PORTSMOUTH, NEW HAMPSHIRE

JULY 2019

Wastewater Pump Station Master Plan

WRIGHT-PIERCE
Engineering a Better Environment

PUMP STATION MASTER PLAN

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SECTION 1

EXECUTIVE SUMMARY

1.1 INTRODUCTION

The City of Portsmouth owns, operates, and maintains wastewater collection and treatment systems that provide service to the City of Portsmouth, the Town of New Castle, and portions of the Towns of Greenland and Rye. The systems include approximately 110 miles of sewer, 9 miles of force main, and 20 municipally operated pumping stations. The City's wastewater pump stations are a critical component to the City's sewer collection system.

Since the majority of the pump stations were originally installed, many stations have undergone upgrades including pump and equipment replacement, electrical improvements, and Supervisory Control and Data Acquisition (SCADA) control integration. Fourteen of the City's pump stations are over 15 years old, with ten of them originally constructed over 30 years ago. This infrastructure is a critical City asset and many of the pumps or equipment may be reaching (or have reached) the end of its useful life. As a proactive means of addressing this aging infastructure and preparing for capital improvements, the City has chosen to develop a Pump Station Master Plan. This Master Plan will be an key part of managing and maintaining the City's Wastewater Pump Station and Forcemain infrastructure moving forward.

Physical pump station evaluations were performed, in addition to reviewing historical plans, operating data, and maintenance reports. Pump Station Evaluation forms were developed and completed for each pump station, and recommendations for improvements were made based on an analysis of the pump station's current physical condition, historical records, current codes and input from City staff.

1.2 RECOMMENDATIONS

Recommendations for improvements at each pump station were broken into three categories, based on the level of priority: Low, Medium, and High. Planning-level cost estimates were developed for each recommendation and assigned a year of completion based on the priority level. The following table summarizes the recommended improvements for each pump station by year

in a 10-year Recommended Facilities Improvement Plan (RFIP). A total of $20.5 M of pump station improvements are recommended over the next 10 years. The full RFIP is available in **Appendix B**.

TABLE 1-1

SUMMARY RECOMMENDED FACILITIES IMPROVEMENT PLAN

RECOMMENDED FACILITIES IMPROVEMENT PLAN COSTS - BY YEAR (20% CONTINGENCY, 20% DESIGN)													
Pump Station		Year 0 2019	Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	TOTAL
1	Mechanic St PS	$484,600	$8,600	$0	$14,400,000	$0	$0	$0	$0	$0	$0	$0	$14,893,200
2	Deer Street PS	$98,600	$385,200	$23,000	$53,300	$0	$0	$32,400	$100,800	$25,900	$1,400	$496,800	$1,217,400
3	Lafayette Street PS	-	-	-	-	-	-	-	-	-	-	-	-
4	Heritage Street PS	-	-	-	-	-	-	-	-	-	-	-	-
5	Gosling Road PS	$14,400	$3,600	$0	$41,000	$0	$118,800	$0	$50,400	$0	$0	$21,600	$249,800
6	Ryeline PS	$16,600	$0	$5,000	$28,800	$14,400	$85,700	$0	$0	$0	$115,200	$223,200	$488,900
7	Constitution Ave PS	$15,100	$21,600	$28,800	$115,900	$0	$144,000	$37,400	$0	$0	$0	$0	$362,800
8	West Road PS	$19,400	$2,900	$7,200	$112,300	$136,100	$149,800	$37,400	$0	$0	$0	$0	$465,100
9	Woodlands I PS	$28,100	$25,200	$0	$127,400	$86,400	$144,000	$28,800	$0	$0	$0	$0	$439,900
10	Woodlands II PS	$19,400	$2,900	$0	$28,100	$17,300	$144,000	$36,000	$0	$0	$0	$0	$247,700
11	Atlantic Heights PS	$49,700	$2,900	$28,800	$257,800	$0	$86,400	$1,400	$0	$0	$0	$0	$427,000
12	Marcy Street PS	$67,100	$8,600	$14,400	$213,800	$0	$70,600	$0	$0	$0	$0	$14,400	$388,900
13	Corporate Drive PS	$0	$2,900	$0	$3,600	$1,400	$21,600	$0	$14,400	$0	$0	$0	$43,900
14	Griffin Park PS	$20,200	$23,800	$0	$17,300	$28,800	$0	$169,900	$0	$0	$108,000	$0	$368,000
15	Tuckers Cove PS	$21,600	$14,400	$0	$0	$10,800	$0	$15,800	$21,600	$0	$0	$0	$84,200
16	Leslie Drive PS	$53,300	$20,600	$57,600	$265,700	$0	$28,800	$23,000	$0	$0	$0	$0	$449,000
17	Clough Drive PS	$9,800	$1,400	$7,200	$11,500	$26,600	$0	$0	$0	$0	$0	$0	$56,500
18	Marsh Lane PS	$3,600	$4,300	$0	$69,100	$0	$0	$0	$21,600	$0	$0	$0	$98,600
19	Mill Pond Way PS	$3,600	$7,200	$0	$11,500	$0	$64,800	$0	$0	$0	$0	$0	$87,100
20	North West Road PS	$3,600	$8,600	$0	$69,100	$0	$0	$0	$21,600	$0	$0	$0	$102,900
TOTAL		**$928,700**	**$544,700**	**$172,000**	**$15,826,200**	**$321,800**	**$1,058,500**	**$382,100**	**$230,400**	**$25,900**	**$224,600**	**$756,000**	**$20,470,900**

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WRIGHT-PIERCE
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SECTION 2

INTRODUCTION

2.1 SCOPE OF WORK

In 2018, Wright-Pierce was retained by the City of Portsmouth, NH to develop a Wastewater Pumping Stations Master Plan. This report will be a key part of the City's management and maintenance of the wastewater pump station and force main infrastructure moving forward. The Master Plan report consists of the following main components:

- Pump Station evaluation
- Force Main evaluation
- Pump Station capacity assessment
- Pump Station and Force Main improvement recommendations
- Pump Station Evaluation summary sheets (**Appendix A**)
- Recommended Facilities Improvement Plan (**Appendix B**)

The City of Portsmouth owns, operates, and maintains wastewater collection and treatment systems that provide service to the City of Portsmouth, the Town of New Castle, and portions of the Towns of Greenland and Rye. There are two separate collection and treatment systems, one conveying wastewater to the Peirce Island Wastewater Treatment Facility (WWTF) and one conveying wastewater to the Pease International Tradeport WWTF. Combined, the two systems include approximately 110 miles of sewer, 9 miles of force main, and 20 municipally operated pumping stations. The City's wastewater pump stations are a critical component to the City's sewer collection system. Overview maps of the pump stations and their sewer sheds are available in **Appendix D**.

The City's twenty pump stations consist of three pump station types:

- **Wet Pit/Dry Pit Pump Station (6 total)**: These medium to large capacity pump stations consist of a below grade wet well and adjacent dry well. The dry well contains centrifugal pumps which draw wastewater from the wet well through suction piping which penetrates from the dry well to the wet well.

- Mechanic Street
- Deer Street
- Lafayette Road
- Heritage Avenue
- Gosling Road
- Ryeline

- **Suction Lift Pump Stations (10 total)**: These medium to large capacity pump stations consist of a pump station dry side (above or below-grade) equipped with self-priming pumps. The pumps are installed in a suction lift configuration situated above the wet well water surface.
  - Constitution Avenue
  - West Road
  - Woodlands I
  - Woodlands II
  - Atlantic Heights
  - Leslie Drive
  - Marcy Street
  - Corporate Drive
  - Griffin Park
  - Tuckers Cove

- **Submersible Pump Stations (4 total)**: Typically the smallest capacity of the three pump station types, this style largely consists of submersible duplex pump configurations located in a circular wet well structure.
  - Clough Drive
  - Marsh Lane
  - Mill Pond Way
  - Northwest Street

On-site pump station evaluations were performed by wastewater process engineers, in addition to reviewing historical plans, operating data, and maintenance reports for each pump station. Pump Station Evaluation forms (**Appendix A**) were developed for each pump station and the stations were photographed to document the current conditions. Additional on-site evaluations were performed by electrical, instrumentation, mechanical, architectural, and structural engineers for five of the City's pump stations: Mechanic Street, Deer Street, Leslie Drive, Constitution Avenue, and Atlantic Heights.

Desktop evaluations were performed by electrical, instrumentation, mechanical, architectural, and structural engineers for 13 of the City's pump stations: West Road, Woodlands I, Woodlands II, Marcy Street, Corporate Drive, Griffin Park, Gosling Road, Ryeline, Tuckers Cove, Marsh Lane, Clough Drive, Mill Pond Way, and Northwest Street. No evaluation was performed on Heritage

Avenue pump station as it is scheduled for a comprehensive upgrade in 2019. No evaluation was performed on Lafayette Road as it underwent a major upgrade in 2018. Historical records and pump station capacity information were reviewed for evaluation of the force mains.

A desktop review was performed to assess the City's pump station force main assets. This includes an evaluation of force main conditions including force main operation (i.e., operational velocity), pipe material type, force main bypass options, corrosion risk, and criticality. City-wide maps delineating the force main locations in relation to potential soil corrosivity are available in **Appendix D.**

2.2 REPORT BACKGROUND INFORMATION

In addition to information gathered during the on-site pump station evaluations, the following background references were used to develop this report.

2.2.1 Pump Station Historical Information

The City provided record drawings, operation and maintenance manuals, and selected pump data sheets for the 20 pump stations, when available. In addition, the City provided institutional knowledge for each of the pump stations for items which were not necessarily recorded. In some instances, specific pump station record data was not available in which case basic assumptions were required to complete the assessment. Assumptions that affected the pump station evaluation or recommendation were noted.

The City provided elapsed time meter (ETM) data for each pump station and totalized daily flow data for the pump stations equipped with flow meters. ETM data was used to evaluate general pump operation trends. Pump station drawdown testing was completed, and magnetic flow meter data was recorded during the on-site visits. This data was combined with the ETM data sets where practicable to estimate flow trends for each pump station. In addition, the City supplied historical totalized magnetic flow meter data (daily) for many of the larger pump stations.

2.2.2 Pump Station Force Main Information

The City provided their current geographical information system (GIS) database for the pump station force mains which included attributes such as pipe length, pipe material, and pipe age. Where available, the GIS database was cross-referenced with pump station record drawings for confirmation. The available force main data was used to evaluate their current conditions, and to develop recommendations for future force main inspection, maintenance, and planning.

The force main locations were overlaid with Natural Resource Conservation Service (NRCS) soils survey data to identify soil-type areas where force mains may be more at risk for corrosion. Depending on pipe material, the installation of force mains in areas of poor or corrosive soils can lead to accelerated deterioration of pipes, and therefore a shorter than expected anticipated useful life. Corrosive soils for steel and concrete from NRCS soils survey data were used to develop this factor. Cast iron and ductile iron pipes were analyzed with the steel corrosivity data. PVC was not investigated due to the material's high resistance to natural degradation (i.e. deterioration caused by soil conditions). Important to note is that most of the urban area soils were generically identified by the NRCS soils survey as "low corrosivity risk soils."

2.2.3 Pump Station Flooding Assessment

In 2013, the City of Portsmouth completed a Coastal Resiliency Initiative Climate Change Vulnerability Assessment and Adaptation Plan (Coastal Resiliency Plan). The Coastal Resiliency Plan provides an overview of sea level flooding elevations across the City for the years 2050 and 2100 based on projected future scenarios. The conclusions from the Coastal Resiliency Plan were used as a basis for flood protection and pump station siting recommendations in the Pump Station Master Plan (**Appendix C**).

2.2.4 Applicable Fire Code

<u>NFPA 37 – Standard for Installation of Combustion Engines</u>

To comply with NFPA 37, facilities must have a 1-hour fire-rated separation between rooms containing a stationary combustion engine (i.e., standby generator) and any other adjacent rooms within the structure. This code applies to many of the City's existing pump stations. Unless the requirement is waived by the local authority having jurisdiction, any major alteration to pump

stations which do not comply with this code, would need to be upgraded in accordance with NFPA 37. The current New Hampshire State Fire Code, Saf-C 6000, adopts by reference NFPA 1 - 2009 edition, which in turn adopts by reference NFPA 37 - 2006 edition.

NFPA 820 – Standard for Fire Protection in Wastewater Treatment & Collection Facilities

NFPA 820 was first issued as a recommendation in 1990 and governs to safeguard against fire and explosion risks in wastewater facilities that, while infrequent, tend to be relatively severe when they do occur. The scope has been expanded and the requirements refined in subsequent editions. This code reference dictates National Electric Code (NEC) classifications of hazardous references and also provides guidance on mechanical ventilation requirements for hazard-specific areas within a pump station.

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SECTION 3

PUMP STATION EVALUATIONS
WET PIT/DRY PIT PUMP STATIONS

3.1 MECHANIC STREET

3.1.1 Existing Conditions

The Mechanic Street Pump Station was originally constructed in the 1970s. It is the City's largest pump station and conveys all the City's wastewater that is treated at the Peirce Island WWTF. The pump station has undergone the following major upgrades:

- Building Renovation and Pump Replacement (1991)
- Screenings Removal Upgrade (2000)
- Electrical upgrade and Odor Control System Upgrade (2008)

3.1.1.1 Equipment

The pump station houses two 450 horse power (HP) dry pit submersible pumps. The Davis-EMU pumps were installed in 1991 and are rated for 22 MGD (15,300 gpm). The pumps operate in a lead/standby configuration and operate as much as 24-hours a day. Each pump is driven by a variable frequency drive (VFD) with the pump speed controlled by wet well level. The pump station wet well is divided into two parts separated by a manual sluice gate. The City indicated that the sluice gate is not operational. If the wet well needs to be bypassed, the City utilizes a permanent pump station bypass pump system which is comprised of a bypass wetwell and 143 HP submersible pump rated for 11.5 MGD (8,000 gpm). The bypass pump system was upgraded in 2000 with the Screenings Removal Upgrade project. The flows to the bypass pump do not pass through the influent screen.

The City indicated that over the past several years they have experienced the following wear and age-related equipment failures in their main pumping system:

- **Pump No. 1**: A hole was worn into the side of the pump volute. In 2015, the City had to complete an emergency pump repair consisting of installation of a temporary wear ring in the volute, and application of a coating inside the pump casing for wear protection.

- **Pump No. 2**: The motor failed which resulted in rewinding. In addition, in 2016 the suction piping failed and required emergency coupling adapters in the dry well.

The Wet Well side of the pump stations contains a hydraulically powered climber-style mechanical bar screen and dual stage wash press for screenings cleaning and compaction. The City indicated that the climber style screen requires constant maintenance. The Wet Well also contains a motor actuated influent sluice gate which can be operated to divert influent flow to the bypass pump station wet well.

Much of the equipment at the Mechanic Street Pump Station, including the main pumps, influent climber screen, screenings wash press, and support equipment has reached the end of its useful life. The existing equipment will require consistence maintenance to remain operational until its planned replacement as part of the City's Capital Improvement Plan.

3.1.1.1.1 Heating, Ventilation, and Air Conditioning

A packaged rooftop air handling unit provides heating (gas), cooling, and ventilation to the Control Room and Pump Room on the dry side of the pump station. This unit only operates during the day due to noise complaints from the neighbors. A ductless split system air conditioning unit provides additional cooling and is the primary source of cooling at night, when the rooftop unit is offline. Air is exhausted from the Control Room and Pump Room by a roof-mounted centrifugal upblast exhaust fan. When the main rooftop unit is not operating, the Dry Well is not ventilated as required by NFPA 820 requirements to declassify the space as required for the current electrical equipment ratings.

The Wet Well's ventilation is provided by a filtered, explosion-proof roof-mounted fan with weather hood. Exhaust air is ducted from the Wet Well through an odor control scrubber located on an elevated platform and its associated enclosed utility set exhaust fan. A bypass exhaust fan and associated ductwork is located adjacent to the odor control equipment. The equipment appears

to be in good condition. Heating is provided by an explosion proof electric unit heater which appears to be in fair condition.

A majority of the ventilation, heating, and cooling equipment were upgraded in 2000, with the dry well ductless split and the odor control system installed in 2008. Overall the equipment appeared to be in good condition. However, much of the HVAC equipment is roof-mounted and cannot be accessed without a complete electrical shutdown to the pump station due to the proximity of pole mounted transformers. In addition, the roof is not adequately equipped with guardrails for fall protection, as required by code. These code restrictions present significant maintenance obstacles when work is required on any of the HVAC equipment at the Mechanic Street Pump Station.

3.1.1.1.2 Electrical

The pump station's electric service is fed from three pole-mounted transformers located in close proximity to the pump station roof. The high voltage proximity presents life-safety access issues with HVAC equipment maintenance. Replacement of the transformers may require the installation of a pad-mounted transformer given the proximity of the pole to the pump station roof.

The main pumps are powered by variable frequency drives (VFDs) which were replaced in 2007. The automatic transfer switches (ATS-1 and ATS-2) allocated to each main pump were replaced in 2016. Much of the remaining electrical equipment was installed as part of the 1990 pump station upgrade and has reached the end of its useful life.

The pump station's diesel standby generator (Cummins 950 HP) was originally installed in 1990. The diesel storage tank for the generator is above-ground dual-wall fuel tank with leak detection port, located directly adjacent to the generator. Capacity information was not available for the storage tank; however, it appeared to be approximately 660 gallons total storage. Based on similar size standby generators, this volume appears to be relatively small and should be evaluated against NHDES' standby generator storage tank requirements. The tank shows some signs of minor surface corrosion, but appears to be in relatively good condition.

Emergency lighting and exit signage was observed to be missing from the Wet Well/Screenings Room as well as the Dry Well.

3.1.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Control Room. A backup float control system is also located in the control panel in case of PLC or level instrument failure. There is a main effluent flow meter, two wet well submersible level transmitters, two high level float switches, and a drywell flood alarm level float switch. The bypass pump system is controlled by its own dedicated control panel and instruments. The bypass system includes an effluent flow meter, ultrasonic wet well level, and wet well float switches. No deficiencies were noted with the wet well level instruments or float switches, but it is noted that the bypass wet well ultrasonic level instrument and magnetic flow meter are approaching the end of their useful life (estimated at 15 years) and should be planned for replacement. All instruments in the wet well should be installed with intrinsically safe relays or intrinsically safe barrier protection installed.

3.1.1.2 Building

3.1.1.2.1 Exterior

The building exterior is in fair condition; however, there is evidence the building has been subjected to flooding at times. The roof houses mechanical equipment which presents life safety code issues as discussed in previous sections. Equipment located within 10 feet of the roof edge may only be accessed with full fall protection equipment when maintenance is required.

3.1.1.2.2 Dry Well/Electrical Room

Interior masonry surfaces on the upper level appeared to be mostly in good condition. The concrete floor near the entrance door has delaminated and missing toe plates were noted on the guard around the stair openings. The concrete stair is open at all levels with a single-height top-mounted guardrail. The concrete is in poor condition with degradation in areas. Corrosion was noted on the mezzanine steel beams, handrails, grating, and welds. The overhead concrete slab from the

mezzanine is degraded and should be resurfaced. Loose, broken, and missing stair nosing was observed.

3.1.1.2.3 Wet Well

The upper level concrete floor surfaces and walls showed significant staining and a few areas of degradation, likely due to the age and environment associated with the wet well area. The stair concrete was in poor condition with several steps missing imbedded stair nosings. The stair deficiencies present a tripping hazard. Concrete beams in the wet well area showed signs of spalling and cracking and should be repaired as soon as possible to prevent further damage

3.1.1.3 Site

As previously noted, there is evidence the site and building have been subject to flooding conditions. The existing finished floor elevation is 8.7 feet (NAVD) and falls within the floodplain for year 2050 and 2100 flooding projection scenarios as described in the City's Climate Change Vulnerability Assessment. See **Appendix C** for additional information regarding vulnerability to potential future flooding scenarios. Future pump station upgrades should consider these elevations when planning all proposed modifications or upgrades at the pump station.

Site observations indicated that the standby generator diesel fuel tank is not protected in any form or fastened to its support. Given the low elevation of the area, tank flotation may be a risk in a severe flooding scenario.

3.1.1.4 Force Main

The pump station's force main was installed during original construction of the pump station in the 1970s and has undergone several upgrades since. The notable force main upgrades occurred in 1988, 1990, and 1998. The force main is primarily ductile iron (DI) with a cast iron (CI) segment along the bridge section. The force main exits the pump station in a 20-inch diameter DI pipe and is immediately upsized to 30-inch diameter before traveling down Mechanic Street and splitting into two force mains before the bridge. After the bridge, the 24-inch DI pipe connects to the existing 24-inch DI force main installed in 1988 and travels 2,100 LF. The 16-inch CI pipe

connects to the existing 18-inch CI pipe installed in 1973 after the bridge and travels down Peirce Island Road, parallel to the 24-inch DI force main. The 16-inch CI and 24-inch DI force mains combine into a 30-inch pipe and continue the last 300 LF before entering the WWTF.

The average useful lifespan of DI force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The older portions of the force main pipe are currently 45-years old.

In 2016, a force main break occurred on the newer 24-inch DI pipe. The break was attributed to a piece of rock bedded under the pipe which cause a small corrosion hole. No other notable breaks have occurred.

The Mechanic Street force main is located in an area of soils identified as low corrosivity to ductile iron. Based on this data, it is unlikely that soil conditions alone would contribute to accelerated degradation of the force main pipe. However, it must be noted that a section of force main before the Peirce Island bridge is in a low elevation area in close proximity to the Piscataqua River. It is expected that the water table is high and has high salinity, which can lead to accelerated corrosion of the force mains. However, if significant exterior force main degradation was occurring, it is likely that more recent force main construction projects at the pump station (i.e., Bypass Pumping upgrade, 2000) would have identified any force main deterioration issues.

3.1.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating almost 24-hours a day. This average day operation equates to approximately 20 million gallons per day (MGD) of wastewater based on the provided totalized flow meter data. It is only under drought conditions that the pumps typically run less, around 10 to 15 hours a day. Under high flow scenarios when the pumps are not able to convey peak sanitary flows, the sewer system overflows via one of two combined sewer overflow (CSO) structures in South Mill Pond. The pump station capacity is adequate for the City's current combined system. As the City continues to separate stormwater from the combined sewer system, the volume of stormwater flows conveyed tied into

the system may be reduced in the future, potentially allowing the Mechanic Street pump station peak capacities to be reduced and minimizing CSOs.

3.1.3 Emergency Bypass Plan

The Mechanic Street Pump Station includes a permanent submersible wet well bypass system which has a capacity of up to 11 MGD, which corresponds to half of the pump station's design flow (22 MGD). In an emergency, this bypass pump system can be used to divert flow from the main pump station, to the bypass pump station. If flows exceed the capacity of the bypass pump station and the main pumps cannot be operated, the result will be a combined sewer overflow event in South Mill pond.

Based on a review of the existing record drawings, there is no permanent system in place to bypass the Mechanic Street force main(s). The City does have the capability to isolate a section of the force main on the pump station side of the Peirce Island bridge. In the event that the City needed to isolate the common force main section (30-inch) or the dual force main sections, the City has several force main bypass options depending on where the force main needed to be accessed:

1) Install a force main bypass connection at the pump station and install a temporary force main to the WWTF. This approach allows the City to utilize existing pumps, but would require a significant capital investment for equipment, materials, and labor.

2) Coordinate force main maintenance efforts for a "low flow" time slot and utilize septage haulers combined with in-line collection system storage to provide a window for force main maintenance. If the City exceeds the in-line storage capacity of the collection system, this approach can result in a CSO event in South Mill Pond (NPDES permitted CSOs 10A and 10B).

3.1.4 Recommendations

Recommendations for the Mechanic Street Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. It must be noted that the Mechanic Street Pump Station is recommended for a comprehensive upgrade/replacement within

3 years and as such, deficiencies which were not considered high priority were assumed to be addressed in the subsequent upgrade. The following discussion addresses high priority and high cost items (greater than $50,000) identified as part of this evaluation:

i. The Mechanic Street Pump Station equipment including pumps, influent screen, and wet well piping have surpassed their useful life. A comprehensive Pump Station replacement in recommended within 1 to 3 years to continue to provide reliable operation.

ii. As a short-term measure, it is recommended that the City contract with an ultrasonic thickness testing agency to confirm the integrity of all piping within the dry well.

iii. Continuously operate the dry well roof exhaust fan to properly de-rate the area per NFPA 820 requirements. If the City determines that the existing exhaust fan unit cannot be operated, the City may consider a higher cost alternative to dry well ventilation which includes installation of new heating, ventilation, and cooling mechanical systems in the dry well.

iv. Provide a capital planning fund for possible emergency VFD replacement until comprehensive pump station upgrades.

v. Several minor improvements are recommended to ensure continued safety and reliability of the existing pump station: install emergency lighting; complete a dry well pipe thickness test; fasten the fuel oil tank to the foundations; repair and sandblast the dry well and wet well piping penetrations; repair the wet well cracked and spalled beams; replace wet well stair nosings; and pressure wash and repair the wet well concrete channel.

3.2 DEER STREET

3.2.1 Existing Conditions

The Deer Street Pump Station was originally constructed in the 1970s. It is the City's second largest pump station. This pump station has the largest sewer shed (approximately 200,000 linear feet of pipe), which includes a large part of the commercial downtown district, the residential areas

around North Mill Pond and Woodbury Avenue, as well as several commercial properties around and including the Durgin Square plaza. The pump station has undergone the following major upgrades:

- Building Renovation and Pump Replacement (1991)
- Comprehensive Pump Station upgrade (2007)

3.2.1.1 Equipment

The pump station houses three 200 HP vertical centrifugal Morris pumps installed in 2007. Each pump is rated for 6.2 MGD (single pump), or a combined 12.7 MGD (two pumps, PLC pump speed limited to 10.5 MGD). The pumps operate in a lead/lag/standby configuration. Each pump is VFD driven with the pump speed controlled by wet well level.

The pump station wet well is divided into two parts, with stop gates installed for wet well isolation. The influent sewer to the wet well can be controlled via a sluice gate. Prior to entering the wet well, wastewater flows through a hydraulically powered grinder. The wet well exhaust air is treated using a granular activated carbon adsorption unit.

The City reported that the existing pump station equipment is in good condition and has operated well since installation in 2008.

3.2.1.1.1 Heating, Ventilation, and Air Conditioning

The Electric Room and Pump Room are supplied with heating and cooling by an air handling unit (AHU) with associated gas fired duct furnace, located in the mezzanine/attic area. The equipment was installed in 2008 and appear to be in relatively good condition. The exterior condensing unit associated with the air handling unit is showing signs of corrosion and the insulation on the refrigerant piping has been severely degraded and has failed in several places. The dry well area does not have a means to positively exhaust air from this space, as is required by NFPA 820 requirements to declassify the space for the current electrical equipment ratings. The Wet Well is ventilated by a duct mounted supply fan located in the electrical room and an exhaust fan and odor control unit located on the ground floor of the wet well. Heating is provided by an explosion proof unit heater. The equipment was installed in 2008 and appear to be in good condition.

3.2.1.1.2 Electrical

As part of the comprehensive upgrade completed in 2007, all of the electrical equipment and distribution systems were replaced. No major deficiencies were noted, although it is recommended that arc flash safety labeling be added.

The pump station's standby generator (Caterpillar 500kW) was installed in 2007 and includes a sub-base 650-gallon fuel tank. The generator (and tank) are housed in a separate room adjacent to the Wet Well. No deficiencies were noted with the standby generator system.

3.2.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Electrical Room. A backup float control system is also located in the control panel in case of PLC or level instrument failure. There is a main effluent flow meter, wet well submersible level transmitters, four level float switches (two are backup switches), and a drywell flood alarm level float switch. No major deficiencies were noted with the instrumentation or control equipment.

The pump station also includes a newly installed gas detection system in both the Pump Room and Wet Well.

3.2.1.2 Building

3.2.1.2.1 Exterior

The building exterior is in excellent condition. On the exterior, only minor graffiti was noted during the site visit. The access doors to the Standby Generator Room are equipped with an internal louver assembly and modified door handle, which present a life safety concern for egress from this room. Minimum egress clear width is 32 inches for code compliance and this access door provides only an 18-inch egress distance with the louvers.

3.2.1.2.2 Dry Well/Electrical Room

The existing concrete stair in the lower level is open at all levels with a single height top-mounted guardrail. The dry well stair shows signs of minor concrete degradation. It was also noted that the

stair nosing is loose, broken, or missing in several locations. Overall the concrete surfaces appear to be in good condition.

3.2.1.2.3 Wet Well

The upper level concrete floor surfaces showed significant staining and a few areas of degradation, likely due to the age of the area. The aluminum stair predates the 1990 pump station upgrade and may date back to the 1970s. The stairs were in fair condition but showed a moderate degree of corrosion with some bent treads. The odor control unit floor supports were questionable and should be structurally evaluated based on the potential weight of the activated carbon unit. The wet well contains an influent grinder that is in good condition. The City should plan on replacing the cutter stacks and possibly the grinder body, depending on its condition, every 4 to 8 years.

3.2.1.2.4 Generator Room

The Generator Room was constructed as an addition in the 2008 upgrade. The room houses the generator as well as provides access to the mechanical equipment platform via an alternating tread staircase. A large crack (drying/shrinkage crack) was observed in the ground level slab near the entrance door. Based on NFPA 37 requirements, the Generator room should be constructed to provide a 1-hour fire rated separation from the rest of the building. Based on the observed construction materials (i.e., plywood), this room does not appear to be adequately fire rated.

3.2.1.3 Site

The pump station is located at the corner of Deer Street and Market Street in the City's commercial downtown area. The Pump Station has a dedicated access drive on the front side (Deer Street) of the station, with Market Street and a residential sidewalk located on the north side of the Pump Station. The site is situated between two commercial buildings with access to one of these buildings' parking areas located on the immediate eastern side of the pump station.

The pump station's finished floor elevation is 13.0 feet (NAVD) with the surrounding grade ranging between 11.0 and 12.0 feet. These elevations fall within the floodplain for projected tidal flooding scenarios in the 2100, based on the City's Climate Change Vulnerability Assessment

(**Appendix C)**. While the Deer Street Pump Station is not considered to be in immediate flooding danger, all future pump station upgrades should consider these elevations when planning all proposed modifications or upgrades at the pump station.

3.2.1.4 Force Main

The pump station's force main was installed during original construction of the pump station in the 1970s and has undergone several upgrades since. The major notable force main upgrades occurred in the 1980s and 1990 as part of the major pump station renovation.

The force main for this pump station begins as a 16-inch ductile iron (DI) pipe which splits into two separate force mains. Each force main is equipped with a buried gate valve for force main isolation. The City has indicated that both of these valves are no longer operational. After the inoperable buried valve, the force main is a 14-inch DI pipe (1976) routed along Ceres Street and northeast on Bow Street before transitioning to 16-inch DI pipe. The second force main is a 16-inch DI pipe which is routed up Market Street to the intersection of Pen hallow and Commercial Alley (1990) before transitioning to a 12-inch ductile iron pipe. Both force mains combine into a 20-inch DI pipe (1990) before discharging into a sewer manhole which conveys flow to the Mechanic Street Pump Station.

The average useful lifespan of DI pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The existing force main pipes are made up of several different construction phases; however, it is estimated that much of the force main alignment is 32-years old. With the exception of the inoperable force main isolation valves, the City has no records of pipe failure or recurring maintenance issues.

The Deer Street force mains are located in an area of soils that do not present a corrosive risk to the force mains. However, much of the force main alignments are in heavily developed areas where soils are likely non-native fill material. If native soils are intact, they may contribute to a reduction in the expected lifespan of the pipe. Based on this data, age, and the criticality of the Deer Street Pump station, the City should monitor/inspect the Deer Street force mains every

5-10 years for integrity. Prior to any force main inspection taking place, the City will need to replace the buried isolation valves immediately outside of the pump station.

3.2.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating around 21-hours a day. Typically, these pump operate well below full speed (~30 Hz) for large portions of the day when influent flows are low, and speeds up during diurnal higher flowrates and storms. The average day pump operation averages to approximately 2.0 - 2.5 million gallons per day (MGD) of wastewater based on the City's provided totalized flow meter data. It is only under drought conditions that the pumps typically run less, around 15 hours a day. Elapsed time meter data indicates that Pump No. 3 operates between 20-30% more often than Pump No. 1 or Pump No. 2. Pump testing confirmed that this pump has a reduced capacity (5800 vs. 6000 gpm) compared to Pump No. 1 and Pump No. 2. This reduced capacity could be due to the pump/piping layout, but could also be indicative of impeller wear or other pump maintenance items. Under high flow scenarios, the Pump Station is limited to discharging 10.5 MGD by the Control Panel PLC to avoid overwhelming the downstream collection system (i.e., sewers, Mechanic Street). During these instances, the sewer system overflows via a combined sewer overflow (CSO) structure located across Market Street in the Piscataqua River (NPDES permitted CSO 013). Based on the downstream flow limitations, the Deer Street pump station is adequately sized to handle the sewershed's combined wastewater flows.

3.2.3 Emergency Bypass Plan

The Deer Street Pump Station includes 12-inch bypass pumping connection if the pump station needed to be bypassed. If required, pump station bypass is considered an extreme event and would require supplemental bypass pumping from either the pump station wet well, or from the sewer manhole immediately upstream of the wet well.

The Deer Street Pump Station is serviced by two force mains which are each equipped with isolation valves for force main isolation. The City has reported that these valves are inoperable, and therefore, the City does not have a means to isolate either force main for maintenance. In the

event that these valves are repaired, the City could utilize one force main temporarily while maintenance of the other force main was completed.

3.2.4 Recommendations

Recommendations for the Deer Street Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses high priority and high cost (greater than $50,000) items identified through this evaluation.

i. Repair buried force main isolation valves to allow for force main maintenance, inspection, etc.

ii. Complete dry well (Electric Room, Pump Room) HVAC upgrades to provide positive ventilation as required per NFPA 820.

iii. Begin long-term planning for Pump rehabilitation/replacement (10 years).

iv. Modify the Generator Room to provide a 1-hour fire rating per NFPA 37.

v. Evaluate Odor Control Unit elevated supports and support connections for structural integrity. Repair/reinforce supports as necessary.

vi. To address several code-related life safety concerns, the following modifications are recommended: modify the Generator Room egress door louvers to allow for adequate egress clearances; add fire dampers to all ductwork that penetrate the Generator Room; add arc-flash safety labeling to electrical equipment where required.

3.3 LAFAYETTE ROAD

3.3.1 Existing Conditions

The Lafayette Road Pump Station was originally installed in 1962 and has undergone several major upgrades in 1991, and 1999. This pump station provides service to a major portion of the

south end of the City. The pump station was completely upgrade in 2018 and as a result, was not evaluated in detail as part of this study.

3.3.1.1 Site

The pump station is located in the parking lot of shopping center on Lafayette Road in the City's commercial area. The existing finished floor elevation is approximately 14.0 feet and falls within the floodplain for 2100 flooding projection scenarios as described in the City's Climate Change Vulnerability Assessment. See **Appendix C** for additional information regarding vulnerability to potential future flooding scenarios.

3.3.1.2 Force Main

The pump station's force main was installed during original construction of the pump station in 1962. The 14-inch asbestos cement (AC) force main extends approximately 2,600 LF before discharging into a sewer manhole on Lafayette Road.

The average useful lifespan of AC force main pipe depends on a variety of factors, including: soil and environmental conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, AC pipe can have a service life of 50 to 100 years. Based on discussions with the City and a review of existing plans, the existing AC force main pipe is 56-years old. During the 2017 Lafayette Road Pump Station upgrade, the City successfully pigged the force main to ensure it's reliable, continued use. No issues were reported during the pigging exercise.

The force main is located in an area of soils with a low corrosion index. Based on this data, it is unlikely that soil conditions alone would contribute to accelerated degradation of the force main pipe. However, it must be noted that section of force main close to the pump station the is in a low elevation area in close proximity to Sagamore Creek, a tidally influenced water body. It is expected that the water table is high and possibly saline, which can lead to accelerated corrosion of asbestos cement force mains.

Based on the success of recent force main pigging in 2018, the 14-inch AC pipe appear to be in good condition internally. However, based on the age of the force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main alignment to provide further confirmation of the interior pipe condition.

3.3.2 Recommendations

It is recommended that the City plan to complete a closed-circuit television (CCTV) investigation in 1 to 3 years along the force main alignment to provide visual indication of the interior pipe condition.

3.4 HERITAGE AVENUE

3.4.1 Existing Conditions

The Heritage Avenue Pump Station was originally constructed in 1976 and provides service to several commercial/industrial properties located on Heritage Avenue. Comprehensive upgrades to the pump station are scheduled for design in 2018-2019; therefore, the pump station's current condition was not evaluated as part of this study.

3.4.1.1 Force Main

The pump station's force main was upgraded in 2010. The 6-inch high density polyethylene (HDPE) force main extends 1,200 LF before discharging into a sewer manhole at the intersection of Heritage Avenue and Post Road.

The average useful lifespan of HDPE force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, HDPE pipe can have a service life of well over 50 years. The force main pipe is currently 8-years old and the City has no records of pipe failure or maintenance issues. HDPE is a very corrosion resistant material, and thus, it is unlikely that the soil type would contribute to deterioration of the pipe.

3.4.2 Recommendations

The City has indicated that the Heritage Avenue pump station will be upgraded in 2019/2020. Based on the capacity of the pump station and historical low pump run times (less than 1 hour per day), the City should consider potential cost savings that could be realized with the application of a submersible-type pump station in lieu of suction lift or dry pit pumps.

3.5 GOSLING ROAD

3.5.1 Existing Conditions

The Gosling Road Pump Station was originally constructed in the early 1970s and underwent a comprehensive upgrade in 2005. This pump station provides service to a portion of the business/commercial district along Woodbury Avenue and Gosling Road.

3.5.1.1 Equipment

The pump station houses two 40 HP vertical centrifugal pumps. Each pump is rated for 900 GPM at 105 feet of total dynamic head. The pumps operate in a lead/standby configuration. Each pump is VFD driven with the pump speed controlled by wet well level. The City indicated that replacement parts for these pumps are no longer available from the manufacturer. While the City has been able to stockpile some spare pump parts for the existing pumps, it is recommended that the pumps be replaced within the next 5 to 7 years with pumps which are supported by the manufacturer. At that time, pumps will have reached their expected useful design life (20 years).

The pump station wet well is divided into two parts, with stop gates installed for wet well isolation. Prior to entering the wet well, wastewater flows through a hydraulically powered grinder. The influent channel grinder is approaching 15 years old, but was observed to be in good condition. Depending on the severity of the grinder application, the City should plan on replacing the cutter stacks every 4 to 8 years, and possibly the grinder body depending on the condition.

3.5.1.1.1 Heating, Ventilation, and Air Conditioning

Ventilation air is circulated through the dry well by an exhaust fan located on the intermediate level, ducted down to the pump room below, and up to a louver in the ground level sidewall. The exhaust fan, louver, damper, and ductwork appear to be in good condition. Heating in the Dry Well is provided by a separated combustion unit heater with high static fan, located on the ground level and ducted down to the pump room below. Exhaust and combustion air are vented through a concentric vent kit in the sidewall. The unit appears to be in good condition, but was installed in 2005 and is approaching the end of its expected useful life. The City indicated that the dry well side of the pump station gets hot in the summertime and is difficult to keep cool. This is likely due to the lack of air conditioning as well as heat rejection from the VFDs, transformers, and other electrical distribution equipment.

The Wet Well is ventilated by an explosion proof FRP sidewall centrifugal exhaust fan ducted down to the lower level of the wet well. The fan and ductwork appear to be in good condition.

3.5.1.1.2 Electrical

As part of the comprehensive upgrade completed in 2005, all of the electrical equipment and distribution systems were replaced. The existing dry well hazardous gas detection system was not operational at the time of the site visit, but the City was in the process of replacing this system. No major deficiencies were noted.

The pump station's standby generator (Onan 125kW) was installed in 2005 and includes a sub-base diesel fuel tank. The generator (and tank) are housed in an exterior skin enclosure within a fenced in area adjacent to the Pump Station. No deficiencies were noted with the standby generator system.

3.5.1.1.3 Instrumentation

The pump station controls are located in a control panel in the upper level of the dry well. A backup float control system is also located in the control panel in case of PLC or level instrument failure. There is a main effluent flow meter, wet well submersible level transmitters, and four level float

switches (two are backup switches). No major deficiencies were noted with the instrumentation or control equipment.

The pump station gas detection system was being upgraded in both the Dry Well and Wet Well.

3.5.1.2 Building

3.5.1.2.1 Exterior

The building exterior is in good condition. The membrane roof age was not able to be verified but may be nearing the end of its useful design life based on observations. In addition, the exterior monorail shows signs of corrosion and should be sandblasted/painted to prevent further corrosion.

3.5.1.2.2 Dry Well/Electrical Room

The interior surfaces and stairs are in good condition. No deficiencies were noted.

3.5.1.2.3 Wet Well

The interior surfaces of the wet well were observed to be in fair condition. The City should replace wet well channel grating where missing on the influent channels.

3.5.1.3 Site

The pump station is located in a commercial district in the back corner of a Ryder truck rental establishment. The City indicated that in 2007/2008, the pump station was hit by a Ryder truck, and brick repair was required. The building structure has since been protected via concrete bollards around the periphery.

The existing finished floor elevation is 31 feet (NAVD) which is greater than 10 feet above flooding elevations identified in the City's Climate Change Vulnerability Assessment. Based on this assessment, the Gosling Road Pump Station does not present a flooding concern (**Appendix C**).

3.5.1.4 Force Main

Based on the reviewed plans, the pump station's force main was installed during the original construction of the pump station in the 1970s. The 8-inch asbestos cement (AC) force main extends 1200 LF before discharging into a sewer manhole on Woodbury Avenue.

The average useful lifespan of AC force main pipe depends on a variety of factors, including: soil and environmental conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, AC pipe can have a service life of 50 to 100 years.

