## STAFF REPORT

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| **Agenda Item:** | 9 | **Name:** | Mike Reed |
| **Proposed No**.: | 2017-B0063 | **Date:** | March 21, 2017 |

**SUBJECT**

Briefing on the West Point Flooding Investigation—Preliminary Findings Report, by CH2M

**SUMMARY**

The Wastewater Treatment Division engaged CH2M to prepare a report on “root causes” of the February 9, 2017 Emergency Bypass Discharge and Flooding Event at the West Point Treatment Plant. The firm has completed a preliminary report on the event. The TrEE Committee will be briefed on the findings of the preliminary report.

**BACKGROUND**

In the early morning hours of February 9, 2016, the West Point Treatment Plant was receiving combined wastewater/stormwater flows at the rate of approximately 450 million gallons/day—marginally above the plant’s listed maximum capacity. At 2:19 that morning, some element in the process chain failed—leading to a series of events that resulted in the flooding of the primary treatment sections of the plant, and the engagement of the emergency bypass function, routing untreated flow volumes past the treatment processes of the plant and directly into Puget Sound.

That day, plant managers engaged CH2M—who had been on site at the plant in the performance of an existing contract—to conduct a “root cause” analysis to determine what had led to the system failure. The Wastewater Treatment Division had earlier retained the firm to design a replacement for system controls—the centralized system by which managers control the volume and direction of process flows to the various treatment functions in the plant. That contract was revised to add this analysis and reporting function. The charge to the firm was to:

“Provide support to the West Point Treatment Plant following the February 9, 2017 equipment failure to provide investigatory assistance into the sequence of events, potential causes, and impacts of the event. Activities include Ovation and PI research, discussions with operators, and site testing. Provide sequence of events and a map of the overflow and damaged areas. Complete a high level cost estimate of damage. Provide support related to investigation as requested and as budget allows.”

David Kelly, Vice President, Global Technology Leader, CH2M, undertook the root cause analysis and report preparation. Mr. Kelly had been the project lead for the earlier project to replace systems controls, and was familiar with the plant and its systems from that work.

Mr. Kelly will brief provide the briefing to the Committee on March 21.

**ANALYSIS**

The Preliminary Report describes a sequence of events that, while triggered by an initial electrical system failure, involved various other plant systems and operations, resulting in the plant flooding and emergency bypass.

On March 10, a “West Point Flooding Investigation—Preliminary Findings Report” was presented to the Wastewater Treatment Division by CH2M.

**Electrical Switchgear Failure**

The Preliminary Report identifies an electrical system failure as the precipitating event. “Pumps 2, 3 and 4 were operating at full speed. Plant records show that at 2:12 a.m., electrical switchgear feeding two of the four…effluent pumps (pumps 1 and 2) failed.”

“Because Pumps 3 and 4 are fed from a different switchgear than Pumps 1 and 2, these were operational until 2:14 a.m., when they failed due to high vibration when the discharge valves closed from power loss.”

The report notes that there is no definitive findings of the source of the electrical fault, but investigative efforts continue.

**Discharge Valves Closure**

The report notes that the discharge valves—which are intended to prevent seawater backflow into the plant, if the effluent pumps aren’t pushing flow seaward through the discharge pipes—these discharge valves closed with the loss of power. With these valves in the closed position, the flow of outward effluent was blocked, and efforts to restart the flow by engaging pumps 3 and 4 appear to have been frustrated by this discharge valve closure, triggered by the loss of power. These pumps, pushing effluent against closed valves, began to vibrate, triggering shutdown. Subsequent attempts to restart the pumps, at 2:21, 2:31, and 3:00 a.m., all resulted in similar pump shutdowns due to high vibration.

**Bent Float Switch Rod**

To prevent flooding where effluent flow is blocked, there is a system to cause the raw sewage pumps at plant entry to cease sending influent flows into the plant and to direct flow to the emergency bypass, circumventing the plant. This system relies on “float switches”—which perform a similar function to a float switch in the water tank of a household toilet—located in aeration tanks early in the treatment process sequence. These switches are activated when water levels reach defined thresholds—shutting down the raw sewage pumps that bring flow into the plant.

This system appears to have failed, according to the report. The float sits inside a “stilling well”—a heavy iron pipe, positioned vertically, in which water rises as plant water levels rise—pushing the float up, which pushes an attached rod up through a guide tube, triggering the raw sewage influent pumps to shut down at a point one foot below the overflow point. The float is a 4.5 inch ball, which sits in a 6 inch iron pipe, intended to float freely with rising water. It appears that the rod attached to the top of the ball was bent, both interfering with its ability to travel up the guide tube, and positioning the ball in contact with the side of the iron pipe, creating friction and impeding free float—with the result that the raw sewage pumps bringing flow into the plant were not triggered to shut down, and the influent flows continued, even while pumps that push flows out of the plant were inoperative and the effluent discharge valve was shut.

The Recommendations section of the report notes that “damage to these floats has been observed previously….in August 2008, it was observed during a function test that none of the switches in question operated correctly due to damage to the floats and rods. Maintenance personnel repaired the switches based on work orders; it appears that between the 2008 repair and this event, that the float mechanisms sustained similar damage.”

This report is described as preliminary, and it is noted that “ongoing testing and data analysis continues to define the root cause(s); this preliminary summary will be updated as more information is gathered.

**ATTACHMENTS**

1. West Point Flooding Investigation—Preliminary Findings Report
2. Transmittal Letter

**INVITED**

David Kelly, Vice President, Global Technology Leader, CH2M