

SECTION 5 - DESIGN STANDARDS FOR WATER PUMPING STATIONS

5.1 General Requirements

- 5.1.01 Technical design criteria of water pumping stations shall focus on operational efficiency, corrosion & wear resistance, longevity, reliability, ease of maintenance and redundancy of systems.
- 5.1.02 A detailed engineering report shall be submitted to and approved by the Department prior to design. The report shall fully evaluate the proposed service area and the overall effect upon present and future utility facilities. If the project requires the development of a new source of water supply, the report shall fully evaluate the quality and quantity of water to be made available.
- 5.1.03 The design must conform to the minimum standards set forth in the Commonwealth of Virginia and New Kent County, Department of Public Utilities “Standard Specification and Detail for Construction”. Department requirements for specific equipment and submittals will be detailed during engineering review.
- 5.1.04 All well systems shall be designed and constructed in accordance with Section 9-Standards for Establishing a Groundwater Withdrawal for County Acceptance.
- 5.1.05 All water pumping stations shall be required to be provided with SCADA per Volume I, Section 8 of these standards.
- 5.1.06 All water pumping stations shall be required to be provided with Equipment Specifications and Operation & Maintenance Manuals.

5.2 Technical Design

5.2.01 System Layout

- A. The sizing and configuration of the pumping station and the sizing of the attendant water lines shall be within the parameters set forth in the engineering report. The facilities to be provided shall be based on ultimate flows unless an interim flow design shall have been incorporated in the approved engineering report. Each water pumping station shall be designed to provide raw water in a quantity equivalent to the peak diurnal flow demand, such that the system may operate at full design capacity without storage.
- B. Primary consideration shall be given to reliability & redundancy of water service, as well as operation, maintenance & permitting costs of the water system. Wherever,

possible interconnection of new distribution systems to existing systems with elevated storage shall be considered, and the use of booster pumps & hydropneumatic tanks shall be minimized.

- C. The type of equipment to be installed in the pumping station will be influenced by the interim and ultimate capacity of the station and an evaluation of the period of time that the service of the station will be required.
- D. An ample, all-weather access road, including pavement, storm drainage and parking, as approved by the Director, shall be provided for easy access to the pumping station, generator and well (as applicable). Pavement design shall be full thickness bituminous pavement unless otherwise specified.
- E. The architecture of the structure shall be considered. Site grading, seeding or sodding, trees or shrubs shall be provided to present a finished appearance, as approved by the County, consistent with the zoning and general appearances of the surrounding area. Site drainage shall be constructed to appropriate stormwater structures, and shall be constructed in a fashion that would allow drainage of all tanks at the site without ponding or flooding the site or adjacent properties. Approved fencing with gates shall be provided as deemed necessary to properly protect the facility. Buildings shall be constructed of maintenance free materials (i.e. architectural block, vinyl soffit, brick veneer, or pre-fabricated concrete utility structure) as approved by the Director, and shall comply with local zoning requirements. Ease of access to interior and exterior system components shall be considered. Wells shall be located in an easily accessible area, free of overhead obstructions, on a pitless adapter outside of the pump house.
- F. The Design Engineer shall determine the availability of electric service and coordinate the available electrical service with that required for the facility and coordinate with the Department on its anticipated future electrical needs. The engineer shall also determine the need for primary service extension and advise the Department if an extension is necessary.
- G. All pumping stations shall have a permanently installed emergency generator, in accordance with Volume II, Section 16620.
- H. Adequate provisions shall be incorporated for the proper ventilation, drainage and flood protection in order to insure maximum reliability, electrical and personnel safety.
- I. All water pumping stations and well buildings shall be of sufficient size and contain adequate clearances to provide ample room for maintenance and equipment replacement. All piping shall have a minimum clearance of 18 inches from finished floor, and 24 inches from finished walls.
- J. All tanks shall be welded steel. No glass lined, bolted, riveted or concrete tanks shall

be acceptable without prior approval from the Director. All tanks coatings shall be Tnemec Company, Inc. Standard 61 Certified, and shall be applied and inspected in accordance with Tnemec's latest version of the *Elevated Storage Tank Coating Specification*.

