

ENGINEERING REPORT
&
TECHNICAL
SPECIFICATIONS

FOR A

**SEWER MAIN EXTENSION
TO SERVE
Britain Woods Residential
Development**

**LITTLE BRITAIN ROAD/NYS ROUTE 207
TOWN/CITY OF NEWBURGH
ORANGE COUNTY, NEW YORK**

PREPARED BY



71 Clinton Street
Montgomery, NY 12549

**September 2023
February 2026**

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1.0 INTRODUCTION

Engineering & Properties, P.C. is pleased to submit this Engineer's Report for a sewer main extension to serve the project known as Britain Woods Residential Development.

The project site encompasses 47.95 acres of land consisting of six tax parcels, identified as Town of Newburgh tax lots 97-1-32.1, 32.2, 32.3, 40.1 and City of Newburgh tax lots 41-1-2 & 3. The proposed project includes the construction of 11 multi-family residential apartment buildings, a clubhouse with a pool, and a pool equipment storage/dog wash/restroom structure. Private roadways will be constructed to provide access to the development from Little Britain Road/NYS Route 207. All buildings will be served by new off-site Town water and sewer main extensions that will be installed by the project sponsor.

The project is located adjacent to the Town of Newburgh's Crossroads Sewer District. The Applicant will file a request with the Town to become an outside sewer district user. During construction of the project the project owner will install a public sewer force main extension approximately 5,741 linear feet in length within the Little Britain Road/NYS Route 207, Unity Place and Old Little Britain Road rights-of-way from the proposed southwestern corner of the project site to an existing sewer forcemain manhole located on Unity Place about 1,100 feet north of its intersection with Old Little Britain Road approximately 4,400 feet to the west of the site. The sewer force main proposed within the public right-of-way from the sites entrance to Unity Place is proposed to be owned and maintained by the Town of Newburgh and all on-site sewer system improvements will be installed and privately owned and operated by the property owner.

2.0 SITE DESCRIPTION

The proposed project site is located in the Town and City of Newburgh, Orange County, New York as shown on the Project Location Map in Appendix A. The 47.95 acres project site is located on the north side of Little Britain Road/NYS Route 207 between Old Little Britain Road to the west and Wisner Avenue to the east.

The site will have two entrances from Little Britain Road/NYS Route 207 on either side of the project site. The development is across NYS Route 207 from the Laborers' International Union Local 17 Training Academy to the south. To the east are numerous commercial and industrial uses and to the north and west are residential communities.

Seven of the proposed multi-family residential buildings will be two-stories in height with 22 apartment units consisting of 10 one-bedroom units and 12 two-bedroom units. Four buildings will have three-stories with "walk-out" ground floors and 26 apartment units consisting of 10 one-bedroom units and 16 two-bedroom units. In all, there will be a total of 110 one-bedroom units and 148 two-bedroom units, for a combined total of 258 apartments and 406 bedrooms. The site will also have a clubhouse with pool, private access roads and private water and sewer infrastructure that will be served by public main extension to the site.

3.0 EXISTING SEWER SYSTEM DESCRIPTION

The Project Site is located adjacent to the Town of Newburgh's Crossroads Sewer District. The Crossroads Sewer District conveys sewerage to the City of Newburgh wastewater collection and treatment facilities. The City's sewage treatment plant is located at 2 Renwick Street, Newburgh, New York. The wastewater treatment facility operates under NYSDEC Permit #NY0026310 and discharges treated effluent into the Hudson River.

Other than an assumed existing subsurface disposal system for the demolished on-site residence, there are no other known wastewater disposal facilities located on the site. The existing system will be abandoned.

The nearest existing municipal sewer main is located within NYS Route 207 near the southeasterly corner of the Site and is operated by the City of Newburgh. This sanitary sewer extends in an easterly direction into the City of Newburgh to a manhole at the intersection of Route 207 and Corwin Court. Additionally, the City of Newburgh has a sewer main that traverses the Site through an existing 20-foot wide utility easement that runs parallel to NYS Route 207 at a depth of 4 feet. The nearest municipal sewer main, operated by the Town of Newburgh, is located within Unity Place, 4,400-feet west of the Site.

Based on information in the Town's 2005 Comprehensive Plan Update, the Town provides sewer service to approximately 3,200 customers in ten separate sewer districts. In the early 1980's, the Town entered into an intermunicipal agreement with the City of Newburgh to treat 2.0 million gallons per day (MGD) of wastewater at the City of Newburgh Wastewater Treatment Facility. The agreement provided the Town access to the City's wastewater treatment system and a 2.0 MGD addition to the City sewer plant was constructed, expanding the system capacity from 2.0 to 4.0 MGD. Under the current sewer agreement between the Town and City of Newburgh, the Town has a permitted capacity of 3.8 MGD of the treatment facility's total capacity. The current sewage flows from the Town to the City is 1.4 MGD in dry periods and 2.0 MGD in wet periods, leaving an available capacity for the Town of 1.80 MGD.

4.0 PROPOSED SEWER SYSTEM

4.1 PROPOSED WASTEWATER FLOWS

Based on accepted industry standards, a bedroom count of 406 and a proposed demand of 110 gallons per day per bedroom and the additional usage for the clubhouse amenities, the proposed wastewater flow for this

project has been calculated in Table 1. The total wastewater demand for the project is expected to be 47,932 gallons per day (GPD) or 33.28 gallons per minute (GPM) and peak hourly flow for the project is 133.12 GPM or 4.0 times the average daily demand. As the Town's available capacity in the City treatment plant is slightly over 1,800,000 GPD, there is sufficient capacity to meet the project's needs.

Table 1 – Estimated Sewer Demand			
Type of Use	# of Units	Demand Rate (gpd)	Average Daily Demand (gpd)
Apartments			
1-bedroom	110 units	110	12,100
2-bedroom	148 units	220	32,560
Clubhouse			
Lounge & Multi-Purpose Room (Banquet Hall use)	86 seats	10	860
Office	2 Employees	15	30
Fitness Center (Health Club use)	60 People	20	1,200
Swimming Pool	150 Swimmers	10	1,500
Dog Wash	1 Station	500	500
20% Reduction for water saving fixtures			-818
Total Demand:			47,932

4.2 PROPOSED PROJECT COLLECTION SYSTEM

Wastewater from the project will be collected in a proposed gravity sewer main system within the proposed development consisting of sanitary manholes, 8" PVC SDR-35 & C-900 gravity sewer mains, which will meet or exceed minimum slope requirements. A total of 23 gravity sewer manholes, 3,726 linear feet of 8" diameter gravity sewer main, 489 linear feet of 6" diameter sewer services and 75 linear feet of 4" diameter sewer services are proposed to collect the wastewater and route it to the

proposed onsite pump station. The effluent collected at the sewer pump station will be pumped through a total of $\pm 7,994$ feet of a 6" PVC SDR-21 sewer force main to an existing manhole installed in the existing wastewater collection system within the Unity Place right-of-way.

