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From:
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Date:
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Arcadis Project No.:
04711006.0000

Subject:
Town of Bedford Sewer District Feasibility Study Update
Task 2 Schematic Design

Purpose

Arcadis was retained by the Town of Bedford to prepare a feasibility study for the development of a new sewer district comprised of a subset of the areas zoned central business (CB) districts, in addition to three properties with existing, on-site wastewater disposal systems. A Technical Memo was prepared and submitted to the Town on April 22, 2016, entitled Task 1 Preliminary Engineering Assessment.

Arcadis was later approved to complete a Task 2 Schematic Design to confirm the parcels in the new district, refine the wastewater flow numbers from these parcels, improve the layout of the sewers, better estimate the presence of rock along the collection system route, evaluate the number of pump stations needed and assess capital upgrades that may be desired at the Bedford Hills Correctional Facility Wastewater Treatment Plant (WWTP). Additionally, if properties are in low lying areas with less potential for future expansion, the use of grinder pumps and low pressure sewers would be evaluated. The cost estimates developed under this Task 2 will have an expected accuracy of +25% and -15%.

Background

In addition to the subsurface disposal systems that serve most residential, commercial and light industrial properties, there are three on-site wastewater disposal systems in the Town of Bedford in proximity to the proposed sewer district parcels. These systems are located at the Bedford Park Apartments, St. Mary's of the Assumption School, and the Katonah Elementary School. Each of these systems have an existing State Pollution Discharge Elimination System (SPDES) Permit. All systems have plans to be upgraded by the NYC DEP. The construction of public sewers and a single treatment plant to serve areas of Bedford

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Hills and Katonah would eliminate the need for individual treatment systems at these locations, as well as protect and enhance water quality.

Besides the on-site wastewater disposal systems mentioned, there is a full WWTP, owned by the New York State Department of Corrections and Community Supervision (DOCCS) and operated by a private sector contract service provider, which discharges to a small tributary of the Muscoot Reservoir. The plan is to transfer the WWTP from the State of New York to the Town of Bedford. The WWTP SPDES permitted flow limit is 500,000 gallons per day (gpd) and the WWTP discharges an average daily flow of approximately 200,000 gpd (based on the 2015 Daily Monitoring Reports (DMR's) and the Veolia report entitled Bedford Hills NY WWTP - Review of Temperature and Ammonia Data for Future NY SPDES Limit.

A listing of the maximum daily flows permitted from these facilities under their existing SPDES permits is shown in Table 1 below.

Table 1 - Existing Facility State Pollution Discharge Elimination System Permits

Facility Name	Service Area	Permitted Flow (gpd)
Bedford Park Apartments	Apartments off Rome Avenue	19,500
Katonah Elementary School	Public Elementary School	13,000
St. Mary's of the Assumption	Previous Parochial School	10,000
Bedford Hills Correctional Facility Wastewater Treatment Plant	Bedford Hills and Taconic Correctional Facilities and Regional Medical Unit; I-684 Rest Area	500,000

Proposed Sewer District

The proposed sewer district would include three central business districts in the Town of Bedford as shown in Figure 1 (attached), together with a number of municipal buildings.

Central Business Area 1 (CB – Area 1) is located on Woods Bridge Road just north of Edgemont Road in the hamlet of Katonah. CB – Area 1 is comprised of small businesses fronting the west side of Woods Bridge Road adjacent to a parking area for the Katonah Metro-North railroad station. Central Business Area 2 (CB – Area 2) is located just south of CB – Area 1, beginning at Edgemont Road east of the intersection of Woods Bridge Road, continuing along Katonah Avenue from Edgemont Road to the intersection of Bedford Road, and ending on Bedford Road just south of Sunrise Avenue. CB – Area 2 includes many small businesses that line both sides of Katonah Avenue near the Katonah Metro-North train station. In addition, businesses and community facilities on Bedford Road south of Katonah Avenue will be served by the collection system within CB – Area 2. The Katonah Library and the Katonah Fire Department are serviced by the collection system in CB – Area 2.

Central Business Area 3 (CB – Area 3) is located approximately one mile southwest of CB – Area 2 in the hamlet of Bedford Hills. The collection system within CB – Area 3 is designed to serve businesses within the vicinity of Adams Street adjacent to the Bedford Hills Metro-North railroad station. These businesses are located on Hill Street, Main Street, Babbitt Road, Griffin Avenue, and School Street. CB – Area 3 services the Bedford Community House on Main Street and the Highway Department garage for the Town of Bedford on Adams Street.

