

6.4.1 MBR Aeration Basin Overview

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.

Process Overview

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 multiple zones to provide for anoxic treatment and four separate aeration zones for control of air in the aerobic zones. The basins zones are summarized in **Table 6.4.1-1**.

Table 6.4.1-1
MBR Aeration Basin #5

Zone	Zone Type	Volume (gallons)
1A	Deox	63,950
1B	Anoxic	58,550
2A	Anoxic	57,900
2B	Anoxic	59,250
3,4,5,6	Aerobic	475,850
Total	-	715,500

The membrane aeration basin is designed as a down and back, two-pass basin. Flow from the fine screen effluent channel, travels through a large pipe, underneath the aeration basin gallery, and comes up the riser box in Zone 1A. Flow can be fed to one of two zones in the basin. It can be fed to Zone 1B, the anoxic zone or to Zone 1A, the re-aeration zone. The flow then leaves those zones and passes through the remaining anoxic zones and then through the aerobic zones. Flow then overflows a weir at the end of the aeration basin and goes on to the MBR basins. There are two mixed liquor recycle pumps that can recycle flow from Zone 6 of the aeration basin, back into the de-ox zone. The goal is to remove the oxygen in Zone 1A, to de-nitrify in the anoxic zones (Zone 1B, Zone 2A, and Zone 2B), and then to nitrify in Zones 3, 4, 5, and 6. Thus, by the end of the aeration basin, it is the goal that all the BOD has been removed, all of the ammonia has been nitrified, and the wastewater has been de-nitrified to the maximum extent possible. By this process sequence, the amount of lime use is minimized while producing the highest quality effluent possible. The flow diagram is shown on **Figure 6.4.1-1**.

The basin is fully covered to eliminate odors from the system and to prevent any debris from entering the MBR system. Air is pulled from Zone 1A and treated in the odorous air treatment system located on the top of Zone 5.

If maintenance is required on this basin, CAS AB#4, from the conventional activated sludge system, can be placed into operation for the membrane system and provide the treatment required on the membrane side. The overall plant capacity will be lowered