- K. All above ground interior/exterior or vault piping shall be flanged Class 53 ductile iron, with a Tnemec Series 140 epoxy coating applied as described above for storage tanks. All exterior piping shall be insulated with 2" fiberglass pipe covering with .016 smooth aluminum finish.
- L. Chemical feed systems and chemical storage shall be located in a physically separated facility from the remainder of the pumping station, such that vapors and spills do not represent a hazard to the pumping and control systems. The chemical feed and storage facility shall be separately climate controlled, and adequately ventilated to prevent degradation of the stored chemical. Chemical storage shall be designed to accommodate one (1) week's storage at full operating capacity. Chemical feed pumps must operate off 4-20 milliamp or 24 volt DC signal output, and must be capable of providing the necessary residual concentration based on design output. The entire chemical storage and feed system must be constructed of corrosion-proof, leak-proof components (ie: CPVC, polyethylene, Teflon, etc).
- M. All water pumping stations shall be equipped with lightning protection, transient voltage surge suppression (TVSS) and proper grounding. Grounding test must be performed on all electrical equipment.
- N. All pumps shall be outfitted with a Variable Frequency Drive (VFD), to include:
 - 1. Continuous rated amps equal or greater to the motor's nameplate maximum amps, RPM, voltage, current and slip without having to utilize the service factor of the motor.
 - 2. Output filter as necessary.
 - 3. Output waveform capable of handling maximum motor cable distance of up to 1,000 feet (unshielded) without tripping or derating.
 - 4. User selected programmable ramp up and ramp down features.
 - 5. Features to detect phase loss and phase imbalance on the incoming power.
 - 6. Capability of operating at ambient temperatures of 0°F to 125°F.
 - 7. Proper cooling and ventilation in accordance with the manufacturer's recommendation.
- O. All flow shall be monitored with a Sensus Omni Turbo flow meter sized such that the pumping station design flow falls within the normal operating range. A bypass of equivalent flow capacity shall be provided with a Sensus Mainline Propeller flow meter. Both shall have 4-20 milliamp signal output, and both shall have flanged connections.

5.2.02 Capacity Design

- A. Hydraulic design for water pumping stations shall be based on Sections 4.2.04 and 4.2.05 - "System Design" of these Standards, and shall take into consideration such parameters as average and maximum pumping rates, and fire flow.
- B. Pump selection shall be based on a hydraulic analysis of the required flows.
- C. The hydraulic analysis shall show static head and total dynamic head for both single and multiple pump operation. It shall also show the pump performance curve for both single and multiple pump operation. Where variable speed pumping is contemplated, pump performance curves shall show performance at maximum speed, minimum speed just above static head and several intermediate speeds that will clearly indicate pump operation. If booster pumps must be incorporated, they shall be axial, split-cased, horizontal suction type. Booster pumps shall be capable of operating efficiently at 60 psi, with cutoff head of at least 90 psi.
- D. Consideration must be given to designs which produce minimum power requirements to accomplish the functions required. If requested, supporting data shall be furnished to the Department.

5.2.03 Drawings

- A. Drawings for pumping stations and plan and profiles for water lines shall be prepared in accordance with Section 1.2. - "Drawing Organization and Format."
- B. Drawings and specifications shall be of such quality and contain sufficient details so that no misunderstanding may reasonably arise as to the extent of the work to be performed, the materials to be used, the equipment to be installed or the quality of the workmanship. Manufacturers of major items of equipment shall be specifically approved per Section 2 Approved Materials. No deviation from the approved manufacturers will be permitted.
- C. Drawings for water pumping stations and wells shall include a site plan drawn to a scale of not less than 1" equals 20' and shall contain existing and proposed contours on no greater than a 2' contour interval. The boundaries of the site shall be clearly shown on the site plan and shall be permanently mounted in the field prior to completion of construction.
- D. Drawings for pumping stations shall be drawn on a scale of not less than ¼" equals 1'-0". Drawings required to clarify construction details shall be drawn on an appropriately larger scale.
- E. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia / County Erosion and Sedimentation Control Handbook.

END OF SECTION