Based on discussions with the City and a review of existing plans, the existing AC force main pipe is 48-years old. The City reported no records of pipe failure or maintenance issues with this force main.

The force main is located in an area of soils identified as medium corrosivity to concrete. It is possible that this may accelerate the rate of deterioration of the force main, reducing the pipes anticipated useful life. Based on the age of the force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

3.5.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of approximately 12 hours per day per pump. The City reported that the pumps are operated at low speeds (around 30 Hz) continuously. This average day operation equates to approximately 0.11 MGD of wastewater based on the provided totalized flow meter data. It must be noted that operating the pumps continuously at low speeds can result in solids settling and scouring issues within the force main due to low wastewater velocities (less than 1 ft/sec). The City should modify the minimum speed of the pump station to provide the minimum flushing velocities (300 GPM, 2 ft/sec) required for the 8-inch AC force main. Under peak conditions, the pumps may run up to 24 hours per day (total run info) and convey up to 0.5 MGD. Based on the low pump operation speed, and the maximum total daily flowrates, the pump station operates within capacity.

3.5.3 Emergency Bypass Plan

Based on review of the historical pump station drawings, the Gosling Road Pump Station does not contain a force main or pump station bypass connection. The dry well does contain a pig launching setup for future force main cleaning. In the event that the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the Gosling Road pump station (less than 0.15 MGD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main maintenance.

3.5.4 Recommendations

Recommendations for the Gosling Road Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses high priority and high cost (greater than $50,000) items identified through this evaluation.

i. It is recommended that the City plan to complete a force main pigging and closed-circuit television (CCTV) investigation in 1 to 3 years along the force main to provide visual indication of the interior pipe condition.

ii. Begin capital planning for pump replacement to provide the City with manufacturer supported pumps;

iii. To address several code-related life safety concerns, the following modifications are recommended: replace wet well grating; installing exit and emergency lighting; and repairing the hazardous gas detection system.

3.6 RYELINE

3.6.1 Existing Conditions

The Ryeline Pump Station was originally constructed in 1964 and underwent a comprehensive improvement in 2009. The pump station provides service to the southernmost portion of Portsmouth, including residential neighborhoods along Ocean Road as well as commercial properties.

3.6.1.1 Equipment

The pump station houses two 20 HP vertical centrifugal Smith & Loveless pumps which were installed in 2009. Each pump is rated for 600 GPM at 85 feet of total dynamic head. The pumps operate in a lead/standby configuration. Each pump is VFD driven with the pump speed controlled by wet well level.

The pump station wet well is divided into two parts, with stop gates installed for wet well isolation. The wet well divider gate was broken during the site visit. Prior to entering the wet well, wastewater flows through a hydraulically powered grinder.

The City reported that the existing pump station equipment is in good condition and has operated well since upgrade in 2009.

3.6.1.1.1 Heating, Ventilation, and Air Conditioning

The dry well, which also contains the standby generator, is ventilated by an inline supply fan located in the Generator Room. The supply fan capacity was noted to not have capacity to properly ventilate the dry well at 6 air changes per hour to declassify the space. During the site visit the supply fan was in AUTO, but the controls were not set up to run continuously, as required by NFPA 820. Heating is provided by a separate combustion unit heater with high static fan observed to be in good condition. The standby generator intake louver/dampers are designed to operate when the emergency generator is operating or when the room temperature exceeds an operator adjustable setpoint. City staff indicated the pump station is extremely hot in the summer time.

The standby generator exhaust piping was not insulated and needs to be insulated for operator safety. While not required, a ventilated generator exhaust wall thimble should be considered to avoid wall damage.

The Wet Well is ventilated by an explosion proof FRP sidewall centrifugal exhaust fan ducted down to the lower level. The fan and ductwork appear to be in good condition. There is no dedicated wet well air intake installed in the wet well meaning that the wet well exhaust fan creates a negative pressure on the influent sewer system.

3.6.1.2 Building

3.6.1.2.1 Exterior

The building exterior is in good condition. A few areas on the building steel framing exhibited minor peeling paint and corrosion that should be sandblasted and repainted to prevent further deterioration.

3.6.1.2.2 Dry Well

The interior surfaces are all noted to be in good condition.

The magnetic flow meter for the pump station is located in an enclosed intermediate confined area, accessible only via a ladder located immediately adjacent to the standby generator. The flow meter area should be treated as a confined space when access is required. In addition, due to the proximity of the standby generator, the standby generator should be locked out of use when the flow meter confined area is entered.

The guard rails for the spiral stairs did not have toe guards installed. Toe guards help prevent tools or occupants from an area where a fall hazard exists from above.

The pump station's standby generator (Caterpillar 80 kW) was installed in 2009 and is supplied by natural gas. The generator is located in the dry well of the pump station. While no deficiencies were noted with the standby generator system, the generator is not provided with a 1-hour space separation. Based on NFPA 37 requirements, the Generator room should be constructed to provide a 1-hour fire rated separation from the rest of the building. The City should consider relocating

the standby generator to an area outside of the dry well (i.e., exterior) during the next major pump station upgrade in order to comply with NFPA 37 requirements.

3.6.1.2.3 Wet Well

The interior surfaces of the wet well were observed to be in fair condition with the exception of the entranceway coatings. The coatings in this area are failing and cracking off of the existing walls in small sectional sheets. Based on site observations, the coating failing could be due to misapplication of the product or incorrect surface preparation which is the most likely case. Based on the low degree of humidity and odors in this area and the high rate of ventilation, it is not considered necessary that the City replace this coating system in the entranceway. The City could continue to monitor the coatings failures and spot repair the areas with epoxy as needed.

The guard rails for the stairs did not have toe guards installed. Toe guards help prevent tools or occupants from an area where a fall hazard exists from above. The wet well second level elevated access area is protected with a chain guard which should be replaced with a rigid rail guard for safety.

3.6.1.2.4 Electrical

As part of the comprehensive upgrade completed in 2009, all of the electrical equipment and distribution systems were replaced. No deficiencies were noted.

3.6.1.2.5 Instrumentation

The pump station controls are located in a control panel in the upper level of the dry well. A backup float control system is also located in the control panel in case of PLC or level instrument failure. There is a main effluent flow meter, wet well radar level sensors, and four level float switches (two are backup switches). No major deficiencies were noted with the instrumentation or control equipment.

3.6.1.3 Site

The station is located on a parcel of low-lying land surrounded by jurisdictional wetlands associated with Berry's Brook. The existing pump station facility was upgraded in 2009 to include a dry well area that is elevated from the original 1970s pump station. This was done in an effort to minimize the risk of flooding from the adjacent wetlands. Based on discussions with the City, the pump station has not had pump station flooding issues since the pump station was raised in 2009. No other issues were noted on-site.

Based on the proximity to tidal waters the Ryeline Pump Station is not at risk for tidal flooding as evaluated in the City's Climate Change Vulnerability Assessment (**Appendix C**).

3.6.1.4 Force Main

Based on the reviewed plans, the pump station's force main was installed during the original construction of the pump station in the early 1970s. The 8-inch asbestos cement (AC) force main extends 4000 LF before discharging into a sewer manhole on Lafayette Road.

The average useful lifespan of AC force main pipe depends on a variety of factors, including: soil and environmental conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, AC pipe can have a service life of 50 to 100 years.

Based on discussions with the City and a review of existing plans, the existing AC force main pipe is 48-years old. The City reported no records of pipe failure or maintenance issues with this force main.

The force main is located in an area of soils identified ranging from low to high corrosivity risk to concrete. However, the existing 8-inch AC force main was excavated as part of the 2009 pump station upgrade and no significant deterioration issues were noted by the City. Based on the age of the force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

3.6.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of approximately 10.5 hours per day per pump. The City reported that the pumps are operated at low speeds (around 30 Hz) continuously. This average day operation equates to approximately 0.18 MGD of wastewater based on the provided totalized flow meter data. It must be noted that operating the pumps continuously at low speeds can result in solids settling and scouring issues within the force main due to low wastewater velocities (less than 1 ft/sec). The City should modify the minimum speed of the pump station to provide the minimum flushing velocities (300 GPM, 2 ft/sec) required for the 8-inch AC force main. Under peak conditions, the pumps may run up to 24 hours per day (total run info) and convey over 0.5 MGD. Based on the low pump operation speed, and the maximum total daily flowrates, the pump station operates within capacity.

3.6.3 Emergency Bypass Plan

Based on review of the historical pump station drawings, the Ryeline Pump Station has an exterior above grade bypass connection to allow temporary force main bypassing using the existing dry well pumps. The arrangement also allows the City to isolate the existing dry well pumps and use temporary pumps to connect to the existing force main.

In the event that the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the Ryeline pump station (< 0.18 MGD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main maintenance.

3.6.4 Recommendations

Recommendations for the Ryeline Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion

addresses high priority and high cost (greater than $50,000) items identified through this evaluation.

i. Restrict access to the magnetic flow meter vault with a sign labeled for “confined space only”. In addition, the sign should indicate that the standby generator should be disconnected (locked out/tagged out) prior to entrance.

ii. Upgrade the dry well HVAC system with proper ventilation controls and ventilation fan requirements per NFPA 820.

iii. Begin long-term planning for Pump rehabilitation/replacement (10 years).

iv. The current interior location of the standby generator does not meet current NFPA 37 code requirements. During the next major pump station upgrade, the City should evaluate relocating the standby generator outside, or to a new area with a 1-hour fire rating.

v. Complete dry well (Electric Room, Pump Room) HVAC upgrades to provide positive ventilation as required per NFPA 820.

vi. To address several code-related life safety concerns, the following modifications are recommended: install rigid handrail on elevated wet well platform; add toe plates to guardrail for dry well staircase.

4

WRIGHT-PIERCE
Engineering a Better Environment

SECTION 4

PUMP STATION EVALUATIONS
SUCTION LIFT PUMP STATIONS

4.1 CONSTITUTION AVENUE

4.1.1 Existing Conditions

The Constitution Avenue Pump Station was originally constructed in 1985 and underwent a SCADA upgrade in 2005. The pump station consists of a pre-fabricated structure which contains the pumps, electrical equipment, and standby generator, along with a circular pre-cast wet well. The pump station provides service to several commercial and industrial properties, including the Southgate Plaza shopping center.

4.1.1.1 Equipment

The suction-lift pump station houses two recently installed (2016 and 2017) Gorman-Rupp T-4 self-priming centrifugal pumps with 15 HP motors. The pump motors date back to the original pump station construction and should be included in capital replacement planning in the near future. Based on the City's records, each pump was originally rated for 320 GPM. Each pump is driven by constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 8-hours a day. The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity closer to 177 GPM. Observed pump head conditions were lower than the anticipated design pressures. It should be noted the sheave configuration of the pumps is unknown and may be contributing to the lower observed pump capacity.

The pump station's 8-foot diameter wet well structure was observed to be in good condition due to the City's biannual cleaning program. The wet well hatch was missing a safety net, but no structural deficiencies were noted. The City indicated that the pump suction piping was replaced

in the wet well in 2015 due to corrosion. Observations indicate that the wet well pump discharge pipe is also showing signs of corrosion and should also be replaced.

4.1.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by two wall-mounted electric unit heaters which have both been replaced recently. The heaters appear to be in good condition. The building is not actively ventilated which is authorized per the Building Code, but a mechanism must be in place to allow the door to remain open while the pump station occupied. The City indicated the pump station can get very hot in the summertime due to the lack of ventilation and/or air conditioning. The City should consider installation of a split air conditioning unit or exhaust fan.

During the site visit, the pump and process area showed signs of condensation. To mitigate corrosion of process equipment and piping, a dehumidifier is recommended for this area.

4.1.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1985. This equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as the lack of exit and emergency lighting, as well as missing arc-flash safety labeling.

A 45-kW Cummins Onan standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator and ATS were installed in 1985 and operates on two 150-gallon propane storage tanks located outside of the building. The generator's exhaust piping should be insulated for safety purposes, and while not required, installation of a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

4.1.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2005 to include PLC (Programmable Logic Controller) based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC, which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the north side of the building. It is recommended the antenna mast be grounded.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). Submersible level instruments in hazardous locations should be installed with an intrinsically safe barriers. For ease of operator maintenance, it is recommended that conduit seal-offs are installed on the instrument conduits outside of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Emergency/exit lighting was observed to be missing from the pump station.

4.1.1.2 Building

4.1.1.2.1 Exterior

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior is missing aggregate in locations that require cosmetic repair. The pre-cast concrete slab is in good condition with the exception of a corner of the slab which needs to be rebuilt/patched. The building joint between the foundation and the superstructure should be pressure washed and the joint sealed to ensure moisture does not penetrate the building envelope. The membrane roof appears to be in good condition but has a relatively low slope which allows water to pool as evidenced by staining. If the roof is replaced, a higher sloped roof is recommended

to assist drainage. The double access door is missing miscellaneous hardware and should be painted to preserve longevity.

The existing pre-cast pump station superstructure is 33 years old. While this pre-fabricated structure has served the City well, the overall condition is deteriorating and building maintenance and improvement needs will only increase in the coming years. Based on the increased building maintenance costs, it is recommended the City evaluate the following options for the Constitution Avenue pump station in the future (7 to 10 years):

- **Option 1: Building Replacement** – Begin capital planning for replacement of the existing building structure.

- **Option 2: Pump Station Conversion** – Convert the suction lift pump station to a submersible style pump station with a small outbuilding electrical distribution equipment and control panels.

4.1.1.2.2 Interior

The interior floors and wall finish need to be recoated for continued use. Several open piping penetrations from the wet well to the interior building were observed. These penetrations should be sealed to mitigate transfer of gases between the wet well and the building and to maintain the proper NFPA 820 classification for the building space. The back wall of the interior structure has a visible crack where the standby generator exhaust penetrates the wall. This crack is likely due to excessive heat from the exhaust pipe, and a lack of a ventilated wall thimble for the exhaust pipe. The wall crack should be sealed to prevent air and water leakage.

4.1.1.3 Site

The pump station is located directly adjacent to Constitution Avenue in a primarily commercial district. The station has its own paved driveway and is abutted by undeveloped forest on three sides. A chain link fence surrounds the two generator propane storage tanks (vertical 150-gallon). Bollards protect the wet well hatch located just outside the pump station building.

The site's grade was raised 3 to 5 feet for construction of the pump station to avoid stormwater issues caused by sheet flow from the adjacent property and road. While the site does not current show signs of erosion/damage from stormwater drainage/runoff, it is recommended the City periodically inspect the surrounding site to ensure that stormwater/erosion issues do not develop.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by flood elevations (**Appendix C**).

4.1.1.4 Force main

Based on a review of the existing plans, the pump station's force main was installed during original construction of the original pump station in 1985. The ductile iron (DI) force main pipe is 6-inches in diameter and discharges to a sewer manhole located approximately 2,600 feet away at the corner of Constitution Avenue and Lafayette Road.

The average useful lifespan of DI force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The older portions of the force main pipe are currently 32-years old. The City did not report any maintenance issues with the ductile iron force main; however, the exposed wet well portions of the force main were noted to be in poor condition.

The Constitution Avenue force main is located in an area of soils that are reported to cause moderate to high corrosivity of steel. Based on this data, this soil type could potentially lead to accelerated degradation of the force main pipe, reducing the pipe's anticipated useful life. Based on the age of the force main and the condition of the exposed wet well force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

Based on observed pump flowrates, the velocity of flow through the PVC force main is 1.9 feet per second, which is near the minimum scour velocity. Long-term low-velocity operation increases the risk of solids settling in the force main, and reduces the force main capacity. While

the City has not reported any issues with force main solids settling, it is recommended the force main is periodically jetted to ensure it remains at full capacity.

4.1.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 2.75 hours per day (total run time for both pumps). Based on draw-down test observations, this equates to approximately 30,000 gallons per day. Under peak conditions, the pumps may run up to 17 hours per day (total run time for both pumps). Given the minimal operating times for the both pumps, the station appears to have adequate capacity to handle existing flows.

The pump station appears to have significant peaks in run times during the spring (March to May). This trend suggests the pump station experiences inflow and infiltration (I/I) during the spring season when groundwater levels and stormwater/meltwater runoff are peaking. The City should investigate the Constitution Avenue sewershed to identify and mitigate potential sources of I/I.

4.1.3 Emergency Bypass Plan

The Constitution Avenue Pump Station does not contain a force main or pump station bypass connection. In the event the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 30,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.1.4 Recommendations

Recommendations for the Constitution Avenue Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following

discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. The existing superstructure is approaching the end of its useful life. The City should consider pump station superstructure replacement, or conversion to a submersible pump station within 7 to 10 years. It should be noted that depending on the City's preference for the future pump station structure upgrade (replacement vs. conversion) and timeline, some of the identified Low and Medium priority recommendations may not apply.

ii. Complete comprehensive electrical upgrade concurrently with Item i including distribution equipment, starters, standby generator, and automatic transfer switch (ATS).

iii. Complete the following modifications to address code-related life safety concerns and to prevent further building deterioration: install a mechanism to hold the building door open while occupied; install exit and emergency lighting; provide arc-flash safety labeling; and ground the antenna mast.

iv. Complete a force main pigging and closed-circuit television (CCTV) investigation along the force main in 3 to 5 years to provide visual verification of the interior pipe condition.

4.2 WEST ROAD

4.2.1 Existing Conditions

The West Road Pump Station was originally constructed in 1984 and underwent a SCADA upgrade in 2005. The pump station consists of a pre-fabricated structure which contains the pumps, electrical equipment, and standby generator, along with a circular pre-cast wet well. The pump station provides service to over a dozen commercial developments along West Road in the southern part of Portsmouth.

4.2.1.1 Equipment

The suction-lift pump station houses two 10 HP Gorman-Rupp T-4 self-priming centrifugal pumps which are original to the pump station (1984). Based on the City's records, each pump was originally rated for 400 GPM. Each pump is driven by a constant speed starter with the pump

operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 5 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity between 270 to 300 GPM. Observed head conditions were lower than the anticipated design pressures. It should be noted the sheave configuration of the pumps was unknown and may be contributing to the lower observed pump capacity. The reduced pump efficiency may also be due to wear attributed to the age of the pumps (33-years). Based on the age of the pumps and motors, this equipment has surpassed it's expected useful design life. While the pumps were noted to run reliably and have relatively low operational hours, the City should begin to plan for replacement of these pumps in the next 3-5 years, or during the next significant pump station upgrade. Based on the low runtimes and pump flowrates, the City may also consider conversion of this pump station to a submersible pump station for a capital cost savings.

The pump station's 8-foot diameter wet well structure was observed to be in good condition due to the City's biannual cleaning program. The wet well hatch was missing a safety net, but no structural deficiencies were noted. The pump suction and pump discharge piping showed significant signs of corrosion and should be considered for replacement.

4.2.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by one wall-mounted electric unit heater which was noted to be in good condition. The building is not actively ventilated which is authorized per the Building Code, but a mechanism must be in place to allow the door to remain open while the pump station occupied. The City indicated the pump station can get very hot in the summertime due to the lack of ventilation and/or air conditioning. The City should consider installation of a split air conditioning unit or exhaust fan.

During the site visit, the pump and process area showed signs of condensation. To mitigate corrosion of process equipment and piping, a dehumidifier is recommended for this area.

While not required, a ventilated exhaust wall thimble should also be considered to avoid wall damage. The exterior standby generator exterior intake and exhaust louvers are corroded and should be replaced/repaired. In addition, the existing exterior propane vent should be relocated to be greater than 5 feet from any building air intake or exhaust.

4.2.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1984. This equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as the lack of exit and emergency lighting, as well as missing arc-flash safety labeling.

A 30-kW Cummins Onan standby generator and automatic transfer switch (ATS) is located inside the pump station. The generator was installed in 1984 and operates on two 100-gallon propane storage tanks located outside of the building. The ATS was replaced more recently based on discussions with the City. The generator's exhaust piping should be re-insulated for safety purposes.

4.2.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2005 to include PLC (Programmable Logic Controller) based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC, which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). Submersible level instruments in hazardous locations should be installed with an intrinsically safe barriers. For ease of operator maintenance, it is recommended that conduit seal-offs are installed on the instrument conduits outside of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Emergency/exit lighting was observed to be missing from the pump station.

4.2.1.2 Building

4.2.1.2.1 Exterior

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition with the exception of degraded sealant between precast sections, which should be replaced. The membrane roof shows evidence of minor leaks and has a relatively low slope which allows water to pool. Although no obvious tears or open joints were observed on the roof membrane, it does appear to be faded and may be thinning and brittle as it is likely nearing the end of its design life. Replacement of the membrane should be anticipated within 5 years. When the roof is replaced, a higher sloped roof is recommended to assist drainage. The double access door and door frame are in poor condition and should be considered for replacement if long term use is anticipated.

The existing pre-cast pump station superstructure is 33 years old. While this pre-fabricated structure has served the City well, the overall condition is deteriorating and building maintenance and improvement needs will only increase in the coming years. Based on the increased building maintenance costs, it is recommended that the City evaluate the following options for the West Road pump station in the future (5 to 10 years):

- **Option 1: Building Replacement** – Begin capital planning for replacement of the existing building structure.

- **Option 2: Pump Station Conversion** – Convert the suction lift pump station to a submersible style pump station with a small outbuilding electrical distribution equipment and control panels.

4.2.1.2.2 Interior

The interior floors and wall finishes appear to have recently been refinished and are in good condition. Several open piping penetrations from the wet well to the interior building were observed. These penetrations should be sealed to mitigate transfer of gases between the wet well and the building, and to maintain the proper NFPA 820 classification for the building space. The pre-cast roof slab seam has been sealed with caulking to mitigate roof leaking. The precast concrete top slab has many pop-outs and a large crack that should be repaired.

4.2.1.3 Site

The pump station is located directly adjacent to West Road in a commercial district. A chain link fence surrounds the two generator propane storage tanks. No issues were noted with the exterior site.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.2.1.4 Force Main

Based on a review of the Town's GIS data, the existing force main is a 6-inch PVC pipe. However, the pump station's original force main installed during original construction of the pump station in 1984 was ductile iron (DI). For the purposes of this evaluation, the force main is assumed to be PVC. The force main discharges to a sewer manhole located approximately 1,300 feet away on West Road.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is

currently 33 years old. The City did not report any maintenance issues with the force main; however, the exposed ductile iron wet well portions of the force main were noted to be in poor condition.

The West Road force main is located in an area of soils that are reported to have a low corrosivity index. Based on this data, soil corrosion is not expected to contribute to accelerated deterioration of the force main pipe, even if the material is ductile iron as the original pump station drawings indicate. However, based on the age of the force main and the condition of the exposed wet well force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

4.2.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of less than 2 hours per day (total run time for both pumps). Based on draw-down test observations, this equates to approximately 30,000 gallons per day. Under peak conditions, the pumps may run up to 5 hours per day (total run time for both pumps). Given the minimal operating times for both pumps, the station appears to have adequate capacity to handle existing flows. Pump runtime data for the pump station was consistent throughout the year, with minimal seasonal peaking. Therefore, the pump station does not appear to be significantly impacted by seasonal inflow and infiltration (I/I).

4.2.3 Emergency Bypass Plan

The West Road Pump Station does not contain a force main or pump station bypass connection. In the event the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a “low flow” time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 30,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.2.4 Recommendations

Recommendations for the West Road Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. The existing superstructure is approaching the end of its useful life and should be considered for replacement. The City should consider pump station superstructure replacement, or conversion to a submersible pump station within 5-10 years. It should be noted that depending on the City's preference for the future pump station structure upgrade (replacement vs. conversion) and timeline, some of the identified Low and Medium priority recommendations may not apply.

ii. The existing suction lift pumps are near the end of their expected useful life and should be considered for replacement. The City should consider pump replacement within 3-5 years, or during the next significant pump station upgrade. Alternatively, the City may choose to abandon the suction lift pumps in favor of a submersible pump station.

iii. Complete comprehensive electrical upgrade concurrently with Item ii including distribution equipment, starters, and standby generator.

iv. Complete the following modifications to address code-related life safety concerns and to prevent further building deterioration: seal dry well penetrations; install a mechanism to hold the building door open while occupied; install exit and emergency lighting; relocate exterior propane vent; provide arc-flash safety labeling; confirm wet well instrumentation has an intrinsically safe barrier; and install a utility power bypass circuit for the UPS.

v. Complete a force main pigging and closed-circuit television (CCTV) investigation in 3 to 5 years along the force main to provide visual verification of the interior pipe condition.

4.3 WOODLANDS I

4.3.1 Existing Conditions

The Woodlands I Pump Station was originally constructed in 1985 and underwent a SCADA upgrade in 2005. The pump station consists of a pre-fabricated structure which contains the pumps, electrical equipment, and standby generator, along with a circular pre-cast wet well. The pump station provides service a residential neighborhood located along FW Hartford Drive.

4.3.1.1 Equipment

The suction-lift pump station houses two 5 HP Gorman-Rupp T-4 self-priming centrifugal pumps which are original to the pump station (1985). Based on the City's records, each pump was originally rated for 150 GPM. Each pump is driven by constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 21 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity between 86 and 92 GPM. Observed head conditions were lower than the anticipated design pressures. It should be noted the sheave configuration of the pumps is unknown and may be contributing to the lower observed pump capacity. The reduced pump efficiency may also be due to wear attributed to the age of the pumps (33 years). Based on the age of the pumps and motors, this equipment has surpassed it's expected useful design life. While the pumps were noted to run reliably and have relatively low operational hours, the City should begin to plan for replacement of these pumps in the next 3 to 5 years. Based on the low runtimes and pump flowrates, the City may also consider conversion of this pump station to a submersible pump station for a capital cost savings.

The pump station's 8-foot diameter interior wet well structure was observed to be in good condition due to the City's biannual cleaning program. However, the underside surface of the top concrete slab showed extensive spalling and deterioration. The wet well hatch showed some minor signs of corrosion which should be monitored. The wet well hatch was missing a safety net. The

pump suction and discharge piping showed significant signs of corrosion and should be considered for replacement.

4.3.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by one wall-mounted electric unit heater which was noted to be in good condition. The building is not actively ventilated which is authorized per the Building Code, but a mechanism must be in place to allow the door to remain open while the pump station is occupied. The City indicated the pump station can get very hot in the summertime due to the lack of ventilation and/or air conditioning. The City should consider installation of a split air conditioning unit or exhaust fan.

During the site visit, the pump and process area showed signs of condensation. To mitigate corrosion of process equipment and piping, a dehumidifier is recommended for this area.

4.3.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1985. This equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as the lack of exit and emergency lighting, as well as missing arc-flash safety labeling.

A 30-kW Cummins Onan standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator was installed in 1985 and operates on one 130-gallon propane storage tank located outside of the building. The ATS was replaced more recently based on discussions with the City. While not required, the generator's exhaust piping should be re-insulated for safety purposes and, installation of a ventilated exhaust wall thimble should be considered to avoid wall damage.

4.3.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2004 to include PLC based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC (Programmable Logic Controller), which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building.

The wet well instruments include an ultrasonic transducer, a differential level float, and two backup alarm floats (high-high and low-low). Based on the City's experience with ultrasonic transducers in wet wells, it is recommended that, once it has failed, the instrument be replaced with a submersible transducer. Submersible transducers can alleviate faulty fats, oils and grease (FOG) related readings which sometimes cause issues with ultrasonic transducers. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

During the site visit, the wet well level floats were observed to be in the immediate vicinity of the influent sewer. To avoid ragging and hydraulic interference, it is recommended the wet well level floats be moved to the opposite side of the wet well.

Emergency/exit lighting was observed to be missing from pump station.

4.3.1.2 Building

4.3.1.2.1 Exterior

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition with the exception of a degraded corner of the foundation, which should be monitored/repaired. The pre-cast roof slab seam is showing signs of roof leaking. Installation of a membrane-type should be anticipated within 2 years to prevent water damage. The joint between the foundation and the superstructure is showing signs of interior leaking at the base of the structure. This joint should be pressure washed and the joint sealed.

The existing pre-cast pump station superstructure is 33 years old. While this pre-fabricated structure has served the City well, the overall condition is deteriorating and building maintenance and improvement needs will only increase in the coming years. Based on the increased building maintenance costs, it is recommended that the City evaluate the following options for the Woodlands I pump station in the future (5 to 10 years):

- **Option 1: Building Replacement** – Begin capital planning for replacement of the existing building structure.
- **Option 2: Pump Station Conversion** – Convert the suction lift pump station to a submersible style pump station with a small outbuilding electrical distribution equipment

4.3.1.2.2 Interior

Several open piping penetrations from the wet well to the interior building were observed. These penetrations should be sealed to mitigate transfer of gases between the wet well and the building, and to maintain the proper NFPA 820 classification for the building space. The pre-cast roof slab seam has been sealed with caulking to mitigate roof leaking.

4.3.1.3 Site

The pump station is located directly adjacent to FW Hartford Drive in a residential district. The station has its own paved driveway and is abutted by single family homes and undeveloped forest. The pump station is located adjacent to a culvert and stream, but no drainage or runoff issues have been observed.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.3.1.4 Force main

Based on a review of the existing plans, the pump station's force main was installed during the original construction of the pump station in 1985. The polyvinyl chloride (PVC) pipe is 4-inches in diameter and discharges to a sewer manhole located approximately 1,900 feet away on FW Hartford Drive.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is currently 34-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

4.3.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 3 hours per day (total run time both pumps). This equates to approximately 16,000 gallons per day. Under peak conditions, the pumps may run up to 22 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have adequate capacity to handle existing flows.

The pump station appears to have significant peaks in run times during the spring (March - June). This trend suggests the pump station experiences inflow and infiltration (I/I) during the spring

season when groundwater levels and stormwater/meltwater runoff are peaking. The City should investigate the Woodlands I sewershed to identify and mitigate potential sources of I/I.

4.3.3 Emergency Bypass Plan

The Woodlands I Pump Station does not contain a force main or pump station bypass connection. In the event the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 20,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.3.4 Recommendations

Recommendations for the Woodlands I Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. The existing superstructure is approaching the end of its useful life and should be considered for replacement. The City should consider pump station superstructure replacement, or conversion to a submersible pump station within 5 to 10 years. It should be noted that depending on the City's preference for the future pump station structure upgrade (replacement vs. conversion) and timeline, some of the identified Low and Medium priority recommendations may not apply.

ii. The existing suction lift pumps are near the end of their expected useful life and should be considered for replacement. The City should consider pump replacement within 3 to 5 years, or during the next significant pump station upgrade. Alternatively, the City may choose to abandon the suction lift pumps in favor of a submersible pump station.

iii. Complete comprehensive electrical upgrade concurrently with Item ii including distribution equipment, starters, and standby generator.

iv. Complete the following modifications to address code-related life safety concerns and to prevent further building deterioration: replace leaking roof, re-grout and seal exterior building seams, seal dry well penetrations; install a mechanism to hold the building door open while occupied; install exit and emergency lighting; provide arc-flash safety labeling; cap/cover exterior wet well conduit junction boxes.

4.4 WOODLANDS II

4.4.1 Existing Conditions

The Woodlands II Pump Station was originally constructed in 1984 and underwent a SCADA upgrade in 2005. The pump station consists of a pre-fabricated structure which contains the pumps, electrical equipment, and standby generator, along with a circular pre-cast wet well. The pump station provides service to a residential neighborhood located along FW Hartford Drive.

4.4.1.1 Equipment

The suction-lift pump station houses two 5 HP Gorman-Rupp T-4 self-priming centrifugal pumps which are original to the pump station (1984). Based on the City's records, each pump was originally rated for 130 GPM. Each pump is driven by constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 15 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity of 75 GPM. Observed head conditions were lower than the anticipated design pressures. It should be noted the sheave configuration of the pumps is unknown and may be contributing to the lower observed pump capacity. The reduced pump efficiency may also be due to wear attributed to the age of the pumps (33 years). Based on the age of the pumps and motors, this equipment has surpassed it's expected useful design life. While the pumps were noted to run reliably and have relatively low operational hours, the City should begin to plan for replacement of these pumps in the next 3 to 5 years. Based on the low

runtimes and pump flowrates, the City may also consider conversion of this pump station to a submersible pump station for a capital cost savings.

The pump station's 8-foot diameter interior wet well structure was observed to be in good condition due to the City's biannual cleaning program. The wet well hatch was missing a safety net. The pump suction piping showed significant signs of corrosion and should be considered for replacement.

4.4.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by one wall-mounted electric unit heater which was noted to be in good condition. The building is not actively ventilated which is authorized per the Building Code, but a mechanism must be in place to allow the door to remain open while the pump station is occupied. The City indicated the pump station can get very hot in the summertime due to the lack of ventilation and/or air conditioning. The City should consider installation of a split air conditioning unit or exhaust fan.

During the site visit, the pump and process area showed signs of condensation. To mitigate corrosion of process equipment and piping, a dehumidifier is recommended for this area.

In addition, the existing exterior propane vent should be relocated to be greater than 5 feet from any building air intake or exhaust.

4.4.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1984. This equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as the lack of exit and emergency lighting, as well as missing arc-flash safety labeling.

A 30-kW Kohler standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator was installed in 2018 and operates on two 130-gallon propane storage tanks located outside of the building. The ATS was replaced more recently based on discussions with the City. While not required, the generator's exhaust piping should be re-insulated for safety purposes, and installation of a ventilated exhaust wall thimble should be considered to avoid wall damage.

4.4.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2004 to include PLC (Programmable Logic Controller) based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC, which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building.

The wet well instruments include an ultrasonic transducer, a differential level float, and two backup alarm floats (high-high and low-low). Based on the City's experience with ultrasonic transducers in wet wells, it is recommended that, once it has failed, the instrument be replaced with a submersible transducer. Submersible transducers can alleviate faulty "fog" related readings which sometimes cause issues with ultrasonic transducers. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

During the site visit, the wet well level floats were observed to be in the immediate vicinity of the influent sewer. To avoid ragging and hydraulic interference, it is recommended the location of the wet well level floats are moved to the opposite side of the wet well.

Emergency/exit lighting was observed to be missing from pump station.

4.4.1.2 Building

4.4.1.2.1 Exterior

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition, but minor graffiti was noted on the back side of the building. Although no obvious tears or open joints were observed on the roof membrane, it does appear to be faded and may be thinning and brittle as it is likely nearing the end of its design life. The pre-cast roof slab seam has been sealed by the City to mitigate leaking. Replacement of the membrane should be anticipated within 5 years. When the roof is replaced, a higher sloped roof is recommended to assist drainage.

The existing pre-cast pump station superstructure is 33 years old. While this pre-fabricated structure has served the City well, the overall condition is deteriorating and building maintenance and improvement needs will only increase in the coming years. Based on the increased building maintenance costs, it is recommended that the City evaluate the following options for the Woodlands II pump station in the future (5 to 10 years):

- **Option 1: Building Replacement** – Begin capital planning for replacement of the existing building structure.
- **Option 2: Pump Station Conversion** – Convert the suction lift pump station to a submersible style pump station with a small outbuilding electrical distribution equipment

4.4.1.2.2 Interior

The interior floors and wall finishes are in good condition. Several open piping penetrations from the wet well to the interior building were observed. These penetrations should be sealed to mitigate transfer of gases between the wet well and the building, and to maintain the proper NFPA 820 classification for the building space.

4.4.1.3 Site

The pump station is located directly adjacent to FW Hartford Drive in a residential district. The station has its own paved driveway and is abutted by undeveloped forest. Several graffiti tags were noted on the side of the pump station. The City may consider installation of a perimeter fence to avoid future tagging or other forms of vandalism.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.4.1.4 Force Main

Based on review of the existing plans, the pump station's force main was installed during original construction of the original pump station in 1984. The polyvinyl chloride (PVC) pipe is 4-inches in diameter and discharges to a sewer manhole located approximately 1,400 feet away at the intersection of Adams Avenue and Harding's Road.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is currently 34-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

Based on observed pump flowrates, the velocity of flow through the PVC force main is 1.9 feet per second, which is near the minimum scour velocity. Long-term low-velocity operation increases the risk of solids settling in the force main, and reducing force main capacity. While the City has not reported any issues with force main solids settling, it is recommended the force main is periodically jetted to ensure it remains at full capacity.

4.4.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 2.25 hours per day (combined). This equates to approximately 10,000 gallons per day. Under peak conditions, the pumps may run up to 15 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have adequate capacity to handle existing flows.

The pump station appears to have significant peaks in run times during the spring (February - May). This trend suggests the pump station experiences inflow and infiltration (I/I) during the spring season when groundwater levels and stormwater/meltwater runoff are peaking. The City should investigate the Woodlands II sewershed to identify and mitigate potential sources of I/I.

4.4.3 Emergency Bypass Plan

The Woodlands II Pump Station does not contain a force main or pump station bypass connection. In the event the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 10,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.4.4 Recommendations

Recommendations for the Woodlands II Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. The existing superstructure is approaching the end of its useful life and should be considered for replacement. The City should consider pump station superstructure replacement, or conversion to a submersible pump station within 5 to 10 years. It should be noted that depending on the City's preference for the future pump station structure upgrade (replacement vs. conversion) and timeline, some of the identified Low and Medium priority recommendations may not apply.

ii. The existing suction lift pumps are near the end of their expected useful life and should be considered for replacement. The City should consider pump replacement within 3 to 5 years, or during the next significant pump station upgrade. Alternatively, the City may choose to abandon the suction lift pumps in favor of a submersible pump station.

iii. Complete comprehensive electrical upgrade concurrently with Item ii including distribution equipment, starters, and standby generator.

iv. Complete the following modifications to address several code-related life safety concerns and to prevent further building deterioration: seal dry well penetrations; relocate exterior propane vent; install a mechanism to hold the building door open while occupied; install exit and emergency lighting; provide arc-flash safety labeling; and confirm intrinsically safe installation of wet well instruments.

4.5 ATLANTIC HEIGHTS

4.5.1 Existing Conditions

The Atlantic Heights Pump Station was originally constructed in 1986 and underwent a SCADA upgrade in 2005. The pump station consists of a two-level dry well structure and a separate circular pre-cast wet well. The station provides service to the Atlantic Heights residential neighborhood.

4.5.1.1 Equipment

The suction-lift pump station houses two 15 HP Gorman-Rupp T-6 (Super T-series) self-priming centrifugal pumps. One of the pumps (Pump No. 1) is original to the pump station construction, while Pump No. 2 was replaced around 2013. Based on the City's records, both pumps were

originally rated for 385 GPM. Each pump is driven by constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 13 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity between 285 and 300 GPM. Observed head conditions were lower than the anticipated design pressures. It should be noted the sheave configuration of the pumps is unknown and may be contributing to the lower observed pump capacity. Based on the age of Pump No. 1, this equipment has surpassed it's expected useful design life although it was reported to be operating reliably upon site visit. The City should begin to plan for replacement of this Pump No. 1 in the next 3 to 5 years. In addition, the motor for Pump No. 2 was noted to be original to the pump station construction. The City should plan on motor replacement for Pump No. 2 concurrently with Pump No. 1 replacement.

The pump station's 8-foot diameter wet well was observed to be in good condition due to the City's biannual cleaning program. The wet well grating appeared to be dislodged and wedged between the manhole interior. It is recommended the loose grating be removed for safety. The pump suction piping showed evidence of corrosion and should be considered for replacement.

4.5.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by two wall-mounted electric unit heaters. One is located in the Pump Room (lower level) and the other is located in the Control Room (upper level); both heating units appear to be in good condition. Ventilation air is circulated by an inline exhaust fan located in the Control Room. The fan and controls date back to the original pump station construction (1986), but they appear to be in fair condition. The exhaust fan must be operated at all times to comply with NFPA 820 requirements. The exhaust register in the Control Room has been removed, which does not allow the exhaust fan to balance airflow to the lower level. The register should be replaced to allow proper airflow balancing throughout the upper and lower levels.

A simplex sump pump with integral float control is located in the Pump Room. The discharge piping is routed to the wet well. The sump pump appears to be in relatively good condition,

however the sump pit is shallow, and the float does not initiate the pump until water has accumulated on the floor well beyond the sump pit. The sump pump float actuator should be adjusted, or the sump pump should be replaced to mitigate water accumulation on the lower level and subsequent equipment rusting and floor finish peeling.

4.5.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1985. This equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. Based on the current standby power setup, only one of the two pumps is connected to standby power at a time. A manual switch on the pump station control panel dictates which pump is available for standby power. The Pump Room's gas detection system is currently not functioning; it is recommended the system be replaced.

Other deficiencies noted at the time of inspection include the need for emergency lighting and arc-flash safety labeling. Also, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety.

A 45-kW Cummins Onan standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator and ATS were installed in 1985 and operates on two 1,000-gallon propane storage tanks located outside of the building. The existing standby generator location does not meet current NEC code for minimum set back requirements from the Motor Control Center. The standby generator and automatic transfer switch (ATS) are both nearing the end of their useful life and should be considered for replacement.

4.5.1.1.3 Instrumentation

The pump and pump station controls are located in a control panel in the Dry Well. The control panel, installed as part of the 2005 upgrade, was found to be in good condition and has an estimated

lifespan of approximately 15 to 20 years. The City should plan to replace the control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC (Programmable Logic Controller), which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the north side of the building. It is recommended the antenna mast be grounded.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). It is recommended the submersible level instruments be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Effluent flow is measured through a Foxboro 6-inch electromagnetic meter (with an integral transmitter). The flow meter is original to the pump station and has exceeded its estimated useful life of 20 years. It is recommended the magnetic flow meter be planned for replacement in the near future.

Emergency/exit lighting was observed to be missing from pump station.

4.5.1.2 Building

4.5.1.2.1 Exterior

The existing building consists of a brick finish, two-story structure with a metal roof. The exterior building materials appear to be in fair condition, however the brick veneer has some staining and deteriorating of the mortar joints. Deteriorating mortar joints should be spot repaired as needed. The metal roof was in fair condition, with no visible signs of leaking. The roof is original to the pump station and has exceeded its 30-year life expectancy. The exterior door is in good condition but is missing miscellaneous hardware which should be replaced. The steel lintel above the

generator louver is exposed and corroding. It is recommended the lintel be repaired or replaced to avoid building envelope leaks.

