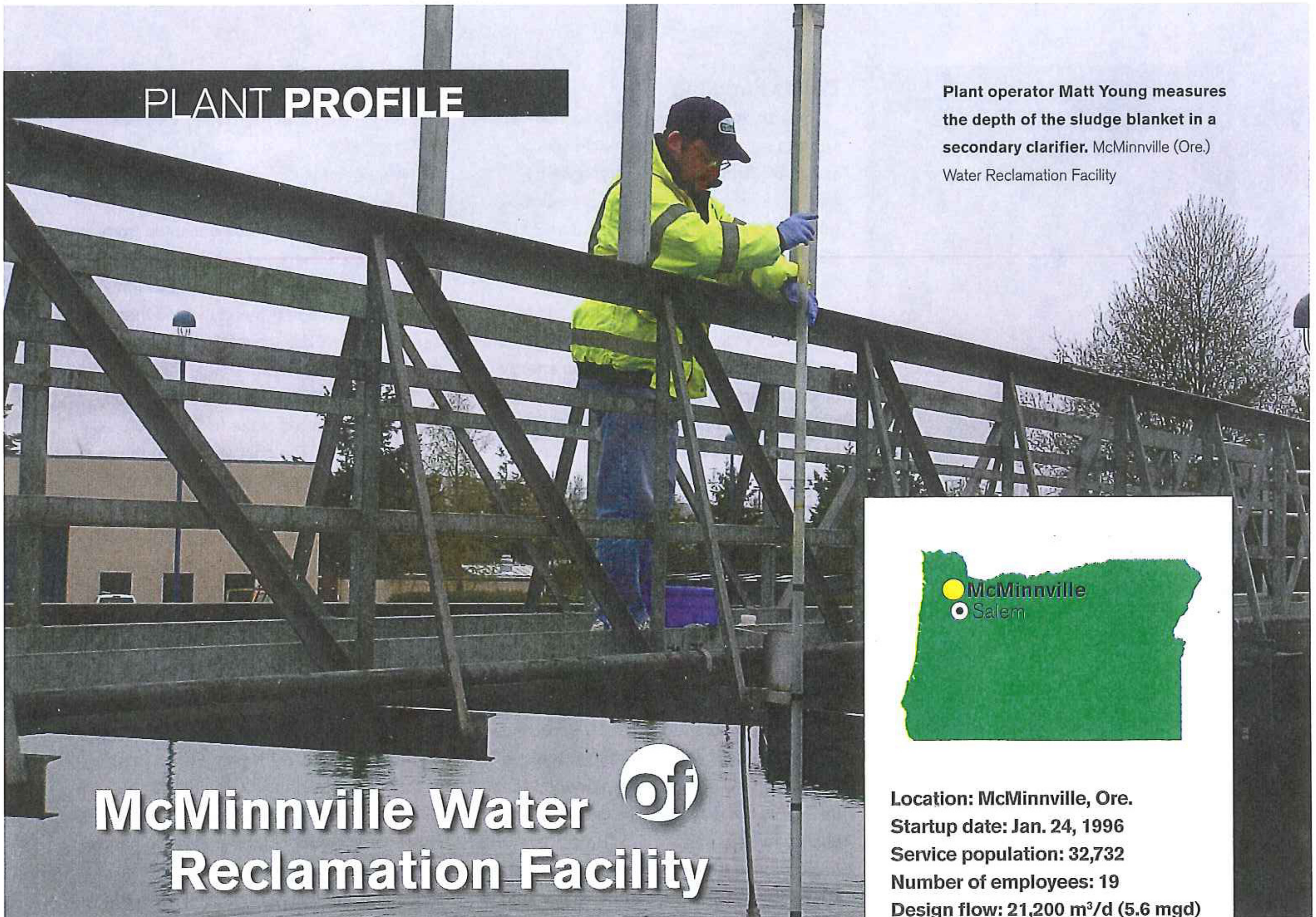


Plant operator Matt Young measures the depth of the sludge blanket in a secondary clarifier. McMinnville (Ore.) Water Reclamation Facility

McMinnville Water of Reclamation Facility

Location: McMinnville, Ore.
Startup date: Jan. 24, 1996
Service population: 32,732
Number of employees: 19
Design flow: 21,200 m^3/d (5.6 mgd)
Average daily flow: wet weather – 27,200 m^3/d (7.2 mgd), dry weather – 12,500 m^3/d (3.3 mgd)
Peak flow: 121,000 m^3/d (32 mgd)
Annual operating cost: $2.8 million

The McMinnville (Ore.) Water Reclamation Facility has a history of excellent treatment and ongoing improvement. Using biological phosphorus removal and tertiary clarification, the facility meets one of the most stringent phosphorus limits in the United States. In addition to that, staff members continually seek out new projects to further increase the efficiency and capabilities of the facility.

