Falmouth Wastewater Department - Capital planning review

By Pete Clark, Falmouth Wastewater Treatment Plant Superintendent
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Over the last ten years, capital replacement cost increases have had a significant impact on the Falmouth and Cumberland wastewater treatment system. Looking forward, replacement of major assets due to age or inadequate capacity will continue to require strategic financial planning.

Introduction

The treatment plant and collection system operate as a utility service or wastewater enterprise. Good planning dictates the need to predict growth in the communities that will correspond to the demand on the system in the future. Recent studies of the treatment and collection system have incorporated assessments of future growth based on land area and build-out potential within the existing and anticipated future service area. Accommodating expansion and growth will be a significant factor when developing a comprehensive capital improvement plan.

Aerial view of the wastewater treatment plant after 2008 upgrades

This report provides a condensed review of past (recent and historical) studies and capital construction projects. The studies acknowledge that future investments should encompass growth, sustainability, new regulations, and changing development patterns. We have provided recommendations at the end of this report that build on the studies and completed projects. These recommendations take into consideration the following:

- Capacity upgrades to meet the demands of predicted growth
- Consistency with the 2013 Comprehensive Plan
- Past capital investments
- Phasing of future investments
- Financial planning to ensure equity and moderation of rate increases

History

The wastewater treatment system was originally constructed in 1969. Ten years later, the system was expanded to accommodate the Town of Cumberland. The original wastewater collection system included 7 pump stations and 10 miles of sewer collection lines. Expansion continued after Cumberland was added to the original system. Those expansion areas included:

- Pleasant Hill
- The Woodlands
- Johnson Road
- Route One North
- Exit 53
- Falmouth Country Club

Aerial view of the new treatment plant in 1970

Today there are roughly 79 miles of sewer lines and 44 pumping stations in both towns.

The original system and subsequent expansions were well planned, constructed, and maintained. The initial state license, allowing an average total of 1.56 million gallons of sewage per day, remains adequate for the near future. The current average daily flow is 0.93 MGD, which is well within the license limits. We believe that projected flow volume growth will result in the need to increase the license limits around 2029 when flows are expected to reach 80% of the license limit. Several factors including growth rates and regulatory changes could impact the timing of any license modifications.

Recent investments in the system, including the renewal and major rehabilitation of the treatment plant and Mill Creek pumping system, will provide future growth. However, study and analysis confirm that similar investments are needed in other parts of the system to meet futures demands. Sewer assets typically last between 20 years (for equipment) and 70 years (for pipes and structures). Repair and replacement is driven by physical condition or failure to provide adequate capacity.

The incremental cost to increase the capacity of new underground assets, in line with their anticipated long life, is typically considered to be negligible. Increasing capacity in this manner when replacing infrastructure at the end of its useful life avoids future premature replacement of assets with remaining useful life. The collection and treatment system should be positioned to always provide capacity for growth.

The consultants who authored the studies assessed future needs for system upgrades based on comprehensive planning conducted in both Falmouth and Cumberland. Cumberland has expressed a desire to utilize its remaining contractual allotment within 10 years. Falmouth's 2013 Comprehensive Plan update established a designated Growth Area and recommended increased zoning density allowances in Growth Areas served by sewer. The Falmouth Town Council has subsequently adopted new zoning to allow for higher density in these growth areas.

Brief Overview of Past Studies and Capital Projects

Treatment Plant renewal, 2005-06

The treatment plant renewal was completed in 2008. The project was designed with consideration for flow projections, pollutant loading trends, and anticipated regulatory changes. The project was built with two aeration tanks but designed to accommodate a third tank in the future to meet new capacity needs.

Pump station evaluation, 2009

This study evaluated each Falmouth pump station for defects and capacity deficiencies. The study influenced several capital upgrades to pump stations in Falmouth. These investments included a complete replacement of the telemetry system, which cost approximately $400,000. The Mill Creek pump station and force main project is another recommendation from this study. The Mill Creek project cost nearly $6M and will be completed soon (see below).

Infiltration and inflow study, 2013

Storm water and high groundwater negatively impact the treatment system. Infiltration and inflow ("I&I") is more severe in older sections of the collection side of the system. I&I also comes from nonpoint sources and specific sources such as private sump pumps. I&I is factored into the analysis of future capacity needs. It was a substantial matter when the Mill Creek pump station was designed. Extra water entering the system has a limiting effect, displacing capacity to handle sewage.