The proposed collection system will also service Out of District Customers (as shown on Figure 1). These customers include those with existing on-site wastewater treatment, namely the Katonah Elementary School, St. Mary's of the Assumption, the Bedford Park Apartments, the Bedford Correctional Facility and the Taconic Correctional Facility.

Estimated Flows

The Town of Bedford has provided Arcadis with the most recent available average daily flow data for individual parcels that comprise the proposed sewer district. This data shows that the parcels that make up the proposed district used, on average, approximately 41,300 gallons of water per day (gpd) in total.

The total estimated daily average flow usually considers that not all of the water distributed to customers will be collected in the sanitary sewer system. Especially in residential areas, a portion of the water used goes to watering lawns, washing cars, and similar purposes. However, customers in this sewer district are primarily local businesses, schools and apartments, where water usage is not anticipated to bypass the sanitary sewer system. Therefore, the estimated daily average flow in this report considers 100% of daily water usage contributing to the flow in the sanitary sewer system.

In addition to the average water use by potential consumers utilizing the collection system, water may enter the system due to infiltration. According to the *Recommended Standards for Wastewater Facilities* as part of the Ten States Standards, for which New York State is a member, a non-defective sewer system shall not have infiltration exceeding 100 gallons per inch of pipe diameter per mile per day. Therefore, the estimated flows take into account an allowance of 100 gpd per inch of pipe diameter per mile of pipe for the approximate two miles of gravity sewer contained within the proposed sewer district, and the one and one quarter mile out of district. This means that an additional 1600 gpd of flow is expected for the gravity sewers located In-District, and an additional 1000 gpd is expected in the Out-Of-District gravity sewer system.

To ensure adequate sizing of sewers for the collection system, the total estimated daily average flow for the three properties with on-site wastewater disposal is based on their current SPDES permitted flow. A portion of the water used at the correctional facilities does not enter the collection system. Based on the 2016 Discharge Monitoring Reports (DMR's) for the plant, a flow of 200,000 gpd was utilized for the DOCCS facilities.

The wastewater flows projected for the entire collection system are presented in Table 2.

Table 1 – Total Daily Average Recorded Water Usage and Estimated Wastewater Flow

	Total Daily Average Recorded Water Usage (gpd)	Total Daily Average Estimated Wastewater Flow (gpd)
In-District Customers	42,000	43,600
Out-of-District Customers	285,470	242,500
Totals	327,470	286,100

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Proposed Collection System

The proposed collection system conveys flow from In-District and Out-Of-District customers to the WWTP through the use of gravity sewers, pumps, and forcemains. In order to meet the anticipated average and peak flow conditions as well as Ten States Standards, 8-inch gravity sewers are utilized for the conveyance of flow. In addition, 4-inch and 6-inch forcemains have been selected to carry flow from three proposed pump stations to the treatment facility. The gravity sewers and forcemains will be made of ductile iron piping, which offers superior strength and durability for the collection system.

The northernmost CB – Area 1 customers will be connected to the system via a 4-inch forcemain that will transport the flow from Woods Bridge Road to Edgemont Road within CB – Area 2. A series of grinder pumps for each lot along Woods Bridge Road will be capable of pumping the flow to CB – Area 2. CB – Area 2, which collects flow through use of 8-inch gravity sewers along Katonah Avenue and Bedford Road, then utilizes a pump station (Pump Station A) and 6-inch forcemain to convey flow to the highpoint on Harris Road. Flow from Katonah Elementary School and St. Mary's are also collected with an 8-inch gravity sewer as Out-Of-District customers and conveyed to Pump Station A.

CB – Area 3, which includes businesses in Bedford Hills around the train station on Adams Street, uses 8-inch gravity sewers to carry flow to Pump Station B. A 4-inch forcemain will then transport the flow along Adams Street to Harris Road, where it connects with the flow from CB – Area 2, and proceeds to the highpoint on Harris Road. The Town of Bedford Highway Department garage, located on Adams Street, connects to the 4-inch forcemain through use of a grinder pump.