The proposed on-site sewer pump station will consist of a concrete wet well which will store the wastewater between pump run cycles (approximately every 30 min). This wastewater will be ejected from the station by a Smith & Loveless factory built automatic pumping station. The pump station will have two – 10.0 horsepower pumps that will be capable of pumping 176 GPM against a total dynamic head of 135.7 ft. This exceeds the required peak flow of 132 GPM and the minimum flow of 176 GPM necessary to attain the required minimum scour velocity in the force-main (see Pump Station Hydraulic Calculations in Appendix B). Discharge pressures at the pump station will range from a high of + 49 psi when the pump is running to a low of + 22 psi when pumps are off. The pump station is not large enough to be able to provide 24 hours of wastewater storage for the entire project therefore, a gas-powered electrical stand-by generator will be installed to provide emergency backup electrical power to operate the sewer pump station in the event of a power interruption.

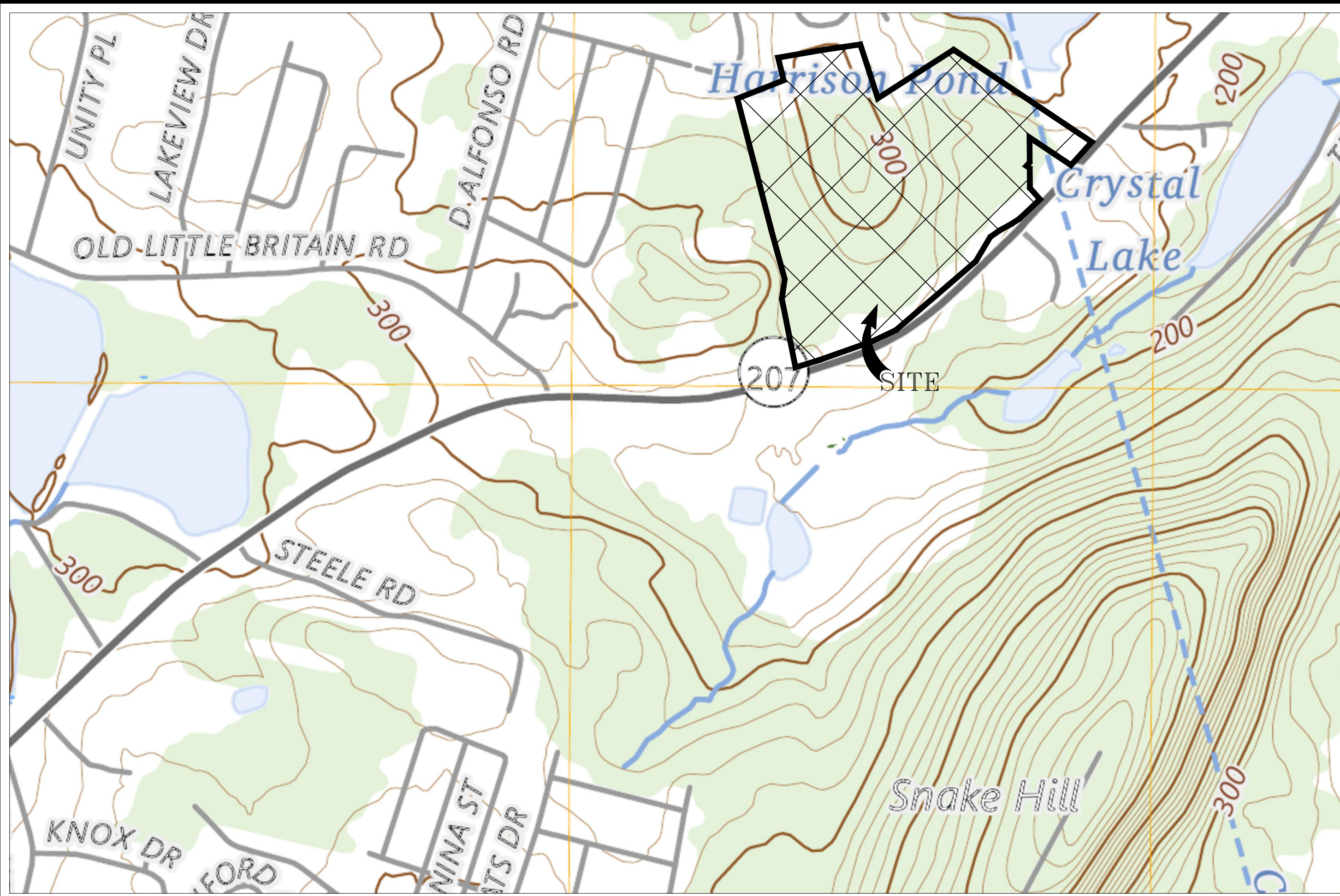
All new sewer mains will be designed and constructed in accordance with the Technical Specifications found in Appendix C, as well as all Town of Newburgh and New York State Department of Environmental Conservation requirements. All improvements will be constructed on lands controlled by the applicant and will be maintained by the project sponsor, except for the public sewer main extension from the sewer main in Unity Place to the site entrance which will be dedicated to the Town of Newburgh.

5.0 CONCLUSION

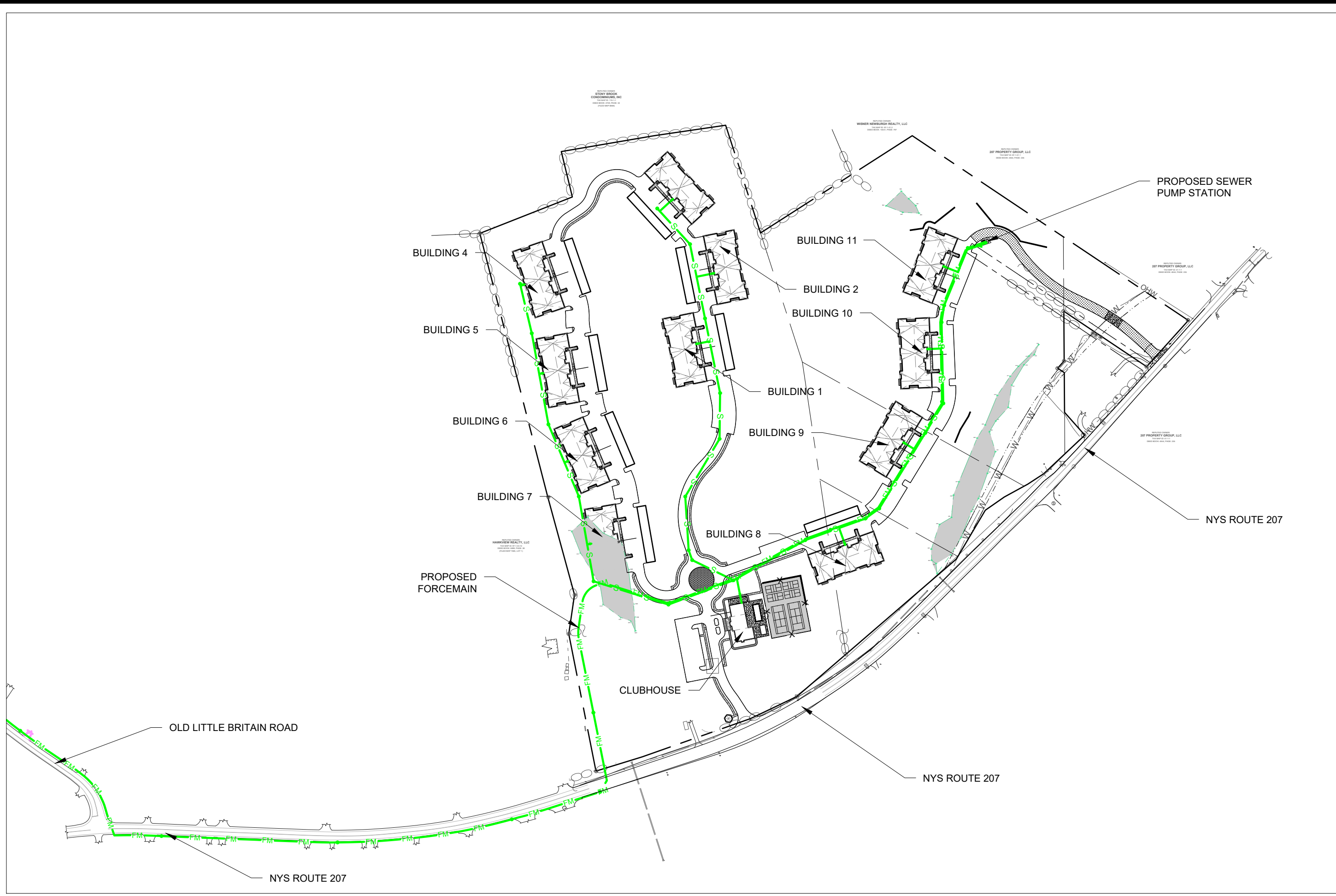
As proposed and described in this report, the proposed sewage collection system will meet or exceed all local and state design requirements.