4.5.1.2.2 Interior

The foundation of the building and interior are in good condition. The interior lower level floors and wall finishes should be cleaned and recoated for continued use.

4.5.1.3 Site

The pump station property is located in a largely residential neighborhood on a parcel that abuts the Piscataqua River. The rear of the building has a fenced-in gated area that contains the standby generator propane tank. There were no deficiencies noted with the site.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.5.1.4 Force Main

Based on review of the existing plans, the pump station's force main was installed during original construction of the pump station in 1986. The ductile iron (DI) pipe is 6-inches in diameter and discharges to a sewer manhole located approximately 800 feet away near the intersection of Kearsarge Way and Falkland Place.

The average useful lifespan of DI force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The older portions of the force main pipe are currently 32-years old. The City did not report any maintenance issues with the ductile iron force main; however, the exposed wet well portions of the force main were noted to be in poor condition.

The force main is located in an area of soils that are reported to have a low corrosivity index. Based on this data, soil corrosion is not expected to contribute to accelerated deterioration of the force main pipe. However, based on the age of the force main and the condition of the exposed wet well force main, it is recommended that the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

4.5.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of less than 2 hours per day (total run time for both pumps). Based on draw-down test observations, this equates to approximately 37,000 gallons per day. Under peak conditions, the pumps may run up to 13 hours per day (total run time for both pumps). Given the minimal operating times for the both pumps, the station appears to have adequate capacity to handle existing flows.

The pump station appears to have slightly longer average run times from February through June. This trend suggests the pump station experiences inflow and infiltration (I/I) during the spring season when groundwater levels and stormwater/meltwater runoff are peaking. We recommend the City investigate this area as part of a larger I/I study to identify and mitigate potential sources of I/I.

4.5.3 Emergency Bypass Plan

The Atlantic Heights Pump Station does not contain a force main or pump station bypass connection. In the event the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a “low flow” time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 30,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.5.4 Recommendations

Recommendations for the Atlantic Avenue Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. Complete comprehensive electrical upgrade concurrently distribution equipment, motor control centers, and control panels.

ii. Complete a comprehensive standby power upgrade including a new, exterior standby generator and automatic transfer switch (ATS). Relocation of the standby generator outside alleviates current code issues caused by the existing MCC/standby generator clearance.

iii. Replace existing pump station exhaust fan and exhaust fan controls to provide reliable ventilation and NFPA declassification of the dry well.

iv. Complete the following modifications to address life safety concerns and to prevent further building deterioration: seal dry well penetrations; provide local pump emergency stops; adjust existing sump pump float; replace gas detection system; install exit and emergency lighting; provide arc-flash safety labeling; and ground the antenna mast.

4.6 LESLIE DRIVE

4.6.1 Existing Conditions

The Leslie Drive Pump Station was originally constructed in 1986 and underwent a SCADA upgrade in 2005. The pump station consists of a two-level dry well structure and a separate rectangular concrete wet well. Leslie Drive Pump Station provides service to several residential neighborhoods including Spinnaker Way and the Atlantic Heights area.

4.6.1.1 Equipment

The suction-lift pump station houses two 25 HP Gorman-Rupp T-10 (Super T-series) self-priming centrifugal pumps. Both pumps were replaced between 2012 and 2015 with the motors being original to the pump station construction (1986). Based on the City's records, both pumps were originally rated for 1,550 GPM. Each pump is driven by constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 17-hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity of 1,485 GPM which is within the expected range of the duty point. The City should begin to plan for replacement of the pump motors in the next 3-5 years to maintain reliable operation.

The pump station's wet well is 12-foot by 12-foot by 11-foot and was observed to be in good condition due to the City's biannual cleaning program. It was noted the wet well has had issues with significant scum accumulation, and to mitigate the City has recently installed a large bubble wet well mixing system. The grating and pump suction piping was observed to be in fair condition. Minor deficiencies were observed in the wet well, such as missing safety net/guard for one of the wet well hatches, and unsealed penetrations in the wet well slab (for old electrical conduit).

4.6.1.1.1 Heating, Ventilation, and Air Conditioning

The pump station building is heated by two wall-mounted electric unit heaters. One is located in the Pump Room (lower level) and the other is located in the Control Room (upper level); both heating units appear to be in good condition. Ventilation air is circulated by an inline exhaust fan located in the Control Room. The exhaust fan intake damper was not operational during the site visit and should be repaired. The fan and controls date back to the original pump station construction (1986), but appear to be in fair condition. The exhaust fan and associated damper system must be operated at all times to comply with NFPA 820 requirements.

A simplex sump pump with integral float control is located in the Pump Room. The discharge piping is routed to the wet well. The sump pump appears to be in relatively good condition,

however the sump pit is shallow, and the float does not initiate the pump until water has accumulated on the floor well beyond the sump pit. The sump pump float actuator should be adjusted, or the sump pump should be replaced to mitigate water accumulation on the lower level and subsequent equipment rusting and floor finish peeling.

4.6.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1985. The City noted the Pump No. 2 motor starter was replaced with a soft starter in 2015. Overall, the pump station electrical equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. Based on the current standby power setup, only one of the two pumps is connected to standby power at a time. A manual switch on the pump station control panel dictates which pump is available for standby power.

The Pump Room's gas detection system is currently not functioning; it is recommended the system be replaced. Other deficiencies noted at the time of inspection include: missing emergency lighting, missing arc-flash safety labeling, and exterior electrical service enclosure corrosion. Also, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety.

A 45-kW Cummins Onan standby generator and automatic transfer switch (ATS) is located inside the pump station. The generator and ATS were installed in 1985 and operates on two 1,000-gallon propane storage tanks located outside of the building. The existing standby generator location does not meet current NEC code for minimum set back requirements from the Motor Control Center. The standby generator and automatic transfer switch (ATS) are both nearing the end of their useful life and should be considered for replacement.

4.6.1.1.3 Instrumentation

The pump and pump station controls are located in a control panel in the Dry Well. The control panel, installed as part of the 2005 upgrade, was found to be in good condition and has an estimated lifespan of approximately 15 to 20 years. The City should plan to replace the control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC (Programmable Logic Controller), which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building. It is recommended the antenna mast be grounded.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). It is recommended the submersible level instruments be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Effluent flow is measured through a Foxboro 10-inch electromagnetic meter (with an integral transmitter). The flow meter is original to the pump station and has exceeded its estimated useful life of 20 years. It is recommended the meter be replaced. The Pump Room's gas detection system is currently not functioning; it is recommended the system be replaced.

Emergency/exit lighting was observed to be missing from the pump station.

4.6.1.2 Building

4.6.1.2.1 Exterior

The existing building consists of a brick finish, two-story structure with a metal roof. The exterior building materials appear to be in fair condition, however the brick veneer has some staining and

deteriorating of the mortar joints. Deteriorating mortar joints should be spot repaired as needed. The roof is original to the pump station and has exceeded its 30-year life expectancy and should be scheduled for replacement. The exterior door is in good condition but is missing miscellaneous hardware and should be repainted to preserve longevity. The steel lintel above the generator louver is exposed and corroding. It is recommended the lintel be repaired or replaced to avoid building envelope leaks.

4.6.1.2.2 Interior

The building foundation and interior dry well were observed to be in good condition. The lower dry well showed signs of significant moisture accumulation and rust on pumps skids and pipe supports. Link seals for the suction piping penetrations showed significant signs of groundwater intrusion. The link seal should be repaired to prevent further water damage. In addition all corroded metal equipment should be stripped and repainted for continued protection. The lower portion of the interior Dry Well should be cleaned and repainted to mitigate moisture damage. The grated aluminum stair is open at both levels with a single-height top mounted guardrail. The stair was observed to be in good condition, but missing a toeplate.

4.6.1.3 Site

The pump station site is located adjacent to the Route 1 bypass between two tidally influenced drainage areas. The rear of the building has a fenced-in gated area that contains the standby generator propane tank.

The pump station's finished floor elevation is 9.5 feet (NAVD) with the surrounding grade between 7.0 – 8.5 feet (NAVD). These elevations fall within the floodplain of multiple flood scenarios from the City's Climate Change Vulnerability Assessment (**Appendix C)**:

1) Year 2013 (present day) mean high tide scenario with a 100-year coastal storm surge (Elev. +11.2 feet)

2) Year 2100 (high sea level rise scenario) mean high tide (Elev. +10.7 feet)

Based on these current and forecasted flood conditions, the Leslie Drive pump station and electrical transformer may be susceptible to flooding in the future. While historical flooding issues were not noted in the pump station, the City should begin to evaluate potential flooding mitigation measures to take for the next significant pump station upgrade. This mitigation measures may include one or more of the following approaches:

- Raising the finished floor elevation in the dry well;
- Upgrading the pump station to a dry-pit *submersible* type station to allow pumps to operate while submerged;
- Upgrading the pump station with flood prevention measures such as flood panel doors, high capacity sump pumps, gasketed door stop gates, etc.

In addition to the pump station, the exterior propane tank is within the area that is a potential flood risk. The City should confirm that the propane tank is properly secured to a stationary foundation capable of resisting flotation forces of the propane tank.

4.6.1.4 Force Main

Based on review of the existing drawings, the force main leaves the pump station as a 12-inch ductile iron (DI) force main and transitions at some point to an asbestos cement (AC) force main based on the City's existing GIS database. Records indicate the pump station's force main was installed in 1986 and connects to a section of force main that pre-dates 1986. Given this information, the age of the AC section of the Leslie Street Pump station is unknown. The force main discharges to a sewer manhole located approximately 850 feet away on the southeast side of the bridge on Market Street.

The average useful lifespan of DI/AC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI/AC pipe can have a service life of 50 to 100 years. The known section of the force main pipe (DI) is currently 32-years old, but the remaining sections of the force main are of unknown age. The City has no records of pipe failure or maintenance issues with this force main.

The force main is located in an area of soils where corrosivity is not an issue for asbestos cement or ductile iron pipes. Based on this data, it is unlikely that soil conditions alone would contribute to accelerated degradation of the force main pipe. However, it should be noted the force main is in a low elevation area in close proximity to the Piscataqua River. It is expected that the water table is high and possibly saline, which can lead to accelerated corrosion of the force mains. Based on the questionable age and material of the entire length of force main, combined with the proximity to a brackish water source, it is recommended the City plan to complete a visual investigation (CCTV) of the force main to provide further confirmation of the interior pipe condition.

4.6.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of less than 2.5 hours per day (total run time for both pumps). Based on draw-down test observations, this equates to approximately 220,000 gallons per day. Under peak conditions, the pumps may run up to 18 hours per day (total run time for both pumps). Given the minimal operating times for the both pumps, the station appears to have adequate capacity to handle existing flows.

The pump station appears to have slightly longer average run times from February through June. This trend suggests the pump station experiences inflow and infiltration (I/I) during the spring season when groundwater levels and stormwater/meltwater runoff are peaking. We recommend the City investigate this area as part of a larger I/I study to identify and mitigate potential sources of I/I.

4.6.3 Emergency Bypass Plan

The Leslie Drive Pump Station is equipped with a 6-inch force main bypass connection which can be accessed from outside of the pump station. This allows the City to bypass the existing force main using the dry well pumps, and connect a temporary force main, if required. If the dry well/pumps needed to be bypassed, which is considered an extreme scenario, the City would need to supply temporary bypass pumps to pump from the wet well via a temporary force main.

4.6.4 Recommendations

Recommendations for the Leslie Drive Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. Complete comprehensive electrical upgrade concurrently distribution equipment, motor control centers, and control panels.

ii. Complete a comprehensive standby power upgrade including a new, exterior standby generator and automatic transfer switch (ATS); relocate the standby generator outside to alleviate code issues caused by the existing MCC/standby generator clearance.

iii. Replace existing pump station exhaust fan and exhaust fan controls/damper to provide reliable ventilation and NFPA declassification of the dry well.

iv. Confirm exterior propane tank foundation bracing and attachment.

v. Complete the following modifications to address life safety concerns and to prevent further building deterioration: seal wet well penetrations; install missing toeplates on dry well stair well; provide local pump emergency stops; adjust existing sump pump float; replace gas detection system; install exit and emergency lighting; provide arc-flash safety labeling; and ground the antenna mast.

4.7 MARCY STREET

The Marcy Street Pump Station was originally constructed in 1986 and underwent a SCADA upgrade in 2005. The pump station consists of a two-level dry well structure and a circular pre-cast concrete wet well. The pump station provides service to a small residential district on the east side of the downtown area.

4.7.1 Existing Conditions

4.7.1.1 Equipment

The suction-lift pump station houses two 10 HP Gorman-Rupp T-4 (Super T-series) self-priming centrifugal pumps. Both pumps were replaced between 2004 and 2008 with the motors being original to the pump station construction (1986). The City should begin to plan for replacement of the pump motors in the next 3 to 5 years to maintain reliable operation. Based on the City's records, both pumps were originally rated for 210 GPM. Each pump is driven by a constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate as much as 24 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station draw-down tests indicated that the pumps are operating at a capacity of 125 GPM which is well below the design capacity. It was also noted that the discharge pressures were more than double the design TDH (44 feet), as reported by the City. Based on the high discharge pressures, the City should consider cleaning and/or assessment of the Marcy Street force main to evaluate the capacity and condition of the force main.

The pump station's 6-foot diameter wet well structure interior was observed to be in overall good condition due to the City's biannual cleaning program. It was noted the concrete top slab was in poor condition, with major degradation and section loss. The reinforcing steel was exposed in many locations. It is recommended the top slab be replaced. In addition, the pump suction piping showed significant signs of corrosion and should be replaced.

4.7.1.1.1 Heating, Ventilation and Air Conditioning

The pump station building is heated by a wall-mounted natural gas-fired unit heater, which appears to be in good condition. Ventilation air is circulated by an inline exhaust fan located in the Control Room. The exhaust fan intake damper was not operational during the site visit and should be repaired. The fan and controls date back to the original pump station construction (1986), but appear to be in fair condition. The exhaust fan and associated damper system must be operated at all times to comply with NFPA 820 requirements.

A simplex sump pump with integral float control is located in the Pump Room. The discharge piping is routed to the wet well. The sump pump appears to be in relatively good condition, however the sump pit is shallow, and the float does not initiate the pump until water has accumulated on the floor well beyond the sump pit. The sump pump float actuator should be adjusted, or the sump pump should be replaced to mitigate water accumulation on the lower level and subsequent equipment rusting and floor finish peeling.

4.7.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1986. Overall, the pump station electrical equipment has surpassed its useful design life. Many of the components are obsolete, and considerations should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. Based on the current standby power setup, only one of the two pumps is connected to standby power at a time. A manual switch on the pump station control panel dictates which pump is available for standby power.

The Pump Room's gas detection system is currently not functioning; it is recommended the system be replaced. Other deficiencies noted at the time of inspection include the need for emergency lighting, arc-flash safety labeling, and exterior electrical service enclosure corrosion. Also, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety.

A 20-kW Cummins Onan standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator and ATS were installed in 1985 and operates on a natural gas service. The existing standby generator location does not meet current NEC code for minimum set back requirements from the Motor Control Center. The standby generator and ATS are both nearing the end of their useful life and should be considered for replacement.

4.7.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Dry Well. The control panel, installed as part of the 2005 upgrade, was found to be in good condition and has an estimated lifespan of approximately 15 to 20 years. The City should plan to replace the control panel, or the major components, based on this timeframe or during the next major pump station upgrade.

The pump station's PLC (Programmable Logic Controller), which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the north side of the building. It is recommended the antenna mast be grounded.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). It is recommended the submersible level instruments be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Effluent flow is measured through a Foxboro 4-inch electromagnetic meter (with an integral transmitter). The flow meter is original to the pump station and has exceeded its estimated useful life of 20 years. It is recommended the magnetic flow meter be planned for replacement in the near future.

Emergency/exit lighting was observed to be missing from pump station.

4.7.1.2 Building

4.7.1.2.1 Exterior

The existing building consists of a wood sided, two story structure with a shingled roof. The exterior building materials appear to be in fair condition, however the pump station is adjacent to

the saltwater portion of the Piscataqua River which is a moist, harsh environment. Based on observations, the City has done a good job keeping up with maintaining the exterior of the pump station. A few areas of trim are in need of repair, replacement, or painting/priming. The City should consider roof gutters for the building to help preserve the trim and siding. The attic louver was noted to be in poor condition and should be replaced.

4.7.1.2.2 Interior

The building foundation and interior dry well were observed to be in good condition. The lower dry well showed signs of significant moisture accumulation and rust on pumps skids. The lower portion of the interior dry well should be cleaned and repainted to mitigate moisture damage. The grated aluminum stair is open at both levels with a single-height top mounted guardrail. The stair is in good condition but is missing a toeplate.

4.7.1.3 Site

The pump station site is located within a residential neighborhood between a house and a tidal portion of the Piscataqua River. The pump station has a small parking area street-side for maintenance access. Observations indicate that high tide levels come within several feet of the pump station wet well and finished floor elevation.

The pump station's finished floor elevation is 10.2 feet (NAVD) with the surrounding grade between 8.0 and 9.5 feet (NAVD). These elevations fall within the floodplain of multiple flood scenarios based on the City's Climate Change Vulnerability Assessment (**Appendix C)**:

3) Year 2013 (present day) mean high tide scenario with a 100-year coastal storm surge (Elev. +11.2 feet)

4) Year 2100 (high sea level rise scenario) mean high tide (Elev. +10.7 feet)

Based on these current and forecasted flood conditions, the Marcy Street pump station and electrical transformer may be susceptible to flooding. While historical flooding issues were not noted in the pump station, the City should begin to evaluate potential flooding mitigation measures

to take for the next significant pump station upgrade. These mitigation measures may include one or more of the following approaches:

- Raising the finished floor elevation in the dry well and wet well;
- Upgrading the pump station to a *submersible* type station to allow pumps to operate while submerged;
- Upgrading the pump station with flood prevention measures such as flood panel doors, high capacity sump pumps, gasketed door stop gates, etc.

The wet well top slab was noted to be significantly damaged by plow use and should be replaced. Bollards or markers should be installed to avoid plow damage in the future.

4.7.1.4 Force Main

The pump station's force main was installed in 1985. The ductile iron (DI) pipe is 4-inches in diameter and discharges to a sewer manhole located approximately 900 feet away on the northwest side of the Marcy Street Bridge.

The average useful lifespan of DI force main pipe depends on a variety of factors, including soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The force main pipe is currently 33-years old. The force main is located in an area of soils where corrosivity is not an issue for ductile iron pipes. Based on this data, it is unlikely that soil conditions alone would contribute to accelerated degradation of the force main pipe. However, it should be noted that the force main is in a low elevation area in close proximity to the Piscataqua River. It is expected that the water table is high and possibly saline, which can lead to accelerated corrosion of the pipe.

Based on observations and discussions with the City, the Marcy Street pumps have been operating at higher than expected pressures under low flows. Based on the small diameter of the pipe, it is difficult to complete a visual inspection of the force main. However, the City may contract a subcontractor to "jet" the force main in an attempt to clean out any solids which may have accumulated over the years of use, potentially causing high discharge pressures. The City may

then re-evaluate the capacity of the force main and assess alternative force main investigations, if warranted.

4.7.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 4.25 hours per day (combined). This equates to approximately 32,000 gallons per day of pumped wastewater. Under peak conditions, the pumps may run up to 24 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have adequate capacity to handle existing flows.

A comparison of average pump run times during the wet spring months versus the dryer summer months indicate the pump sewer shed experiences infiltration/inflow (I/I). We recommend the City investigate this area as part of a larger I/I study to identify and mitigate potential sources of I/I.

4.7.3 Emergency Bypass Plan

The Marcy Street Pump Station does not contain a force main or pump station bypass connection. In the event that the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 30,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.7.4 Recommendations

Recommendations for the Marcy Street Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. Complete comprehensive electrical upgrade of distribution equipment, motor control centers, and control panels;

ii. Complete a comprehensive standby power upgrade including a new, exterior standby generator and automatic transfer switch (ATS). Relocation of the standby generator outside alleviates current code issues caused by the existing MCC/standby generator clearance.

iii. Replace existing pump station exhaust fan and exhaust fan controls/damper to provide reliable ventilation and NFPA declassification of the dry well.

iv. Complete the following modifications to address code-related life safety concerns and to prevent further building deterioration: install missing toeplates on dry well stair well; provide local pump emergency stops; adjust existing sump pump float; replace gas detection system; install exit and emergency lighting; provide arc-flash safety labeling; and ground the antenna mast.

4.8 CORPORATE DRIVE

The Corporate Drive Pump Station was originally constructed in 2001. The pump station consists of an at-grade dry well structure and a separate pre-cast concrete circular wet well. The pump station provides service to commercial and industrial properties located along Corporate Drive in the Pease Tradeport Area.

4.8.1 Existing Conditions

4.8.1.1 Equipment

The suction lift pump station houses three 30 HP Gorman-Rupp T-6 (Super T-series) self-priming centrifugal pumps designed for 600 GPM. Each pump is driven by a VFD with the pump operation controlled by wet well level. The pumps operate in a lead/lag/standby configuration and operate up to 2.5 hours a day (combined). Pump station drawdown tests indicated that the pumps are operating at a capacity of 940 GPM against a reduced head condition compared to the original design.

The pump station's 8-foot diameter wet well structure was observed to be in overall good condition due to the City's biannual cleaning program. No deficiencies were noted at the time of observation.

4.8.1.1.1 Heating, Ventilation, and Air Conditioning

The pump station building is heated by a combustion (natural) gas fired unit heater. A propeller sidewall exhaust fan provides ventilation for the space. All units, piping, and ducts appeared to be in good working condition.

4.8.1.1.2 Electrical

The existing electrical distribution equipment at the pump station were installed as part of the 2001 upgrade and are in good condition. No deficiencies were noted.

A 100-kW Olympian standby generator is located inside the pump station. It was installed in 2001 and runs off of a natural gas service line which provides fuel to the generator and unit heater. The generator and automatic transfer switch (ATS) are both in good condition. The generator's exhaust piping should be insulated for safety purposes, and while not required, installation of a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

4.8.1.1.3 Instrumentation

The pump and pump station controls are located in a control panel in the pump station. The control panel, installed in 2001 has an anticipated useful design life of 15-20 years. The control panel is controlled by Allen Bradley SLC 50/5 PLC's which are no longer actively supported. These PLC's can be difficult to find replacements for if maintenance is required. It is recommended the existing PLC's in the control panels are upgraded to updated PLC's which are actively supported by the manufacturer.

The wet well instruments include an air bubbler, submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low).

4.8.1.2 Building

4.8.1.2.1 Exterior

The pump station building was constructed in 2001 and all exterior surfaces were observed to be in fair condition. The masonry appears to be in good condition with no observed deficiencies. It is recommended the gable end of the buildings be reprimed and painted within the next five years. The shingled roof is also in good condition, but replacement or repairs will likely be warranted in 8-10 years.

4.8.1.2.2 Interior

The interior masonry surfaces were observed to be in good condition with no deficiencies.

4.8.1.3 Site

The station is located in a commercial section of Pease Development with a dedicated access driveway. No site issues were noted.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by flood elevations (**Appendix C**).

4.8.1.4 Force Main

The pump station's force main was installed during the original construction of the pump station in 2001. The polyvinyl chloride (PVC) pipe is 8-inches in diameter and discharges to a sewer manhole located approximately 1,400 feet away at the intersection of Corporate Drive and Rye Street. There is a 30-foot section of the force main that is Ductile Iron (DI) where it passes under a 36-inch drain pipe approximately 50 feet before Rye Street.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is

currently 17-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

4.8.2 Capacity Review

Based on a review of the pump station runtime data, each pump is currently operating an average of 30 minutes per day. This equates to approximately 36,000 gallons per day of pumped wastewater total. Under peak conditions, the pumps may run up to 2.25 hours per day (total run time for all three pumps). Given the minimal average use of the pumps, the station appears to have adequate capacity to handle existing flows.

4.8.3 Recommendations

Recommendations for the Corporate Drive Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. Given the relatively good condition of the pump station, this evaluation did not identify any High Priority or high cost (greater than $50,000) recommendations.

4.9 GRIFFIN PARK

The Griffin Park Pump Station was originally constructed in 1990 and underwent a SCADA upgrade in 2005. The pump station consists of a single room above grade structure and a separate pre-cast circular wet well. The pump station provides service to a small number of commercial properties located along Griffin Road, including the Griffin Park Professional Building.

4.9.1 Existing Conditions

4.9.1.1 Equipment

The suction-lift pump station houses two 7.5 HP Gorman-Rupp T-4 self-priming centrifugal pumps. Pump No. 1 is original to the pump station construction (1990) and Pump No. 2 was

installed in 2001. Both motors are original to the pump station construction (1990). Based on the City's records, the pumps were originally rated for 200 GPM. Each pump is driven by a constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate up to 2 hours a day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station drawdown tests indicated that the pumps are operating at a capacity of approximately 220 to 250 GPM. The pumps appear to be operating against a lower duty discharge pressure, resulting in higher than design flowrates. It is recommended the City begin to plan for replacement of Pump No. 1, in addition to replacement/rehabilitation of both pump motors.

The pump station's 8-foot diameter wet well structure was observed to be in overall good condition due to the City's biannual cleaning program. The interior concrete surfaces were found to be in good condition with no significant observed deficiencies. The top side of the top slab appeared to be in good condition with minimal to no spalling or exposed aggregate. The suction pipes showed signs of limited corrosion, but were still in good operating condition. The discharge pipe which penetrates through the wet well was observed to be severely corroded and the pipe support bracket was broken. It is recommended the discharge pipe be replaced and redirected so the force main does not route under the building foundation.

4.9.1.1.1 Heating, Ventilation, and Air Conditioning

The pump station building is heated by a combustion (natural) gas fired unit heater. The unit was installed in 2016 and appears to be in very good condition. The building is not actively ventilated which is authorized per the Building Code, but a mechanism should be in place to allow the door to remain open while the pump station occupied.

4.9.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1990. The equipment, while in good condition, is approaching the end of its useful design life. Many of the components are obsolete or will become obsolete within the next 5 to 10 years. Low priority consideration should be given to a comprehensive electrical

upgrade including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as the lack of exit and emergency lighting, as well as missing arc-flash safety labeling.

A 30-kW Cummins Onan standby generator and automatic transfer switch (ATS) is located inside the pump station. The ATS was replaced in 2009 and may be able to be reused depending on the generator upgrade requirements. The generator operates on a natural gas service. While not required, installation of a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

4.9.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2005 to include PLC (Programmable Logic Controller) based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade. The pump station's PLC, which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building.

The wet well instruments include a submersible pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). Submersible level instruments in hazardous locations should be installed with an intrinsically safe barriers. For ease of operator maintenance, it is recommended that conduit seal-offs are installed on the instrument conduits outside of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Effluent flow is measured through a Fischer Porter 4-inch electromagnetic meter (with an integral transmitter). The flow meter is original to the pump station and has exceeded its estimated useful life of 20 years. It is recommended the magnetic flow meter be planned for replacement in the near future.

Emergency/exit lighting was observed to be missing from pump station.

4.9.1.2 Building

4.9.1.2.1 Exterior

The existing pump station building was constructed in 1990 and consists of a slab on-grade with. split rib masonry exterior. The exterior surfaces appear to be in fair condition, with some staining of the masonry in the bottom several feet. The concrete foundation is cracked near the entrance pad, which should be repaired. The exterior wood trim surfaces appear dried, faded, and have peeling paint. It is recommended the trim be re-primed and repainted. The wood soffit was observed to be coming apart on one side of the building and should be repaired.

The shingle roof is original to the construction of the pump station. While it was observed to be to be in good condition, the roof is approaching the end of its useful life. It is recommended the City begin to plan for roof replacement and consider adding roof gutters to prolong the life of the eaves/trim.

4.9.1.2.2 Interior

The interior masonry surfaces appear to be in good condition with no observed deficiencies.

4.9.1.3 Site

The station is located in a commercial district adjacent to Griffin Road. The station has its own dedicated access driveway. No site issues were noted.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.9.1.4 Force Main

The pump station's force main was installed in 1990. The ductile iron (DI) pipe is 6-inches in diameter and discharges to a sewer manhole located approximately 1,200 feet away at the intersection of Oxford Avenue and Greenland Road.

The average useful lifespan of DI force main pipe depends on a variety of factors, including soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The older portions of the force main pipe are currently 28 years old. The City did not report any maintenance issues with the ductile iron force main; however, the exposed wet well portions of the force main were noted to be in poor condition.

The force main is located in an area of soils where corrosivity is not an issue for ductile iron pipes. Based on this data, it is unlikely that soil conditions alone would contribute to accelerated degradation of the force main pipe. However, based on the age of the force main and the condition of the exposed wet well force main, it is recommended the City plan to complete a visual investigation (CCTV) of the force main to provide further verification of the interior pipe condition.

4.9.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of less than 0.5 hours per day (total run time for both pumps). Based on drawdown test observations, this equates to approximately 4,000 gallons per day. Under peak conditions, the pumps may run up to 2 hours per day (total run time for both pumps). Given the minimal operating times for the both pumps, the station appears to have adequate capacity to handle existing flows.

Evaluation of average and maximum pump runtimes indicate that I/I is not a problem in the pump station' sewershed.

4.9.3 Emergency Bypass Plan

The Griffin Park Pump Station does not contain a force main or pump station bypass connection. In the event that the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (less than 5,000 GPD), temporary septage hauling from the upstream sewer manhole or from the pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.9.4 Recommendations

Recommendations for the Griffin Park Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. Replace the corroded wet well discharge piping.

ii. Complete the follow recommendations to address code-related life safety concerns and to prevent further building deterioration: install exit and emergency lighting and provide arc-flash safety labeling.

4.10 TUCKERS COVE

4.10.1 Existing Conditions

The Tuckers Cover Pump Station was originally constructed in 1998 and underwent a SCADA upgrade in 2004. The pump station consists of a two-level dry well structure and a circular pre-cast concrete wet well. The pump station provides service to a residential development adjacent to Sagamore Creek, in addition to business and residences along the southern portions of Sagamore Road.

4.10.1.1 Equipment

The suction lift pump station houses two 15 HP Gorman-Rupp T-4 self-priming centrifugal pumps installed in 1998. Based on the City's records, the pumps were originally rated for 280 GPM. Each pump is driven by a constant speed starter with the pump operation controlled by wet well level. The pumps operate in a lead/standby configuration and operate up to 1 hour per day (combined). The pumps are operated at constant speed from a pump station control panel located within the pump station. Pump station drawdown tests indicated that the pumps are operating at a capacity of 240 GPM at a reduced head condition.

The pump station's 8-foot diameter wet well structure interior was observed to be in overall good condition due to the City's biannual cleaning program. The steel hatch closure arm was observed to be corroded and detached from the hatch. The arm should be removed for safety during confined space entry. Interior concrete surfaces were in good condition with no observed deficiencies.

4.10.1.1.1 Heating, Ventilation, and Air Conditioning

The pump station building is heated by a wall-mounted gas-fired unit heater. The heater appears to be in good condition, but has exceeded its expected useful life. A sidewall mounted exhaust fan and motorized damper provides ventilation air for the space when the area is occupied. This equipment was also found to be in good condition.

4.10.1.1.2 Electrical

The existing electrical distribution equipment and pump motor starters date back to the original pump station construction in 1998. The existing electrical distribution equipment is approaching the end of its useful design life. Many of the components will become obsolete within the next 10-15 years and consideration should be given to a comprehensive electrical upgrade, including panelboards, emergency power equipment, and other ancillary electrical components. A few minor deficiencies were noted, such as lack of emergency lighting, as well as missing arc-flash safety labeling.

A 45-kW Cummins Onan standby generator and automatic transfer switch (ATS) are located inside the pump station. The generator operates on a natural gas service. While not required, installation of a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

4.10.1.1.3 Instrumentation

The pump station controls are located in a control panel in the Pump Room. The control panel was upgraded in 2004 to include PLC (Programmable Logic Controller) based controls. The control panel was found to be in good condition, but has an estimated lifespan of approximately 20 years. The City should plan to replace the pump control panel, or the major components, based on this timeframe or during the next major pump station upgrade. The pump station's PLC, which is installed in the control panel, is connected to a pole-mounted microwave radio that communicates with the City's SCADA system for monitoring, control, and alarming. The radio uses an antenna mounted on the side of the building.

The wet well instruments include an ultrasonic pressure transducer, differential level floats, and two backup alarm floats (high-high and low-low). For ease of operator maintenance, it is recommended that conduit seal-offs are installed on the instrument conduits outside of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry.

Effluent flow is measured through a 4-inch electromagnetic meter (with an integral transmitter). The flow meter is original to the pump station and has exceeded its estimated useful life of 20 years. It is recommended the magnetic flow meter be planned for replacement in the near future.

Emergency/exit lighting was observed to be missing from pump station.

4.10.1.2 Building

4.10.1.2.1 Exterior

The pump station building was constructed in 1998. The exterior surfaces were found to be in fair to good structural condition. The bottom two courses of masonry were stained, potentially due to moisture from the ground. The exterior wood trim surfaces were faded with peeling paint. It is recommended they are reprimed and painted.

The shingle roof is original to the construction of the pump station. The roof's asphalt shingles are near the end of their useful life as they appeared to be curled and weathered. It is recommended the City begin to plan for roof replacement, and consider adding roof gutters to prolong the life of the eaves/trim.

4.10.1.2.2 Interior

The interior masonry appeared to be in good structural condition, but it is recommended the surfaces be pressure-washed and sealed or painted for aesthetic purposes. There was evidence of efflorescence on the inside face of masonry in the vicinity of the generator intake louver. It appears that a sealant was not installed, or has failed, allowing water to migrate into the building.

4.10.1.3 Site

The pump station site is located in a residential neighborhood. It is accessed via a dedicated paved driveway. No issues were noted with the exterior site.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by tidal flood elevations (**Appendix C**).

4.10.1.4 Force Main

Based on a review of the existing plan, the Tucker Cove pump station's force main was installed in 1998. The ductile iron (DI) pipe is 6-inches in diameter and travels cross country before discharging into a sewer manhole located approximately 1,450 feet away by Elwyn Road.

The average useful lifespan of DI force main pipe depends on a variety of factors, including soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, DI pipe can have a service life of 50 to 100 years. The force main pipe is currently 20-years old and the City has no records of pipe failure or maintenance issues. The force main is located in an area of soils that have a low to moderate soil corrosivity index. However, the force main is relatively new and will likely not yet have been adversely affected by the soil conditions.

4.10.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of less than 0.5 hours per day (total run time for both pumps). Based on drawdown testing, this equates to approximately 10,000 gallons per day. Under peak conditions, the pumps may run up to 1.5 hours per day (total run time for both pumps). Given the minimal operating times for the both pumps, the station appears to have adequate capacity to handle existing flows.

Evaluation of average and maximum pump runtimes indicate that I/I is not a problem in the pump station' sewershed.

4.10.3 Emergency Bypass Plan

The Tucker Cove Pump Station does not contain a force main or pump station bypass connection. In the event that the City needed to isolate the force main for maintenance, the City would coordinate maintenance efforts for a "low flow" time slot and utilize septage haulers to provide a window for force main maintenance. Based on the relatively low average day flows to the pump station (< 10,000 GPD), temporary septage hauling from the upstream sewer manhole or from the

pump station wet well is an acceptable bypass management approach for force main or pump station maintenance.

4.10.4 Recommendations

Recommendations for the Tucker Cove Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**. The following discussion addresses High Priority and high cost (greater than $50,000) items identified through this evaluation.

i. Replace roof and add roof gutters.

ii. Provide arc-flash safety labeling.

4.11 COMBINED PROJECT RECOMMENDATIONS

As described in the previous Sections, facilities improvement recommendations for each pump station were made based on their current conditions. A full list of all recommended improvements can be found in the Recommended Facilities Improvement Plan (RFIP) attached under **Appendix B.** In addition to the individual recommendations for each suction lift pump station, several combined sample Improvement Projects have also been developed which group together improvements based on similar scope of work and prioritization.

4.11.1 Combined Electrical, Standby Generator, and HVAC Upgrades

General Scope: Comprehensive electrical distribution equipment upgrade including distribution panels, motor control centers, automatic transfer switches, and standby generators. The combined upgrade should also include upgrade of the existing HVAC systems in the buildings to provide reliable heating, cooling, and ventilation.

Proposed Suction Lift Pump Stations for Combined Project:

- Leslie Drive

- Atlantic Heights
- Marcy Street

The costs for the proposed combined pump station upgrade project are included under each individual Pump Station in **Appendix B**. If the City elects to move forward with the proposed combined project, the total project cost (all three pump stations combined) should be evaluated further based on City input on proposed project scope, approach, construction specifications, etc.

4.11.2 Combined Pump Station Conversion or Building Replacement

General Scope: Comprehensive pump station upgrade including building replacement, pump station conversion (optional), electrical upgrades, standby generator upgrades, etc.;

- Constitution Avenue
- West Road
- Woodlands I
- Woodlands II

The costs for the proposed combined pump station upgrade project are included under each individual Pump Station in **Appendix B**. If the City elects to move forward with the proposed combined project, the total project cost (all four pump stations combined) should be evaluated further based on City input on proposed project scope, approach (suction lift vs. submersible), construction specifications, etc.

5

SECTION 5

PUMP STATION EVALUATIONS
SUBMERSIBLE PUMP STATIONS

5.1 CLOUGH DRIVE

5.1.1 Existing Conditions

The Clough Drive Pump Station was originally constructed in 2005 and provides service to a small residential area, including the Little Harbour School.

5.1.1.1 Equipment

The pump station houses two ITT-Flygt Submersible grinder pumps with double-sealed vortexing semi-recessed impellers. Each pump is rated for 55 GPM at 40 feet of total dynamic head. The 2.3 HP pumps are constant speed and are powered from a pad-mounted electrical cabinet. A wet well draw-down test was conducted to verify the pumping capacity of the station. Pump 1 was found to have a capacity of 31 GPM, and Pump 2 was found to have a capacity of 41 GPM. The pumps are configured to operate as lead/standby based on wet well setpoints. The City has indicated that these pumps are removed and rehabilitated every 1 to 2 years.

The pumps are located in the station's 8-foot diameter pre-cast concrete wet well and are accessible via a pump lifting rail. The wet well is cleaned three times a year and appears to be in good condition. The wet well hatch is also in good condition, although it should be equipped with a safety net/hatch grating for operational protection. The wet well has a 4-inch PVC vent that vents immediately adjacent to the electrical cabinet. The clearance from the vent to the cabinet does not meet current NFPA 820 standards and it is recommended it be relocated to provide a minimum of 3-feet clearance.

A pre-cast concrete valve pit with 30-inch access hatch is located adjacent to the wet well (outside of the fenced area). The vault houses 2-inch check valves and a resilient gate valve. During the site inspection, the vault was observed to be flooded with water. The valve vault does not include a

means to drain back to the wet well. It is recommended a passive valve vault drain be installed to prevent the vault from future flooding.

A pad-mounted electrical cabinet is located adjacent to the pump station wet well. The weatherproof cabinet is rated NEMA 4X and contains the motor starter panels, electrical distribution equipment, and pump control panels. Currently, pump station alarms are transferred to the City's WWTF SCADA system through radio transmission. The pump is equipped with a microwave remote terminal unit (RTU) for future transition to microwave transmission.

The pump station does not have a dedicated standby generator, so in the event of a power failure, a temporary gas-powered generator is transported to the site and used on an as-needed basis. Alternatively, the City may use their vactor truck to empty the wet well as needed. The pump station has sufficient capacity to accommodate short-term power outages.

5.1.1.2 Site

The pump station is located adjacent to the Little Harbour School. The electrical (service) cabinet is within a fenced area, but the wet well and valve vault are located outside of the fence, adjacent to Clough Drive. The un-enclosed area is not protected from traffic (bollards, etc.), and the valve vault and wet well hatch show signs of plow damage. It is recommended vehicle protection be installed to prevent the site from being used as snow storage by vehicles plowing the road.

The fenced area containing the electrical cabinet is commonly locked. During the site visit, the wet and valve vault were not locked. It is recommended the City install locks to prevent unauthorized access of these facilities.

The pump station's wet well hatch is at an of elevation 14 feet (NAVD). This elevation falls within the floodplain for projected tidal flooding scenarios in the year 2100. However, based on the City's Climate Change Vulnerability Assessment (**Appendix C)**, the pump station is not likely to be impacted by tidal flooding within the next 30 years.

5.1.1.3 Force Main

The pump station's force main was installed during original construction of the pump station in 2005. The polyvinyl chloride (PVC) pipe is 2-inches in diameter and discharges to a sewer manhole located 500-feet away on Clough Drive.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is currently 13-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

5.1.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 1.5 to 2 hours per day. This equates to approximately 3,000 to 4,300 gallons per day of pumped wastewater. Under peak conditions, the pumps may run up to 22 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have adequate capacity to handle existing flows.

5.1.3 Recommendations

Recommendations for the Clough Drive Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**.

5.1.3.1 High Priority

- Install wet well and valve pit hatch security lock;
- Install industrial bollards to protect the un-fenced area (wet well and valve vault);
- Install valve vault drain to wet well;
- Relocate the wet well vent to be more than 3-feet from the electrical panel (as per current NFPA 820 requirements);

- Install utility power bypass circuit for UPS.

5.1.3.2 Medium Priority

- Install safety net/fall protection on the wet well hatch;
- Replace grinder pumps (planning level).

5.1.3.3 Low Priority

- Expand the fence limits to include the valve vault and wet well access hatches;
- Upgrade the control panel/pump starters;
- Replace submersible transducer/wet well float (planning).

5.2 MARSH LANE

5.2.1 Existing Conditions

The Marsh Lane Pump Station was originally constructed in 1985 and underwent a pump and control panel upgrade in 2004. It provides service to a small residential area on the north side of North Mill Pond.