Following screening and grit removal, flows enter the facility's two oxidation ditches. Conventional pollutants, such as total suspended solids and biochemical oxygen demand, are removed to levels comparable to a well-operated activated sludge system. But where these units excel is in nutrient removal. Phosphorus and ammonia are removed biologically with little additional chemical use.

In the first channel, dissolved oxygen is suppressed, allowing for biological phosphorus removal to take place. While this process is followed by secondary and tertiary clarification, as well as sand filters, most of the phosphorus removal takes place in the biological process.

The facility's permit limit for total phosphorus is 0.07 ppm, one of the most stringent in the country. To provide perspective on how stringent this limit is, consider that to produce permit-compliant effluent, the facility must operate at almost 99% efficiency. McMinnville's operators consistently do much better. The result is an average effluent total phosphorus concentration of 0.04 ppm.

The oxidation ditches also efficiently remove ammonia, averaging 99.9% removal. As an added bonus, partial denitrification also takes place, and total nitrogen concentrations often are in the 8-ppm range. The facility currently has no limitations for total nitrogen, but some modification would enable even better removal.

Oxidation ditch expansions

There are two expansion projects in the works for the next 5 years. The first is to increase the capacity of the oxidation ditches by adding a contact stabilization mode. This project is designed to bring the ditches' 91,000-m^3/d (24-mgd) capacity into harmony with the headworks and disinfection capacity of 121,000 m^3/d (32 mgd). The first project will not bring the ditches all the way to 121,000 m^3/d (32 mgd) but will make progress toward that goal.

The primary purpose of achieving this higher capacity is to avoid any need for blended effluent during rain storms. To say that flows vary at the McMinnville facility is an understatement. The facility's average dry weather flow is about 12,500 m^3/d (3.3 mgd), but during a storm, the flow often rises to between 76,000 and 114,000 m^3/d (20 and 30 mgd).

Currently, if the flows exceed 91,000 m^3/d (24 mgd) during a storm, a portion of the facility's flow has to bypass secondary treatment. This creates a blended discharge.

The McMinnville (Ore.) Water Reclamation Facility uses a pair of oxidation ditches to achieve biological phosphorus removal. The facility also uses chemical addition, tertiary clarification, and sand filtration to ensure that it meets its stringent phosphorus limit. City of McMinnville, Ore.

McMinnville's goal is to avoid the need for that scenario.

The second project is related to the first and calls for the addition of a third oxidation ditch and secondary clarifier train. This will achieve a twofold benefit: The secondary process will be large enough to treat all of the wastewater produced by a larger-magnitude storm, and the additional units will provide better efficiencies, higher capacity, and redundancy to the existing system.

These two projects are slated to begin the design phase in fiscal year 2011.

Clarifier performance

The facility's process includes both secondary and tertiary clarification. Oxidation ditch effluent flows by gravity to two secondary clarifiers. Effluent from the secondary clarifiers flows into two 12-m-diameter (40-ft-diameter) tertiary clarifiers, where alum and aluminum chlorohydrate are added to improve flocculation and remove phosphorus.

The effluent from the tertiary clarifiers is further polished through six continuous backwash sand filters. By the time the liquid reaches this point, there is little left to do but polish it, as the total suspended solids levels are consistently below 1 mg/L.

The effluent from the sand filters is then disinfected through three low-intensity ultraviolet disinfection channels before the effluent flows to the outfall structure and into the South Yamhill River.

Solids handling

Solids that are wasted from the secondary clarifiers are processed to about 5% total solids by two gravity belt thickeners. The chemical sludge generated from the alum addition is blended with the secondary sludge prior to processing.

The thickened solids are then fed to the facility's two autothermal thermophilic aerobic digesters (ATADs). These energy-efficient aerated digesters use the natural heat from bacterial action to heat the solids to about 60°C (140°F) for 6 to 8 days, producing Exceptional Quality, Class A biosolids.