APPENDIX A

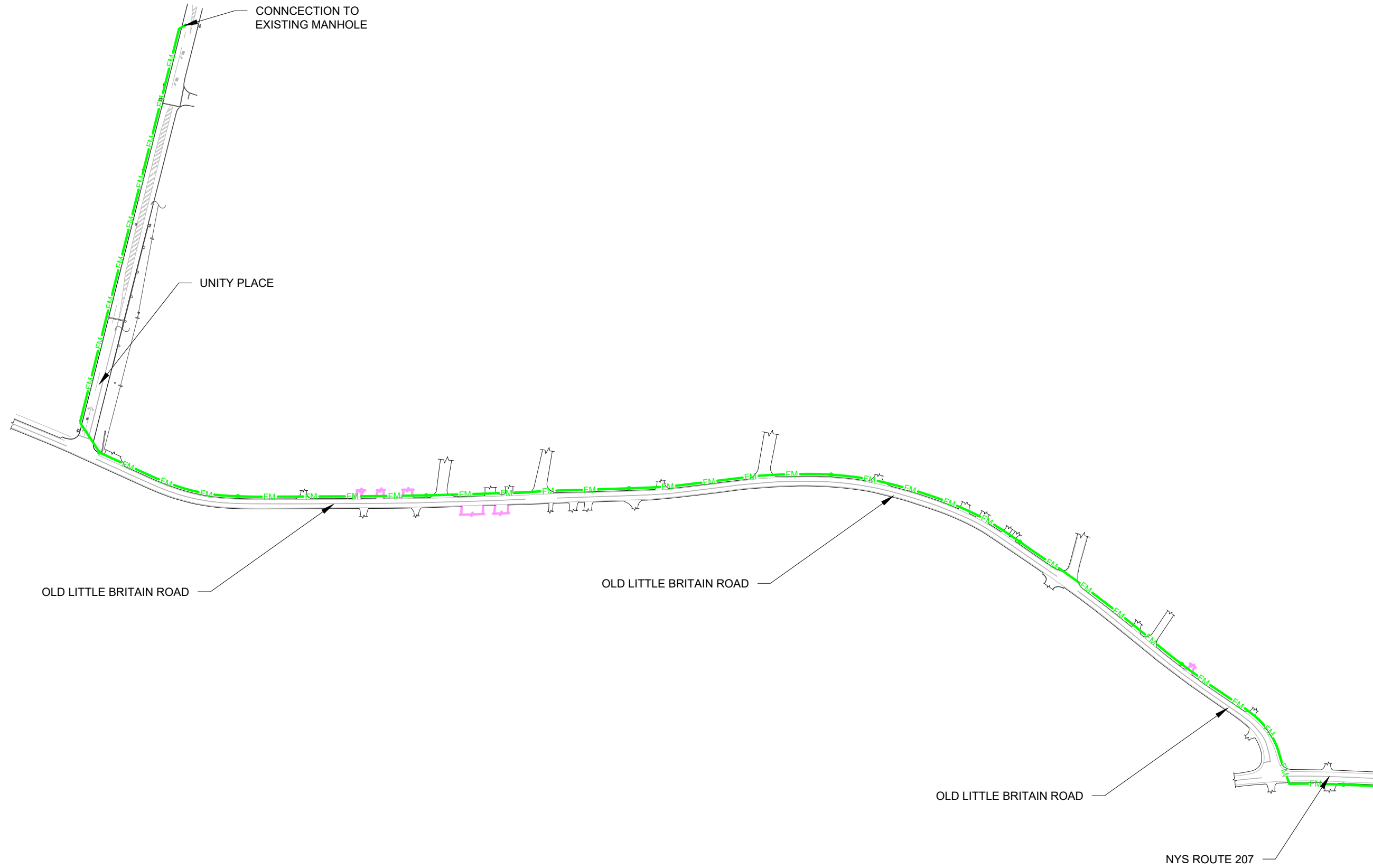
FIGURES



LOCATION MAP	BRITAIN WOODS NEW YORK STATE ROUTE 207 T/C OF NEWBURGH ORANGE COUNTY, NEW YORK	DATE: 09/21/2023	JOB # 1146.01	MONTGOMERY OFFICE 71 CLINTON STREET MONTGOMERY, NY 12549 Ph: (845) 457-7727 WWW.EP-PC.COM
		SCALE: 1" = 500'	SHEET # F-1	ENGINEERING & SURVEYING PROPERTIES Achieving Successful Results with Innovative Designs



PROPOSED SEWER SYSTEM LAYOUT A	BRITAIN WOODS NEW YORK STATE ROUTE 207 T/C OF NEWBURGH ORANGE COUNTY, NEW YORK		DATE: 09/21/2023 REV 02/10/2026 SCALE: 1" = 500'	JOB # 1146.01 SHEET # 3.7B1	MONTGOMERY OFFICE 71 CLINTON STREET MONTGOMERY, NY 12549 Ph: (845) 457-7724 WWW.EP-PC.COM



PROPOSED SEWER SYSTEM LAYOUT B	BRITAIN WOODS NEW YORK STATE ROUTE 207 T/C OF NEWBURGH ORANGE COUNTY, NEW YORK	DATE: 09/21/2023 REV 02/10/2026 SCALE: 1" = 250'	JOB # 1146.01 SHEET # 3.7B2	MONTGOMERY OFFICE 71 CLINTON STREET MONTGOMERY, NY 12549 Ph: (845) 457-7774 WWW.EP-PC.COM
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APPENDIX B
PUMP STATION
CALCULATIONS

**PUMP STATION
HYDRAULICS WORKSHEET**

WO. NO. 1146.01	DATE 09/20/23	REVISED 02/10/26	SHEET 1	OF 2
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PROJECT TITLE Britain Woods		LOCATION Town of Newburgh / City of Newburgh		
CALCULATED BY ZS	APPROVED BY RW	REF DRAWING(S)		

