



Thern Winches Help Liquid Waste Technology Position Floating Dredges For HCL Removal At Orange County Water District Facilities



Above: The Orange County Water District built winch stations at each lagoon replacing older steel track systems. Winches connect to floating dredge units and maneuver them across the water, effectively removing silt deposits.

After three generations of remote controlled, underwater dredges, the Orange County Water District (OCWD) was in need of a new system. Their facility needed a new dredge and positioning system that was both cost effective and efficient at removing the hardened crust layer that forms in the water basins. The hardened crust layer or HCL, accumulates year-round in the recharge basins, builds up during the year and prevents water from percolating into Southern California's major source of well-pumped water.

Knowing the regions lack of natural water resources the groundwater basin plays a critical role in the lives of many California residents. In fact, the large aquifer is the main source of well-pumped water to approximately 2.3 million residents of north and

central Orange County. The aquifer itself, which was formed millions of years ago after mountain erosion trapped water from the Santa Ana River, has the usable capacity of 1.0 million acre-foot (one acre-foot of water, which would cover a football field to a depth of twelve inches, would supply two average families for a full year).

The Problem

The main source of fresh water used to supply the recharge basins is also the cause of the hardened crust layer that is preventing percolation into the aquifer. The Santa Ana River contains a variety of organic particle matter, inorganic particle matter and dissolved solids. It is these intruders that form the hardened crust layer inside the recharge basins. These basins consist of a series of shallow and deep-





the hardened crust layer inside the recharge basins. These basins consist of a series of shallow and deep-water basins that are used to recharge the aquifer. Percolation in the recharge basin system is prevented by build-up of a hardened crust layer.

After careful analysis of crust OCWD concluded that most layers were formed from silicates and aluminum silicates. The formation of silicates, is a result of physical, chemical and biological processes. Understanding the chemical composition of the crust layer is essential to the improvement of groundwater recharge process in Orange County.



Above: Winch placement provides a convenient and centralized control for OCWD. The result is time and money saved.

Faced with a continual problem, OCWD adapted to the situation by trying a variety of methods to eradicate the crust layer. Their latest tool in their fight against the HCL was a remote operated underwater vehicle. For movement around the basin floor the vehicle utilized electrically driven tracks. All components of their third generation Basin Cleaning Vehicle (BCV) were designed for underwater usage, which made them highly specialized and expensive.

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**Max Rasouli,
OCWD**

Special O & M technicians needed to be at the facility to operate and maintain them, which proved to be an expensive task. OCWD came to the conclusion that what they really needed was a less complicated system that also cost less to maintain.

The Solution

OCWD’s early experimental vehicles moved the project forward, but one OCWD engineer, Max Rasouli had the good idea to use more off the shelf technology and get sensitive components out of the water. Early equipment included highly specialized remote controlled dredging units. The first three generation units were designed to operate at depths of 100 ft. (30 m), but when used they proved difficult to maintain. After using a total of three equipment designs OCWD was ready to look at something new for the shallow-water recharge basins. The new design they found consisted of a floating dredge unit that could be moved using another type of positioning device that wasn’t as cost prohibitive as steel tracks. The floating dredge unit designed by Liquid Waste Technology, used a different approach. They were designed as a floating dredge but were still able to reach deep enough to remove the silts and clay particles that formed part of the hardened crust layer.

Liquid Waste Technology (LWT), designer of the Pit Hog™ line of lagoon dredges and remote controlled lagoon pumpers, robotic submersibles and track-driven pump crawlers, created the design for OCWD. LWT custom built four floating Pit Hog™ dredges for OCWD that would operate in their shallow recharge basins.

“The new system is much easier to operate and maintain,” says Max Rasouli, Principal Engineer for OCWD. “Components for the new system aren’t as complicated as the underwater design so we don’t





need the specialized technicians to be available all the time to make sure the equipment is running smoothly.” The new shallow-water BCV, utilizes an OCWD patented roto-tiller type cutterhead to break up the hard lakebed crust and captures the silt-sand slurry inside a chamber (hood) where the silt is hydraulically separated from the sand. The sand drops back to the lakebed, while the silt slurry is pumped to shore for dewatering. The four dredge models consisted of Liquid Waste Technology’s Pit Hog Dredge Model BCV-4. The remote controlled dredges were designed to have a working depth of 20 ft. (6 m) and weigh somewhere in the ballpark of 36, 450 lbs. (16,533 kg).

In conjunction with the dredges, the BCVs utilize heavy duty positioning power from Thern, Inc. power winches. The winch system was used to position floating dredges in basins instead of the rail system. Liquid Waste Technology used Thern Series 4HS Helical/Spur Gear Power Winches fitted with a custom clutch. Known for their durability and strength, the 4HS6MC features TEFC severe duty brake motors for precise control, enclosed gearing for added protection and flange style roller bearings for a long product life. The clutch was added as a customized tool for added control during horizontal pulling.

Four to five winches are positioned around the recharge basins and used to position the dredge anywhere it needs to go (this can include irregular shaped basins). The dredge is moved around recharge basins via steel cables that are connected to the winches. Movement for each winch is automatic and preprogrammed. After testing the new system, OCWD noticed how efficient the winch and cable system were—simple yet effective. The winches provided the dredge with the flexibility of covering majority of the basin bottom, whereas the track system limits certain areas of the basin if it has an irregular shape. “We chose the Thern winches for

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Thern winches presented OCWD with a new level of versatility. Winch systems afford a high degree of flexibility allowing the dredges to move in ways older track systems could not accommodate.

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The Benefits

“The biggest benefit with the new system is its cost effective solution. The capital cost of installing a rail system for an underwater basin cleaning vehicle just didn’t make sense from a budget standpoint,” says Rasouli.

Also, OCWD doesn’t have to hire specialty O&M technicians with exclusive underwater equipment training to maintain the dredge and winch equipment. According to Rasouli, the maintenance is very





minimal and easy to perform. In fact, he states the new dredge is such an efficient tool that it is used five days a week, full time.

Another benefit to OCWD is the mobility the winch system provides. Track systems can limit the areas where the dredge can move in a pond. This isn't a problem if the pond has a regular shape, however ponds that have an irregular shape make it difficult for track systems to be effective. Also the cost of installing a steel track system can prove to be quite expensive.

OCWD is now able to operate their floating dredge system using computers and programs that allow them to automatically clean the basins. There isn't

a need for an expensive technician to operate the machinery it is all programmed into the computer and runs on a timed schedule.

Looking Ahead

Currently OCWD does not have an operable basin-cleaning vehicle for the deep recharge basins. However they are looking into new systems for the future. In the meantime OCWD will continue to research and analyze the hardened crust layer in the aquifer at a microbial and microscopic level to continue supplying the residents of Orange County with enough fresh water year in and year out.

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