A 6-inch forcemain capable of carrying flows from CB – Areas 1, 2 and 3 travels up Harris Road to the intersection of Babbitt Road. An 8-inch gravity sewer collects flow from the Bedford Park Apartments on Rome Avenue and transports this flow to the intersection of Babbitt Road and Harris Road. This junction at Babbitt Road and Harris Road then feeds to an 8-inch gravity sewer, which carries the total flow downhill to a final pump station (Pump Station C), where it is then pumped with a 6-inch forcemain the remaining short distance to the WWTP.

The opinion of probable construction cost for the collection system is \$12,400,000. The annual O&M cost associated with the collection system has been estimated at approximately \$50,650. A detailed breakdown of these quantities and associated costs is found in Tables A and B in the appendix. They have been escalated 3%/yr until 2019 to reflect the first year costs.

Wastewater Treatment Plant Improvements

The WWTP has excess capacity and, hence, no flow-related improvements to the plant should be necessary as were previously recommended. However, during our recent site visits there were some conditions that we observed that the Town may choose to address before taking over operation of the facility.

As was identified in previous reports prepared by Arcadis, the influent Parshall flume does not operate correctly, due to hydraulic issues, and the ultrasonic level sensor associated with it has been removed. The rapid sand filter effluent flow is currently being measured and is used for reporting purposes. In the future, the Town may wish to install an influent flow meter that captures all In- and Out-of-District flow before the equalization tanks. The Town may also wish to make other improvements to the WWTP to increase efficiency and improve operation of the plant. The rapid sand filters appear to need scraping and painting and there may be a need to replace the media to achieve better performance at higher flows. Additionally, the Control Building, which was constructed in 1953, does not meet the National Fire Protection Association's guidelines for separation of process areas (sludge pumps in the basement with

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the potential to emit hazardous gases) and electrical and heating areas (boiler with an open flame and electrical equipment capable of emitting sparks on the main floor). In consultation with the Town's Building Inspector, we recommend modification be made to allow the building to come into compliance. We recommend allocating \$400,000 to address these WWTP concerns.

The estimated annual WWTP O&M costs have been estimated at \$601,000 and the breakdown is presented in Table C. These costs reflect actual budgets provided by DOCCS that were increased to reflect the costs associated with incrementally larger flows that will be experienced at the plant due to the new sewer district. They have been escalated 3%/yr until 2019 to reflect the first year costs.

Opinion of Probable Project Cost

Construction costs are only a part of the total capital expenditures incurred in establishing a new sewer district and building a collection system. Other necessary capital expenditures include, but are not limited to the following;

- Engineering design costs, including surveying, conducting a soil boring program, facilities planning, design and permitting, assistance in obtaining bids, and administering the construction contracts (Design Services During Construction or DSDC). Resident engineering includes conducting field oversight of the work, preparation of record documents, and operation and maintenance manuals.
- Land acquisition costs including potential purchase costs for pumping station sites and/or for easements for sewers that cross privately owned property.
- Legal, administrative, bonding and financing costs including fees associated with attending meetings, reviewing State Environmental Review Act documents, negotiating with state and other outside agencies, preparing and filing deeds and easement descriptions, underwriting bonds issued for long term financing.

The total cost for a project includes all of the above items plus an allowance for construction contingencies and is traditionally referred to as the "Total Project Cost". The Total Project Cost for the proposed sewer district is presented in Table 3.

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Table 3 - Opinion of Probable Project Cost

Item	Cost
Collection System Construction	\$12,400,000
WWTP Improvements	\$400,000
Subtotal	\$12,800,000
Construction Contingency (20%)	\$2,560,000
Subtotal Construction Costs	\$15,360,000
Land Acquisition/Easements	\$100,000
Engineering Design & DSDC (12%)	\$1,843,000
Resident Engineering	\$500,000
Legal and Administrative	\$100,000
Bonding and other Financial	\$250,000
Opinion of Probable Total Project Cost* (Point Estimate)	\$18,153,200
Opinion of Probable Total Project Cost* (Low Range Estimate -15%)	\$15,430,200
Opinion of Probable Total Project Cost* (High Range Estimate +25%)	\$22,691,500

*Exclusive of grants and other financial contributions from outside entities

The Table 3 presents a low and high range estimate to account for the level of detail and accuracy of the point estimate at the current stage of project definition. It is recommended that the Town consider these ranges when developing capital program budgets. As future estimates are developed based on higher levels of project definition, the accuracy of the estimate is anticipated to improve. This opinion of probable cost also assumes that there is no cost to the Town to obtain the Bedford Hills Correctional Facility WWTP from the DOCCS.