The 2013 I&I study segmented the system into many drainage areas and each was monitored during the spring, when ground water is at its highest level. The data was then correlated to rain duration and intensity over the monitoring period. A model was developed to project sewer and extraneous flows in each drainage area.

The results of this study identified certain areas where periodic flow is excessive and where I&I removal should be directed. A new staff position has been created since the completion of the study, and includes coordination of efforts to reduce storm water intrusion into the sewer system. The current capital improvement plan sets aside funding for remediation work.

Shoreline sewers and structures, 2015 –16

Sections of sewer along the Foreside and Mackworth Point shoreline are at increased risk from shoreline erosion. Recent evaluations of two at risk areas have resulted in the development of tentative remediation plans.

- Along Mackworth Point, sewer extends from the bridge on Route One to Brown Street along the shore at the bottom of the seaward slope. Manholes along this section of sewer are routinely exposed to tidal effects. These manholes were buttressed with riprap around 1980. Most of the riprap has been displaced over time

Raised manhole along Shoreline Drive in need of additional reinforcement against tidal action

and 7 to 12 manholes now need added protection. The preliminary design for reinforcing these structures calls for larger stone enclosed with wire screening.

- South of Town Landing, the gravity sewer runs along the top edge of the clay bluff shoreline for several hundred feet. In this area, the shoreline is regularly eroding. The worst failures are associated with periodic sloughing of the clay bluff. The department has developed plans to reinforce the sloughed shoreline sections to address the immediate needs. Our analysis recommends repairs to the most obvious sections and continued study and monitoring of adjacent areas. Some private property owners have advocated for a more proactive and preventive approach to currently unaffected sections of the shore.

These projects suggest that additional consideration of potential risk is warranted. Additional pump stations are at elevations potentially exposed to future flooding should sea levels rise appreciably or the frequency of stronger storms increase, as some predict.

Mill Creek pump station and force main replacement, 2015-16

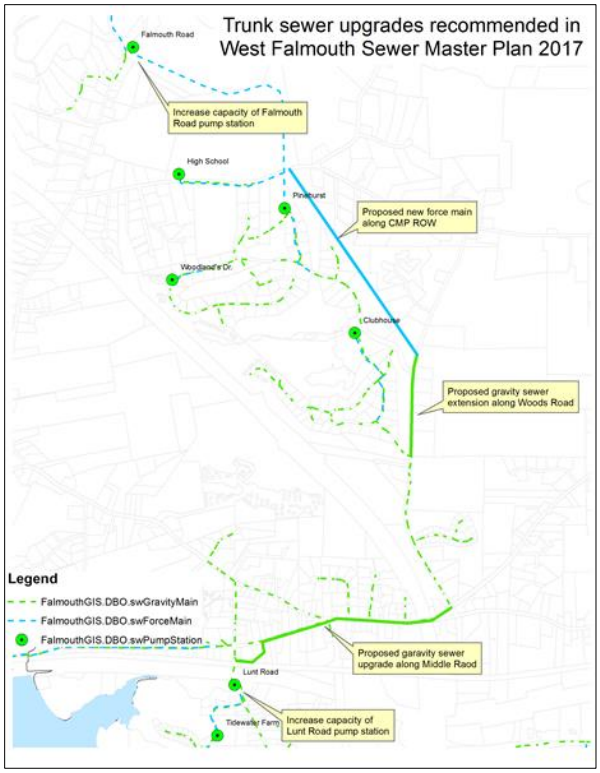
Design work related to replacement of the Mill Creek pump station included an evaluation of peak demand with I&I and future capacity needs based on projected growth. The service area includes all areas of Cumberland that are served by sewer, Falmouth Foreside, and the Route One corridor in Falmouth. Approximately 60% of all sewage flow in both communities rely on this one pump station.

The new pump station was designed to accommodate future flow needs with larger pumps and replacement of the force main. With these design considerations, the expected life cycle of the new station is well over 40 years.