DESIGN FLOW:

Determine Avg. Daily Flow:

Flow: 47,452 Gallons per Day (GPD)

Total Average Daily Flow = 47,452 Gallons per Day (GPD)

Peak Hourly Flow (Peaking Factor of 4.0) = 131.8 Gallons per Minute (GPM)

REQUIRED SCOUR FLOW:

Required Scour Velocity (V) 2.0 ft/sec

Force Main Diameter (D) 6.0 inches

Forcemain Material Schd. 21 - PVC

Hazen-Williams Constant © 120

Cross Sectional Area (A) 28.3 in² { A = π * (D / 2)² }

Required Scour Flow (Q) 176.3 GPM { Q = (A) / 144 * (V) * 7.4805 * 60 } *more than 131.8GPM

Friction Head Loss (h_f) hf = 10.44 * (L) * (Q)^{1.85} / (C)^{1.85} * (D)^{4.8655} = 77.3

*Note: If Scour Flow is less than Peak Hourly Flow, use Peak Hourly Flow to determine Total Dynamic Head.

PUMP SELECTION:

STATION	Pump Elevation	Max F.M. Elevation	Static Head	F.M. Length	Minor Loss. 25%	Total Adj. Length	Friction Head Loss	Total Dyn. Head (h _T)	Pump Model
			(ft)	(ft)	(ft)	(L, ft)	176 GPM	176 GPM	
1	223.00	324.00	101.0	7994	1998.5	9992.5	34.7	135.7	4B2D

Pump is to be Smith & Loveless Wet Well Mounted Pump, Model(s) as specified above.

WET WELL SIZING:

Design Holding Period (min) 30.0

Required Volume (gal) 988.6

Inside Dia. (ft) 8.0

Required Min Depth b/w Pump Off to Pump On 2.6

* Base has 6" extension

BUOYANCY CALCULATION:

Outside Dia. (ft)	9.500	Volume of Concrete (ft ³)				Water Displaced	
		Lid	Ring	Base*	Total	Depth to Ground Water (ft)	6.00
Inside Dia. (ft)	8.000	43.25	264.58	57.73	365.56	Finish Grade to Top Lid (ft)	-1.0
Lid Thickness (ft)	0.667	Weight of Concrete (#)				Volume (ft ³)	508.0
Top Opening Area (ft ²)	6.000	Lid	Ring	Base	Total	Weight (#)	31,698.50
Height of Wet Well (ft)	12.833	6,488.22	39,687.14	8,659.01	54,834.37	#'s of Concrete>Water?	YES
Base Thickness (ft)	0.667						

WO. NO. 1146.01	DATE 09/20/23	REVISED	SHEET 2	OF 2
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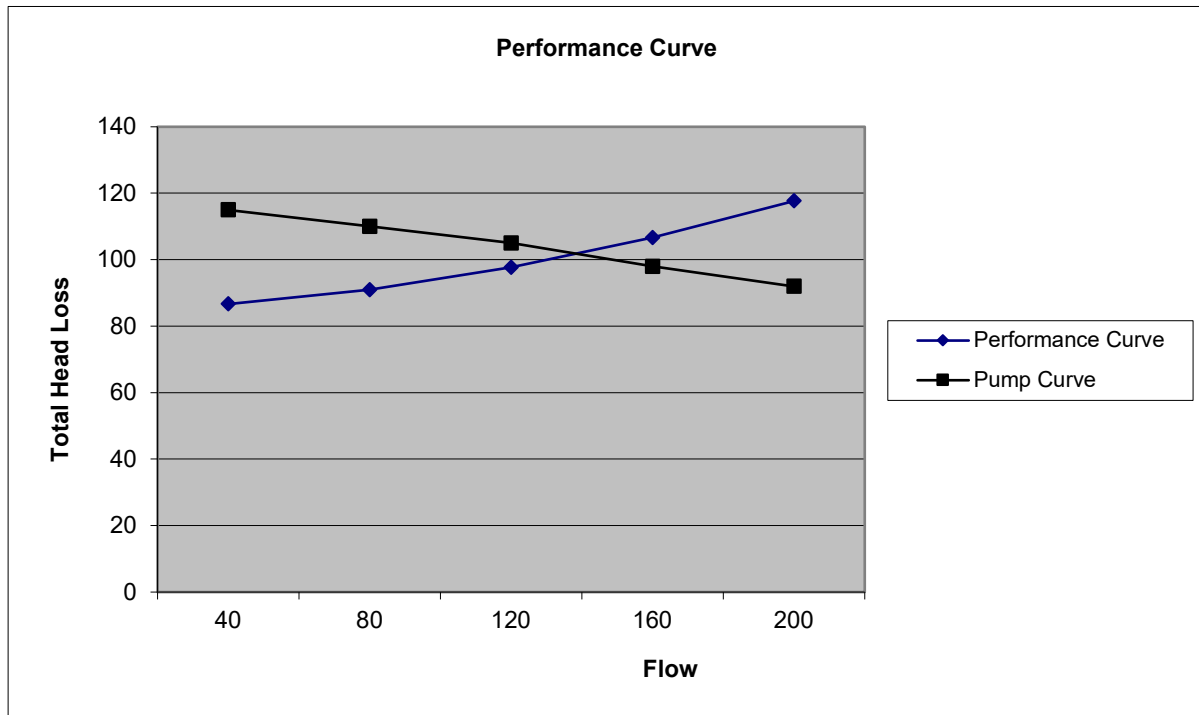
PROJECT TITLE Britain Woods		LOCATION Town of Newburgh / City of Newburgh
CALCULATED BY ZS	APPROVED BY RW	REF DRAWING(S)

Performance Curve

Flow (Q,gmp)	Total Head Loss (ft)
40	86.7
80	91
120	97.7
160	106.7
200	117.7

Pump Curve

40	115
80	110
120	105
160	98
200	92



Maximum Performance:
 Total Dynamic Head of 110.8 at a flow rate of 176 GPM.

APPENDIX C
TECHNICAL
SPECIFICATIONS

SECTION 02530

SANITARY SEWER SYSTEM

PART 1.00 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.02 WORK INCLUDED

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the Sanitary Sewer System as shown on the drawings and specified herein, including, but not limited to, the following:
 - 1. Installation of onsite sanitary sewers consisting of manholes, drop connections, pipe and all necessary and required accessory items and operations including connections to existing facilities.
 - 2. Alteration and/or reconstruction of existing structures including resetting existing and/or new castings to grade as required.
 - 3. Connection of building sanitary sewer service lines to the onsite sanitary sewer system.
 - 4. Installation of onsite sanitary sewer pump station and force main.
 - 5. Installation of sanitary sewer facilities within the Public R.O.W. including connections to existing sanitary sewer facilities.
 - 6. Cleaning, testing and repairing of sanitary sewer system.

1.03 RELATED WORK

- A. Section 02315 Trenching and Backfilling
- B. Section 02370 Erosion and Sediment Control
- C. Section 03305 Concrete (Site)
- D. Section 02510 Water Distribution System

1.04 QUALITY ASSURANCE

- A. The Contractor shall perform all his operations in accordance with the rules, regulations and ordinances of those governing bodies having jurisdiction.
- B. The installation of all sanitary sewer structures and pipe within the Public R.O.W. shall conform to the requirements of all agencies having jurisdiction.