On August 16, the Town approved a proposal from Arcadis to proceed with a Map, Plan and Report (MPR) for the new sewer district, as required by New York State Town Law. That document will identify, based on the capital and operations and maintenance costs estimated here and further refined in the Map, Plan and Report, the maximum average first year cost expected to be charged to a typical property within the district.

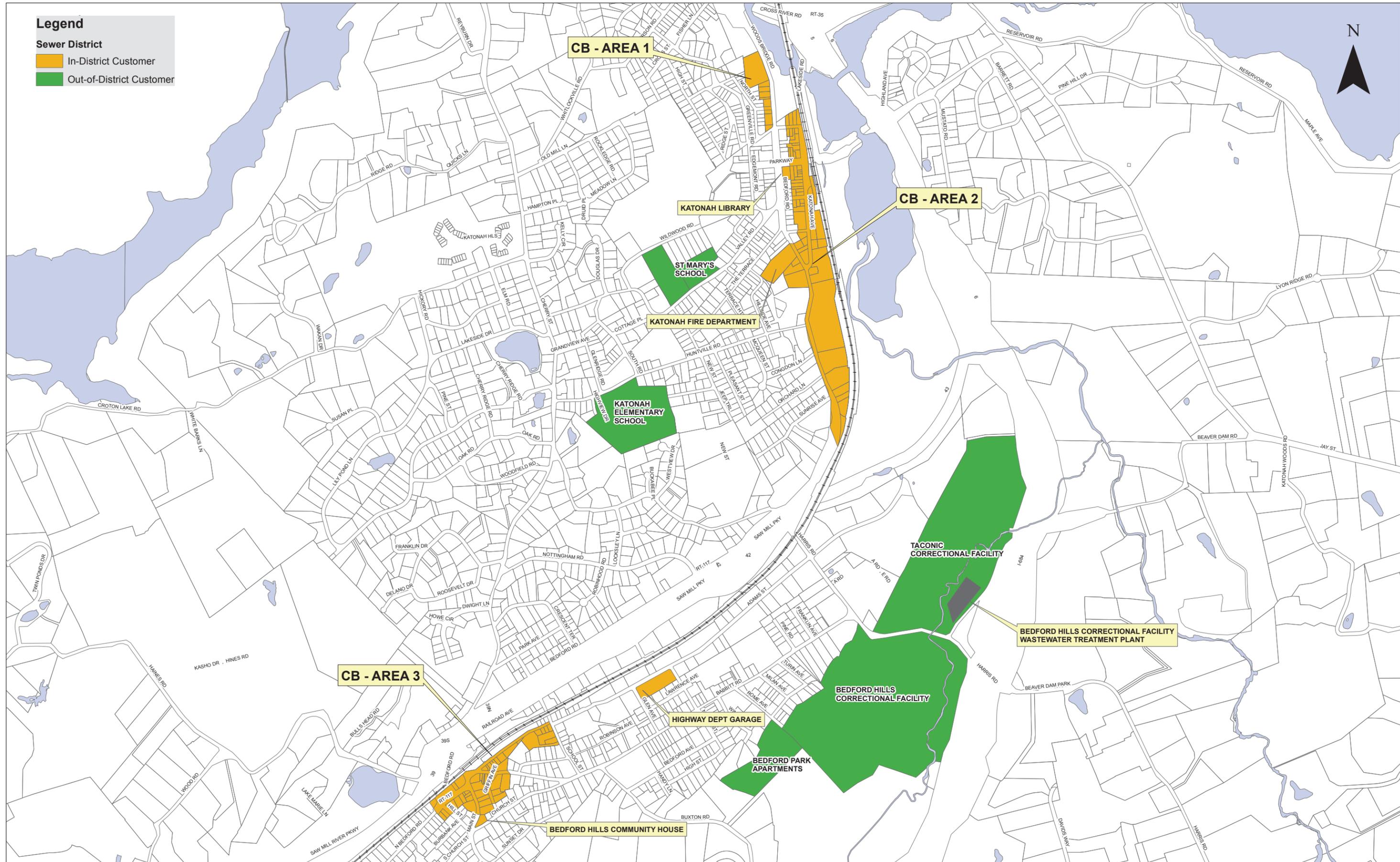


FIGURES

Legend

Sewer District