West Falmouth Sewer Master Plan, 2016

This is the most recent study. It evaluated the entire area west of Interstate 295. Sewer currently serves the following West Falmouth areas:

- Extending from the I-295 overpass on Lunt Road,
- Middle Road, from Pleasant Hill to Woods Road,
- Falmouth Road, from Ridgewood to Bucknam Road,
- The Woodlands, to Exit 53 and Route 100, and
- Winn Road to Hazeltine Drive in Cumberland.



This area has seen growth since it was originally served with sewer. The existing sewer capacity that serves the area west of I-295 is inadequate when considering long-term objectives. The 2013 update of the Town's Comprehensive Plan includes the current sewer service area and adjoining lands as part of the designated "Growth Area." The Comprehensive Plan recommended increased zoning density allowances within this Growth Area and the Town Council has subsequently adopted an amended zoning ordinance that allows for increased density. The ordinance requires a lower density in those areas not served by sewer. The Town Council has also recognized that some areas not served by sewer, such as Longwoods and

Middle Road corridors north of Woods Road, may be developed in the future. In these areas, it is presumed that the developer will pay to extend sewer.

The West Falmouth Sewer Master Plan confirmed that the existing sewer west of I-295 is currently already capacity limited. Often, pump stations cannot keep up with the highest storm related flows. Modeling also shows limitations along a significant length of the gravity sewer in Middle Road.

The recommendations in this study address the need to increase the size of two force mains and to upgrade two undersized pump stations. The estimated cost to fund these improvements will approach several million dollars. These upgrades take into consideration the current needs as well as future growth.

Overall Assessment & Recommendations for Next Steps

The past studies and projects are critical to help the Town plan for the next 25 to 50 years. Staff recommendations are outlined in Table 1. The recommended phased work can be grouped into three categories by the expected timing and priority of when these projects should be undertaken.

Phase 1 Projects ("Current Projects")

The first phase of projects includes moving forward with shoreline work to reduce the risk to sewer structures and lines. It also recommends conducting a risk assessment to similarly situated sewer assets and determining possible mitigation plans where risks are identified. The project to buttress sections of the shoreline south of Town Landing will require Town Council approval to develop a collaborative plan with private property owners. Staff has indications that private property owners are amenable to sharing costs with the Town.

Phase 2 Projects ("Next Phase Projects")

The second phase of projects addresses the most immediate existing capacity issues in the West Falmouth section of the system. Initially, three projects are most important and include:

- Upgrades at the Falmouth Road pump station,
- Construction of a new force main and gravity sewer (bypass two pump stations in The Woodlands), and
- Replacement of the Middle Road sewer line with larger diameter pipe.

Subsequent upgrades in this group target the following:

- Lunt Road pump station and force main (the timing is dependent on upstream growth and the effectiveness of I&I reduction and interim pump improvements), and
- Pump station upgrades at Brown Street and Clearwater Drive.

Phase 3 Projects ("Successive Phase Projects")

The final phase of projects is generally comprised of necessary, and eventual, plant upgrades. The eventual timing of these projects relies on several variables including:

- Effectiveness of I&I reduction efforts,
- Actual growth on the system, and
- Impacts from potential regulatory changes.

The Town will need to consider these factors and make adjustments as needed.

