

# **ENVIRONMENTAL PROTECTION**

## **Water Resource Protection**

### **Pleasantdale Separation – Thornton Heights Phase IV**

Since the early 1980s, the City has been actively engaged in a phased approach to reducing/eliminating the number, frequency and duration of combined sewer overflows (CSOs) by implementing numerous sewer separation projects. These projects are selected and constructed based on recommendations from the CSO Facilities Plan (Plan). The Plan updated in October 2011 also updated the 12 Year Implementation Schedule that includes this project. The City of South Portland is required to implement the schedule as part of its requirements as a regulated CSO community and in accordance with the city's Maine Pollutant Discharge Elimination System (MPDES) discharge permit that regulates discharges from the wastewater treatment facility set forth by the Maine Department of Environmental Protection (DEP).

This 2019 capital improvement request is for the Pleasantdale Separation Project, the fourth and final Phase of the Thornton Heights Project. Combined sewers in the Pleasantdale neighborhood contribute flow to the Elm Street CSO #024, one of the most active CSO's left in the system. The number of CSO events at Elm Street ranged from 2 to 11 per year between January 2002 to December 2016 with a total of 77 events and a total volume of approximately 55 million gallons discharged to the Fore River. The proposed Pleasantdale project will contribute to mitigating these CSO events through the separation of combined sewers within the neighborhood on and along Broadway. The project will also include the replacement of aging utilities by Portland Water District and Unitil and, the reconstruction of the streetscape incorporating Complete Streets design principles. The project went out to bid in January and the Council approved the construction costs for the project which is underway. This early bid process puts the project on the successful bidders construction schedule so it can begin early and be completed by the end of the construction season. This has been a very successful process in the previous three phases.

A detailed description of the proposed work is included in the attached Summary of Work Specification Section with project location maps.

The Anthoine Separation project is included in Pleasantdale which is going to remove some catch basins on Broadway near Anthoine Creek. This project has been bid twice, with extremely high bids

received, which prompted them to be rejected. To help with the cost of getting the work completed, the project was incorporated into Pleasantdale.

The pond next to the Greenbelt at the end of Mildred Street will also be remediated as a part of this project. Public meetings were held to incorporate the public's input into a study (initiated by the Conservation Commission) to determine an appropriate remediation effort of what is considered a blight in the neighborhood. Attached is the project summary. The study evaluated several remediation alternatives but recommends converting the pond area back to a tidal wetland with proprietary 'end of pipe' treatment for the storm water pipe outfall and upgrading the outlet culvert to the bay. The cost for this piece of the project was negotiated with the general contractor, Gorham Sand & Gravel. The cost of Engineering for the project has been included for preliminary site investigation, design, construction administration, and construction inspection.

The intersection at Broadway and Elm is another improvement that will combine better traffic lighting and a broader turn radius that allows trucks turning west from Elm Street to turn directly into the west travel lane. This negates the need for trucks to cross over the east travel lane.

As discussed, this is the last phase of a four-phase project; three phases completed in Thornton Heights and this last phase in Pleasantdale. The total project cost incorporates the construction costs, Engineering costs, and Mildred Street pond remediation costs. Sources of funding that will cover this year's Phase 4 project costs include TIF Funds, previously approved TIF Funds, Public Works Paving Funds, previously approved funds from the Anthoine Separation Project, Sewer User Fund surplus, and Thornton Heights Phase 3 project surplus.

Project Cost: \$4,802,000

Funding:

TIF Funds	\$3,242,000
Prior Years CIP	\$1,160,000
Public Works Paving	\$150,000
Sewer User Fund	\$250,000

Source of Cost Estimate: Sebago Technics Engineers

Projected Useful Life: 65 Years



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CITY OF SOUTH PORTLAND  
PLEASANTDALE  
SEWER SEPARATION PROJECT



OVERALL PLAN 1

DRAWN BY: BRF  
APPROVED BY:  
DATE: 11-15-17  
CHECKED BY: DLR  
DATE:  
PROJECT NO. 13036-01  
SCALE: AS NOTED

REVISIONS		APP'D	DATE
PROGRESS PRINT		DLR	1-15-18

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1

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DWG 2

CITY OF SOUTH PORTLAND  
PLEASANTDALE  
SEWER SEPARATION PROJECT



OVERALL PLAN 2

DRAWN BY: BRF  
 APPROVED BY: [Signature]  
 DATE: 11-15-17  
 CHECKED BY: DLR  
 DATE: [Blank]  
 PROJECT NO.: 13036-01  
 SCALE: AS NOTED

REVISIONS		APP'D	DATE
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SCALE: 1" = 400'

DATE: 01/15/18

INFORMATION:  
 IMAGERY ACQUIRED SPRING 2017  
 GIS DATA FROM THE CITY OF SOUTH PORTLAND

FOR: CITY OF SOUTH PORTLAND

LOCATION:  
 PLEASANTDALE VICINITY  
 SOUTH PORTLAND, MAINE

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 South Portland, ME 04106  
 Tel. 207-200-2100

**FIGURE 1-2 PROJECT AREA - PHASE 4**  
**OF PLEASANTDALE SEWER SEPARATION**

Maine GeoLibrary



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January 18, 2018



Brad Weeks, Engineer  
Water Resources Protection  
City of South Portland  
111 Waterman Drive  
South Portland, ME 04106

Re: Mildred Street Pond Planning – Project Summary

Dear Brad:

Woodard & Curran has completed a Planning Study for the Mildred Street Pond, a waterbody located between Mildred Street and Broadway in the City of South Portland, Maine. Woodard & Curran kicked-off the Planning Study with the City of South Portland and the Conservation Commission at a meeting on August 30, 2017. At this meeting, we discussed the goals for the project and the level of public engagement for the project. The goal of the Planning Study was to identify an economically viable management alternative for the Pond that would enhance aesthetics, improve ecological value, provide stormwater treatment, address public concerns, and that would be permissible by the Maine Department of Environmental Protection (MaineDEP) and the Army Corps of Engineers (ACOE). To achieve this goal, Woodard & Curran worked with the City to gather pertinent information on the existing conditions and history of the Pond, and engaged the public, Sebago Technics, the Casco Bay Estuary Partnership (CBEP), and regulators to evaluate management alternatives. This letter and its attachments serve to document the work completed and the concept-level design of the preferred management alternative.

#### **INFORMATION GATHERING:**

##### **Mildred Street Pond Watershed**

The Mildred Street Pond is an urban water body that abuts the South Portland Greenbelt Walkway trail. GIS data of the topography and drainage infrastructure was obtained from the City to delineate and model the Pond and its watershed. A figure depicting the Pond's watershed is provided in Attachment A. The watershed is approximately 68.3-acres, which includes the approximately 1-acre Pond and approximately 26-acres of impervious area. The amount of impervious area draining to the Pond was determined utilizing the City Right-of-Way and building GIS data, and was verified utilizing Maine GIS imperviousness data.

The watershed is approximately 38% impervious and largely developed. Soils data for the watershed was obtained from the Natural Resources Conservation Service (NRCS) Web Soils Survey, and is provided in Attachment B for your reference. The watershed consists primarily of Hydrologic Soil Group (HSG) A, with some HSG B and D soils.

This information was utilized to prepare a stormwater model that has been used as a basis for design of the preferred management alternative, as described herein. Stormwater modeling was completed using the HydroCAD 10.00 Stormwater Modeling System by Applied Microcomputer Systems, which uses TR-20 runoff calculation methodology. A 24-hour duration and Type III rainfall distribution was applied to the rainfall depths for the storm events from Appendix H of the DEPs Chapter 500 Rules. HydroCAD provides a lookup table for curve number (CN), which is a measure of the retention and runoff properties of various surfaces based on the Hydrological Soil Group (HSG) and land cover type using TR-55 methodology. HydroCAD computes the final CN for each subcatchment based on an area-weighted average.



The Time of Concentration (Tc) is the time required for runoff to travel from the most hydrologically distant point of a watershed to the point of discharge. The Tc was computed within HydroCAD as the sum of the travel times for each consecutive flow segment along the longest hydraulic flow path. The longest hydraulic flow path was delineated utilizing topographical data and partitioned into segments based on flow types, land cover, and slopes. The primary types of flow consist of sheet flow and shallow concentrated flow; sheet flow typically occurs within the first 100-feet of runoff. A minimum Tc of six minutes was utilized.

It should be noted that the HydroCAD model currently indicates that the stormdrain outfall may be undersized; however, a detailed model of the stormdrain system has not been conducted at this time. Additionally, a conservative Tc of six minutes has been utilized for the subcatchment associated with the stormdrain outfall, as there is insufficient information to model the stormdrain system; there is no GIS data on the pipe material and slope of the stormdrain system within the watershed, and, in some cases, the pipe size data also appears to be inaccurate (GIS data indicates that the stormdrain outfall is 36-inches in diameter, however this pipe was verified in the field as 30-inches). Furthermore, as indicated by the Figure provided as Attachment A, the invert at the field drain upstream of the stormdrain outfall could not be verified, so the precise slope of the outfall is unknown (the slope was assumed to be the same from the drain manhole further upstream to the outfall); the slope may impact capacity. The City should consider whether a more detailed evaluation of the stormdrain system should be conducted as part of future design efforts.

**Existing Drainage Infrastructure**

Stormwater within the watershed is conveyed to the Pond largely via the City's stormwater drainage system (approximately 6.6-acres of the watershed is conveyed via overland flow directly to the Pond). The City's drainage system ultimately discharges to the Pond via a 30-inch diameter Reinforced Concrete Pipe (RCP). This outlet is located at the southwestern part of the Pond, adjacent to a parking lot located off of Elm Street. The Pond drains to the Fore River via a 30-inch diameter RCP that crosses below the Greenbelt trail at the northeast part of the Pond. The City obtained rim and invert elevations of this drainage infrastructure, in addition to the upstream field inlet and drainage manhole. Relevant information collected from the City's survey and from the City's GIS is illustrated in the Figure provided as Attachment A and shown in the table below:

**Summary of Relevant Existing Drainage Infrastructure Information**

Drainage Infrastructure	Elevations*	Size / Material / Length (Linear Feet)
<b>UPSTREAM</b>		
<b>Drainage Manhole (DMH)</b>	Rim: 14.87' NAVD88	
<b>Pipe from DMH to Field Inlet</b>	Inlet Invert: 7.47' NAVD88 Outlet Invert: Unknown	30" Diameter RCP 91 LF
<b>Field Inlet</b>	Rim: 12.41' NAVD88	
<b>Pipe from Field Inlet to Outfall</b>	Inlet Invert: Unknown	30" Diameter RCP 70 LF
<b>Outfall</b>	Invert: 6.18' NAVD88	30" Diameter RCP
<b>DOWNSTREAM</b>		
<b>Culvert</b>	Inlet Invert: 4.83' NAVD88 Outlet Invert: 4.69' NAVD88	30" Diameter RCP

\*According to City's survey results received on September 12, 2017.



### Observations on Tidal Exchange

Woodard & Curran analyzed available information on tidal levels in the area of Mildred Street Pond to assess the degree to which the Pond is currently tidally influenced. A summary of relevant tidal data published by the National Ocean Service (NOS) is presented on the Figure provided as Attachment A. Mean Higher High Water (MHHW) represents the average elevation of the higher of the two-daily high-tide events recorded from 1983-2001, and the Highest Astronomical Tide (HAT) represents the highest tide elevation recorded from 1983-2001; these elevations are 4.65-feet and 6.69-feet respectively. It should also be noted that it's predicted that the HAT will be reached three times from 2015 to 2019. Since MHHW is lower than the culvert's inlet, it was confirmed that the Pond experiences minimal tidal exchange during daily conditions.

Woodard & Curran's site visit on October 05, 2017, occurred shortly after a high tide event. According to the NOS, the tide reached an elevation of 4.86-feet at 11:20 AM that day. The following photos of the culvert outlet and inlet were taken within an hour of high tide:

#### Culvert Outlet



Photo taken at 12:00 PM – NOS reports a tide elevation of 4.57-feet at this time; this appears consistent with the invert elevation of 4.69-feet. Based on the water marks, the culvert outlet appeared to have had a few inches (approximately 4-inches or less) of water, consistent with the high tide elevation of 4.86-feet.



### Culvert Inlet



Photo taken at 12:20 PM – Based on the water marks, it appeared that the inlet (elevation 4.83) had less than one inch of water; this appears consistent with the high tide elevation of 4.86-feet.

### Stormwater Outfall Screening

A dry-weather screening of the stormdrain outlet into the Pond was conducted by Woodard & Curran on October 5, 2017. No flow was observed discharging from the pipe at the time of the inspection. Dry-weather inspections of stormwater drainage system outfalls are the preliminary step in determining if a stormwater drainage system is conveying illicit discharges. Illicit discharges are non-stormwater inputs into a stormwater drainage system and can include sanitary wastewater (incorrectly connected into the stormdrain), illegal dumping, hydrant flushing water, or other non-stormwater sources. The lack of base flow present during dry-weather conditions is a preliminary and positive result that indicates illicit discharges are less likely to be present in the stormwater drainage system discharging into Mildred Street Pond.

### Wetland Assessment

A wetland assessment of the Pond area was conducted by Sebago Technics in October of 2017. A copy of the wetland report and a figure showing the delineated wetlands is provided in Attachment C. The assessment determined that the Pond and the downstream tidal marsh are classified as Wetlands of Special Significance in accordance with the Natural Resources Protection Act (NRPA), Chapter 310 – Wetlands and Waterbodies Protection, Section 4. The primary functions served by the Pond are floodflow alteration, sediment/toxicant retention, nutrient removal, and visual quality/aesthetics. The primary functions served by the tidal marsh, to the northeast of the Pond outlet, are sediment/ shoreline stabilization, and visual quality/aesthetics. According to the wetlands report, the Pond has approximately 1,400 SF of emergent marsh vegetation and soils are generally deep organic deposits.



### Pond Sediment Sampling

The City of South Portland collected Pond sediment samples on October 5, 2017. The objective of the sediment sampling was to determine if contamination was present that would impact sediment dredging and reuse under state guidelines. Several sediment samples were obtained in various locations around the perimeter of the Pond and two composite samples were provided to Katahdin Analytical Services for analysis. Sediment samples were analyzed for chemical parameters including metals, pesticides, PCBs, PAHs, extractable petroleum hydrocarbons (EPH), and phosphorus. Although Dioxin was not tested, the analytical results were compared against MaineDEP reduced procedure beneficial reuse standards where available; the concentrations of all parameters at all sampled locations were below these standards. A copy of the analytical results is provided in Attachment D.

Additionally, Woodard & Curran visually evaluated Pond sediments while measuring pond depths during a site visit on November 30, 2017. Typically, the top 6 to 12 inches of Pond sediments consist of organic material (muck), and are underlain by soft, gray clay. Surficial muck depths are described in greater detail in the following section.

