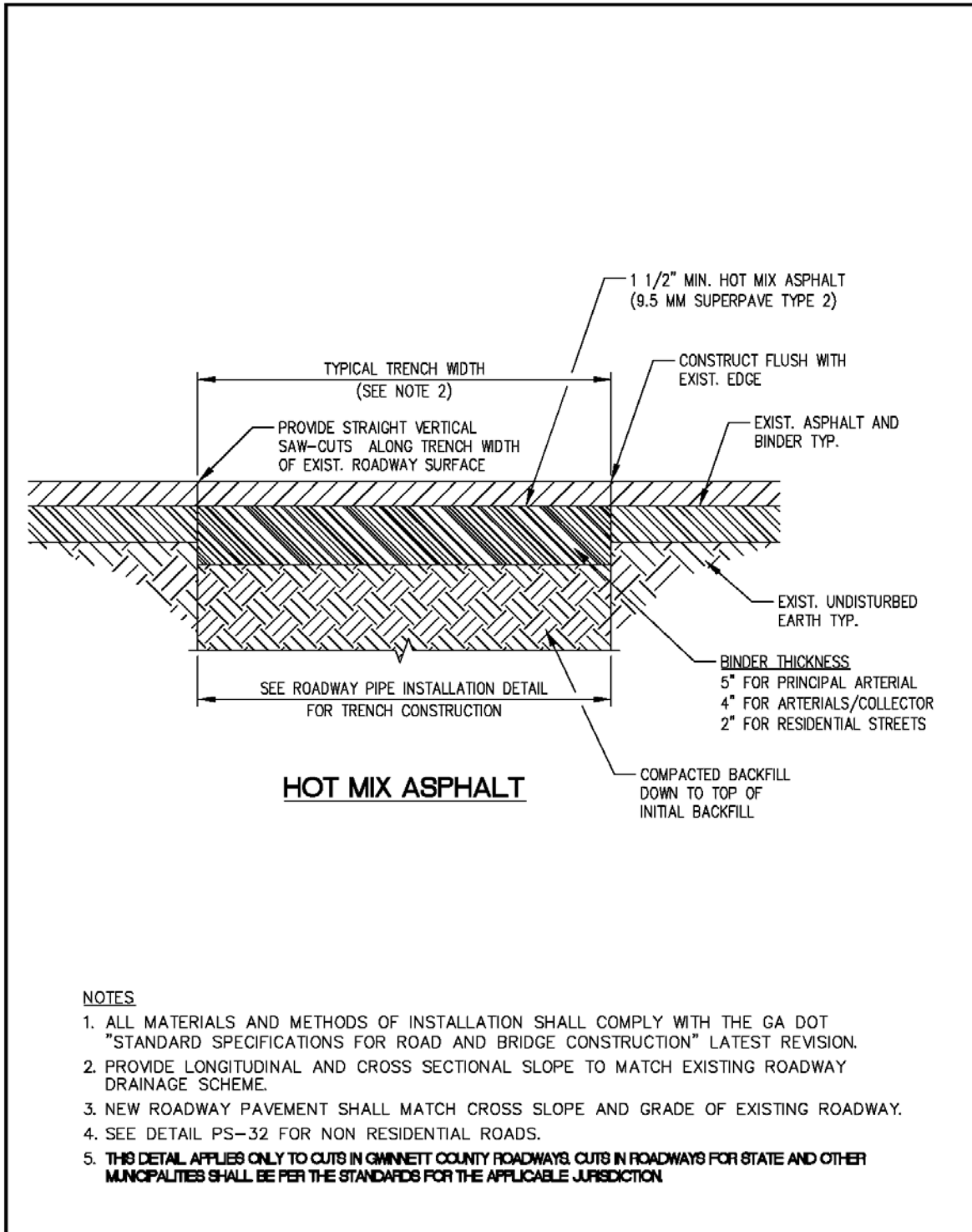


<b>GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES</b>				
JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO. BY	DATE
PUMP STATION STANDARD DRAWING	TYPICAL ROADWAY CUT REPAIRS	CKD BY:		
	GWINNETT COUNTY ROADS	APPD. BY:		
	DETAIL NO. PS-32	DATE: 12/01/11		
		FILE NO:	SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix**

**Standard Details**



**NOTES**

1. ALL MATERIALS AND METHODS OF INSTALLATION SHALL COMPLY WITH THE GA DOT "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" LATEST REVISION.
2. PROVIDE LONGITUDINAL AND CROSS SECTIONAL SLOPE TO MATCH EXISTING ROADWAY DRAINAGE SCHEME.
3. NEW ROADWAY PAVEMENT SHALL MATCH CROSS SLOPE AND GRADE OF EXISTING ROADWAY.
4. SEE DETAIL PS-32 FOR NON RESIDENTIAL ROADS.
5. **THIS DETAIL APPLIES ONLY TO CUTS IN GWINNETT COUNTY ROADWAYS. CUTS IN ROADWAYS FOR STATE AND OTHER MUNICIPALITIES SHALL BE PER THE STANDARDS FOR THE APPLICABLE JURISDICTION**