- C. The requirements of the Department of Health and New York State Department of Environmental Conservation and/or any other agency having jurisdiction shall govern the horizontal and vertical separation of water lines from sanitary sewers.
- D. PVC Sewer Pipe
1. Polyvinyl chloride (PVC) gravity sewer and force main pipe shall be so installed as to not exceed a maximum deflection across the diameter of 5.0 percent. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
 2. Upon completion of a section of sewer, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gauge assembly through the completed section. The gauge assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Owner's Field Representative.
 3. Should the installed pipe fail to meet this requirement, the Contractor shall do all work to correct the problem, to the satisfaction of the Owner's Field Representative, without additional compensation.
- E. Leakage Tests
1. General Requirements
 - (a) The Contractor shall test the completed sewers, including manholes and laterals, for leakage by infiltration, exfiltration or low-pressure air exfiltration tests as specified herein. The tests will be conducted as approved by the Owner's Field Representative. The Contractor shall furnish all necessary equipment, materials and labor for performing the tests as specified. All sewer pressure pipe leak testing shall be performed in accordance with Part 4.0 of the "Water Distribution System, 02660" specifications.
 - (b) The Contractor shall notify the Owner's Field Representative at least 48 hours prior to the start of testing. Testing shall only be performed in the presence of the Owner's Field Representative.
 - (c) Sections of pipe tested for infiltration and exfiltration prior to completion of the Project shall be subject to additional leakage tests, if warranted in the opinion of the Owner's Field Representative, prior to acceptance of the Project.
 2. Infiltration and Exfiltration Testing
 - (a) The test length intervals for either type of leakage test shall be approved by the Owner's Field Representative, but in no event shall they exceed one thousand (1000) feet. In the case of sewers laid on steep grades, the length of line to be tested by exfiltration at any one time may be limited by the maximum allowable internal pressure on the pipe and joints at the lower end of the line.
 - (b) The test period, wherein the measurements are taken shall not be less than four (4) hours in either type of test.

(c) Depending on field conditions, the following tests for leakage shall be employed:

(1) Infiltration Test

The test may be used only when ground water levels are at least five (5) feet above the top of the pipe for the entire length of the section to be tested during the entire period of the test. Ground water levels may be measured in an open trench or in standpipes previously placed in backfilled trenches during the backfilling operations. When standpipes are installed in the backfill for ground water measurement, the lower ends of these shall be satisfactorily embedded in a mass of crushed stone or gravel to maintain free percolation and drainage. Infiltration through joints shall be measured by using a watertight weir or any other approved device for volumetric measurement installed at the lower end of the section under test.

(2) Exfiltration Test

This test consists of filling the pipe with water to provide a head of at least five (5) feet above the top of the pipe or five (5) feet above ground water, whichever is higher, at the highest point of the pipe line under test, and then measuring the loss of water from the line by the amount which must be added to maintain the original level. In this test the line must remain filled with water for at least twenty four (24) hours prior to the taking of measurements. Exfiltration shall be measured by the drop of water level in a closed-end standpipe or in one of the sewer manholes available for convenient measuring.

When a standpipe and plug arrangement is used in the upper manhole of a line under test, there must be some positive method of releasing entrapped air in the sewer prior to taking measurements.

(3) Leakage Requirements

The total leakage of any section tested shall not exceed the rate of 50 gallons per day per mile per inch of nominal pipe diameter. For purposes of determining the maximum allowable leakage, manholes shall be considered as sections of 48 inch diameter pipe, five (5) feet long, and the equivalent leakage allowance shall be 2.25 gallons per manhole per 24 hours.

3. Low-Pressure Air Exfiltration Testing

(a) The sewer mains and/or laterals shall be tested for leakage by the use of low-pressure air as specified hereinafter and as approved by the Owner's Field Representative. The test length shall not exceed one (1) interval of pipe between two (2) manholes. Air test procedures may be dangerous and the Contractor shall take all necessary precautions to prevent blowouts.

- (b) After the pipe has been backfilled and cleaned, pneumatic plugs shall be placed in the line at each manhole and inflated to 25 psi. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psi greater than the average back pressure of any ground water that may be over the pipe. At least two (2) minutes shall be allowed for the air pressure to stabilize.
- (c) After the stabilization period (3.5 psi minimum pressure in the pipe), the portion of line being tested shall be acceptable if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psi (greater than the average back pressure of any ground water that may be over the pipe) is not less than the time indicated in the following table:

Pipe Size (In.)	Time (Min.)
4	2-1/2
6	4
8	5
10	6-1/2
12	7-1/2

4. Correction of Defective Work

- (a) If leakage exceeds the specified amount, the Contractor shall at his own expense make the necessary repairs or replacements required to permanently reduce the leakage to within the specified limit, and the tests shall be repeated until the leakage requirement is met.
- (b) Any defects found in the system are to be repaired at the expense of the Contractor so as to conform strictly to the Specifications and to the satisfaction of the Owner's Field Representative. All repairs shown necessary by the tests are to be made, broken or cracked pipe replaced, all deposits removed, and sanitary sewer left true to line and grade and entirely clean, free from lumps of cement, protruding gaskets, bulkheads, etc., and ready for use before final acceptance by the Owner.

5. Compliance with Agency Requirements

- (a) In the event of conflict between the leakage test requirements specified herein with the leakage test requirements of agencies having jurisdiction over all or any portion of the sanitary sewers installed under this Contract, the more restrictive requirements shall govern.

F. Cleaning and Repair

- 1. The Contractor will be required to clean the entire newly constructed sanitary sewer system of all debris and obstructions. This shall include, but not be limited to removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing sanitary sewers or streams; all debris shall be removed from the system.

2. After the system has been cleaned, the Contractor shall thoroughly inspect the system and all repairs shown to be necessary shall be promptly performed by the Contractor.
3. All work of cleaning and repair as specified herein shall be performed at the Contractor's expense and to the complete satisfaction of the Owner's Field Representative.

G. Final Inspection

1. Upon completion of the Work and before final acceptance by the Owner, the entire sanitary sewer system shall be subjected to a final inspection in the presence of the Site Engineer and/or Owner's Field Representative. The Work shall not be considered as complete until all requirements for line, grade, cleanliness, leakage tests and workmanship have been met.

1.05 SUBMITTALS

- A. The Contractor shall submit the following material designs for the type specified for review and approval prior to materials being delivered to the site:

1. Polyvinyl Chloride Pipe and Fittings
2. Elastomeric Gaskets
3. Brick
4. Concrete Block
5. Concrete and Mortar Mixes
6. Pumps
7. Generator
8. Automatic Transfer Switch

- B. Submit shop drawings of the following items for the type specified prior to materials being delivered to the site:

1. Precast Manholes
2. Manhole Frames and Covers
3. Ladder Rungs
4. Sanitary Pump Station
 - (a) Valve Vault
 - (b) Wet Well
 - (c) Control Systems and Control Box

(d) Access Lid

1.06 DELIVERY, STORAGE & HANDLING

A. Storage

1. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations, subject to the approval of the Owner's Field Representative.
2. PVC pipe shall be stored at the site until installation in a manner, acceptable to the Owner's Field Representative, which will keep the pipe at ambient outdoor temperatures. Temporary shading shall be provided as required to meet this requirement. Simply covering the pipe or structures which allows temperature build-up when exposed to direct sunlight will not be permitted.

