



## Technical Memorandum

Subject: Overflow Basin Overview

PWB Project #s: W02229

Date: July 26, 2023

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EXPIRES: 6/30/2025

## 1.0 Introduction

The Filtration Facility includes two large Overflow Basins in the southwestern corner of the site, as shown in Figure 1. The primary purpose for the Overflow Basins, which can hold a combined volume of 13.5 million gallons, is to receive water in the unlikely event that one or more of the process basins overflows. There are no connections between the Overflow Basin inlet and the stormwater or sanitary drain systems. Therefore, with the limited exception of rain falling directly into the basins, stormwater will not enter the Overflow Basins.

Water collected in the Overflow Basins is returned to the head of the plant or to the treatment residuals process through two pump stations – the Large Overflow Pump Station with a capacity of 9.0 million gallons per day (MGD) and the Small Overflow Pump Station with a capacity of 310 gallons per minute (gpm).

This Technical Memorandum (TM) provides an overview of the purpose, configuration, and design criteria for the Overflow Basins.

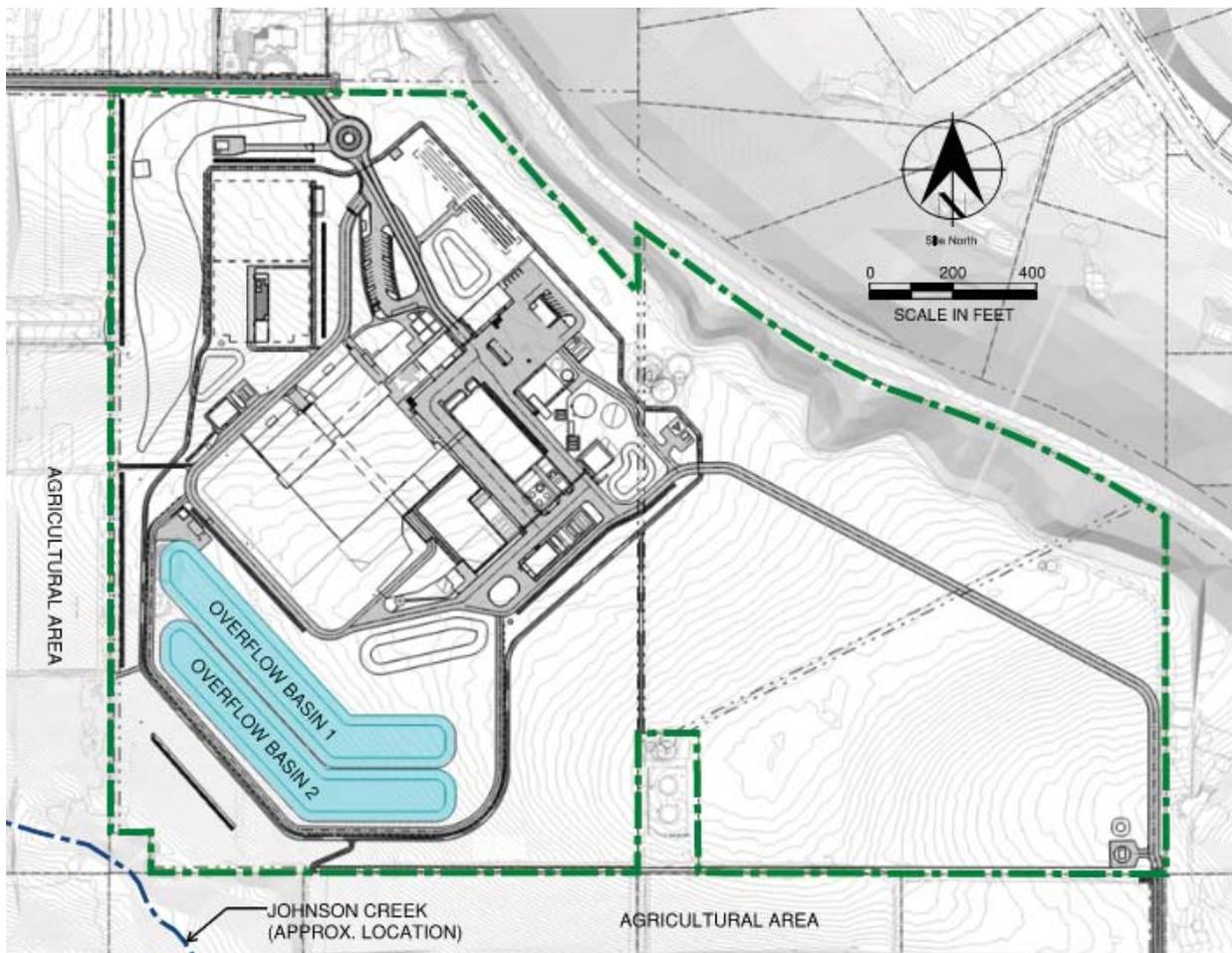


Figure 1. Filtration Facility Site Plan Showing Location of Overflow Basins

## 2.0 Plant Overflow Protection

Overflow weirs and piping connections are provided at multiple locations through the process, so that if a process basin overflows the flow will be safely directed to the Overflow Basins. Overflow weirs are provided ahead of all locations where process basins could be isolated by closing valves or gates. Specific locations are shown in Table 1, which includes a description of the gates or valves whose closure could cause an overflow. Details of the overflow hydraulics are provided on Sheet GEN-G-502 – Process Overflow Hydraulic Profile, attached to this Memorandum.

