



A base station was set up at the plant site

Undoing Past Sins

A long-term surveying project at a mine reclamation job in Maine shows how using multiple satellite positioning constellations can improve productivity.

By David Morningstar

Since 1880, copper, zinc, and other metals have been mined on a 90-acre site near Blue Hill, Maine, bringing all the environmental complications you might expect from such a situation. The extensive use of tailings and rock spoil as construction materials on the site has created a major source of acid mine drainage, which affects local groundwa-

ter and Carlton Stream as it flows through the site and on to several environmentally-sensitive areas downstream.

A comprehensive environmental remediation effort is now underway on the site, which was acquired in 2006 by EMSOURCE Blue Hill LLC, a special purpose entity established by Portland, Maine-based EMSOURCE, Inc. EMSOURCE is a privately held company in the business of acquiring other companies' environmental liabilities. EMSOURCE then

develops a remediation plan acceptable to all concerned individuals and agencies and proceeds to rehabilitate the site. By assuming all the environmental liability involved, EMSOURCE relieves the current owner of any long-term uncertainty associated with a polluted site.

EMSOURCE approached Herrick & Salsbury, a regional land surveying company based in Ellsworth, Maine, to provide survey support for the remediation project early in the process. Steve

Salsbury, PLS of the firm reports, "Our survey of pre-existing conditions formed the basis of the action plan put together by the engineering team and the U.S. Environmental Protection Agency that is the basis for the whole remediation project."

Erosion Undermines Previous Attempts

Located along Route 15/176 in Hancock County, Maine, the site includes a 53-acre waste disposal area containing former primary and auxiliary tailings ponds that have been covered with till and vegetation plus a mill process area with a hoist house, service and concentrator buildings, foundations of former thickener units, and the mine shaft head frame. Three unnamed intermittent streams and Carlton Stream flow through the property, which is bordered by Second Pond to the west, Carlton Stream to the south, and undeveloped land to the east and north.

The last owners, Kerramerican Mining, closed the mine in 1977 and covered the tailings ponds with 12 inches of fill material that was stabilized by seeding. Under terms of an administrative enforcement agreement with the Maine Department of Environmental Protection (ME DEP), Kerramerican covered all exposed mine tailings on the site in 1981 to prevent contamination of surface water and groundwater.

By 1994, erosion had exposed some of the waste tailings, and water with a pH of 2.8 was observed in the tailings pond and leading toward an auxiliary pond. Subsequent analysis of samples collected from the property in 1995 and 1999 detected the presence of arsenic, silver, mercury, iron, cadmium, lead, zinc, copper, and chromium. Other investigations of the

property include: periodic surface water sampling by the Environmental Improvement Commission (EIC) and ME DEP between 1971 and 1982, a Preliminary Assessment (PA) completed in 1995, a Site Inspection (SI) completed in 1996, and an Expanded Site Inspection (ESI) completed in 1999.

Salsbury describes the situation: "Essentially, the rock that came from the mine, both the ore and the spoil, was broken into small pieces, and that created a lot of exposed surface area for erosion to work on. Over the years all that rock was spread around the site for various reasons. EMSOURCE is gathering it all into a few places where it will be stabilized and protected from further erosion. This will be as permanent a fix as today's technology can provide, asnd we're confident it will prevent any further downstream contamination attributable to the mining operations that took place on this site."

Remediation of the Blue Hill site is a two-year project that got underway in late summer of 2006. The plan includes:

- Construction of a new site access road
- Removal of waste rock from and re-grading of the existing access road
- Reduction of existing concrete structures at the plant site
- Construction of a low-permeability cover system over the plant site
- Construction of a low-permeability cover system at the saddle dam
- Re-vegetation of barren areas within the existing soil cover system at the tailings impoundment
- Construction of a controlled outlet at the auxiliary pond
- Improvements to the north diversion ditch





Steve Salsbury of Herrick & Salsbury sets up and uses the Topcon GR-3 RTK GNSS system and the FCS data collector

Small Company Improves Productivity

Herrick & Salsbury was founded in 1962 by Steve Salsbury's father Richard and by Malcolm P. "Mac" Herrick, who left the business in 1970. Steve Salsbury began working for the firm as a teenage apprentice in 1982 and took over management of the company from his father, who is still involved on a part-time basis, in the 1990s.

"We are a relatively small company," Salsbury says, "and meeting the demands of this project required some innovative thinking to make sure we could satisfy EMSOURCE and still serve our existing clients. It's not so much the size of the job; 90 acres is nothing out of the ordinary. But, we don't usually get involved with projects that require us to be on site once or twice a week for two years. We can typically field three crews on any given day, so dedicating one of them to this job meant we needed to find ways to improve our overall productivity to make up for the additional workload. We had been investigating new technologies for awhile, and the Blue Hill assignment was another reason to upgrade our capabilities sooner rather than later."

They owned two single-frequency, L1 static/GIS/GPS mapping grade systems but were looking to upgrade. "We approached the selection task very systematically, evaluating RTK survey-grade systems from several manufacturers in the most realistic field trials we could put together," Salsbury explains. They bought the Topcon GR-3 RTK and used it for the first time on the Blue Hill job.

Most of the work Herrick & Salsbury crews perform on the Blue Hill site consists of relatively standard surveying tasks, including staking road centerlines and drainage ditches, setting finish grades, performing quantity surveys of materials, and conducting as-built surveys to document various aspects of the project. These are typically completed in a few days to a few weeks.

The only unusual aspect of this part of the assignment is the need to keep a detailed log covering everything done over the two-year course of the project. These activities are also complicated by the fact that the site is getting a major facelift, which makes keeping accurate survey control more difficult. "Because the GR-3 base station can be set up virtually anywhere, even a half mile away from



the site," Salsbury says, "we can extend our control well outside the project limits. We have several convenient control points scattered around the site, so we can quickly set up and get to work. The site is hilly with scattered trees plus trucks and earthmoving equipment to interrupt conventional lines of sight, but with the GR-3 RTK, we don't need to maintain line of sight."

"The Blue Hill contract requires us to be on site at least once and usually twice

a week, and the portability and speed of the Topcon system helps us do that efficiently. The bottom line is that the GR-3 lets one person get the job done," Salsbury reveals. "With a total station, or even a robot, we would have to assign two people. Just re-setting control points under conventional conditions would eat up 20 to 40 percent of our time on the site. With the GR-3 RTK we can do it once, and it's good for two years. All the time we save makes us more productive and helps us meet our customer's needs more efficiently and cost-effectively." The survey firm's record for performing topographic surveys with the GR-3 is about 600 points in eight hours. "That's better than a point per minute, which is as fast as you can walk. Not needing line-of-sight between the base and rod is a huge advantage."

Looking back on the learning experience, Salsbury reports, "I probably know enough about the RTK system to teach classes now, but it was a fairly steep learn-

ing curve. It took a few months to be proficient, but I suspect that is true with any RTK system."

The Topcon GR-3 RTK can use GPS and GLONASS and can also pick up the European Galileo system test signals. The ability to receive more signals guarantees additional uptime in the field. Equipped with Topcon's new G3 chip technology, the system already incorporates all the planned signal modernization of the GPS and GLONASS satellite systems, enabling it to track all satellite positioning signals now available and all those planned for the future.

With Herrick & Salsbury's surveying work proceeding smoothly and efficiently, the task of remediating the mine site can do the same. And everyone benefits. ¶

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1. View of new ditch going into Second Pond

2. Map of the project area

3. View of new ditch going into Second Pond