B. All pipe shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe.

C. Pipe which is defective from any cause, including damage caused by handling, and determined by the Owner's Field Representative as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the Owner as directed by the Owner's Field Representative.

D. Pipe that is damaged or disturbed through any cause prior to acceptance of the Work shall be repaired, realigned or replaced as directed by the Owner's Field Representative, at the Contractor's expense.

1.07 JOB CONDITIONS

A. The Contractor shall exercise whatever precautions are necessary to protect existing conditions or other Work from damage.

B. Excavation and Backfill

1. The provisions of Section 02315 of these Project Specifications shall govern all work under this Section.

C. Connections to Existing Facilities

1. General Requirements

The Contractor shall make all required connections of the proposed sanitary sewer into existing sanitary sewer facilities, where and as shown on the Drawings and/or as approved by the Owner's Field Representative.

2. Connections into existing sanitary sewer facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum.

1.08 WARRANTY

A. Sanitary Pump Station

1. All manufacturer warranties shall be turned over to the Owner.
2. The Contractor shall guarantee all work for a period of one (1) year.

PART 2.00 - PRODUCTS

2.01 MATERIALS DEFINITIONS

A. Sanitary Sewer Pipe, Fittings and Joints

1. Gravity Polyvinyl Chloride Pipe and Fittings (PVC)
 - (a) Pipe shall be Bell and Spigot, utilizing an elastomeric gasket, shall conform to "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings," SDR-35, ASTM Specification D 3034, latest edition.
 - (b) The minimum "pipe stiffness" at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM designation D-2412. Straight pipe shall be furnished in lengths of not more than 13 feet, and Y-branches shall be furnished in lengths of not more than 3 feet. Saddle Y-branches will not be allowed.
 - (c) Elastomeric gaskets shall be used for all pipe joints, shall conform to "Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals," ASTM Specification D 3212, latest edition. Joints for the polyvinyl chloride pipe shall be push-on bell and spigot joints using elastomeric ring gaskets. The gaskets shall be securely fixed into place in the bells so that they cannot be dislodged during joint assembly. The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.
 - (d) Lubricant, as recommended by the pipe manufacturer and approved by the Owner's Field Representative, shall be used for all pipe joints.
 - (e) All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the above-mentioned ASTM specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Owner's Field Representative to apply such tests as he deems necessary.
2. Pressure Polyvinyl Chloride Pipe and Fittings (PVC)
 - (a) Polyvinyl Chloride Pipe shall conform in all respects to "Polyvinyl Chloride (PVC) Pressure Pipe, CL 150, 4 inch through 12 inch, for Water," AWWA Specifications C-900, latest revision, in 20-foot nominal lengths except as may otherwise be specified herein.

- (b) PVC elastomeric gasket joints shall be in accordance with AWWA Specifications C-900 and referenced ASTM Specifications.
- (c) Lubricant, as recommended by the pipe manufacturer and approved by the Owner's Field Representative, shall be used for all pipe joints.
- (d) All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to the above-mentioned ASTM Specifications. In addition, the pipe shall be subject to thorough inspection and tests, the right being reserved for the Owner's Field Representative to apply such tests as he deems necessary.

B. Manholes

1. Brick shall conform to the "Specifications for Sewer and Manhole Brick (Made from Clay or Shale)," AASHTO Designation M-91, latest revision, Grade MS.
2. Precast Manholes
 - (a) Where called for on the Drawings or approved in writing by the Site Engineer, the Contractor may substitute precast manholes. Precast Reinforced Concrete Manhole Sections shall conform to the "Specifications for Precast Reinforced Concrete Manhole Sections," AASHTO Designation M-199, latest revision and ASTM- C478
 - (b) Prior to fabrication, the Contractor shall submit four (4) sets of plans of the proposed precast structures to the Owner's Field Representative for approval, along with design criteria and certification by the manufacturer that the structure will support the design load.
 - (c) The minimum compressive strength of the concrete used for all precast structures shall be 4,000 psi. Where steps are required in structures, steps shall be installed during the casting of the structures, aligned as specified herein. Joints in the structures shall be tongue and groove joints, formed in such a manner so that either a mortar or rubber seal can be applied.
 - (d) No precast manhole shall be fabricated or delivered to the job site until it has been approved by the Owner's Field Representative and/or Site Engineer. All structures shall have number and manufacturer's name on each section.
 - (e) Approval for the use of precast structures shall relieve the Owner and Site Engineer of any additional costs for modification of openings due to line or grade changes, deletion of structures, relocation of structures, or addition or deletion of lines to be connected into the structures, and such additional cost shall be at the Contractor's expense.
3. Manhole Frames and Covers
 - (a) Manhole Frames and Covers shall be gray cast iron castings Campbell Foundry Pattern Number 1007C or equal, conforming to the requirements of AASHTO Designation M-105, latest revisions, Class 30. The castings shall be true to pattern in form and dimensions as specified and shall be free from pouring faults, sponginess, cracks, blowholes and

other defects that affect their strength and other characteristics for the intended use. All surfaces shall have a workmanlike finish.

- (b) All component parts shall fit together in a satisfactory manner and frames and covers shall be of non-rocking design so as to prevent rocking or rattling under traffic. Frames and covers that are warped or rocking, as determined by the Owner's Field Representative, will be rejected and shall be removed and replaced by the Contractor to the satisfaction of the Owner's Field Representative at no cost to the Owner.
 - (c) Unless otherwise specified, the word "SEWER" shall be integrally cast on the cover in raised letters and centered. Letter size shall be three (3) inches.
 - (d) All castings shall be coated with an asphalt paint which shall result in a smooth coating and not be tacky or brittle.
4. Concrete shall conform to the requirements for concrete as specified herein under Section 03305 Concrete (Site) of these Project Specifications.
5. Reinforcement shall be new billet stock deformed steel bars conforming to AASHTO Designation Grade 40. Steel wire fabric shall conform to AASHTO Designation M-55. Metal accessories, chairs, ties and other items necessary for proper placement of reinforcing, shall be provided. Reinforcement shall be free from scale, oil, ice and structural defects and shall be stored so as to prevent contact with the ground.
6. Mortar
- (a) Mortar shall be composed of one (1) part Portland cement and two (2) parts sand by volume. Hydrated lime, not to exceed four (4) pounds of lime to each bag of cement, may be added as approved by the Owner's Field Representative. Material requirements shall be as follows:
 - (1) Portland Cement shall conform to the requirements of AASHTO Designation M-85, Type II.
 - (2) Hydrated Lime shall conform to the requirements of ASTM C-6.
 - (3) Mortar Sand shall conform to the requirements of AASHTO Designation M-45, except that aggregate shall be no coarser than #8 sieve size.
 - (4) Water shall be clean and shall not contain any oil, acid, alkali, salts, vegetable matter, organic matter or other deleterious substances.
 - (b) Hand mixing of mortar will be permitted only when, in the opinion of the Owner's Field Representative, the amount of mortar to be used makes machine mixing undesirable. When hand mixing is used, the ingredients must first be thoroughly mixed dry in a tight box, after which the proper quantity of clean water shall be gradually added and then the materials shall be hoed or worked until a uniform mixture is secured. Admixtures may be added only with the prior written approval and in the presence of the Owner's Field Representative.

