1.1 Tri-City WPCP Overview

The Tri-City Water Pollution Control Plant (WPCP) was first placed into operation in 1986. There were minor upgrades to the treatment facility with no increase in operating capacity. These projects included:

- Effluent Dechlorination
- Biosolids Facility Upgrades
- Aeration Basin Modifications
- Headworks, Primary Clarifier and Stormdrain Improvements
- IPS and Digester VFD Upgrades
- Phase I Liquids Expansion
- Temporary Solids Dewatering and Storage Facility

The Phase I Liquids Expansion was placed into operation in March 2011. This expansion increased the dry weather treatment capacity from the original 8.4-mgd to 11.9-mgd. The plant facilities are shown in ***Figure 1.1-1***.

Figure 1.1-1 – Tri-City WPCP 2011

The treatment plant provides wastewater treatment services to the Tri-City Service District and certain areas of Clackamas County Service District No. 1. The liquids and solids treatment processes provide treatment under an NPDES permit for discharge to the Willamette River.

Liquids Treatment Processes

The liquids treatment processes provide primary and secondary treatment to the incoming waste stream. The influent flows are highly variable between the dry summer season and the wet season when infiltration and inflow (I/I) in the collections system result in high flows. The design liquids capacities are summarized in ***Table 1.1-1***.

Table 1.1-1
Tri-City WPCP Design Capacity

Flow Condition	Design Flow (mgd)
Average Day Dry Weather Flow (ADDWF)	11.9
Maximum Month Dry Weather Flow (MMDWF)	17.1
Maximum Week Dry Weather Flow (MWDWF)	18.6
Maximum Day Dry Weather Flow (MDDWF)	22.6
Average Day Wet Weather Flow (ADWWF)	17.1
Maximum Month Wet Weather Flow (MMWWF)	31.7
Maximum Week Wet Weather Flow (MWWWF)	39.5
Maximum Day Wet Weather Flow (MDWWF)	55.7
Peak Hour Flow (PHF)	68.6

Influent Flow Sources

The treatment plant receives flows from three sources. This includes the gravity system from the Tri-City Service District and two pump stations that divert flow from Clackamas Service District No. 1 (CCSD#1).

Gravity System

The gravity system collects flow from the City's of Gladstone, Oregon City and West Linn. The gravity sewer is a 72-inch pipe that collects flows at the flow control structure located at the intersection of Agnes Avenue and Main Street and follows Agnes Road for 3110-feet to the plant where it discharges into the plant's influent pump station. The design capacity of the gravity system is 75-mgd.

Intertie II Pump Station

The Intertie II Pump Station pumps flow from the Kellogg Interceptor directly to the coarse screening building. This station was placed into service in November 2012 to divert flow and load from the Kellogg Creek WPCP. The peak capacity of this station is 10-mgd.

Clackamas Pump Station

The Clackamas Pump Station pumps from the industrial area of CCSD#1 directly to the coarse screening building. This station was placed in service in January 2000 to divert load from the Kellogg Creek WPCP. The peak capacity of this station is 2.5-mgd.

Influent Pump Station

The flows from the gravity system enter the plant's influent pump station. This station has three 12,500-gpm pumps and two 5000-gpm pumps. All of the pumps are on variable frequency drives. The station's firm design capacity is 58.6-mgd.

Coarse Screening

Flow is received into the influent channel of the coarse screening building from the plant influent pump station, the Intertie II pump station and the Clackamas pump station. The screening building has four screening channels. Three of the channels have mechanically cleaned bar screens with 5/8-inch bar spacing. One is a four-foot wide screen and two are six-foot wide screens. The fourth channel has a manually raked six-foot wide screen with 1-inch bar spacing. The design capacity of the coarse screening facility is 68.6-mgd. The screenings are stored in the loading area of the screenings building. The screenings are hauled to a local landfill for disposal.

Influent Flow Measurement

The influent flow is measured by parshall flumes located at the discharge of the coarse screens. The sum of the flows through the flumes is the plant influent flow.

Grit Removal

The grit removal system is two aerated grit basins with an original design capacity of 50-mgd. As a cost saving measure, the grit system was not expanded with the Phase I Expansion so the design capacity was increased to the hydraulic capacity of 68.6-mgd. Grit is concentrated, washed and stored in the loading area of the screenings building. The grit is hauled to a local landfill for disposal.