### Pond Water Depths

During rain events and tidal conditions, Pond water levels can vary above the invert of the Pond culvert outlet (4.83-feet). On November 30, 2017, Woodard & Curran measured pond depths at several locations throughout the Pond during dry-weather and low-tide conditions. The pond depth measurements represent the difference in elevation from the water surface to pond bottom and are summarized in the Table below, along with the surficial muck depth measurements. Sample locations are depicted in the following figure:

Sample Location	Water Depth (inches)	Surficial Muck Depth (inches)
1	5	< 4
2	6	< 4
3	10	8-12
4	7	8-12
5	10	8-12
6	13	8-12
7	8	10-12



During the November 30, 2017 site visit, the distance from the Pond culvert outlet invert to the bottom of the downstream tidal “channel” was also measured; this distance was 24-inches.



### **Initial Public Feedback**

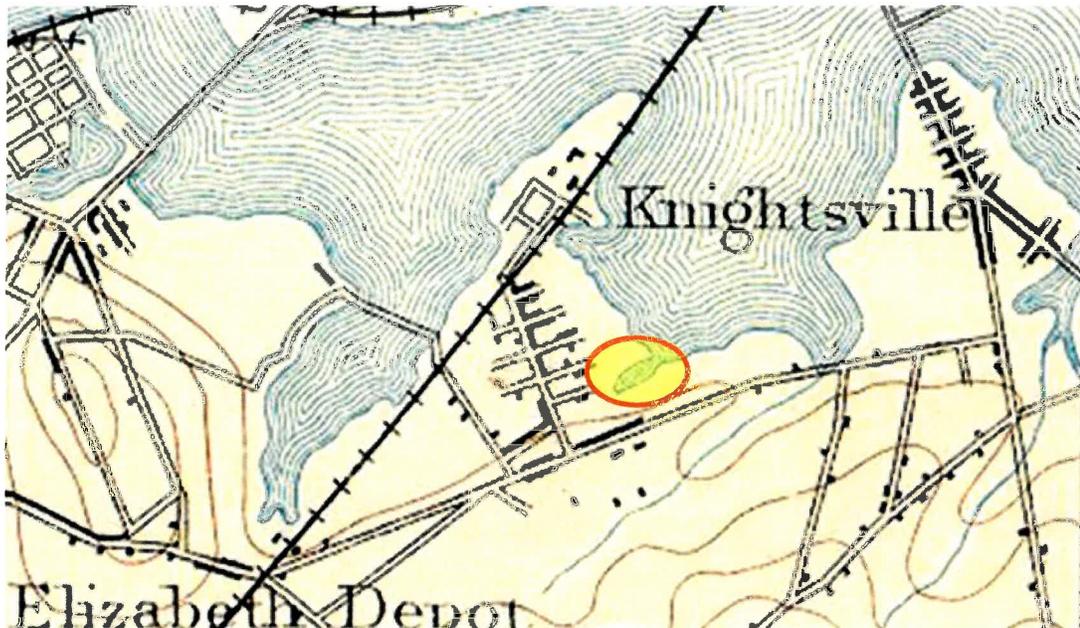
In an effort to gain more information on the history of the Pond and an understanding of the issues, a public meeting was held on September 20, 2017. Several residents attended the meeting who have lived in the neighborhood 35 to 64 years, and three other residents who were unable to attend the meeting provided additional information via email. The following is a summary of the feedback received from the residents:

- The Pond is stagnant; it smells like rotten eggs. The smell is worse in the mid to late summer.
- The Pond looks mucky, brown, and shallow (canoes scrape the bottom; it's approx. 6-12" deep); it used to be deeper before the Pond's culvert outlet was replaced and modified.
- Residents report that the culvert at the Pond outlet often gets clogged and blocked by logs and that yard waste is often dumped in this area.
- Residents were concerned about the amount of trash (leaves, dead trees, railroad ties, etc.) in and around the Pond and would like to see it cleaned up.
- Residents have not observed any algae problems in the Pond.
- Residents used to be able to skate on the Pond in the winter, but the Pond no longer freezes (one resident reported that the Fire Department used to bring water to the Pond for skating).
- Residents confirmed that they have basements and have not had any issues with drainage or flooding; it is likely there are some foundation drains or sumps that discharge to the Pond.
- None of the residents expressed concerns regarding granting temporary construction easements for work on the Pond.
- Residents reported that the Pond currently appears to get flushed out by astronomical high tides approximately once or twice a month and that tidal exchange in the Pond seems to reduce odors and improve the Pond's appearance. They recalled a time where the Pond experienced more frequent tidal exchange, before the culvert outlet under the Greenbelt trail was replaced and modified.

The residents indicated that problems noted above seem to have begun after the Pond outlet culvert was replaced and modified. The date and intent of the culvert modification is unknown, but it appears to have been raised. Residents seemed to prefer the idea of a tidally-influenced Pond over an engineered freshwater wetland system; however, all residents ultimately agreed that the primary goals should be to reduce odors and improve appearance, regardless of how that goal is achieved.

### **History**

Below is a historical map showing the Pond (circled in red) dated 1893:



The map appears to indicate that the Pond was once open to the sea, before the railroad (which today serves as the Greenbelt trail) was constructed. The Pond is presumed to have once been a tidal salt marsh or tidal flat with direct connectivity to the Fore River. As previously described, the date and intent of the most recent culvert modification is unknown, and the circumstances under which the Pond transitioned from a tidally influenced wetland to a primarily freshwater impoundment is uncertain.

#### **ALTERNATIVES ANALYSIS:**

Several alternatives were identified and evaluated to achieve the goals of addressing the issues with the Pond and providing stormwater treatment. The following sections summarize the alternatives identified for Pond management and stormwater management.

#### **Pond Management Alternatives**

Upon reviewing the conditions of the Pond, Woodard & Curran worked with Sebago Technics and CBEP to identify the following three Pond management alternatives:

- **Freshwater Pond** – This alternative would involve dredging the Pond to remove the buildup of organic sediments and modifying the outlet to limit tidal exchange, providing a permanent pool of open water. The removal of organic sediments in combination with a deeper water system would reduce issues with odor and provide residents with a recreational resource. However, it should be noted that without an aeration/circulation system and continued management of organic debris and sediments, odors may return.
- **Tidal Pond** – This alternative would involve dredging the pond and modifying the outlet size and elevation to increase tidal exchange, which would remove the buildup of organic sediments and provide a permanent pool of open water. The permanent pool would be shallower than the freshwater pond alternative, as the outlet would be lower; however, the removal of organic sediments in combination with more frequent tidal exchange would meet public desires for enhanced flushing.
- **Tidal Wetland** – This alternative would involve modification of the outlet size and elevation to increase tidal exchange, which would naturally remove the buildup of organic sediments and



increase tidal exchange. The Pond may revert to a more natural tidal wetland, with limited open water and will meet public desires for enhanced flushing and reduced odors. Depending on the presence of historic tidal peat soils, plantings may be required to fully establish the tidal wetland.

### **Stormwater Management Alternatives**

Three stormwater management alternatives were also considered:

- Convert Pond to Stormwater Treatment System – This alternative would be viable only in conjunction with the Freshwater Pond Management alternative, as it would involve constructing a freshwater stormwater treatment system, such as a Gravel Wetland. A stormwater treatment system would have minimal odors, but would require long-term maintenance.
- Expand Sediment Forebay – This alternative would involve expanding the existing sediment forebay to be sized to fully accommodate the watershed; the existing forebay is undersized and requires reconstruction. This would improve sediment removal and reduce sediment buildup in the Pond, thereby alleviating issues with odor; however, the forebay would need to be very large to be appropriately sized. This alternative could be implemented in conjunction with any of the three Pond management alternatives.
- Install Subsurface Proprietary Pretreatment System – This alternative would involve the installation of a proprietary pretreatment system before the stormdrain outfall discharge into the Pond. This system would help reduce trash, debris, leaf litter, and sediments from entering the Pond via the stormwater drainage system, thereby reducing buildup up of organic debris and sediments in the Pond; however, the system would require long-term maintenance. This alternative could be implemented in conjunction with any of the three Pond management alternatives.

### **Permitting Considerations**

Woodard & Curran met with the MaineDEP and ACOE on November 7, 2017 to review the Pond management and stormwater management alternatives described above. The following is a summary of the permitting requirements associated with each Pond management alternative (which includes the work to implement stormwater management):

- Freshwater Pond – This alternative would require an individual Natural Resource Protection Act (NRPA) permit for coastal wetland impacts with conversion to freshwater, and may also require compensation, which can be provided via payment of an In-Lieu-Fee.
- Tidal Pond – This alternative would require an individual Natural Resource Protection Act (NRPA) permit for coastal wetland impacts due to dredging.
- Tidal Wetland – This alternative would be exempt from MaineDEP permitting as it involves the modification of an existing culvert and does not include dredging; however, a General Permit would be required from the ACOE.

It should be noted that the MaineDEP indicated that converting the Pond to a freshwater pond or stormwater treatment system would be very difficult to permit, as the Pond is viewed as a regulated, natural resource, and these alternatives would change the current tidal conditions and ultimately diminish the value of the Pond.



### Management Alternatives Pros & Cons

The permitting requirements, comparative costs, and the extent of impacts were considered, and the pros and cons for each Pond management and stormwater management alternative are summarized in the following tables:

#### Pond Management Alternatives

Management Alternative	Pros	Cons
<b>Freshwater Pond</b>	<ul style="list-style-type: none"> <li>Restored open water</li> </ul>	<ul style="list-style-type: none"> <li>Pond odors may return– may require aeration/ circulation system</li> <li>Limited ecological value</li> <li>Disruptive and expensive to construct</li> <li>Most costly permitting</li> </ul>
<b>Tidal Pond</b>	<ul style="list-style-type: none"> <li>Increased tidal exchange reduces Pond stagnation</li> <li>Provides open water</li> </ul>	<ul style="list-style-type: none"> <li>Disruptive and expensive to construct</li> </ul>
<b>Tidal Wetland</b>	<ul style="list-style-type: none"> <li>Increased tidal exchange, reducing Pond stagnation</li> <li>Least disruptive and least expensive to construct</li> <li>Easiest to permit</li> </ul>	<ul style="list-style-type: none"> <li>May require planting/revegetation</li> <li>Limited open water</li> </ul>

#### Stormwater Management Alternatives

Management Alternative	Pros	Cons
<b>Convert Pond to Stormwater Treatment System</b>	<ul style="list-style-type: none"> <li>Most beneficial for stormwater quality treatment before discharging to the Fore River</li> </ul>	<ul style="list-style-type: none"> <li>System would be undersized for contributing watershed</li> <li>Extensive long-term maintenance required</li> <li>Limited ecological value</li> <li>Disruptive and expensive to construct</li> <li>Most costly permitting</li> </ul>
<b>Expand Sediment Forebay</b>	<ul style="list-style-type: none"> <li>Enhanced sediment removal</li> </ul>	<ul style="list-style-type: none"> <li>Would need to be very large to provide sufficient pre-treatment for entire watershed</li> <li>Resuspension of sediments is likely</li> </ul>
<b>Install Subsurface Proprietary Pretreatment System</b>	<ul style="list-style-type: none"> <li>Removes both sediment and trash</li> <li>Eliminates need for Sediment Forebay</li> <li>Minimal impacts to install</li> <li>Easiest to permit</li> </ul>	<ul style="list-style-type: none"> <li>Requires regular maintenance and cleanout</li> </ul>

### Preferred Management Alternatives

Ultimately, the tidal wetland with a subsurface proprietary pretreatment system would be the easiest, most cost-effective solution. The results of the alternatives analysis and the preferred management alternatives were presented at a second public meeting held on December 13, 2017. Residents were supportive of the proposed management alternatives, as long as the work included the removal of existing trash and debris

from the Pond. Below are conceptual renderings of what the Pond could look like, after natural or assisted revegetation, as a tidal wetland at high and low tides:



*High Tide*



*Low Tide*

### CONCEPT-LEVEL DESIGN

Woodard & Curran has developed a concept-level design of the proposed work. Work will consist of the following:

- Installation of a Suntree Baffle Box for stormwater treatment in the existing stormwater drainage system upstream of the outfall discharge to the Pond;
- Replacement of the existing Pond outlet with a larger box culvert;
- Stabilization of the Pond outlet with natural stone armoring; and
- Removal of trash and debris from the Pond.

The figure provided in Attachment G shows the proposed work. It should also be noted that Woodard & Curran recommends a one-year period of monitoring following the completion of construction to determine whether additional work should be conducted, such as plantings, dredging, and/or targeted sediment removal.

The following sections describe how the culvert outlet and pretreatment baffle box were sized, and summarizes the cost estimate that has been prepared for the proposed work.

#### Culvert Sizing

The modification to the pond outlet to create a tidal wetland involves lowering and expanding the culvert to increase tidal exchange into the Pond. For the purposes of this concept-level design, a 12-foot wide by 3-foot tall concrete box culvert with an invert set at elevation 3.83-feet is being proposed based on the available information. It should be noted that, as part of future design efforts, more detailed information such as a survey and tide monitoring data should be obtained. The process for determining the box culvert parameters is summarized below.

The proposed box culvert invert elevation is set one-foot below the existing Pond outlet culvert elevation; however, based on site observations, it is likely that lowering the culvert more than one-foot may result in the need for expanded dredging of adjacent tidal wetland or Pond sediments. The height of the proposed box culvert was selected by determining how much distance is between the proposed invert elevation (3.83-feet) and the HAT (6.69-feet). Therefore, the culvert height of 3-feet was selected, such that height of the culvert will not restrict the flow of the tide into the Pond.

A weir equation was used to size the box culvert width based on the desire to maximize tidal input into the Pond area; see Attachment F for detailed calculations. The culvert width represents the weir crest length. The



time was derived from a basic graph of the tide, assuming that the tide would reach MHHW once over a 12-hour time period; a copy of this graph is also provided in Attachment F. Based on this graph, it was determined that the amount of time that the tide would rise over the proposed culvert invert (3.83-feet) and into the Pond would be approximately 79-minutes.

Assuming a desired water depth of 13-inches over the 1-acre Pond, the box culvert would need to be wide enough to convey approximately 47,200 cubic-feet into the Pond during average high tides; to achieve a water depth of 13-inches on an average day, the culvert would have to be approximately 14-foot wide. However, it should be noted that costs for concrete box culverts increase more significantly for widths over 12-feet; for this reason, a maximum width of 12-feet was assumed. A 12-foot wide by 3-foot tall box culvert with an invert set at 3.83-feet would allow approximately 40,300 cubic-feet of water to flow into the Pond during average high tides; this would equate to a water depth of approximately 11-inches across the current Pond area, resulting in the visual aesthetics of a "pond" during high tide cycles.

### **Stormwater Pretreatment Sizing**

A Suntree Nutrient Separating Baffle Box will be utilized for stormwater pretreatment. The Baffle Box will be installed in-line of the stormwater drainage system upstream of the outfall discharge into the Pond. The Baffle Box is sized based on stormdrain size and stormwater flows. For a 30-inch pipe, either a 6'x12' or an 8'x14' Baffle Box may be used. The 6'x12' Baffle Box can treat stormwater flows from 24 to 46 cubic-feet per second (cfs). The 8'x14' Baffle Box can treat stormwater flows from 32 to 60 cfs. As previously described, a HydroCAD model was developed, which was utilized to determine the flow rates in the stormdrain outfall during various storm events. The peak flow is approximately 36 cfs during the 1-year storm, and approximately 60 cfs during the 2-year storm (see the HydroCAD Report in Attachment E). For this reason, it was determined that a 6'x12' Baffle Box would be sufficient to treat the first few inches of rain (which is more than the typical water quality storm event of 1-inch over impervious areas and 0.4-inches over pervious areas). It should be noted that the 8'x14' Baffle Box would increase the cost by approximately \$20,000. Costs are described in greater detail in the following section.

