DUFFIELD ASSOCIATES
Soil, Water & the Environment

1060 S Governors Avenue, Suite 101
Dover, DE 19904
Phone: 302.674.9280
duffnet.com

March 24, 2025

Duffield Project 11382-CB

Kevin Bronson
Department of Natural Resources
and Environmental Control
Division of Water
89 Kings Highway
Dover, DE 19901

Re: Port St. Georges Subdivision – Pumping Stations Design Narrative Summary

Dear Mr. Bronson:

This letter report outlines the basis of design for the wastewater pumping and conveyance system to serve the proposed Port St. Georges development. The wastewater pumping and conveyance system is generally described below and in more detail in the following sections:

1. The North Pump Station serves the northern portion of the development (i.e., north of Lorewood Grove Road). The North Pump Station will be located on Lot PS-25, at the intersection of Benjamin Street and AFT Alley per the most recent Record Plan submission, dated December 20, 2024, by Duffield Associates. The North Pump Station will discharge through a force main to sanitary manhole 138 of the on-site sanitary sewer system, which flows to the South Pump Station.

2. The South Pump Station receives wastewater flows from the southern portion of the development (i.e., of south Lorewood Grove Road) as well as the pumped flows from the North Pump Station. South Pump Station will be located on Lot PS-26, adjacent to Schooner Street per the most recent Record Plan submission dated December 20, 2024. The South Pump Station will deliver all wastewater flows from the development through a directionally drilled force main across a proposed easement on the Delaware State Lands to an existing easement on the off-site public sewer system located in the Crossland Neighborhood.

The locations of the pumping stations and force mains are shown in the attached Sanitary Sewer Construction Plans. The wastewater pumping and conveyance system will be turned over to New Castle County Department of Special Services (NCCDSS) upon final completion and acceptance.

I. DESIGN STANDARDS

The wastewater pumping and conveyance system will be designed in conformance with the following standards, with NCCDSS standards taking precedence:

A. NCCDSS Sewer Design Policy No. SS 7, May 1, 2012 and last revised April 18, 2024.

B. NCCDSS Sewer Use Design Flows, July 31, 2000 and last revised July 1, 2007.

C. Recommended Standards for Wastewater Facilities ("Ten State Standards"), 2014 edition.

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II. DEVELOPMENT DESIGN FLOWS

Tables 1 and 2 show the breakdown of average daily wastewater flows for each side of the development, based on Record Plan submission dated December 20, 2024, and unit flows from NCCDSS Sewer Use Design Flows guideline. At the time of this writing, the total proposed average daily wastewater flow from the entire development is 197,322 gpd. In a letter dated December 10, 2019, NCCDPW stated that the regional Crossland system has capacity to accept 225,000 gpd average daily flow from the development.

Table 1: Sewer Tabulation – North Side
Pumping Station - A

Description	Unit	Quantity	Unit Flow (gpd/Unit)	Total Flow(gpd)
Single Family (detached)	Each	19	300	5,700
Single Family (attached)	Each	32	250	8,000
Retail	Sq. Ft.	42,374	0.1	4,237
Apartment	Each	257	200	51,400
Clubhouse	Sq. Ft.	7,000	0.1	700
Total North Side Development Flows				70,037

Table 2: Sewer Tabulation – South Side
Pumping Station - B

Description	Unit	Quantity	Unit Flow (gpd/Unit)	Total Flow(gpd)
Single Family (detached)	Each	136	300	40,800
Single Family (attached)	Each	196	250	49,000
Retail	Sq. Ft.	54,918	0.1	5492
Apartment	Each	155	200	31,000
Clubhouse	Sq. Ft.	9,930	0.1	993
Total South Side Development Flows				127,285

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III. PUMPING STATION DESIGN FLOWS

The pumping stations are required to handle peak wastewater flows from the development. Peak flows are determined by multiplying the average flows by a peaking factor of 4.0 per NCCDSS Sewer Design Policy No. SS 7.

- North Peak Flow = 70,037 gpd x 4.0 = 280,150 gpd (195 gpm)
- South Peak Flow = 127,285 gpd x 4.0 + 331,200 gpd (230gpm) = 840,340 gpd (584 gpm)

The design pump flow rate for the North Pump Station will be 230 gpm. The design pump flow rate for the South Pump Station will be 600 gpm, accounting for the peak flow from the South Side development in addition to the pumped flow rate from the North Pump Station.

IV. PUMPING STATION DESIGN

A. Overview

The wastewater pumping stations will be suction lift type – wastewater flowing into a wet well structure is withdrawn by self-priming centrifugal pumps mounted on equipment skids above the top of the wet well. Suction lift stations are the type preferred by NCCDSS. The pumping units and other mechanical equipment, pump isolation valves and check valves, electrical equipment, and pump control panels will be located in a building for accessibility, maintenance, and protection from the outside environment.

The buildings will be a split face block building with a pitched room.

Potable yard hydrants will be provided for both pumping stations for housekeeping purposes.

B. Number of Units

The pumping stations will be equipped with duplex pumping units providing 100% redundancy for peak flow capacity at each station. The duplex pumping units will normally operate automatically on an alternating basis to distribute runtimes between the equipment. Pumping units will be designed for raw wastewater service and be capable of passing a 3-inch spherical solid.