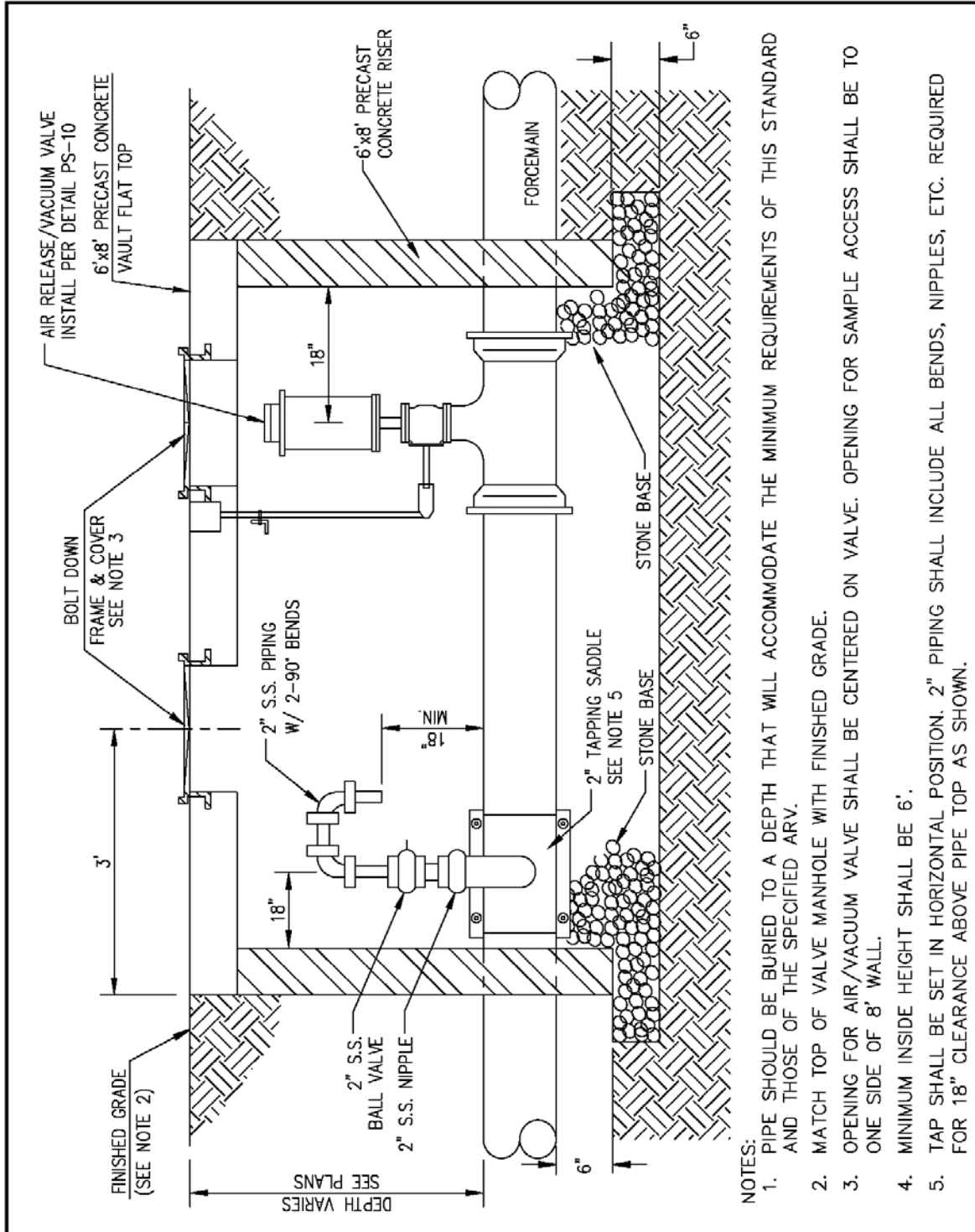
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE  PUMP STATION STANDARD DRAWING	SHEET TITLE TYPICAL ROADWAY CUT REPAIRS GWINNETT COUNTY ROADS  DETAIL NO. PS-33	DRN. BY:	REV. NO.	BY	DATE
		CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
		FILE NO:		SCALE: N.T.S.	

**Gwinnett County Department of Water Resources  
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**Appendix**

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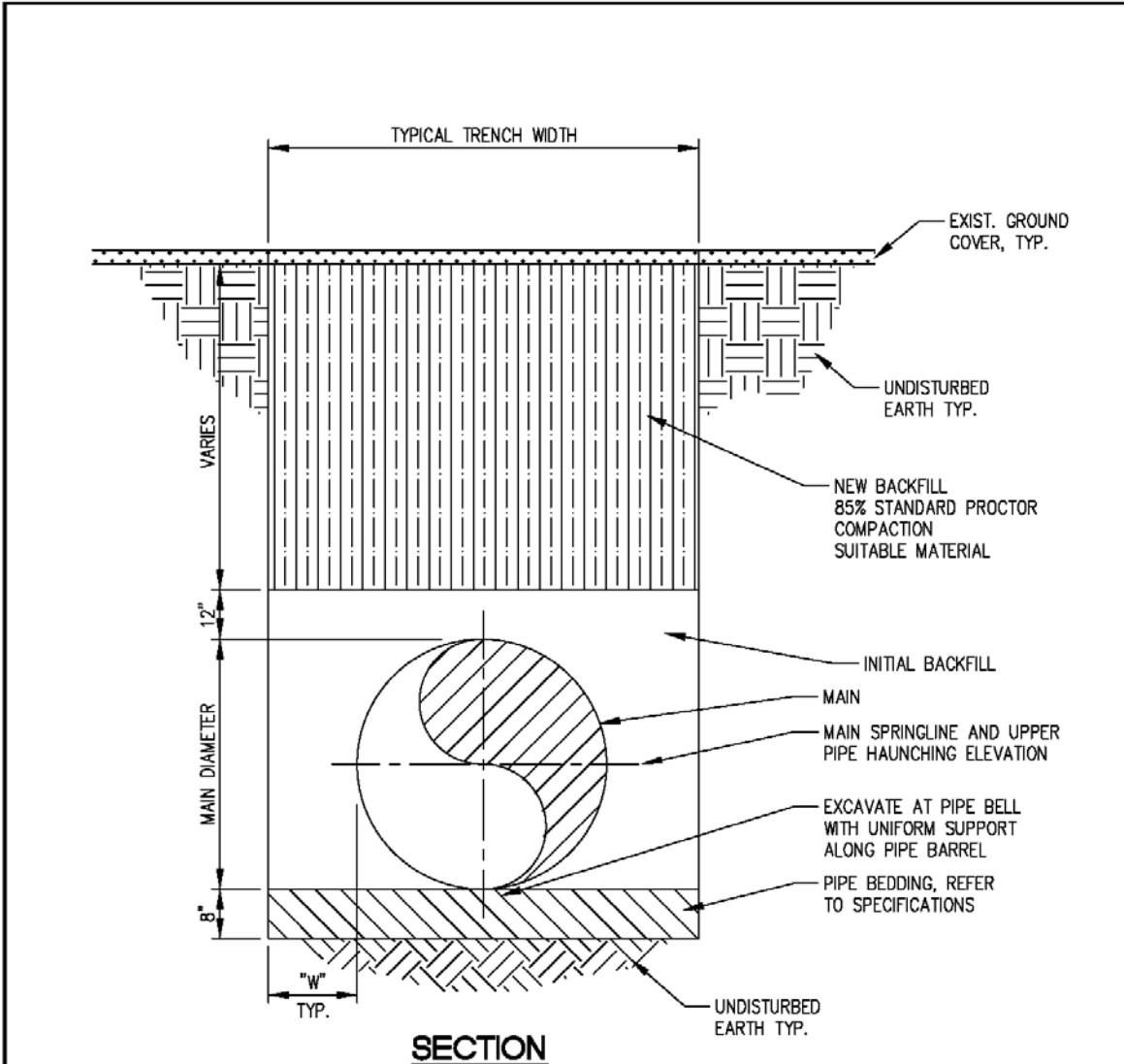
**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	COMBINATION SAMPLING AND AIR RELIEF VALVE VAULT	CKD BY:			
		APPD. BY:			
		DATE: 12-01-11			
DETAIL NO. PS-34		FILE NO:	SCALE: N.T.S.		

