Plant HVAC Improvements

Project Purpose:
The purpose of this project is to upgrade and replace aging HVAC systems in various buildings at the treatment plant. HVAC systems are vital at the treatment plant to provide a safe environment for staff, meet building codes, and to protect equipment from damage due to excessive heat, excessive cold, harsh atmospheres and condensation. Due to the harsh environments many of these systems are in, they have deteriorated beyond reasonable repair and need to be replaced. Several buildings have also been identified as needing a HVAC redesign to increase air changes and to meet current codes. Planned replacement of these systems will ensure proper plant operations, reduce the safety risk to staff who work in these buildings and protect equipment within the buildings.

Project Proposers/Champions: Erik Rehr

Department: Operations & Maintenance/Engineering

Project Involvement:
Management of the project will be provided by the O&M department. Staff from the O&M Department and Engineering Department will be assigned to areas of need as the project schedule and scope become better defined.

Project History and Status:
The HVAC systems to be replaced were installed according to the following table:

Building	Year	Project
DAF Thickener	1985	Dissolved Air Floatation Sludge Thickeners
GBT Building	1988	Sludge Thickening Project

These HVAC systems are critical to individual building function, and thus plant function. These systems have reached the end of their useful life and are either in a failed state or are in constant need of repair. Equipment within the buildings above has seen mild to major deterioration as a result, reducing reliability and creating additional work for staff. These HVAC systems present a significant risk to plant function and staff safety if a failure occurs.

To perform this project, a consultant will be retained for design and bidding purposes. This will ensure that the HVAC systems are designed properly to today's standards and codes. This will also ensure the proper equipment is installed in lieu of an "in-kind" replacement project. The project will be bid and contracted to a HVAC contractor. Construction administration and inspection will be completed by MMSD staff.

DAF Thickener :
Dissolved air floatation (DAF) thickener 1 has an exhaust fan located on the peak of its fiberglass dome. This exhaust fan serves as the HVAC system for the thickener tank and provides the necessary air changes to protect equipment. Air is pulled in at the base of the dome by the fan and exhausted out of the top of the dome.

In 2014, the fan began having operational issues and the fan finally failed in 2017. The fan is no longer operational and safety concerns with its location on top of the dome doesn't allow for a direct replacement. Since its failure, equipment within the DAF tank and dome has deteriorated at an accelerated rate due to the lack of air changes. This project would install a new fan located at ground level with ductwork extending to the peak of the fiberglass dome. Upgrades in the DAF electrical system will be necessary to facilitate this installation.

GBT Building HVAC upgrades
The GBT building was constructed in the late 1980's and the HVAC system remains original. Currently there are two air handling units (AHU) that serve the building; one AHU serves the polymer room and basement and the other AHU serves the belt room. There are also four exhaust fans that complete the HVAC system in the building. Although functional, these units are past their useful life and need replacement.

There are also concerns that the belt room isn't receiving the proper number of air changes per hour. This concern is derived from the deterioration of equipment and from intense ammonia smell in the room.

Alternatives
Alternatives generally are to defer work, wait for a larger project to incorporate the work, or not make improvements. Projects in this section are items that in many cases have been deferred or staff have (and are) operating "as-is". The downside to continued deferment or denial of projects depends on the project but generally could be classified as continued degradation of material condition, or continued operation in a less than optimal means (with respect to important operating considerations such as energy use, labor, sustainability or safety). An attempt will be made to touch on the specific risks or downside as each project is summarized below.

<u>Null alternative – Maintain existing HVAC systems (No change)</u>
In the null alternative, the current condition of the HVAC systems is completely failed to fair. The systems can be maintained by extra maintenance and repair when failures occur, but several systems require replacement to become functional again. With this alternative there will be continued degradation of equipment, reduced reliability and safety threats to staff.

Alternative 1 – Replace the identified HVAC systems
In this alternative, each of the identified building systems for replacement would be replaced and upgraded with new systems that meet current codes and standards.

Alternative 2 – Replace only failed HVAC systems
In this alternative, only the systems that were identified as failed would be replaced and upgraded with new systems which would reduce the overall project cost.

Key Risks and Issues

Null alternative – Maintain existing HVAC systems (No change)
In the null alternative, the current condition of the HVAC systems is completely failed to fair. The systems are prone to breakdowns at any time, which result in inadequate air changes within buildings, poor or hazardous atmospheric conditions, and increased work for staff. During extreme failures, a contractor may need to be called into perform the repair.

Alternative 1 – Replace all identified HVAC systems
Under this alternative all deficient systems would be brought up to current standards and codes. Major equipment failures would be avoided, leading to improved process performance and improving worker safety.

Alternative 2 – Replace only failed HVAC systems
In Alternative 2, only the failed systems are replaced. This does provide for increased reliability and safety with some of the systems, but other systems in fair to poor condition will remain. These systems will still be prone to breakdowns resulting in inadequate air changes within buildings, poor or hazardous atmospheric conditions, and increased work for staff.

Economic Analysis
The present worth analysis is presented below.

	Alt. 0 No Change	**Alt. 1 All Systems**	**Alt. 2 Failed Systems**
Total Capital Cost	$0	$400,000	$200,000
Engineering and Project Management	$0	$150,000	$50,000
Annual O&M Cost	$40,000	$0	$20,000
Total Present Worth Cost	**$800,000**	**$550,000**	**$650,000**

Recommended Option:

The recommended alternative is Alternative 1. The null alternate was not considered due to plant function criticality rating and safety issues of endangering staff.

Project schedule:

Project timeline	
Design and Engineering	January-September 2020
Bidding	October-November 2020
Construction	January-December 2021

Financial Summary (2019$):

Total Project Cost	
District Staff & Engineering	$150,000
Contractor	$400,000
Total	$550,000

Fiscal Allocation (2019$):

	2020	2021
Engineering	$125,000	$25,000
Construction	$0	$400,000
Total	$125,000	$425,000