Primary Treatment

Primary treatment consists of six rectangular primary clarifiers. Each clarifier has a treatment capacity of 10-mgd for a total treatment capacity of 60-mgd. Flows greater than 60-mgd are sent directly to the MBR facility. Primary effluent is collected in the primary effluent channel where it is sent to either the conventional activated sludge system, the MBR system or to the chlorine contact tank, depending on the plant flow. The primary sludge and scum are collected and pumped to the anaerobic digestion process for further treatment.

Conventional Activated Sludge Secondary Treatment System

The conventional activated sludge (CAS) system receives flow from the primary effluent channel. The system has a design average dry weather flow capacity of 7.9-mgd and a peak wet weather capacity of 25.2-mgd.

Aeration Basins

There are four aeration basins that have the capability to operate in a number of treatment modes, depending on the plant flow and loads. Each basin is divided into four zones. The three zones are mixed and not aerated. These zones can be operated as either anaerobic or anoxic zones. A mixed liquor recycle system returns flow back to the first zone from the end of the aerobic zone. The third zone can be operated as either an anaerobic/anoxic zone or an aerobic zone. It has both mixing and diffusers. The fourth zone is an aerobic zone equipped with fine bubble diffusers. This zone has three aeration zones where the air can be controlled to a specific DO setpoint.

Secondary Clarifiers

There are two secondary clarifiers that receive flow from the aeration basins. These 120-foot diameter tanks are equipped with TowBro rapid sludge withdrawal mechanisms and a full radius scum collection system.

Return Sludge Pump Station

The return activated sludge (RAS) pump station pumps return activated sludge from the bottom of the secondary clarifiers to the aeration basin. There are five RAS pumps: two small pumps with a capacity of 1500-gpm each and three large pumps with a capacity of 4700-gpm each.

Chlorine Disinfection

The secondary effluent from the CAS system is disinfected with chlorine. This is a gas chlorine system with gas taken from 1-ton chlorine cylinders. The chlorine is mixed with the CAS secondary effluent and is provided contact in two chlorine contact basins with a capacity of 274,500 gallons each.

Dechlorination

Sodium bisulfite is added to the disinfected waste stream at the end of the chlorine contact basin prior to discharge. The bisulfite is fed as a liquid from on-site storage tanks.

MBR Secondary Treatment System

The Phase I Liquids Expansion is a membrane bioreactor (MBR) treatment system that operates in parallel with the plant's CAS system. The MBR system has an average dry weather capacity of 4-mgd and a peak flow capacity of 10-mgd. This system has been designed to be expanded to an average dry weather capacity of 24-mgd with a peak flow capacity of 60-mgd.

Intermediate Pump Station

The flow to the MBR system is taken from the primary clarifier effluent channel and pumped to the inlet channel of the fine screen building by the intermediate pumps. There are three intermediate pumps. The small pump has a capacity of 1.5 to 5.0-mgd and the two large pumps have a capacity of 2.0-mgd to 10.0-mgd. The system has been designed for the maximum flow through the primary clarifiers to be 60-mgd. When the flow to the plant reaches 58-mgd, the flow to the MBR system is changed from the primary effluent channel to the primary influent channel.

Fine Screening

The fine screens receive flow from the intermediate pumps. There are two fine screens with a peak hydraulic capacity of 15-mgd each. The screens have a punch-plate hole size of 2-mm. The screenings that are removed by the screens are discharged into a sluice that transports the screenings to one of two rotary screens that wash the screenings. The washed screenings are discharged into hoppers that are discharged into the screenings truck for transport to a local landfill for final disposal.

MBR Aeration Basin

The MBR aeration basin (AB#5) receives flow from the fine screen building and provides the environment for the biomass to reduce the organics and nitrify the ammonia in the waste stream. The MBR aeration basin effluent goes to the MBR building for solids/liquid separation in the MBR basins. The MBR aeration basin is a 715,500-gallon basin. The basin is a two-pass plug flow basin with a length to width ratio of 18:1. The basin operates at a water level of 24-feet. The basin has one de-ox zone and three anoxic zones to provide for denitrification and an aerobic zone with four separate aeration zones for control of air to provide BOD removal and nitrification.

MBR Basins

There are four membrane basins located in the MBR Building. Each membrane basin is has space for 10 membrane cassettes. Each basin is equipped with 9 cassettes of hollow fiber membranes with a membrane surface area of 131,920-ft^2 each. Each membrane basin has a dedicated filtrate pump with a capacity of 2,031-gpm that pumps the filtrate to the UV building. The mixed liquor transfer return system consists of two 114,400 gpm pumps that return the filtered mixed liquor back to the aeration basin. The MBR system also has a number of ancillary systems that provide for the control and cleaning of the membranes.