- (c) No greater quantity of mortar is to be prepared than is required for immediate use and it shall be worked over constantly with hoe or shovel until used. No Mortar shall be retempered and none shall be used more than one and one-half (1½) hours after mixing. All mortar containing cement which remains upon stopping work shall be discarded.

7. Steps for Manholes

This Specification covers the material requirements for steps for manholes.

- 1. General: The minimum design live load, for steps, appurtenances and fastenings, shall be a single concentrated load of 13.5 kN. The live loads imposed by persons occupying the steps shall be considered to be concentrated at such points as will cause the maximum stress in the Structural member being considered.

Steps shall be designed so a worker's foot cannot slide off the end. The minimum length of the rungs shall be 10 inches.

Whenever a combination of dissimilar types of metals are used in the manufacture of steps, appurtenances and fastenings, the materials shall be treated to prevent deleterious effects.

- 2. Materials: Manhole steps shall be fabricated from one of the following:

- (a) Ferrous Metal. Steps: Are not permitted

- (b) Non-Ferrous Metal. Steps shall conform to the following requirements:

Aluminum Castings - Alloy 356-T6, □715-03.

Wrought Aluminum 6061-T6, 6005-T5, or 6351-T6, □715-04.

When aluminum steps are used, the portion of the step which will be in direct contact with cement concrete or concrete mortar, shall be coated with Zinc Chromate Primer conforming to the requirements of subsection 708-04 or shall be coated with bituminous material approved by the materials Bureau.

- (c) Reinforced Plastic. Steps shall consist of polypropylene or other plastic material meeting this specification. It may be extruded, cast, or molded into the standard size and shape manhole steps, having a steel core center for strength and completely covered by the plastic molding for corrosion protection. The plastic material shall have the following characteristics:

- (1) Resistance to Salt and Caustic Solutions. Resistance to the following solutions when submerged for 30 days:

- 10% Sodium Chloride
- 10% Hydrochloric Acid
- 10% Sodium Hydroxide
- 10% Sulfuric Acid

- (2) Flow Point. A flow point of 160°C or greater.
- (3) Flexibility. It shall remain flexible over a temperature range of -30°C to +120°C upon long aging.
- (4) Fire Resistance. It shall be non-burning, self-extinguishing, or very slow burning. The steel core shall be not less than 12 mm diameter and shall have the following physical characteristics:

Tensile Yield - Minimum - 275 MPa
Tensile Strength - Minimum - 482 MPa

The plastic step, when cast into a concrete block the proper depth, shall withstand a minimum load of 13.5 kN applied on 625 mm⁽²⁾ area in the center of the step without cracking or breaking the plastic coating, loosening the step in the concrete or permanently deforming the step.

PART 3.00 - EXECUTION

3.01 INSPECTION

- A. Examine the areas and conditions where the Sanitary Sewer System is to be installed and notify the Owner's Field Representative of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Owner's Field Representative.

3.02 INSTALLATION

A. General Requirements

1. The Contractor shall install all sanitary sewer structures and pipe in the locations as shown on the Drawings and/or as approved by the Owner's Field Representative. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

B. Pipe Installation

1. Laying Pipe
 - (a) Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Section 02315 of these Project Specifications. Pipe will be laid upgrade with bells upgrade unless otherwise approved by the Owner's Field Representative.
 - (b) Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so that joints may

be properly assembled without overstressing the bells. No pipe is to be trimmed or chipped to fit.

- (c) No length of pipe shall be laid until the preceding lengths of pipe have been thoroughly embedded in place, so as to prevent movement or disturbance of the pipe.
- (d) Installation of polyvinyl chloride (PVC) sewer pipe shall be as follows:
 - (1) Each pipe unit shall be inspected before being installed. No single piece of pipe shall be laid unless it is generally straight. The centerline of the pipe shall not deviate from the ends of the pipe by more than 1/16 inch per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Any pipe unit or fitting discovered to be defective either before or after installation shall be removed and replaced with a sound unit.
 - (2) Polyvinyl chloride pipe shall be supported on a minimum of four (4) inches of compacted crushed stone, or as directed by the Owner's Field Representative. No pipe or fitting shall be permanently supported on saddles, blocking, or stones. Crushed stone shall be 3/4 inch in size or such other sized as may be approved. The gravel shall consist of clean, hard, and durable particles or fragments, free from dirt, vegetation, or other objectionable matter and free from an excess of soft, thin elongated, laminated or disintegrated pieces. The crushed stone shall be spread in layers of uniform thickness and shall be compacted to a minimum density of ninety-five (95) percent of the maximum density of the soil as determined by the Standard Proctor Test (AASHTO Designation T-99).
 - (3) Suitable bell holes shall be provided, so that after placement, only the barrel of the pipe receives bearing pressure from the supporting material.
 - (4) All joint surfaces shall be cleaned. Immediately before jointing the pipe, the bell or groove shall be lubricated in accordance with the manufacturer's recommendation. Each pipe unit shall then be carefully pushed into place without damage to pipe or gasket. Suitable devices shall be used to force the pipe units together so that they will fit with a minimum open recess inside and outside and have tightly sealed joints. Care shall be taken not to use such force as to wedge apart and split the bell or groove ends.
 - (5) Joints shall not be "pulled" or "cramped" unless permitted by the Owner's Field Representative.
 - (6) Where any two pipe units do not fit each other closely enough to enable them to be properly jointed, they shall be removed and replaced with suitable units and new gaskets.
 - (7) All premolded gasket joint polyvinyl chloride pipe of a particular manufacturer may be rejected if there are more than five

unsatisfactory joint assembly operations or "bell breaks" in 100 consecutive joints, even though the pipe and joint conform to the appropriate ASTM Specifications as specified. If the pipe is unsatisfactory, as determined above, the Contractor shall, if required, remove all pipe of that manufacturer of the same shipment from the Work and shall furnish pipe from another manufacturer which will conform to all of the requirements of these Project Specifications.

- (8) Open ends of pipe and branches shall be closed with polyvinyl chloride stoppers secured in place in an acceptable manner.
- (9) After each pipe has been properly bedded, enough crushed stone shall be placed between the pipe and the sides of the trench, and thoroughly compacted, to hold the pipe in correct alignment. Bell holes, provided for jointing, shall be filled with crushed stone and compacted, and then crushed stone shall be placed and compacted to a minimum of six (6) inches over the top of the pipe to complete the pipe bedding.
- (10) Polyvinyl Chloride (PVC) gravity sewer pipe shall be so installed as to not exceed a maximum deflection of 5%. Such deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
- (11) Upon completion of a section of sewer, including placement and compaction of backfill, the Contractor shall measure the amount of deflection by pulling a specially designed gauge assembly through the completed section. The gauge assembly shall be in accordance with the recommendations of the pipe manufacturer and be acceptable to the Owner's Field Representative.

2. Pipe Extension

- (a) Where existing pipe is to be extended, the same type of pipe shall be used unless otherwise specified or approved by the Owner's Field Representative.