**Gwinnett County Department of Water Resources  
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Appendix

Standard Details



**SECTION**

MAIN DIAMETER (INCHES)	4	6	8	10	12	16	24	30	36	42	48
"W" (INCHES)	12	12	12	13	13	14	16	18	20	24	24

**NOTES**

1. ALL MATERIALS AND METHODS OF INSTALLATION SHALL COMPLY WITH THE GA DOT "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" LATEST REVISION.
2. NEW GROUND COVER SHALL PROVIDE FOR DRAINAGE TO FOLLOW NATURAL FLOW OF WATER.

**GWINNETT COUNTY DEPARTMENT OF WATER RESOURCES**

JOB TITLE	SHEET TITLE	DRN. BY:	REV. NO.	BY	DATE
PUMP STATION STANDARD DRAWING	OUTSIDE OF ROADWAY CUTS BEDDING AND BACKFILL	CKD BY:			
		APPD. BY:			
		DATE: 12/01/11			
	DETAIL NO. PS-35	FILE NO:	SCALE: N.T.S.		

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix B Gwinnett County Gravity Sewer Design Flow Calculation Guidelines**

Unit Wastewater Contributions from Proposed Land Use (Any major deviations from the following guidelines should be so noted and substantiated by the Engineer in the project report.)	Average Annual Daily Residential & Commercial Flow Amount in Gallons per day (GPD) (See note #3)	Per Unit	Reference
Airport	25	Employee	#1
Airport - food service not included	25	Employee	#1, #2
Airport - food service not included	5	Passenger	#2
Apartment - one bedrooms	200	Unit	#2
Apartment - two bedrooms	300	Unit	#2
Apartment - three bedrooms	400	Unit	#2
Auditorium, Convention Center, Assembly Hall - food service not included	10	Person, max. cap.	#1, #2
Bar, Tavern, Cocktail Lounge - food service not included	50	Seat	#1, #2
Beauty/Barber Shop	333	Wet Chair	#1
Bowling Alley - food service not included	125	Lane	#1, #2
Bowling Alley - food service not included	25	Employee	#2
Campground - overnight	175	Space	#2
Carwash - automatic	166	Bay	#1
Carwash - self-operating	100	Bay	#1
Church	5	Sanctuary Seat	#1
Coin Laundry	400	Machine	#1, #2
Commercial Laundry	640	Machine	#1
Country Club	250	1,000 sq. ft.	#1
Country Club - food service not included	100	Resident Member	#1, #2
Country Club - food service not included	25	Non-resident	#2
Hospital	200	Bed	#1, #2
Hospital	25	Employee	#2
Industrial - toilet waste and showers	35	Employee	#2
Industrial - toilet waste only	25	Employee	#2
Mobile Home Park - double wide	400	Space	#1
Mobile Home Park - single wide	300	Space	#1, #2
Motel, Hotel - food service not included	100	Unit	#1, #2

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix B Gwinnett County Gravity Sewer Design Flow Calculation Guidelines**

Nursing Home	125	Bed	#1, #2
Nursing Home	25	Employee	#2
Office Medical	500	1,000 sq. ft.	#1
Office Standard - food service not included	175	1,000 sq. ft.	#1, #2
Office - food service not included	25	Employee	#2
Picnic Area, Park	10	Visitor	#2
Picnic Area, Park - with showers	25	Visitor	#2
Police, Fire Station - food service not included	75	Resident Employee	#2
Police, Fire Station - no food service	25	Day Employee	#2
Residence Single Family, Condo, Townhome	400	Unit	#1, #2
Rest Stop, Comfort Station	25	Employee	#2
Rest Stop, Comfort Station	6	Visitor	#2
Restaurant	55	Seat	#2
School	17	Student	#1
School - with gym	21	Student	#1
School - based on average daily attendance (ADA); add 10% for visitors.	25	Teacher, Employee	#2
School, Cafeteria with garbage grinder - based on average daily attendance (ADA); add 10% for visitors.	5	Student	#2
School, Cafeteria - based on average daily attendance (ADA); add 10% for visitors.	4	Student	#2
Service Station	25	Employee	#1, #2
Store, Shopping Center, Retail Only - food service not included	100	1,000 sq. ft.	#1, #2
Swimming Pool	25	Employee	#2
Swimming Pool	20	Swimmer	#2
Theater, Regular - employees included	5	Seat	#1, #2
Warehouse	25	1,000 sq. ft.	#1

References:

- #1 Gwinnett County Department of Water Resources Fee Schedule (As of September 1, 1985. Adopted by Board of Commissioners on August 20, 1985. Note that this fee schedule is not currently used.)
- #2 "A Practical Approach to the Design of Small Sewage Pump Stations", Julian C. Shaw, Smith & Loveless, Inc., 1991.
- #3 Peak Hour Flow (PHF) is calculated using the formulas in Table 10-3 (645x13x.xls) of the Water and Wastewater Master Plan Update, Gwinnett County Department of Public Utilities, July 13, 1998, Disaggregate Factor = 1.00.