Table 1. Table Example 1	
Overflow Weir Location	Isolation Mechanism(s)
Inlet Structure	Inlet Gates Flash Mix Valves
Filter Inlet Channel	Filter Influent Valves Filter Effluent Valves
Backwash Channel	Backwash Channel Isolation Valves CT Channel Isolation Valves Clearwell Isolation Valves

Raw water is delivered to the Filtration Facility from the Headworks facility through three pipelines, known as Conduits 2, 3 and 4, each running approximately 9.5 miles from the Headworks to the Facility. As shown in Figure 2, while the elevation distance between Headworks and the Facility is only approximately 30 feet, the pipelines run downhill to the Sandy River, and then uphill to the Facility. To prevent over-pressurization of the conduits, flow to the facility is controlled at Headworks. Even after flow is stopped at Headworks, water will continue to flow until the segment of each conduit near Station 1050+00 drains to the static head at the Filtration Facility Inlet Structure, a volume of approximately 700,000 gallons.

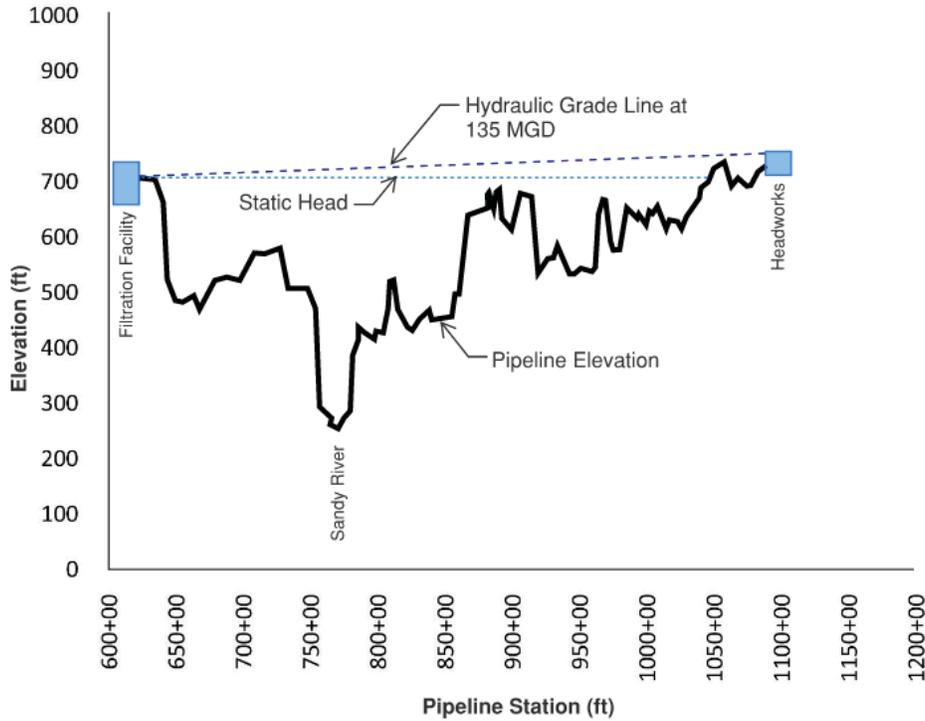
The Overflow Basins were sized to conservatively accommodate a worst-case scenario in which, during operation at peak capacity, a mechanical or controls failure causes isolation valves to shut suddenly or a process failure causes operators to intentionally close filter or clearwell effluent valves to prevent water not meeting drinking water standards from entering the distribution system.

Multiple potential failure scenarios were evaluated, and the controlling scenario made the following conservative assumptions.

- The Facility is operating at peak capacity of 135 MGD. (Average day flow is 85 MGD)
- Overflow Basins each held two feet of water prior to the start of the overflow event.
- If an overflow occurs, control systems at the Facility and at the Water Bureau’s main operations center will immediately receive alarms. A response time of 30 minutes is required for operations staff to assess the situation and decide to shut down flow to the Facility at the Headworks.
- Valves are systematically closed, requiring up to 180 minutes to fully shut down flow from all three Conduits as flow through each of the conduits is gradually reduced from a combined rate of 135 MGD.