- In-District Customer
- Out-of-District Customer



TOWN OF BEDFORD
SEWER DISTRICT FORMATION
FIGURE 1 - PROPOSED SEWER DISTRICT

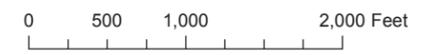
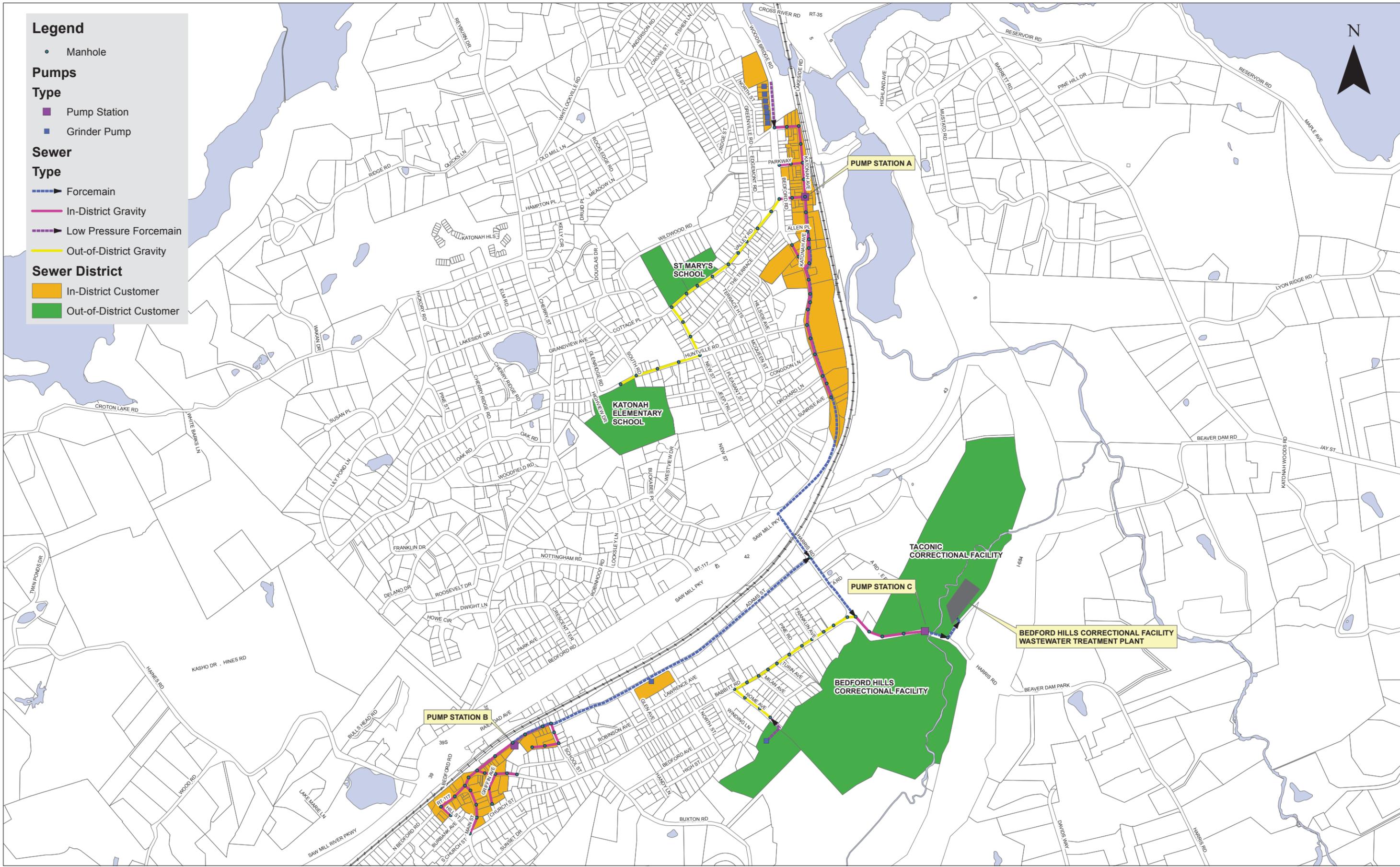


FIGURE 1

- Legend**
- Manhole
 - Pumps**
 - Type**
 - Pump Station
 - Grinder Pump
 - Sewer**
 - Type**
 - ▬ Forcemain
 - ▬ In-District Gravity
 - ▬ Low Pressure Forcemain
 - ▬ Out-of-District Gravity
 - Sewer District**
 - In-District Customer
 - Out-of-District Customer