**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix C Sanitary Sewer Pump Station Design Data Form**

Sanitary sewer pump station submittals must include this form with ALL indicated information provided. Design formulas, design minimums and given variables are shown below or on reverse, and are to be utilized in providing the required data. In addition to the below, the designer must submit all design information from manufacturer(s) supporting the proposed pumps and electrical equipment.

**Name of Project:** \_\_\_\_\_  
**Name of Developer:** \_\_\_\_\_  
**Name of Engineer:** \_\_\_\_\_  
**Location:** \_\_\_\_\_ **L.L.** \_\_\_\_\_ **Dist.** \_\_\_\_\_

\*\*\*\*\*

**FLOW INFORMATION**

Proposed Flow  
 From Development: 400 GPD (single family residences) x  $\frac{\text{_____}}{\text{(No. of lots)}}$  = \_\_\_\_\_  
 (GPD) (GPD)  
 Design Flow Average: \_\_\_\_\_ / 1440 (minutes per day) = \_\_\_\_\_  
 (GPD) (GPM A)  
 Design Flow Peak: \_\_\_\_\_ x 2.5 (peaking factor) = \_\_\_\_\_  
 (GPD) (GPM P)

Force Main Size: \_\_\_\_\_ inch  
 Design Pump Rate: \_\_\_\_\_ GPM  
 Actual Pump Rate: \_\_\_\_\_ GPM \*  
 Force Main Velocity: \_\_\_\_\_ fps \*\*  
 Force Main Size Total Length: \_\_\_\_\_ ft  
 Force Main Size Hydraulic Length: \_\_\_\_\_ ft \*\*\*  
 Maximum No. of Lots: \_\_\_\_\_ \*\*\*\*\*  
 That Can Be Served  
 Is depth of flow in receiving sewer  
 greater than half of sewer diameter? \_\_\_\_\_ \*\*\*\*\* (Attach Calculations)

- \* Based on duty point of manufacturer system head curve for selected pump model. This number to be used for calculating total dynamic head.
- \*\* As calculated in attached documents. Note - must maintain recommended minimum 2.5 fps scour velocity.
- \*\*\* For force mains where gravity flow exists in some sections prior to the end of the force main.
- \*\*\*\* Based on rate of flow of selected pump model (i.e. - Actual Pump Rate).
- \*\*\*\*\* Based on Actual Pump Rate. Do not include existing flows in calculations. Coordinate with GCDWR if depth of flow is greater than half of sewer diameter.

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix C**

**Sanitary Sewer Pump Station Design Data Form**

**TOTAL DYNAMIC HEAD INFORMATION**

**Static Discharge Head:**                       $\frac{\text{High-point Elev.}}{\text{Centerline Pump Elev.}} - \frac{\text{Centerline Pump Elev.}}{\text{Centerline Pump Elev.}} = \frac{\text{SDH}}{\text{Centerline Pump Elev.}}$  ft

**Static Suction Head:**                       $\frac{\text{Centerline Pump Elev.}}{\text{Centerline Pump Elev.}} - \frac{\text{Pump-Off Elev.}}{\text{Centerline Pump Elev.}} = \frac{\text{SSH}}{\text{Centerline Pump Elev.}}$  ft

**Station Loss:**                       $\frac{\text{SL}}{\text{Centerline Pump Elev.}}$  ft (From Manufacturer)

**Wetwell Piping Loss:**

Wetwell Piping Loss includes frictional losses in all suction and discharge piping located inside the wetwell to Station 0.00 of the forcemain.

Suction Pipe Diam:                      \_\_\_\_\_ inch

Suction Pipe Length:                      \_\_\_\_\_ ft

Suction Pipe Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Total Suction Pipe Fittings Eq. Length = \_\_\_\_\_ ft

**Suction Pipe Friction Loss** =  $\left( \frac{\text{Pipe Length}}{\text{Pipe Length}} + \frac{\text{Fittings Eq. Length}}{\text{Fittings Eq. Length}} \right) \times \frac{\text{C-Value Mult. (From Chart)}}{\text{C-Value Mult. (From Chart)}} \times \frac{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100$

=  $\frac{\text{SPFL}}{\text{Centerline Pump Elev.}}$  ft

Wetwell Discharge Pipe Diam:                      \_\_\_\_\_ inch

Wetwell Discharge Pipe Length:                      \_\_\_\_\_ ft

Wetwell Discharge Pipe Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Total Wetwell Discharge Pipe Fittings Eq. Length = \_\_\_\_\_ ft

**Gwinnett County Department of Water Resources  
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**Appendix C**

**Sanitary Sewer Pump Station Design Data Form**

$$\begin{aligned} \text{Wetwell Discharge Pipe Friction Loss} &= \left( \frac{\text{Pipe Length}}{\text{Pipe Length}} + \frac{\text{Fittings}}{\text{Eq. Length}} \right) \times \frac{\text{C-Value Mult.}}{\text{C-Value Mult. (From Chart)}} \times \frac{\text{Fric. Loss}}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100 \\ &= \frac{\text{WDFL}}{\text{WDFL}} \text{ ft} \end{aligned}$$

$$\text{Total Wetwell Loss} = \frac{\text{SSH}}{\text{SSH}} + \frac{\text{SPFL}}{\text{SPFL}} + \frac{\text{WDFL}}{\text{WDFL}} = \frac{\text{TWL}}{\text{TWL}} \text{ ft}$$

**Force Main Loss:**

Forcemain Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

$$\text{Total Forcemain Fittings Eq. Length} = \text{_____} \text{ ft}$$

**Force Main Design Length\*** \_\_\_\_\_ ft

\* The force main design length is either the total length of the force main or the hydraulic length of the force main. The hydraulic length may apply if there is an intermediate high point in the system.

$$\begin{aligned} \text{Total Force Main Loss} &= \left( \frac{\text{Forcemain Length}}{\text{Forcemain Length}} \text{ ft} + \frac{\text{Fittings}}{\text{Eq. Length}} \right) \times \frac{\text{C-Value Mult.}}{\text{C-Value Mult. (From Chart)}} \times \frac{\text{Fric. Loss}}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100 \\ &= \frac{\text{TFML}}{\text{TFML}} \end{aligned}$$

$$\begin{aligned} \text{Total Dynamic Head} &= \frac{\text{SDH}}{\text{SDH}} + \frac{\text{SL}}{\text{SL}} + \frac{\text{TFML}}{\text{TFML}} + \frac{\text{TWL}}{\text{TWL}} \\ &= \frac{\text{TDH}}{\text{TDH}} \end{aligned}$$