UV Disinfection

The membrane filtrate is pumped to the UV Building for disinfection. The UV disinfection system consists of two UV channels with two UV modules in each channel. The UV system has bulbs in a vertical orientation with 40 bulbs in each module. The UV system dosage is maintained by turning bulbs on and off based on the MBR plant flow rate and quality of the treated effluent.

Effluent Disposal

The effluent from the MBR system is discharged from the UV treatment system into the UV effluent channel. From this channel it can go to the reuse contact basin, the non-potable water wet well or the mixing box for discharge to the river.

River Discharge

The effluent from the CAS and MBR secondary systems is combined in the mixing box at the UV building. At this point the effluent is sampled for compliance with the NPDES permit. The effluent overflows the mixing box weir into the plant outfall for discharge in the Willamette River.

The combined treated effluent is transported from the mixing box through the 72-inch outfall to the flow control structure located at the intersection of Main and Agnes Avenue. At this point the outfall line increases to an 84-inch line that transports the flow to the outfall flow control structure. The outfall flow control structure distributes the flow to the diffuser that is three 42-inch pipes that discharge treated effluent into the Willamette River. The most upstream of the 42-inch pipes has a duckbill valve on

the end for summer season operation and the other two are open for winter season operation.

Recycled Water Reuse

On-Site Water Reuse

The water used in the treatment plant for non-potable uses such as tank sprays, hosedown and landscape irrigation is treated effluent from the UV effluent channel. This is provided at the W3 water pump station located in the lower level of the UV Buiding.

Off-Site Water Reuse

The Phase I Expansion included the facilities for additional disinfection of the MBR effluent, a reuse pump station and a reuse pipeline along Agnes Road. This system has the capacity to treat and pump up to 15-mgd of Class A reuse water for off-site uses.

Solids Handling Systems

The solids handling systems provide for thickening, stabilization, dewatering and storage of the solids produced in the treatment plant. The solids handling systems also have the capability to receive stabilized solids from the Kellogg Creek WPCP for dewatering.

Waste Activated Sludge Thickening

The waste activated sludge (WAS) thickening process receives WAS from both the CAS and MBR secondary facilities. The CAS waste pumps are located in the CAS return sludge pump station. The MBR waste pumps are located in the MLTR pump gallery. There are two gravity belt thickeners (GBT) for WAS thickening. One of the GBTs is dedicated to each of the waste streams. The thickened WAS is pumped to the anaerobic digesters for stabilization.

Anaerobic Digestion

There are two anaerobic digesters with a volume of 1,000,000 gallons each. The digesters receive primary solids and scum from the primary treatment process and TWAS from the waste activated sludge thickening process. Each digester is mixed with an external pump pumping through a fixed nozzle system in each digester.

Gas Utilization

Biogas that is produced in the process is collected and burned in the boiler, the 250 kW generator or in the waste gas burner.

Centrifuge Dewatering

The plant has two dewatering facilities. One was constructed in the solids building as a temporary facility in 2002. The second was constructed on the south end of the plant in 2011 to be a redundant facility for the main centrifuge and to provide for dewatering of the Kellogg Creek liquid biosolds.

Primary Dewatering Facility

The primary dewatering facility is a single centrifuge located in solids building. This high solids solid bowl centrifuge has a capacity of 3500 lbs/hour of dry solids. The dewatered solids are conveyed from the centrifuge directly to trucks for hauling and utilization of the biosolids. There is no cake storage for this unit other than the trucks. The centrate is pumped to the centrate storage tanks.

Temporary Dewatering Facility

A temporary dewatering facility was constructed on the south end of the site to provide a redundant dewatering unit. This facility has two 30,000-gallon blend tanks that can receive biosolids pumped from the anaerobic digesters or from the unloading facility. The solids are dewatered in a high solids solid bowl centrifuge with a capacity of 1500 lbs/hour of dry solids. The dewatered solids are discharged into the covered cake storage facility. Dewatered cake is loading by front-end loader into trucks for hauling and utilization off-site. The centrate is pumped to the centrate storage tanks.

Centrate Equalization

The centrate storage tanks are two membrane basins that were constructed for future use located in the MBR Building. These tanks were designed to be temporary tanks to support dewatering until the new solids handling building is constructed. The centrate tanks have a total volume of 220,000-gallons. The centrate can be returned to four points: influent pump station wet well, primary influent, CAS aeration basin influent and MBR primary effluent box. The two centrate pumps have a design capacity of 200-gpm each.