### **Concept-Level Cost Estimate**

Woodard & Curran has prepared a concept-level cost estimate for the proposed work, which includes costs for construction, engineering and permitting, construction administration, post-construction monitoring, and contingencies for conceptual design. It should be noted that costs for engineering and construction administration have been calculated as a percentage of the overall construction cost (15% and 8% respectively), and that costs for post-construction monitoring services are based on 12 site visits. The total project cost has been estimated as approximately \$294,000. A detailed cost estimate is provided as Attachment H for your reference.

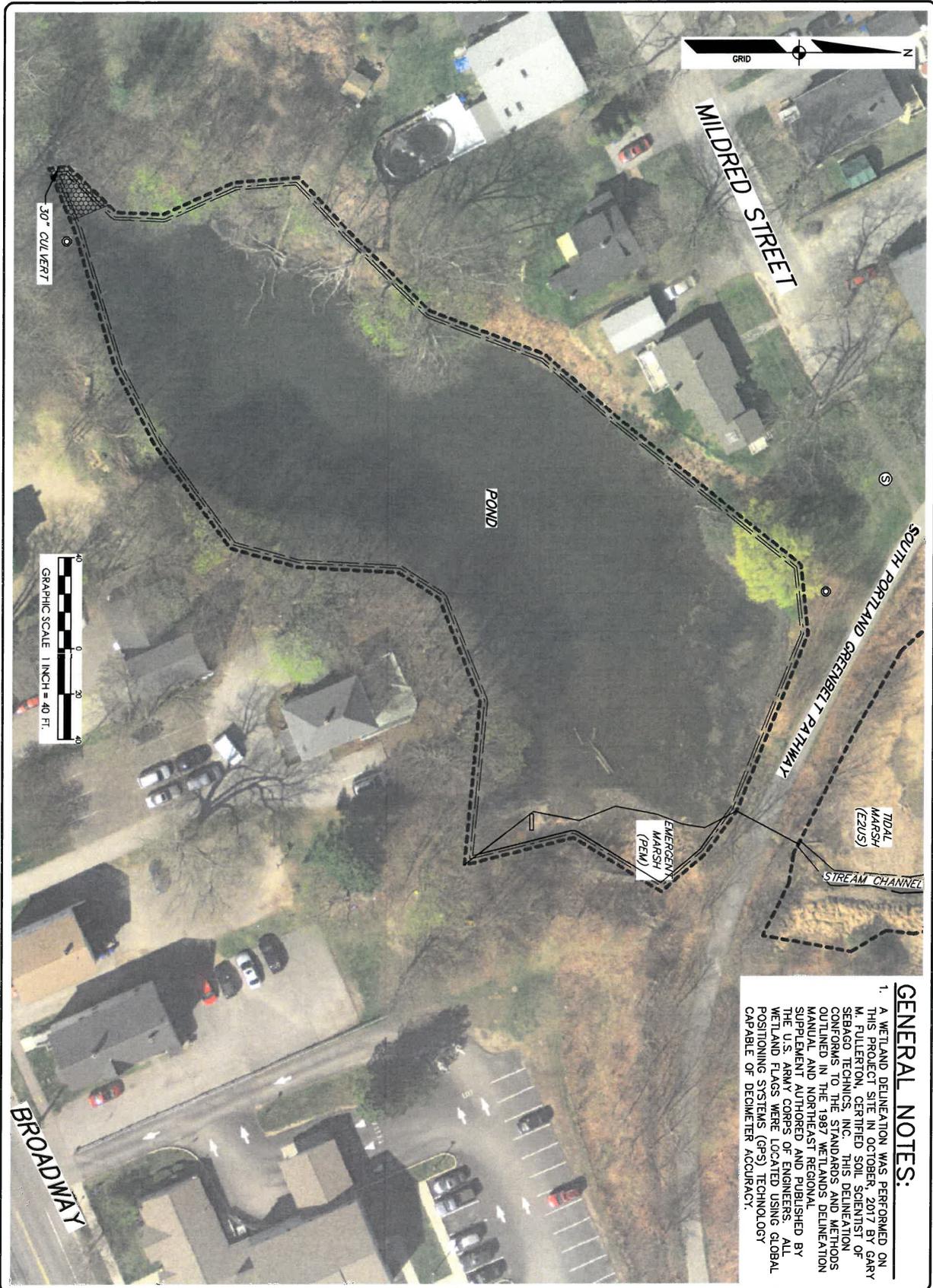
Woodard & Curran appreciates the opportunity to work with you on this project. Please do not hesitate to reach out to us with any questions.

Sincerely,

WOODARD & CURRAN

A handwritten signature in black ink, appearing to read "Ashley Auger".

Ashley Auger, PE  
Project Engineer



30" CULVERT

MILDRED STREET

POND

SOUTH PORTLAND GREENBELT PATHWAY

EMERGENCY MARSH (PEM)

TOTAL MARSH (E2US)

STREAM CHANNEL



BROADWAY

**GENERAL NOTES:**

1. A WETLAND DELINEATION WAS PERFORMED ON THIS PROJECT SITE IN OCTOBER, 2017 BY GARY M. FULLERTON, CERTIFIED SOIL SCIENTIST OF SEBAGO TECHNICS, INC. THIS DELINEATION CONFORMS TO THE STANDARDS AND METHODS OUTLINED IN THE 1987 WETLANDS DELINEATION MANUAL AND NORTHEAST REGIONAL SUPPLEMENT AUTHORED AND PUBLISHED BY THE U.S. ARMY CORPS OF ENGINEERS. ALL WETLAND FLAGS WERE LOCATED USING GLOBAL POSITIONING SYSTEMS (GPS) TECHNOLOGY CAPABLE OF DECIMETER ACCURACY.

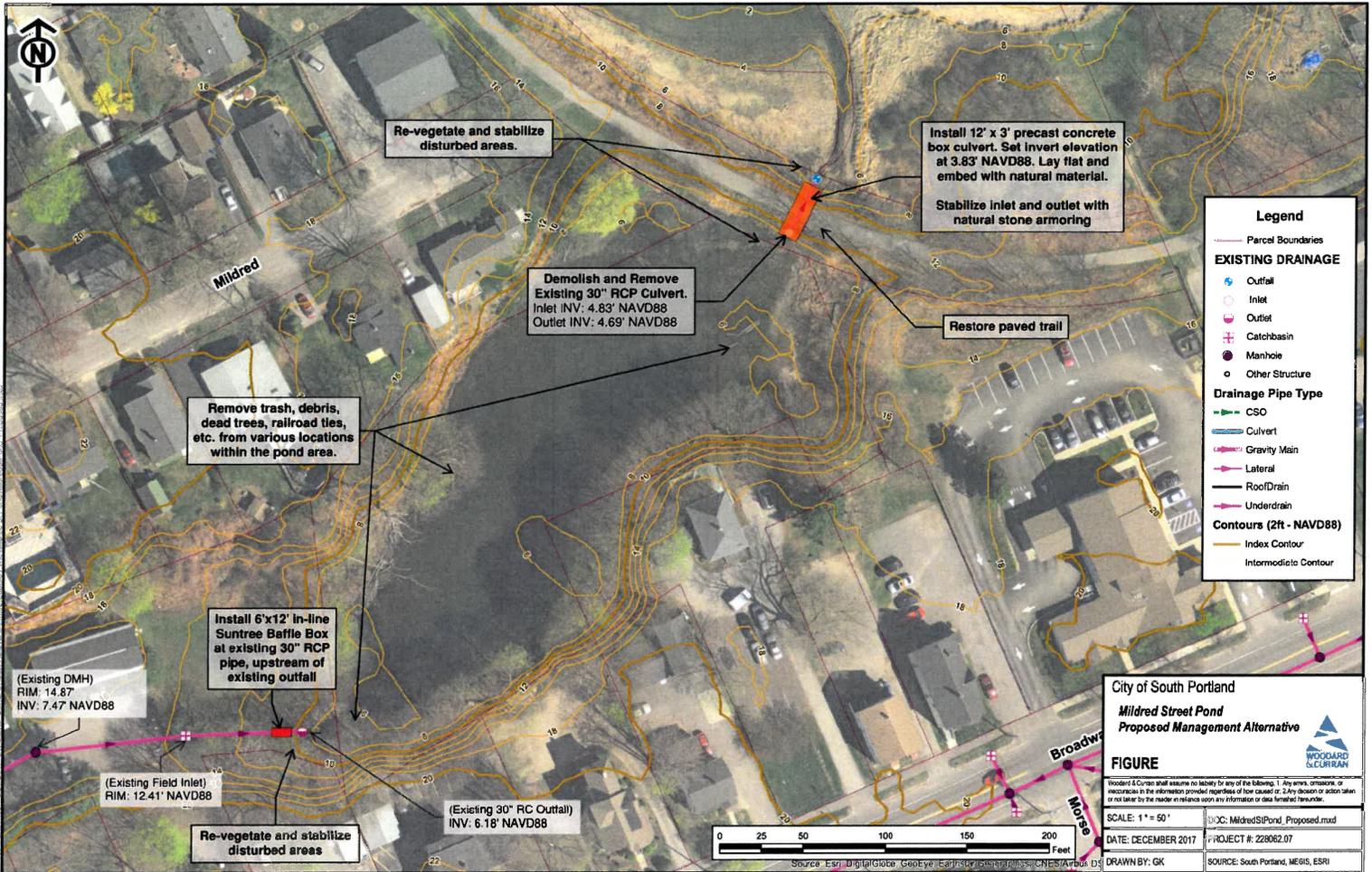
SHEET 1 OF 1	PROJECT NO.	SCALE
	15009	1"=40'
DESIGNED	CHECKED	
G.M.F./B.R.F.	G.M.F.	

**WETLAND PLAN**  
 OF:  
**MILDRED STREET POND**  
 MILDRED STREET  
 SOUTH PORTLAND, MAINE  
 FOR:  
**CITY OF SOUTH PORTLAND**  
 25 COTTAGE ROAD  
 SOUTH PORTLAND, MAINE 04106

**SEBAGO**  
 TECHNICS  
 WWW.SEBAGOTECHNICS.COM

75 John Roberts Rd. Suite 1A South Portland, ME 04106 Tel. 207-200-2100	250 Goddard Rd. Suite B Lewiston, ME 04240 Tel. 207-783-5656
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**Legend**

**EXISTING DRAINAGE**

- Outfall
- Inlet
- Outlet
- Catchbasin
- Manhole
- Other Structure

**Drainage Pipe Type**

- CSO
- Culvert
- Gravity Main
- Lateral
- Roof/Drain
- Underdrain

**Contours (2ft - NAVD88)**

- Index Contour
- Intermediate Contour

City of South Portland  
**Mildred Street Pond**  
 Proposed Management Alternative

**FIGURE**

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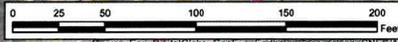
SCALE: 1" = 50'

DATE: DECEMBER 2017

DRAWN BY: GK

PROJECT #: 228062.07

SOURCE: South Portland, MEGIS, ESRI



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**Water Resource Protection**  
**Wastewater Treatment Facility**  
**Electrical Systems Improvements Phase 1**

This 2019 capital improvement request is to supplement last years request for funding the Phase 1 Electrical Systems upgrade to the treatment plant. The cost approved for last years request came from the Treatment Plant Facility Plan Facility Update 2014 for \$804,000. Over the past year, the consultants, Woodard & Curran, and city staff have been developing a Preliminary Design Report (PDR) exploring alternatives and examining their scope and cost. While there were alternative scenarios developed for serious consideration, the alternative scenario first decided upon in phasing the project turned out to be the most cost effective. Attached is the narrative section of the PDR. The work is designed around upgrading 40-year-old electrical equipment and systems. Code issues and aging equipment in the primary distribution system which is, quite literally the backbone of the treatment plant, abound. The distribution system consists of the secondary transformer service entrance, 2000A main switchboard, the 2000A automatic transfer switching (ATS), two standby generators w/ housings, associated conduits and cabling, old bus duct building entrance, and new main breaker at the Main Pump Station (MPS).

The cost for the recommended alternative for Phase 1 is \$2,020,000. WRP is still proceeding with the phasing approach to doing the work. The cost of the three phases together will be \$3,397,500. This request to continue with replacing/upgrading the treatment plants first phase electrical system means the second and third phases are going to be bumped back by two years. This years request is for \$1,216,000.

Project Cost:	\$1,216,000
Funding Source:	Sewer User Fund Reserve
Source of Cost Estimate:	Electrical Conceptual Design Report, Woodard & Curran
Projected Useful Life:	30 years



# Electrical Conceptual Design Report

## Water Resource Recovery Facility

South Portland, ME

Revision 0



*A.J.F.*  
2018-03-23

41 Hutchins Drive  
Portland, ME 04102  
800-426-4262

**woodardcurran.com**  
COMMITMENT & INTEGRITY DRIVE RESULTS

0228062.48  
South Portland, ME  
March 2018

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## 1. INTRODUCTION

### 1.1 PROJECT BACKGROUND

A majority of the electrical distribution equipment at the WRRF is original to the plant which was constructed in the mid 1970's. There have been three significant upgrades to the plant which included modifications to the electrical system. Two of those occurred in the mid 1990's including a significant upgrade to the electrical system in 1995 which increased the utility transformer and service size to a 1000kVA. The electrical system has been well maintained and historically, the service has been reliable with minimal downtime. The availability of components and spare parts is becoming more difficult and expensive to obtain. The system as it is configured does have some issues as identified in the October 2014 Wastewater Treatment Facility - Facility Plan Update for the City of South Portland by Wright Pierce Engineers. The existing system in general does not meet modern design standards and some code requirements. In order to provide reliable electrical system performance, improved efficiency and prepare for future additions for the next 40 years, the Owner has made the decision to upgrade the electrical system at the WRRF.

Wright Pierce produced a facility plan in October of 2014. Based on that plan further evaluation of the electrical system was recommended. In January of 2017, Woodard & Curran performed a site visit to evaluate electrical equipment, documenting the existing gear and its condition. W&C documented power monitoring data, equipment loads, utility peak demand values, and system topology. From the gathered data W&C worked with South Portland WRRF staff to develop potential alternative design approaches and a preliminary construction phase sequencing approach.

### 1.2 PURPOSE OF THIS REPORT

The primary purpose of this report is to detail and develop a phased approach for replacing obsolete electrical distribution equipment at the South Portland Water Resource Recovery Facility within a time frame suitable to the WRRF. The report contains an in-depth look at the existing condition of the distribution system starting at the primary service entrance and utility transformer down to major distribution equipment such as MCCs, Panelboards, Switchboards, and Motor Control Cabinets. Additionally, the report details the potential generator options, distribution equipment technology, and feasibility of proposed alternatives.