3. Full Lengths of Pipe

- (a) Only full lengths of pipe are to be used in the installation except that partial lengths of pipe may be used at the entrance to structures where necessary to obtain a proper connection to the structure.

4. Pipe Entrances to Structures

- (a) All pipe entering structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation. The method of cutting and finishing shall be subject to the approval of the Owner's Field Representative.

5. Bedding and Backfilling

- (a) The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of the Section 02315 of these Project Specifications and as shown on the Details of the Drawings.

6. Protection During Construction

- (a) The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.
- (b) At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary water tight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

7. Tolerance

- (a) Pipe shall be laid accurately to the line and grade as shown on the Drawings and/or as approved by the Owner's Field Representative. Allowable tolerances shall be one-quarter (1/4) inch in grade and one-half (1/2) inch in line in any section of pipe between manholes. No adverse grades shall be allowed. Deviations from these tolerances shall be grounds for rejection of the line of pipe by the Owner's Field Representative. Any line which has been rejected shall be rebuilt to the correct line and grade by the Contractor at his own expense.

C. Pipe Joints

1. All joints are to be made watertight in accordance with the requirements specified herein.
2. Pipe shall be jointed in strict accordance with the Pipe manufacturer's instruction. Jointing of all pipe shall be done entirely in the trench.

D. Manholes

1. General Requirements

- (a) All manholes shall be built in accordance with the Details and in the locations shown on the Drawings and as specified herein.
- (b) Structures shall be constructed of precast Concrete. Structures will require Shop Drawing approval by the Owner's Field Representative and/or the Site Engineer.

2. Inverts

- (a) Smooth concrete invert channels shall be constructed in all manholes to insure a smooth flow of water through the structure.
 - (b) The invert channels shall be carried up to the elevations shown on the Drawings and/or as approved by the Owner's Field Representative. Channels shall slope smoothly and evenly from the entrance pipe to the outlet pipe.
 - (c) Invert channels shall be built for future extensions where shown on the Drawings and/or where directed by the Owner's Field Representative.
3. Frames, Covers and Gratings
- (a) Frames, Covers and/or Gratings for manholes shall be of the type and size indicated on the Drawings. Frames shall be well bedded in mortar and shall be set accurately to the correct alignment and grade. In areas to be paved, frames shall be set by using four (4) points of reference, set ninety (90) degrees apart, to insure accurate setting to proposed pavement grade.
4. Ladder Rungs
- (a) Ladder rungs shall be installed in all manholes, spaced twelve (12) inches on center vertically and staggered. Rungs shall be set securely in place during the construction of the masonry wall.
5. Precast Manholes
- (a) Precast manholes shall be installed only after Shop Drawings have been approved.
 - (b) The base unit of the precast structures shall be founded on an approved compacted subgrade. Should the base unit be a slab only, the first riser unit shall be set in a pad of 2½-inch minimum thick mortar or as recommended by the Manufacturer and approved by the Owner's Field Representative. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.
 - (c) The top grade of the precast concrete corbel section shall be set sufficiently below finished grade to permit a maximum of four (4) and a minimum of two (2) courses of eight (8) inch brick to be used as risers to adjust the grade of casting. Manhole frames shall be set on a grout pad as specified hereinabove.
6. Bitumastic Coating
- (a) The entire exterior surface of all manholes shall be coated with two (2) coats of an approved bitumastic material to produce a dry film thickness of 0.07 inches (70 mils) per coat.

E. Connections to Existing Facilities

1. The Contractor shall make all required connections of the proposed sanitary sewer into existing sanitary sewer facilities, where and as shown on the Drawings and/or as approved by the Owner's Field Representative.
2. Connections into existing sanitary sewer facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor shall be required to comply with all such requirements, including securing of all required permits, and paying the costs thereof. The cost of making the connections in accordance with the requirements of the Owner of the existing facility shall be included in the Contract Sum.

F. Alterations and/or Reconstruction of Existing Structures

1. General Requirements

- (a) The Contractor shall alter and/or reconstruct existing structures where shown on the Drawings, and/or as approved by the Owner's Field Representative. In general, alterations shall be made with the same type of material used in the original construction unless otherwise indicated on the Drawings or approved by the Owner's Field Representative.

2. Adjustment to New Grade and Alignment

- (a) All castings on existing sanitary sewer structures, that are to remain, shall be adjusted to new grade and alignment. When such adjustment is required, the castings shall be carefully removed and the walls of the structure reconstructed as required. The castings shall be cleaned and reset in a firm mortar bed to the new grade and alignment. Existing castings which are broken, damaged or otherwise unfit for incorporation in the new work shall be replaced under the Contract Sum.

3. Removal of Portions of Walls of Existing Structures

- (a) In all cases of alteration and/or reconstruction of existing structures, existing walls shall be removed to a point where the existing walls will provide sound and adequate foundation for the construction of the new walls as approved by the Owner's Field Representative.

4. Damage to Existing Structure and/or Pipe

- (a) The Contractor shall exercise extreme care during such alteration and/or reconstruction so as not to damage any portions of the structure and/or pipe shown to remain. Any such damage shall be repaired to the satisfaction of the Owner's Field Representative.

5. Structures to be Cleaned

- (a) Upon completion of alteration and/or reconstruction of existing structures, all structures shall be cleaned of any accumulation of debris or foreign matter of any kind and shall be kept clean of such accumulation until final acceptance of the Work.

G. Relocation and/or Abandonment of Existing Facilities

1. The Contractor shall not abandon, disconnect, obstruct or in any other way interfere with the operation of an existing sewer facility until such time as adequate permanent or temporary substitute facilities have been constructed and placed in operation.

H. Service Lines

1. General Requirements

- (a) The Contractor shall make all required connections of the building sanitary sewer service lines into the onsite sanitary sewer system where and as shown on the Drawings and/or as approved by the Owner's Field Representative. Work shall include making the service line connections into the onsite sanitary sewer system, furnishing and installing all service line pipe from the existing onsite sanitary sewer system to points located ten (10) feet outside of the proposed right-of-way lines and properly sealing the ends with watertight plugs. Service line extensions from these points into the building will be performed by others.

2. Coordination with Building Contractor

- (a) The Contractor will be required to coordinate his Work with the work of the Building Contractor to determine the exact location and elevation of the point of entry into the building. If the Building Contractor has installed his portion of the sanitary sewer service line, Work under this Contract shall also include final connection of the sanitary sewer service line five (5) feet outside the building line to the building service line at no additional cost to the Owner.

3. Connection into Onsite Sanitary Sewer System

- (a) Sanitary sewer service line connections to the pipe of the onsite sanitary sewer system shall be made with proper fittings supplied by the pipe manufacturer and as shown on the Drawings into existing manholes, new manholes, or the onsite mains in a manner satisfactory to the Owner's Field Representative.
- (b) The Contractor shall install 45 degree wye branches in the onsite sanitary sewer mains in all locations where building sewer service line connections are shown on the Drawings directly entering the onsite sewer main. Connections of the sanitary sewer service lines shall be made into the wye branches by means of 45 degree bends. The connections shall be made thoroughly watertight and Class A Concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection. All Work shall be performed to the satisfaction of the Owner's Field Representative.

END OF SECTION