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix C**

**Sanitary Sewer Pump Station Design Data Form**

**WETWELL VOLUME/SIZE INFORMATION**

Wetwell Diam. = \_\_\_\_\_ gal/v.f. = \_\_\_\_\_

$$\begin{aligned} \text{Min. Wetwell Volume} &= \frac{\text{TBSS}}{\text{Qp}} \times \frac{\text{Qp}}{(\text{Qs} - \text{Qp})} \div \frac{\text{Qs}}{\text{Vp}} \\ &= \frac{\text{TBSS}}{\text{Vp}} \text{ gal.} \end{aligned}$$

- Where:
- Vp = Volume of Wetwell from Pump On to Pump Off
  - BSS = Time Between Successive Starts (Use 10 min. minimum)
  - Qp = 50% (Worst Case) of Peak Flow (GPM Peak)
  - Qs = Actual Pump Rate (GPM)

Using the above listed wetwell size minimums, divide Vp by gal/v.f. and round up to the larger 1-foot increment. This is the minimum distance in the wetwell between "Pump On" and "Pump Off". Use this figure in establishing wetwell depth and elevations as below.

$$\text{Minimum Distance Between "Pump On" and "Pump Off"} = \frac{\text{Vp}}{\text{gal/v.f.}} = \frac{\text{ft}}{\text{(Rounded up)}}$$

**Gwinnett County Department of Water Resources  
Developer Pump Station Standards**

**Appendix C**

**Sanitary Sewer Pump Station Design Data Form**

**PUMP STATION ELEVATION & EMERGENCY STORAGE INFORMATION**

Top of Wetwell: \_\_\_\_\_ ft

Lowest Overflow Elevation: \_\_\_\_\_ ft

Inlet Pipe Invert: \_\_\_\_\_ ft (minimum of 2 feet below "Top of Wetwell" or "Lowest Overflow Elevation")

High Level Alarm: \_\_\_\_\_ ft

Lag Pump On: \_\_\_\_\_ ft ("High Level Alarm" - 1 ft min.)

Lead Pump On: \_\_\_\_\_ ft ("Lag Pump On" - 1 ft min.)

Pumps Off: \_\_\_\_\_ ft ("Lead Pump On" - Minimum Distance Between "Pump On" and "Pump Off")

Pump Suction: \_\_\_\_\_ ft ("Pumps Off" - manufacturer minimum)

Bottom of Wetwell: \_\_\_\_\_ ft ("Pump Suction" - manufacturer minimum)

Required Emergency Storage: \_\_\_\_\_ gal (minimum of 3 hours at Design Flow Average)

Calculate the volume of emergency storage available in the wetwell. This is equal to the distance between the Top of Wetwell or Lowest Overflow Elevation (whichever is less) and the High Level Alarm elevation multiplied by the gal/v.f.

**Emergency Storage Available in Wetwell** =  $\left( \frac{\text{_____}}{V_p} - \frac{\text{_____}}{\text{High Level Alarm}} \right) \times \frac{\text{_____}}{\text{gal/v.f.}} = \text{_____ gal}$

Does wetwell by itself provide the minimum Required Emergency Storage?

Yes \_\_\_\_\_ No \_\_\_\_\_

If not, describe how the minimum Required Emergency Storage will be provided. Include all relevant calculations:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**Appendix C**

**Sanitary Sewer Pump Station Design Data Form**

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DEPTH OF FLOW CHECK

From Mannings Equation:

Pipe Shape: \_\_\_\_\_  
Pipe Diameter: \_\_\_\_\_ in  
Flowrate: \_\_\_\_\_ gpm  
Minimum Slope: \_\_\_\_\_ ft/ft  
Manning's n: \_\_\_\_\_  
Full Flow X-Sectional Area: \_\_\_\_\_ s.f.  
Wetted Area: \_\_\_\_\_ s.f.  
Wetted Perimeter: \_\_\_\_\_ in  
Full Flow Perimeter: \_\_\_\_\_ in  
Hydraulic Radius: \_\_\_\_\_ in  
Percent Full: \_\_\_\_\_ %  
Depth of Flow: \_\_\_\_\_ in