The facility's staff has made improvements to these units by retrofitting two of the digesters with 10-hp aerators. These additional aerators increased the digesters' capacity and better stabilize their operation.

After treatment, the solids from the digesters are pumped into a 10.6-million-L (2.8-million-gal) tank to store for later land application. All of the solids produced at the facility are recycled through a land-application program.

To reduce the amount of biosolids hauled offsite for land application, the facility staff developed a system to dewater the solids using the biosolids storage tank. Operators collected samples from various depths in the tank and measured the percent solids. They found that some of the solids had settled, resulting in a layer of thin material – about 0.5% solids.

Next, the staff designed a piping system that would pull decant from the thinnest layer of the tank. The liquid decanted from the biosolids storage tank is pumped into the facility's influent, where the oxidation ditches continue to break down the thermally digested biosolids, achieving significant overall solids reduction.

During the winter 2009–2010 season, the facility decanted close to 7.6 million L (2 million gal). The cost savings to the McMinnville ratepayers on biosolids that will not have to be trucked to the field this year total more than $60,000. This practice also has extended the length of time between biosolids storage tank upgrades by reducing the storage volume needed.

Odor control

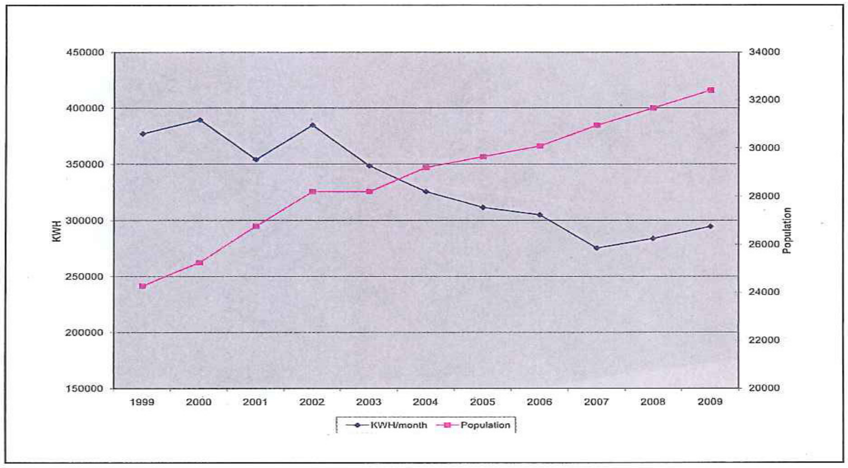
Also stemming from the facility's solids treatment processes was a change in its odor-control strategy. Upon initial startup of the facility, odors were controlled with a chemical scrubber using chlorine. However, the odor scrubber failed to handle the high levels of mercaptans, ammonia, reduced sulfur compounds, and many other odor-causing compounds produced by the digesters. In addition, the necessary chemicals were expensive and required care to handle.

Lee Koester and Roy Carter work on an additional aerator that was added to the facility's digesters to increase capacity. David Gehring

To remedy this situation, the McMinnville facility installed a biofilter that uses naturally occurring bacteria grown in wood media to neutralize odors. This new biofilter consisted of a large concrete slab with a 0.6-m-high (2-ft-high) plenum measuring 6.4 m x 13.7 m (21 ft x 45 ft), with a slotted concrete top.

The plenum was then covered with approximately 2.4 to 3 m (8 to 10 ft) of wetted root wood chips. The odorous air from the ATAD system and headworks building is piped and forced by fans into the plenum. The odorous air passes through the wood-chip pile. Microorganisms use the wood chips as a growth medium and feed on the odorous compounds, reducing odors. The biofilter wood chips are replenished every 3 to 5 years as needed and have proven to be the best and most cost-effective way to eliminate odors while ending the need for chemicals.

Energy use versus population



Energy reduction

Sustainability is a high priority for leadership and staff. The facility is always looking for ways to become more efficient. For example, in the last year, the facility added variable-frequency drives to the oxidation ditch aerators to provide better dissolved-oxygen efficiencies and lower energy use.

The result, so far, has been a steady decrease in energy use, while the population of McMinnville has increased. In fact, the trends are proportionally similar, albeit opposites. The figure (left) shows how both population and energy use has changed in McMinnville. ■