TOWN OF BEDFORD
SEWER DISTRICT FORMATION
FIGURE 2 - PROPOSED COLLECTION SYSTEM

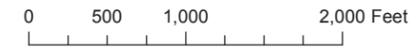


FIGURE 2

TABLES

Table A – Collection System Opinion of Probable Construction Cost

Description	Quantity	Unit Cost Installed	Total
8-inch DIP Gravity Sewer	16,900 LF	\$180 /lf	\$3,042,000
48-inch Precast Manholes	90	\$5,000 ea.	\$450,000
6-inch DIP Service Laterals ¹	106	\$2,400 ea.	\$254,400
Pump Station A	1	Lump Sum	\$500,000
Pump Station B	1	Lump Sum	\$500,000
Pump Station C	1	Lump Sum	\$475,000
4-inch DIP Forcemain	5,290 LF	\$120 /lf	\$634,800
6-inch DIP Forcemain	6,200 LF	\$160 /lf	\$992,000
6-inch DIP Forcemain (State Road) ²	780 LF	\$700 /lf	\$546,000
Creek Forcemain Crossing ³	250 LF	\$700 /lf	\$175,000
Grinder Pump Station and Connection	8	\$15,000 Ea.	\$120,000
Air Relief Structures and Valves	8	\$20,000 ea.	\$160,000
Concrete and Rock Excavation ⁴	14,500 CY	\$150 /cy	\$2,175,000
Trench Repair with Temporary Pavement ⁵	27,200 LF	\$1.75 /lf	\$47,600
Pavement Overlay ⁶	12760 Ton	\$90 /Ton	\$1,148,400
Sidewalk Restoration ⁷	590 SY	\$45 /SY	\$26,550
Curb Restoration ⁸	530 LF	\$25 /lf	\$13,250
Stormwater Pollution Prevention Plan	1 LS	Lump Sum	\$200,000
Maintenance and Protection of Traffic	18 mos	\$30,000 /month	\$540,000
Allowance for Utility Relocation		Lump Sum	\$400,000
Probable Construction Cost			\$12,400,000

- ¹ Service laterals assumed to be 20 feet (10 approximate roadway width, 10 feet from curb line to property).
- ² Forcemain in Route 117 from intersection with Bedford Road to intersection with Adams Street is assumed to be constructed with trenchless technology.
- ³ Forcemain crossing of creek assumed to be constructed with trenchless technology.
- ⁴ Assumes that 80% of length of sewer will encounter a depth of 3 feet of rock/concrete to excavate. 6 foot wide trench assumed for calculation.
- ⁵ Trench repair for all sewers (gravity and force main) and service laterals in Town roads includes 18 inches of subbase, binder and temporary pavement.
- ⁶ Pavement overlay includes cost of paving an average roadway width of 15 feet. The remainder of the width to achieve curb to curb paving will be completed by the Town Highway Department.
- ⁷ Sidewalk restoration is required due to service lateral construction. Cost assumes that two 5'x5', 4" thick concrete sidewalk sections are to be re-constructed.
- ⁸ 5 feet of concrete curb expected to be replaced where service laterals impact sidewalks and curb lines.

Table B – Collection System Annual Operation and Maintenance Cost

Description	Quantity	Unit Cost	Cost (\$/yr)
Sewer Maintenance	3.2 miles	\$930 /mile	\$3,000
Pumping Station Power Costs	102,000 kw-hr/yr	\$0.11 /kw-hr	\$11,300
Pumping Station Labor	461 man-hr/yr	\$50 /hr	\$23,050
Spare Parts, Consumables, Tools, etc.		Lump Sum	\$9,000
Total Estimated Annual O&M Cost			\$46,350
Escalation to 2019 based on 3%/yr			\$50,650

Table C - WWTP Annual Operation and Maintenance Cost

Description	Cost (\$/yr)
Personnel	\$200,000
Repair & Maintenance	\$119,000
Chemicals	\$30,000
Lab/Safety	\$11,000
Sludge Hauling	\$46,000
Utilities	\$13,000
Administrative	\$15,000
Maintenance Budget	\$30,000
Capital Expenditures	\$50,000
Electrical	\$36,000
Total Estimated Annual O&M Cost	\$550,000
Escalation to 2019 based on 3%/yr	\$601,000