5.2.1.1 Equipment

The pump station houses two ITT-Flygt Submersible grinder pumps. Each pump is rated for 55 GPM at 40 feet of total dynamic head. The 2.3 HP pumps are constant speed and are run from a pad-mounted electrical cabinet. A draw-down test was conducted to verify the pumping capacity of the station. Pump 1 was found to have a capacity of 32 GPM, and Pump 2 was found to have a capacity of 37 GPM. The pumps are configured to operate as lead/standby based on wetwell setpoints.

The pumps are located in the station's 6-foot diameter wet well and are accessible via a pump lifting rail. The wet well is cleaned three times a year and appears to be in good condition. Minor cracks were observed at the electrical conduit penetration and upper hatch foundation, which are recommended for repair. The wet well has experienced flooding and the City has plans to raise

the wet well hatch. It is recommended the hatch be replaced with a gasketed, watertight hatch (with safety net) to help mitigate flooding concerns.

As part of the 2004 upgrade, the original 3-inch ductile iron discharge pipe was replaced with a 2-inch PVC pipe, including isolation valves located within the wet well. The original isolation valves outside of the wet well have been abandoned in place.

A pad-mounted electrical cabinet is located adjacent to the pump station wet well. The cabinet door latch was broken at the time of the site visit.

A separate enclosure houses the electrical distribution equipment. The enclosure is showing signs of aging and there are several unsealed penetrations. The electrical distribution equipment, including the enclosure, are original to the pump station and are recommended for replacement.

The pump station does not have a dedicated generator, so in the event of a power failure, a temporary gas-powered generator (10 kW) can be used, or the City's vactor truck can empty the wet well as-needed. The pump station has sufficient capacity to accommodate short-term power outages.

5.2.1.2 Site

The pump station is located at the end of Marsh Lane less than 50 feet from a tidal inlet to North Mill Pond. The pump station is close to being submerged during high tide events. The City has had minimal success mitigating flood impacts by placing sandbags around the wet well hatch. At the time of the site visit, the wet well hatch elevation was 5.9 feet (NAVD). However, since the site visit, the City has replaced the top slab wet well sections and increased the rim elevation by 18 inches (approximately). Based on the new assumed rim elevation of 7.5 feet, the pump station falls within the floodplain of multiple flood scenarios from the City's Climate Change Vulnerability Assessment (**Appendix C)**:

1) Year 2013 (present day) mean high tide scenario with a 100-year coastal storm surge (Elev. +11.2 feet)

2) Year 2100 (high sea level rise scenario) mean high tide (Elev. +10.7 feet)

Based on these forecasted flood conditions, the Marsh Lane pump station and its electrical equipment may be susceptible to flooding in the future. The City should continue to monitor flood events in the area and consider these minimum flood elevations for all future pump station upgrades.

The pump station is not fenced, but the electrical panels and wet well utilize standard door padlocks. The above-grade wet well hatch is marked by industrial bollards.

5.2.1.3 Force Main

The pump station's force main was installed during original construction of the pump station in 1985. The polyvinyl chloride (PVC) pipe is 2-inches in diameter and discharges to a sewer manhole located 460-feet away on Maplewood Avenue.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is currently 33-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

5.2.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 1.5 hours per day (combined). This equates to approximately 3,000 gallons per day of pumped wastewater. Under peak conditions, the pumps may run up to 18 hours per day (total run time for both pumps). Given the minimal average use of both pumps and the small sewershed that the pump station serves, the station appears to have adequate capacity to handle existing flows and is not considered a significant I/I concern.

5.2.3 Recommendations

Recommendations for the Marsh Lane Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**.

5.2.3.1 High Priority

- Install utility power bypass circuit for UPS.

5.2.3.2 Medium Priority

- Install safety net/fall protection on the wet well hatch;
- Replace grinder pumps (planning);
- Install intrinsically safe barrier for wet well instruments.

5.2.3.3 Low Priority

- Upgrade electrical distribution enclosure and equipment;
- Upgrade the control panel/pump starters.

5.3 MILL POND WAY

5.3.1 Existing Conditions

The Mill Pond Way Pump Station was originally constructed in 1985 and underwent a pump and control panel upgrade in 2009. It provides service to a small residential area on the east side of North Mill Pond.

5.3.1.1 Equipment

The pump station houses two ITT-Flygt Submersible grinder pumps. Each pump is rated for 55 GPM at 40 feet of total dynamic head. The 2.3 HP pumps are constant speed and are run from a pad-mounted electrical cabinet. A draw-down test was conducted to verify the pumping capacity of the station. Pump 1 was found to have a capacity of 24 GPM, and Pump 2 was found to have a capacity of 25 GPM. The pumps are configured to operate as lead/standby based on wetwell setpoints.

The pumps are located in the station's 6-foot diameter wet well and are accessible via a pump lifting rail. The wet well is cleaned three times a year and appears to be in good condition. The wet well hatch is also in good condition, but does not meet current safety standards as it is missing

a safety net/hatch grating. The wet well has a 3-inch galvanized vent that vents immediately adjacent to the wet well. The wet well hatch is equipped with a padlock.

Based on the site visit observations, the original discharge piping and isolation valves were replaced with PVC valves located inside the wet well. The PVC piping and valves were observed to be in good condition. The original isolation valve boxes were observed, but their operability was not verified.

A pad-mounted electrical cabinet is located adjacent to the pump station wet well. The weatherproof cabinet houses the motor starter panel (Flygt), a pump control panel, and electrical disconnects. The cabinet is equipped with a standard door padlock. Currently, pump station alarms are transferred to the City's WWTF SCADA System through radio transmission. The pump is equipped with a microwave remote terminal unit (RTU) for future transition to microwave transmission. City staff have installed a small battery-powered exhaust fan to mitigate heat issues.

The pump station does not have a dedicated standby generator, so in the event of a power failure, a temporary gas-powered generator is transported to the site and used on an as-needed basis. Alternatively, the City may use their vactor truck to empty the wet well as needed. The pump station has sufficient capacity to accommodate short-term power outages.

5.3.1.2 Site

The pump station is located in a grass lot within a residential area. The wet-well is marked by two light-duty bollards and the site showed no signs of damage or flooding.

The wet well hatch elevation is 11.8 feet (NAVD) which is close to the range of possible floodplain scenarios based on the City's Climate Change Vulnerability Assessment (**Appendix C)**:

1) Year 2013 (present day) mean high tide scenario with a 100-year coastal storm surge (Elev. +11.2 feet)

2) Year 2100 (high sea level rise scenario) mean high tide (Elev. +10.7 feet)

Based on these forecasted flood conditions, the Mill Pond pump station and electrical equipment may be susceptible to flooding in the future. The City should continue to monitor flood events in the area and consider these minimum flood elevations for all future pump station upgrades.

5.3.1.3 Force Main

The pump station's force main was installed during original construction of the pump station in 1985. The 3-inch diameter pipe discharges to a sewer manhole located 580 feet away on Mill Pond Way.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is currently 33-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

5.3.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 1.5 hours per day (combined). This equates to approximately 2,800 gallons per day of pumped wastewater. Under peak conditions, the pumps may run up to 20 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have adequate capacity to handle existing flows. Given the minimal average use of both pumps and the small sewershed that the pump station serves, the station appears to have adequate capacity to handle existing flows and is not considered a significant I/I concern.

5.3.3 Recommendations

Recommendations for the Mill Pond Way Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**.

5.3.3.1 High Priority

- Install utility power bypass circuit for UPS.

5.3.3.2 Medium Priority

- Install safety net/fall protection on the wet well hatch;
- Replace grinder pumps (planning);
- Replace buried valve operator boxes/valves.

5.3.3.3 Low Priority

- Upgrade electrical distribution enclosure and equipment;
- Upgrade the control panel/pump starters.

5.4 NORTHWEST STREET

5.4.1 Existing Conditions

The Northwest Street Pump Station was originally constructed in 1985 and underwent a pump and control panel upgrade in 2004. It provides service to a small residential area on the north end of North Mill Pond.

5.4.1.1 Equipment

The pump station houses two ITT-Flygt Submersible grinder pumps. Each pump is rated for 55 GPM at 40 feet of total dynamic head. The 2.3 HP pumps are constant speed and are run from a pad-mounted electrical cabinet. A draw-down test was conducted to verify the pumping capacity of the station. Pump 1 was found to have a capacity of 55 GPM, and Pump 2 was found to have a capacity of 43 GPM. The pumps are configured to operate as lead/lag based on wet well setpoints.

The pumps are located in the station's 6-foot diameter wet well and are accessible via a pump lifting rail. The wet well is cleaned three times a year and appears to be in good condition. The wet well hatch is also in good condition, but does not meet current safety standards as it is missing a safety net/hatch grating. The wet well hatch is equipped with a padlock.

As part of the 2004 upgrade, the original discharge piping and isolation valves were replaced with PVC valves located inside the wet well. The PVC piping and valves were observed to be in good condition. The original isolation valve boxes were observed, but their operability was not verified.

A pad-mounted electrical cabinet is located adjacent to the pump station wet well. The weatherproof cabinet houses the motor starter panel (Flygt), a pump control panel, and electrical disconnects. The cabinet is equipped with a standard door padlock. Currently, pump station alarms are transferred to the City's WWTF SCADA System through radio transmission. The pump is equipped with a microwave remote terminal unit (RTU) for future transition to microwave transmission. City staff indicated concerns with the combined panel overheating in the summer and have installed a small battery-powered exhaust fan to mitigate heat issues.

The pump station does not have a dedicated generator, so in the event of a power failure, a temporary gas-powered generator (10 kW) can be used, or the City's vactor truck can empty the wet well as-needed. The pump station has sufficient capacity to accommodate short-term power outages.

5.4.1.2 Site

The pump station is located within a fenced-in area directly adjacent to Northwest Street. The site shows no signs of damage or flooding.

Based on the City's Climate Change Vulnerability Assessment, the pump station will not be impacted by flood elevations (**Appendix C**).

5.4.1.3 Force Main

The pump station's force main was installed during original construction of the pump station in 1985. The 2.5-inch diameter PVC pipe discharges to a sewer manhole located 710 feet away on Northwest Street.

The average useful lifespan of PVC force main pipe depends on a variety of factors, including: soil conditions, pumping conditions, and installation methods. Under normal conditions and good engineering practice, PVC pipe can have a service life of 50 to 75 years. The force main pipe is

currently 33-years old and the City has no records of pipe failure or maintenance issues. PVC is very resistant to corrosion, so the soil conditions should not impact the expected lifespan of the pipe.

5.4.2 Capacity Review

Based on a review of the pump station runtime data, the pumps are currently operating an average of 30 minutes per day. This equates to approximately 1,500 gallons per day of pumped wastewater. Under peak conditions, the pumps may run up to 3 hours per day (total run time for both pumps). Given the minimal average use of both pumps, the station appears to have more than adequate capacity to handle existing flows. Given the minimal average use of both pumps and the small sewershed that the pump station serves, the station appears to have adequate capacity to handle existing flows and is not considered a significant I/I concern.

5.4.3 Recommendations

Recommendations for the Northwest Street Pump Station have been broken into three categories based on the level of priority. Medium and Low Priority recommendations can be found in the Recommended Facilities Improvement Plan attached as **Appendix B**.

5.4.3.1 High Priority

- Install utility power bypass circuit for UPS.

5.4.3.2 Medium Priority

- Install intrinsically safe barrier for wet well instruments;
- Install safety net/fall protection on the wet well hatch;
- Replace grinder pumps.

5.4.3.3 Low Priority

- Upgrade electrical enclosure exhaust fan;
- Install pump discharge isolation valves;
- Upgrade electrical distribution enclosure and equipment;

- Upgrade the control panel/pump starters.

5.5 COMBINED PROJECT RECOMMENDATIONS

As described in the previous Sections, recommended facility improvements for each pump station were made based on their current condition. A full list of all recommended improvements can be found in the Recommended Facilities Improvement Plan (RFIP) attached under **Appendix B.** In addition to the individual recommendations for each submersible pump station, several combined sample Facilities Improvement Projects have also been developed which group together recommended improvements based on similar scope of work and prioritization.

5.5.1 Combined Electrical Upgrade

General Scope: Comprehensive electrical distribution equipment upgrade including distribution panels, motor control centers, automatic transfer switches, and electrical enclosures.

Pump Stations:

- Marsh Lane
- Northwest Road
- Mill Pond Way

The costs for the proposed combined pump station upgrade project are included under each individual Pump Station in **Appendix B**. If the City elects to move forward with the proposed combined project, the total project cost (all three pump stations combined) should be evaluated further based on City input on proposed project scope, approach, construction specifications, etc.

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A

WET PIT/DRY PIT EVALUATION FORMS

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation
Mechanic St.

Last Update: MAC *By:* 11/7/2018
This Update: *By:*

General Pump Station Information	
Location:	113 Mechanic Street
Pump Station Finished Floor Elevation, ft.:	8.5
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	0.5
Year Constructed/Upgraded:	1976/1990/2000/2007
Station Type:	Dry Pit submersible
Wet Well Size, L x W x H, ft:	22 x 10 x 11
Wet Well Volume (1+2), gallons	14,481
No. of Pumps: Raw Influent Pumps (Dry Pit Submersible)	2
Bypass Pump (Submersible)	1
Main Pump Installation Date:	1991
Bypass Pump Installation Date:	2000
Main Pump Design Operating Point, 1 Pump	
Flow, MGD:	22.05
Total Dynamic head, ft.:	95
Bypass Pump Design Operating Point, 1 Pump	
Flow, MGD:	11.53
Total Dynamic head, ft.:	59
Main Pump Make/Model:	Davis EMU, Submersible, FA 50.97-690
Motor Size, HP:	450
Motor/Pump Speed, rpm:	880
Bypass Pump Make/Model:	Flygt Model CP 3356-610, 735 drive unit
Bypass Motor Size, HP:	143
Bypass Motor/Pump Speed, rpm:	1160
Electrical Service, V/Ph/Hz:	480/3/60
Drive Type:	VFD
Seal Make & Type:	Upper and Lower mechanical shaft seal
Force Main Diam., in.:	30, 24, 18, 16
Force Main Velocity (1 pump, average day flow), feet per sec (varying diameters):	2.3 - 2.9
Force Main Velocity (typical low flow), feet per sec. (varying diameters):	1.3 - 1.7
Force Main Type:	Ductile Iron & Cast Iron
Force Main Age:	1973-1998
Force Main Length, ft.:	3100

Pump Flow and Run Time Information			
	P1	*P2*	*P3(Bypass)*
Pump Flow Data (Magnetic Flow Meter)			
Data Start Date		1/1/2016	
Data End Date		10/31/2017	
Observed Instantaneous Flowrate*, GPM	10,688	10,688	Not tested
Observed Instantaneous Flowrate*, MGD	15.4	15.4	-
*Maximum pump capacity may be greater than observed flowrates when high flow elevate the wet well water surface level. Historical magnetic flow meter data indicates that a single raw pump has conveyed 20-22 MGD reliably in the past.			
Pump Totalized Data			
Data Start Date	1/1/2014	1/1/2014	1/1/2014
Data End Date	10/31/2017	10/31/2017	10/31/2017
Annual Average Flow, GPM (Magnetic Flow Meter)	5,025		465
Annual Average Flow, MGD (Magnetic Flow Meter)	7.24		0.67

Generator Information	
Make/Model:	DMT, Cummins KTA-38G1, 940 HP
Interior/Exterior:	Exterior within enclosure
Gen. Installation Date	1990
Size, KW:	750
Fuel Type:	Oil, aboveground double walled storage tank, Unknown volume (< 1000 gallon estimate)

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/Standby sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. The pumps use wet well level and a proportional control logic to vary the speed of the pumps based on wet well level. Alternatively, the City can divert influent flow from the main wet well to a separate submersible wet well via an electrically actuated bypass gate if pump station bypass is required.
Pump Control Panel:	Dedicated Main Pump Control Panel and Separate Bypass Pump Control Panel
Installation Date:	Main Pump Control Panel (2007), Bypass Pump Control Panel (1990s)
Control Type:	PLC based (SLC 5/05)
Location:	In pump station Control Room
SCADA Connectivity:	Radio, future microwave system transition in progress
Level & Alarm Controls (Main Pumps):	Division 13 Control Panels
Type:	Two submersible pressure transducers (primary)
Backup Alarm	High level float switches in wet well
Flow Meter Make/Model:	Magnetic Flow Meter, 20-inch
Level & Alarm Controls (Bypass Pump):	Division 13 Control Panels
Type:	Ultrasonic Level Element, Siemens Miniranger
Backup Alarm	Low and High Level Float Switches
Flow Meter Make/Model:	Magnetic Flow Meter, 16-inch
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters (Main) :	Allen-Bradley Powerflex 18 Pulse Custom VFD Drives (500 HP)
Pump Motor Starters (Bypass) :	Allen-Bradley Powerflex

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Mechanical				
Heating & Cooling (Dry well):			Ventilation:	Building (Dry Well)
Type:	Gas Fired Rooftop unit		Exhaust Fan:	Roof Mounted
Furnace Size(MBH) and Fan (CFM)	158 MBH, 4500 CFM	Quantity: 1 each	Size (CFM)	1200/600
Furnace Make/Model:	-			
Supplemental Cooling	Ductless Split AC unit, Carrier		Ventilation:	Wet Well
City Water Supply:	1" with RPZ BFP		System	Qty: 1-supply 1-exhaust
			Size:	1200 CFM (supply), 2450 CFM (exhaust)
Heating (Wet Well):			L&D	-
Type:	Electric Unit Heater			
Size (kW)	15 (estimated)	Quantity: 1		
Make/Model	-			
Odor Control :	Granular Activated Carbon, 1500 CFM fan	Quantity: 1		
Make/Model	Siemens RJMC-0550			

Energy Efficiency Information

The maximum observed pump capacity during the site visit (15.4 MGD) is lower than totalized pump station flows observed over the past several years of data. This may be due in part to elevated wet well water surface levels. Historical magnetic flow meter data indicates that a single raw pump has conveyed 20-22 MGD reliably since 2014. At this flowrate, both main pumps are operating between 80-82% optimization rating. While the existing pumps remain efficient, they are quickly approaching the end of their useful life and replacement/upgrade of pumps should be considered in the near future. Further discussion regarding replacement/repair of the existing main pumps can be found in the Pump Station Master Plan Report.

The pump station is serviced by two separate force mains with varying diameters between 12 and 20-inch. Flow is divided between the two force mains. Based on an approximation of the flow split between the two force mains, the approximate velocity at low flow (1 pump, ~30 Hz) is < 1 fps. Velocities below 2 fps can lead to solids settling within the force main. The City reported that they have not experienced issues with the force mains with this type of pump control. While short duration operation at low velocities is acceptable, it is recommend that the City ensure that the pump station flowrate is increased to at least 6,000 gpm periodically to properly scour/flush solids which may have accumulated in the force main at lower flows.

The City could see a heating savings benefit with a new dry well heating system which would allow for interior air recirculation (75%) depending on occupancy and outside temperature.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment testing on 5/1/18 indicated the pumps have the following capacities: P1 - 10,700 gpm (92 ft TDH) and P2 - 10,700 gpm (102 ft TDH). Historical magnetic flow meter data indicate that the P1 and P2 have the capability to convey between 20-22 MGD (15,300 gpm) during peak flow events. These results compare favorably with the pump curves, indicating the pumps at full speed are operating as designed. Each pump runs for as much as 24 hours per day. The existing pump station cannot convey peak combined (sanitary & stormwater) flows to the pump station and during high flow events, the existing sewer system has relief in one of two CSO structure in Mill Pond. The City has indicated the pumps cavitate at low and high flows.

The City indicated that over the past several years, Pump No. 1 had developed a hole in the side of the pump volute. This required the pump be removed. A third party installed a wear ring within the volute to patch the hole. In addition, Pump No. 1 motor was re-wound for future reliability. The pump was then re-installed for continued use. The condition of the volute for Pump No. 2 is unknown.

Exterior Site:

The pump station is located in a residential neighborhood at the entrance of the bridge to Peirce Island. The exterior of the pump station site includes the standby generator, standby generator diesel storage tank, odor control system (structural frame lofted), and submersible bypass wet well. The fuel tank was not protected by bollards, which are recommended with a parking area nearby. The top slab of the bypass wet well is degrading and should be repaired/replaced to prolong the life of the structure. The City has indicated they have received neighbor noise complaints when the pump station rooftop air handling unit is operated, and as such, the rooftop air unit is operated sparingly. The pump station is approximately 30 feet from a main tidal channel. The finished grade on the tidal channel side of the pump station site is approximately 7.4-ft +/-, with the finished floor of the pump station located at 8.6-ft +/-. Based on historical observations, the tidal channel has flooded to < 6" below the finished floor of the pump station. All future pump station upgrades should consider future flood elevations in this area.

The City indicated that the adjacent lot to the north, currently an apartment complex, is owned by the City and is a potential site for the future pump station.

Building Structures (if applicable):

The exterior brick veneer appeared to be in good condition, with the exception of some mold growth and minor mortar deterioration. Building trim and fascia showed signs of minor deterioration to the finish. The City indicated that both skylights in the roof leak. Roof leaks should be remedied immediately to avoid future damage. The roof is equipped with much of the mechanical HVAC equipment for the pump station, but was not accessed as part of the building evaluation. The existing outdoor electrical transformers are located close to the roof, making it a hazard to access the HVAC equipment on the roof without shutting off power to the pump station. It should also be noted that all equipment located within 10 feet of the roof edge should be provided with a 42" high fall protection on the edges, or be accessed using the requisite fall protection.

Wet Well:

The upper level concrete floor surfaces and walls showed significant staining and a few areas of degradation, likely due to the age and environment associated with the wet well area. The floor should be repaired by the City as needed. The stair concrete was in poor condition with several steps missing imbedded stair nosings. The stair deficiencies present a tripping hazard and should be repaired to reduce tripping hazards. The wet well contains a climber screen, screenings wash press, and influent sewer sluice gate for wet well bypass. The wet well divider gate was severely corroded and no longer in use. This equipment is approaching the end of it's useful life and should be replaced or upgraded. Concrete beams in the wet well area showed signs of spalling and cracking and should be repaired as soon as possible to prevent further damage. Steel columns in the wet well area showed signs of moderate corrosion and should be sandblasted/repainted to extend their useful life.

Dry Well:

Control Room (upper level): Interior masonry surfaces on the upper level appeared to be mostly in good condition. The concrete floor near the entrance door has delaminated and should be repaired for safety. The City should replace the missing toe plates on the guard around the stair openings for safety. Corrosion was noted on the mezzanine steel beams, handrails, grating, and welds. The City should monitor this corrosion for integrity and replace if the lifespan for the existing pump station exceeds 3 years. The overhead concrete slab from the mezzanine is degraded and should be resurfaced. The dry well contains two main influent pumps which were installed in 1990 and have reached the end of their useful life. Pump 1 recently was rehabilitated to fix a hole in the volute and re-wind the motor. The condition and reliability of Pump 2 is unknown. However, based on the age, criticality, and continuous operation of these pumps, replacement is recommended within 0-3 years to sustain reliable operation.

Pump Area (lower level): Interior masonry surfaces are in poor condition. Pump 1 pipe penetrations have loose and degraded concrete and should be sandblasted, repainted, and repaired to prevent further corrosion. Pump 2 suction piping was recently replaced after a leak developed. The City reported the pumps experience cavitation at low and high speeds. This could potentially be due to inadequate net positive suction head due to the small wet well volume, volute recirculation, or pump size limitations at lower flows. Similar to the pumps, the suction and discharge piping has reached the end of its useful life. One of the pump discharge check valves was noted as being faulty and should be replaced for continued operation. A comprehensive pump station replacement is recommended to upgrade all of the dry well equipment including umps, piping, valves, etc;

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Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station has undergone several upgrades including a comprehensive upgraded in 2008, and more recently a VFD replacement and ATS replacement. The existing equipment is in good condition, but a complete overhaul of the electrical equipment should be considered within 3 years or when the next substantial upgrade is completed. The existing standby generator should be evaluated for capacity to ensure the pump station has adequate fuel to operate for 48 hours (peak flows) and 96 hours (normal flows). The existing transformers (utility-owned) are mounted on a telephone pole which is adjacent to the pump station and causes access restrictions for the rooftop HVAC equipment. Future transformers should be located away from the pump station building to avoid maintenance interference. The City should label electrical distribution equipment with appropriate arc-flash safety labeling. The pump station emergency lighting systems should be repaired.

Based on the ventilation requirements for the dry side of the pump station, it is recommended that a horn is installed within the pump station to notify the occupant of an unsafe atmosphere. In addition, the City should begin planning for replacement of the bypass wetwell magnetic flow meter and bypass wetwell flow instrument. The existing main and bypass pump Control Panels are equipped with a SLC 5/05 controller platform which is considered to be a mature product that should be replaced with updated PLC equipment (i.e., Compact Logix Series). The existing alarming communication system (Radio, Esteem Model 192C) is obsolete, but based on discussions with the City, plans are in place to replace this system with a microwave system soon.

HVAC:

A majority of the ventilation, heating, and cooling equipment were upgraded in 2000, with the dry well ductless split and the odor control system installed in 2008. Overall the equipment appeared to be in good condition. However, much of the HVAC equipment is roof mounted and cannot be accessed without a complete electrical shutdown to the pump station due to the proximity of pole mounted transformers. In addition, the roof is not adequately equipped with guardrails for fall protection, as required by code. The code restrictions present significant maintenance obstacles when work is required on this equipment. Further discussion regarding future HVAC upgrades are included in the Pump Station Master Plan Report.

DRY WELL: A packaged rooftop air handling unit supplies heating (natural gas) and cooling to the dry well. Noise complaints from the neighbors have lead to the unit being operated only during the day, and shutdown at night. When the main rooftop unit is not operating, the dry well is not ventilated as required by NFPA 820 to declassify the space. It is recommended this unit be operated at all times, or an alternative mechanical system be installed to provide the required space ventilation (see report discussion). A ductless split air conditioning system is installed in the dry well to supplement cooling during the day, and act as the primary source of cooling during the night. Air is exhausted from this space through a rooftop up blast exhaust fan. A dehumidifier in the lower level of the dry well was noted to be in poor condition and has been discontinued in use.

WET WELL: A roof mounted supply fan provides air to the wet well, with exhaust air directed to the odor control unit. Overall the equipment appeared to be in good condition.

Security Measures:

The station is equipped with a security system, but it is not actively used. The pump station is equipped with a fire alarm system for both the wet well and dry well. The pump station is equipped with gas detection systems (recently replaced) in both the wet well and dry well.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) recommended upgrade of the screenings system (completed in 2000), replacement of the odor control system (completed in 2000 and 2008), and evaluation of the pump capacity. Based on historical flow meter totalized data, the pumps are capable of conveying 20-22 MGD per pump.

Other:

Miscellaneous Issues:

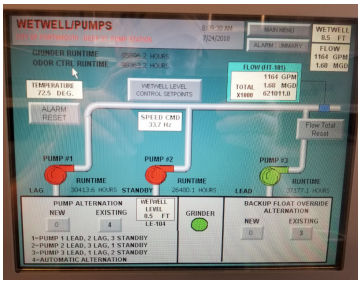
Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	Wet well, dry well (See Sections above)

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation
Deer St.

Last Update: MAC *By:* 10/31/2018
This Update: *By:*

General Pump Station Information	
Location:	2 Deer Street
Pump Station Finished Floor Elevation, ft.:	13
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	1
Year Constructed/Upgraded:	1976/2008
Station Type:	Wet Well Dry Well
Wet Well Size, L x W x H, ft:	22 x 10 x 7.5
Wet Well Volume, gallons	15,140
No. of Pumps:	3
Pump Installation Date:	2008
Design Operating Point, 1 Pump	
Flow, gpm:	4300
Total Dynamic head, ft.:	116
Two Pump Capacity (max)	12.7
Two Pump Capacity (PLC limited)	10.4
Pump Make/Model:	Morris, Series 7100, NC 12X14-25 3V3
Motor Size, HP:	200
Motor/Pump Speed, rpm:	890 (max)
Electrical Service, V/Ph/Hz:	460/3/60
Drive Type:	Digital AC Pulse, VFD
Seal Make & Type:	Mechanical flushing seal water
Force Main Diam., in. (varies)	12, 14, 16, 20
Force Main Velocity (1 pump, full speed), feet per sec (varying diameters):	3.0 - 6.9
Force Main Velocity (typical low flow), feet per sec. (varying diameters):	0.8 - 1.9
Force Main Type:	Ductile Iron
Force Main Age:	1981-1990
Force Main Length, ft.:	2200

Pump Flow and Run Time Information				
		P1	*P2*	*P3*
Pump Flow Data (Magnetic Flow Meter)				
Observed Instantaneous Flowrate, GPM		6080	5970	5800
	MGD	8.8	8.6	8.4
Pump Totalized Data				
Data Start Date		1/1/2014	1/1/2014	1/1/2014
Data End Date		10/31/2017	10/31/2017	10/31/2017
Annual Average Flow, MGD (Magnetic Flow Meter)			1.21	



Pump Performance Testing Results		
Date of Test:		1-May-18
Min./Max. VFD Setpoints (Hz)		32, 60 (SCADA limits total flow to 10.4 MGD total)
VFD Speed (Hz)		60
Pump RPM		890
Pump Test Flow, gpm:		P1 - 6080, P2 - 5970, P3 - 5800
Pump Test TDH, ft:		P1 - 97, P2 - 92, P3 - 95
Influent Pump Station Flow @ Test		N/A
Note for Pump Start Type		VFD, soft start

Generator Information	
Make/Model:	Caterpillar/3456
Interior/Exterior:	Interior
Gen. Installation Date	2008
Size, kW:	500
Fuel Type:	Diesel Storage Sub Base Fuel Tank 650 Gallons

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/Lag/Standby sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. Pumps operate in Lead/Lag arrangement based on wetwell set points until the Lead reaches a certain speed and the Lag turns on. The pumps are limited by the Control Panel to discharge a maximum of 10.4-MGD to control CSO discharges.
Pump Control Panel:	Division 13 Control Panel
Installation Date:	2008
Control Type:	PLC Based
Location:	Control Room in Pump Station
SCADA Connectivity:	Radio, future microwave system
Level & Alarm Controls:	Division 13 Control Panel
Type:	Submersible pressure transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low back up floats
Flow Meter Make/Model:	16" Siemens Magnetic Flowmeter Mag5100
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave.
Pump Motor Starters :	Allen Bradley Standard 1336 PLUS II AC pulse with VFDs. VFDs No. 1 and VFD No. 3 are equipped with bypass contactors.

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Mechanical			
Heating (Dry well):		Ventilation:	Generator
Type:	Gas fired duct furnace, Electric Unit Heater (Generator Room)	System	Louvers and Damper
Furnace Size(MBH) and Fan (CFM):	158 MBH, 2,400 CFM Quantity: 1 each	Size:	Qty: 1-intake 1-exhaust
Furnace Make/Model:	Trane CLCH-08	Make & Model:	-
City Water Supply:	1-1/4" with RPZ BFP	Ventilation:	Building
		Exhaust Fan:	None
		L&D:	Gravity intake dampers
Heating (Wet Well):		Ventilation:	Wet Well
Type:	Electric Unit Heater	System	Qty: 1-supply 1-exhaust
Size (kW)	20 Quantity: 1	Size:	1200 CFM (supply), 2450 CFM (exhaust)
Make/Model	Markel HLA20	L&D	-
Odor Control :	Granular Activated Carbon, 1400 CFM fan		

Energy Efficiency Information

At full speed (60 Hz), all three pumps are operating between 85-90% pump efficiency. The Deer Street Pumps typically operate at lower frequencies, which can result in lower operating pump efficiencies. Pump efficiency curves for the variable speeds were not available for review. However, based on the full speed pump testing, the Deer Street Pumps appear to be operating within an acceptable range.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment testing on 5/1/18 indicated the pumps have the following capacities: P1 - 6080 gpm (97 ft TDH) and P2 - 5970 gpm (92 ft TDH) and P3 - 5800 (95 ft TDH). These results compare favorably with the pump curves, indicating the pumps at full speed are operating as designed. The station appears to have adequate capacity to handle existing flows as typically only a single pump is operating at < 60 Hz. During high flow events, the City limits the pump discharge rates to 10.5 MGD to avoid CSO events downstream. Each pump runs for about 6-8 hours per day on average, but under peak conditions, two pumps may run as much as 24 hours per day to keep up with flow. Elapsed time meter data indicates that Pump No. 3 operates 20-30% more than the other two pumps. The City should investigate this pump to determine what is causing these differing operating times. Although not designed as in-line storage, the influent sewer system to the Deer Street Pump Station provides the City with storage when influent pump station flows exceed the 10.5 MGD. In these instances, the City monitors the level of CSO-013 via a third party monitoring company to avoid CSO events when possible.

The Deer Street pump station is serviced by two separate force mains with varying diameters between 12 and 20-inch. Flow is divided between the two force mains. Based on an approximation of the flow split between these two force main sections, the velocity in the force main at low flows (1 pump, ~30 Hz) is < 1 fps. Velocities below 2 fps can lead to solids settling within the force main. The City reported they have not experienced issues with the force mains with this type of pump control. While short duration operation at low velocities is acceptable, it is recommend the City ensure the pump station flowrate is increased to at least 3,000 gpm once per day to properly scour/flush solids which may have accumulated in the force main at lower flows.

Exterior Site:

The Pump Station is located at the corner of Deer Street and Market Street in the downtown area of Portsmouth. The Pump Station has a dedicated access drive on the front side (Deer Street) of the station, with Market Street and a residential sidewalk located on the north side of the Pump Station. The site is situated between two commercial buildings with access to one of these buildings' parking areas located on the immediate eastern side of the pump station. The southern side of the building houses a transformer and air cooling unit condenser pad. No significant concerns were noted with the exterior site.

The Pump Station discharges to one of two force mains which exit the pump station property on the northern boundary. Each force main is equipped with a buried valve for force main isolation. Based on review of available plans, these valves are at least 30 years old. The City indicated that both of these valves are not operational and remain open at all times. It is recommended the City replace these valves to allow for force main isolation and general maintenance.

Building Structures (if applicable):

The building was upgraded in 2008 and the exterior, including the brick veneer, concrete, shingles, fascia, and trim were observed to be in good condition. Minor graffiti was noted on the outside of the pump station. The access doors to the Standby Generator Room are equipped with an internal louver assembly and modified door handle, which present a life safety concern for egress from this room. Minimum egress clear width is 32" for code compliance and this access door provides only an 18" egress distance with the louvers. It is recommended the City evaluate modifications to this area to provide proper egress width. No further issues were noted.

Wet Well:

The upper level concrete floor surfaces showed significant staining and a few areas of degradation, likely due to the age of the area. The floor should be repaired by the City as needed. The aluminum stair pre-dates the 1990 pump station upgrade and may date back to the 1970s. The stairs were in fair condition, but showed a moderate degree of corrosion with some bent treads. It is recommended the City plan on replacing these stairs within 5-7 years. The odor control unit floor supports were questionable and should be structurally evaluated based on the potential weight of the activated carbon unit. The wet well contains an influent grinder that is in good condition. The City should plan on replacing the cutter stacks and possibly the grinder body, depending on its condition, every 4-8 years. Considering the age of the grinder, it is recommended the City begin to plan to replace the grinder stack, and potentially the grinder in the future.

Dry Well:

Pump Area: The interior masonry surfaces appeared to be in good condition. The dry well stairs pre-date the 1990 pump station upgrade and may date back to the 1970s. Several stair tread nosings were loose/broken and should be repaired. The handrail guards for the stairwell should have the missing toe-plates replaced for falling hazards.

Generator Room: The Generator Room contains an influent grinder hydraulic power pack that is in good condition. As described in the Building Structures section, the access doors to the Generator Room do not meet code for egress requirements. It is recommended the City evaluate modifications to these doors to provide proper egress pathways. In addition, the Generator Room does not meet NFPA 37 requirements for a 1-hour fire rating as it contains combustible materials such as particle board. The City should evaluate Generator Room upgrades to bring the space into compliance with a 1-hour fire rating. A floor crack was noted in the Generator Room. This crack should be repaired with pressure injected epoxy to prevent further degradation.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station was installed in 2008 and found to be in good condition. The existing exterior pad mounted transformer (utility owned) showed signs of rust, but based on discussions with the City, the utility company is aware of this weathering. The City should label electrical distribution equipment with appropriate arc-flash safety labeling. The existing alarming communication system (Radio, Esteem Model 192C) is obsolete, but based on discussions with the City, plans are in place to replace this system with a microwave system soon. The existing main Control Panel is equipped with a SLC 5/05 controller platform which is considered to be a mature product that should be replaced with updated PLC equipment (i.e., Compact Logix Series).

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HVAC:

The ventilation and heating equipment were upgraded in 2008 and appeared to be in good condition overall. However, much of this equipment has a lifespan of 15-20 years depending on the severity of use.

DRY WELL: An air handling unit and duct furnace in the upper mezzanine area supplies heating and cooling to the dry well and generator room. These units appeared to be in good condition, but the City should plan for replacement over the next 7-10 years. The exterior condensing unit for the air handing unit showed exterior signs of corrosion, but was fully functional. It should be noted that no air is positively exhausted from the dry well, which is required by NFPA 820 to unclassified the dry well. It is recommended the City add an exhaust fan, louver, and associated ductwork to provide positive exhaust from the dry well. The utility sink potable water line is not backflow prevented from other process water connections, this sink should be labeled as non-potable water source. In addition, the utility sink drain line is unvented and should have an air admittance valve installed to mitigate trap priming issues. The supply fan which provides air to the wet well has damaged ductwork insulation. This insulation should be repaired.

WET WELL: No issues noted.

GENERATOR ROOM: Per NFPA 37 requirements, the generator room should be fire separated from all other areas of the building, including connecting ductwork. All existing ductwork penetrating into the generator room should be equipped with fire dampers.

Security Measures:

The station is equipped with a security system, but it is not actively used. The pump station is equipped with a fire alarm system for both the wet well and dry well. The pump station is equipped with gas detection systems (recently replaced) in both the wet well and dry well.

Summary of Previous Reports

The pump station has undergone a complete renovation since the 201 Facilities Plan Update (Underwood Engineers, 1999).

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation

Gosling Rd.

Last Update: MAC *By:* 10/29/2018
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Dry Well
Type:	Gas Combustion unit heater	System	Exhaust Fan, Louver Damper
Size, kW:	24600 BTU/hr, 400 CFM Quantity: 1	Size:	1/3 HP 400 CFM, Exhaust 12"x36", Intake 16"x48"
Make/Model:	Reznor UDBS30	Make & Model:	Cook
Odor Control :	None	Ventilation:	Dry Well
City Water Supply:	1.5", BFP	Exhaust Fan:	Smartwout, 12SA2, 800 CFM 1/8 HP Qty: 1
		L&D:	Yes

Energy Efficiency Information

The pumps are operating between 65-70% of their efficiency based on the provided pump curves. However, based on the low operating point (<30 Hz) the pumps are likely operating outside of their best efficiency point. Pump efficiency curves for the variable speeds were not available for review. It is recommended the City adjust the minimum operating pump speed to be higher to allow not only proper flushing of the force main, but also be closer to the pump's intended operational efficiency point. The dry well ventilation system is not currently set up to recirculate building air, or reduce ventilation rates when the outside air temperature is < 50 degrees F. The City may realize a heating cost savings if the HVAC system is upgraded to include this control.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via drawdown testing on 4/3/18 indicated that the pumps have the following capacities: P1 - 800 gpm (99 ft TDH) and P2 - 807 gpm (88 ft TDH). Both of these pump conditions are less than the original estimated operating point of 900 gpm (105 ft TDH). The reduced capacity could be due to general impeller/clearance wear, but is not considered to be outside the acceptable operating range. The City indicated the typical operation of these pumps is to operate at very low flowrates (~150 gpm) continuously for long portions of the day (8-12 hours). Based on this "low speed" operation, the pump station is within it's current design capacity. However, at these low flowrates, the force main velocity is < 1 fps which could lead to settling issues in the force main. The City should consider increasing the minimum speed of the pumps to provide 300 gpm to provide the minimum flushing velocity (2 fps) for the force main and also increase the efficiency of the pump. Based on the magnetic flow meter maximum totalized daily readings over a 3 year span, the pump station is operating within it's current capacity.

Exterior Site:

The pump station is located in a commercial district in the back corner of a Ryder rental truck establishment. The pump station consists of a wet well and dry well, along with a fenced in area containing a standby generator and electrical ATS equipment. The City indicated that years ago a Ryder truck hit the side of the pump station wet well, requiring brick repair. The building structure has been protected via concrete bollards around the periphery. No issues were noted on-site.

Building Structures (if applicable):

The pump station dry well and wet well exterior buildings were upgraded in 2005 and the surfaces were found to be in good condition. The top sides of each painted monorails exhibited failed paint, corroding steel, and were missing a load capacity label. The age of the membrane roof could not be verified. However, based on observations, the membrane may be nearing the end of its design life and need replacement.

Wet Well:

The interior surfaces of the wet well were observed to be in fair condition. The City should install toeplates on all the guards in the wet well, and replace wet well channel grating where missing on the influent channels. The wet well contains an influent grinder that is in good condition. The City should plan on replacing the cutter stacks and possibly the grinder body, depending on it's condition, every 4-8 years. Considering the age of the grinder, it is recommended that the City begin to plan for grinder and/or grinder stack replacement.

Dry Well : The interior masonry surfaces were mostly in good condition. The monorails were missing load capacity labels; these labels should be added for operator information. Painted concrete wall, top slab, and steel framing surfaces were in good condition with minimal to no peeling paint. The City should replace the missing toe plate on the guard around the spiral stair opening for safety. The dry well contains an influent grinder hydraulic power pack that is in good condition. The City has indicated the current pumps have been discontinued and that replacement parts are no longer available. While the City has stocked spare parts to the best extent possible, it is recommended that pump replacement be planned for within 5-7 years.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station was installed in 2005 and appeared to be in good condition. The City should begin to plan on replacement of the Control Panel and magnetic flow meter within the next 5 years or so, based on typical equipment life. The existing hazardous gas system should be repaired/replaced.