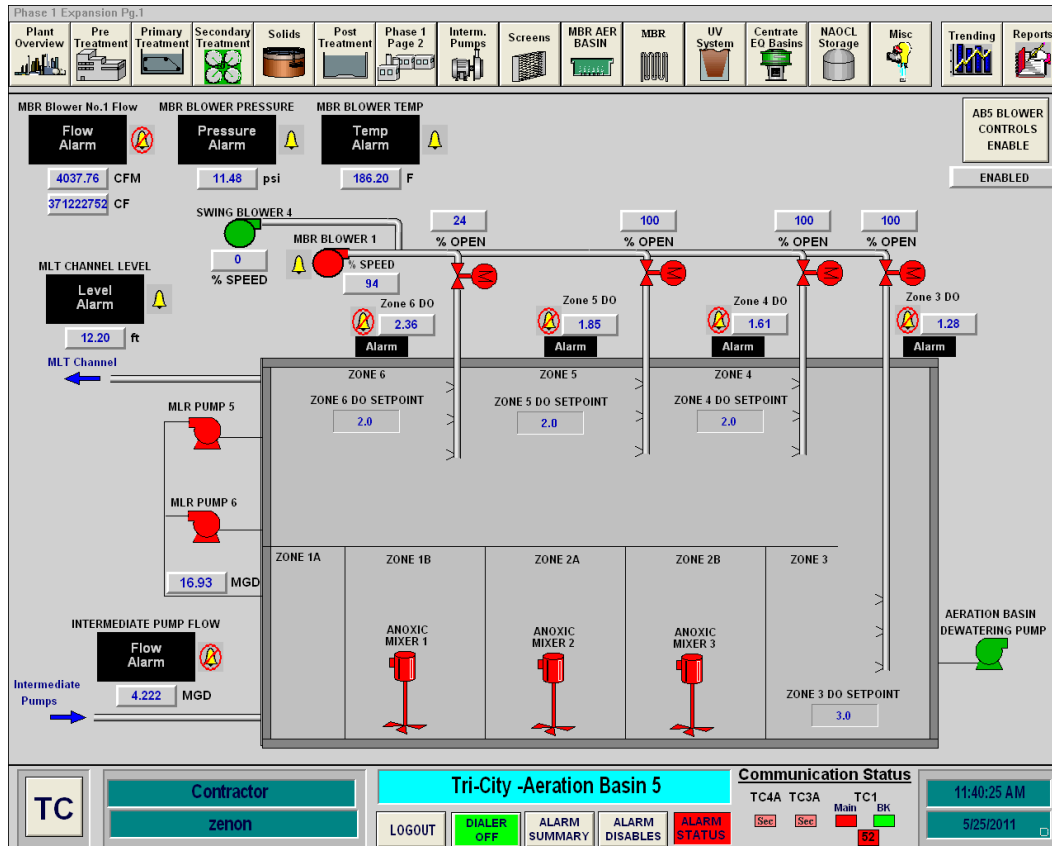


Figure 6.4.1-1 – Aeration Basin #5 Main Screen

when this happens, so this needs to be done some time during the late summer when flows are low. Using CAS AB#4 was a way to cost-effectively provide a redundant basin with the Phase I Expansion. In the future, as more MBR aeration basins are built, the other membrane aeration basins will provide the required redundancy.

Aeration Basin #5 Components

Aeration Basin 35 is made up of a number of components that operate interactively to provide an optimum environment for the biomass while maximizing nitrification and denitrification as well as optimize the utilization of oxygen. These components are:

- MBR System Flow Measurement
- Deox Zone
- Anoxic Zones
- Aerobic Zones
- Mixed Liquor Return Pumping
- Aeration Basin Dewatering Pump
- Aeration Basin #4 Backup

MBR System Flow Measurement

The flow enters the basin in a riser box located in Zone 1A. The flow can be sent to either Zone 1A or Zone 1B with isolation gates. A level sensor in the riser box measures the depth of flow leaving the riser box determines the MBR system flow rate. This flow is provided to the intermediate pumps to pace the flow to the MBR system and is used by the MLTR Pumps to adjust the mixed liquor return flow from the MBR basins.

Deox Zone

Some of the mixed liquor is recycled back through the wall to the de-ox zone (Zone 1A). The de-ox zone is an aerobic zone as DO is present in the MLSS that is recycled. The biomass utilizes the free oxygen that is available in the waste stream so when the wastewater leaves the de-ox zone and flows to the first anoxic zone, there is no free oxygen. This maximizes the amount of de-nitrification that is occurring in the following anoxic zones.

Anoxic Zones

The waste stream can be introduced into Zone 1A or Zone 1B of the aeration basin. Zones 1B, 2A and 2B are anoxic zones where there is no free oxygen available to the biomass. With no free oxygen available, the bacteria use the nitrate is available in the MLSS Return as their oxygen source, resulting in de-nitrification and the removal of nitrogen from the waste stream as the nitrate is converted to nitrogen gas. When the bacteria utilize the nitrate, alkalinity is produced. This additional alkalinity that is produced in the anoxic zones reduces the lime feed that is required to the process.

Aerobic Zones

There are four separate aeration zones in the aerobic zone. Air is introduced at the bottom of the basin through 9-inch Sanitaire fine bubble dome diffusers. Each zone has a dissolved oxygen meter and a control valve to automatically control the volume of air to produce the desired oxygen level in each zone. This provides the operator with flexibility to manage the energy required to provide air to the system.

Mixed Liquor Return

The mixed liquor return pumps recirculate flow from Zone 6 of the aeration basin to the de-ox zone, Zone 1A. These pumps are submersible mixers mounted in the wall of the basin. This type of pump was used because they use very little energy to pump high volumes of MLSS. Each of these pumps is on a variable speed drive. The flow rate of MLSS return can be varied from 1 to 4 times the plant flow. Operators adjust the flow rate based on the amount of nitrate leaving the basin to maximize the amount of denitrification occurring in the system.

Aeration Basin Dewatering Pump

There is a dedicated dewatering pump for the aeration basin. The floor of the basin slopes to a trough on the interior wall of the basin that drains to a sump on the east end of the basin. The dewatering pump takes flow from a sump and discharges to the fine

screen effluent channel. W5 flushing water can be introduced to both passes of the west end of the basin to flush solids from the basin and assist in cleaning of the basin.

Aeration Basin #4 Backup

The Phase I Expansion only provided one MBR aeration basin. Piping was provided to use CAS Aeration Basin #4 as a backup to MBR Aeration Basin #5 until additional MBR aeration basins are constructed in future expansions. CAS Aeration Basin #4 is to be operated as a backup for only a short period of time so inspection and repairs to MBR Aeration Basin #5 can be performed.

