

North Creek Station, Washington

The Latest in Pump Design,
Ease of Maintenance

The new North Creek Pumping Station in King County, Wash., had to maintain the Department of Natural Resources' national reputation for outstanding reliability. To make sure it did, the design team applied the most advanced pump technology and vibration prevention methods.

And the designers and utility put extra attention on meeting operations and maintenance needs. "We included folks from O&M in our project team so their input could be incorporated," says **Dave Dittmar, P.E.**, conveyance program manager for the King County wastewater treatment division. "Not everyone does this."

The station, located in an office park, also stands out for its integration of art and architecture.

North Creek has been operating successfully since January 2000. With a capacity of 36 million gallons per day (mgd) and twin 5-mile-long force mains, North Creek diverts sewage out of one interceptor and delivers it to another to relieve flow to a downstream treatment plant. As a subconsultant to Tetra Tech/KCM Inc., Brown and Caldwell provided systemwide hydraulic modeling and capacity analysis, mechanical design, and construction management assistance.

Advanced tools to anticipate and avoid vibration problems

"What's most unique about this project is our use of the latest tools to anticipate potential problems and redesign accordingly" notes Brown and Caldwell Project Manager Doug Schneider, P.E. "These tools were developed for the petrochemical and nuclear industries and hadn't been applied yet to municipal pumping stations."

For example, computer-based, finite-element analyses of stress, torsion, and rotor dynamics revealed that the pump supplier's initial submittal-while it offered high-quality components that would meet all specifications - could have led to heavy vibrations and operational trouble under certain conditions. So the pumping unit was redesigned with a stiffer motor mounting plate, a different type of shaft coupling, and an intermediate shaft of different diameter and material. The pump manufacturer wrote Brown and Caldwell to thank them for requiring the analyses.

"The station is smooth and quiet over the complete range of operating speeds," says Schneider.

The station includes a self-cleaning wet well; standby power

that achieves low emissions and limits harmonic distortion (a challenge when pumps run at variable speeds); and surge control without complex equipment, as a result of specification of just the right rotational inertia in the pump drive and proper location of certain force main valves.

Exceptional ease of maintenance

"It might seem obvious that operators need convenient access for equipment repair," says Schneider, "but it's amazing to discover the number of pumping stations where equipment can't be removed without shutting down all or part of the station. This might be caused by a tangle of piping right where you need access, no isolation valves, no way to drain large pipelines, no bypasses, or no way to lift heavy components."

At North Creek, in contrast, powered lifting equipment was installed for all components requiring servicing outside the station, such as jib cranes above sump pumps, a monorail for engine cylinders, and a bridge crane that can access any of the three pumps.

Typically forgotten large valves were positioned to allow direct crane removal. Even conduits were artfully laid out to ensure access.

Integrating art, architecture, and odor control

Close to homes and businesses, North Creek was designed to please, with consideration of noise, appearance, and odor. The station benefited from the county's policy of incorporating art

into wastewater projects: it has an inverted roof that funnels rainwater to cascade over a copper sculpture and into a rock basin below.

To control odor, first Brown and Caldwell modeled the sulfide generation in the new force main, then performed atmospheric modeling to determine odor levels beyond the fence line. Using the results, the team designed a ferrous chloride system for liquid stream odor control and two carbon towers for foul air treatment.

A new SSO facility

North Creek was fashioned to accommodate operation with a raw sewage storage facility. Almost immediately after the station was built, planners identified the need to reduce peak flow and help prevent overflows until a new regional treatment plant is brought on line in 2010. Design of a 6-mg storage tank began. With design and permitting taking less than a year, the project recently went to bid. It includes an automatic cleaning system that will be activated following any overflow into the storage facility, a ventilation system, an innovative odor-control system, and public access to a landscaped park-like setting.