During an emergency, valves could be closed faster, but overflow basin sizing was based on normal valve closing speeds.

Based on these assumptions and using a safety factor of 1.5, a design overflow basin volume of 13.5 million gallons was established.



**Figure 2. Raw Water Pipeline Hydraulics (Conduit 3)**

After an overflow event, the Overflow Basins would contain raw or partially treated water which would be returned to the head of the Facility, blended with additional raw water from the Bull Run Headworks, and treated. If the overflow occurred prior to any chemical addition (i.e., at the Inlet Structure), there would be no limit on the amount of return water that could be blended with the raw water. If the overflow occurred after chemical addition, the flowrate from the Overflow Basins would be limited to no more than ten percent of the total inflow.

As noted above, the stormwater system is not connected to the process overflow system, so rainwater will not enter the process basins or Overflow Basins, except for rainwater falling directly into the basins. Even during an extreme rainfall event the Overflow Basins, which are eight to ten feet deep, would only rise by one or two inches over 24 hours and can easily be drawn down by the Overflow Pump Stations. Similarly, overflows from process basins will not be directed to the ground surface, stormwater piping, or storm water basins, but will all be directed to the Overflow Basins.

Given the conservative sizing of the Overflow basins, the multiple alarm and automated control systems included in the design, and the standard and emergency operations procedures that will be implemented at the Facility, it is highly unlikely that the capacity of the Overflows Basins would ever be exceeded. In the unlikely event that that an exceedance were to occur due to unforeseeable circumstances, the road at the southern edge of Overflow Basin 2 would act as a flow spreader weir to prevent erosion of the embankment.

## 3.0 Secondary Uses

The Overflow Basins will also be used to support operations and maintenance activities, including the following. In no case would the Overflow Basins be used to store hazardous materials.

- After a treatment process upset, operators could send flow from one or more flocculation and sedimentation trains to the Overflow Basins (clarification-to-waste) for a short time to verify effective pre-treatment prior to bringing filters online or making the decision to initiate a Facility shutdown. This is a design feature that is unlikely to be used during normal operation, but could facilitate initial startup and testing activities, when flow through the plant will likely be 25 percent or less of the maximum Facility capacity.
- During an extreme turbidity event or failure of a portion of the residuals or solids processing train, process residuals can be diverted to one of the overflow basins, and then returned to the residuals processing train with the Small Overflow Pump Station. The volume of solids sent to the overflow basins would be relatively small compared to the Overflow Basin volume (150,000 to 300,000 gallons per day).
- Process basin floor drains can be directed to the Overflow Basins, allowing washdown water to be stored and recycled into the treatment process through the residuals processing train. Basins will typically be drained for cleaning and inspection annually during low-demand periods. Washdown volumes would be relatively small compared to the volume of the Overflow Basins, and would be simultaneously recycled to the head of the Facility or to the residuals treatment system so additional water would not accumulate in the basins.
- After a filter is backwashed, there are provisions for the first portion of water to be filtered to be sent to an Overflow Basin to be returned to the head of the treatment facility for retreatment. This is referred to as Filter to Waste. These flows are equalized over a 24-hour period to minimize any disruption to the main treatment process. The volume allocated for this equalization is approximately 360,000 gallons.

During these temporary and periodic secondary uses, and during planned maintenance activities such as annual maintenance inspection and cleaning, the basin being cleaned or used for a secondary use could be isolated from the overflow piping, leaving the other basin available to receive Facility overflows. This would allow operators to segregate flow streams and protect staff entering a basin while keeping one basin online for overflow protection. If an overflow occurs while one basin is isolated, the basin connected directly to the overflow piping would overflow into the off-line basin.

