AWPCA
2005 WASTEWATER
PROJECT OF THE
YEAR

PINEWOOD TREATMENT PLANT, MUNDS PARK, ARIZONA

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Six years ago the Pinewood Wastewater Treatment Plant was a vastly different facility. It was operating without a license, and had no legal means of discharging effluent. A plethora of problems required attention before an operating license and the necessary permits could be issued. Massive inflow and infiltration (I & I) problems in the collection system caused the plant to frequently exceed its capacity and on occasion, release raw sewage directly into nearby Munds Creek. This was a time bomb that had many people worried.

The treatment plant is located in Munds Park, Arizona, 17 miles south of Flagstaff on Interstate 17. Munds Park is a vacation destination with around 20% of the population being year-round residents. Winter population averages 1,600, summer weekday population averages 2,500, and a summer holiday weekend population can easily exceed 10,000 people. Over 2,500 residences and businesses had a vested interest in the safe and legal operation of this facility. The unlicensed status of the plant caused considerable concern for them in regard to property value, resale value, and continued business. These stakeholders rely on its treatment services. It was also a major source of concern for downstream residents because Munds Creek is a tributary of Oak Creek, a pristine body of water greatly treasured by the residents of Sedona and indeed all of Arizona.

The plant was originally owned and operated by the Pinewood Country Club which also owns the adjacent golf course. Munds Park homeowners formed the Pinewood Sanitary District and purchased the plant and collection system in 1992. During summer months, the plant’s effluent is purchased by the adjacent golf course for irrigation. However, during the winter months there was inadequate effluent storage capacity and they lacked the permits needed to discharge into Munds Creek.
The Pinewood Sanitary District began the long journey to bring the facility into compliance. This included upgrading the plant to function efficiently and meet the newer, more stringent requirements and reducing the I & I problem. A step-by-step compliance plan was developed and followed. ADEQ issued a consent order allowing operation under the stipulation that the plant be brought into compliance and the collection system repaired. The permitting process, which ultimately took six years to complete, was initiated. The challenges presented by the environmental permitting process were daunting. The 208 amendment was the first hurdle. To aid in the process Jim Wilson, Pinewood plant manager, volunteered and was appointed to the Northern Arizona Council of Governments (NACOG) Water Quality Board. This Board made recommendation to the State Water Quality Board for approval of 208 amendments in the NACOG region. This Board was originally against the amendment. A result of Jim’s participation was that he was able to become a voice of reason on the board. He worked patiently with the Board and helped concerned citizens understand the entire situation and to make decisions based on proven science rather than emotion. After more than 2 years the NACOG Water Quality Board recommended to the State that the 208 amendment be approved.

The District also began to address the infiltration and inflow problems. Leaking manholes and sewer lines needlessly channeled thousands of gallons of stormwater through the plant, often exceeding its capacity. It once caused a peak flow of 1.4 million gallons in a single day, exceeding the plant’s capacity by 800,000 gallons. The District waterproofed manholes and repaired leaking pipelines, greatly reducing the infiltration problem. This program is still ongoing. As part of the program, the District purchased a closed circuit television system for inspecting the collection system. They also purchased a vacuum truck and equipment to perform repairs. All of the easy fixes have been done and today the District forces correct the system as problems are discovered. They also implemented an inspection program for all real estate transactions in the District. Prior to the close of any property sale, the District must inspect the service line from the cleanout to the street. This change in practice has uncovered many flaws and they are corrected when they are found.

With I & I problems being corrected and the permitting moving forward, it was time to look at the treatment plant. Formerly, the I & I had caused extreme swings and hydraulically overloaded the plant. As those problems began to subside it became very obvious that the existing plant configuration and process had to be rethought. A design concept study was prepared and investigated several different treatment processes. The challenge was to bring this plant into compliance within the existing treatment volume, keep it cost effective from an operations standpoint, and do it with as little capital expenditure as possible. The process that made the most sense was to use a single sludge process for biological nitrogen reduction and chemical injection for the removal of phosphorous. This process was modeled and tested and it best met the requirements for treatment that were imposed in the permits for the plant. The District wanted to produce A+ quality effluent for use by the golf course and this was required for the NPDES permit that was being drafted.