To adequately develop a phased approach for replacement of the distribution system equipment, a review of existing power monitoring data as well as a review of future process loading was established and discussed. The data, along with input from South Portland staff, a preliminary approach was developed. The report details the multiple alternatives developed and provides a final recommended approach. The final approach is based on specific factors such as desired electrical system topology, electrical equipment technology, emergency generator support requirements, evaluation of load operation, cost, and construction feasibility.

The scope of this report and subsequent upgrade recommendations are limited to the main service entrance, electrical distribution equipment within the Operations Building Electrical Room, Influent Pump Station distribution equipment and emergency generator support. The Disinfection Building and Dewatering Room electrical distribution equipment is not addressed as part of this report other than refeeding the equipment from a new location.

## 2. ELECTRICAL ENGINEERING

### 2.1 ELECTRICAL DISTRIBUTION SYSTEM TOPOLOGY

The electrical distribution system is sourced from a Central Maine Power Company (CMP) primary feed at the last utility pole on E St. The primary feed transitions underground and feeds a 1000kVA utility-owned pad mount distribution transformer located in front of the Influent Pump Station. The service is secondary metered, and the transformer is owned by CMP. The transformer secondary feeds two separate distribution locations: The Influent Pump Station and the Operations (OPS) Building. Refer to Appendix G – E10.01 for the existing system one-line diagram.

The secondary feed to the Influent Pump Station transitions from the transformer secondary to an exterior pad-mount, single section, Square D 1200A, 480V, 3-phase, 4-wire main breaker. The main breaker then feeds an interior pad-mounted Kohler 1200A automatic transfer switch (ATS). The load side of the ATS then feeds a 2000A rated Square D switchboard (SWBD-1) within the Blower Room. The switchboard distributes to (4) 75HP Influent Pumps, MCC-6, and various other ancillary loads. The Influent Pumps are operated by stand-alone Toshiba P9 VFDs located within the Blower Room. MCC-6 distributes load primarily to the Grit and Screenings Building as well as the (3) 100-150HP Overflow pumps. Two of the Overflow Pumps are controlled by VFDs and one is controlled by an across the line motor starter. Starters are integral to MCC-6.

The 480V, 3-phase, 4-wire secondary feed to the OPS Building is routed underground to the western side of the building. The feeders transition above grade to a junction box where they are converted to a 2000A rated bus duct. The bus duct transitions overhead to the electrical room and feeds the 2000A rated Main Switchboard (MSB). MSB main breaker is a 2000A Westinghouse motor operated circuit breaker. The two feeder breakers include one that feeds MCCs (1-4), and one breaker that feeds the Disinfection Building Switchboard (SWBD-2). The MCC feeder breaker is a 1600A Westinghouse motor operated circuit breaker. The SWBD-2 feeder breaker is a Square D NW Masterpact 2000A frame with a 1200A trip rated plug.

MCC-1 through MCC-4 are all located directly adjacent to MSB. These MCCs feed various loads throughout the facility including the RAS/WAS pumps, Plant Water pumps, Spray Wash pumps, Effluent pumps, various valves & gates, Clarifier drives, Scum pumps, HVAC systems, and additional miscellaneous 480V loads. The configuration is not intuitive based on the MCC numbering. MCC-1/3 is a single back-to-back MCC and is fed from MCC-2/4 which is also a back-to-back MCC. MCC-2/4 also feeds the Dewatering MCC-5. MCC-1/3 feeds the Disinfection building MCC-7.

MCC-5 is located on the second floor at the eastern end of the OPS building. The MCC is fed from MCC-2/4 and is located within the dewatering room directly behind the belt filter press systems. The MCC is a 600A rated 480V, 3-phase, 4-wire MCC with a 300A main breaker. It distributes loads to all the belt filter press and truck loading systems.

SWBD-2 and MCC-7 are located in the Disinfection Building electrical room. These two pieces of distribution equipment are fed separately from the MSB and MCC-1/3 in the OPS building. SWBD-2 distributes power to the (4) 200HP blowers, controlled by Square D Altistart Soft Starters, and a local 480V panel which provides power to various valves. MCC-7 distributes power to (3) Plant Water pumps, (3) Primary Sludge pumps (3) Chlor/Dechlor Mixers and other various HVAC loads.

### 2.2 CONDITIONS ASSESSMENT

As a general definition, the following summary uses three major terms to describe condition: Poor, Moderate, Good. Poor condition is considered high risk of failure and should be given higher priority depending on usage. Moderate condition is considered low risk of failure, mostly cosmetic damage but may lead to a poor condition if left without addressing. Good condition is considered no risk of failure with little to no cosmetic issues. The assessment given below is based on visual observations and may not fully encompass the conditions of electrical equipment. Most of the problems with electrical equipment is located behind protective enclosures that may not be accessible without proper

PPE. This assessment was performed visually and did not include opening all protective enclosures to examine terminations, bus work and cabling.

## 2.2.1 Primary Service and Pad Mount Transformer

During the 1995 Facility Upgrades, the 1000kVA pad-mount transformer was installed directly in front of the Influent Pump Station. The primary feed was sourced from a utility pole on the WRRF property. However, during the most recent facility additions the primary feed was migrated to a new pole on the opposite side of E St. The condition of the primary and secondary cables from the transformer were not able to be visually inspected. It is assumed the primary feeder cables and underground conduits are in good condition but were not visually inspected at the transformer terminations.

The transformer appears in moderate condition with minimal signs of rust build up and moderate paint fading. The transformer resides on a concrete pad outside the Influent Pump Station. The metering equipment is located adjacent to the transformer. The metering enclosures are in moderate to poor condition showing significant signs of rust build up with the potential for ingress of water.

The secondary feeder configuration doesn't appear compliant with NEC Table 450.3. The maximum combined rating of the secondary protection may not exceed 250% of the rated secondary current. However, the transformer is owned and maintained by CMP. CMP selects the transformer size.

The OPS Building MSB is fed by an exterior 2000A rated bus duct. The bus duct appears to be in moderate condition. There are visible signs of rust on the exterior junction box, supporting poles and the bus duct itself.



Figure 2: Utility Transformer



Figure 1: Junction Box & Bus Duct

The main system bonding jumper and connection to the grounding electrode conductor appears to be installed in the exterior junction box as the conduits transition above ground.

## 2.2.2 Main Switchboard (MSB, OPS Building)

The MSB was installed as part of the original facility in mid-1970's. The switchboard is a Square D Power Style, 2000A, 85kAIC rated 480V, 3-phase, 4-wire system. The switchboard appears in moderate condition with no visible signs of damage or rust. The circuit breakers are considered obsolete. Only third-party products are available for repair, otherwise breakers are replaced in their entirety.

The main breaker and feeder breakers, apart from the Disinfection Building feeder breaker, cannot be operated without proper PPE. When the main breaker compartment is opened, staff are exposed to the line side of the breaker and bus work which typically presents as the worst potential for incident energy at any distribution location. The facilities Arc Flash Hazard Analysis does not indicate the incident energy values resulting from a fault on the line side of the main breaker. However, the main does appear to have a "Maintenance" switch which is required to be activated before opening the main compartment.

There are a series of other concerns with the current configuration of the main switchboard and distribution equipment location:

- Based on the age of the equipment, there is a concern the main breaker and the MCCs feeder breaker would not operate properly upon a fault condition.
- The switchboard is also located directly below hot water piping as well as lab drain piping.
- There is major process piping within the vicinity that could present problem if a valve or piping section was to break out.
- The distribution equipment is rated above 1200A and does not comply with current working clearance code standards and may present a hazard to staff if a fault was to occur by not allowing a direct egress path to an exit.



Figure 3: OPS Building MSB & MCC

### 2.2.3 MCC-1,2,3,4 (OPS Building)

The OPS Building MCCs are original and installed in the mid-1970's. MCC-2/4 is a main lug 1600A, 50kAIC rated Square D MCC. MCC-1/3 is a main lug 600A, 50kAIC rated Square D MCC. MCC-2/4 is fed from MSB and MCC-1/3 is fed from a breaker within MCC-2/4.

The MCCs appear in moderate condition with minor damage and little to no rust build up. There are compartments with missing protective covers and screws. Many of the MCC buckets are either blank or occupied by nothing more than a feeder breaker or fuses.

The feeder configuration of the MCCs leaves the WRRF vulnerable to losing all power to motors if a fault was to occur in MCC-2/4 because MCC-1/3, MCC-5 and MCC-7 are all fed from MCC-2/4. However, MCC-1/3 does contain an ATS and can be supported by the 375kVA Cummins generator.

The majority of the loads are bottom fed and are routed through a large wireway in the pump room directly below the electrical room. The wireway does not appear to provide separation between power and control wiring.

The MCCs do not house motor controllers as a typical MCC would. The MCCs are used mostly for feeder breakers with wall mount motor controllers local to each motor they serve.



Figure 4: MCC Wireway

### 2.2.4 MCC-5 (Solids Handling, OPS Building)

MCC-5 is located on the second floor of the OPS Building within the Solids Handling room. MCC-5 is a 600A, Model 6 Square D MCC with a 300A main breaker and is fed from MCC-2/4. The MCC was installed as part of the 1998 Dewatering Upgrades. The MCC appears in moderate condition. There are no major visible signs of rust or damage to the MCC, but most nameplates are illegible and are replaced with printed labels. The majority of the MCC components are obsolete and likely do not have factory ready products available.

The Solids Handling Room, under current NFPA 820 guidelines, is considered a classified location. The current distribution equipment is not compliant with current NEC classification guidelines. Modifications or replacement of MCC-5 is not part of the scope of this project.

## 2.2.5 Switchboard 1 (SWBD-1), MCC-6 (Main Influent Pump Station)

The Influent Pump Station is fed by a single section 1200A service rated disconnect located exterior directly adjacent to the door entrance and feeds the ATS and SWBD-1. The majority of the distribution equipment, apart from the MCC, was installed as part of the 1995 facility wide upgrades.

SWBD-1 is a 1200A 65kAIC rated, 480V, 3-phase, 4-wire, QED-2 Square D switchboard. SWBD-1 is in good condition and distributes power to the Influent Pumps and MCC-6. SWBD-1 contains a large fused distribution section which is mostly unused and likely not required for any foreseeable future upgrades.

MCC-6 is a 600A 25kAIC rated, 480V, 3-phase, 4-wire, Model 4 Square D MCC. The MCC is in moderate condition with minimal rust build up. The majority of the MCC components are obsolete and likely are do not have factory ready products available.

MCC-6 distributes power and controls mostly to the Grit and Screenings Building motors. Staff have stated a concern with the control and power wiring due to lack of labeling and clear identification as to what the wiring serves. Tracing the wiring in this area has been troublesome in the past.

As part of the most recent SCADA and controls upgrades, new Influent Pump VFDs were installed in the blower room adjacent to SWBD-1.



Figure 6: SWBD-1



Figure 5: MCC-6 Control Wiring

## 2.2.6 Switchboard 2 (SWBD-2) and MCC-7 (Disinfection Building)

SWBD-2 and the aeration blowers were installed as part of the 2003 Aeration Upgrades. SWBD-2 is fed separately from MSB in the OPS Building. SWBD-2 is a 1200A 65kAIC rated, 480V, 3-phase, 4-wire QED-2 Square D switchboard. The switchboard is in good condition with no visible signs of degradation.

The Disinfections Building and MCC-7 were built as part of the 1995 facility wide upgrades. MCC-7 is a 600A 65kAIC rated, 480V, 3-phase, 4-wire Model 5 Square D MCC. The MCC is in moderate condition with little signs of rust and degradation.

The Disinfection Building electrical room is relatively small. It is large enough to support the distribution gear currently. Future work in this area may require special consideration to maintain operation of existing equipment while installing new distribution equipment. Addressing replacement or relocation of the Disinfection Building distribution equipment is not included in the scope of this project.

Additionally, there is an exhaust louver located directly adjacent and above SWBD-2. This doesn't appear to be a problem currently but could be an issue if the louver remains open during a weather event with windblown rain or snow.

All motors in the basement have local disconnects and appear to be operating appropriately.

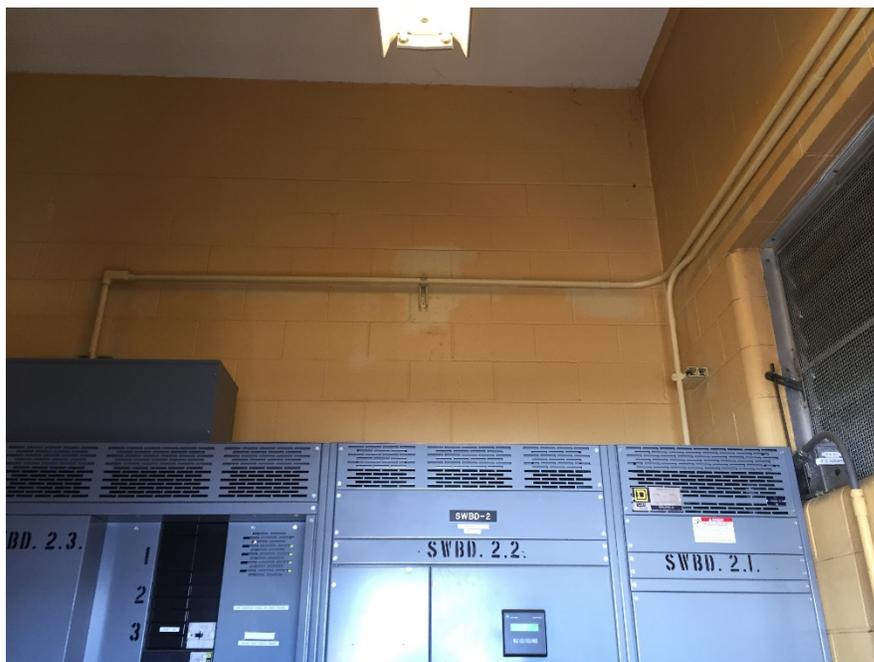


Figure 7: SWBD-2 Disinfection

## 2.2.7 Pump Room (OPS Building)

The Pump Room in the OPS Building houses all the RAS, WAS, Plant Water, Spray Water, Belt Filter Feed and Effluent Filtrate Pumps. All the pumps within the pump room were installed or modified during the 1995 facility wide upgrades or the 1998 dewatering upgrades. The room appears very clean and well maintained.

The RAS pumps are controlled by a local VFD control panel with Allen Bradley model Powerflex 70 drives. The Plant Water pumps are controlled by a local VFD control panel with Allen Bradley model 1336 drives. The WAS pumps are controlled by local VFD control panels with Allen Bradley model 1336 drives. The Belt Filter Press Feed pumps are controlled by a local VFD control panel with Allen Bradley model 1336 drives. The Effluent Filtrate pumps are controlled by motor starters which reside in the MCC. The motor controllers for all pumps in the pump room are past their useful life or very near to it. There are no replacement parts for Allen Bradley 1336 drives apart from third party products.

The Plant Water pumps VFD control panel is located in the back corner of the pump room and is not readily accessible. The panel is located with limited working clearances in front and on the sides of the panel. The installation does not appear to comply with current NEC working clearance requirements based on the distance between the front of the VFD cabinet and the Unistrut supports.