Table 1: Recommended Projects

Project	Description	Estimated cost	Dependencies /Drivers	Benefits	Status	Next steps	Source
Current Projects							
Slope repair, near Town Landing	Spot repair of slumped sections of the shoreline bluff, South of Town Landing, potentially jeopardizing the town sewer at the top of the bluff.	$100,000	Condition	Reduces risk to adjacent sewer line	Design complete	Bid development and construction	Letter report, Wright-Pierce, Slope Failures, 2015
Manhole reinforcement, along Shoreline Drive	Spot repair of 7 manholes along the shore between Mackworth Point bridge and Brown Street by the addition of rip rap gabions around the structures.	$120,000	Condition	Reduces failure risk from storm event	Design complete	Bid development an construction	Letter Report and verbal , M. Millett, Manhole Stabilization, 2014
Risk assessment of flood prone assets	Assess the risk of shoreline assets to future flooding and storm related impacts and develop mitigations plans	$35,000	Location	Reduces failure risk from storm event	Proposed	Develop grant application	
Infiltration reductions	Annually funded program currently budgeted at $50,000 annually	$1,000,000	Ability to identify cost effective repairs	Reduces effects of storm and high groundwater on systems	Ongoing	Ongoing assessment	2013 I/I report
Next phase projects, design and implement over the next over the next 3 to 6 years							
Middle Road Interceptor Replacement	The interceptor sewer from the intersection of Longwoods Road and Woods Road, along Middle Road, then cross-country to Lunt Road is recommended for replacement. The 4,450' stretch of sewer is 8" diameter with many sections laid at either minimum slope or less than minimum slope. The project will replace the entire 8" diameter section with 15" diameter pipe.	$1,294,000	Condition	Alleviates current bottleneck and assures future growth	New	Design	West Falmouth Sewer Master Plan
Falmouth Road Pump Station upgrade	The pump station requires an upgrade with new generator, pumps, electrical, instrumentation, and other building improvements. The new pump station would be designed for 500 gpm to handle peak flows from Mill Road and Leighton Road Pump Stations and peak gravity flows.	$355,000	Condition	Alleviates current bottleneck and assures future growth	New	Design	West Falmouth Sewer Master Plan
Falmouth Road force main extension	The Falmouth Road Pump Station force main is recommended to be extended to downstream of two pump stations in the Woodlands and connected to the 12-inch gravity sewer on Woods Road. Multiple options for upgrades were considered. The recommended option bypasses existing sewer in the Woodlands complex and alleviates necessary upgrades to the Pinehurst and Clubhouse pump stations and sewer line upgrades within the Woodlands.	$1,088,000	Condition	Alleviates current bottleneck and assures future growth	New	Design	West Falmouth Sewer Master Plan
Treatment plant dewatering system improvements	Addition of centrifuge rotating assembly to spare parts to provide redundancy to the dewatering process and allow for 4 to 6 month turnaround to renew existing equipment which is approaching rebuild recommendation	$350,000	Condition	Reduces effects or risks associated with failure	Design complete	Coordinate timing and funding with Cumberland	Equipment manufacturer
Lunt Road Pump Station Interim Upgrade (Pump Station)	Interim pump upgrades and minor improvements may be practical to defer replacement.	$50,000	Condition	Defer replacement	New	Preliminary design	2009 Comprehensive Pump Station Evaluation report
Middle Road Pump Station Interim Improvements	Interim pump upgrades and minor improvements may be practical to defer replacement.	$50,000	Condition	Defer replacement	New	Preliminary design	2009 Comprehensive Pump Station Evaluation report
Treatment Plant hydraulic capacity increase	Assorted pipe and structure modifications to allow greater flows though the treatment plant.	$500,000	Growth, infiltration reductions	Assures future growth	Planned future	Monitor flow regimes	Preliminary design 2005, Cost update from the West Falmouth Sewer Master Plan
Brown Street pump station interim improvements	Interim pump upgrades and minor improvements may be practical to defer replacement.	$50,000	Condition	Defer replacement	New	Preliminary design	2009 Comprehensive Pump Station Evaluation report
Clearwater Drive pump station renewal	2010 pump station report recommends renewal of station components due to age, configuration, and minor capacity restrictions.	$74,000	Condition	Increased reliability	Planned future	Review feasibility of interim pump upgrade	2009 Comprehensive Pump Station Evaluation report
Successive phase projects, likely implemented within 7 to 15 years							
Lunt Road Pump Station Phase I Upgrade (Pump Station)	Lunt Road Pump Station will need to be upgraded to handle full build-out of West Falmouth to more than double the current capacity. Cost estimate is for station replacement.	$1,000,000	Growth	Assures future growth	New	Review feasibility of interim pump upgrade	West Falmouth Sewer Master Plan
Lunt Road Pump Station Phase II Upgrade (If needed, force main)	The second phase to afford increased capacity of the Lunt Road station would involve replacement of the 4,500 foot long force main with new ten inch pipe. The existing line can handle more than double existing peak flows.	$736,000	Growth	Assures future growth	New	Monitor flow regimes	West Falmouth Sewer Master Plan
Middle Road Pump Station Upgrade (If Needed)	Middle Road Pump Station will be under capacity to handle estimated future flows at build-out. The force main has sufficient capacity.	$355,000	Growth	Assures future growth	New	Monitor flow regimes	West Falmouth Sewer Master Plan
Add third aeration basin at the Treatment Plant	Anticipated upgrade to afford future capacity. Adds a third aeration tank at the treatment plant once capacity from the 2008 plant upgrade is exhausted.	$2,900,000	Growth	Assures future growth	Planned future	Monitor flow regimes	Preliminary design 2005, Cost update from the West Falmouth Sewer Master Plan
Add outfall extension at the Treatment Plant	Contingency upgrade dependent on regulatory changes. Extends the treatment plant outfall to near the Route 295 bridge to afford greater effluent dilution with the receiving stream.	$2,250,000	Regulations	Undetermined	Planned future	Monitor regulatory drivers	Preliminary design 2005, Cost update from the West Falmouth Sewer Master Plan
Brown Street pump station replacement	2009 pump station report recommends replacement of the station due to age, configuration, and capacity restrictions. Cost estimate is for station replacement. improvements may be practical to defer replacement.	$490,000	Condition	Increased reliability	Planned future	Review feasibility of interim pump upgrade	2009 Comprehensive Pump Station Evaluation report
Treatment Plant, enhanced nutrient removal upgrade	Contingency upgrade to address new regulatory requirements that are in development. Scope of work is similar to adding a third aeration tank, in this case additional tanks where nitrate is utilized in the presence of a soluble carbon source, often glycol addition.	$2,900,000	Regulations	Undetermined	Planned future	Monitor regulatory drivers	Preliminary design 2005, Cost update from the West Falmouth Sewer Master Plan