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Appendix D

Sanitary Sewer Pump Station Design Data Example

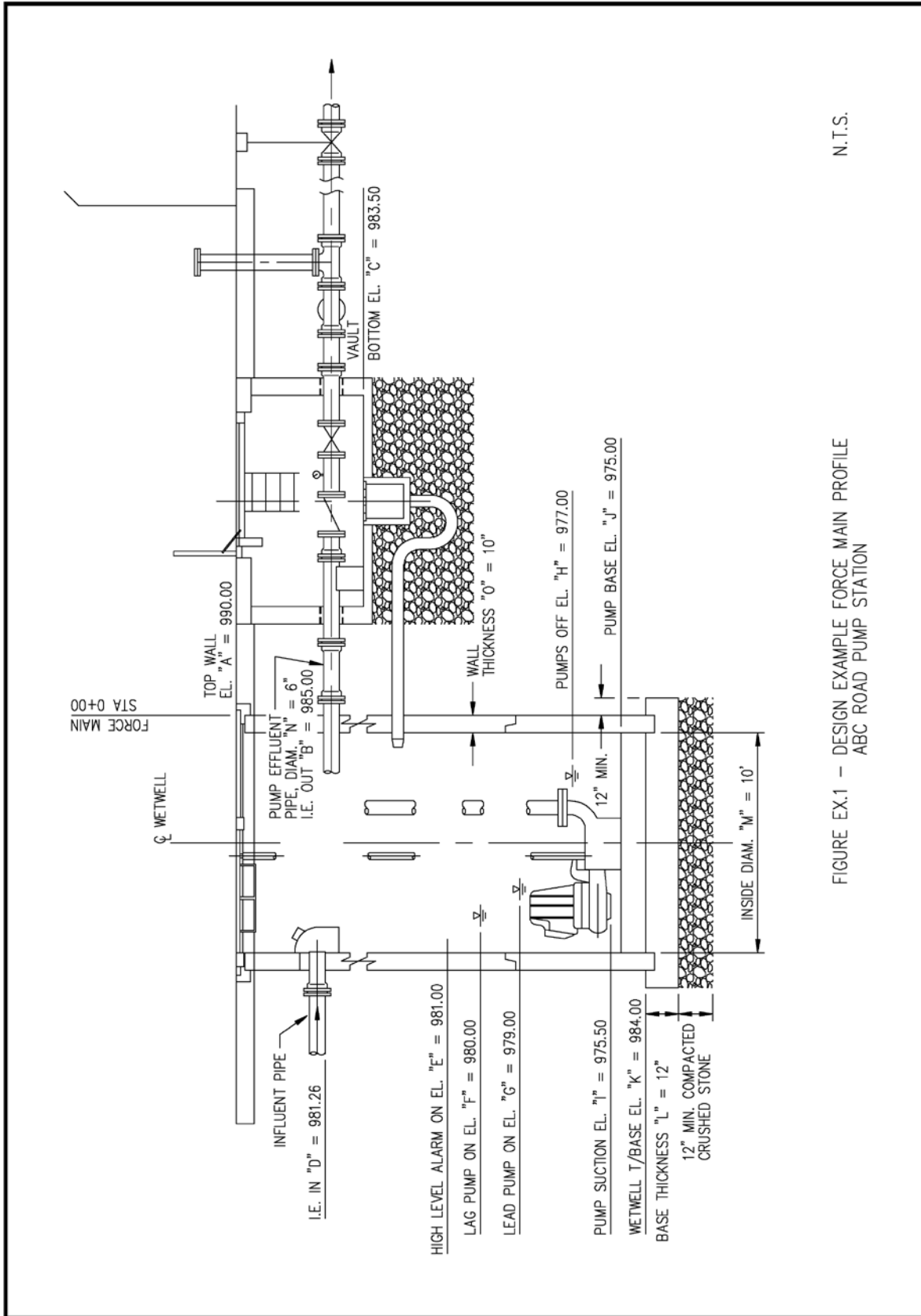


FIGURE EX.1 - DESIGN EXAMPLE FORCE MAIN PROFILE  
 ABC ROAD PUMP STATION

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Appendix D

Sanitary Sewer Pump Station Design Data Example

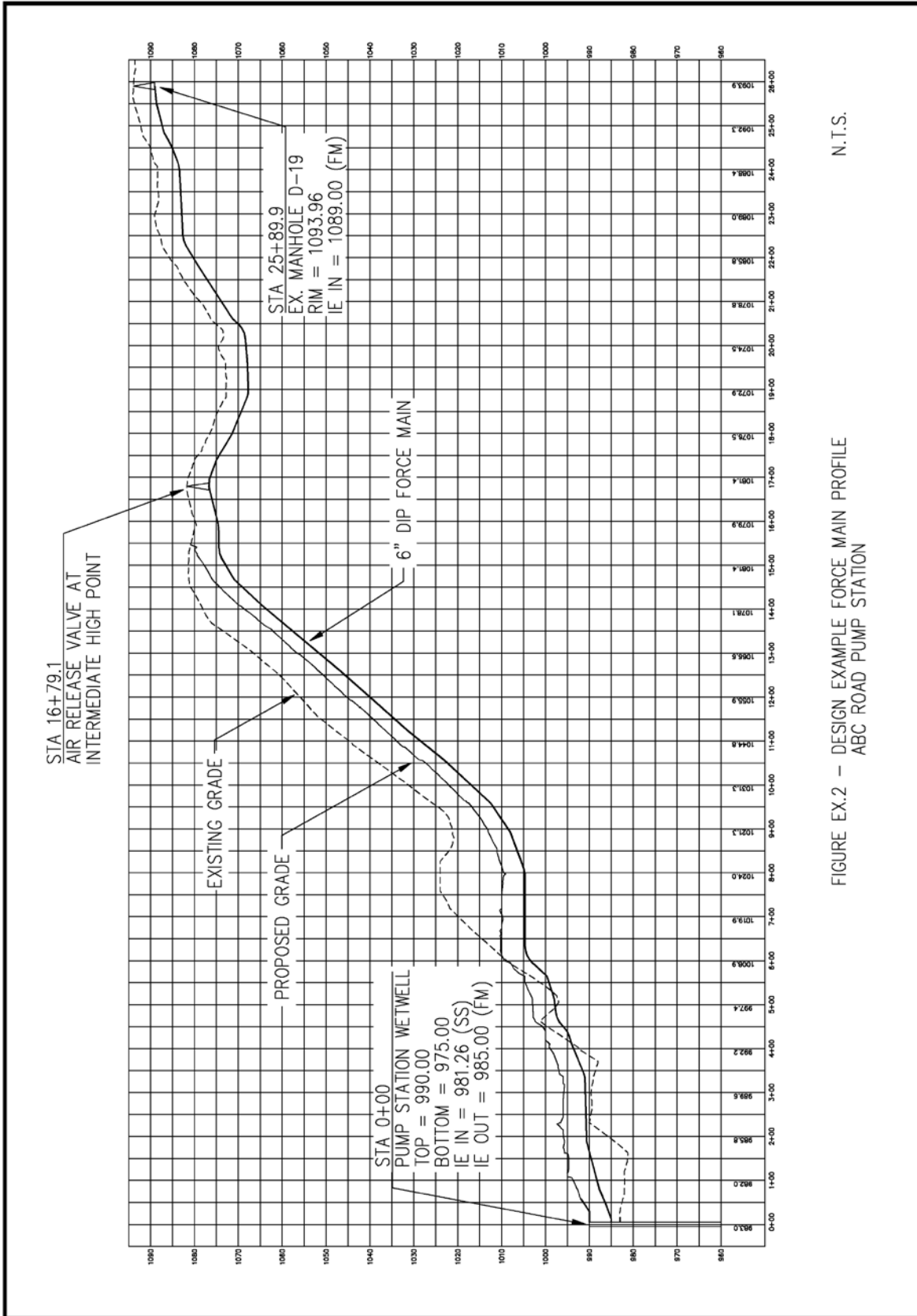


FIGURE EX.2 - DESIGN EXAMPLE FORCE MAIN PROFILE  
 ABC ROAD PUMP STATION



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**Appendix D Sanitary Sewer Pump Station Design Data Example**

Sanitary sewer pump station submittals must include this form with ALL indicated information provided. Design formulas, design minimums and given variables are shown below or on reverse, and are to be utilized in providing the required data. In addition to the below, the designer must submit all design information from manufacturer(s) supporting the proposed pumps and electrical equipment.

