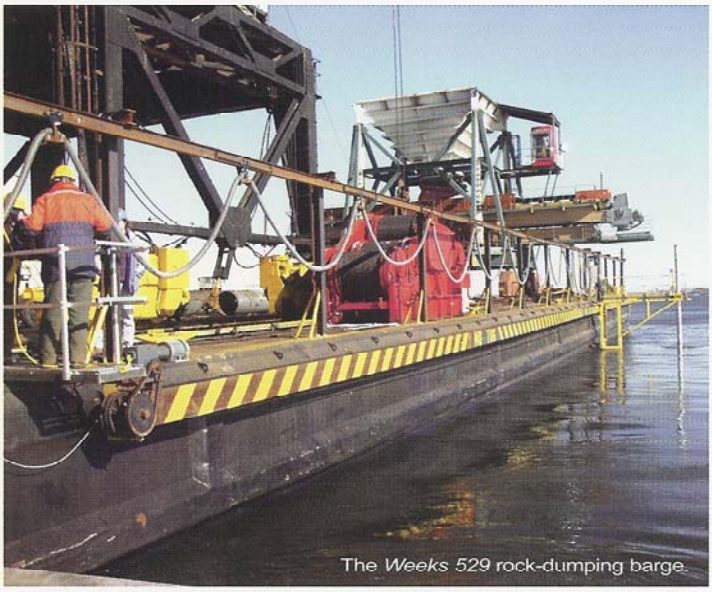
Case Studies: Inland/Coastal Surveys

Surveys performed in inland and coastal waters present contractors with quite a different set of obstacles than those encountered offshore. After all, you just never know what you might find on the bottom of a river or lake. We surveyed (pardon the pun) survey contractors from every corner of the globe – even Russia – to find out what they use to get the job done in the unique conditions found in inland and coastal waterways.

Seafloor Mapping for Shallow Water Rock Dumping Operations

Iroquois Gas Transmission System's Eastchester Extension Project is a 24-inch gas pipeline running from Hunts Point, New York (East River), up to Northport, Long Island. The construction project posed many obstacles since the pipeline not only runs through some of the busiest waterways in the United States, but it also covers extremely varied geology over the course of the route. Add to these factors a seafloor littered with debris, cable crossings, and other pipelines, and proper seafloor mapping during construction becomes critical.



The *Weeks 529* rock-dumping barge.

Weeks Marine (Cranford, NJ) was entrusted with one of the trickiest portions of the project – dumping rock over the installed pipeline in order to ensure it was protected against anchor dragging, etc. Proving the correct rock coverage had been met was essential not only from a design perspective, but also from a permitting stance. Weeks Marine was faced with four major obstacles:

1. A varying geology (from soft silt to rock) meant that each area would react differently to rock dumping operations, affecting both the method of dumping and the amount of rock required to achieve proper coverage. In some cases an entire hopper would be dropped on the pipe and disappear into the silt, leaving only 10-foot mud waves in its wake. Therefore seafloor conditions, and the effects of a specific rock dump, had to be monitored in close to real time.

Furthermore, it was essential that proper coverage be proven prior to moving the rock dumping barge and re-anchoring. Otherwise, a large percentage of the pipe would have remained unprotected, and once discovered during a traditional post-survey, would have required the remobilization of the barge, resulting in a significant loss of time and money.

2. Since specifications were extremely stringent, Weeks required a visual confirmation of the pipe's location prior to dumping rock, and they were not allowed to rely solely on the as-laid coordinates. They also had to position the barge extremely carefully in certain areas to avoid hooking electric and telecom cables or damaging other pipelines.

3. The monitoring system had to achieve its goals while remaining in the project's budget constraints and being simple enough to operate by project engineers without specialized assistance.

4. A very tight timetable required data from the monitoring system to be rapidly available to the decision makers. Operations started in December of 2002 and were completed in June of 2003.

To solve these problems Weeks Marine designed a dedicated rock dumping barge, the *Weeks 529*, and hired Alpine Ocean Seismic Survey (Norwood, NJ), which had already performed the pre-engineering route surveys, and Geod Corporation (Newfoundland, NJ), to engineer a specialized positioning and bathymetric surveying system. Alpine was tasked with the seafloor mapping system, while Geod handled the surface positioning. Alpine and Geod were also charged with installing, testing and deploying the systems, as well as training Weeks Marine personnel on their use.

The heart of the seafloor mapping system was a Reson 9001 shallow water multi-beam system operating at 455Khz with a 90 degree swath coverage. The 9001 was installed with the backscatter option, which allowed it to be interfaced to Chesapeake Technologies' Sonarwiz software, giving the engineers a virtual sidescan sonar image of the seafloor in addition to detailed bathymetry. Coastal Oceanographics' Hypack Max software was used to acquire and process the multibeam data. Heave, pitch and role compensation was accomplished using a TSS DMS2-05 unit.

Trimble MS750 RTK GPS receivers, provided by **Measutronics (Lakeland, Florida)**, were used to position the barge, rock hopper, multibeam transducer, and provide heading and real-time tide corrections. Trimble HYDROpro software was used to integrate all positioning and heading data and provide tug and anchor information to the barge manager.

One of Weeks Marine's primary design criteria for the seafloor mapping package was that it should be deployable from the rock dumping barge without the use of a separate dedicated survey vessel. This would allow for operational cost and time savings, increased ability to operate in inclement weather, and full integration of rock dumping and surveying operations. Alpine and Weeks marine worked together to design and construct a self-propelled trolley onto which the multibeam transducer, the GPS RTK antenna, and the heave, pitch and roll sensor were mounted. The remotely operated trolley traveled on a track down the side of the barge, allowing it to map the entire area of seafloor covered by the rock hopper on any given barge anchoring station.

Once the barge was anchored on location, the engineer would run a pre-dump survey to assess exact pipe location and seafloor conditions. The information was used by the barge manager and construction engineers to plan rock dumping operations for maximum efficiency. It also provided a baseline to determine the effect of each rock dump. This pre-survey operation took 15 minutes.

After each cycle of rock dumping, a post-survey was performed. The data was compared to the pre-dump survey to ascertain if proper rock cover had been achieved. This took about 30 minutes.

This process was repeated until rock cover specifications were met. The data was presented to the client and the section signed off as complete prior to moving the barge to the next location.

The effort, preparation and upfront design costs resulted in a large payoff when it came down to the efficiency, speed and effectiveness of the rock dumping operations. The final system was so integrated and easy to use that the positioning and seafloor mapping system could be operated by one engineer. The system aided Weeks in completing the work before permit deadlines were imposed. In addition, no post-surveying was required, since Weeks had collected all the data immediately upon completion of the dumping operations, providing the client and permitting agencies with all the information they required to sign off on the project.

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