The next large challenge was to determine the most cost effective way to complete this retrofit. The existing process included an influent lift station with fixed frequency pumps, a static screen, an equalization basin, three aeration basins, two clarifiers, a chlorine contact chamber, and a pressure sand filter. The District had been experiencing many operational challenges with the existing plant and had many recommendations. They needed more flexibility with the system. The flows varied too widely for the current configuration to work well. It was too difficult and time consuming bring basins on line and take them off line. They needed variable speed pumps. They wanted to be able to chlorinate the effluent after rather than before the filter. The aeration equipment were surface mechanical type and were set at a fixed elevation. No aeration could take place when basins were filling and emptying. The wish list was very long.

Each element was discussed and alternatives considered. The primary goal of keeping the O&M reasonable was always weighed against the capital cost. District staff had input every step of the way. Every part of the plant was looked at and wherever existing equipment could be utilized again to contain costs, it was.

The plant was to treat 600,000 gallons per day. The minimum flows were around 80,000 gallons per-day. It was determined that by providing four treatment trains, operation costs could be reduced and this would also be the most economical from a capital perspective. When limited treatment volume is needed, trains can be taken off-line and energy consumption is reduced. This also allowed the District to use only the existing tanks with different flow configurations.

The existing equalization basin was converted to an anoxic zone and divided into two parallel reactors. From there the wastewater would flow into one of four reactors. The original plant used pumps for this transfer and it was now converted to gravity flow. New walls were constructed in the existing tanks and ports were cut and drilled into the existing walls to allow the wastewater to flow. Diffused air was added to replace the mechanical aerators. A new blower building was constructed to house the blowers and a new standby generator. The influent pump station was modified with variable frequency drives to give greater control to the operators. The static screen was reused. It had to be rotated and moved but was still in very serviceable condition. A splitter box was constructed that took the influent from the static screen and allowed it to be directed.
to either or both anoxic reactors. Static mixers were added in the anoxic zones to promote uptake of nitrogen. An internal recycle was added and the return activated sludge pumps and piping was upgraded. A new chemical mixing tank was added for the mixing of alum with the effluent off of the clarifiers. This reduced the phosphorus to well below the permit limits. We reused the feed lines and storage tanks for the alum and replaced the feed pumps, diffuser and mixer only.

No modifications were made to the clarifiers. The District would have liked to upgrade these but they were functioning within their design parameters and they were a lower priority. Money saved by not upgrading the clarifiers could be used for things that were more important, like the disinfection system. A new chlorine contact chamber was constructed downstream of the pressure sand filters. New chlorination and de-chlorination equipment was installed. This was placed in a small prefabricated building next to the new contact chamber. The District chose to continue with gas chlorine in 150# cylinders and sulfur dioxide for de-chlorination. A metering flume and outfall structure were constructed that outlet into the golf course ponds for irrigation, or directly into the water course as permitted.

The media in the existing filter was replaced. A new filter system was on the wish list for the District but will wait for a future day. We all know how funding constraints work. The existing sludge bagger was replaced with a belt filter press. New aeration equipment was placed in the aerobic digester and air was taken off of the new blower manifold. And the final modification: there was originally an old treatment plant that had been abandoned on the site. It was a circular steel tank that had most of the equipment taken out. There was a considerable amount of demolition that had to be done inside that old plant. Once that was complete, it was painted and the floor sloped and a sump constructed. Rails were added and some of the old pumps were placed in that tank. The floating mechanical aerator from the original equalization basin was placed in there and with some piping and valving, a new equalization basin was born. Since it could be done so inexpensively, the District had decided to include this in the project. What a great investment that proved to be.

Within one month, a storm passed that dropped 10” of rain on Munds Park. A couple of manhole lids on manholes that were located in drainage ways were washed off and the district had close to 1,000,000 gallons of water come in that day. Every reactor was filled and the equalization basin as well. Not one drop of untreated water was discharged from the plant. Those manholes now have inserts and bolted down lids to prevent future reoccurrences. What a change. In the past the plant would have been overwhelmed and a large portion of that water would have ended up in the creek.

To learn more about the 2005 Wastewater Project of the Year you may contact David Fabiano - fabianodavid@stanleygroup.com, or Jim Wilson - jim@pinewoodsanitary.com.