HVAC:

DRY WELL: Ventilation and heating equipment were operational and in good condition. Dry well ventilation should operate at all times to maintain proper NFPA 820 classifications. The City reported the pump station dry well gets hot during the summer and is difficult to keep cool. It is recommended a split AC unit be installed to help maintain reasonable temperatures in the dry well.

WET WELL: Ventilation and heating equipment were operational and in good condition. No operational or mechanical deficiencies were noted.

Security Measures:

There is no active security system in the building.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated the pump station needed to be upgraded for capacity reasons. The 2005 upgrade appears to have addressed this issue.

Other:

Miscellaneous Issues:

Grease Accumulation?	Yes (minor)	Source:	Restaurants in the sewer shed
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation

Gosling Rd.

Last Update: MAC *By:* 10/29/2018
This Update: *By:*

General Pump Station Information	
Location:	120 Gosling Road
Pump Station Finished Floor Elevation, ft.	31.3
Coastal Resiliency Flood Elevation (2050 High Emissions), ft	13.5
Distance from WWTF (straight line), miles	2.9
Year Constructed/Upgraded:	1970/2005
Station Type:	Wet Well Dry Well
Wet well Shape	Rectangular
Wet Well Size, L x W x H, ft:	9 x 5.5 x 8
Wet Well Volume (1+2), gallons	4300
No. of Pumps:	2
Pump Installation Date:	2005
Design Operating Point, 1 Pump	
Flow, gpm:	900
Total Dynamic head, ft.:	105
Pump Make/Model:	Paco Model 52-401221
Motor Size, HP:	40
Motor/Pump Speed, rpm:	1800
Electrical Service, V/Ph/Hz:	480/3/60
Drive Type:	VFD
Seal Make & Type:	Mechanical flushing seal water
Force Main Diam., in.:	8
Force Main Velocity (observed full speed), feet per sec.:	5.12
Force Main Type:	AC
Force Main Age (estimate):	1969
Force Main Length, ft.:	2847

Pump Flow and Run Time Information		
	P1	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flowrate, GPM	800	806
Pump Totalized Data		
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Magnetic Flow Observed)	80	

Pump Performance Testing Results	
Date of Test:	3-Apr-18
Min./Max. VFD Setpoints (Hz)	-
VFD Speed (Hz)	60
Pump RPM	1800
Pump Test Flow, gpm:	P1 - 800, P2 - 806
Pump Test TDH, ft:	P1 - 99, P2 - 88
Influent Pump Station Flow @ Tes	N/A
Note for Pump Start Type	Slow start, VFD

Generator Information	
Make/Model:	Onan/Model DGDK5700184/B
Interior/Exterior:	Exterior
Gen. Installation Date	2005
Size, KW:	125
Fuel Type:	Diesel underbelly dual wall storage tank

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Division 13 Control Panel
Installation Date:	2004
Control Type:	PLC based
Location:	Dry well upper level
SCADA Connectivity:	Radio, future microwave system
Level & Alarm Controls:	Division 13 Control Panel
Type:	Submersible level transducers (primary) with differential floats (secondary)
Backup Alarm	High-high, low-low back up floats
Flow Meter Make/Model:	Krohne Aquaflux F with IFC 010 K signal converter. 8-inch diameter
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Allen Bradley Powerflex 700 Series 40 HP VFD

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation
Ryeline

Last Update: MAC *By:* 10/29/2018
This Update: *By:*

General Pump Station Information	
Location:	3618 Lafayette Road
Pump Station Finished Floor Elevation, ft.:	44.3
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	4.8
Year Constructed/Upgraded:	1964/2009
Station Type:	Wet Well Dry Well
Wet Well Size, L x W x H, ft:	14.67 x 5.5 x 8
Wet Well Volume (1 & 2), gallons	4300
No. of Pumps:	2 (space for future 3rd)
Pump Installation Date:	2009
Design Operating Point, 1 Pump	
Flow, gpm:	600
Total Dynamic head, ft.:	85
Pump Make/Model:	Smith & Loveless/4C2, 9.875" imp.
Motor Size, HP:	20
Motor/Pump Speed, rpm:	1800
Electrical Service, V/Ph/Hz:	460/3/60
Drive Type:	VFD
Seal Make & Type:	Mechanical flushing seal water (potable)
Force Main Diam., in.:	8
Force Main Velocity (observed full speed), feet per sec.:	3.22
Force Main Type:	Asbestos cement
Force Main Age:	1970
Force Main Length, ft.:	4083

Pump Flow and Run Time Information	*P1*	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flowrate, GPM	507	500
Pump Totalized Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Observed)	125	

Pump Performance Testing Results	
Date of Test:	2-May-18
Min./Max. VFD Setpoints (Hz)	30, 60
VFD Speed (Hz)	60
Pump RPM	1765
Pump Test Flow, gpm:	P1 - 507, P2 - 500
Pump Test TDH, ft:	P1 - 78, P2 - 78
Influent Pump Station Flow @ Test	N/A
Note for Pump Start Type	Slow start, VFD

Generator Information	
Make/Model:	Caterpillar/Olympian Model AVR14-AREP
Interior/Exterior:	Interior
Gen. Installation Date	2009
Size, KW:	80
Fuel Type:	Natural Gas fired

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Division 13 Control Panel
Installation Date:	2009
Control Type:	PLC based
Location:	In the dry well on the upper level
SCADA Connectivity:	Radio, future microwave system
Level & Alarm Controls:	Division 13 Control Panel
Type:	Radar level sensor (primary) with differential floats (secondary)
Backup Alarm	High-high, low-low back up floats
Flow Meter Make/Model:	10" Siemens Sitrans F Magflow MAG 5100
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave.
Pump Motor Starters :	Allen Bradley Powerflex (standalone)

City of Portsmouth, New Hampshire
WET PIT DRY PIT Pump Station Evaluation
Ryeline

Last Update: MAC *By:* 10/29/2018
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Mechanical			
Heating:		Ventilation:	Standby Generator
Type:	Gas Combustion unit heater	System	Louvers and Damper
Size:	60,000 BTU/hr, 700 CFM Quantity: 1	Size:	60"x72" Qty: 1 intake, 1 exhaust
Make/Model:	Reznor SDH-75	Make & Model:	Unknown
Odor Control :	None	Ventilation:	Building
City Water Supply:	1.5", BFP	Exhaust Fan:	None
		L&D:	None

Energy Efficiency Information

Ryeline Pump Curves were not readily available for review. It is recommended the City adjust the minimum operating pump speed to be higher to allow not only proper flushing of the force main, but also be closer to the pump's intended operational efficiency point.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via drawdown testing on 5/2/18 indicated the pumps have the following capacities: P1 - 507 gpm (78 ft TDH) and P2 - 500 gpm (78 ft TDH). Both of these pump conditions are less than the original estimated operating point of 600 gpm (85 ft TDH). The reduced capacity could be due to general impeller/ clearance wear, but is not considered to be outside an the acceptable operating range for the pump. The City indicated the pumps typically operate at very low flowrates (~150 gpm) continuously for long portions of the day (8-12 hours). Based on this "low speed" operation, the pump station is within it's current design capacity. However, at these low flowrates, the force main velocity is < 1 fps which could lead to settling issues in the force main. The City should consider increasing the minimum speed of the pumps to provide 300 gpm to provide the minimum flushing velocity (2 fps) for the force main and also increase the efficiency of the pump. It must be noted that no specific pump curve information was available for review. Based on the magnetic flow meter maximum totalized daily readings over a 2 year span, the pump station is operating within it's current capacity.

Exterior Site:

The station is located on a parcel of low lying land surrounded by jurisdictional wetlands associated with Berry's Brook. The existing pump station facility was upgraded in 2009 to include a dry well area that is elevated from the original 1970s pump station. This was done in an effort to minimize the risk of flooding from the adjacent wetlands. No issues were noted on-site.

Building Structures (if applicable):

The pump station dry well and wet well exterior buildings were upgraded in 2009 and their surfaces appeared to be in good condition overall. A few spots on the steel framing were exhibiting peeling paint and corroding steel that should be sandblasted and repainted. Interior surfaces were in good condition with minimal corrosion. Hand rail toeplates should be installed on each guard.

Wet Well:

Interior surfaces of the wet well were in fair condition. The epoxy wet well coating which was applied as part of the 2009 upgrade was peeling in localized concrete and masonry areas in the wet well entrance area. While the failing coating is undesirable, it is not recommended the City repair the existing coating system based on cost considerations. The City should install toeplates on all the guards in the wet well in addition to installing a rigid guard (in lieu of a chain guard) on the wet well elevated platform to conform with OSHA regulations. The wet well divider sluice gate was broken and should be replaced to allow for wet well isolation/combining and wet well cleaning. The wet well contains an influent grinder that is in good condition. The City should plan on replacing the cutter stacks on this type of grinder every 4-8 years depending on the pump station use.

Dry Well (if applicable): The dry well contains an upper and lower level of continuous space and contains all of the HVAC, process, electrical, and standby power equipment for the pump station. The dry well contains two vertical centrifugal pumps (Smith & Loveless) in the lower level, a magnetic flow meter and grinder hydraulic power pack in an intermediate level, and the standby generator and electrical equipment on the first level. In general, the dry well equipment is all new (< 10 years old) and in good condition.

The existing standby generator is common to the entire dry well space and is not provided with a 1-hour space separation as required by NFPA 37. Additional discussion regarding standby generator location and code is included in the Pump Station Master Plan Report.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station was installed in 2009 and found to be in good condition. The City should begin to plan on replacement of this equipment beginning in 2029 based on typical equipment life. The magnetic flow meter is located in an area that should be considered a confined space entry area and should be labeled appropriately.

HVAC:

DRY WELL: The existing ventilation and heating equipment appeared to be in good condition. The inline supply fan and damper provides air to the dry well. During the site visit, the AUTO setting of the fan was not operational when the station was occupied. Based on NFPA 820 requirements, the dry well should be ventilated at 6 ACH (air changes per hour) continuously to declassify the space for electrical equipment. The existing supply fan does not have the capacity to provide this air quantity. It is recommended the ventilation system (supply and exhaust) is upgraded (controls and equipment) to comply with NFPA 820 requirements. Heat is provided by a gas fired unit heater. The standby generator intake louver/dampers is designed to operate when the emergency generator is operating or when the room temperature exceeds an operator adjustable setpoint. City staff indicated the pump station is extremely hot in the summer time. The dry well contains a simplex sump pump which appears to be in good condition. The standby generator exhaust piping needs to be insulated for safety. While not required, a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

WET WELL: The wet well contains an FRP explosion proof exhaust fan that operates continuously. No dedicated intake is provided in the wet well, meaning that much of the supply air is likely being pulled from the influent sewer. The wet well should have a dedicated supply louver/damper assembly.

Security Measures:

There is no active security system in the building.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) identified numerous pump station issues which were addressed as part of the 2009 upgrade.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

SUCTION LIFT EVALUATION FORMS

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Constitution Ave.

Last Update: 10/19/2018 *By:* MAC
This Update: *By:* W-P

General Pump Station Information	
Location:	278 Constitution Ave.
Pump Station Finished Floor Elevation, ft.:	49
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	3.1
Year Constructed/Upgraded:	1985
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	
Pump No. 1	2017
Pump No. 2	2016
Design Operating Point, 1 Pump	
Flow, gpm:	320
Total Dynamic head, ft.:	67
Pump Make/Model:	G-R T-Series, T4A3-B STD
Self-Priming Method	Air Purge
Motor Size, HP:	15
Motor/Pump Speed, rpm:	1558
Electrical Service, V/Ph/Hz:	208/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	6
Force Main Velocity, feet per sec.:	1.9
Force Main Type:	Ductile iron
Force Main Age:	1985
Force Main Length, ft.:	2624

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data		
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	10	10

Pump Peformance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	60
VFD Speed (Hz)	N/A
Pump RPM	1280
Drawdown Flow, gpm:	P1 - 177, P2 - 177
Drawdown TDH, ft:	P1 - 53 ft, P2 - 28 ft
Influent Pump Station Flow @ Test	Estimate during visit, 5 gpm
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Cummins Onan
Interior/Exterior:	Interior
Gen. Installation Date	1985
Size, KW:	45
Fuel Type:	Propane Storage Two Vertical Tanks 150 g

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel with original G-R starters (controls bypassed), PLC based Control Panel Upgrade
Installation Date:	Motor Starter Panel (Updated starters), PLC Control Panel (2005)
Control Type:	PLC-based
Location:	In station at pump level
SCADA Connectivity:	Yes, microwave RTU installed
Level & Alarm Controls:	PLC Based Control Panel
Type:	Submersible pressure transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Motor starters updated and installed through original combined G-R panel

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Constitution Ave.

Last Update: 10/19/2018 *By:* MAC
This Update: *By:* W-P

Mechanical			
Heating:		Ventilation:	Generator
Type:	Electric Unit heater Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 2	Size:	Qty: 1-motorized fresh air intake louver, 1-exhaust louver
Make/Model:	Dayton 3UG73	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" Potable Water Supply with BFP	Exhaust Fan:	None
		L&D:	-

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating at < 45% efficiency which is not atypical for suction lift style pumps. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. Regardless, it is recommended that the City staff investigate the difference in discharge pressure conditions between the two pumps.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via drawdown testing on 3/29/18 indicated that the pumps have the following capacities: P1 - 177 gpm (53 ft TDH) and P2 - 177 gpm (28 ft TDH). Both of these pump conditions are less than the original estimated operating point of 320 gpm (67 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for about 1.5 hours per day on average, but under peak conditions, both pumps may run as much as 8 hours per day.

Exterior Site:

The station is located off the side of the road in a largely commerical district. The station has it's own driveway and is surrounded by forested area on the remaining three sides. The station grade was raised by 3-5 ft from the surrounding area for construction to avoid stormwater issues associated with nearby drainage. While current surrounding site drainage does not appear to be an issue as of the date of the site visit, City staff should periodically check to ensure that stormwater/erosion issues do not develop.

Building Structures (if applicable):

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior aggregate is missing aggregate in locations that require cosmetic repair. The pre-cast concrete slab is in good condition with the exception of a corner which needs to be rebuilt. The joint between the foundation and the superstructure should be pressure washed and the joint sealed. The interior floors and wall finishes need to be recoated for continued use. Several old piping penetrations from the wet wet well to the interior were observed. These penetrations should be sealed. The back wall of the interior structure contains a visible crack where the standby generator exhaust penetrates the wall. This crack is likely due to excessive heat from the exhaust pipe, and a lack of a ventilated wall thimble and should be sealed to prevent air and water leakage. The membrane roof appears to be in good condition, but has a relatively low slope which allows water to pool. If the roof is replaced, a higher sloped roof is recommended to assist drainage. The double access door is missing misc. hardware and should be painted to preserve longevity.

Wet Well:

The pump suction piping was replaced in the wet well 3 years ago due to corrosion. The pump discharge pipe is showing significant signs of corrosion, and should also be replaced. In general, the wet well strcuture is in good condition due to bi yearly cleaning. Hatch should have safety net

Dry Well (if applicable): See Building Structure section. Pump Station consists of a single, abovegrade room.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. The emergency generator and automatic transfer switch should be considered for replacement based on their age (33-years).

Submersible level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The electric unit heaters are in good condition. No ventilation is provided for the space. In order to adhere to HVAC code requirements the Town should installed a mechanism to hold the door open when the pump station is occupied. The standby generator exhaust piping needs to be insulated for safety. While not required, a ventilated exhaust wall thimble should be considered to avoid continued wall damage. The dry well was noted to have condensation around some of the process equipment. A small local dehumidifier is recommended.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) did not note any significant pump station issues.

Other:

Miscellaneous Issues:

Grease Accumulation?	Minor	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	Minimal	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
West Rd.

Last Update: 10/19/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	280 West Rd.
Pump Station Finished Floor Elevation, ft.:	43.8
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	3.1
Year Constructed/Upgraded:	1984
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	377
No. of Pumps:	2
Pump Installation Date:	1984
Design Operating Point, 1 Pump	
Flow, gpm:	400
Total Dynamic head, ft.:	40
Pump Make/Model:	T4A3-B (Classic Series)
Self-Priming Method	Manual Air Purge
Motor Size, HP:	10
Motor/Pump Speed, rpm:	1745/1280
Electrical Service, V/Ph/Hz:	208/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	6
Force Main Velocity, feet per sec.:	2.9
Force Main Type:	Ductile Iron
Force Main Age:	1984
Force Main Length, ft.:	1281

Pump Flow and Run Time Information	*P1*	*P2*
Pump Runtime Data		
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	12	12

Pump Peformance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	60
VFD Speed (Hz)	N/A
Pump RPM	1280
Drawdown Flow, gpm:	P1 - 300, P2 - 278
Drawdown TDH, ft:	P1 - 28 ft, P2 - 28 ft
Influent Pump Station Flow @ Test	Estimate during visit, 15 gpm
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Cummins Onan
Interior/Exterior:	Interior
Gen. Installation Date	1984, (ATS replaced within past 5 years)
Size, KW:	30
Fuel Type:	Propane Storage Two Vertical Tanks 100 g

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel with original G-R starters (controls bypassed), PLC based Control Panel Upgrade
Installation Date:	Motor Starter Panel (1984), PLC Control Panel (2005)
Control Type:	PLC-based
Location:	In station at pump level
SCADA Connectivity:	Yes, microwave RTU installed
Level & Alarm Controls:	PLC Based Control Panel
Type:	Submersible pressure transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to r
Pump Motor Starters :	Motor starters in original combined G-R panel

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
West Rd.

Last Update: 10/19/2018 *By:* MAC
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Generator
Type:	Electric Unit heater Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 1	Size:	Qty: 1-motorized fresh air intake louver, 1-exhaust louver
Make/Model:	Dayton 3UG73	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" Potable Water Supply with BFP	Exhaust Fan:	None
		L&D:	-

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating between 40-50% depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. Based on the low pump runtime operation at the station, this pump station may benefit form smaller, submersible style pumps which would increase overall efficiency.

Condition of Equipment/Identified Issues

Capacity:
Recent capacity assessment via drawdown testing on 3/29/18 indicated that the pumps have the following capacities: P1 - 300 gpm (28 ft TDH) and P2 - 278 gpm (28 ft TDH). Both of these pump conditions are less than the original estimated operating point of 400 gpm (40 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for less than 1 hour per day on average. Under peak conditions, both pumps may run close to 3 hours per day.

Exterior Site:
The station is located in a largely commerical area with a dedicated access driveway. No issues were noted with the exterior site.

Building Structures (if applicable):
The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition with the exception of degraded sealant between precast sections, which should be replaced. Interior wall surfaces appear to be in good condition with no observed deficiencies. The interior floors and wall finishes appear to have recently been redone and are in good condition. The pre-cast roof slab seam has been sealed with caulking to mitigate roof leaking. The precast concrete top slab has many pop-outs and a large crack that should be repaired. Several old piping penetrations from the wet wet well to the interior were observed. These penetrations should be sealed. The membrane roof shows evidence of minor leaks and has a relatively low slope which allows water to pool. Although no obvious tears or open joints were observed on the roof membrane, it does appear to be faded and may be thinning and brittle as it is likely nearing the end of its design life. Replacement of the membrane should be anticipated within 5 years. When the roof is replaced, a higher sloped roof is recommended to assist drainage. The double access door is missing misc. hardware and should be painted to preserve longevity.

Wet Well:
The pump suction and pump discharge pipe showing significant signs of corrosion, and should also be replaced. In general, the wet well strcuture is in good condition due to bi yearly cleaning. Wet well hatch should be equipped with a safety net.

Dry Well (if applicable): See Building Structure section. Pump Station consists of a single, abovegrade room.

Electrical/Instrumentation:
The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. The emergency generator ashould be considered for replacement based on age (33-years). The ATS has been recently replaced and may be able to be re-used depending on the generator upgrade requirements.

Submersible level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20 years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:
The electric unit heater is in good condition. No ventilation is provided for the space. In order to adhere to HVAC code requirements the Town should installed a mechanism to hold the door open when the pump station is occupied. While not required, a ventilated exhaust wall thimble should be considered to avoid wall damage. The dry well was noted to have condensation around some of the process equipment. A small local dehumidifier is recommended.

Security Measures:
There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports
The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that the pump stations was operating at 1/2 of the design capacity. Based on the 2018 tests, the pumps are operating below the proposed design point, but are able to handle the current pump station flows.

Other:

Miscellaneous Issues:

Grease Accumulation?	Minor	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Woodlands I

Last Update: 10/22/2018 *By:* MAC
This Update: *By:* W-P

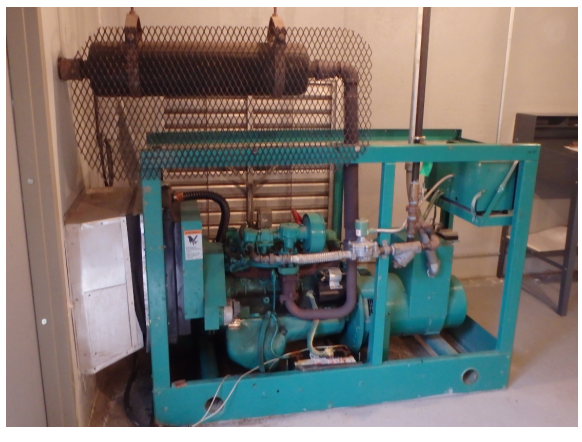
General Pump Station Information	
Location:	307 F.W. Hartford
Pump Station Finished Floor Elevation, ft.:	31
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	3.4
Year Constructed/Upgraded:	1985
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	1985
Design Operating Point, 1 Pump	
Flow, gpm:	150
Total Dynamic head, ft.:	38.5
Pump Make/Model:	T4A3-B
Self-Priming Method	Air Purge
Motor Size, HP:	5
Motor/Pump Speed, rpm:	1740
Electrical Service, V/Ph/Hz:	230/1/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	4
Force Main Velocity, feet per sec.:	2.3
Force Main Type:	PVC
Force Main Age:	1985
Force Main Length, ft.:	1902

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data		
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	5.7	5.5

Pump Peformance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	60
VFD Speed (Hz)	N/A
Pump RPM	1280 (assumed)
Drawdown Flow, gpm:	P1 - 92, P2 - 86
Drawdown TDH, ft:	P1 - 30 ft, P2 - 28 ft
Influent Pump Station Flow @ Test	Estimate during visit, 10 - 20 gpm
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Onan
Interior/Exterior:	Interior
Gen. Installation Date	1985
Size, KW:	30
Fuel Type:	Propane Storage Vertical Tank 130 g

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel with original G-R starters (controls bypassed), PLC based Control Panel Upgrade
Installation Date:	Motor Starter Panel (1985), PLC Control Panel (2004)
Control Type:	PLC-based
Location:	In station at pump level
SCADA Connectivity:	Yes, microwave RTU installed
Level & Alarm Controls:	PLC Based Control Panel
Type:	Ultrasonic transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition t
Pump Motor Starters :	Motor starters in original combined G-R panel



City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Woodlands I

Last Update: 10/22/2018 *By:* MAC
This Update: *By:* W-P

Mechanical			
Heating:		Ventilation:	Generator
Type:	Electric Unit heater Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 2	Size:	Qty: 1-motorized fresh air intake
Make/Model:	Dayton 3UG73	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" Potable Water Supply with BFP	Exhaust Fan:	None
		L&D:	-

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating between 40-50% depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. Based on the low pump runtime operation at the station, this pump station may benefit form smaller, submersible style pumps which would increase overall efficiency from the suction lift style pump.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via drawdown testing on 3/29/18 indicated that the pumps have the following capacities: P1 - 92 gpm (30 ft TDH) and P2 - 86 gpm (28 ft TDH). Both of these pump conditions are less than the original estimated operating point of 150 gpm (39 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for 1.5 hours per day on average. Under peak conditions, both pumps may run close to 20 hours per day. Seasonal high runtimes between March-May of each year indicate that this pump station may experience I/I from the sewershed. Sources of I/I should be

Exterior Site:

The station is located off the side of the road in a residential district. The station has it's own driveway and is surrounded by forested areas. The pump station is located adjacent to a culvert and stream.

Building Structures (if applicable):

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition. The pre-cast concrete slab is in good condition with the exception of a corner which needs to be rebuilt. The joint between the foundation and the superstructure is showing signs of interior leaking. This joint should be pressure washed and the joint sealed. The pre-cast roof slab seam is showing signs of roof leaking. The pre-cast roof slab should be covered with an EPDM membrane roof to prevent further water damage on the interior of the structure. Several old piping penetrations from the wet wet well to the interior were observed. These penetrations should be permanantly sealed. The double access door has been recently replaced and should be properly sealed between the interior door frame and the existing superstructure.

Wet Well:

The underside surface of concrete top slab is in poor condition with extensive spalling and deterioration. In addition, the steel hatch frame is corroding. The pump suction and pump discharge pipe showing significant signs of corrosion, and should also be replaced. In general, the wet well strcuture is in good condition due to bi yearly cleaning. Wet well hatch should be equipped with a safety net.

Dry Well (if applicable): See Building Structure section. Pump Station consists of a single, abovegrade room.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. The emergency generator ashould be considered for replacement based on age (33-years). The ATS has been recently replaced and may be able to be re-used depending on the generator upgrade requirements.

Level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2004) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade. In the interim, it is recommended that the City modify the location of the wet well level float away from the influent sewer pipe to avoid hydraulic interference and mitigate ragging.

HVAC:

The electric unit heater is in good condition. No ventilation is provided for the space. In order to adhere to HVAC code requirements the Town should installed a mechanism to hold the door open when the pump station is occupied. While not required, a ventilated exhaust wall thimble should be considered to avoid wall damage. The dry well was noted to have condensation around some of the process equipment. A small local dehumidifier is recommended to mitigate humidity and condensation in the building.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that the pump station had no significant issues and was operating within adequate capacity.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	Yes (minor)	Location:	Wet well

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Woodlands II

Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	516 F.W. Hartford
Pump Station Finished Floor Elevation, ft.:	35.8
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	3
Year Constructed/Upgraded:	1984
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	1984
Design Operating Point, 1 Pump	
Flow, gpm:	130
Total Dynamic head, ft.:	31
Pump Make/Model:	T4A3-B
Self-Priming Method	Air Purge
Motor Size, HP:	5
Motor/Pump Speed, rpm:	1750 (assumed)
Electrical Service, V/Ph/Hz:	240/1/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	4
Force Main Velocity, feet per sec.:	1.9
Force Main Type:	PVC
Force Main Age:	1984
Force Main Length, ft.:	1369

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data		
Data Start Date	10/1/2015	10/1/2015
Data End Date	7/24/2017	7/24/2017
Annual Average Flow, GPM (Calculated)	3.3	3.6

Pump Peformance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	60
VFD Speed (Hz)	N/A
Pump RPM	1280
Drawdown Flow, gpm:	P1 - 75, P2 - 76
Drawdown TDH, ft:	P1 - 12 ft, P2 - 11 ft
Influent Pump Station Flow @ Test	Estimate during visit, 10 gpm
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Kohler
Interior/Exterior:	Interior
Gen. Installation Date	2018
Size, KW:	30
Fuel Type:	Propane, two 130 g tanks

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel with original G-R starters (controls bypassed), PLC based Control Panel Upgrade
Installation Date:	Motor Starter Panel (1984), PLC Control Panel (2004)
Control Type:	PLC-based
Location:	In station at pump level
SCADA Connectivity:	Yes, microwave RTU installed
Level & Alarm Controls:	PLC Based Control Panel
Type:	Ultrasonic transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to micro
Pump Motor Starters :	Motor starters in original combined G-R panel

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Woodlands II

Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Generator
Type:	Electric Unit heater Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 1	Size:	Qty: 1-motorized fresh air intake louver, 1-
Make/Model:	Dayton 3UG73	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" Potable Water Supply with BFP	Exhaust Fan:	None
		L&D:	-

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating between 40-50% depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. Based on the low pump runtime operation at the station, this pump station may benefit form smaller, submersible style pumps which would increase overall efficiency.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via drawdown testing on 3/29/18 indicated that the pumps have the following capacities: P1 - 75 gpm (12 ft TDH) and P2 - 76 gpm (11 ft TDH). Both of these pump conditions are less than the original estimated operating point of 130 gpm (31 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for approximately 1 hour per day on average. Under peak conditions, both pumps may run close to combined 15 hours per day. Seasonal high runtimes between March-May of each year indicate that this pump station may experience I/I from the sewershed. Sources of I/I should be investigated.

Exterior Site:

The station is located off the side of the road in a residential district. The station has it's own driveway and is surrounded by forested areas. The backside of the pump station has some graffiti, but nothing of significant damage.

Building Structures (if applicable):

The existing building consists of a precast concrete structure with a stone aggregate exterior finish. The exterior of the building appears to be in good condition. Interior wall surfaces appear to be in good condition with no observed deficiencies. The wall finishes are in good condition, but the floor finish needs to be re-coated. The pre-cast roof slab seam has been sealed with caulking to mitigate roof leaking. The precast concrete top slab has many pop-outs and a large crack that should be repaired. Several old piping penetrations from the wet wet well to the interior were observed. These penetrations should be sealed. Although no obvious tears or open joints were observed on the roof membrane, it does appear to be faded and may be thinning and brittle as it is likely nearing the end of its design life. Replacement of the membrane should be anticipated within 7 years. When the roof is replaced, a higher sloped roof is recommended to assist drainage. The double access door is missing misc. hardware and should be painted to preserve longevity.

Wet Well:

The pump suction pipe is showing significant signs of corrosion and should be replaced. In general, the wet well structure is in good condition due to bi yearly cleaning. Wet well hatch should be equipped with a safety net.

Dry Well (if applicable): See Building Structure section. Pump Station consists of a single, abovegrade room.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. The emergency generator was replaced recently and could be re-used.

Level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2004) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The electric unit heater is in good condition. No ventilation is provided for the space. In order to adhere to HVAC code requirements the Town should installed a mechanism to hold the door open when the pump station is occupied. While not required, a ventilated exhaust wall thimble should be considered to avoid wall damage. The dry well was noted to have condensation around some of the process equipment. A small local dehumidifier is recommended to mitigate humidity and condensation in the building.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that the pump station has high run times but still has adequate capacity.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Atlantic Heights

Last Update: 10/23/2018 *By:* MAC
This Update: *By:* W-P

General Pump Station Information	
Location:	134 Preble Way
Pump Station Finished Floor Elevation, ft.:	49
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	2
Year Constructed/Upgraded:	1986
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	
Pump 1	2013 +/-
Pump 2	1985
Design Operating Point, 1 Pump	
Flow, gpm:	385
Total Dynamic head, ft.:	43
Pump Make/Model:	Pump 1 - T6A3S-B, Pump 2 - Classic T
Self-Priming Method	Air Purge
Motor Size, HP:	15
Motor/Pump Speed, rpm:	1750
Electrical Service, V/Ph/Hz:	460/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	6
Force Main Velocity, feet per sec.:	3.3
Force Main Type:	Ductile Iron
Force Main Age:	1986
Force Main Length, ft.:	802

Pump Flow and Run Time Information	*P1*	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flowrate, GPM	300	285
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	12.819	12.753

Pump Peformance Testing Results	
Date of Test:	3-Apr-18
Min./Max. VFD Setpoints (Hz)	60, Constant speed
VFD Speed (Hz)	1875
Pump RPM	1875 (assumed)
Flow Meter Flow, gpm:	P1 - 300, P2 - 285
Flowmeter test TDH, ft:	P1 - 33, P2 - 33
Influent Pump Station Flow @ Test	N/A
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Onan
Interior/Exterior:	Interior
Gen. Installation Date	1985
Size, KW:	30
Fuel Type:	1,000 gal exterior Propane Storage Tank

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	MCC for starters, separate Control Panel (Electrical Installations, Inc.) for Alarm and Level Control Panel
Installation Date:	1986 (Motor Control Center), 2005 (Control Panel)
Control Type:	PLC-based
Location:	Within main pump station, dry well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2005)
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Foxboro 6" Mag. Flow Meter on Discharge Header
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to micr
Pump Motor Starters :	Motor starters in original MCC

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Atlantic Heights

Last Update: 10/23/2018 *By:* MAC
This Update: *By:* W-P

Mechanical			
Heating:		Ventilation:	Generator & Building
Type:	Electric Unit heater, Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 2	Size:	66"x 72" , two separate sections
Make/Model:	Dayton, 3UF80, 480 V 3 ph	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	1" City water with BFP	Exhaust Fan:	Inline, 1/3 HP Qty: 1
		L&D:	Yes

Energy Efficiency Information
Pump curves not readily available for review.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/3/18 indicated that the pumps have the following capacities: P1 - 300 gpm (33 ft TDH) and P2 - 285 gpm (33 ft TDH). Both of these pump conditions are below the reported rated capacity of 385 gpm (43 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for approximately 1 hours per day on average. Under peak conditions, both pumps may run close to combined 13 hours per day. Seasonal high runtimes between Jan-May of each year indicate that this pump station may experience I/I from the sewershed. Sources of I/I should be investigated. The existing MCC/instrumentation scheme requires the City to manually select which pump is on standby power. This operation should be addressed with subsequent MCC/control panel upgrades.

Exterior Site:

The pump station is located in a largely residential neighborhood on a parcel which backs up to the Piscataqua River. The rear of the building has a fenced in gate area containing a propane tank. No issues were noted with the site.

Building Structures (if applicable):

The exterior of the building, including the brick and metal roof appeared to be in fair condition. The exterior brick is original to the construction of the building and should be cleaned and repointed in areas where mortar has degraded. The access door sill in particular needs to be repaired with mortarted to prevent further damage. The roof appears to be in fair condition but has reached the end of its useful life and should be scheduled for replacement. The exterior door is in good condition, but missing hardware should be replaced. The foundation and the interior of the building appeared to be in good condition. The lower portion of the interior dry well should be cleaned and repainted based on moisture damage In addition, the City should consider moisture mitigation as described in the HVAC section. The corroded lintel steel above the generator louver should be replaced/repaired to prevent building envelope leaks.

Wet Well:

Wet Well Good condition due to bi-yearly cleaning. Grating for the wet well appears to have been dislodged and wedged between manhole interior. It is recommende that loose grating sections be removed for safety. Pump suction piping shows signs of corrosion and should be considered for replacement evaluation.

Dry Well (if applicable): See Building Structure section.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. It is recommended that the City install emergency lighting, arch-flash safety labeling, and hazardous gas detection system in the dry well side of the pump station. In addition, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety.

Level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The existing ventilation equipment is operational and in fair condition considering it's age. The ventilation equipment should planned to be replaced within the next several years. Consideration should be given to equipment that reduces ventilation rates based on space occupancy and outside air temperature. Proof of air flow switches are recommended if a new ventilation system is installed. The exhaust fan should be operated continuously to satisfy NFPA 820 requirements for declassification. The associated intake damper for the exhaust fan does not open and should be repaired/replaced. The lower level sump pump float should be adjusted to avoid water from overtopping the sump pit.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999)indicated that the sewershed was a combined sewer system. The pump station was reported to have adequate capacity, but the pumps were discahrging at of the design capacity.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Leslie Dr.

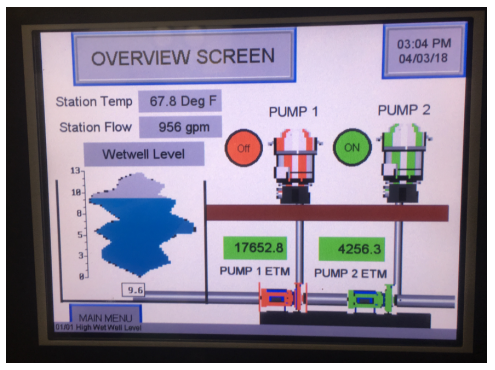
Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	590 Market Street
Pump Station Finished Floor Elevation, ft.:	9.5
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	1.4
Year Constructed/Upgraded:	Constructed: 1986
Station Type:	Gorman-Rupp suction-lift
Wet Well Dimensions, L x W x D:	12 x 12 x 11
Wet Well Volume, gal/ft	1,077
No. of Pumps:	2
Pump Installation Date:	1986
Design Operating Point, 1 Pump	
Flow, gpm:	1550
Total Dynamic head, ft.:	34
Pump Make/Model:	T10A3S-B
Self-Priming Method	Air Purge
Motor Size, HP:	25
Motor/Pump Speed, rpm:	1760
Electrical Service, V/Ph/Hz:	480/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	12
Force Main Velocity, feet per sec.:	2.1
Force Main Length, ft.:	846
Force Main Type:	Ductile iron
Force Main Age:	1986

Pump Flow and Run Time Information		
	P1	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flowrate, GPM	1487	1485
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, MGD (Calculated)	0.11	0.11

Pump Peformance Testing Results	
Date of Test:	3-Apr-18
Min./Max. VFD Setpoints (Hz)	60, Constant speed
VFD Speed (Hz)	1760
Pump RPM	1760
Flow Meter, gpm:	P1 - 1487, P2 - 1485
Flowmeter test TDH, ft:	P1 - 28, P2 - 18.5
Influent Pump Station Flow @ Test	N/A
Note for Pump Start Type	P1 constant speed starter (1986), P2 soft starter (2015)

Generator Information	
Make/Model:	Onan
Interior/Exterior:	Interior
Gen. Installation Date	1986
Size, KW:	45
Fuel Type:	1,000 gal exterior Propane Storage Tank



Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	MCC for starters, separate Control Panel (Electrical Installations, Inc.) for Alarm and Level Control Panel
Installation Date:	1986 (Motor Control Center), 2005 (Control Panel)
Control Type:	PLC-based
Location:	Within main pump station, dry well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2005)
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Foxboro 10" Mag. Flow Meter on Discharge Header
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	P1: 1986 MCC starter, P2: 2015 soft starter in MCC.

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Leslie Dr.

Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Generator & Building
Type:	Electric Unit heater, Wall mount	System	Louvers and Damper
Size, kW:	5 Quantity: 2	Size:	66"x 72" , two separate sections
Make/Model:	Dayton, 3UF80, 480 V 3 ph	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	1" City water with BFP	Exhaust Fan:	Inline, 1/3 HP Qty: 1
		L&D:	Yes

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating between 60-70% depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/3/18 indicated that the pumps have the following capacities: P1 - 1487 gpm (28 ft TDH) and P2 - 1485 gpm (18.5 ft TDH). Both of these pump conditions considered to be within the reported rated capacity of 1550 gpm (34 ft TDH). The station appears to have adequate capacity to handle existing flows as, each pump runs for approximately 1.25 hours per day on average. Under peak conditions, both pumps may run close to combined 16 hours per day. Seasonal high runtimes between Jan-May of each year indicate that this pump station may experience I/I from the sewershed. Sources of I/I should be investigated.

Exterior Site:

The station is located on a parcel adjacent to the Route 1 bypass and between two tidally influenced drainage areas. No significant issues were noted with the site.

Building Structures (if applicable):

The exterior of the building, including the brick and metal roof appeared to be in fair condition, with the exception of some graffiti. The exterior brick is original to the construction of the building and should be cleaned and repointed in areas where mortar has degraded. The pump piping penetration link seals in the lower level show significant signs of leakage. It is recommended that this penetration is repaired/replaced to prevent further moisture from entering the drywell. The roof appears to be in fair condition but has reached the end of its useful life and should be scheduled for replacement. The exterior door is in good condition, but should be repainted and missing hardware should be replaced. The foundation and the interior of the building appeared to be in good condition. The lower Dry Well shows signs of significant moisture accumulation and rust. All corroded metal equipment (i.e., pipe supports, pump skids) should be stripped and repainted for continued protection. The lower portion of the interior dry well should be cleaned and repainted based on moisture damage In addition, the City should consider moisture mitigation as described in the HVAC section.

Wet Well:

Wet Well Good condition due to bi-yearly cleaning. The City noted that the wet well has issues with significant scum accumulation. The City has recently installed a large bubble wet well mixing system (Medora) to try and mitigate scum accumulation, results have not yet been confirmed. Grating and pump suction piping are in fair condition. Each wet well access hatch should have a safety net/guard installed. The old eletrical penetrations into the wet well slab should be patched/sealed.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. It is recommended that the City install emergency lighting, arch-flash safety labeling, and hazardous gas detection system in the dry well side of the pump station. In addition, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety. The existing MCC/instrumentation scheme requires the City to manually select which pump is on standby power. This operation should be addressed with subsequent MCC/control panel upgrades.

Level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the

HVAC:

The existing ventilation equipment is operational and in fair condition considering it's age. The ventilation equipment should planned to be replaced within the next several years. Consideration should be given to equipment that reduces ventilation rates based on space occupancy and outside air temperature. Proof of air flow switches are recommended if a new ventilation system is installed. The exhaust fan should be operated continuously to satisfy NFPA 820 requirements for declassification. The associated intake damper for the exhaust fan does not open and should be repaired/replaced. The lower level sump pump float should be adjusted to avoid water from overtopping the sump pit.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that Leslie Drive has adequate capacity for next 20 years.

Other:

Miscellaneous Issues:

Grease Accumulation?	Yes	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Marcy St.

Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	535 Marcy St
Pump Station Finished Floor Elevation, ft.:	10.2
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	0.5
Year Constructed/Upgraded:	1986
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	6
Wet Well Volume, gal/ft	211
No. of Pumps:	2
Pump Installation Date:	P1 - 2008, P2 - 2004
Design Operating Point, 1 Pump	
Flow, gpm:	210
Total Dynamic head, ft.:	44
Pump Make/Model:	T-4A3S-B
Self-Priming Method	Air Purge
Motor Size, HP:	10
Motor/Pump Speed, rpm:	1755
Electrical Service, V/Ph/Hz:	480/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	4
Force Main Velocity, feet per sec.:	3.2
Force Main Type:	Ductile iron
Force Main Age:	1985
Force Main Length, ft.:	878

Pump Flow and Run Time Information	*P1*	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flowrate, GPM	125	125
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	10.7	11.3

Pump Peformance Testing Results	
Date of Test:	3-Apr-18
Min./Max. VFD Setpoints (Hz)	Constant speed, 60
VFD Speed (Hz)	1875
Pump RPM	1875 (assumed)
Drawdown Flow, gpm:	P1 - 125, P2 - 125
Drawdown TDH, ft:	P1 - 94, P2 - 92
Influent Pump Station Flow @ Test	Estimate during visit
Note for Pump Start Type	Slow start, constant speed, etc;

Generator Information	
Make/Model:	Onan
Interior/Exterior:	Interior
Gen. Installation Date	1986
Size, KW:	20
Fuel Type:	Natural Gas

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	MCC for starters, separate Control Panel (Electrical Installations, Inc.) for Alarm and Level Control Panel
Installation Date:	1986 (Motor Control Center), 2005 (Control Panel)
Control Type:	PLC-based
Location:	Within main pump station, dry well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2005)
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Foxboro 4" Mag. Flow Meter on Discharge Header
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition t
Pump Motor Starters :	Motor starters in original MCC

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Marcy St.

Last Update: 10/23/2018 *By:* MAC
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Generator & Building
Type:	Natural Gas Unit heater, Wall mount	System	Louvers and Damper
Size, MBH:	50 Quantity: 2	Size:	66"x 72" , two separate sections
Make/Model:	Modine	Make & Model:	-
Odor Control :	None	Ventilation:	Building
City Water Supply:	1" City water with BFP	Exhaust Fan:	Inline, 1/3 HP Qty: 1
		L&D:	Yes

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating at less than 40% efficiency depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. The low efficiency is due at least in part to the high head conditions the pumps are experiencing. Based on the low pump runtime operation at the station, this pump station may benefit from submersible style pumps which would increase overall efficiency.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/3/18 indicated that the pumps have the following capacities: P1 - 125 gpm (94 ft TDH) and P2 - 125 gpm (92 ft TDH). Both of these pump conditions are below the reported rated capacity of 210 gpm (44 ft TDH). However, it must be noted that no information was available regarding the belt and sheave setup, which may be the cause for the reduced pump capacity. Based on the high TDH conditions observed during pump testing, the forcemain should be evaluated for possible flow impediments or deterioration. Regardless of the observed flowrates, the station appears to have adequate capacity to handle existing flows as, each pump runs for approximately 2 hours per day on average. Under peak conditions, both pumps may run close to combined 24 hours per day. Seasonal high runtimes between April-May of each year indicate that this pump station may experience I/I from the sewershed. Sources of I/I (i.e., direct roof drain and sump pump influence) should be investigated.

Exterior Site:

The station is located in a residential neighborhood between a house and a tidal portion of the river. Observations indicated that high tide levels come within several feet of the pump station finished floor elevation. The pump station has a small access driveway where the front door and wet well access hatch can be accessed. The wet well top slab has been significantly damagd by plow use and should be replaced. Bollards or markers should be installed to avoid plow damage in the future. Based on the small parcel footprint, the City should consider an alternative pump station approach (i.e., submersible) for future upgrades.

Building Structures (if applicable):

The exterior of the building, including the wood siding and shingled roof appeared to be in fair condition. A few areas of trim are in need of repair/painting/replacement. It is recommended that the City install roof gutters to preserve siding/trim. The roof appears to be in fair condition. The lower portion of the interior dry well shows significant signs of moisture accumulation and resulting corrosion. The floors and equipment should be cleaned and repainted. In addition, the City should consider moisture mitigation as described in the HVAC section.

Wet Well:

The concrete top slab is in poor condition with major degradation and section loss. Reinforcing steel is exposed in many locations. This top slab should be replaced. Wet Well Good condition due to bi-yearly cleaning. Pump suction piping shows signs of corrosion and should be considered for replacement evaluation.

Dry Well (if applicable): See Building Structure section.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is approaching the end of its useful design life. Many of the components are obsolete. Consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. It is recommended that the City install emergency lighting, arch-flash safety labeling, and hazardous gas detection system in the dry well side of the pump station. In addition, the belt drive pumps are recommended to have emergency stop switches adjacent to the pumps for operator safety.

Level instruments are recommended to be installed with an intrinsically safe barrier for compliance with the NEC. For ease of operator maintenance, it is recommended that seal-offs are installed on the instrument conduits out of the wet well with a junction box on the wet well side of the seal off, but still outside the wet well to allow for instrument replacement without confined space entry. The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The existing ventilation equipment is operational and in fair condition considering it's age. The ventilation equipment should planned to be replaced within the next several years. Consideration should be given to equipment that reduces ventilation rates based on space occupancy and outside air temperature. Proof of air flow switches are recommended if a new ventilation system is installed. The exhaust fan should be operated continuously to satisfy NFPA 820 requirements for declassification. The associated intake damper for the exhaust fan linkage for ventilation and standby generator need to be repaired/replaced. The lower level sump pump float should be adjusted to avoid water from overtopping the sump pit. Based on the proximity of tidal water and the depth of the dry well, a dehumidifier is recommended for installation on the lower level.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that the pump station had high operational run times and required electrical

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Corporate Drive

Last Update: 10/26/2018 *By:* MAC
This Update: *By:* W-P

General Pump Station Information	
Location:	215 Corporate Dr.
Pump Station Finished Floor Elevation, ft.:	30
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	2.7
Year Constructed/Upgraded:	2001
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	3
Pump Installation Date:	2001
Design Operating Point, 1 Pump	
Flow, gpm:	600
Total Dynamic head, ft.:	83.5
Pump Make/Model:	T6A3-B/F
Self-Priming Method	Air Purge
Motor Size, HP:	30
Motor/Pump Speed, rpm:	1765/1875
Electrical Service, V/Ph/Hz:	480/3/60
Drive Type:	Belt & Sheave, VFD
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	8
Force Main Velocity, feet per sec. (full speed):	5.9
Force Main Type:	PVC
Force Main Age:	2001
Force Main Length, ft.:	2286

Pump Flow and Run Time Information			
	P1	*P2*	*P3*
Pump Flow Data (Magnetic Flow Meter)			
Observed Instantaneous Flowrate (60 Hz), GPM	930	940	930
Pump Runtime Data	Yes	Yes	Yes
Data Start Date	12/1/2014	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017	10/31/2017
Annual Average Flow, GPM (Calculated)	9.8	10.0	5.4

Pump Peformance Testing Results		
Date of Test:		3-Apr-18
Min./Max. VFD Setpoints (Hz)		10, 60
VFD Speed (Hz)		1875
Pump RPM		1770
Observed Flow, gpm:		P1 - 940, P2 - 940, P3 - 930
Observed TDH, ft:		P1 - 58, P2 - 58, P3 - 58
Influent Pump Station Flow @ Test		Estimate during visit
Note for Pump Start Type		Slow start, variable speed

Generator Information	
Make/Model:	Olympian (Caterpillar)
Interior/Exterior:	Interior
Gen. Installation Date	2001
Size, KW:	100
Fuel Type:	Natural Gas

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/Lag/Standby sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Combination Control and Power Panel by Gorman Rupp, separate MCC panels for VFDs
Installation Date:	2001
Control Type:	PLC based
Location:	Within pump station building
SCADA Connectivity:	Radio, RTU to master MTU connection to SCADA. City will be connecting this pump station to microwave in the near future.
Level & Alarm Controls:	Gorman-Rupp Pump Control Panel
Type:	Air bubbler (Gorman Rupp original - primary), submersible pressure transducer (secondary), differential level floats (backup)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	6" Krohne Magnetic Flow Meter
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, nearterm transition to microwave
Pump Motor Starters :	Allen Bradley 30 hp VFD

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Corporate Drive

Last Update: 10/26/2018 *By:* MAC
This Update: *By:* W-P

Mechanical					
Heating:			Ventilation:	Generator	
Type:	Gas Unit heater, Wall mount (2018)		System	Louvers and Damper	
Size, kW:	Unk.	Quantity: 1	Size:	54"x54" (exhaust) 72"x66" (intake)	
Make/Model:	Modine Hot Dawg		Make & Model:	-	
Odor Control :	None		Ventilation:	Building	
City Water Supply:	3/4" water supply with RPZ BFP		Exhaust Fan:	Penn Model 40340, 1 PH, 1/2 HP	
			L&D:	Yes	

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, pumps are operating at full speed between 55-60% efficiency depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/3/18 indicated that all three pumps are operating at relatively the same capacity 930 gpm (58 ft TDH). The reported duty point of these pumps was reported as 600 gpm (84 ft TDH). Based on this evaluation the pumps are operating against a lower pressure and as a result, producing higher flowrates. It must be noted that no information was available regarding the belt and sheave setup, which could lead to a different duty point pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for less than 20 minutes per day on average. Under peak conditions, each pump can operate for as much as an hour per day indicating that the pump station is operating well under the total capacity.

Exterior Site:

The station is located in a commercial section of Pease Development with a dedicated access driveway. No site issues were noted.

Building Structures (if applicable):

The pump station Building was constructed in (2001). All exterior surfaces were observed to be in fair condition. Masonry appears to be in good condition with no observed deficiencies. The gable end of the buildings should planned to be reprimed/painted within the next 5 years. The shingled roof is in good condition but the City should plan on replacement/repair in 8-10 years. Interior masonry surfaces are in good condition with no observed deficiencies.

Wet Well:

Top surface of the concrete top slab appears to be in fair to good condition with no observed structural deficiencies.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station is new and in good condition. While the existing bubbler level instrument remains in-use, the City should consider replacement with a submersible pressure transducer once the instrument needs to be replaced. The Control Panel is controlled by Allen Bradley PLC's which are no longer actively supported (SLC 5/05) and can be difficult to find replacements for. It is recommended that the City replace the existing SLC 5/05 components with more updated PLC products (i.e., Micrologix 1200) which are actively supported by the manufacturer.

HVAC:

Ventilation and heating equipment are operational and in good condition. The emergency generator exhaust piping should be insulated for safety. The building wall sleeve for the generator exhaust penetration should be equipped with a ventilated wall thimble to prevent wall damage.

Security Measures:

There is no fire alarm or security system in the building. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

Not applicable.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Griffin Park

Last Update: 10/26/2018 *By:* MAC
This Update: *By:* W-P

General Pump Station Information	
Location:	205 Griffin Park
Pump Station Finished Floor Elevation, ft.:	37.75
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	3
Year Constructed/Upgraded:	1990
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	1990
Design Operating Point, 1 Pump	
Flow, gpm:	200
Total Dynamic head, ft.:	40
Pump Make/Model:	T4A3/S-B (Classic & Super T)
Self-Priming Method	Air Purge
Motor Size, HP:	7.5
Motor/Pump Speed, rpm:	1745
Electrical Service, V/Ph/Hz:	460/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	G-R , Double Mech Oil Bath
Force Main Diam., in.:	6
Force Main Velocity, feet per sec.:	2.7
Force Main Type:	Ductile Iron
Force Main Age:	1990
Force Main Length, ft.:	1200

Pump Flow and Run Time Information	*P1 (1990)*	*P2 (2001)*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flow, MGD	0.35	0.32
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPD (Calculated)	1807	1602

Pump Peformance Testing Results	
Date of Test:	2-Apr-18
Min./Max. VFD Setpoints (Hz)	N/A
VFD Speed (Hz)	60 Hz, Constant
Pump RPM	1875
Drawdown Flow, gpm:	P1 - 246, P2 - 222
Drawdown TDH, ft:	P1 - 21, P2 - 20
Influent Pump Station Flow @ Test	Estimate during visit
Note for Pump Start Type	Slow start, constant speed

Generator Information	
Make/Model:	Cummins Onan
Interior/Exterior:	Interior
Gen. Installation Date	1990 (ATS is 2009)
Size, KW:	30
Fuel Type:	Natural Gas

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	MCC for starters, separate Control Panel (Electrical Installations, Inc.) for Alarm and Level Control Panel
Installation Date:	1990 (Motor Control Center), 2005 (Control Panel)
Control Type:	PLC-based
Location:	Within main pump station, dry well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2005)
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Fischer Porter 4" Mag. Flow Meter on Discharge Header
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Motor starters in original GR Control Panel (1990)

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Griffin Park

Last Update: 10/26/2018 *By:* MAC
This Update: *By:* W-P

Mechanical			
Heating:		Ventilation:	Generator
Type:	Gas Unit heater, Wall mount (2016)	System	Louvers and Damper
Size, kW:	Unk. Quantity: 1	Size:	Qty: 1-intake 1-exhaust
Make/Model:	Modine Hot Dawg	Make & Model:	Unk.
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" water supply with RPZ BFP	Exhaust Fan:	None
		L&D:	-

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating at less than 40% efficiency depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. The low efficiency is typical for this type of pump.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/2/18 indicated that all three pumps are operating between 220-250 gpm (20 ft TDH). The reported duty point of these pumps was reported as 200 gpm (40 ft TDH). Based on this evaluation the pumps are operating against a lower pressure and as a result, producing higher flowrates. It must be noted that no information was available regarding the belt and sheave setup, which could lead to a different duty point pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for less than 10 minutes per day on average. Under peak conditions, each pump can operate for as much as 1.5 hours per day indicating that the pump station is operating well under the total capacity.

Exterior Site:

The pump station is located in a commercial district. No site issues were noted.

Building Structures (if applicable):

The pump station was constructed in 1990. The Exterior building split rib masonry surfaces appear to be in fair condition with some staining of the masonry in the bottom several feet. The concrete foundation is cracked near the entrance pad. Exterior wood trim surfaces exhibit dried, faded, and peeling paint and should be reprimed/repainted. The roof is in good ocndition but is approaching the end of its useful life. The wood soffit is coming apart on one side of the building. Interior masonry surfaces appear to be in good condition with no observed deficiencies.

Wetwell:

The interior concrete surfaces are in good condition with no significant observed deficiencies. Some leakage is evident at isolated locations in a few joints. The top side of the top slab appears to be in good condition with minimal to no spalling or exposed aggregate. The suction pipes show signs of limited corrosion, but are still in good operating condition. The discharge pipe which penetrates through the wet well is severely corrodede and the pipe support bracket has been broken. It is recommended that this discharge pipe is replaced and redirected so that the force main does not route under the building foundation.

Dry Well (if applicable): See Building Structure section.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station was installed in 1990 is approaching the end of its useful design life. Many of the components are obsolete, or will become obsolete within the next 5-10 years. Low priority consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. It is recommended that the City install emergency lighting nad provide arch-flash safety labeling.

The Control Panel (2005) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The electric unit heater and are in good condition. No ventilation is provided for the space. In order to adhere to HVAC code requirements the Town should installed a mechanism to hold the door open when the pump station is occupied. While not required, a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

Security Measures:

There is no active security system in the building. A smoke detector appears to be wired to the Control Panel for alarming. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that the pump station was in good condition and had adequate capacity.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Tuckers Cove

Last Update: 10/29/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	91 Gosport Rd.
Pump Station Finished Floor Elevation, ft.:	19.5
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	2
Year Constructed/Upgraded:	1998
Station Type:	Gorman-Rupp suction-lift
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ft	376
No. of Pumps:	2
Pump Installation Date:	1998
Design Operating Point, 1 Pump	
Flow, gpm:	280
Total Dynamic head, ft.:	33
Pump Make/Model:	T4A3-B
Self-Priming Method	Air Purge
Motor Size, HP:	15
Motor/Pump Speed, rpm:	1780/1125
Electrical Service, V/Ph/Hz:	460/3/60
Drive Type:	Belt & Sheave, Constant Speed
Belt and Sheave Speed:	Unknown
Seal Make & Type:	GR Double Mechanical Oil
Force Main Diam., in.:	6
Force Main Velocity, feet per sec.:	2.7
Force Main Type:	Ductile Iron
Force Main Age:	1998 (est.)
Force Main Length, ft.:	1450

Pump Flow and Run Time Information		
	P1	*P2*
Pump Flow Data (Magnetic Flow Meter)		
Observed Instantaneous Flow, MGD	0.35	0.34
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	1031/2017
Annual Average Flow, GPD (Calculated)	4766	4860

Pump Peformance Testing Results	
Date of Test:	2-May-18
Min./Max. VFD Setpoints (Hz)	N/A
VFD Speed (Hz)	60 Hz, Constant
Pump RPM	1765
Drawdown Flow, gpm:	P1 - 243, P2 - 233
Drawdown TDH, ft:	P1 - 18.5, P2 - 24
Influent Pump Station Flow @ Test	Estimate during visit
Note for Pump Start Type	Slow start, constant speed

Generator Information	
Make/Model:	Cummins Onan
Interior/Exterior:	Interior
Gen. Installation Date	1998 (ATS 2015)
Size, KW:	45
Fuel Type:	Propane

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	MCC for starters, separate Control Panel (Electrical Installations, Inc.) for Alarm and Level Control Panel
Installation Date:	1998 (Motor Control Center), 2004 (Control Panel)
Control Type:	PLC-based
Location:	Within main pump station, dry well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2004)
Type:	Ultrasonic transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Fischer Porter 4" Mag. Flow Meter on Discharge Header
Alarm Transmission:	All pump station alarms transffered via radio (existing) to WWTF SCADA, equipment in place to transition t
Pump Motor Starters :	Motor starters in original GR Control Panel (1990)

City of Portsmouth, New Hampshire
SUCTION LIFT Pump Station Evaluation
Tuckers Cove

Last Update: 10/29/2018 *By:* MAC
This Update: *By:*

Mechanical			
Heating:		Ventilation:	Generator
Type:	Gas Unit heater, Wall mount	System	Louvers and Damper
Size, kW:	Unk. Quantity: 1	Size:	Qty: 1-exhaust
Make/Model:	Modine	Make & Model:	Unk.
Odor Control :	None	Ventilation:	Building
City Water Supply:	3/4" water supply with RPZ BFP	Exhaust Fan:	FRP Prop Fan, occupancy linked
		L&D:	Yes, automatic

Energy Efficiency Information

Based on pump information gathered from the pump manufacturer's website, both pumps are operating at less than 40% efficiency depending on the sheave configuration. It must be noted that the pump belt/sheave configuration was unknown, which may change the operating efficiency conclusion. The low efficiency is typical for this type of pump.

Condition of Equipment/Identified Issues

Capacity:

Recent capacity assessment via flow meter observation on 4/2/18 indicated that all three pumps are operating between 230-240 gpm (18-24 ft TDH). The reported duty point of these pumps was reported as 280 gpm (33 ft TDH). It must be noted that no information was available regarding the belt and sheave setup, which could lead to a different duty point pump capacity. The station appears to have adequate capacity to handle existing flows as, each pump runs for approximately 20 minutes per day on average. Under peak conditions, each pump can operate for as much as 1 hour per day indicating that the pump station is operating well under the total capacity.

Exterior Site:

The station pump station is located in a residential neighborhood and can be accessed via a long dedicated paved driveway. No issues were noted for the exterior site.

Building Structures (if applicable):

The pump station was constructed in 1998. Exterior surfaces are in fair to good condition structurally. The bottom 2 courses of masonry are stained, potentially due to moisture/mold working up from the ground. Exterior wood trim surfaces exhibit dried, faded, and peeling paint and should be reprimed/repainted. Asphalt shingles are near the end of their useful life, are curled and weathered, and in need of replacement. Efflorescense can be seen on the inside face of masonry in the vicinity of the generator intake louver. It appears that a sealant was not installed or has failed and is allowing water to migrate into the building. Aesthetically, the interior surfaces of masonry should be pressurewashed and sealed or painted.

Wet Well:

The top surface of the top slab appears to be in good condition with no observed deficiencies. The steel closure arm is corroded and detached from the hatch. This should be completely removed for safety during confined space entry. Interior concrete surfaces are in good condition with no observed deficiencies.

Dry Well (if applicable): See Building Structure section.

Electrical/Instrumentation:

The existing electrical distribution equipment at the pump station was installed in 1998. Many of the components will become obsolete within the next 10-15 years. Low priority consideration should be given to a comprehensive electrical upgrade including panelboards, emergency power equipment, and other ancillary electrical components. It is recommended that the City install emergency lighting nad provide arch-flash safety labeling.

The Control Panel (2004) is in good condition and has an estimated lifespan of approximately 20-years. The City should plan to replace the control panel or the major components based on this timeframe or during the next major pump station upgrade.

HVAC:

The propane unit heater and exhaust fan/damper assemblies are in good condition. The pump station exhaust fan and associated dampers operates when the station is occupied. This existing control arrangement is not required by code, but is considered good practice. The emergency generator exhaust pipe was observed to not be insulated through the wall. While not required, a ventilated exhaust wall thimble should be considered to avoid continued wall damage.

Security Measures:

There is no active security system in the building. There is no gas detection system in this station, as it is not required.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) indicated that pump station was relatively newer PS and does not receive elevated flows.

Other:

Miscellaneous Issues:

Grease Accumulation?	Yes	Source:	Possible restaurant sources (Atlantic Grill)
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

SUBMERSIBLE EVALUATION FORMS

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Clough Drive

Last Update: 7/17/2018 *By:* MAC

This Update: *By:*

General Pump Station Information	
Location:	210 Clough Drive
Pump Station Finished Floor Elevation, ft.:	14
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	0.7
Year Constructed/Upgraded:	Constructed: 2002
Station Type:	Flygt Submersible grinder pumps
Wet Well Diameter, ft:	8
Wet Well Volume, gal/ vertical ft	376
No. of Pumps:	2
Pump Installation Date:	2002
Design Operating Point, 1 Pump	
Flow, gpm:	55
Total Dynamic head, ft.:	45
Pump Make/Model:	ITT-FLYGT M3068-1770
Motor Size, HP:	2.3
Motor/Pump Speed, rpm:	Motor: 3,325
Electrical Service, V/Ph/Hz:	230/1/60
Drive Type:	Direct Drive, Constant Speed
Seal Make & Type:	Double mechanical
Force Main Diam., in.:	2
Force Main Velocity, feet per sec.:	3.7
Force Main Type:	PVC, SDR 21
Force Main Age:	2002
Force Main Length, ft.:	504

Pump Flow and Run Time Information	*P1*	*P2*
Pump Runtime Data	Yes	Yes
Assumed Pump Flowrate, GPM	55	55
Data Start Date	12/1/2014	1/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPD (Calculated)	1042	2107

Pump Performance Testing Results	
Date of Test:	29-Apr-18
Min./Max. VFD Setpoints (Hz)	N/A - Full Speed
VFD Speed (Hz)	N/A - Constant Speed
Pump RPM	
Drawdown Flow, gpm:	P1 - 31, P2 - 41
Drawdown TDH, ft:	N/A
Influent Pump Station Flow @ Test	Estimate during visit, < 5 gpm
Note for Pump Start Type	Constant speed

Generator Information	
Make/Model:	N/A
Interior/Exterior:	N/A
Gen. Installation Date	N/A
Size, KW:	N/A
Fuel Type:	Portable generator connection

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel (Flygt), separate adjacent PLC Control Panel
Installation Date:	2003
Control Type:	PLC Based
Location:	Inside a NEMA 4X weatherproof cabinet
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel
Type:	Submersible transducer (primary)
Backup Alarm	High float level switch
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Square D motor starters in Flygt Control Panel (2002)

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Clough Drive

Last Update: 7/17/2018 *By:* MAC
This Update: *By:*

Mechanical					
Heating:			Ventilation:	None	
Type:	Electrical cabinet unit heater			System	-
Size:	200 watt	Quantity: 1		Size:	-
Make/Model:	Unk.			Make & Model:	-
Odor Control :	None		Ventilation:		-
City Water Supply:	None			Exhaust Fan:	-
				L&D:	-

Energy Efficiency Information

Based on an assumed pump model, the submersible grinder pumps operate at < 25% efficiency due to the small pump size and the type of grinder impeller utilized. Due to the low HP requirements of this station, this pump efficiency is considered to be typical for this type of pump and is not considered detrimental to pump station operation.

Condition of Equipment/Identified Issues

Capacity:

Capacity assessment via drawdown testing on 4/29/18 indicated the pumps have the following capacities: P1 - 31 gpm and P2 - 41 gpm. The current pumping rate of P1 and P2 is less than the original pump design operating point (55 gpm @ 45-ft TDH). Based on pump runtime data, the station appears to have adequate capacity to handle existing flows. Each pump runs for about 50 minutes per day on average, but under peak conditions, both pumps may run a combined total of as much as 21 hours per day.

Exterior Site:

The pump station is located adjacent to a school with the Control/Power enclosure located within a fenced in area. The wet well and valve vault are located outside of the fence adjacent to a roadway. The valve vault and wet well access hatch are located in a grassed area exposed to the roadway without bollard protection and show signs of plow damage. The City indicated that during the winter, the area of the valve vault and wet well hatch are used to pile snow from the adjacent roadway, causing flooding issues at the valve vault. The City should consider plow/vehicle protection of the wet well/valve vault (i.e., bollards) or further measures to expand the fenced area to include the valve vault/wet well to mitigate snow accumulation on the hatches.

Building Structures (if applicable):

Not applicable

Wet Well:

The wet well was observed to be in good condition due to tri- yearly cleaning. The wet well hatch was observed to be in good condition but does not have a safety net/hatch grating. The PVC piping was in good condition. The wet well has mild grease accumulation on the wet well walls and power cables. The wet well is vented with a 4-inch PVC vent routed to vent immediately adjacent to the Control/Power panel.

Dry Well (if applicable): Not applicable.

Valve Pit (if applicable): The concrete valve vault consists of a 30-inch square access hatch, 2-inch check valves and resilient gate valves. During the site visit, the valve pit was completely flooded with water. The City indicated the valve vault floods in the winter when snow from the adjacent school parking lots are piled up in the area of the pump station wet well and valve pit. The valve pit does not contain a valve vault drain back to the wet well.

Electrical/Instrumentation:

The pad mounted electrical cabinet houes the pump station's motor starter panel, control panel, electrical disconnects, alarm bell and light. The wet well level instruments are operational, but the City should plan to replace them within the next 5 years to maintain reliability.

HVAC:

Not applicable.

Security Measures:

The pump station is situated adjacent to a school. The electrical and control panels are situated in a locked fenced area. The valve vault and wet well hatches are out in the open and were not locked upon site inspection. It is recommended that these hatches remain locked at all times.

Portsmouth Coastal Resilience Initiative Report:

Emergency Procedures:

Pump Station : If main power is lost, the City can either 1) connect a gas powered mobile emergency generator to power the pump station, or 2) use the City's vac truck to empty the pump station wet well daily or as-needed. The pump station has substantial wet well capacity to accommodate short term power outages. Per NHDES regulations, the City is allowed to utilize wet well storage with an emergency generator receptacle for sewage pumping stations with a capacity of 100-GPM or less.

Force Main Bypass: The City would rely on a vacuum truck if the force main required bypassing.

Summary of Previous Reports

Clough Drive was not evaluated as part of the 201 Facilities Plan Update (Underwood Engineers, 1999).

Other:

Miscellaneous Issues:			
Grease Accumulation?	Yes	Source:	Residential grease from Clough Dr and Bracket Rd houses
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Marsh Ln. (Dearborn Place)

Last Update: 8/26/2018 *By:* MAC
This Update: *By:*

General Pump Station Information	
Location:	4 Marsh Lane
Pump Station Finished Floor Elevation, ft.:	5.9
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (striaghtline), miles:	1.4
Year Constructed/Upgraded:	Constructed: 1985 Pump and Control Panel Upgrade: 2004
Station Type:	Flygt Submersible grinder pumps
Wet Well Diameter, ft:	6
Wet Well Volume, gal/ft	211
No. of Pumps:	2
Pump Installation Date:	2004
Design Operating Point, 1 Pump	
Flow, gpm:	55
Total Dynamic head, ft.:	40
Pump Make/Model:	ITT-FLYGT M3068
Motor Size, HP:	2.3
Motor/Pump Speed, rpm:	Motor: 3,325
Electrical Service, V/Ph/Hz:	230/1/60
Drive Type:	Direct Drive, Constant Speed
Seal Make & Type:	Double mechanical
Force Main Diam., in.:	2
Force Main Velocity (observed), feet per sec.:	3.5
Force Main Type:	PVC
Force Main Age:	1985
Force Main Length, ft.:	463

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPD (Calculated)	1495	1777

Pump Performance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	N/A - Full Speed
VFD Speed (Hz)	N/A - Constant Speed
Pump RPM	
Drawdown Flow, gpm:	P1 - 32, P2 - 37
Drawdown TDH, ft:	N/A
Influent Pump Station Flow @ Test	Estimate during visit, < 5 gpm
Note for Pump Start Type	Constant speed

Generator Information	
Make/Model:	N/A
Interior/Exterior:	N/A
Gen. Installation Date	N/A
Size, KW:	N/A
Fuel Type:	Portable generator connection within electrical enclosure

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Motor Starter Panel (Flygt), separate adjacent Control Panel (Electrical Installation, Inc)
Installation Date:	2004 (Flygt), 2011 (Control Panel)
Control Type:	PLC Based
Location:	Exterior enclosure adjacent to wet well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2011) City reported the UPS for the PLC has been discontinued from service because it caused false SCADA alarms.
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Square D motor starters in Flygt Control Panel (2004)

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Marsh Ln. (Dearborn Place)

Last Update: 8/26/2018 *By:* MAC
This Update: *By:*

Mechanical				
Heating:		Ventilation:		N/A
Type:	Small portable unit heater in Panel enclosure		System	-
Size, kW:	- Quantity: 1		Size:	-
Make/Model:	-		Make & Model:	-
Odor Control :	None	Ventilation:		N/A
City Water Supply:	Hydrant access adjacent to the Pump Station		Exhaust Fan:	-
			L&D:	-

Energy Efficiency Information

Based on assumed pump model, the submersible grinder pumps operate at < 25% efficient due to the small pump size and the type of grinder impeller utilized. Due to the low HP requirements of this station, this pump efficiency is considered to be typical for this type of pump and is not considered detrimental to overall pump station operation.

Condition of Equipment/Identified Issues

Capacity:
Capacity assessment via drawdown testing on 3/29/18 indicated the pumps have the following capacities: P1 - 32 gpm and P2 - 37 gpm. These pump are operating below the intended operating point of 55 gpm. The reduced flowrate is potentially due to the 2-inch PVC discharge piping installed on each pump. The station appears to have adequate capacity to handle existing flows, even at reduced pumping capacity, as each pump runs for about 0.75 hours per day on average. Under peak conditions, both pumps may run as much as 10 hours per day.

Exterior Site:
The pump station wet well and associated hatch are located at a low elevation, less than 50 feet from a tidal inlet to North Mill Pond. During extreme high tidal events, the pump station is close to being submerged and experiences significant infiltration. The City uses sand bags to combat tidal effects with limited success. It is recommended the wet well access hatch and upper concrete section be raised and patched to mitigate flooding concerns. The buoyancy of the structure will need to be analyzed based on the new top of structure elevation. The above-grade wet well should have heavy duty steel bollards installed on the roadside to ensure snow plows do not damage the structure.

Building Structures (if applicable):
Not applicable.

Wet Well:
The wet well was observed to be in relatively good condition due to tri- yearly cleaning. The electrical conduit penetrations and upper hatch foundation showed minor cracks with masonry and concrete sections recommended for repair. The wet well hatch was observed to be in good condition. However, if the wet well access level is raised, the City should consider a gasketed watertight hatch with a safety net as a replacement. The City has indicated they plan to raise the elevation of the hatch in the near future to mitigate flooding concerns. The original ductile iron discharge piping was abandoned in place in lieu of the new 2-inch PVC discharge piping with isolation valves within the wet well.

Dry Well (if applicable): Not applicable.

Valve Pit (if applicable): The submersible station does not currently have a valve pit. The submersible pumps have PVC isolation/check valves installed within the wet well. Record drawings from the original pump station design indicate the pump station was formerly equipped with buried isolation valves and a force main bypass located adjacent to the wet well. These features appear to have since been abandoned.

Electrical/Instrumentation:
The main electrical enclosure and internal equipment (breaker box, manual transfer switch, disconnects, etc.) date back to the original pump station construction and are showing signs of age. The enclosure door latch/handle was broken at the time of the site visit and the enclosure was showing minor signs of ageing (i.e., rusting). In addition, the enclosure has several penetrations which have not been sealed on the cabinet. It is recommended the main electrical distribution enclosure and all associated components be scheduled for replacement within the next 5-7 years. In addition, since the Flygt Control Panel has been discontinued (2004) the float switches and submersible transducers do not have an intrinsically safe barrier as required by the NEC. It is recommended that an intrinsically safe barrier is installed for all wet well instruments.

HVAC:
Not applicable.

Security Measures:
The electrical panels and wet well are situated in a residential area with standard door padlock. No security issues were noted.

Emergency Procedures:
Pump Station : If main power is lost, the City can either 1) connect a gas powered mobile emergency generator to power the pump station, or 2) use the City's vac truck to empty the pump station wet well daily or as-needed. The pump station serves fewer than 5 houses on Marsh Lane and has substantial wet well capacity to accommodate short term power outages. Per NHDES regulations, the City is allowed to utilize wet well storage with an emergency generator receptacle for sewage pumping stations with a capacity of 100-GPM or less.

Force Main Bypass: The City would rely on a vacuum truck if the force main required bypassing.

Summary of Previous Reports
The 201 Facilities Plan Update (Underwood Engineers, 1999) identified several issues which were addressed with the pump station upgrade in 2004.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	Grease mitigated significantly by tri-annual cleaning
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Mill Pond Way (Dearborn Extension)

Last Update: 7/17/2018 *By:* MAC

This Update: *By:*

General Pump Station Information	
Location:	131 Mill Pond
Pump Station Finished Floor Elevation, ft.:	11.8
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	1.4
Year Constructed/Upgraded:	Constructed: 1985 Pumps and Control Panel: 2011
Station Type:	Flygt Submersible grinder pumps
Wet Well Diameter, ft:	6
Wet Well Volume, gal/ft	211
No. of Pumps:	2
Pump Installation Date:	Installed 2009, rebuilt 2017
Design Operating Point, 1 Pump	
Flow, gpm:	55
Total Dynamic head, ft.:	40
Pump Make/Model:	ITT-FLYGT M3068
Motor Size, HP:	2.3
Motor/Pump Speed, rpm:	Motor: 3,325
Electrical Service, V/Ph/Hz:	230/1/60
Drive Type:	Direct Drive, Constant Speed
Seal Make & Type:	Double mechanical
Force Main Diam., in.:	2
Force Main Velocity, feet per sec.:	2.5
Force Main Type:	PVC
Force Main Age:	1985
Force Main Length, ft.:	581

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPD	1423.0	1459.0

Pump Performance Testing Results	
Date of Test:	29-Apr-18
Min./Max. VFD Setpoints (Hz)	N/A - Full Speed
VFD Speed (Hz)	N/A - Constant Speed
Pump RPM	
Drawdown Flow, gpm:	P1 = 24, P2 = 25
Drawdown TDH, ft:	N/A
Influent Pump Station Flow @ Test	Estimate during visit, < 5 gpm
Note for Pump Start Type	Constant speed

Generator Information	
Make/Model:	N/A
Interior/Exterior:	N/A
Gen. Installation Date	N/A
Size, KW:	N/A
Fuel Type:	Portable generator connection

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Mill Pond Way (Dearborn Extension)

Last Update: 7/17/2018 *By:* MAC
This Update: *By:*

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If Lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Combined motor starter and control panel
Installation Date:	2009
Control Type:	PLC Based
Location:	Inside a common electrical cabinet
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Motor starters in combined panel

Mechanical					
Heating:	Enclosure		Ventilation:		Enclosure
Type:	Small electric cabinet heater			System	Electric exhaust fan
Size, kW:	Unk.	Quantity: -		Size:	Unk.
Make/Model:	Unk.			Make & Model:	Unk.
Odor Control :	None		Ventilation:		-
City Water Supply:	None			Exhaust Fan:	-
				L&D:	-

Energy Efficiency Information
Based on an assumed pump model, the submersible grinder pumps operate at < 25% efficient due to the small pump size and the type of grinder impeller utilized. Due to the low HP requirements of this station, this pump efficiency is considered to be typical for this type of pump and is not considered detrimental to pump station operation.

Condition of Equipment/Identified Issues
Capacity: Capacity assessment via drawdown testing on 3/29/18 indicated the pumps have the following capacities: P1 - 24 gpm and P2 - 25 gpm. These pump are operating below their design operating point of 55 gpm. With both pumps operating at a similar reduced capacity, it is possible that the forcemain may be restricted,. The station appears to have adequate capacity to handle existing flows even with a reduced pumping capacity, as each pump only runs for about 1 hour per day on average. Under peak conditions, both pumps may run as much as 11 hours per day.
Exterior Site: The station is situated in a grassed lot within a residential neighborhood. The pump station lot is adjacent to North Mill Pond, a tributary pond. The wet well hatch is protected by two light-duty bollards. No issues were noted at the pump station exterior site.
Building Structures (if applicable): Not applicable.
Wet Well: The wet well was observed to be in good condition due to tri- yearly cleaning. The wet well hatch was observed to be in good condition, but did not have a safety net/hatch grating. The PVC piping and pump check valves were in good condition. There was mild grease accumulation on the wet well. The wet well is vented with a 3-inch galvanized vent routed adjacent to wet well.
Dry Well (if applicable): Not applicable.
Valve Pit (if applicable): The submersible station does not currently have a valve pit. The submersible pumps have PVC check valves installed within the wet well. The original pump station design included buried isolation valves for each pump, in addition to a force main bypass/flushing connection with buried isolation valves. The valve boxes were observed during the site visit, but the City could not confirm the condition/operability of the buried valves.
Electrical/Instrumentation: The electrical service to the service panel is an underground conduit from a nearby utility pole. The main electrical enclosure and equipment (breaker box, manual transfer switch, disconnects, etc.) date back to the original pump station construction and are showing signs of age. It is recommended the main electrical distribution enclosure and all associated components be scheduled for replacement within the next 5-7 years to remain reliable.
HVAC: Not applicable.
Security Measures: The panel and wet well are situated in a gated area with standard door padlocks. No security issues were noted.

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Mill Pond Way (Dearborn Extension)

Last Update: 7/17/2018 *By:* MAC
This Update: *By:*

Portsmouth Coastal Resilience Initiative Report:

Emergency Procedures:

Pump Station : If main power is lost, the City can either 1) connect a gas powered mobile emergency generator to power the pump station, or 2) use the City's vac truck to empty the pump station wet well daily or as-needed. The pump station has substantial wet well capacity to accommodate short term power outages. Per NHDES regulations, the City is allowed to utilize wet well storage with an emergency generator receptacle for sewage pumping stations with a capacity of 100-GPM or less.

Force Main Bypass: The City would rely on a vacuum truck if the force main required bypassing.

Summary of Previous Reports

The 201 Facilities Plan Update (Underwood Engineers, 1999) identified potential long pump run times due to I/I experienced by the sewershed.

Other:

Miscellaneous Issues:

Grease Accumulation?	Yes	Source:	Minor residential grease
Clogging Issues?	Yes	Describe:	Minor, hair and dental floss issues
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Northwest Street

Last Update: 7/17/2018 *By:* MAC

This Update: *By:*

General Pump Station Information	
Location:	221 Northwest Street
Pump Station Finished Floor Elevation, ft.:	11
Coastal Resiliency Flood Elevation (2050 High Emissions), ft:	13.5
Distance from WWTF (straightline), miles:	1.4
Year Constructed/Upgraded:	Constructed: 1985 Pump and Control Panel Upgrade: 2012
Station Type:	Flygt Submersible grinder pumps
Wet Well Diameter, ft:	6
Wet Well Volume, gal/ft	211
No. of Pumps:	2
Pump Installation Date:	2012
Design Operating Point, 1 Pump	
Flow, gpm:	55
Total Dynamic head, ft.:	40
Pump Make/Model:	ITT-FLYGT M3068
Motor Size, HP:	2.3
Motor/Pump Speed, rpm:	Motor: 3,325
Electrical Service, V/Ph/Hz:	230/1/60
Drive Type:	Direct drive, constant speed
Seal Make & Type:	Double mechanical
Force Main Diam., in.:	2.5
Force Main Velocity, feet per sec.:	3.2
Force Main Type:	PVC
Force Main Age:	1985
Force Main Length, ft.:	711

Pump Flow and Run Time Information		
	P1	*P2*
Pump Runtime Data	Yes	Yes
Data Start Date	12/1/2014	12/1/2014
Data End Date	10/31/2017	10/31/2017
Annual Average Flow, GPD (Calculated)	912	575

Pump Performance Testing Results	
Date of Test:	29-Mar-18
Min./Max. VFD Setpoints (Hz)	N/A - Full Speed
VFD Speed (Hz)	N/A - Constant Speed
Pump RPM	
Drawdown Flow, gpm:	P1 - 55, P2 - 43
Drawdown TDH, ft:	N/A
Influent Pump Station Flow @ Test	Estimate during visit, < 5 gpm
Note for Pump Start Type	Constant speed

Generator Information	
Make/Model:	N/A
Interior/Exterior:	N/A
Gen. Installation Date	N/A
Size, KW:	N/A
Fuel Type:	Portable generator connection within electrical enclosure

Controls Information	
Pump Control Sequence:	Controls start and stop the pumps in an alternating Lead/ Lag sequence based on wet well level setpoints. If lead pump fails to start, Lag pump starts. If level rises above Lag start both will run.
Pump Control Panel:	Combined Control and Power Panel (Electrical Installation, Inc)
Installation Date:	2011
Control Type:	PLC Based
Location:	Exterior enclosure adjacent to wet well
SCADA Connectivity:	Yes, microwave RTU
Level & Alarm Controls:	PLC Based Control Panel (2011)
Type:	Submersible transducer (primary), differential level floats (secondary)
Backup Alarm	High-high, low-low level floats
Flow Meter Make/Model:	Not installed
Alarm Transmission:	All pump station alarms transferred via radio (existing) to WWTF SCADA, equipment in place to transition to microwave
Pump Motor Starters :	Square D motor starters within the Control Panel (2011)

City of Portsmouth, New Hampshire
SUBMERSIBLE Pump Station Evaluation
Northwest Street

Last Update: 7/17/2018 *By:* MAC
This Update: *By:*

Mechanical					
Heating:			Ventilation:		Control Panel exhaust
Type:	Small portable unit heater in Panel enclosure			System	Electric exhaust fan
Size, kW:	Unk.	Quantity: 1		Size:	Unk.
Make/Model:	Unk.			Make & Model:	Unk.
Odor Control :	None		Ventilation:		-
City Water Supply:	None			Exhaust Fan:	-
				L&D:	-

Energy Efficiency Information

Based on assumed pump model, the submersible grinder pumps operate at < 25% efficiency due to the small pump size and the type of grinder impeller utilized. Due to the low HP requirements of this station, this pump efficiency is considered to be typical for this type of pump and is not considered detrimental to pump station operation.