# Attachment A. Sheet GEN-G-502 – Process Overflow Hydraulic Profile

**Legend:**

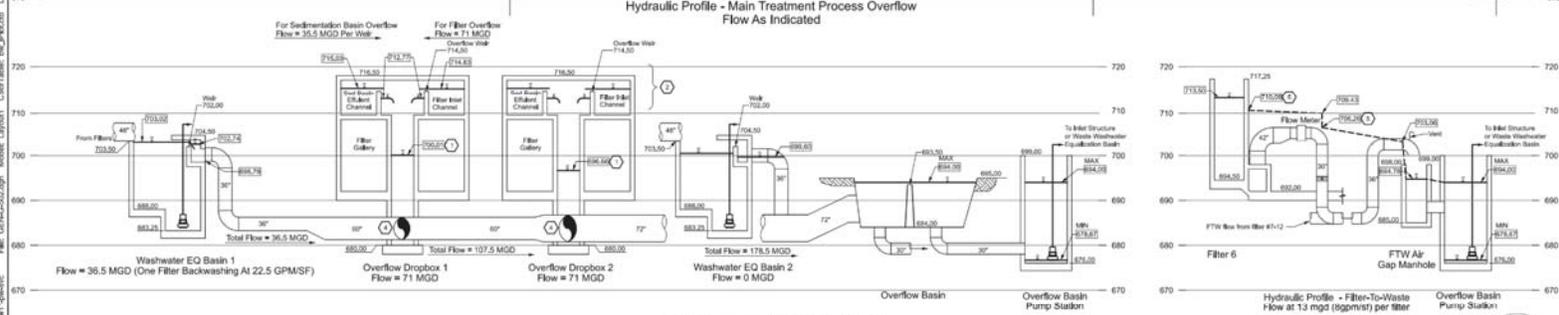
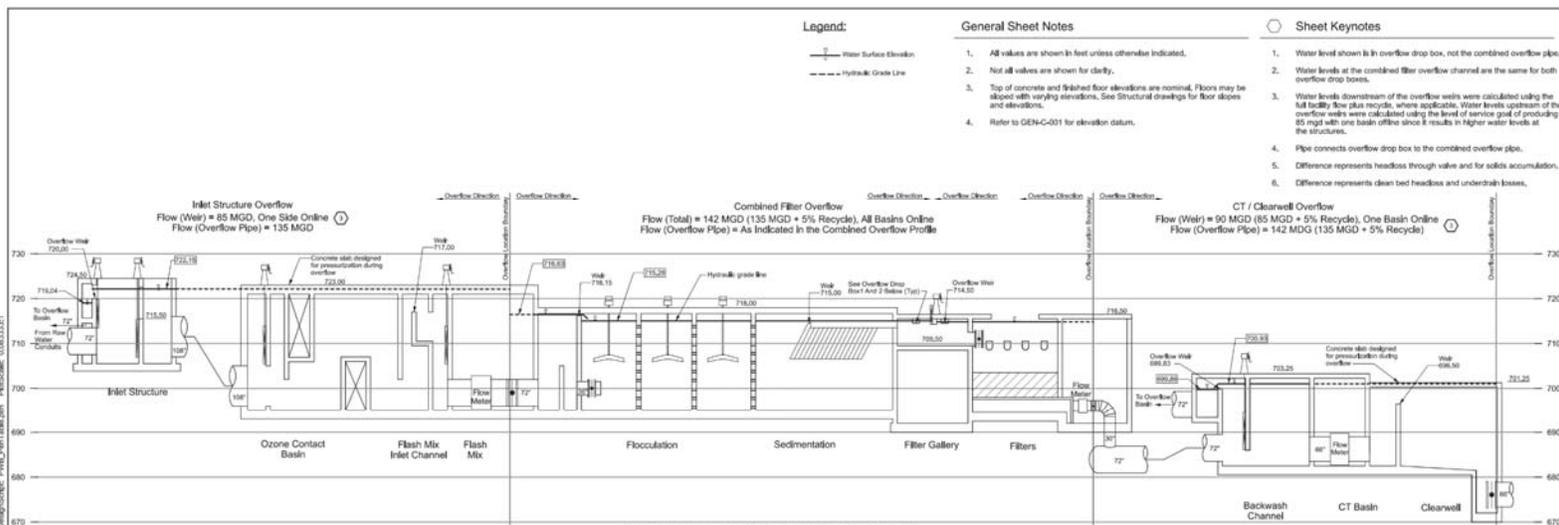
- Water Surface Elevation
- Hydraulic Grade Line

**General Sheet Notes**

- All values are shown in feet unless otherwise indicated.
- Not all values are shown for clarity.
- Top of concrete and finished floor elevations are nominal. Floors may be sloped with varying elevations. See Structural drawings for floor slopes and elevations.
- Refer to GEN-G-001 for elevation datum.

**Sheet Keynotes**

- Water level shown in its overflow drop box, not the combined overflow pipe.
- Water levels at the combined filter overflow channel are the same for both overflow drop boxes.
- Water levels downstream of the overflow weirs were calculated using the full facility flow plus recycle, where applicable. Water levels upstream of the overflow weirs were calculated using the level of service goal of producing 85 mgd with one basin offline since it results in higher water levels at the structures.
- Pipe connects overflow drop box to the combined overflow pipe.
- Difference represents headloss through valve and for solids accumulation.
- Difference represents clean bed headloss and underdrain losses.



**Hydraulic Profile - Combined Overflow Flow As Indicated**

Project No: 20200202202048

Client: Stantec

Project Name: Bull Run Filtration Facility

Sheet Title: Main Treatment Process Overflow and Filter-To-Waste

Checked By: [Signature]

Project No: 410-2023

Portland Water Bureau

FROM FOREST TO FAUCET

**Bull Run Filtration Facility**

**General**

Hydraulic Profile

Main Treatment Process Overflow and Filter-To-Waste

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14 Issues

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GEN-G-502

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