Figure 8: Plant Water VFD Panel 1



Figure 9: Plant Water VFD Panel 2

## 2.2.8 Grit & Screenings Building

The electrical distribution equipment within the Grit & Screenings building includes Grit Pump and Grit Screw motors, disconnects, conduits and general building systems components such as hazardous rated fixtures, receptacles, and switches. The raceways, boxes and fixtures are showing signs of corrosion and paint delamination. Further investigation would be necessary to determine how advanced the corrosion is at each piece of equipment.

Control panels located just exterior of the classified spaces are subject to weather and are showing signs of water ingress with water stains at the base of the cabinets.



Figure 10: Grit Pump CP

Conduits mounted to the exterior of the building that are not either PVC or PVC coated rigid are showing signs of rust and deterioration.

As stated in section 2.2.5, control and power wiring are sourced from the Main Influent Pump Station MCC-6. Staff have stated concerns regarding the routing and condition of the wiring. Staff have had to troubleshoot wire failures within junction boxes and conduits feeding the Grit and Screenings Buildings. Further investigation will take place during the design phase of the project.

## 2.2.9 Facility Lighting and Controls

The majority of the interior OPS Building Interior fixtures are fluorescent 1'x4' fixtures with T-8 or T-12 tubes. Fixtures are controlled mostly by manual switches. Fixtures are in moderate to good condition.

The Main Influent Pump station ground level fixtures are fluorescent 1'x4' with T-8 or T-12 tubes and are controlled by manual switches. The pump room fixtures are hazardous location fixtures likely with incandescent bulbs. All fixtures are manually controlled with switches. The ground level fixtures are in moderate to good condition. The pump room fixtures are obsolete fixtures however are not used very often.

The Grit Screenings Buildings fixtures are all hazardous location listed fluorescent fixtures with T-8 or T-12 tubes with manual switches. The fixtures appear in moderate to good condition.

The exterior roadway fixtures are likely metal halide. Roadway fixtures are controlled by photocells. Staff stated concerns with some fixtures not operating properly. The metal halide fixtures are considered out dated.

Most fixtures appeared in moderate to good condition. The new office spaces were not considered as part of this evaluation.

## 2.2.10 Facility General Panel Distribution and Loads

The OPS Building contains a number of general power panels in a range of conditions. These panels are fed from various locations. MCC-1/3 distributes power to a 75kVA dry type transformer T3 in the electrical room, which then distributes power to panel DP1. DP1 serves as the distribution to panels PP1, PP2 and PP3. These panels were installed as part of the original facility in the mid-1970s and provide general power to the majority of the facility including lighting, receptacles and control panels. Panel PP1, PP2 and PP3 located on the second floor of the OPS Building are showing signs of deterioration.

MCC-2/4 distributes power to a 25kVA dry type transformer T4 in the electrical room, which distributes power to panel H located within the Laboratory.

There are a few additional 480V and 120V panels that were installed as part of the recent OPS Building upgrades which included HVAC modifications and office renovations. Panels in the new renovated portion of the OPS Building are in good condition.

## 2.2.11 Generators

The WRRF is supported with two separate emergency generators. The Main Influent Pump Station is supported fully by a single Kohler 750kVA (600kW) 480V, 3-phase, 4-wire exterior diesel generator. The OPS Building houses a second generator which is fed through an ATS integral to MCC-1/3. The generator is a Cummins 375kVA (270kW), 480V, 3-phase, 4-wire interior diesel generator.

The Cummins generator is connected to the distribution system through an antiquated ATS located within MCC-1/3. The diesel fuel tank is in the pump room located adjacent to the RAS VFD control panel within a concrete containment wall.

The Influent Pump Station Kohler generator was installed as part of the 1995 facilities upgrade and was recently damaged and required to be repaired. The generator has reached its useful life. The OPS Building Cummins generator was installed as part of the original facility and is well past its useful life.



Figure 12: PS Generator



Figure 11: OPS Building Generator

## 2.3 LOAD ANALYSIS

W&C performed a site visit in February of 2017 to collect data on motor sizes, locations and the distribution topology. The information was consolidated into a load calculations spreadsheet in order to accurately categorize the existing

loads at the WRRF. W&C also worked with the SCADA integration group to gather power monitoring data from various locations. The raw data included Apparent Power (kVA), Real Power (kW) and Power Factor (PF) at three locations: The Main Influent Pump Station, The MSB and the Disinfection Building SWBD-2. It is important to note that data gathered from SWBD-2 is already part of the MSB power data because all feeders for the Disinfection Building originate at the MSB.

W&C also installed a power monitor, for approximately 1 month, on the feeder to MCC-5 to capture that power usage during solids handling operations. MCC-5 is also fed from MSB therefore the information is also captured within the MSB power data. The following sections detail the results of the load analysis at the WRRF.

### 2.3.1 Existing Load Calculations

The following information is a result of the data gathered as well as discussions with facility staff during the workshops to arrive at the best understanding of the current load configuration at the WRRF. Refer to Appendix A for full load calculation results. The load calculations are based on what facility staff have determined could potentially run in parallel. The load calculation data represents peak loading conditions when multiple systems operate simultaneously. However, this doesn't align with power monitoring data likely due to these situations not occurring specifically during the recorded periods.

Table 1: Existing Load Information

Equipment	Location	Connected Load	Derated Load	Power Monitoring (Peak)	Comments
Service Entrance Transformer	Exterior	2748kVA 3307A	1692kVA 2036A	731kVA 880A	Total Service load
MSB	OPS Building Electrical Room	1823kVA 2194A	1130kVA 1360A	489kVA 588A	
SWBD-1	Main Influent Pump Station	925kVA 1113A	562kVA 676A	328kVA 394A	
SWBD-2	Disinfection Building	827kVA 996A	399kVA 480A	360kVA 433A	
MCC-1/3	OPS Building Electrical Room	543kVA 654A	417kVA 501A	NA	Power measured as Part of MSB
MCC-2/4	OPS Building Electrical Room	995kVA 1198A	732kVA 881A	NA	Power measured as Part of MSB
MCC-5	Solids Handling	81kVA 98A	45kVA 54A	NA	Power measured as Part of MSB
MCC-6	Main Influent Pump Station	568kVA 684A	369kVA 445A	NA	Power measured as Part of MSB

### 2.3.2 Power Monitoring Data

W&C imported facility power monitoring data from (3) locations within the WRRF: Main Influent Pump Station, MSB and SWBD-2 in the Disinfection Building. The data is an accumulation of one year of data logged every 30 minutes daily. The values are instantaneous apparent & real power as well as power factor. Each daily peak demand value was plotted for the yearly term. Four graphical representations were produced to represent each power monitor location and one stacked graph that displays the total of all locations and represents the total power utilized at the WRRF.

Appendix B.1 displays the power usage at SWBD-2 and represents the power used by the blowers only. The blowers and a few valves are the only loads fed from SWBD-2. The data appears to show that between the months of January and April of 2016 operations switched between operating one or two blowers at various times. Then between the months of May and October, two blowers were running consistently. Finally, in the months between October and December only one blower was running. The blower nameplates indicate each are 200HP motors with .885PF, which converts to approximately 170-180kVA depending on efficiency and actual mechanical load. This matches up accurately with the data presented. Peak demand for SWBD-2 is approximately 350kVA.

Appendix B.2 displays the power usage at the OPS Building MCCs. This data is calculated by taking the data from the MSB power monitor and subtracting the SWBD-2 (blower data) from it. The remaining value is the power used on MCC-1/3 and MCC-2/4. The data indicates power usage is regularly somewhere between 50kVA and 150kVA with a few fluctuations above. Again, the data are daily peak demand values and may incorporate some larger motor inrush data. But when looking at the data over a year it becomes clear the power usage is generally within this range. Peak demand for the OPS Building is approximately 150kVA.

Appendix B.3 displays the power usage at the Main Influent Pump Station SWBD-1. The data represents the entire power usage for the pump station as well as the Grit and Screenings Building. The data is varied anywhere from 50kVA to 330kVA. There are only 15 data points greater than 150kVA, apart from missing data during the period of August through September. The peak demand values above 150kVA were reviewed in more detail by examining the peak data surrounding the specific date and time. Some data points could be excluded due to motor inrush, but other data points were consistently above 200kVA for long periods of time during that day. It will be difficult to determine specifically if these data points were instances of the power monitor capturing motor inrush. Further examination of motor run status would be needed to objectively state whether the data represents motor inrush or true peak demand. The following are a few of the evaluated data points.

- Jan 10<sup>th</sup> – around 220kVA with peak of 310kVA (likely not inrush, rain event)
- Feb 1<sup>st</sup> – around 50kVA with peak of 250kVA (Potentially inrush)
- March 21<sup>st</sup> – around 40kVA with peak of 250kVA (Potentially inrush, light snow event)
- April 19<sup>th</sup> - around 50kVA with peak of 250kVA (Potentially inrush, light rain event)
- May 4<sup>th</sup> – around 50kVA with peak of 200kVA (Potentially inrush, light rain event)
- June 5<sup>th</sup> – around 40kVA until 9pm, peak is consistently 300kVA (likely not inrush, heavy rain event)
- June 13<sup>th</sup> – around 40kVA but ramps up to 221kVA for a short period (likely not inrush, light rain event)

Appendix B.4 displays the power monitoring performed on the MCC 5 feeder for the Solids Handling system. The power monitor was attached on the load side of the breaker in MCC 2/4 and was monitored for 30 days, beginning in mid-February (2/17/17) and ending in mid-March (3/17/17). The peak load of the MCC as measured was 18.59 kVA.

Finally, Appendix B.5 displays a stacked graph showing the entire WRRF power usage as seen by the utility transformer secondary. The data from all sources is stacked with Red indicating the power usage from SWBD-2 (blowers), Blue indicating the power usage from OPS Building MCCs and the Green indicating power usage from the Influent Pump Station. Approximately 77% of the time power usage is 500kVA or less. 30 data points out of 388 represent periods that were greater than 500kVA. Again, further investigation into motor run status would be required to eliminate any potential motor inrush data points. However, through the investigation of some of these

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data points it is clear not all represent inrush data, which could be inferred that the WRRF has an operational load greater than 500kVA of power but likely no greater than 800kVA.

Given the results shown in power monitoring data over the yearly period it doesn't appear the WRRF will utilize more than 80% of the available system capacity. Furthermore, through discussions during the workshops, the WRRF does not anticipate major growth in process capacity for the foreseeable future. With the combination of the existing data and anticipated future loads it appears the current 1000kVA transformer is adequate to serve the needs of WRRF over foreseeable future.

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### 3. ALTERNATIVES

In May 2017, W&C and South Portland staff held an Alternatives workshop to discuss (3) potential alternatives to the electrical conceptual design. The alternatives were developed based on input from South Portland staff during the preceding informational workshops. The alternatives included the following:

- Alternative 1: Reuse the existing electrical room in the OPS Building and provide additional protection to new distribution gear
- Alternative 2: Repurpose the existing generator and maintenance room for a new electrical room
- Alternative 3: Provide an exterior electrical powerhouse

Each of the alternatives were discussed, reviewing the benefits and drawbacks, distribution equipment types, equipment locations, relative costs, and potential construction phasing approach. Through this process a single alternative was selected. The key difference in each alternative is primarily the location of the main distribution equipment and generator. The following section summarizes the information and discussions that were presented. Refer to Appendix H for all workshop and Alternatives meeting minutes.

#### 3.1 ALTERNATIVE 1

The general approach to Alternative 1 includes reusing the existing space within the existing electrical room in the OPS Building for new distribution equipment, installing new generators, and replacing the Main Pump Station MCC and refeeding equipment at the Grit and Screenings Building. The key concerns are ensuring proper protection, clearance, and safety of staff for operation of the new distribution equipment. Refer to Appendix C for Alternative 1 drawings.

##### 3.1.1 Electrical Distribution

All existing electrical distribution equipment was installed either when the original facility was built or during various upgrades during the 1990's. Most distribution equipment is at or nearing the end of its useful life. The new electrical distribution equipment for Alternative 1 includes a new main switchboard, automatic transfer switch, generator, new MCC at the Main Influent Pump Station, and new feeders to the Grit and Screenings Building. The intent is to combine the two secondary feeders from the utility transformer to provide a single service entrance in order to provide emergency generator support and operation of the entire facility or certain loads as specified by South Portland staff.

A few options are available for locating the utility transformer that include the following: maintaining the existing location, directly adjacent to the existing location at the Main Influent Pump Station or adjacent to the OPS Building where the secondary service rises up to junction box. Throughout the load evaluation process, which included reviewing the proposed load calculations and revised load operations, as directed by South Portland staff, it was determined the existing transformer has sufficient capacity to serve the distribution system and any potential future additions.

The existing electrical room within the OPS Building will house a new main switchboard, automatic transfer switch and a single MCC capable of supporting all motor loads that are currently supported by MCC-1/3 and MCC-2/4.

The Main Influent Pump Station currently utilizes a switchboard and an MCC to distribute power to the pump station influent pumps, overflow pumps as well as the Grit and Screenings Buildings loads. The proposed distribution system includes a single MCC sized appropriately for all loads. Due to limited available space within the pump station, the new MCC will occupy the same footprint of the existing MCC. Additional consideration is needed for determining specifically how motor loads will be migrated.

The Disinfection Building switchboard SWBD-2 and MCC-7 will be refed from the new main switchboard. No further modifications for the Disinfection Building are part of the scope of this project.

The Solids Handling Room MCC-5 will be refed from the new main switchboard. No further modifications for the Solids Handling Room MCC are part of the scope of this project.

Further evaluation will take place during the design phase to determine refeeding power and control equipment within the Grit and Screenings Building. This may include new conduit routing and junction boxes as needed to support the existing motors, lighting, and HVAC components.

### 3.1.2 Generator

The existing generators that serve the pump station and the OPS Building are near or past their service life. The alternative 1 approach includes installing two new generators that will operate in parallel. Each generator will be sized to serve the facility under most operating conditions approximately 77% of time based on the power monitoring and load calculations. Two generators offer redundancy under normal operating conditions and additional power for high process loading conditions to handle 100% of the operating load based on the sequence of operations developed by the South Portland Staff.

The generators will be installed within the same footprint as the existing Main Influent Pump Station generator and directly adjacent. A new emergency switchboard will be installed against the overflow concrete wall to collect both generator power feeds and provide a single feeder back to the automatic transfer switch within the OPS Building electrical room. Additional options will be evaluated during the design phase which include housing both generators in one enclosure, a separate above ground storage tank, and whether to house the emergency switchboard within the generator enclosure. These options are cost dependent and will be examined in more detail.

During the initial workshop a single 1500kVA natural gas generator was discussed as an option. However, due to multiple factors this option was not pursued. Primarily, the cost of a 1500kVA gas generator is roughly 2-2.5 times the price of diesel generator of the same size. The metering and gas manifold equipment would be excessively large and require additional space. Lastly, due to the space limitations of the site it would be challenging to install a generator of this size.

### 3.1.3 Structural

Alternative 1 includes building two new rooms within the OPS Building. The first room addition will be installed in the current electrical room and will allow for the protection and segregation of the electrical gear from common spaces. The room will be constructed of galvanized light gauge metal joists and galvanized form decking for the roof. The walls will be insulated with fiberglass insulation batt. The walls and ceiling will be standard painted gypsum wallboard. The second room will be installed within the Solids Handling room. The size, location and materials will be further investigated during the phase 3 design effort.