Condition of Equipment/Identified Issues

Capacity:
Capacity assessment via drawdown testing on 3/29/18 indicated that the pumps have the following capacities: P1 - 55 gpm and P2 - 42 gpm. These pump are operating near the design operating point of 55 gpm. The station appears to have adequate capacity to handle existing flows with each pump only operating for about 0.25 hours per day on average. Under peak conditions, both pumps may run as much as 2 hours per day.

Exterior Site:
The pump station is located in a gated area at the end of a dead end street. The City has gated in the pump station to combat dog waste.

Building Structures (if applicable):
Not applicable

Wet Well:
The wet well appears to be in good condition due to tri- yearly cleaning. The wet well hatch was observed to be in good condition but does not have a safety net/hatch grating. The original ductile iron pump discharge piping has been replaced with flanged PVC piping, including check valves located within the wet well. No isolation valves were observed.

Dry Well (if applicable): Not applicable.

Valve Pit (if applicable): The submersible station does not currently have a valve pit. The submersible pumps have PVC check valves installed within the wet well. Record drawings from the original pump station design indicate the pump station was formerly equipped with buried isolation valves and a force main bypass located adjacent to the wet well. These features appear to have since been abandoned. Isolation valves are recommended to be installed with in a new valve pit, buried valves, or within the wet well itself.

Electrical/Instrumentation:
The electrical service to the pump station was recently replaced after breaking. The new service is an underground conduit from a nearby utility pole. Overhead electrical lines will be removed once this upgrade is complete. The main electrical enclosure and equipment (breaker box, manual transfer switch, disconnects, etc.) date back to the original pump station construction and are showing signs of age. It is recommended the main electrical distribution enclosure and all associated components be scheduled for replacement within the next 5-7 years to remain reliable.

HVAC:
The combined control and power panel was reported to get hot in the summertime. The City has installed a small, battery powered exhaust fan in an effort to mitigate heat issues within the panel.

Security Measures:
The panels and wet well are situated in a gated area with standard door padlocks. No security issues were noted.

Emergency Procedures:
Pump Station : If main power is lost, the City can either 1) connect a gas powered mobile emergency generator to power the pump station, or 2) use the City's vac truck to empty the pump station wet well daily or as-needed. The pump station serves fewer than 5 houses on Northwest Street and has substantial wet well capacity to accommodate short term power outages. Per NHDES regulations, the City is allowed to utilize wet well storage with an emergency generator receptacle for sewage pumping stations with a capacity of 100-GPM or less.

Force Main Bypass: The City would rely on a vacuum truck if the force main required bypassing.

Summary of Previous Reports
The 201 Facilities Plan Update (Underwood Engineers, 1999) identified no issues with the pump station.

Other:

Miscellaneous Issues:

Grease Accumulation?	No	Source:	
Clogging Issues?	No	Describe:	
Nuisance Odors?	No	Cause:	
Concrete Corrosion?	No	Location:	

B

WRIGHT-PIERCE
Engineering a Better Environment

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Revision 1
Date 2/11/2019

RECOMMENDED FACILITIES IMPROVEMENT PLAN COSTS - BY YEAR (20% CONTINGENCY, 20% DESIGN)

		Year 0 2019	Year 1 2020	Year 2 2021	Year 3 2022	Year 4 2023	Year 5 2024	Year 6 2025	Year 7 2026	Year 8 2027	Year 9 2028	Year 10 2029	TOTAL
1	**Mechanic St PS**	$484,600	$8,600	$0	$14,400,000	$0	$0	$0	$0	$0	$0	$0	$14,893,200
2	**Deer Street PS**	$98,600	$385,200	$23,000	$53,300	$0	$0	$32,400	$100,800	$25,900	$1,400	$496,800	$1,217,400
3	**Lafayette Street PS**	-	-	-	-	-	-	-	-	-	-	-	-
4	**Heritage Street PS**	-	-	-	-	-	-	-	-	-	-	-	-
5	**Gosling Road PS**	$14,400	$3,600	$0	$41,000	$0	$118,800	$0	$50,400	$0	$0	$21,600	
6	**Ryeline PS**	$16,600	$0	$5,000	$28,800	$14,400	$85,700	$0	$0	$0	$115,200	$223,200	$488,900
7	**Constitution Ave PS**	$15,100	$21,600	$28,800	$115,900	$0	$144,000	$37,400	$0	$0	$0	$0	$362,800
8	**West Road PS**	$19,400	$2,900	$7,200	$112,300	$136,100	$149,800	$37,400	$0	$0	$0	$0	$465,100
9	**Woodlands I PS**	$28,100	$25,200	$0	$127,400	$86,400	$144,000	$28,800	$0	$0	$0	$0	$439,900
10	**Woodlands II PS**	$19,400	$2,900	$0	$28,100	$17,300	$144,000	$36,000	$0	$0	$0	$0	$247,700
11	**Atlantic Heights PS**	$49,700	$2,900	$28,800	$257,800	$0	$86,400	$1,400	$0	$0	$0	$0	$427,000
12	**Marcy Street PS**	$67,100	$8,600	$14,400	$213,800	$0	$70,600	$0	$0	$0	$0	$14,400	$388,900
13	**Corporate Drive PS**	$0	$2,900	$0	$3,600	$1,400	$21,600	$0	$14,400	$0	$0	$0	$43,900
14	**Griffin Park PS**	$20,200	$23,800	$0	$17,300	$28,800	$0	$169,900	$0	$0	$108,000	$0	$368,000
15	**Tuckers Cove PS**	$21,600	$14,400	$0	$0	$10,800	$0	$15,800	$21,600	$0	$0	$0	$84,200
16	**Leslie Drive PS**	$53,300	$20,600	$64,800	$265,700	$0	$28,800	$23,000	$0	$0	$0	$0	$456,200
17	**Clough Drive PS**	$9,800	$1,400	$7,200	$11,500	$26,600	$0	$0	$0	$0	$0	$0	$56,500
18	**Marsh Lane PS**	$3,600	$4,300	$0	$69,100	$0	$0	$0	$21,600	$0	$0	$0	$98,600
19	**Mill Pond Way PS**	$3,600	$7,200	$0	$11,500	$0	$64,800	$0	$0	$0	$0	$0	$87,100
20	**North West Road PS**	$3,600	$8,600	$0	$69,100	$0	$0	$0	$21,600	$0	$0	$0	$102,900
TOTAL		**$928,700**	**$544,700**	**$179,200**	**$15,826,200**	**$321,800**	**$1,058,500**	**$382,100**	**$230,400**	**$25,900**	**$224,600**	**$756,000**	**$20,478,100**

CITY OF PORTSMOUTH, NEW HAMPSHIRE

Pump Station Recommended Facilities Improvement Plan

Mechanic Street Pump Station

Updated 11/8/2018

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
General Improvements																				
	1	Operate dry well roof exhaust fan continuously to maintain proper ventilation rates for NFPA 820.	Interior, Dry Well	-	-	-	-	High	2018											
Civil Improvements																				
	1	Install industrial bollards surrounding exterior oil fuel tank	Exterior	$1,000	LS	4	$4,000	Medium	-											
	2	Fasten fuel oil tank to foundation	Exterior	$500	LS	1	$500	High	2019	$500										
	3	Evaluate estimated oil storage requirements for standby generator (48 hours peak, 96 hours normal)	Exterior	-	-	-	-	High	2019	-										
Architectural / Structural Improvements																				
	1	Resurface damaged dry well floor section at ground level	Interior, Control Room	$1,000	LS	1	$1,000	High	2020		$1,000									
	2	Install a toeplate on the stairwell grating platform guard	Interior, Control Room	$500	LS	1	***$500***	Medium	-											
	3	Monitor steel beam corrosion that supports grating on the mezzanine in the dry well. Sandblast/paint steel beams recommended if corrosion worsens	Dry Well Mezzanine	$3,000	LS	1	***$3,000***	Medium	-											
	4	Replace the stair side guard with a guard confirming with OSHA requirements.	Dry Well Mezzanine	$2,500	LS	1	***$2,500***	Medium	-											
	4	Resurface concrete slab overhead	Dry Well Mezzanine	$500	LS	1	***$500***	Medium	-											
	5	Repair and sandblast dry well/wet well piping penetrations	Wet Well	$5,000	LS	1	$5,000	High	2020		$5,000									
	6	Repair wet well cracked and spalled beams immediately	Wet Well	$7,500	LS	1	$7,500	High	2019	$7,500										
	7	Sandblast and repaint steel columns in wet well	Wet Well	$4,000	LS	1	$4,000	Medium	-											
	8	Replace broken stair nosings in wet well	Wet Well	$1,000	LS	1	$1,000	High	2019	$1,000										
	9	Pressure wash and repair all concrete channel degraded surfaces in wet well	Wet Well	$7,500	LS	1	***$7,500***	Medium	-											
	10	Install aluminum plate over open channels	Wet Well	$5,000	LS	1	***$5,000***	Low	-											
Mechanical Improvements																				
	1	If the existing rooftop unit is not operated continuously due to noise, a complete HVAC upgrade is recommended, including new supply fans, indoor air handling unit, and satellite ductless split AC systems. See Mechanical memo regarding discussion.	Roof/Control Room	$150,000	LS	1	$150,000	High	2019	$150,000										
	2	Replace Electric XP Unit Heater in wet well	Wet Well	$5,000	LS	1	$5,000	Low	-											
Process Improvements																				
	1	Complete Pump Station Upgrade	-	$10,000,000		1	$10,000,000	High	2022				$10,000,000							
	2	Pump Replacement	Dry Well	See Item 1	-	-	-	High	-											
	3	Replace suction/discharge piping	Dry Well	See Item 1	-	-	-	High	-											
	4	Complete a comprehensive dry well pipe thickness testing evaluation	Dry Well	$15,000	LS	1	$15,000	High	2019	$15,000										
	5	Replace faulty pump discharge check valve	Wet Well	See Item 1	LS	1	***$20,000***	High	-											
Electrical/Instrumentation Improvements																				
	1	VFD Replacement (planning)	Dry Well	$150,000	LS	1	$150,000	High	2019	$150,000										
	2	Label all equipment required to have arc-flash safety ratings	Dry Well	$2,500	LS	1	$2,500	High	2019	$2,500										
	3	Repair, upgrade, install emergency lighting in the dry well and wet well	Dry Well/Wet Well	$10,000	LS	1	$10,000	High	2019	$10,000										
	4	Replace transformer, primary and secondary feeders (pending major upgrade)	Exterior	$100,000	LS	1	***$100,000***	Low	-											
	5	Upgrade Control Panel PLC (SLC 5/05 obsolete, pending major upgrade)	Interior	$7,500	LS	1	***$7,500***	Low	-											
	6	Upgrade PLC to redundant PLCs (pending major upgrade)	Interior	$25,000	LS	1	***$25,000***	Low	-											

***Bold italicized prices are included within the $10,000,000 Complete PS Upgrade**

High Priority Projects	$10,362,500
Medium Priority Projects	$22,000
Low Priority Projects	$142,500

Subtotal		$10,527,000		$336,500	$6,000	$0	$10,000,000	$0	$0	$0	$0	$0	$0	$0	$0
Contingencies	20%	$2,105,400		$67,300	$1,200	$0	$2,000,000	$0	$0	$0	$0	$0	$0	$0	$0
Estimated Construction Cost		$12,632,400		$403,800	$7,200	$0	$12,000,000	$0	$0	$0	$0	$0	$0	$0	$0
Engineering and Administrative Allowance		$2,526,500		$80,800	$1,400	$0	$2,400,000	$0	$0	$0	$0	$0	$0	$0	$0
Estimated Total Project Cost		**$15,158,900**		**$484,600**	**$8,600**	**$0**	**$14,400,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Deer Street Pump Station
Updated 10/10/2018

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Modify Generator Room Egress Door Louvers to allow for adequate egress clearance	Generator Room	$20,000	LS	1	$20,000	High	2020		$20,000									
	2	Provide 1-hour fire rating for Emergency Generator room per NFPA 37	Generator Room	$40,000	LS	1	$40,000	High	2020		$40,000									
	3	Install missing toeplate on stairwell guard	Dry Well	$500	LS	1	$500	Low	2022				$500							
	4	Repair stair nosing and concrete in dry well	Dry Well	$1,500	LS	1	$1,500	Low	2022				$1,500							
	5	Repair foundation crack in Generator room slab	Generator Room	$1,000	LS	1	$1,000	Medium	2021			$1,000								
	6	Evaluate repair/reinforcement of Odor Control Unit structural supports	Wet Well	$10,000	LS	1	$10,000	High	2019	$10,000										
	7	Resurface the ground floor slab in wet well	Wet Well	$5,000	LS	1	$5,000	Low	2020		$5,000									
	8	Replace the aluminum stair in wet well	Wet Well	$15,000	LS	1	$15,000	Medium	2025							$15,000				
Mechanical Improvements																				
	1	Install exhaust fan and louver for space to meet NFPA 820 classification requirements	Electric/Pump Room	$35,000	LS	1	$35,000	High	2019	$35,000										
	2	Add Fire Dampers to all ductwork that penetrates Emergency Generator Room	Generator Room	$10,000	LS	1	$10,000	High	2019	$10,000										
	3	Replace exterior refrigerant piping insulation	Exterior	$1,500	LS	1	$1,500	Low	2020		$1,500									
	5	Install replacement Emergency Generator louvers (See Arch Line item in addition)	Generator Room	$10,000	LS	1	$10,000	High	2019	$10,000										
	6	Replace supply fan insulation	Wet well	$500	LS	1	$500	Medium	2020		$500									
	7	Add air admittance valve to utility sink	Dry well	$500	LS	1	$500	Medium	2020		$500									
	9	Replace water heater	Dry well	$1,000	LS	1	$1,000	Low	2028										$1,000	
	10	Replace condensing unit	Exterior	$15,000	LS	1	$15,000	Low	2022				$15,000							
	11	Replace gas fired duct furnace	Attic space	$7,500	LS	1	$7,500	Low	2025							$7,500				
	12	Replace air handling unit	Attic space	$18,000	LS	1	$18,000	Low	2027										$18,000	
Process Improvements																				
	1	Replace grinder cutter stack	Wet Well	$15,000	LS	1	$15,000	Medium	2021			$15,000								
	2	Replace grinder	Wet Well	$70,000	LS	1	$70,000	Low	2026								$70,000			
	3	Pump Rehabilitation/Replacement (planning)	Wet Well	$115,000	EA	3	$345,000	Low	2029											$345,000
	4	Replace force main isolation valves (two buried gate valves)	Exterior	$200,000	LS	1	$200,000	High	2020		$200,000									
Electrical/Instrumentation Improvements																				
	1	Upgrade Control Panel PLC components (SLC 505)	Control Room	$20,000	LS	1	$20,000	Low	2022				$20,000							
	2	Install a horn within the pump station to alert occupants of unsafe atmosphere	Interior	$2,500	LS	1	$2,500	Medium	2019	$2,500										
	3	Provide arc-flash safety labeling	Interior	$1,000	LS	1	$1,000	High	2019	$1,000										
	4	Monitor transformer corrosion	Exterior	-	-	-	-	Medium	2020		-									

High Priority Projects	$326,000
Medium Priority Projects	$34,500
Low Priority Projects	$485,000

Subtotal		$845,500	$68,500	$267,500	$16,000	$37,000	$0	$0	$22,500	$70,000	$18,000	$1,000	$345,000		
Contingencies	20%	$169,100	$13,700	$53,500	$3,200	$7,400	$0	$0	$4,500	$14,000	$3,600	$200	$69,000		
Estimated Construction Cost		$1,014,600	$82,200	$321,000	$19,200	$44,400	$0	$0	$27,000	$84,000	$21,600	$1,200	$414,000		
Engineering and Administrative Allowance		$202,900	$16,400	$64,200	$3,800	$8,900	$0	$0	$5,400	$16,800	$4,300	$200	$82,800		
Estimated Total Project Cost		**$1,217,500**	**$98,600**	**$385,200**	**$23,000**	**$53,300**	**$0**	**$0**	**$32,400**	**$100,800**	**$25,900**	**$1,400**	**$496,800**		

CITY OF PORTSMOUTH, NEW HAMPSHIRE

Pump Station Recommended Facilities Improvement Plan

Gosling Road

Updated 10/10/2018

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Sandblast/paint exterior monorail	Exterior	$2,500	EA	1	$2,500	Medium	2020		$2,500									
	2	Roof replacement	Exterior	$15,000	EA	1	$15,000	Low	2029											$15,000
	3	Install wet well channel grating where missing	Interior	$3,500	EA	1	$3,500	High	2022				$3,500							
Mechanical Improvements																				
	1	Install split-duct AC unit for dry well	Dry Well	$15,000	EA	1	$15,000	Low	2022				$15,000							
Process Improvements																				
	1	Replace cutter stack in influent grinder	Wet Well	$10,000	EA	1	$10,000	Medium	2022				$10,000							
	2	Replace influent grinder	Wet Well	$35,000	EA	1	$35,000	Low	2026								$35,000			
	3	Pump rehabilitation/replacement (planning)	Dry Well	$30,000	EA	2	$60,000	Medium	2024						$60,000					
Electrical/instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Dry Well	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Repair hazardous gas detection system in dry well	Dry Well	$2,500	LS	1	$2,500	High	2019	$2,500										
	3	Control Panel Upgrade	Dry Well	$15,000	LS	1	$15,000	Medium	2024						$15,000					
	4	Magnetic Flow Meter Replacement	Dry Well	$7,500	LS	1	$7,500	Medium	2024						$7,500					
	5	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										

High Priority Projects	$13,500
Medium Priority Projects	$95,000
Low Priority Projects	$65,000

Subtotal	$173,500	$10,000	$2,500	$0	$28,500	$0	$82,500	$0	$35,000	$0	$0	$15,000
Contingencies (20%)	$34,700	$2,000	$500	$0	$5,700	$0	$16,500	$0	$7,000	$0	$0	$3,000
Estimated Construction Cost	$208,200	$12,000	$3,000	$0	$34,200	$0	$99,000	$0	$42,000	$0	$0	$18,000
Engineering and Administrative Allowance	$41,600	$2,400	$600	$0	$6,800	$0	$19,800	$0	$8,400	$0	$0	$3,600
Estimated Total Project Cost	**$249,800**	**$14,400**	**$3,600**	**$0**	**$41,000**	**$0**	**$118,800**	**$0**	**$50,400**	**$0**	**$0**	**$21,600**

CITY OF PORTSMOUTH, NEW HAMPSHIRE

Pump Station Recommended Facilities Improvement Plan

Ryeline

Updated 10/29/2018

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	disconnected for entrance into this vault.	Dry Well	-	-	-	-	High	2019	-										
	2	Evaluate relocation of the emergency generator to an exterior location for next significant upgrade	Dry Well	$80,000	EA	1	$ 80,000	Low	2028										$80,000	
	3	Spot repair tnemec coating failed areas in wet well (optional)	Wet Well	$5,000	EA	1	$5,000	Low	2022				$5,000							
	4	Add toe plates to aluminum stair handrails.	Dry Well & Wet Well	$1,000	EA	1	$1,000	Medium	2021			$1,000								
	5	Install rigid handrail guard on elevated wet well platform to replace safety chain	Wet Well	$2,000	EA	1	$2,500	Medium	2021			$2,500								
Mechanical Improvements																				
	1	Repair existing AUTO ventilation controls for SF-1	Dry Well	$1,500	EA	1	$1,500	High	2019	$1,500										
	2	Install dedicated air intake in wet well	Wet Well	$7,500	EA	1	$7,500	Medium	2019	$7,500										
	3	HVAC Upgrade to address lack of ventilation and NFPA Code compliance	Dry Well	$35,000	EA	1	$35,000	Medium	2024						$35,000					
	4	Provide ventilated thimble penetration for emergency generator exhaust	Dry Well	$3,000	EA	1	$3,000	Medium	2024						$3,000					
	5	Insulate emergency generator exhaust piping	Dry Well	$1,500	EA	1	$1,500	Medium	2024						$1,500					
	6	Install split AC unit for dry well side cooling	Dry Well	$20,000	EA	1	$20,000	Low	2024						$20,000					
Process Improvements																				
	1	Replace wet well divider sluice gate	Wet Well	$10,000	EA	1	$10,000	Medium	2022				$10,000							
	2	Replace cutter stack in influent grinder	Wet Well	$5,000	EA	1	$5,000	Medium	2022				$5,000							
	3	Replace influent grinder	Wet Well	$30,000	EA	1	$30,000	Low	2029											$30,000
	4	Pump Impeller Replacement	Dry Well	$5,000	EA	2	$10,000	Low	2023					$10,000						
	5	Pump rehabilitation/replacement (planning)	Dry Well	$25,000	EA	2	$50,000	Low	2029											$50,000
Electrical Improvements																				
	1	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	2	Electrical Equipment Upgrade - Planning (MCC, VFDs, Control Panel)	Dry Well	$75,000	EA	1	$75,000	Low	2029											$75,000

High Priority Projects	$4,000
Medium Priority Projects	$65,500
Low Priority Projects	$270,000

Subtotal	$339,500	$11,500	$0	$3,500	$20,000	$10,000	$59,500	$0	$0	$0	$80,000	$155,000
Contingencies (20%)	$67,900	$2,300	$0	$700	$4,000	$2,000	$11,900	$0	$0	$0	$16,000	$31,000
Estimated Construction Cost	$407,400	$13,800	$0	$4,200	$24,000	$12,000	$71,400	$0	$0	$0	$96,000	$186,000
Engineering and Administrative Allowance	$81,500	$2,800	$0	$800	$4,800	$2,400	$14,300	$0	$0	$0	$19,200	$37,200
Estimated Total Project Cost	**$488,900**	**$16,600**	**$0**	**$5,000**	**$28,800**	**$14,400**	**$85,700**	**$0**	**$0**	**$0**	**$115,200**	**$223,200**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvements Plan
Constitution Avenue
Updated **11/14/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Investigate inflow and infiltration sources in the sewershed	-	-	-	-		Low												
	2	Conduct CCTV survey of force main to confirm condition	Pump Room	$5,000	LS	1	$5,000	Medium	2021			$5,000								
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	EVALUATE BUILDING REPLACEMENT OR CONVERSION TO SUBMERSIBLE STATION (7-10 years)	-	-	-	-	-	Medium	2025							-				
	2	Pressure inject emergency generator exhaust crack	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	3	Seal conduit penetrations to wet well	Wet Well	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Seal pump station dry well penetrations permanently	Pump Room	$500	LS	1	$500	High	2019	$500										
	5	Replace roof with higher slope and adequate roof drainage	Wet Well	$10,000	LS	1	$10,000	Low	2025							$10,000				
	6	Door Hardware Replacement	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	7	Interior surface refinishing	Pump Room	$5,000	LS	1	$5,000	Medium	2020		$5,000									
Mechanical Improvements																				
	1	Install mechanism to hold door open while pump station is occupied.	Pump Room	$1,000	LS	1	$1,000	High	2019	$1,000										
	2	Insulate emergency generator exhaust piping	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	3	Replace emergency generator exhaust through the wall with a ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Replace the water service entrance piping insulation	Pump Room	$1,000	LS	1	$1,000	Low	2022				$1,000							
	5	Add a small dehumidifier to remove excess humidity	Pump Room	$1,500	LS	1	$1,500	Low	2022				$1,500							
	6	Add a split AC unit for summertime interior heat	Pump Room	$5,000	LS	1	$5,000	Medium	2020		$5,000									
							$0													
Process Improvements																				
	1	Replace wet well discharge piping	Wet Well	$5,000	LS	1	$5,000	Medium	2021			$5,000								
	2	Pump Motor Replacement (planning)	Pump Room	$5,000	LS	2	$10,000	Medium	2021			$10,000								
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Comprehensive Electrical Upgrade	Pump Room	$100,000	LS	1	$100,000	Medium	2024						$100,000					
	4	Emergency Generator and ATS Upgrade	Pump Room	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	8	Install an intrinsically safe barrier for submersible transducer	Exterior	$3,000	LS	1	$3,000	Medium	2022				$3,000							
	7	Ground the antennae mast	Exterior	$500	LS	2	$1,000	High	2019	$1,000										
	8	Install wet well seal instrument bypass seal-offs	Exterior	$1,000	LS	1	$1,000	Low	2025							$1,000				
	8	Control Panel/Pump Starter Replacement	Exterior	$15,000	LS	1	$15,000	Low	2025							$15,000				
	11	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										

High Priority Projects	$10,500
Medium Priority Projects	$213,000
Low Priority Projects	$28,500

Subtotal	$252,000	$10,500	$15,000	$20,000	$80,500	$0	$100,000	$26,000	$0	$0	$0	$0
Contingencies (20%)	$50,400	$2,100	$3,000	$4,000	$16,100	$0	$20,000	$5,200	$0	$0	$0	$0
Estimated Construction Cost	$302,400	$12,600	$18,000	$24,000	$96,600	$0	$120,000	$31,200	$0	$0	$0	$0
Engineering and Administrative Allowance	$60,500	$2,500	$3,600	$4,800	$19,300	$0	$24,000	$6,200	$0	$0	$0	$0
Estimated Total Project Cost	**$362,900**	**$15,100**	**$21,600**	**$28,800**	**$115,900**	**$0**	**$144,000**	**$37,400**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
West Road
Updated **11/14/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Conduct CCTV survey of force main to confirm condition	Pump Room	$5,000	LS	1	$5,000	Medium	2021			$5,000								
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	EVALUATE BUILDING REPLACEMENT OR CONVERSION TO SUBMERSIBLE STATION (5-10 years)	-	-	-	-	-	Medium	2025							-			
	2	Replace entrance door/frame	Exterior	$3,000	LS	1	$3,000	Low	2023					$3,000						
	3	Re-grout pump station exterior seams	Exterior	$1,500	LS	1	$1,500	Low	2023					$1,500						
	4	Seal pump station dry well penetrations permanently	Pump Room	$500	LS	1	$500	High	2019	$500										
	5	Replace roof with higher slope and adequate roof drainage	Wet Well	$10,000	LS	1	$10,000	Medium	2023					$10,000						
	6	Refinish interior floor	Pump Room	$5,000	LS	1	$5,000	Low	2025							$5,000				
Mechanical Improvements																				
	1	> 5 ft from any louver or air intake	Pump Room	$1,000	LS	1	$1,000	High	2019	$1,000										
	2	Replace/repair exterior emergency generator intake/exhaust louvers	Pump Room	$4,000	LS	1	$4,000	Medium	2024						$4,000					
	3	Install mechanism to hold door open while pump station is occupied	Exterior	$1,000	LS	1	$1,000	High	2019	$1,000										
	4	Replace insulation for emergency generator exhaust piping	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	5	Replace emergency generator exhaust through the wall with a ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	6	Insulate water service lines	Exterior	$1,500	LS	1	$1,500	Low	2022				$1,500							
	7	Add a small dehumidifier to remove excess humidity	Pump Room	$1,500	LS	1	$1,500	Low	2022				$1,500							
	8	Add a split AC unit for summertime interior heat	Pump Room	$5,000	LS	1	$5,000	Low	2025							$5,000				
Process Improvements																				
	1	Pump Replacement (including motors)	Pump Room	$30,000	EA	2	$60,000	Medium	2023					$60,000						
	2	Replace wet well suction/discharge piping	Wet Well	$10,000	LS	1	$10,000	Medium	2023					$10,000						
	3	Replace pump motors	Pump Room	$5,000	LS	2	$10,000	Medium	2023					$10,000						
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Comprehensive Electrical Upgrade	Pump Room	$100,000	LS	1	$100,000	Medium	2024						$100,000					
	4	Emergency Generator Upgrade	Pump Room	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	5	Confirm intrinsically safe barrier for submersible transducer	Exterior	$3,000	LS	1	$3,000	High	2019	$3,000										
	6	Install wet well seal instrument bypass seal-offs	Exterior	$1,000	LS	1	$1,000	Low	2025							$1,000				
	7	Control Panel/Pump Starter Replacement	Exterior	$15,000	LS	1	$15,000	Low	2025							$15,000				
	8	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										

High Priority Projects	$13,500
Medium Priority Projects	$276,000
Low Priority Projects	$33,500

Subtotal	$323,000	$13,500	$2,000	$5,000	$78,000	$94,500	$104,000	$26,000	$0	$0	$0	$0
Contingencies (20%)	$64,600	$2,700	$400	$1,000	$15,600	$18,900	$20,800	$5,200	$0	$0	$0	$0
Estimated Construction Cost	$387,600	$16,200	$2,400	$6,000	$93,600	$113,400	$124,800	$31,200	$0	$0	$0	$0
Engineering and Administrative Allowance	$77,500	$3,200	$500	$1,200	$18,700	$22,700	$25,000	$6,200	$0	$0	$0	$0
Estimated Total Project Cost	**$465,100**	**$19,400**	**$2,900**	**$7,200**	**$112,300**	**$136,100**	**$149,800**	**$37,400**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE

Pump Station Recommended Facilities Improvement Plan

Woodlands I

Updated **11/14/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Investigate inflow and infiltration sources in the sewershed	-	-	-	-		Low												
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	EVALUATE BUILDING REPLACEMENT OR CONVERSION TO SUBMERSIBLE STATION (5-10 years)	-	-	-	-	-	Medium	2025							-				
	2	Replace roof with higher slope EPDM roof	Exterior	$12,000	LS	1	$12,000	High	2020		$12,000									
	3	Repair exterior concrete pad degradation	Exterior	$2,000	LS	1	$2,000	Medium	2020		$2,000									
	4	Grout/seal exterior seams	Exterior	$2,500	LS	1	$2,500	High	2019	$2,500										
	5	Seal pump station dry well penetrations permanently	Pump Room	$500	LS	1	$500	High	2019	$500										
	6	Permanently seal off 12x12 building penetration	Exterior	$5,000	LS	1	$5,000	High	2019	$5,000										
Mechanical Improvements																				
	1	Install mechanism to hold door open while pump station is occupied.	Exterior	$1,000	LS	1	$1,000	High	2019	$1,000										
	2	Replace insulation for emergency generator exhaust piping	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	3	Replace emergency generator exhaust through the wall with a ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Replace the water service entrance piping insulation	Pump Room	$1,000	LS	1	$1,000	Low	2022				$1,000							
	5	Add a split AC unit for summertime interior heat	Pump Room	$5,000	LS	1	$5,000	Low	2025							$5,000				
Process Improvements																				
	1	Pump Replacement (including motors)	Pump Room	$30,000	EA	2	$60,000	Medium	2023					$60,000						
	2	Replace wet well suction/discharge piping	Wet Well	$10,000	LS	1	$10,000	Medium	2022				$10,000							
							$0													
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Move level float away from influent sewer	Wet Well	$1,500	LS	1	$1,500	Low	2020		$1,500									
	4	Replace ultrasonic with submersible transducer	Wet Well	$2,500	LS	1	$2,500	Low	2022				$2,500							
	5	Seal/close instrument conduit exterior LB into wet well	Wet Well	$2,500	LS	1	$2,500	High	2019	$2,500										
	6	Comprehensive Electrical Upgrade	Pump Room	$100,000	LS	1	$100,000	Medium	2024						$100,000					
	7	Emergency Generator and ATS Upgrade	Pump Room	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	8	Control Panel/Pump Starter Replacement	Exterior	$15,000	LS	1	$15,000	Low	2025							$15,000				
	9	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										

High Priority Projects	$31,500
Medium Priority Projects	$249,000
Low Priority Projects	$25,000

Subtotal	$305,500	$19,500	$17,500	$0	$88,500	$60,000	$100,000	$20,000	$0	$0	$0	$0
Contingencies (20%)	$61,100	$3,900	$3,500	$0	$17,700	$12,000	$20,000	$4,000	$0	$0	$0	$0
Estimated Construction Cost	$366,600	$23,400	$21,000	$0	$106,200	$72,000	$120,000	$24,000	$0	$0	$0	$0
Engineering and Administrative Allowance	$73,300	$4,700	$4,200	$0	$21,200	$14,400	$24,000	$4,800	$0	$0	$0	$0
Estimated Total Project Cost	**$439,900**	**$28,100**	**$25,200**	**$0**	**$127,400**	**$86,400**	**$144,000**	**$28,800**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Woodlands II
Updated **11/14/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
General Improvements																				
	1	Investigate inflow and infiltration sources in the sewershed	-	-	-	-		Low												
Civil Improvements																				
	1	Extend exterior fence to encompass entire pump station for security	Exterior	$10,000	LS	1	$10,000	Medium	2022				$10,000							
Architectural / Structural Improvements																				
	1	EVALUATE BUILDING REPLACEMENT OR CONVERSION TO SUBMERSIBLE STATION (5-10 years)	-	-	-	-	-	Medium	2025							-				
	2	Replace roof with higher slope roof with proper drainage	Exterior	$12,000	LS	1	$12,000	Low	2023					$12,000						
	3	Seal pump station dry well penetrations permanently	Pump Room	$500	LS	1	$500	High	2019	$500										
Mechanical Improvements																				
	1	Install mechanism to hold door open while pump station is occupied	Pump Room	$1,000	LS	1	$1,000	High	2019	$1,000										
	2	Replace insulation for emergency generator exhaust piping	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	3	Replace emergency generator exhaust through the wall with a ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Replace the water service entrance piping insulation	Pump Room	$1,000	LS	1	$1,000	Low	2022				$1,000							
	5	Add a split AC unit for summertime interior heat	Pump Room	$5,000	LS	1	$5,000	Low	2025							$5,000				
	6	to > 5 ft from any louver or air intake	Pump Room	$1,000	LS	1	$1,000	High	2019	$1,000										
Process Improvements																				
	1	Replace pump motor starters	Pump Room	$3,000	LS	2	$6,000	Medium	2022				$6,000							
	2	Replace pump suction piping in wet well	Wet Well	$5,000	LS	1	$5,000	Low	2025							$5,000				
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Replace ultrasonic with submersible transducer	Wet Well	$2,500	LS	1	$2,500	Low	2022				$2,500							
	4	Level instruments to be installed with intrinsically safe methods	Wet Well	$3,000	LS	1	$3,000	High	2019	$3,000										
	5	Comprehensive Electrical Upgrade	Pump Room	$100,000	LS	1	$100,000	Medium	2024						$100,000					
	6	Control Panel/Pump Starter Replacement	Exterior	$15,000	LS	1	$15,000	Low	2025							$15,000				
	7	Install utility power bypass circuit for UPS	Controls	$2,500	LS	1	$2,500	High	2019	$2,500										

High Priority Projects	$13,500
Medium Priority Projects	$118,000
Low Priority Projects	$40,500

		2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
Subtotal	$172,000	$13,500	$2,000	$0	$19,500	$12,000	$100,000	$25,000	$0	$0	$0	$0
Contingencies (20%)	$34,400	$2,700	$400	$0	$3,900	$2,400	$20,000	$5,000	$0	$0	$0	$0
Estimated Construction Cost	$206,400	$16,200	$2,400	$0	$23,400	$14,400	$120,000	$30,000	$0	$0	$0	$0
Engineering and Administrative Allowance	$41,300	$3,200	$500	$0	$4,700	$2,900	$24,000	$6,000	$0	$0	$0	$0
Estimated Total Project Cost	**$247,700**	**$19,400**	**$2,900**	**$0**	**$28,100**	**$17,300**	**$144,000**	**$36,000**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Atlantic Heights
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Clean exterior brick face, localized repointing as required	Exterior	$10,000	LS	1	$10,000	Medium	2021			$10,000								
	2	Replace corroded lintel steel above generator louver	Exterior	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	3	Replace door hardware	Interior	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Replace roof with single point drainage	Exterior	$10,000	LS	1	$10,000	Medium	2022				$10,000							
	5	Refinish walls/floors through lower level of structure	Interior	$5,000	LS	1	$5,000	Low	2024						$5,000					
Mechanical Improvements																				
	1	Replace Exhaust Fan and Controls	First floor, Generator Area	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Seal propane tank exterior/interior building penetrations	Exterior	$1,000	LS	1	$1,000	Low	2019	$1,000										
	3	Adjust sump pump float/replace sump pump	Dry Well	$500	LS	1	$500	High	2019	$500										
	4	Replace Unit Heaters	Generator Room/Pump Room	$3,000	EA	2	$6,000	Low	2022				$6,000							
	5	Repair emergency generator exhaust piping insulation	Generator Room/Pump Room	$500	LS	1	$500	Low	2019	$500										
Process Improvements																				
	1	Pump/motor rehabilitation/replacement (planning)	Dry Well	$20,000	EA	2	$40,000	Medium	2024						$40,000					
	2	Replace wet well piping	Wet Well	$10,000	LS	1	$10,000	Medium	2022				$10,000							
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Comprehensive MCC/Electrical Upgrade	Mult.	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	4	Emergency Generator and ATS Upgrade	Mult.	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	5	Install pump E-Stops	Pump Room	$4,000	LS	1	$4,000	High	2019	$4,000										
	6	Replace gas detection system (O2, H2S) recommended	Interior	$5,000	EA	2	$10,000	High	2019	$10,000										
	7	Ground the antennae mast	Exterior	$500	LS	2	$1,000	High	2019	$1,000										
	8	Install wet well seal instrument bypass seal-offs	Exterior	$1,000	LS	1	$1,000	Low	2025							$1,000				
	9	Install an intrinsically safe barrier for submersible transducer	Exterior	$3,000	LS	1	$3,000	Medium	2022				$3,000							
	10	Install proof of airflow switches for ventilation confirmation	Exterior	$2,000	LS	1	$2,000	Medium	2019	$2,000										
	11	Control Panel Upgrade	Dry Well	$15,000	LS	1	$15,000	Medium	2024						$15,000					
	12	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	Medium	2019	$2,500										
	13	Replace magnetic flow meter	Dry Well	$10,000	EA	1	$10,000	Medium	2021			$10,000								
	14	Install a horn within the pump station to alert occupants of unsafe atmosphere	Interior	$2,500	LS	1	$2,500	Medium	2019	$2,500										

High Priority Projects	$26,000
Medium Priority Projects	$257,000
Low Priority Projects	$13,500

Subtotal	$296,500	$34,500	$2,000	$20,000	$179,000	$0	$60,000	$1,000	$0	$0	$0	$0
Contingencies (20%)	$59,300	$6,900	$400	$4,000	$35,800	$0	$12,000	$200	$0	$0	$0	$0
Estimated Construction Cost	$355,800	$41,400	$2,400	$24,000	$214,800	$0	$72,000	$1,200	$0	$0	$0	$0
Engineering and Administrative Allowance	$71,200	$8,300	$500	$4,800	$43,000	$0	$14,400	$200	$0	$0	$0	$0
Estimated Total Project Cost	**$427,000**	**$49,700**	**$2,900**	**$28,800**	**$257,800**	**$0**	**$86,400**	**$1,400**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Marcy Street
Updated 10/10/2018

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Investigate inflow and infiltration sources in the sewershed	-	-	-	-		Low												
	2	Complete force main jetting/cleaning	-	$7,500	LS	1	$7,500	High	2019	$7,500										
Civil Improvements																				
	1	Evaluate flooding mitigation issues																		
Architectural / Structural Improvements																				
	1	Minor trim repair, replace rotten trim board	Exterior	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	2	Install missing toe plate on the aluminum guard at the stairwell	Interior	$500	LS	1	$500	Low	2022				$500							
	3	Replace roof (planning)	Exterior	$10,000	LS	1	$10,000	Low	2029											$10,000
	4	Provide roof gutters to prolong structure siding	Exterior	$3,000	LS	1	$3,000	Medium	2020		$3,000									
	5	Replace wet well top slab and hatch	Exterior	$2,000	LS	1	$2,000	Medium	2020		$2,000									
	6	Replace damaged attic lover	Exterior	$1,000	LS	1	$1,000	Low	2024						$1,000					
	7	Refinish floors in lower level	Interior	$3,000	LS	1	$3,000	Low	2024						$3,000					
Mechanical Improvements																				
	1	Replace Exhaust Fan and Controls	First floor, Generator Area	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Adjust sump pump float/replace sump pump	Dry Well	$500	LS	1	$500	High	2019	$500										
	3	Repair emergency generator exhaust piping insulation	Generator Room/Pump Room	$100	LS	1	$100	Low	2019	$100										
	4	Install dehumidifier in lower level	Dry Well	$1,000	LS	1	$1,000	Low	2019	$1,000										
	5	Replace missing damper actuator linkage/parts	Generator Room/Pump Room	$500	LS	1	$500	Low	2019	$500										
Process Improvements																				
	1	Pump/motor rehabilitation/replacement (planning)	Dry Well	$15,000	EA	2	$30,000	Medium	2024						$30,000					
	2	Replace wet well piping	Wet Well	$10,000	LS	1	$10,000	Medium	2022				$10,000							
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Comprehensive MCC/Electrical Upgrade	Mult.	$75,000	LS	1	$75,000	Medium	2022				$75,000							
	3	Emergency Generator and ATS Upgrade	Mult.	$60,000	LS	1	$60,000	Medium	2022				$60,000							
	4	Replace exterior electrical service entrance enclosure	Exterior	$5,000	LS	1	$5,000	High	2019	$5,000										
	5	Install pump E-Stops	Pump Room	$4,000	LS	1	$4,000	High	2019	$4,000										
	6	Replace gas detection system (O2, H2S) recommended	Interior	$5,000	EA	2	$10,000	High	2019	$10,000										
	7	Ground the antennae mast	Exterior	$500	LS	2	$1,000	High	2019	$1,000										
	8	Install an intrinsically safe barrier for submersible transducer	Exterior	$3,000	LS	1	$3,000	Medium	2022				$3,000							
	9	Install proof of airflow switches for ventilation confirmation	Exterior	$2,000	LS	1	$2,000	Medium	2019	$2,000										
	10	Control Panel Upgrade	Dry Well	$15,000	LS	1	$15,000	High	2024						$15,000					
	11	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	12	Replace magnetic flow meter	Dry Well	$10,000	EA	1	$10,000	Medium	2021			$10,000								
	13	Install a horn within the pump station to alert occupants of unsafe atmosphere	Interior	$2,500	LS	1	$2,500	Medium	2019	$2,500										

