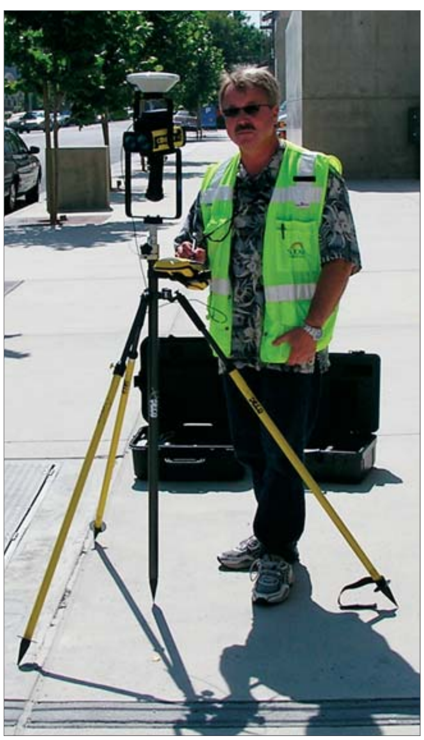
Locating Critical Valves and Meters

Inventory of recycled water distribution system infrastructure more efficient with GPS.

The San José/Santa Clara Water Pollution Control Plant (WPCP) discharges chemically treated effluent to the South San Francisco Bay (South Bay) in Northern California. Over the years, as the South Bay area developed, an increasing amount of fresh water was being discharged to the shallow estuary, which began converting the wetlands from brackish (between 0.5 and 30 percent water salinity) to fresh water marshes (less than 0.5 percent salinity). Since this change in habitat held the potential to affect two endangered species—the California clapper rail bird and the salt marsh harvest mouse—the State Water Resources Control Board amended the WPCP's discharge permit in 1990 to include a provision to limit the discharge of effluent flows to the South Bay to 120 mgd during the dry weather period.



ESD GIS Specialist with GeoXH and Lasercraft XLRic Laser Rangefinder.

To address the new California state requirement, the WPCP developed the South Bay Action Plan, which included the creation of the South Bay Water Recycling program (SBWR). In 1997, construction began on the first phase of the SBWR distribution system, which included about 60 miles of pipeline, three pump stations, and a storage reservoir.

Today, SBWR consists of more than 110 miles of pipeline serving more than one million people in the cities of Milpitas, Santa Clara, and San José. During the summer, an average of 10.9 MG of recycled water are produced and distributed to more than 500 customers per day. The SBWR Program is managed by the Water Utility Division of the City of San José's Environmental Services Department (ESD).

Lost Valves and Meters

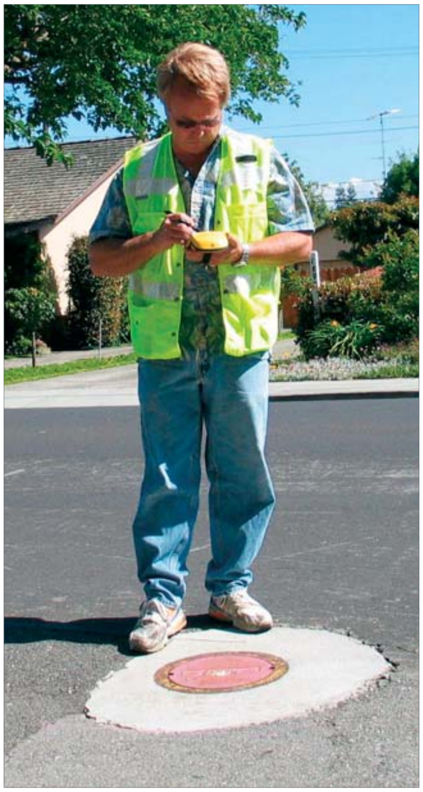
The decision to use GPS was a result of many factors. First, the SBWR infrastructure on the existing construction drawings—CAD-based and in hard-copy format—did not reflect what was actually found in the field. They also lacked an up-to-date system map that could be used for planning purposes.

Valves were getting paved over or buried under dirt due to ongoing, but unrelated, construction projects throughout the service area, making it difficult, and sometimes impossible, to locate them. And, like the valves, the meters were also difficult to locate, sometimes buried or hidden within shrubbery.

In addition, there was no way for the engineering and maintenance staff to identify how many, or the location and condition of critical infrastructure such as valves, test stations, monitoring wells, and meters, in a timely manner.

Finally, while some of the assets were correctly identified as being in the field, their locations were as far off as 500 ft. All of those inefficiencies resulted in maintenance staff having to spend many hours, and, in some cases, days, trying to locate and identify infrastructure while out working in the field.

ESD already had an existing GIS Section, staffed by two GIS Specialists. It was decided that the use of internal GIS staff resources would be the most efficient way to begin using GPS for an inventory of the entire SBWR infrastructure. The objective was to obtain GPS data for all aboveground assets. A data dictionary was created with Trimble® GPS Pathfinder® Office software (www.trimble.com). Twenty attributes were collected for each asset. Those attributes included fields denoting horizontal and vertical accuracy, type of post-processing used, and other fields to allow for Quality Assurance/Quality Control of the GPS data. Other information collected for a meter, for example, included meter number; size; status (connected or not connected); customer type (irrigation, cooling, dual-plumbed); and problems (meter cover damaged, meter damaged, meter not identified as recycled water meter). In addition, a digital photograph was taken of each asset and linked to each GPS point.