There are several benefits to housing the electrical equipment within an isolated room. Primarily, it is for the protection and safety of facility staff. The electrical distribution equipment should only be accessible to qualified and trained staff to prevent unauthorized operation of equipment and to protect staff from electrical hazards. Secondly, it is to protect the equipment itself. Modern electrical equipment incorporates sensitive electronics in almost every component from circuit breakers, motor starters, VFDs, transfer switches, power monitoring equipment, control panels and networking equipment. The life of this equipment is highly dependent upon the environment it is installed in. By providing a degree of protection from dust, dirt, moisture, and temperature fluctuations the life of the components can be extended. Furthermore, the current environments the distribution equipment resides includes large process piping which transfers water, wastewater, and chemicals. Installing the new distribution equipment in a protective room will protect against potential pipe, fittings, or valve failures.

The new distribution equipment as well generators will require new equipment pads. The interior distribution equipment will be installed on 4" housekeeping pads. The generators will be installed on 12" concrete slabs with rebar reinforcement.

### 3.1.4 Civil

Alternative 1 includes site work to support the installation of new electrical duct banks and generators. The extent of the work is expected to be minimal. Civil work will include evaluating and designing potential grading and drainage components, erosion control plans as well as trenching and resurfacing for new duct banks. Further investigation will be required during the design phase to investigate all utility crossings, including any yard process piping, yard electrical ducts, manholes and handholes. The area surrounding the OPS Building is very busy with process piping. Special attention will be needed to locate electrical duct banks to serve the new distribution equipment. Final routing of duct banks will be finalized during phase 1 design. Soil contamination issues were noted as part of the workshop process. Further information will need to be collected regarding existing soil containments to determine if there will be special handling requirements for soils excavated on site.

### 3.1.5 Benefits and Drawbacks

The benefits to building a new electrical room within the existing space include the following:

- Protect staff from electrical hazards
- Protect electrical equipment from potential damage or inadvertent operation
- Controlled environmental conditions
- Reduced relative cost

The drawbacks to this approach include the following:

- Less space for future expansion than other alternatives
- Potential concerns with clearance around hatchway to pump room

## 3.2 ELECTRICAL UPGRADE ALTERNATIVE 2

The general approach to Alternative 2 includes repurposing the existing generator and maintenance room. Following the demolition of the existing generator and relocation of the maintenance room equipment, the adjoining wall will be removed, and the room refinished. New electrical distribution equipment will be installed along with minor modifications to HVAC. The new generators will be installed in the same location as the existing Main Influent Pump Station generator. Refer to Appendix D for Alternative 2 drawings.

### 3.2.1 Electrical Distribution

Alternative 2 is nearly identical to the first. The only difference is the location of the new main switchboard, automatic transfer switch and the OPS Building MCC. Instead of utilizing the existing electrical room the generator and maintenance room will be used. Repurposing these rooms offer significant benefits in that the space is well protected with ample space for the new equipment. Additionally, it allows installation of the new equipment with minimal interference with the operation of the existing distribution system. Structural and HVAC modifications will be required to prepare the space.

The remainder of the distribution system including all the MCCs and switchboards in the Main Influent Pump Station, Disinfection Building and the Solids Handling Room will be identical to the proposed solution in Alternative 1. Feeders and duct bank routing will be altered due to a different electrical room location.

### 3.2.2 Generators

The Alternative 2 generator approach is identical to Alternative 1.

### 3.2.3 Structural

Repurposing the generator and maintenance rooms requires structural modifications. Once the generator and all associated fuel and exhaust piping is removed floor and wall penetrations will be infilled. South Portland staff will be required to relocate the maintenance shop to an alternative location in the interim. The wall between the maintenance shop and the generator room is believed to be non-load-bearing and can be removed. The room will be refinished with new 4" housekeeping pads for the switchboard, automatic transfer switch and MCC. Following the last phase of the project, when the existing MCCs are removed, the original electrical room could be utilized as a maintenance shop.

### 3.2.4 Civil

Alternative 2 civil work is identical to Alternative 1 with the exception that duct banks would be routed farther along the rear access of the building to the new electrical room entrance.

### 3.2.5 Benefits and Drawbacks

The benefits to creating a new electrical room utilizing the existing generator and maintenance room include the following:

- Protect staff from electrical hazards
- Protect electrical equipment from potential damage or inadvertent operation
- Controlled environmental conditions
- Ample space for expansion

The drawbacks to this approach include the following:

- Relocation of the maintenance room
- Higher cost option

## 3.3 ELECTRICAL UPGRADE ALTERNATIVE 3

The 3<sup>rd</sup> Alternative focuses on migrating the distribution equipment to an external power house enclosure. The enclosure will include the main distribution switchboard, the automatic transfer switch and MCC. New generators will be installed along with all new MCCs. Refer to Appendix E for Alternative 3 drawings.

### 3.3.1 Electrical Distribution

The new distribution equipment will be installed in an exterior power house enclosure. Distribution equipment will include a new switchboard, automatic transfer switch and MCC. The enclosure will be provided with pre-wired lighting and HVAC. Due to the size and ratings of the gear two door access points will be required.

The proposed solutions for the utility transformer are equivalent to Alternative 1. The transformer could be moved to a few alternative locations including across the entrance pathway to the Main Influent Pump Station or directly adjacent to the OPS Building near the entrance to the electrical room. However, the transformer is owned and maintained by CMP and in review of the power monitoring data and peak demand data from CMP it appears the existing transformer is adequately sized to serve the needs of the WRRF.

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The remainder of the distribution system including all of the MCCs and switchboards in the Main Influent Pump Station, Disinfection Building and the Solids Handling Room will be identical to the proposed solution in Alternative 1. Feeders and duct bank routing will be altered due to a different electrical room location.

### **3.3.2 Generators**

The Alternative 3 generator approach is identical to Alternative 1.

### **3.3.3 Structural**

There are no major structural requirements as part of the Alternative 3 approach. Minimal effort is required to review floor loading requirements to ensure new equipment will be properly supported.

### **3.3.4 Civil**

Alternative 3 civil work will include new secondary duct bank from the transformer location to the power house enclosure, new duct banks from the power house to the OPS Building, duct banks from the generators to the power house enclosure and new duct banks to a new manhole/handhole in order to feed all motor loads in the clarifiers and Disinfection Building. Alternative 3 civil work will be more in-depth due to the quantity and size of underground duct banks. The MCC will be installed in the power house which means a significant quantity of motor loads will be fed from here. Special attention and close coordination will be required between the civil and electrical design to ensure new duct bank installations do not interfere with existing underground utilities such as yard piping and existing electrical duct banks.

### **3.3.5 Benefits and Drawbacks**

The benefits to installing a new power house includes the following:

- Ideal option for protecting the staff from electrical hazards and protecting the electrical equipment
- Doesn't use any existing floor space within the OPS Building
- Completely isolated during the construction process

The drawbacks to this approach include the following:

- Highest cost option
- Not as readily accessible as existing locations

## 4. RECOMMENDATIONS

### 4.1 SUMMARY

Through the workshop and alternatives collaborative meetings with South Portland staff, Woodard & Curran recommends the Alternative #1 approach. This includes the creation of a new, separated electrical room within the existing electrical room in the OPS Building. The new room will house the switchboard, the ATS, and the MCC. The generator configuration will be a parallel setup consisting of two 350kW (437kVA) or 400kW (500kVA) generators all located outside. An exterior NEMA3R rated switchboard will be installed local to the generators to consolidate the feeds for transition to the ATS in the building. Further evaluation during the design phase will take place to determine if both generators and emergency switchboard components can be housed within one enclosure.

The existing utility-owned transformer will remain in place. The secondary service will be intercepted and routed to the new distribution gear. The routing will either rise up the exterior of the building and penetrate above grade or will utilize the existing manholes in front of the electrical room exit. Further investigation will be needed during the design phase to ensure duct banks are designed such that there is no interference with existing sub grade utilities.

New switchboards and MCCs will be installed at the Main Influent Pump Station. The equipment will be installed as part of phase 3. Refer to Appendix G for proposed drawings. Modifications to the Disinfection Building and Solids Handling distribution equipment will occur as part of separate future contract.

### 4.2 PROPOSED LOAD CALCULATIONS

In reviewing the power monitoring data, CMP peak demand data, as well as the discussions regarding potential future process loading and equipment upgrades, it appears the existing utility-owned 1000kVA transformer has capacity to serve the facility for the foreseeable future. Therefore, the design approach will be to maintain the existing transformer and install gear rated for a 2000A secondary distribution service. The proposed load calculations assume the consolidation of MCC-1/3 and MCC-2/4 into a single MCC. Refer to Appendix F for complete load calculations.

The derated values are still slightly conservative and will be further modified through discussions with South Portland staff to be in line with power monitoring and peak loading data. During the design phase additional monitoring of motor run status can be logged to revise motor operational data in the load calculations.

Table 2: Proposed Load Calculations

Equipment	Location	Connected Load	Derated Load	Comments
SWBD-01	OPS Building Electrical Room	3041kVA 3660A	1661kVA 2000A	
SWBD-02	Influent Pump Station	941kVA 1133A	414kVA 498A	
SWBD-03	Disinfection Building	1110kVA 1336A	532kVA 641A	
MCC-01	OPS Building Electrical Room	599kVA 721A	514kVA 618A	
MCC-02	Influent Pump Station	593kVA 741A	237kVA 285A	
MCC-03	Disinfection Building	283kVA 341A	119kVA 143A	
MCC-04	OPS Building Second Floor	81kVA 97A	45kVA 54A	

### 4.3 ELECTRICAL DISTRIBUTION

The distribution system will start with new secondary feeders from the existing utility transformer to the new equipment in the electrical room. The new duct bank will be trenched as close to the transformer as possible and the existing secondary service will be cut and connected to the new duct bank. New secondary conductors will be installed. The existing duct bank will be abandoned in place up to the building. The old riser conduits, junction box and bus duct will be demolished. The building penetrations will be infilled to a finished appearance.

The new electrical room will be built in phases as described in the following section. The new room will consist of a new 2000A switchboard, 2000A ATS and 800A MCC. Some existing panels and conduits will need to be relocated to accommodate the new equipment.

Equipment:

- Main Switchboard – MSB
  - 2000A front access Type 1 enclosure 100kA bracing.
  - Molded case circuit breakers with adjustable electronic trip settings and ground fault as needed.
  - Integral 2000A ATS, open transition, fixed mounting
  - Power monitoring
  - Surge Protection
- Panelboard – PP-01
  - 480V, 3-phase, 4-wire, 400A
  - Molded case breakers
  - Surge Protection
- Generator Switchboard – GSWBD-01
  - 2000A front access Type 3R enclosure 100kA bracing. Type 1 construction if integral to generator enclosure
  - Molded case circuit breakers with adjustable electronic trip settings
  - Surge Protection
- MCCs (MCC-01 OPS Building, MCC-02 Influent PS)
  - 480V, 3-phase, 4-wire, 800A
  - MCC with integral network communication to each motor controller
  - Power monitoring
  - Motor starters with electronic overloads
  - VFDs

### 4.4 SMART (NETWORKED) MCC

In an effort to present an alternative to the traditional hardwired MCC and wall mounted individual VFDs design and installation, the following outlines the benefits of a Networked MCC with integral motor controllers (VFDs, Starters).

Woodard & Curran have designed and integrated many smart MCC installations and have found the benefits to outweigh the upfront cost and in many cases, save money. The operational feedback obtained from these devices easily allows monitoring of amperage, drive information, and bucket disconnect switch status. There is significant time savings during start-up of smart MCC systems, which eliminates hardwiring of motor controls to PLC terminals and

working with electricians to check these terminations, therefore increasing efficiency. Less IO Points for hardwired control and feedback of the MCC will lead to lower panel modification costs.

The elimination of hardwired Input/output points will reduce the amount of labor associated with engineering and integration tasks. These design efficiencies include the generation of PLC panel drawing IO sheets and instrumentation loop sheets. Integration and start-up time is saved with elimination of FAT and SAT hardwired input testing relying on the quality of work on Electricians ensuring polarity and accurate terminations are completed.

Integration of a smart MCC is streamlined by standardizing MCC parameters, wiring, and data mapping. Woodard & Curran have developed thorough standards for these MCC configurations with documentation to outline the transfer of data between the PLC and MCC.

For construction the smart MCC greatly reduces Electrician labor time with the elimination of hundreds of wires from the MCC to the PLC. Two electricians and foreman onsite installing conduit and wire following control panel and vfd/starter wiring details can be time consuming and challenging.

Eliminating these points from the contractor requirements reduces labor and reduces the chance for wiring errors leading to longer point to point checkout and start-up testing. In addition to labor during start-up the elimination of conduit and copper wire for this IO is greatly reduced with simply an Ethernet cable between the PLC panel and the MCC. The smart MCC offers streamlined start-ups with less contractor interaction.

By installing VFDs and motor starters within MCCs, there is a significant savings in conduit and wire between MCC breakers and control panels. For the most part, the only wiring entering or leaving the MCC is the main feeder, motor loads, and the communication cables.

Provided the smart MCC is installed in a temperature/humidity/dust-controlled environment the equipment is expected to last as long as standard MCCs.

## 4.5 GENERATORS

The final design approach will incorporate two (2) 350kW (437kVA) or two (2) 400kW (500kVA) generators. This option is consistent with the power monitoring data and peak demand data and offers significant cost savings vs the 1500kVA gas generator. The two generators will operate in an alternating lead-lag configuration the majority of the time, with one generator operating for most process operating scenarios. The second generator could be brought online during times of heavier process operations and will allow operation of the loads identified in the sequence of operations provided by South Portland staff.

### Generators

- 350-400kW (437-500kVA), 480V, 3-phase, 4-wire
- Sound Attenuated weatherproof enclosures
- Diesel, 24hr fuel storage for two (2) units. Final quantity of fuel storage will be finalized during the design phase.
- Paralleling controls
- Standard 2yr warranty with 10yr extended warranties available

A new 2000A NEMA 3R switchboard will be installed local to the generators to consolidate the generator feeds together for a single feed to the ATS. Further evaluation will take place during the design phase to potentially house the

generators and emergency switchboard together within one enclosure. Additionally, if access to a single enclosure is perceived to be difficult for staff and maintenance personnel, a separate above ground diesel storage tank will be investigated. This option may reduce the height of entry to the generator enclosure.

## 4.6 STRUCTURAL

The recommended approach includes building a new room within the OPS Building. The electrical room addition will be installed within the current electrical room and will allow for the protection and segregation of the electrical gear from common spaces. The room will be constructed of galvanized light gauge metal joists and galvanized form decking for the roof. The walls will be insulated with fiberglass insulation batt. The walls and ceiling will be standard painted gypsum wallboard. The roof will be sloped towards away from the exterior wall to shed any potential water on the roof.

Alternatively, the electrical room heating and drain piping, as described in section 2.2.2, could be re-routed to avoid installing a roof for the new interior electrical room. Further investigation will take place during the design phase of the project to determine the optimal solution to mitigate the potential water hazards.