High Priority Projects	$55,500
Medium Priority Projects	$198,500
Low Priority Projects	$16,100

Subtotal	$270,100	$46,600	$6,000	$10,000	$148,500	$0	$49,000	$0	$0	$0	$0	$10,000
Contingencies (20%)	$54,000	$9,300	$1,200	$2,000	$29,700	$0	$9,800	$0	$0	$0	$0	$2,000
Estimated Construction Cost	$324,100	$55,900	$7,200	$12,000	$178,200	$0	$58,800	$0	$0	$0	$0	$12,000
Engineering and Administrative Allowance	$64,800	$11,200	$1,400	$2,400	$35,600	$0	$11,800	$0	$0	$0	$0	$2,400
Estimated Total Project Cost	**$388,900**	**$67,100**	**$8,600**	**$14,400**	**$213,800**	**$0**	**$70,600**	**$0**	**$0**	**$0**	**$0**	**$14,400**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Leslie Drive
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Conduct CCTV survey of force main to confirm condition	Pump Room	$5,000	LS	1	$5,000	Medium	2021			$5,000								
Civil Improvements																				
	1	Confirm propane tank is fastened to foundation supports	Exterior	$500	LS	1	$500	High	2019	$500										
Architectural / Structural Improvements																				
	1	Clean exterior brick face, repoint	Exterior	$15,000	LS	1	$15,000	Low	2025							$15,000				
	2	Repair/replace link seal from piping penetration in dry well	Dry Well	$7,500	LS	1	$7,500	Medium	2020		$7,500									
	3	Sandblast/repaint/reseal exposed lintel steel over louver	Exterior	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	4	Replace pipe supports with new supports set atop grout pads	Dry Well	$2,500	LS	1	$2,500	Medium	2022				$2,500							
	5	Replace door hardware	Interior	$750	LS	1	$800	Low	2020		$800									
	6	Replace roof	Exterior	$10,000	LS	1	$10,000	Medium	2022				$10,000							
	7	Refinish walls/floors through structure	Interior	$5,000	LS	1	$5,000	Low	2024						$5,000					
	8	Strip/repaint corroding pump skids	Interior	$2,500	LS	1	$2,500	Medium	2022				$2,500							
	9	Install missing toeplate on the guard at the stairwell	Interior	$500	LS	1	$500	High	2019	$500										
	10	Seal old conduit penetrations into existing wet well top slab	Wet well exterior	$500	LS	1	$500	Low	2022				$500							
Mechanical Improvements																				
	1	Replace Exhaust Fan and Controls	First floor, Generator Area	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Seal propane tank exterior/interior building penetrations	Exterior	$1,000	LS	1	$1,000	Low	2019	$1,000										
	3	Adjust sump pump float/replace sump pump	Dry Well	$500	LS	1	$500	High	2019	$500										
	4	Replace intake damper associated with exhaust fan (linkage removed)	Dry Well	$1,000	LS	1	$1,000	High	2019	$1,000										
	5	Replace Unit Heaters	Generator Room/Pump Room	$3,000	EA	2	$6,000	Low	2022				$6,000							
Process Improvements																				
	1	Pump motor rehabilitation/replacement (planning)	Dry Well	$15,000	EA	2	$30,000	Medium	2021			$30,000								
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Comprehensive MCC/Electrical Upgrade	Mult.	$80,000	LS	1	$80,000	Medium	2022				$80,000							
	4	Emergency Generator and ATS Upgrade	Mult.	$80,000	LS	1	$80,000	Medium	2022				$80,000							
	5	Install pump E-Stops	Pump Room	$4,000	LS	1	$4,000	High	2019	$4,000										
	6	Ground the antennae mast	Exterior	$500	LS	2	$1,000	High	2019	$1,000										
	7	Replace exterior electrical service entrance enclosure	Exterior	$5,000	LS	1	$5,000	Medium	2020		$5,000									
	8	Replace gas detection system (O2, H2S) recommended	Interior	$5,000	EA	2	$10,000	High	2019	$10,000										
	9	Ground the antennae mast	Exterior	$500	LS	2	$1,000	High	2019	$1,000										
	10	Install wet well seal instrument bypass seal-offs	Exterior	$1,000	LS	1	$1,000	Low	2025							$1,000				
	11	Install an intrinsically safe barrier for submersible transducer	Exterior	$3,000	LS	1	$3,000	Medium	2022				$3,000							
	12	Install proof of airflow switches for ventilation confirmation	Exterior	$2,000	LS	1	$2,000	Medium	2019	$2,000										
	13	Control Panel Upgrade	Dry Well	$15,000	LS	1	$15,000	Medium	2024						$15,000					
	14	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	Medium	2019	$2,500										
	15	Replace magnetic flow meter	Dry Well	$10,000	EA	1	$10,000	Medium	2021			$10,000								
	16	Install a horn within the pump station to alert occupants of unsafe atmosphere.	Interior	$2,500	LS	1	$2,500	Medium	2019	$2,500										

High Priority Projects	$29,000
Medium Priority Projects	$258,500
Low Priority Projects	$29,300

Subtotal	$316,800	$37,000	$14,300	$45,000	$184,500	$0	$20,000	$16,000	$0	$0	$0	$0
Contingencies (20%)	$63,400	$7,400	$2,860	$9,000	$36,900	$0	$4,000	$3,200	$0	$0	$0	$0
Estimated Construction Cost	$380,200	$44,400	$17,200	$54,000	$221,400	$0	$24,000	$19,200	$0	$0	$0	$0
Engineering and Administrative Allowance	$76,000	$8,900	$3,400	$10,800	$44,300	$0	$4,800	$3,800	$0	$0	$0	$0
Estimated Total Project Cost	**$456,200**	**$53,300**	**$20,600**	**$64,800**	**$265,700**	**$0**	**$28,800**	**$23,000**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Corporate Drive
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Prime/paint gable end	Exterior	$1,000	LS	1	$1,000	Low	2023					$1,000						
	2	Install new shingled roof	Exterior	$10,000	LS	1	$10,000	Low	2026								$10,000			
Mechanical Improvements																				
	1	Replace emergency generator exhaust piping through wall with a new ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	2	Insulate emergency generator exhaust piping	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Process Improvements																				
	1	N/A					$0													
Electrical/Instrumentation Improvements																				
	1	Replace bubbler with submersible transducer	Wet Well	$2,500	LS	1	$2,500	Low	2022				$2,500							
	2	Control Panel PLC upgrade (SLC 5/05 obsolete)	Exterior	$15,000	LS	1	$15,000	Medium	2024						$15,000					

High Priority Projects	$0
Medium Priority Projects	$17,000
Low Priority Projects	$13,500

Subtotal	$30,500	$0	$2,000	$0	$2,500	$1,000	$15,000	$0	$10,000	$0	$0	$0
Contingencies (20%)	$6,100	$0	$400	$0	$500	$200	$3,000	$0	$2,000	$0	$0	$0
Estimated Construction Cost	$36,600	$0	$2,400	$0	$3,000	$1,200	$18,000	$0	$12,000	$0	$0	$0
Engineering and Administrative Allowance	$7,300	$0	$500	$0	$600	$200	$3,600	$0	$2,400	$0	$0	$0
Estimated Total Project Cost	**$43,900**	**$0**	**$2,900**	**$0**	**$3,600**	**$1,400**	**$21,600**	**$0**	**$14,400**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Griffin Park
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Repair structure eaves/trim	Exterior	$6,000	LS	1	$6,000	Medium	2019	$6,000										
	2	Replace roof, add roof drains	Exterior	$12,000	LS	1	$12,000	Medium	2025							$12,000				
	3	Repair foundation chipping near the entrance door	Exterior	$2,000	LS	1	$2,000	Medium	2022				$2,000							
Mechanical Improvements																				
	1	Replace emergency generator exhaust piping through wall with a new ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Process Improvements																				
	1	Replace Pump No. 1 (1990)	Pump Room	$10,000	LS	1	$10,000	Medium	2022				$10,000							
	2	Pump motor replacement/rehabilitation	Pump Room	$10,000	LS	2	$20,000	Medium	2023					$20,000						
	3	Replace magnetic flow meter	Pump Room	$6,000	LS	1	$6,000	Low	2025							$6,000				
	4	Replace corroded wet well discharge piping and pipe support	Wet Well	$7,500	LS	1	$7,500	High	2020		$7,500									
	5	Re-route force main out from under the building structure (optional)	Exterior	$8,000	LS	1	$8,000	Low	2020		$8,000									
Electrical/Instrumentation Improvements																				
	1	Install Exit/Emergency lighting	Mult.	$5,000	LS	1	$5,000	High	2019	$5,000										
	2	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	3	Comprehensive Control Panel/Electrical Upgrade	Pump Room	$100,000	LS	1	$100,000	Low	2025							$100,000				
	4	Emergency Generator Upgrade	Pump Room	$75,000	LS	1	$75,000	Low	2028										$75,000	
	5	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										

High Priority Projects	$15,500
Medium Priority Projects	$51,000
Low Priority Projects	$189,000

Subtotal	$255,500	$14,000	$16,500	$0	$12,000	$20,000	$0	$118,000	$0	$0	$75,000	$0
Contingencies (20%)	$51,100	$2,800	$3,300	$0	$2,400	$4,000	$0	$23,600	$0	$0	$15,000	$0
Estimated Construction Cost	$306,600	$16,800	$19,800	$0	$14,400	$24,000	$0	$141,600	$0	$0	$90,000	$0
Engineering and Administrative Allowance	$61,300	$3,400	$4,000	$0	$2,900	$4,800	$0	$28,300	$0	$0	$18,000	$0
Estimated Total Project Cost	**$367,900**	**$20,200**	**$23,800**	**$0**	**$17,300**	**$28,800**	**$0**	**$169,900**	**$0**	**$0**	**$108,000**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Tuckers Cove
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019 (0)	2020 (1)	2021 (2)	2022 (3)	2023 (4)	2024 (5)	2025 (6)	2026 (7)	2027 (8)	2028 (9)	2029 (10)
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Repair structure eaves/trim	Exterior	$6,000	LS	1	$6,000	Medium	2020		$6,000									
	2	Replace roof and add roof gutters	Exterior	$12,000	LS	1	$12,000	High	2019	$12,000										
	3	Pressure wash and seal interior masonry CMU	Interior	$5,000	LS	1	$5,000	Low	2023					$5,000						
	4	Replace wet well hatch hinge	Wet Well	$5,000	LS	1	$5,000	Low	2025							$5,000				
Mechanical Improvements																				
	1	Replace emergency generator exhaust piping through wall with a new ventilated thimble	Pump Room	$1,000	LS	1	$1,000	Medium	2020		$1,000									
	2	Replace gas fired unit heater	Pump Room	$3,000	LS	1	$3,000	Medium	2020		$3,000									
Process Improvements																				
	1	Replace magnetic flow meter	Pump Room	$6,000	LS	1	$6,000	Low	2025							$6,000				
Electrical/Instrumentation Improvements																				
	1	Comprehensive Control Panel/Starter Upgrade	Exterior	$15,000	LS	1	$15,000	Low	2026								$15,000			
	2	Install utility power bypass circuit for UPS	Controls	$2,500	LS	1	$2,500	High	2019	$2,500										
	3	Provide arc-flash safety labeling	Mult.	$500	LS	1	$500	High	2019	$500										
	4	Replace ultrasonic transducer with submersible transducer	Wet Well	$2,500	LS	1	$2,500	Low	2023					$2,500						

High Priority Projects	$15,000
Medium Priority Projects	$10,000
Low Priority Projects	$33,500

Subtotal	$58,500	$15,000	$10,000	$0	$0	$7,500	$0	$11,000	$15,000	$0	$0	0
Contingencies (20%)	$11,700	$3,000	$2,000	$0	$0	$1,500	$0	$2,200	$3,000	$0	$0	$0
Estimated Construction Cost	$70,200	$18,000	$12,000	$0	$0	$9,000	$0	$13,200	$18,000	$0	$0	$0
Engineering and Administrative Allowance	$14,000	$3,600	$2,400	$0	$0	$1,800	$0	$2,600	$3,600	$0	$0	$0
Estimated Total Project Cost	**$84,200**	**$21,600**	**$14,400**	**$0**	**$0**	**$10,800**	**$0**	**$15,800**	**$21,600**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvements Plan
Clough Drive
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	Install wet well and valve pit hatch security lock	Wet Well	$250	LS	1	$300	High	2019	$300										
Civil Improvements																				
	1	Expand fence to include hatches (optional)	Site	$5,000	LS	1	$5,000	Low	2021			$5,000								
Architectural / Structural Improvements																				
	1	Add safety net/fall protection for wet well hatch	Wet Well	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Mechanical Improvements																				
	1	N/A					$0													
Process Improvements																				
	1	Install valve vault drain to wet well	Valve Vault	$2,500	LS	1	$2,500	High	2019	$2,500										
	2	Relocate wet well vent > 3 ft from Control Panel	Site	$1,500	LS	1	$1,500	High	2019	$1,500										
	3	Pump Replacement (planning)	Wet Well	$4,000	EA	2	$8,000	Medium	2022				$8,000							
Electrical/Instrumentation Improvements																				
	1	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	2	Control Panel/Starters Upgrade (planning)	Controls	$15,000	LS	1	$15,000	Low	2023					$15,000						
	3	Replace submersible transducer/wet well float (planning)	Controls	$3,500	LS	1	$3,500	Low	2023					$3,500						

High Priority Projects	$6,800
Medium Priority Projects	$9,000
Low Priority Projects	$23,500

Subtotal	$39,300	$6,800	$1,000	$5,000	$8,000	$18,500	$0	$0	$0	$0	$0	$0
Contingencies (20%)	$7,900	$1,400	$200	$1,000	$1,600	$3,700	$0	$0	$0	$0	$0	$0
Estimated Construction Cost	$47,200	$8,200	$1,200	$6,000	$9,600	$22,200	$0	$0	$0	$0	$0	$0
Engineering and Administrative Allowance	$9,400	$1,600	$200	$1,200	$1,900	$4,400	$0	$0	$0	$0	$0	$0
Estimated Total Project Cost	**$56,600**	**$9,800**	**$1,400**	**$7,200**	**$11,500**	**$26,600**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Marsh Lane
Updated **10/10/2018**

										0	1	2	3	4	5	6	7	8	9	10
		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General Improvements																				
	1	-																		
Civil Improvements																				
	1	-																		
Architectural / Structural Improvements																				
	1	Add safety net/fall protection for wet well hatch	Wet Well	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Mechanical Improvements																				
	1	-																		
Process Improvements																				
	1	Pump Replacement (planning)	Wet Well	$4,000	EA	2	$8,000	Medium	2022				$8,000							
Electrical/Instrumentation Improvements																				
	1	Upgrade Electrical Distribution Enclosure/Equipment (M	Exterior	$40,000	LS	1	$40,000	Low	2022				$40,000							
	2	Install intrinsically safe barrier for wet well instruments	Controls	$2,000	LS	1	$2,000	Medium	2020		$2,000									
	3	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	4	Control Panel/Starters Upgrade (planning)	Controls	$15,000	LS	1	$15,000	Low	2026								$15,000			

High Priority Projects	$2,500
Medium Priority Projects	$11,000
Low Priority Projects	$55,000

Subtotal	$68,500	$2,500	$3,000	$0	$48,000	$0	$0	$0	$15,000	$0	$0	$0
Contingencies (20%)	$13,700	$500	$600	$0	$9,600	$0	$0	$0	$3,000	$0	$0	$0
Estimated Construction Cost	$82,200	$3,000	$3,600	$0	$57,600	$0	$0	$0	$18,000	$0	$0	$0
Engineering and Administrative Allowance	$16,400	$600	$700	$0	$11,500	$0	$0	$0	$3,600	$0	$0	$0
Estimated Total Project Cost	**$98,600**	**$3,600**	**$4,300**	**$0**	**$69,100**	**$0**	**$0**	**$0**	**$21,600**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvements Plan
Mill Pond Way
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
Architectural / Structural Improvements																				
	1	Add safety net/fall protection for wet well hatch	Wet Well	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Mechanical Improvements																				
	1	N/A																		
Process Improvements																				
	1	Replace buried valve operator boxes	Site	$2,000	EA	2	$4,000	Medium	2020		$4,000									
	2	Pump Replacement (planning)	Wet Well	$4,000	EA	2	$8,000	Medium	2022				$8,000							
Electrical Improvements																				
	1	Upgrade Electrical Distribution Enclosure/Equipment (MTS, panel, disconnect)	Exterior	$30,000	LS	1	$30,000	Low	2024						$30,000					
	3	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	4	Control Panel/Starters Upgrade (planning)	Controls	$15,000	LS	1	$15,000	Low	2024						$15,000					

High Priority Projects	$2,500
Medium Priority Projects	$13,000
Low Priority Projects	$45,000

Subtotal	$60,500	$2,500	$5,000	$0	$8,000	$0	$45,000	$0	$0	$0	$0	$0
Contingencies (20%)	$12,100	$500	$1,000	$0	$1,600	$0	$9,000	$0	$0	$0	$0	$0
Estimated Construction Cost	$72,600	$3,000	$6,000	$0	$9,600	$0	$54,000	$0	$0	$0	$0	$0
Engineering and Administrative Allowance	$14,500	$600	$1,200	$0	$1,900	$0	$10,800	$0	$0	$0	$0	$0
Estimated Total Project Cost	**$87,100**	**$3,600**	**$7,200**	**$0**	**$11,500**	**$0**	**$64,800**	**$0**	**$0**	**$0**	**$0**	**$0**

CITY OF PORTSMOUTH, NEW HAMPSHIRE
Pump Station Recommended Facilities Improvement Plan
Northwest Road
Updated **10/10/2018**

		Item	Location	Unit Cost	Unit	Estimated Quantity	Estimated Cost	Priority	Year	0 2019	1 2020	2 2021	3 2022	4 2023	5 2024	6 2025	7 2026	8 2027	9 2028	10 2029
General Improvements																				
	1	N/A																		
Civil Improvements																				
	1	N/A																		
	2																			
Architectural / Structural Improvements																				
	1	Add safety net/fall protection for wet well hatch	Wet Well	$1,000	LS	1	$1,000	Medium	2020		$1,000									
Mechanical Improvements																				
	1	Upgrade electrical enclosure exhaust fan	Control Panel	$1,000	LS	1	$1,000	Low	2020		$1,000									
Process Improvements																				
	1	Pump Replacement (planning)	Wet Well	$4,000	EA	2	$8,000	Medium	2022				$8,000							
	2	Install pump discharge isolation valves	Wet Well	$1,000	EA	2	$2,000	Low	2020		$2,000									
Electrical/Instrumentation Improvements																				
	1	Upgrade Electrical Distribution Enclosure/Equipment (MTS, panel, disconnect)	Exterior	$40,000	LS	1	$40,000	Low	2022				$40,000							
	2	Install intrinsically safe barrier for wet well instruments	Controls	$2,000	LS	1	$2,000	Medium	2020		$2,000									
	3	Install utility power bypass circuit for UPS	Controls	$2,500	EA	1	$2,500	High	2019	$2,500										
	4	Control Panel/Starters Upgrade (planning)	Controls	$15,000	LS	1	$15,000	Low	2026								$15,000			

High Priority Projects	$2,500
Medium Priority Projects	$11,000
Low Priority Projects	$58,000

Subtotal	$71,500	$2,500	$6,000	$0	$48,000	$0	$0	$0	$15,000	$0	$0	$0
Contingencies (20%)	$14,300	$500	$1,200	$0	$9,600	$0	$0	$0	$3,000	$0	$0	$0
Estimated Construction Cost	$85,800	$3,000	$7,200	$0	$57,600	$0	$0	$0	$18,000	$0	$0	$0
Engineering and Administrative Allowance	$17,200	$600	$1,400	$0	$11,500	$0	$0	$0	$3,600	$0	$0	$0
Estimated Total Project Cost	**$103,000**	**$3,600**	**$8,600**	**$0**	**$69,100**	**$0**	**$0**	**$0**	**$21,600**	**$0**	**$0**	**$0**

WRIGHT-PIERCE
Engineering a Better Environment

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TO:	Appendix C	**DATE:**	10/12/2018
FROM:	Paige Howard, Michael Curry	**PROJECT NO.:**	13969A
SUBJECT:	Portsmouth, New Hampshire Pump Station Master Plan Coastal Resiliency Assessment		

This memorandum is to present the findings from the City of Portsmouth's 2013 Coastal Resiliency Initiative Climate Change Vulnerability Assessment and Adaptation Plan as they relate to the City's twenty public wastewater pumping stations. The 2013 plan provides a broad overview of risk and vulnerability of the City's assets as a result of projected climate change and resulting sea level and flood elevations rise. The conclusions from the plan will be used as a basis for flood protection and pump station siting recommendations in the Pump Station Master Plan.

The 2013 assessment evaluated impacts of tidal flooding in Portsmouth as a result from sea level rise and coastal storms. The study evaluated various sea level rise scenarios using a range of greenhouse gas emission scenarios and projected flood elevations for the years 2050 and 2100. Modeling efforts used two baseline flood conditions including:

- Mean Higher High Water (MHHW): The higher average high tide
- Mean Higher High Water Flood (MHHW Flood): The higher average high tide with coastal storm surge from a 100-year coastal storm

The modeled scenario results are described in detail below:

SCENARIO 1: A ***7.5-foot*** elevation model correlates to a predicted MHHW in the year 2100 given a low climate change estimate.

SCENARIO 2: An ***11.5-foot*** elevation correlates to the present-day 100-year coastal flood elevation (11.2 ft.) and to two future conditions: the 2050, 100-year coastal flood elevation at

MHHW under a low greenhouse gas emission scenario (12.2 ft.), and the MHHW in 2100 given a high greenhouse gas emission scenario (10.7 ft.).

SCENARIO 3: A ***13.5-foot*** elevation correlates to the 100-year coastal flood elevation at MHHW given the 2050 high greenhouse gas emission scenario (12.9 ft.) as well as the 100-year coastal flood elevation at MHHW with the 2100 low emission scenario (13.7 ft.).

SCENARIO 4: An ***18.0-foot*** modeled elevation corresponds to the 100-year coastal flood at MHHW given the 2100 high emission scenario (17.5 ft.).

Using the elevations developed as part of the Climate Change Vulnerability Assessment, the City's twenty public wastewater pump stations were analyzed for impacts due to each of the four flooding scenarios. **Table 1** provides a summary of the pump stations which would be potentially affected by flooding scenarios 1 through 4.

Pump stations within the area of impact for each scenario are depicted in **Figures 1** through **4,** which are attached. Recommendations for flood impact mitigation is included in Section 2 – Section 4 of the Pump Station Master Plan.

WRIGHT-PIERCE
Engineering a Better Environment

MEMORANDUM

TABLE 1 – PORTSMOUTH PUMP STATION POTENTIAL FLOOD IMPACTS

Pump Station	Address	Lowest Impacted Flood Elevation (ft) above NAVD	Pump Station Elevation (ft) above NAVD
Atlantic Heights	134 Preble Way	Not impacted	49.0
Clough Dr.	**210 Clough Dr.**	**18.0 (Scenario 4)**	**14.0**
Constitution Ave.	278 Constitution Ave.	Not impacted	49.0*
Corporate	215 Corporate Dr.	Not impacted	30.0
Deer St.	**2 Deer St.**	**13.5 (Scenario 3)**	**13.0**
Griffin	205 Griffin Park	Not impacted	37.75
Gosling Rd.	120 Gosling Rd.	Not impacted	42.0*
Heritage Ave.	329 Heritage Ave.	Not impacted	50.0
Lafayette Rd.	**630 Lafayette Rd.**	**18.0 (Scenario 4)**	**14.0**
Leslie Dr.	**590 Market St.**	**11.5 (Scenario 2)**	**9.5**
Marcy St.	**535 Marcy St.**	**11.5 (Scenario 2)**	**10.2**
Marsh Ln.	**4 Marsh Ln.**	**7.5 (Scenario 1)**	**5.9**
Mechanic St.	**113 Mechanic St.**	**11.5 (Scenario 2)**	**8.7**
Mill Pond Way	**131 Mill Pond**	**13.5 (Scenario 3)**	**11.8**
North West Rd.	**221 North West**	**11.5 (Scenario 2)**	**11.0**
Ryeline	3618 Lafayette Rd.	Not impacted	44.3
Tuckers Cover	91 Gosport Rd.	Not impacted	19.5
West Rd.	280 West Rd.	Not impacted	43.8
Woodlands I	307 F.W. Hartford	Not impacted	32.0*
Woodlands II	516 F.W. Hartford	Not impacted	35.8

*Elevations derived from GIS.

Flood elevations displayed are from the Portsmouth Coastal Resiliency Initiative Report, using GIS data delivered to Wright-Pierce by the City of Portsmouth.

GOSLING RD PS
ATLANTIC HEIGHTS PS
LESLIE DRIVE PS
NORTHWEST ST PS
MARSH LANE PS
DEER ST PS
MILL POND WAY PS
MECHANIC ST PS
MARCY ST PS
CLOUGH DRIVE PS
CORPORATE DRIVE PS
GRIFFIN ROAD PS
LAFAYETTE RD PS
WEST RD PS
CONSTITUTION AVE PS
HERITAGE RD PS
WOODLANDS 2 PS
WOODLANDS 1 PS
TUCKER'S COVE PS
RYE LINE PS
WWTF

Piscataqua Dr
Gosling Rd
Oriental Gdns
Commerce Way
Woodbury Ave
Portsmouth Blvd
Blue Heron Dr
Spinnaker Way
Kearsarge Way
Market St
Spaulding Tpke N
Echo Ave
Corporate Dr
Goose Bay Dr
International Dr
Unknown 10
Meadow Rd
Diamond Dr
Edmond Ave
Myrtle Ave
US Route 1 Bypass S
US Route 1 Bypass N
Dennett St
Thornton St
Franklin Dr
Maplewood Ave
Vaughan St
Bow St
Hanover St
Court St
State St
Pleasant St
Junkins Ave
Marcy St
Pierce Island Rd
Memorial Brg
New Hampshire Ave
Aviation Ave
Ashland Rd
Interstate 95 N
Portsmouth Traffic Cir
Bartlett St
Middle St
Union St
Islington St
Cooksey Rd
Lincoln Ave
Brackett Rd
Clough Dr
Wibird St
Orchard St
South St
Curriers Cv
Belle Isle Rd
Little Harbor Rd
Jones Ave
Walker Bungalow Rd
Sagamore Ave
Portsmouth Ave
Newcastle Ave
Grafton Dr
Greenside Ave
Sherburne Rd
Borthwick Ave
Middle Rd
Harvard St
Greenland Rd
NH Route 33
Griffin Rd
Hillside Dr
Summit Ave
Greenleaf Ave
Greenleaf Woods Dr
Peverly Hill Rd
Ledgewood Dr
Gosport Rd
Odiorne Point Rd
Elizabeth Ln
Pioneer Rd
Elwyn Rd
Ragmo Rd
West Rd
Grant Ave
Taft Rd
Harding Rd
Coolidge Dr
Campus Dr
Banfield Rd
Constitution Ave
Lafayette Rd
Springbrook Cir
Fw Hartford Dr
Forest Green Rd
Clark Rd
Parsons Rd
Marsh Rd
Harborview Dr
Wentworth Rd
Ocean Rd
Suzanne Dr
Wallis Rd
Mariette Dr
Nathaniel Dr
Beechstone Ave
Bluefish Blvd
Coach Rd
Liberty Cmn
Victory Ln
Young Ln
Rands Ln
Long John Rd
Geremia St
Ocean Blvd
Lang Rd
Eastwood Dr
Alehson St
Tehias Rd
Acorn Ave
Washington Rd
Merrymeeting Ln
Central Rd
Libbey Ln

Flood Elevation 7.5 ft (230cm)
DN
1
2
SCENARIO 1

N

0 250 500 1,000 1,500 2,000 Feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geograp

Flood Elevations from Coastal Resilience Initiative

Portsmouth, NH

PROJ NO:	DATE:	FIGURE:
13969	3/5/2018	4-7.5

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Flood elevations displayed are from the Portsmouth Coastal Resiliency Initiative Report, using GIS data delivered to Wright-Pierce by the City of Portsmouth.

GOSLING RD PS
ATLANTIC HEIGHTS PS
LESLIE DRIVE PS
NORTHWEST ST PS
MARSH LANE PS
DEER ST PS
MILL POND WAY PS
CORPORATE DRIVE PS
MECHANIC ST PS
MARCY ST PS
CLOUGH DRIVE PS
LAFAYETTE RD PS
GRIFFIN ROAD PS
TUCKER'S COVE PS
WEST RD PS
CONSTITUTION AVE PS
HERITAGE RD PS
WOODLANDS PS
RYE LINE PS
WWTF

Gosling Rd
Oriental Gdns
Piscataqua Dr
Commerce Way
Woodbury Ave
Portsmouth Blvd
Blue Heron Dr
Spinnaker Way
Kearsarge Way
Market St
Spaulding Tpke N
Goose Bay Dr
Unknown 10
Corporate Dr
International Dr
Echo Ave
Meadow Rd
Diamond Dr
Edmond Ave
Myrtle Ave
US Route 1 Bypass S
US Route 1 Bypass N
Franklin Dr
Dennett St
Thornton St
Maplewood Ave
Leslie Dr
Market St
Memorial Brg
Vaughan St
Bow St
Hanover St
Court St
State St
Pleasant St
Marcy St
Pierce Island Rd
Junkins Ave
Portsmouth Ave
Newcastle Ave
Lincoln Ave
Middle St
Union St
Islington St
Bartlett St
Ashland Rd
New Hampshire Ave
Aviation Ave
Interstate 95 N
Portsmouth Traffic Cir
Cook Way
Peverly Hill Rd
Elwyn Rd
Gosport Rd
Odiorne Point Rd
Pioneer Rd
Elizabeth Ln
Regina Rd
Coakley Rd
Grafton Dr
Greenside Ave
Sherburne Rd
Holly Ln
Colonial Dr
Decatur Rd
Borthwick Ave
Harvard St
Greenland Rd
NH Route 33
Griffin Rd
Middle Rd
Hillside Dr
Summit Ave
Wibird St
Orchard St
South St
Brackett Rd
Clough Dr
Currier C
Belle Isle Rd
Little Harbor Rd
Jones Ave
Walker Bungalow Rd
Sagamore Ave
Harborview Dr
Wentworth Rd
Ledgewood Dr
Greenleaf Ave
Greenleaf Woods Dr
Campus Dr
Banfield Rd
Constitution Ave
Lafayette Rd
Springbrook Cir
Fw Hartford Dr
Coolidge Dr
Taft Rd
Grant Ave
Harding Rd
West Rd
Forest Green Rd
Clark Rd
Parsons Rd
Marsh Rd
Dr Way
Sagamore Rd
Ocean Rd
Wallis Rd
Suzanne Dr
Mariette Dr
Nathaniel Dr
Bluefish Blvd
Beechstone Ave
Coach Rd
Liberty Cmn
Victory Ln
Wallis Rd
Young Ln
Rands Ln
Long Rd
Eastwood Dr
Alehson St
Tehias Rd
Acorn Ave
Long John Rd
Geremia St
Brackett Rd
Ocean Blvd
Washington Rd
Libbey Ln
Merrymeeting Ln
Central Rd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geograp

Flood Elevation 11.5 ft (350cm)
DN
1
2
SCENARIO 2

N

0 250 500 1,000 1,500 2,000 Feet

Flood Elevations from Coastal Resilience Initiative

Portsmouth, NH

PROJ NO:	DATE:	FIGURE:
13969	3/5/2018	3-11.5

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Flood elevations displayed are from the Portsmouth Coastal Resiliency Initiative Report, using GIS data delivered to Wright-Pierce by the City of Portsmouth.

GOSLING RD PS
ATLANTIC HEIGHTS PS
LESLIE DRIVE PS
NORTHWEST ST PS
MARSH LANE PS
DEER ST PS
MILL POND WAY PS
CORPORATE DRIVE PS
MECHANIC ST PS
MARCY ST PS
CLOUGH DRIVE PS
GRIFFIN ROAD PS
LAFAYETTE RD PS
TUCKER'S COVE PS
WEST RD PS
CONSTITUTION AVE PS
HERITAGE RD PS
WOODLANDS 2 PS
WOODLANDS 1 PS
RYE LINE PS
WWTF

Flood Elevation 13.5 ft (410cm)
DN
1
2
SCENARIO 3

N

0 250 500 1,000 1,500 2,000 Feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geograp

Flood Elevations from Coastal Resilience Initiative

Portsmouth, NH

PROJ NO:	DATE:	FIGURE:
13969	3/5/2018	2-13.5

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Flood elevations displayed are from the Portsmouth Coastal Resiliency Initiative Report, using GIS data delivered to Wright-Pierce by the City of Portsmouth.

GOSLING RD PS
ATLANTIC HEIGHTS PS
LESLIE DRIVE PS
NORTHWEST ST PS
MARSH LANE PS
DEER ST PS
MILL POND WAY PS
MECHANIC ST PS
MARCY ST PS
CLOUGH DRIVE PS
CORPORATE DRIVE PS
GRIFFIN ROAD PS
LAFAYETTE RD PS
WEST RD PS
CONSTITUTION AVE PS
HERITAGE RD PS
WOODLANDS 2 PS
WOODLANDS 1 PS
TUCKER'S COVE PS
RYE LINE PS
WWTF

Piscataqua Dr
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Kearsarge Way
Market St
Spaulding Tpke N
Goose Bay Dr
Unknown 10
International Dr
Corporate Dr
Echo Ave
Maplewood Ave
US Route 1 Bypass N
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Vaughan St
Bow St
Hanover St
Myrtle Ave
Dennett St
Franklin Dr
Thornton St
Bartlett St
Diamond Dr
Edmond Ave
Meadow Rd
New Hamshire Ave
Aviation Ave
Ashland Rd
Interstate 95 N
Ports Traffic Cir
State St
Court St
Pleasant St
Mirey St
Pierce Island Rd
Junkins Ave
Portsmouth Ave
Newcastle Ave
Middle St
Union St
Islington St
Lincoln Ave
Bracket Rd
Clough Dr
Wibird St
Orchard St
South St
Currier Ct
Belle Isle Rd
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Greenleaf Ave
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Peverly Hill Rd
Elwyn Rd
Gosport Rd
Odiorne Point Rd
Elizabeth Ln
Pioneer Rd
Regina Rd
Banfield Rd
Campus Dr
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Grant Ave
Taft Rd
Harding Rd
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Lafayette Rd
Springbrook Cir
Mt Hartford Dr
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Sagamore Rd
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Parsons Rd
Marsh Rd
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Wallis Rd
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Nathaniel Dr
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Bluefish Blvd
Coach Rd
Liberty Cmn
Victory Ln
Young Ln
Rands Ln
Long John Rd
Geremia St
Brackett Rd
Ocean Blvd
Lang Rd
Eastwood Dr
Alehson St
Tehias Rd
Acorn Ave
Washington Rd
Libbey Ln
Merrymeeting Ln
Central Rd

Flood Elevation 18.5 ft (550cm)
DN
1
2
SCENARIO 4

N

0 250 500 1,000 1,500 2,000 Feet

Source: Esri, DigitalBoge, GeoEye, Earthstar Geograp

Flood Elevations from Coastal Resilience Initiative

Portsmouth, NH

PROJ NO:	DATE:	FIGURE:
13969	3/5/2018	1-18.5

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Sewer System

Portsmouth, NH

PROJ NO: 13969	DATE: 6/27/2018	FIGURE:
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Sewer System

Portsmouth, NH

PROJ NO: 13969	DATE: 6/27/2018	FIGURE:
WRIGHT-PIERCE Engineering a Better Environment		S

Corrosivity - Concrete

- Moderate
- High

Force Mains

- Unknown Material
- Asbestos Cement
- Polyethylene
- Polyvinyl Chloride
- Vitrified Clay Pipe
- Cast or Ductile Iron
- Gravity Main

N

0 0.25 0.5 Miles

Sewer Pipe Materials and Soil Corrosivity

Portsmouth, NH

PROJ NO:	DATE:
13969	11/14/2018

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FIGURE: 1

JMN W:\GIS_Development\Projects\NH\Portsmouth\13969_PS-MasterPlanMXDs\SoilCorrosivity_11x17.mxd

Corrosivity - Steel

- Low
- Moderate
- High

Force Mains

- Unknown Material
- Cast Iron
- Ductile Iron Pipe
- Other
- Gravity Main

N

0 0.25 0.5 Miles

Sewer Pipe Materials and Soil Corrosivity

Portsmouth, NH

PROJ NO:	DATE:
13969	11/14/2018

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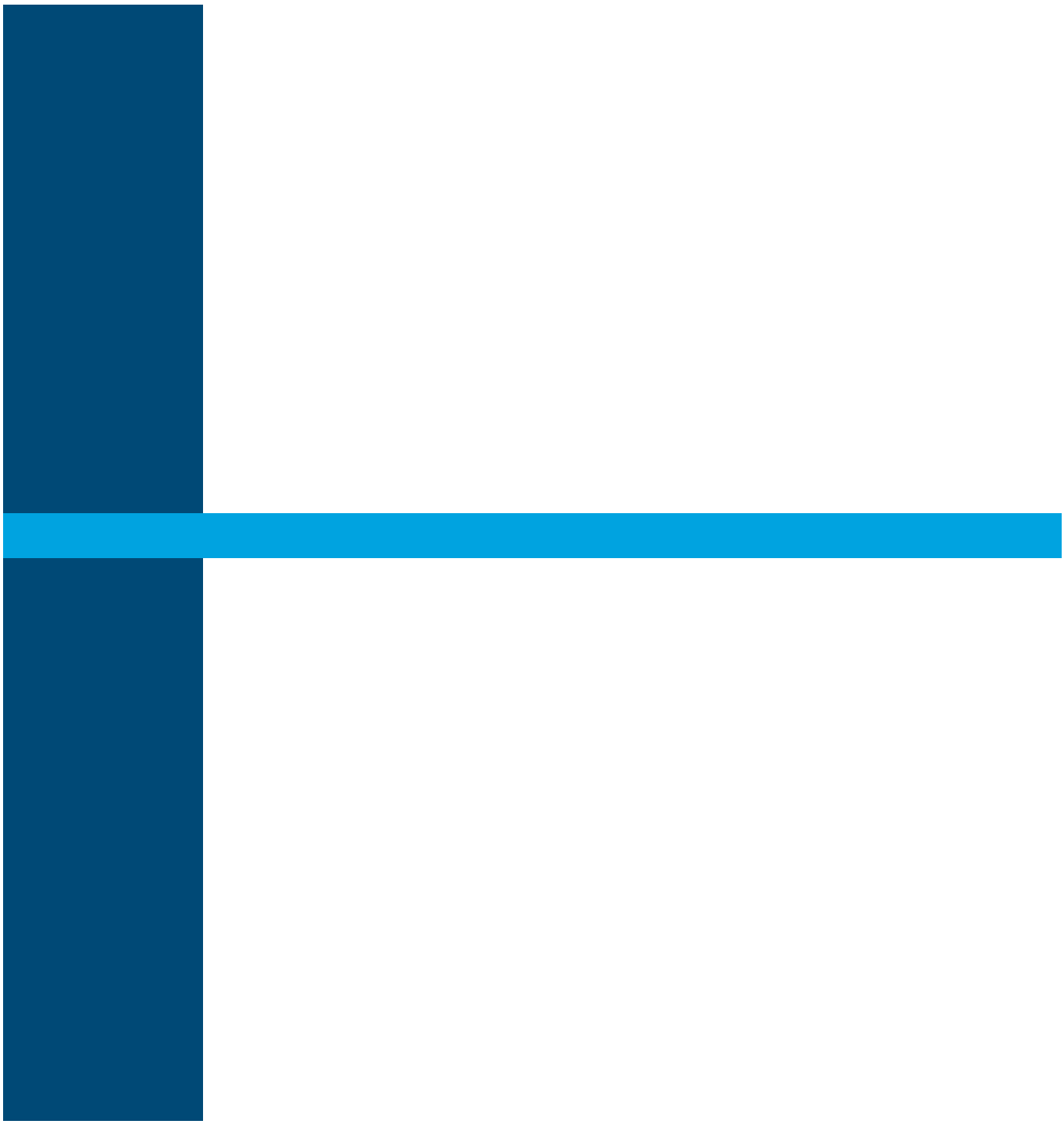
FIGURE: 2

JMN W:\GIS_Development\Projects\NH\Portsmouth\13969_PS-MasterPlan\MXDs\SoilCorrosivity_11x17.mxd



WRIGHT-PIERCE
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230 Commerce Way, Suite 302
Portsmouth, NH 03801
603.430.3728 | www.wright-pierce.com