C. Critical Elevations

For the purposes of this letter report, the following reasonable assumptions based on other available design information were used (all elevations are based on NAVD 88 datum):

Table 3: Design Elevations

Pumping Station	Top of Wet Well Elevation (ft.)	Sanitary Sewer Invert Elevation at Wet Well (ft.)
North	34.75	21.98
South	26.67	13.90

D. Pumping Unit Selections

The assumptions stated above were shared with Envirep Inc. who prepared the pump selection report provided in Attachment A for a duplex Gorman-Rupp pump package. The design duty point for the North Pump Station is 230 gpm @ 37.7 feet TDH, based on a 6-inch diameter force main. The recommended pump is an T Series, Model T4A3S-B, 4x4, with 9.75-inch impeller, and 10 HP motor operated at 1160 RPM. Available NPSH and reprime lift capabilities are both well within the manufacturer's recommendations for this pump model. The design duty point flow rate is higher than the NCCDSS required 195-gpm capacity; however, the selected operating condition results in a pump selection, which, provides greater efficiency than other possible, pump selections.

The design duty point for pumping the South Pump Station is 600 gpm @ 42.0 feet TDH, based on a 8-inch diameter force main. The recommended pump is an T Series, Model T6A3S-B, 6x6, with 12.38-inch impeller, and 20 HP motor operated at 1050 RPM. Available NPSH and reprime lift capabilities are both well within the manufacturer's recommendations for this pump model. The design duty point flow rate is higher than the NCCDSS required 584-gpm capacity; however, the selected operating condition results in a pump selection, which, provides greater efficiency than other possible, pump selections.

E. Wet Well Design

The pumping station wet wells will be circular precast concrete manholes. The anticipated wet well diameters (inside dimensions) will be 6 feet for the North Pump Station and 10 feet for the South Pump Station. The wet wells will have sufficient volumes to allow no more than six pump starts per hour in accordance with NCCDSS Sewer Design Policy No. SS 7.

A 6-inch diameter stainless steel inverted-J gravity air vent pipe fitted with stainless steel insect screen will be provided atop the wet wells for passive ventilation.

Aluminum hatches with fall protection grating will be provided for direct access into the wet wells from outside the buildings. There will be no access to the wet wells from within the buildings.

F. Building

The pump station building will be a split face block building with a pitched roof. Exterior dimensions are 16-feet 8-inches wide by 32-feet 8-inches long. The interior space will include the pumps and generator. There will be two points of exterior access via two 6-foot wide double leaf doors. Controls and electrical gear will be located in the pump station building. Ventilation for the building will be designed to meet NFPA 820 requirements.

G. Level Controls

Sensors will be provided to monitor the wet well water levels at each pumping station. The primary level sensor will be an air bubbler as specified in NCCDSS Sewer Design Policy No. SS 7. Float switches will be provided as backups to the primary sensors.

H. Telemetry Systems

The status of the pumping stations will be continuously monitored remotely by the New Castle County SCADA system. Conditions such as pump run, wet well high water level alarm, pump failure, and power outage will be relayed to the County via radio frequency (RF) telemetry systems at each pumping station. A 40-foot Rohn telemetry pole will be installed at each pumping station.

I. Standby Power

Each pumping station will have a diesel generator and automatic transfer switch for backup power. The generator will be located in the pumping station building for aesthetics, noise reduction, and protection from the outside environment. Diesel fuel will be stored in a belly tank under the generator in the building.

J. Emergency Pump Connection

The pumping stations will each have a bypass connection for emergency pumping capability in the event of complete mechanical and electrical failure. A quick disconnect coupling will be provided outside the building for connection to a mobile self-priming trailer pump (e.g., Godwin Dri-Prime).

K. Security

Building intrusion alarms will be relayed to the County SCADA system.

L. Flood Protection

All wastewater pumping station structures, electrical, and mechanical equipment will be above the 100-year floodplain.

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V. Force Main Design

A. Sizing and Velocities

The force mains will be sized to provide a minimum cleansing velocity of 2.5 feet per second within the pipeline at the design pump flow rates in accordance with NCCDSS Sewer Design Policy No. SS 7. Table 4 shows the nominal sizes and velocities of the force mains for the pumping stations.

Table 4: Force Main Sizing and Velocities

Pumping Station	Design Pump Flow Rate (gpm)	PVC DR18 I.D. (inch)	Pipe Velocity (ft./sec)
North	230	6.09	2.53
South	600	7.98	3.85

The total length of the North Pump Station force main will be approximately 1,230 linear feet. The total length of the South Pump Station force main will be approximately 2,035 linear feet.

B. Materials of Construction

The pump discharge headers within the buildings will be ductile iron conforming to AWWA C150 and C151, Thickness Class 52. Outside the pumping station buildings and downstream of the bypass connections, the force mains will transition to AWWA C900 PVC DR 18 (235 psi). All bends below grade will be restrained mechanical joint ductile iron fittings. All force main pipe materials will exceed the minimum 150 psi pressure rating required by NCCDSS Sewer Design Policy No. SS 7.

C. Thrust Restraint

Mechanical joint restraints and concrete thrust blocks will be provided at all buried fittings. Thrust blocks are intended to protect against joint separation and movement of the pipeline within the trench by transferring thrust forces at bends to undisturbed earth.

D. Force Main Markers

The force mains will be installed with direct bury tracer wire and metallic locator tape to facilitate locating the underground pipelines. Soil markers will also be set at regular intervals on the ground surface above the force mains in non-paved areas per NCCDSS requirements.

E. Cleanouts

In-line cleanouts will be provided at 400-foot maximum intervals along the trenched sections of the force mains, and terminal cleanouts will be provided at all bends greater than 30 degrees in accordance with NCCDSS Sewer Design Policy No. SS 7.

F. Receiving Manholes

The North Pump Station will discharge through a force main to sanitary manhole 138 of the on-site sanitary sewer system, which flows to the South Pump Station.

The South Pump Station will discharge through a force main to an existing manhole on the Crosslands Neighborhood development. The existing manhole includes a 10 foot 24" PVC stub which will be used for connection of the force main.

Sincerely,

Duffield Associates Inc.

Ryan K. Minnick, PE
Project Engineer

Attachments
Pump Stations Plans & Calculations

cc: List of ccs

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