The new distribution equipment as well generators will require new equipment pads. The interior distribution equipment will be installed on 4" housekeeping pads. The generators will be installed on 12" concrete slabs with rebar reinforcement.

## 4.7 CIVIL

The recommended approach includes site work to support the installation of new electrical duct banks and generators. The extent of the work is expected to be minimal. Civil work will include evaluating and designing potential grading and drainage components, erosion control plans as well as trenching and resurfacing for new duct banks. Further investigation will be required during the design phase to investigate all utility crossings, including any yard process piping, yard electrical ducts, manholes and handholes. The area surrounding the OPS Building is very busy with process piping. Special attention will be needed to locate electrical duct banks to serve the new distribution equipment. Final routing of duct banks will be finalized during phase 1 design. Soil contamination issues were noted as part of the workshop process. Further information will need to be collected regarding existing soil containments to determine if there will be special handling requirements for soils excavated on site.

## 4.8 HVAC

Additional investigation will occur during the design phase of the project to identify necessary HVAC upgrades to each new modified space. Additional cooling and heating will be provided to maintain a controlled environment in each space. Either separate AC units will be provided or potentially extending the existing building cooling systems to the new electrical room.

## 4.9 CONSTRUCTION PHASING APPROACH

The construction phasing for this project will be as described below. The purpose of the phased approach is to spread the cost of the electrical upgrades to better match South Portland's CIP budgeted outline goal of roughly \$1M per year for 3 years.

### 4.9.1 Phase 1 (2018) – Generators and Distribution Equipment

Phase 1 will include the backbone of the distribution system, which consists of the transformer secondary service entrance, 2000A main switchboard, the 2000A ATS, the generators, associated conduits and cabling, structural infill of windows and old bus duct building entrance, and a new main breaker at the Main Influent Pump Station.

1. Electrical - Demolish/Relocate electrical panels, conduit, and cables on north wall of electrical room.

2. Structural - infill of windows on north wall of electrical room
3. Structural - housekeeping pads
4. Civil/Electrical - Install secondary service entrance, generator, Main Influent Pump Station duct banks
5. Structural/Civil - Install generator equipment pads
6. Electrical – Install Distribution equipment within existing electrical room against north wall
  - o 2000A Switchboard, ATS, Panelboard PP-01
7. Electrical – Install Generators and cables
8. Electrical – Install new main breaker and cables at Influent Pump Station
  - o A new main breaker is required to be installed in parallel at the Influent Pump Station in order to transition the feed from the existing service to the new service while maintaining active use.
9. Electrical – 1<sup>st</sup> service cut over (the following events occur simultaneously)
  - o Secondary service from transformer (new cables to the new switchboard)
    - The service will be cut over from the existing bus duct connection to the new cables
  - o Re-feed MCC-1/3, MCC-2/4 (new cables)
    - New cables will be installed from the new switchboard to the existing MCCs at the same time as the service cut over to ensure seamless operation
  - o Cutover Main Influent Pump Station main breaker (re-use cables)
    - The Main Influent Pump Station will be cut over to the new main breaker at the same time to ensure seamless operation.
10. Electrical – 2<sup>nd</sup> service cut over (simultaneously)
  - o Re-feed MCC-5 Solids Handling (re-use cables)
  - o Re-feed MCC-7 Disinfection (re-use cables)
  - o Re-feed SWBD-2 Disinfection (re-use cables)

#### 4.9.2 Phase 2 (2019) – New Interior Room and MCC-1

Phase 2 will include demolishing the existing MCC-1/3 and MCC-2/4, installing a new MCC-1 and building an interior room. All motor cables capable of being re-used will be migrated, some will need to be refed entirely.

1. Structural – Install new housekeeping pads
2. Electrical – Install new MCC-1, feed from new switchboard
3. Electrical – cut over motors (time frame to be determined)
4. Electrical – Demolish existing MCC-1/3, MCC-2/4 and old switchboard
5. Structural – Refinish floors
6. Structural – Install new interior room
7. HVAC – provide modifications to existing HVAC system as needed to cool room

#### 4.9.3 Phase 3 (2020) – Influent Pump Station MCC and Grit/Screening Building Feeders

The 3<sup>rd</sup> phase will include the replacement of the remaining MCC at the Main Influent Pump Station and new feeders to equipment at the Grit and Screenings Buildings. Further investigation will be needed closer to the design phase of this project to identify specific locations of MCC.

1. Main Influent Pump Station
  - a. Electrical - Migrate motor loads in the existing MCC
  - b. Electrical – Install new MCC (location to be determined)
  - c. Electrical – Re-feed motor loads which includes all loads at the Grit and Screenings Buildings
  - d. Electrical – Demolish existing MCC

## 5. OPINION OF PROBABLE COST

### 5.1 OPINION OF PROBABLE COST SUMMARY

Based on the information in this report, the Engineer's estimate of probable construction cost is \$3,397,500. This includes a contingency of 20% percent. Preliminary quantity take-offs were made with costing data from RSMEANS. Equipment bid quotes were gathered from local vendors. Refer to Appendix J for Equipment bid quotes. The project final design and construction administration costs will be provided at a later date.

**Table 3: Overall Construction Costs**

<b>Phase 1: Generator, ATS, Switchboard</b>	
Construction Costs	\$1,300,000
Contingency: (20%)	\$260,000
General Conditions (15%)	\$200,000
Contractor OH & Profit (20%)	\$260,000
<b>Phase 1 SubTotal:</b>	<b>\$2,020,000</b>
<b>Phase 2: MCC-1 and Room Addition</b>	
Construction Costs	\$500,000
Contingency: (20%)	\$100,000
General Conditions (15%)	\$75,000
Contractor OH & Profit (20%)	\$100,000
<b>Phase 2 SubTotal:</b>	<b>\$775,000</b>
<b>Phase 3: Remaining MCC Replacement</b>	
Construction Costs	\$350,000
Contingency: (20%)	\$100,000
General Conditions (15%)	\$52,500
Contractor OH & Profit (20%)	\$100,000
<b>Phase 3 SubTotal:</b>	<b>\$602,500</b>
<b>Project Total:</b>	<b>\$3,397,500</b>

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**Environmental Protection**  
**Water Resource Protection**  
**Computerized Maintenance Management System (CMMS)**

This 2019 capital improvement request is for the purchase of Computerized Maintenance Management System (CMMS) software and the implementation of the software. The CMMS software along with the robust asset management capabilities will support the City's project vision *'being a self-sustaining and fiscally responsible entity providing effective solutions for public infrastructure needs by integrating long-term standard operating procedures to analyze and prioritize the management of city-wide assets and data to support cost efficient decisions'*. The CMMS will improve the ability to track and manage work and asset information across the City's various departments. The CMMS will also promote consistent practices and efficiencies in data gathering, information sharing, long term financial planning and capital improvements.

An overview of the scope of services, with more details provided in the attached RFP, for this project shall include the following:

- Provide asset management software that is both GIS-enabled and browser-based.
- Software shall be able to accommodate the management of city assets by performing the following functions; Service Requests & Work Orders, Inspections, Risk Analysis, Valuations, Capitol Improvement Planning/Budgeting, Inventory/Workforce Tracking, Asset Condition Assessment, Mobile Applications, Public Portal, Permitting, Billing, Reporting, Dashboards.

- Install and configure the software as required to provide the City with a ‘turn-key’ product, including creating inspection forms, service request forms, and work order forms; training staff in the administration and creation of additional forms; and providing user manuals in the form of online or digital user manual, cheat sheets, and/or hardcopy of final as-built configuration.
- Import City’s existing data and integrate the software with the City’s GIS and other software systems currently used such as JobCal, Granite EP, Paver7, SCADA, RTA, and Munis.
- Conduct both on-site and remote trainings for City staff on the use of the software, including a minimum of four 8-hour days of consecutive initial on-site training and a minimum of 14 8-hour days of remote ‘GO-LIVE’ training support.
- Provide annual remote technical support and software maintenance, including patches, service packs, and version updates; vendor shall specify the typical frequency of software maintenance and how it will be conducted.

The city has gone through a thorough and extensive vendor preselection process since 2016. In the beginning it was primarily the WRP and Public Works departments working together for a mutually beneficial software package that could then expand to fit the needs of the entire city. IT represented the balance of the city departments during the vetting process to represent its needs. Attached is a letter which summarizes the procurement process. We have also provided a summary of the project scope of service and software requirements taken from the request for proposals. This project was bid and brought forward to the Council for approval in March.

Project Estimate Cost: \$173,500

Funding Source:

Sewer User Fund Balance \$86,750

General Fund Reserve \$86,750

Source of Cost Estimate: Woodard & Curran, City

## **City of South Portland, Maine**



### **Request for Proposals**

**for**

### **Computerized Maintenance Management System with Asset Management Capabilities and Implementation Services**

**City of South Portland  
Purchasing Office – Room 105  
PO Box 9422  
25 Cottage Road  
South Portland, Maine 04116**

**1. INTRODUCTION**

The City of South Portland ("City") is soliciting proposals to provide a Computerized Maintenance Management System (CMMS) with robust asset management capabilities to support the City's vision of *being a self-sustaining and fiscally responsible entity providing effective solutions for public infrastructure needs by integrating long-term standard operating procedures to analyze and prioritize the management of city-wide assets and data to support cost efficient decisions*. The CMMS will improve the ability to track and manage work and asset information across the City's various departments. The CMMS will also promote consistent practices, information sharing, and enhance asset management. It will leverage the ESRI GIS environment currently in use within the City. The selected vendor will be requested to perform a wide range of implementation services as outlined in, but not limited to, the tasks in the Scope of Services of this RFP. Included in this contract will be provisions for the software and appropriate licenses, as well as services related to installation, training, and ongoing support.

Sealed proposals should be received by the City Purchasing Agent located at 25 Cottage Road, South Portland, Maine, by the date indicated in the schedule below. Clearly mark the outside of the envelope to indicate the proposal title: "PROPOSAL FOR COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM SOFTWARE AND SERVICES"

The Proposal and Project Schedule for this request is provided below:

Proposal Schedule:

- Deadline for Questions December 15, 2017
- Addendum(s) Issued No Later than December 22, 2017
- Proposals Due January 6, 2018
- Notification of Award/Contract Negotiations February 2018

Project Schedule:

To be completed within 4 months of Start of Contract

- Installation and Configuration
- Data Importing and System Integrations
- Training
- Testing
- Startup Assistance

All questions about the meaning or intent of this Request for Proposals are to be submitted in writing (submission of questions via email is acceptable) to the following:

Woodard & Curran  
 41 Hutchins Drive  
 Portland, ME 04102  
 Attention: Ashley Auger, PE  
 Telephone: 207-558-3665  
 Email: [aauger@woodardcurran.com](mailto:aauger@woodardcurran.com)

Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda via email. The Proposal shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the bid form. Proposals shall be submitted in the format specified under the Submittal Requirements Section, and shall include the bid form provided as Appendix A. The City reserves the right to negotiate any outstanding issues concerning the proposal with the successful Proposer. If a mutually agreeable

contract cannot be reached within a reasonable time frame, the City reserves the right to terminate negotiations with the Proposer and begin discussions with the next in line.

## **2. BACKGROUND INFORMATION**

The City of South Portland is a city in Southern Maine. Situated next to the Portland Harbor, the City of South Portland has a total area of 14 square miles and a population of approximately 25,000 residents.

The City's Water Resource Protection Department operates and maintains the sewer utilities and a municipal stormwater system. The City's sewer utilities consist of a wastewater treatment facility (9.3 MGD capacity), 31 pumping stations, 2,571 manhole structures, and approximately 107 miles of piping. The City's municipal stormwater system consists of 3,723 catch basin and manhole structures and approximately 61 miles of piping. The City has a Combined Sewer Overflow (CSO) Program and is responsible for complying with the MaineDEP General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4). The City is also responsible for maintaining 53 pieces of non-stationary equipment and vehicles associated with their collection systems.

The City of South Portland Public Works Department provides a variety of services including street and sidewalk maintenance, street sweeping, snow plowing, trash and recycling collections, and operation of the City's transfer facility. The Public Works Department is responsible for maintaining 118 miles of roadway, 92 miles of sidewalks, and over 1,200 pedestrian ramps. The City installs and maintains all street signs, traffic signs, and pavement markings for the roadways.

It is anticipated that all assets associated with the Water Resource Protection and Public Works Departments will be incorporated into the new CMMS initially. The ultimate goal is for the new CMMS to be utilized city-wide to serve all departments in the future, including but not limited to Police and Fire Departments, Parks, Recreation, and Waterfront Departments, Planning and Development, and Code Enforcement. Organizational charts for the City of South Portland, and the Water Resource Protection Department and the Public Works Department are provided as Appendix B for reference.

The City's current work order processes for collection system and treatment plant activities are provided as Appendix C. It should be noted that there are separate work order processes for general and emergency maintenance associated with the City's collection systems. The goal of this project is to implement a new CMMS software that will enhance the work flow process for work orders by eliminating manual and/or redundant data entry and automating certain workflow activities such as routing work orders and QA/QC.

### **3. PROJECT SCOPE**

The scope of service for this project shall include the following:

- Provide asset management software that is both GIS-enabled and browser-based with the requirements and functionality outlined in Section 3.A.
- Install and configure the software as required to provide the City with a 'turn-key' product, including creating inspection forms, service request forms, and work order forms; training City staff in the administration and creation of additional forms; and providing user manuals in the form of online or digital user manuals, cheat sheets, and/or hardcopy manuals of final as-built configuration.
- Import City's existing data and integrate the software with the City's GIS and other systems further described in Section 3.B.
- Conduct both on-site and remote trainings for City staff on the use of the software, including a minimum of four 8-hour days of consecutive initial on-site training and a minimum of 14 8-hour days of remote 'GO-LIVE' training support.
- Provide annual remote technical support and software maintenance, including patches, service packs, and version updates; vendor shall specify the typical frequency of software maintenance and how it will be conducted.

#### **A. Software Requirements**

The basic requirements for the new CMMS are listed, as follows:

1. General
  - a) The layout shall be user-friendly; data entry and viewing shall be straightforward for end users. Graphic representations of the data are highly desirable.
  - b) The software should have an ESRI-based interface for viewing and managing geospatial data on assets and work orders using a web browser.
  - c) The software shall have security safeguards and user content management capabilities to protect data and control user permissions.
  - d) Data entry forms shall have drop down menus to the extent possible to expedite populating.
  - e) Software shall have comprehensive functionality available on apple and android mobile devices, such as tablets, phones, or laptops. The vendor shall be responsible for ensuring that the functionality of the application is not limited based on the device being utilized, which may be the result of issues such as screen resolution.
  - f) User should have the ability to distinguish between mandatory and optional data fields.
  - g) Administrators shall be able to customize and create user definable fields.
  - h) Data entry, corrections to information, completion of forms, access to online help, etc. must be able to be done remotely (in the field) by crews, as well as in the office.