ESD GIS staff with GeoXH.

Construction began on the SBWR distribution system in 1996. At that time, some GPS work was done by various private consultants to identify distribution main locations. The centerline of the distribution mains on the hardcopy engineering drawings were tagged with GPS coordinates. Before the start of the current GPS project, the GPS coordinates for the distribution mains were manually input into an ESRI ArcGIS 9.1 (www.esri.com) geodatabase. Once this was done, the pipeline routes were drawn on each city's aerial photo basemap (in ArcGIS) to an accuracy of within one ft. Once the pipeline routes were identified, the GPS work could begin.

Equipment Purchased

Two Trimble GeoXH™ GPS handhelds and two Zephyr™ external antennae were purchased, along with Trimble TerraSync™ field software and GPS Pathfinder Office software. The GeoXH handheld and Zephyr antenna were chosen because they allowed for the highest possible accuracy—sub-eight in.

"The choice to use Trimble GPS products was made to due their ease of use, ruggedness, high-level of accuracy, and their compatibility with our existing ESRI GIS software," said Tim Hayes, ESD GIS Manager.

The following assets were located and inventoried: meters, blowoffs, air relief valves, anodes, cathodic protection stations, manways, pipeline markers, monitoring wells, pump stations, reservoirs, and pressure monitoring stations. SBWR staff was sent into the field to walk the entire 110 miles of pipeline. They photographed each asset, obtained GPS coordinates for each asset location, and then opened any vault covers or lids to assess the conditions of each and every asset.

"Using the GeoXH handheld GPS receiver with the Zephyr antenna allowed us to achieve an accuracy of eight inches or less," said Kent Brown, ESD GIS Specialist.

Furthermore, for those assets that were difficult to access—typically isolation valves that were behind a fence or in the middle of the street—a Lasercraft XLRic Laser Rangefinder was used, along with the GeoXH handheld and Zephyr antenna. Both were mounted on a tripod. The Laser Rangefinder sent the GPS coordinates to the GeoXH handheld via Bluetooth® technology.

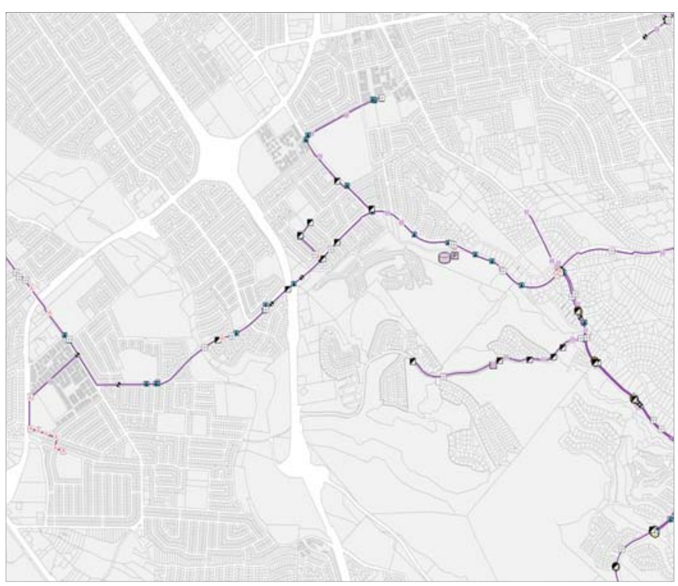
Since the start of this project, 1800 SBWR assets have been identified using GPS to an accuracy level of sub-foot or better. In addition, 120 otherwise unknown maintenance problems were found and documented during the GPS field work.

"The incorporation of using GPS receivers for the South Bay Water Recycling Program has led to increased productivity, faster location and identification of field assets, decreased staff frustration in trying to locate critical asset information, and the overall improvement of the system maintenance workflow," said Bob Wilson, ESD Water Utility Division Engineering Unit Manager.

All of the new GPS data was imported into an ArcGIS geodatabase, which was used as the relational database management software. Now, for the first time, using information from this database, SBWR operations and maintenance staff are able to quickly and efficiently locate aboveground assets in a matter of minutes instead of hours or days. As with any growing system, it will continue to evolve. Ongoing work associated with this project includes GPS training for all staff and eventually incorporating this data into a computerized maintenance management system.

The setting up and enforcement of strict GPS data management and field mapping standards for future system expansion is critical to maintaining the integrity of the GIS and GPS data. And, highly accurate recycled water distribution system maps can now be created and used for expansion planning and reliability improvements.

"Because of the success of this project, other opportunities for GPS receivers at SBWR include incorporation into regulatory compliance and site oversight, and horticultural site review," said Eric S. Hansen, SBWR Recycled Water Supply Manager. GE



South Bay Water Recycling program GPS assets.