A Temporary Water Treatment System for Construction Runoff at a Planned Community Development

Lincoln Crossing is a 1,070-acre planned community located in Lincoln, California, one of the fastest growing cities in the Sacramento Valley. SunCal Companies, a developer specializing in large scale mixed-use and re-use development projects, is heading up the Lincoln Crossing project, which includes nearly 3,000 homes, 30 acres of commercial space, and 210 acres of open space.

Construction and earthwork on a project of this scale necessarily involves significant erosion control and stormwater management. Runoff from the site flows into Ingram Slough, which then flows into Orchard Creek and finally into Auburn Ravine. The Auburn Ravine Watershed is a steelhead trout habitat. Steelhead trout were recently listed as threatened species under the federal Endangered Species Act. Consequently, maintaining water quality of stormwater runoff was a high priority at the project.

"SunCal spent close to a million dollars on traditional erosion control measures such as hydroseeding, wattles, and protective blanketing," says Ed Horn, Construction Manager, SunCal Companies. "These methods weren't enough. To meet discharge permit requirements of the California Regional Water Quality Control Board, we needed a temporary water treatment system to treat site runoff. We looked at several companies that provide filtration systems, and found that ProTech General Contracting Services Inc.'s water treatment system met our water quality criteria at substantial cost savings. ProTech incorporates the latest and greatest in filtration technology, and meets Best Management Practices and Best Available Technologies standards of the California Regional Water Quality Control Board."

Runoff at the project was very turbid, with measured turbidities commonly over 1,000 NTU (Nephelometric Turbidity Units), largely from silt, clay, and colloidal materials. The colloidal material did not settle and was difficult to remove, which necessitated the use of a chemical coagulation/flocculation unit in the treatment system, as described below.

The ProTech system was sized for a continuous 1,000 gpm (gallons per minute), sufficient to handle design storm events of 3.5 inches of rain over a five day cycle, as the discharge permit required. The system consisted of six, 21,000 gallon clarifier tanks, with two, 4 pod sand filters, followed by a 20 micron bag filter and a 1 micron cartridge filter. One feed pump and two booster pumps, all connected with six-inch PVC piping, completed the installation.

"The system was installed on a gravel base, requiring only minor grading to create a pad," notes Horn. "The complete system was operational in five days, once all equipment was in place."

The ProTech system can be also equipped with an automated turbidity meter with chart recorder, overflow sensors and automatic flow control switches, or pressure sensors linked to cellular devices for remote system monitoring or remote shut down capability.

The treatment system removes suspended material in a multi-step clarification process. A chemical coagulant is added to the influent water, mixed, and allowed to react, forming a dense floc that settles out by gravity and is collected in a series of clarification tanks. Sediment settles by gravity in the clarifier tanks, then water is routed through a sand filter and cartridge filters for final polishing. Sludge is removed from the clarifier by vacuum truck, and then transferred to phase separator tanks for dewatering and drying.

The coagulation/flocculation system was a crucial element of the overall treatment system. When properly applied in a gravity clarification system, chemical coagulation/flocculation can increase sedimentation rates by a factor of 10, and possibly much more. This allows higher flow rates and reduced holding tank or basin volume, with improved water quality. This system used a high molecular weight polymer specifically designed for water treatment systems. Polymers offer significant operational and cost benefits when used for coagulation and flocculation of construction site runoff and stormwater, especially for water with high concentrations of colloidal materials. Polymers have been used in industrial and other types of water treatment systems for many years, but have only recently been applied to construction site runoff. This is a direct result of the stricter discharge standards of NPDES and other regulatory requirements.

The specific polymer and its dosage were determined based on site-specific water quality and soil types. Many polymers are available with variable coagulation and flocculation properties, which is a function of both the polymer and water/sediment characteristics. A series of jar tests were conducted to select the proper polymer and dosage, accounting for sediment composition, mineralogy, size, and overall water chemistry. Coagulant dosage was electronically linked to the metered influent flow rate, assuring a constant dosage as influent flow varies. Proper mixing of the coagulant and influent water is critical. The coagulant was injected into the line 20 feet upstream from the clarifier tank, providing about 10 seconds of mixing time. However, the system was also designed to prevent violent agitation or high speed mixing, which can decrease coagulant activity.

The system was installed in November 2003 and is still operational at the time of this writing. Although the system is capable of continuous 24 hours a day, 7 days a week operation, round-the-clock operation was only required during high flow periods. Maintenance requirements were minimal. Sediment is pumped from the settling tanks about once per week. Sand filters are self-cleaning. The 280 gallon polymer totes are refilled or replaced every five million gallons of treated water.

“During the winter rainy season, several storms occurred during the month of February, including one storm that produced two inches of rainfall in six hours,” says Horn. “Throughout these storms, the treatment system operated flawlessly. Discharge never exceeded 50 NTU, although influent was probably well in excess of 1,000 NTU.”

Overall the ProTech treatment system met all standards and was cost-effective and easy to maintain and operate. As Horn states, “We undergo periodic inspections by the California Regional Water Quality Control Board, and we continue to meet their standards.”