- i) The software must provide those user groups with permission the ability to edit the GIS database, including adding assets and modifying attributes, through the web browser.
- j) Software shall be able to integrate data in ArcGIS viewer.
- k) The City prefers maintaining the data locally on its own servers. If the vendor has a compelling argument for maintaining the data in a remote environment, the City is open to this option, provided the vendor shows that the data is secure and easily accessible. Additionally, the City shall maintain ownership of the data at such a time as their contract with the CMMS vendor is terminated.
- l) The software should be expandable, with optional modules to be added at a later date, if desired.
- m) The software must not set limits on the number of assets or the size or complexity of the asset data, other than those imposed by the underlying ESRI system.
- n) The software shall be open architecture and an integrated system, as described herein.

## 2. Assets

- a) The software shall be able to accommodate the following types of assets:
  - i. Roads;
  - ii. Sewer Collection System (i.e. pipes, manholes, laterals, etc.);
  - iii. Facilities (WWTP & Pump Stations);
  - iv. Stormwater Collection System (i.e. pipes, manholes, catch basins, treatment units, etc.); and
  - v. Fleets.
- b) The software should be able to accommodate additional future assets, including but not limited to sidewalks, IT fiber infrastructure, fire hydrants, street lights, fire extinguishers, traffic signals, fire alarms, pools, and street signs.
- c) The vendor shall specify additional assets, if any, that can be provided to the City that may be of interest, based on their review of the City's organizational charts, provided as Appendix B.

## 3. CMMS Functions

- a) The software shall be able to perform the following functions:
  - i. Service Requests & Work Orders;
  - ii. Inspections;
  - iii. Risk Analysis (Consequence of Failure and Likelihood of Failure);
  - iv. Valuations;
  - v. Budgeting & Capital Improvement Planning;
  - vi. Inventory & Workforce Tracking;
  - vii. Condition Assessment (or ability to integrate with GraniteXP & Paver7);
  - viii. Mobile Applications (Apple and Android OS);
  - ix. Public Portal (or provide a third-party system that easily integrates with the software);
  - x. Permitting;
  - xi. Billing; and
  - xii. Reporting & Dashboard.

It should be noted that, if a third-party system is necessary to provide the required CMMS functions, the third-party system shall be fully integrated and seamless, such that the primary vendor shall be fully responsible for resolving all issues within 24-hours.

#### 4. Work Management

- a) The software shall have straightforward processes to create, complete, and close service requests and work orders, readily customizable to the City's work processes summarized herein and as shown on the diagrams provided as Appendix D. The software shall be able to record, manage, track, and report all relevant details of the work.
- b) Work orders must track tasks, parts, labor, equipment, and other resources associated with the work; templates for common work order activities reports shall be provided.
- c) City supervisors, based on CMMS user profile, shall be able to review, reject and amend work orders.
- d) The City desires to have certain information like equipment run time, power use thresholds, vibration limits, etc. from the SCADA system trigger work activities in the CMMS.
- e) Software shall be able to schedule maintenance based on a number of parameters (calendar, run time, etc.) and allow the maintenance schedules to slide based on these parameters. For example, if a preventive maintenance activity is performed after its scheduled date, the date for the next scheduled activity should be based on when the work was performed, not the original due date.
- f) The software shall be able to produce a number of reports that provide useful information on the status of work orders, resources, assets, financial, and related information to assist City staff in identifying problem areas.
- g) The software must provide functionality for logging, mapping, and tracking service requests via a public portal; if a public portal module is not available through the vendor, a third-party system that can be integrated with the CMMS must be provided.

#### 5. System Integration

- a) The vendor shall be a designated ESRI partner.
- b) The software shall allow data transfers with the City's existing GIS and SCADA systems, Job Cal, GraniteXP, Paver7, RTA, and Munis. The work order system should interface with an ArcGIS environment and not require duplicating data or converting to a different format.
- c) The software shall have the ability to receive batch SCADA data, in order to schedule preventive and predictive maintenance, based on run times or other parameters.
- d) The software must allow for the exchange of information with other databases and software, including the City's existing software, as described in the previous sections.

#### 6. Inventory and Resource Management

- a) The software shall store and manage multiple financial metrics about assets including purchase cost (original cost), accumulated depreciation, and replacement cost (current dollars).

- b) The software shall store and manage multiple metrics about labor and materials including average time to complete work orders, work orders by person, labor per time period (week, month, etc.), materials used per period, etc.
- c) Software shall have an inventory module, with the ability to trigger alerts when parts inventories are reduced to specified levels.

#### 7. Data/Records Management

- a) Vendor shall import as much of the historical database records into the new CMMS system, as possible.
- b) Software shall have ability to easily import and export Excel records.
- c) Assets and work orders shall have capability to link to supporting information, such as CAD & REVIT drawings, pictures, O&M manuals, lock-out-tag-out procedures, safety manuals, and Job Hazard Analyses.

#### 8. Cost Control

- a) The software shall have ability to calculate work order costs based on manually inputted labor rates.

#### 9. Reporting

- a) The software shall include pre-developed, as well as customizable dashboards with the following functions:
  - i. Drop down menus to pick which categories are needed for a specific report; drop down menus should be customizable.
  - ii. Reports should be able to be viewed on screen, sent to a printer, or exported to a PDF format file.
- b) Reports shall be automatically sent to managers at periodic intervals via email. Email notifications should also be automatically generated for new and overdue work orders.
- c) Reports should display the following minimum information:
  - i. Work order status;
  - ii. Work order types;
  - iii. Work order frequency by problem code, asset, etc;
  - iv. External Issues; and
  - v. Financial Information.

### **B. Existing Software Integrations**

The new CMMS will build on the City's existing data and software. The City currently uses both geographic and nongeographic software packages that will work alongside and be integrated with the new CMMS. The software includes SCADA for the treatment facility and pump stations, GraniteXP for pipeline video inspections, Paver7 for pavement condition assessment, and RTA for fleet management. The City currently has a Geographic Information

System (GIS) that includes extensive data on utility infrastructure; the new CMMS must be GIS-centric. The GIS data is currently stored in an ESRI ArcGIS database hosted on a city-server.

The following is a summary of the City's current software that will need to be either integrated with or replaced by the new CMMS:

- SCADA: The City has a SCADA system for the treatment facility and pump stations, and desires to have information like equipment run time, power use thresholds, vibration limits, etc. from the SCADA Historian data archive system trigger work activities in the CMMS, so they can apply run-time and sensor-based preventive and predictive maintenance. The new CMMS shall allow batch data transfers with the City's existing SCADA system.
- GraniteXP: The City is currently using GraniteXP to conduct condition assessments of pipeline video inspections; the new CMMS will need to be able to integrate with GraniteXP. Existing data from GraniteXP shall be imported into the new CMMS.
- Paver7: The City is currently using Paver7 to conduct pavement condition assessments, but anticipates replacing Paver7 with the new CMMS; if the new CMMS does not have this capability, it will need to be able to integrate with Paver7. Existing data from Paver7 shall be converted into the new CMMS.
- RTA: The City is currently using RTA for fleet management, and anticipates continuing to use RTA; the new CMMS will need to be able to integrate with RTA. Existing data from RTA shall be imported into the new CMMS.
- Job Cal: The City is currently using Job Cal for documenting work orders at the treatment facility, but anticipates replacing Job Cal with the new CMMS. Existing data from Job Cal shall be imported into the new CMMS.
- GIS Collector Application: The City currently uses a GIS Collector Application that field crews utilize to prepare forms for activities such as outfall inspections, catch basin cleanings, and road opening permits; the City anticipates that the new CMMS will have a mobile functionality that will utilize the City's existing forms and replace the GIS Collector Application.

The City has made available, via an FTP site, a summary of the existing data to be imported into the new CMMS software for the purpose of providing proposers additional background to develop their CMMS proposal. To access Woodard & Curran's FTP site, use the following instructions:

HTTPS URL: <https://ftp.woodardcurran.com/SoPoCMMSdata>

username: SoPoCity2

password: CMMSrfpDATA2!

Your password is case-sensitive; please keep it a secret. Comments, questions, or problems may be directed to Ashley Auger at [aauger@woodardcurran.com](mailto:aauger@woodardcurran.com).

**C. Number of Users Anticipated**

The City anticipates having 40 concurrent users of the CMMS. The software must be available to all City staff; therefore, licensing must not be tied to specific users or computers. The package must either provide concurrent use licenses, or allow unlimited use. It is anticipated that there will be distinct user types with associated permissions such that some users will have the full abilities to review, edit and write across the entire platform, others will have limited capabilities. The vendor shall clearly state how the software is licensed, whether through a limited number of seats or another configuration. If alternate licensing options are available, please describe options.

Via Electronic Mail

January 12, 2018



Brad Weeks, Engineer  
Water Resource Protection  
City of South Portland  
111 Waterman Drive  
South Portland, ME 04106

Re: Computerized Maintenance Management System Procurement Process Summary

Dear Brad:

In the Fall of 2016, the City of South Portland's Water Resource Protection and Public Works Departments initiated an Asset Management project in accordance with Woodard & Curran proposal and Agreement executed by the City on January 19, 2016. The goal of this Asset Management project was to develop a program that would help the City integrate long-term standard operating procedures for analyzing and prioritizing the management of city-wide assets and data to support cost efficient decisions. To achieve this goal, the City desired to procure and implement a Computerized Maintenance Management Systems (CMMS) software for the tracking and managing of assets. This letter serves as a summary of the process facilitated by Woodard & Curran for the City, to procure CMMS software for use in a new Asset Management program, consistent with Task 2 of that Agreement.

Woodard & Curran kicked-off the Asset Management project with the City of South Portland at a meeting on September 23, 2016. At this meeting, we discussed the City's goals for the software, which included full integration with the City's existing GIS and other programs (Job Cal, Granite XP, Paver7, etc.), a work order and inspection management system, mobile functionality, user friendly interface, public portal, and the ability for future expansion to all City departments. Initially, the City was only aware of Cityworks as a potential CMMS software, and was interested in identifying alternatives. Following this meeting, Woodard & Curran identified a list of potential CMMS vendors based on review of what other local entities were utilizing and resources such as the *Water Finance Research Foundation 2012 Comparative Review of Municipal Maintenance and Infrastructure Asset Management Systems*. The initial list of potential CMMS vendors consisted of the following:

1. Cityworks;
2. Maximo;
3. Lucity;
4. MaintStar;
5. VUEWorks;
6. SEMS;
7. JOB Cal; and
8. Cityview.

Over the course of the next couple months, Woodard & Curran continued to evaluate these CMMS vendors via a series of high-level questions regarding the City's needs and responses received by the vendors. In addition, on October 24, 2016 Dude Solutions reached out to Woodard & Curran at the City's recommendation and we held a conference call to assess their product. In November of 2016, the list was revised to include the following additions (indicated by **bold**) and eliminations (indicated by ~~strikethrough~~):



1. **Dude Solutions** - *Contacted the City of South Portland*
2. **Innovyze**
3. **Beehive** - *Contacted the City of South Portland*
4. Cityworks
5. Maximo
6. Lucity
7. Maintstar
8. VUEWorks
9. **SEMS** - *Eliminated due to limited GIS Functionality & No Mobile Functionality*
10. **JOB-CAL** - *Eliminated due to a lack of GIS Functionality*
11. **Cityview** - *Eliminated due to no work order functionality, no risk management functionality, and low rating in 2012 Water Finance Research Foundation Comparative Review of CMMS*

In December of 2016, the list was revised again to identify CMMS vendors to conduct presentations for the City; several more vendors were therefore eliminated, as indicated below:

1. Dude Solutions - *Conference call with Woodard & Curran on 10/24/16*
2. ~~Innovyze~~ - *Eliminated due to Water Asset Management software only*
3. Beehive
4. Cityworks
5. ~~Maximo~~ - *Eliminated due to additional reviews indicating software as overly complex and not user friendly*
6. ~~Lucity~~ - *Eliminated due to local references reporting issues with the GIS mobile functions*
7. Maintstar
8. VUEWorks

CMMS vendors were offered the opportunity to make remote presentations. Video demonstrations were provided to the City and Woodard & Curran by Cityworks and Beehive on January 3, 2017, and by Maintstar and VUEWorks on January 5, 2017. The notes from these demonstrations, in addition to the notes from the presentation previously provided by Dude Solutions were compiled into a matrix summarizing the primary features of each alternative; a copy of this matrix has been attached for reference.

The City met internally on April 11, 2017, to review the CMMS Alternatives Matrix Summary and the City's Information Technology Director performed additional interviews with Beehive and VUEWorks on April 21, 2017. The City then eliminated several vendors for the reasoning indicated below:

1. ~~Dude Solutions~~ - *Eliminated due to lack of GIS editing capabilities in the application, limited asset and risk management capabilities, and the South Portland School Department did not provide a good recommendation for Dude Solutions.*
2. Beehive
3. ~~Cityworks~~ - *Eliminated due to high cost versus perceived value and anticipated need for dedicated staff member to manage.*
4. ~~Maintstar~~ - *Eliminated due to lack of GIS editing capabilities in the application and limited graphical representations of data.*
5. VUEWorks

We compiled a detailed list of interview questions and submitted them to Beehive and VUEWorks on May 12, 2017, and follow-up presentations were conducted by Beehive and VUEWorks on June 6, 2017 to address these questions. Several references were also checked for Beehive and VUEWorks in July of 2017; the notes from these reference checks are attached. Based on the additional presentations and reference checks, the City decided to proceed with requesting formal proposals from both vendors.



A Request for Proposal (RFP) was issued to both Beehive and VUEWorks on December 7, 2017, and an addendum was issued on December 22, 2017; a copy of the RFP is attached. The City received proposal packages from both Beehive and VUEWorks on January 10, 2018. The City will be creating an Evaluation Committee to review the proposals and select a CMMS software to be recommended for use in a new Asset Management program.

We greatly appreciate the opportunity to facilitate the CMMS procurement process for the City. Should you have any questions, please don't hesitate to contact me at 207.558.3785 or by email at mmcdevitt@woodardcurran.com.

Sincerely,

WOODARD & CURRAN INC.

A handwritten signature in blue ink, appearing to read "Megan McDevitt".

Megan McDevitt, P.E.  
Project Manager

Enclosure: CMMS Alternatives Matrix Summary  
CMMS Vendor Reference Checks  
CMMS Request for Proposals

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**Environmental Protection**  
**Water Resource Protection Department**  
**Marsh Road Sewer Replacement**

This 2019 capital improvement request is for the replacement of approximately 565-feet of 15-inch sewer pipe located next to Trout Brook between manholes 4B\_46 and 4B\_51. This 1940's vintage vitrified clay pipe is significantly cracked and quartered from years of root intrusion. Over the years, staff has made several spot repairs but the sewer line has passed its useful life and must now be replaced.

Trout Brook is one of the five urban impaired streams in South Portland that does not meet State water quality standards. Consequently, the City has been working diligently since 2010 to address various impairment sources through the implementation of a Watershed Management Plan. Bacteria from aging sewer lines can often be a significant source of impairment to local water resources. Replacing this line will ensure that no exfiltration of sewerage is entering Trout Brook and adding to the impairment. The project cost of \$70,625 was obtained from Sebago Technics.

Project Cost:	\$70,625
Funding Source	Sewer User Fund Reserve
Source of Cost Estimate:	Sebago Technics, Inc.
Projected Useful Life:	65 years