**Name of Project:** ABC Road Pump Station  
**Name of Developer:** John Q. Jones and Associates  
**Name of Engineer:** Acme Engineering, Inc.  
**Location:** ABC Road **L.L.** 237 **Dist.** 5th

\*\*\*\*\*

**FLOW INFORMATION**

Proposed Flow  
 From Development: 400 GPD (single family residences) x  $\frac{530}{\text{(No. of lots)}}$  = **212,000**  
(GPD)

Design Flow Average:  $\frac{212,000}{\text{(GPD)}}$  / 1440 (minutes per day) = **147.2**  
(GPM A)

Design Flow Peak:  $\frac{147.2}{\text{(GPD)}}$  x 2.5 (peaking factor) = **368.1**  
(GPM P)

Force Main Size: **6 (nom)** inch  
 Design Pump Rate: **368.1** GPM  
 Actual Pump Rate: **385.0** GPM \*  
 Force Main Velocity: **4.37** fps \*\*  
 Force Main Size Total Length: **2,589.9** ft  
 Force Main Size Hydraulic Length: **N/A** ft \*\*\*  
 Maximum No. of Lots: **554** \*\*\*\*  
 That Can Be Served  
 Is depth of flow in receiving sewer  
 greater than half of sewer diameter? **No** \*\*\*\*\* (Attach Calculations)

- \* Based on duty point of manufacturer system head curve for selected pump model. This number to be used for calculating total dynamic head.
- \*\* As calculated in attached documents. Note - must maintain recommended minimum 2.5 fps scour velocity.
- \*\*\* For force mains where gravity flow exists in some sections prior to the end of the force main.
- \*\*\*\* Based on rate of flow of selected pump model (i.e. - Actual Pump Rate).
- \*\*\*\*\* Based on Actual Pump Rate. Do not include existing flows in calculations. Coordinate with GCDWR if depth of flow is greater than half of sewer diameter.

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**Sanitary Sewer Pump Station Design Data Example**

**TOTAL DYNAMIC HEAD INFORMATION**

**Static Discharge Head:**       $\frac{1089.00}{\text{High-point Elev.}} - \frac{975.50}{\text{Centerline Pump Elev.}} = \frac{113.5}{\text{SDH}}$  ft

**Static Suction Head:**       $\frac{975.50}{\text{Centerline Pump Elev.}} - \frac{977.00}{\text{Pump-Off Elev.}} = \frac{-1.5}{\text{SSH}}$  ft

**Station Loss:**       $\frac{1.1}{\text{SL}}$  ft (From Manufacturer)

**Wetwell Piping Loss:**

Wetwell Piping Loss includes frictional losses in all suction and discharge piping located inside the wetwell to Station 0.00 of the forcemain.

Suction Pipe Diam:       $\frac{\text{N/A}}{\text{inch}}$

Suction Pipe Length:       $\frac{0}{\text{ft}}$

Suction Pipe Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
6" 90-Deg.	1	6.6	6.6
6" 45-Deg	0	5.3	0.0
6" 22.5-Deg	0	2.0	0.0
Total Suction Pipe Fittings Eq. Length =			<b>6.6</b> ft

**Suction Pipe Friction Loss** =  $\left( \frac{0}{\text{Pipe Length}} + \frac{6.6}{\text{Fittings Eq. Length}} \right) \times \frac{0.715}{\text{C-Value Mult. (From Chart)}} \times \frac{2.07}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100$

=  $\frac{0.1}{\text{SPFL}}$  ft

Wetwell Discharge Pipe Diam:       $\frac{6}{\text{inch}}$

Wetwell Discharge Pipe Length:       $\frac{12}{\text{ft}}$

Wetwell Discharge Pipe Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
6" 90-Deg.	2	6.6	13.2
6" 45-Deg	0	5.3	0.0
6" 22.5-Deg	0	2.0	0.0
Total Wetwell Discharge Pipe Fittings Eq. Length =			<b>13.2</b> ft

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**Sanitary Sewer Pump Station Design Data Example**

$$\begin{aligned} \text{Wetwell Discharge Pipe Friction Loss} &= \left( \frac{12}{\text{Pipe Length}} + \frac{13.2}{\text{Fittings Eq. Length}} \right) \times \frac{0.715}{\text{C-Value Mult. (From Chart)}} \times \frac{2.07}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100 \\ &= \frac{0.4}{\text{WDFL}} \text{ ft} \end{aligned}$$

$$\text{Total Wetwell Loss} = \frac{-1.5}{\text{SSH}} + \frac{0.1}{\text{SPFL}} + \frac{0.4}{\text{WDFL}} = \frac{-1.0}{\text{TWL}} \text{ ft}$$

**Force Main Loss:**

Forcemain Fittings Equivalent Lengths:

Type	Number	Eq. Length	Total Len.
6" 90-Deg.	10	6.6	66
6" 45-Deg.	1	5.3	5.3
6" 22.5-Deg.	1	2.0	2
6" Check Valve	1	33.0	33
6" Gate Valve	0	2.7	0
6" Plug Valve	4	6.0	24
Total Forcemain Fittings Eq. Length =			<b>130.3</b> ft

$$\text{Force Main Design Length}^* = \frac{2,589.9}{\text{ft}}$$

\* The force main design length is either the total length of the force main or the hydraulic length of the force main. The hydraulic length may apply if there is an intermediate high point in the system.