Funding

The Town utilized low interest long-term debt to fund the 2008 treatment plant and 2016 Mill Creek upgrades. The remaining debt obligations of these two projects are incorporated into the existing sewer capital improvement plan. Incorporating the new capital needs discussed in this report will require additional revenues, including annual user rate increases and connection fees. The Town anticipates that most of the future growth will occur within the area currently served by sewer.

The current capital improvement plan addresses the near term new capital needs, such as the remediation along shoreline areas and the roughly $6M in improvements identified in Phase 2 projects (in West Falmouth). Staff is currently projecting that bonding for the West Falmouth work will be necessary in 2019 or 2020. To meet this schedule, preliminary design work should begin this year.

Consequently, the current capital improvement plan provides the funding for the recommended work through ongoing modest service fee increases. The plan strives to maintain unencumbered balances of $750,000 in the emergency operating fund and a balance of at least $1,500,000 in future years supporting the department's other less substantive projects in the Capital Improvement Plan.

Connection fees are another revenue that will support needed capital projects. This is a fee assessed when properties connect to the system, unless that connection is exempt. Property is currently exempt from the fee if it connects via a section of sewer built and paid by a developer who then transferred ownership of the sewer to the Town. The collected fees are typically dedicated to capital projects and offset some of the cost that would otherwise be needed from rate payers.

To minimize future service charge increases, staff recommends amending the sewer ordinance and fee schedule to remove the connection fee exemption. Staff also recommends amending and redefining the current fee structure and based it on a proportional share of the undepreciated equity value of the sewer system and the capacity needs that each new connection requires. This fee structure is generally described as an "equity buy-in fee."

Conclusions and Next Steps

- Over the last ten years, renewal of major components of the system has been undertaken.
- Numerous planning and evaluation studies have been accomplished that collectively provide an excellent blueprint for decision-making and future consideration.
- The studies recommend that additional work is needed in the next 15 years.
- With the information that has been gathered, staff proposes moving forward with future work in three prioritized phases and is hopeful that the Town Council agrees with this approach.

- Staff suggests the following next steps for Council consideration and action:

    1. Guidance and necessary authorization to negotiate agreeable terms with private owners to repair slope failures near Town Landing,

    2. Formal resolution to authorize preliminary engineering to address the initial recommended capital replacement and upgrade of stations and sewer lines between the Lunt Road and

Falmouth Road pump stations and later work recommended by the West Falmouth Sewer Master plan, and

3. Replacing the existing sewer connection fee with an equity buy-in fee as a dedicated means of supporting future capital work and strategic fiscal plan.