MBR Aeration Basin #5 Controls

The controls for the process equipment serving MBR Aeration Basin #5 are located in the MBR electrical room. These include the MCC's, VFD's, PLC and blower control panel.

Mixed Liquor Return Pump Controls

The mixed liquor return pumps are variable speed pumps. Each pump has a dedicated variable frequency drive located in the electrical room. The pump can be controlled from the VFD by placing the HAND/OFF/REMOTE switch in the HAND position and controlling the speed with a controller on the front of the VFD. When the switch is in the REMOTE position, the pumps are controlled through SCADA.

Anoxic Zone Mixer Controls

There are three anoxic zone mixers, one in each of the anoxic zones. The mixers are vertical shaft mixers with the motors and controls located on the aeration basin deck above each anoxic zone. The mixers are controlled with an ON/OFF/AUTO switch located on the MCC of each mixer. A local emergency stop switch and lockout switch is located next to each mixer motor and gearbox. When in the AUTO position, the mixers can be turned on and off in SCADA.

Aeration Basin #5 Dewatering Pump Controls

The aeration basin dewatering pump is operated through SCADA. There are no controls for operation of the pump local to the pump. The local lockout switch must be closed to operate the pump. There is an emergency stop switch at the pump to stop the pump if a problem occurs. The pump is a constant speed pump.

MBR Aeration Controls

The MBR aeration blowers are located in the blower building. Each blower has a control panel in its blower cabinet for control of the blower. The MBR process air system controls are located in the MBR electrical room. These controls provide control of the air valves on the aeration basin and the blower output.

Each of the four aerobic zones has a DO meter and an air control valve. The DO setpoint is set on SCADA. The process air control system takes this reading and adjusts the air valve to provide the volume of air necessary to meet the DO setpoint. Each valve has a minimum closure to ensure that the blowers are not deadheaded and go into surge. In

the case when DO demand is low, the DO can be over the DO setpoint as the air control valves are at their minimum closure.

The blowers are controlled to maintain a setpoint air pressure in the blower air header. The setpoint is set in the process air control panel. The blower speed is increased or decreased as necessary to maintain the setpoint air pressure.

Aeration Basin #5 Station Sustainable Features

Aeration Basin #5 has been designed with a number of sustainable features. These features are summarized in the following sections.

De-ox Zone

The de-ox zone removes the oxygen present in the recycle MLSS prior to the anoxic zones. This maximizes the amount of de-nitrification that is occurring in the following anoxic zones reducing the amount of lime that is required in the process and maximizing the amount of nitrate removed by the process.

Anoxic Zones

There are three anoxic zones in series following the de-ox zone. This combined with the capability to recycle MLSS up to 4-times the plant flow provides the capability to maximize denitrification in the system. This minimizes the amount of lime required by the system and maximizes the amount of nitrate removed by the process.

MLSS Return Pumping

The mixed liquor return pumps are submersible mixers mounted in the wall. This type of pump was used as they use very little energy to pump high volumes of MLSS. Each of these pumps is on a variable speed drive.

High Efficiency Diffusers

The diffusers in the aeration basin are Sanitaire Silver Series fine bubble dome diffusers. These high efficiency diffusers combined with the deep aeration basins operating at 24 feet water depth provide extremely high oxygen transfer at 42%. This optimizes the power required for aeration.

Multiple Zone Dissolved Oxygen Control

The aeration system was designed to provide and control air to a setpoint dissolved oxygen in four zones as the flow passes through the aeration basin. This provides for optimum control of the process air to match the organic loading to the system.

MBR Aeration Basin Master Plan

MBR Aeration Basin #5 is the first of the MBR aeration basins. The system was laid out for up to five MBR aeration basins, depending on future plant loads. The system was designed to add up to four additional basins to the south of AB#5. The foundations were constructed as part of the gallery system for the construction of AB#6. The feed line to AB#5 has a tee and as stub-out for feeding the future AB#6. A knockout wall was

placed in the gallery for the tie-in of a new gallery for AB#7 and AB#8. The feed line from the fine screen effluent channel to the future AB#6 and AB#6 has been installed and is stubbed out for tie-in when the gallery is constructed.