$$\begin{aligned} \text{Total Force Main Loss} &= \left( \frac{2,589.9 \text{ ft}}{\text{Forcemain Length}} + \frac{130.3}{\text{Fittings Eq. Length}} \right) \times \frac{0.715}{\text{C-Value Mult. (From Chart)}} \times \frac{2.07}{\text{Fric. Loss (Calculated from Hazen-Williams Eqn.)}} / 100 \\ &= \frac{40.3 \text{ (ft)}}{\text{TFML}} \end{aligned}$$

$$\begin{aligned} \text{Total Dynamic Head} &= \frac{113.5}{\text{SDH}} + \frac{1.1}{\text{SL}} + \frac{40.3}{\text{TFML}} + \frac{-1.0}{\text{TWL}} \\ &= \frac{153.8}{\text{TDH}} \end{aligned}$$

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**Appendix D**

**Sanitary Sewer Pump Station Design Data Example**

**WETWELL VOLUME/SIZE INFORMATION**

Wetwell Diam. = 10 ft      gal/v.f. = 587

$$\begin{aligned} \text{Min. Wetwell Volume} &= \frac{10}{\text{TBSS}} \times \frac{184.0}{Q_p} \times \frac{201.0}{(Q_s - Q_p)} \div \frac{385}{Q_s} \\ &= \frac{960.6}{V_p} \text{ gal.} \end{aligned}$$

- Where:
- $V_p$  = Volume of Wetwell from Pump On to Pump Off
  - BSS = Time Between Successive Starts (Use 10 min. minimum)
  - $Q_p$  = 50% (Worst Case) of Peak Flow (GPM Peak)
  - $Q_s$  = Actual Pump Rate (GPM)

Using the above listed wetwell size minimums, divide  $V_p$  by gal/v.f. and round up to the larger 1-foot increment. This is the minimum distance in the wetwell between "Pump On" and "Pump Off". Use this figure in establishing wetwell depth and elevations as below.

$$\text{Minimum Distance Between "Pump On" and "Pump Off"} = \frac{960.6}{V_p} \div \frac{587}{\text{gal/v.f.}} = \frac{2}{\text{(Rounded up)}} \text{ ft}$$

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**Sanitary Sewer Pump Station Design Data Example**

**PUMP STATION ELEVATION & EMERGENCY STORAGE INFORMATION**

Top of Wetwell: 990.00 ft  
 Lowest Overflow Elevation: 988.34 ft  
 Inlet Pipe Invert: 981.26 ft (minimum of 2 feet below "Top of Wetwell" or "Lowest Overflow Elevation")  
 High Level Alarm: 981.00 ft  
 Lag Pump On: 980.00 ft ("High Level Alarm" - 1 ft min.)  
 Lead Pump On: 979.00 ft ("Lag Pump On" - 1 ft min.)  
 Pumps Off: 977.00 ft ("Lead Pump On" - Minimum Distance Between "Pump On" and "Pump Off")  
 Pump Suction: 975.50 ft ("Pumps Off" - manufacturer minimum)  
 Bottom of Wetwell: 975.00 ft ("Pump Suction" - manufacturer minimum)  
 Required Emergency Storage: 26,500 gal (minimum of 3 hours at Design Flow Average)

Calculate the volume of emergency storage available in the wetwell. This is equal to the distance between the Top of Wetwell or Lowest Overflow Elevation (whichever is less) and the High Level Alarm elevation multiplied by the gal/v.f.

$$\text{Emergency Storage Available in Wetwell} = \left( \frac{988.34}{V_p} - \frac{981.00}{\text{High Level Alarm}} \right) \times \frac{587}{\text{gal/v.f.}} = \underline{\underline{4,309}} \text{ gal}$$

Does wetwell by itself provide the minimum Required Emergency Storage?

Yes \_\_\_\_\_ No   X  

If not, describe how the minimum Required Emergency Storage will be provided. Include all relevant calculations:

Additional storage will be obtained form 3 10-foot diameter wetwells set above the high level alarm, so that the total volume of available emergency storage is equal to 35,000 gallons. (Additional calculations required)

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**Appendix D**

**Sanitary Sewer Pump Station Design Data Example**

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DEPTH OF FLOW CHECK

From Mannings Equation:

Pipe Shape:	<u>Circular</u>	
Pipe Diameter:	<u>8.00</u>	in
Flowrate:	<u>385.0</u>	gpm
Minimum Slope:	<u>0.0120</u>	ft/ft
Manning's n:	<u>0.0100</u>	
Full Flow X-Sectional Area:	<u>0.3491</u>	s.f.
Wetted Area:	<u>0.1715</u>	s.f.
Wetted Perimeter:	<u>12.4568</u>	in
Full Flow Perimeter:	<u>25.1327</u>	in
Hydraulic Radius:	<u>1.9824</u>	in
Percent Full:	<u>49.3152</u>	%
Depth of Flow:	<u>3.94</u>	in

Depth of Flow 3.94 in < 4.00 in (half of sewer diameter). Therefore **OK**

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**Appendix E Request for Exception/Change to Pump Station Construction Form**

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Date: \_\_\_\_\_

Requested By: \_\_\_\_\_

Company Name: \_\_\_\_\_

Contact Phone Number: \_\_\_\_\_ Fax Number: \_\_\_\_\_

The following exception/change is requested at \_\_\_\_\_  
Pump Station.

Station is: \_\_\_\_\_ New \_\_\_\_\_ Upgrade

Description: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Purpose for change: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Detail Attached: \_\_\_\_\_ Yes \_\_\_\_\_ No

Date of Stamped Plans: \_\_\_\_\_ Station: \_\_\_\_\_ Force Main: \_\_\_\_\_

Page # \_\_\_\_\_ Page # \_\_\_\_\_ Page # \_\_\_\_\_ Page # \_\_\_\_\_

Engineer has been consulted: \_\_\_\_\_ Yes \_\_\_\_\_ No

Engineer's name: \_\_\_\_\_ Contact phone number: \_\_\_\_\_

Date of consult: \_\_\_\_\_

Engineer agrees to show any and all changes on as-builts.

Engineer's Signature: \_\_\_\_\_

Pump Station Trade Manager Initial to request: \_\_\_\_\_

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

Must be signed by the Distribution/Collection Division Director or authorized designee.