6.2.2 Intermediate Pumping Process Control

The intermediate pumps take flow from the primary effluent channel and pumps it to the channel in front of the fine screens. The pumping rate of the intermediate pump station determines the rate of flow to the MBR treatment system. The operations staff determines these flow set points in the SCADA system. The flow rate to treat in the MBR system is determined by the desired flow to treat based on the plant's influent flow and the flow mode that is selected.

Flow Management

The treatment plant has an average dry weather capacity of 11.9-mgd, an average wet weather capacity of 17.1-mgd and a peak flow capacity of 68.6-mgd. As flows increase during a wet weather event, the flows must be managed between each of the treatment alternatives to maximize the level of treatment. The flow management plan provides for four flow steps as shown in ***Table 1***.

Table 1
Tri-City WPCP
Flow Management Steps

System	Step 1 Ave Day	Step 2 Max Month	Step 3 Max Week	Step 4 Max Day	Step 5 Peak
Plant Flow	11.9	17.1	39.5	55.7	68.6
CAS	7.9	12.1	25.2	25.2	25.2
MBR	4.0	5.0	7.0	9.0	10
Blending	0	0	7.3	21.5	33.4

Each flow management step will minimize operations costs while maximizing the capacity of the individual systems.

Step 1 – Average Flows

In Step 1, each of the treatment trains is operated at flows up to its design average dry weather flow. This will optimize the treatment capability of each system.

Step 2 – Maximum Month Flows

As flows increase during the wet weather season, the flow to each of the treatment trains is increased up to its maximum month flow capacity. This will optimize the treatment capacity of each system under higher flow events and during the winter season.

Step 3 – Maximum Week Flows

As flows continue to increase during a major wet weather event, the flow to the MBR facility can be increased for a short duration and then the plant will need to begin blending a small portion of the flow.

Step 4 – Maximum Day Flows

During a maximum day flow event, the plant will be receiving extremely high flows up to 55.7-mgd for a daily average. Under these rare circumstances, all flows beyond the maximum week flow rate of 39.5-mgd will be blended.

Step 4 – Peak Flow

All additional flows beyond maximum day flows will be blended. This will be a rare event that statistically will happen less than one time every 5-years.

Modes of Flow Control

There are four modes of control that the operator can select. The mode of control determines the set point flow for the intermediate pumps and controls the flow sent to the MBR process.

Mode 1 – Percent Influent

The percent influent flow mode controls the set point flow as a percent of the plant influent flow. Under this mode, the flow to the membranes will vary with the plant influent flow diurnal curve. This mode will be used if it is desired to maximize the flow treated in each facility. There will be limitations in using this flow mode as a low minimum flow during the low flow nighttime period may cause issues with disinfection in the CAS system.

Mode 2 – Constant Flow

The constant flow mode controls the setpoint flow as a constant flow rate. The MBR system will run at a constant flow rate no matter the plant influent flow. This can cause problems during low flow periods with disinfection in the CAS system. In addition, this mode will increase the peaking factor during higher flow periods to the CAS system. The advantage of this mode is that it will optimize the operation of the MBR system by providing a constant feed to the aertion basin and minimize the changes in flux rate to the membranes.

Mode 3 – Diversion Flow

The diversion flow mode controls the set point flow as the same flow as the diversion flow. Under this mode, the flow to the membranes will vary with the diversion flow diurnal curve. This mode provides the capability to ensure that the volume of flow that is diverted through the CCSD#1 diversion is treated in the MBR facility. This mode should be used with care if the flow from the diversion gets less than 1.5-mgd at any point during the diurnal cycle as this is the lowest flow that can be treated by the MBR system.

Mode 4 – Diurnal Table

The diurnal flow control mode allows for setting the flow rate on an hourly basis. The MBR plant flow will then match the desired set point. The operator can set the flow rate for each hour on the diurnal flow set point table. This mode provides the operator hour-by-hour control of the flow to the MBR system. This mode provides the advantages of each of the other three modes while providing the capability to limit the problems that can occur with the other modes.

High Flow Operation Controls

The High Flow Mode Setpoint determines the flow when the flow to the MBR system is changed from the primary effluent box to the primary influent box. The High Flow Mode Reset is the flow the flow is changed back to the primary effluent box.

These set points allow the operator to determine the maximum flow that will pass directly through primary treatment. Flows above the High Flow Mode Setpoint will go directly to the MBR system, up to 10-mgd. The operator needs to take care to only divert primary influent during peak flow events with the influent flow are diluted. Sending primary influent to the MBR during low flow periods will overload the MBR aeration system.