

## Research Update

S&T Program Project ID 7738-01  
Bulletin 2017-05

### Bottom Line

This research project showed that ROVs can be used for condition assessments and to collect photogrammetric imagery.

### Better, Faster, Cheaper

Using ROVs are a solution to inspecting structures that are otherwise impossible (such as using divers) to determine the makeup and condition of mechanical dewatering equipment that has been unknown for over 60 years.

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## ROV Data Collection and Photogrammetry From Trinity Dam Intake Structure

*Building a photogrammetric 3D model from ROV-collected data as supplement for underwater condition assessment*

### Problem

Trinity Dam, located in the southernmost part of the Cascade Mountain Range in north-central California, is one of the first water control structures on the Central Valley Project, which feeds into 500 miles of canals. The earthen structure was built between 1957 and 1962 and is just over 500 feet tall.

Over the past few years, Reclamation has been planning to rehabilitate several mechanical components at Trinity Dam, including the hemispherical bulkhead and fixed wheel gate. Part of the rehabilitation project also includes addressing any potential deterioration within the concrete intake structure. However, the condition of the equipment is unknown because the intake structure has not been dewatered since the time it was built in 1962. The unknown conditions cause widely variable estimates for repair costs.

The initial plan consisted of lowering the bulkhead and dewatering the intake structure to allow inspection and repair of any found defects. This approach, however, comprises several issues:

1. The condition of the bulkhead seal is unknown and it may not seal adequately with the bulkhead.
2. The 150-foot-tall vertical section will require scaffolding or complicated rope access.
3. Dam operations limit the time that the intake structure can be dewatered so repair may have to be done in stages requiring an indefinite schedule.
4. The cost estimates for this stage of the project are highly speculative because of the unknown conditions.

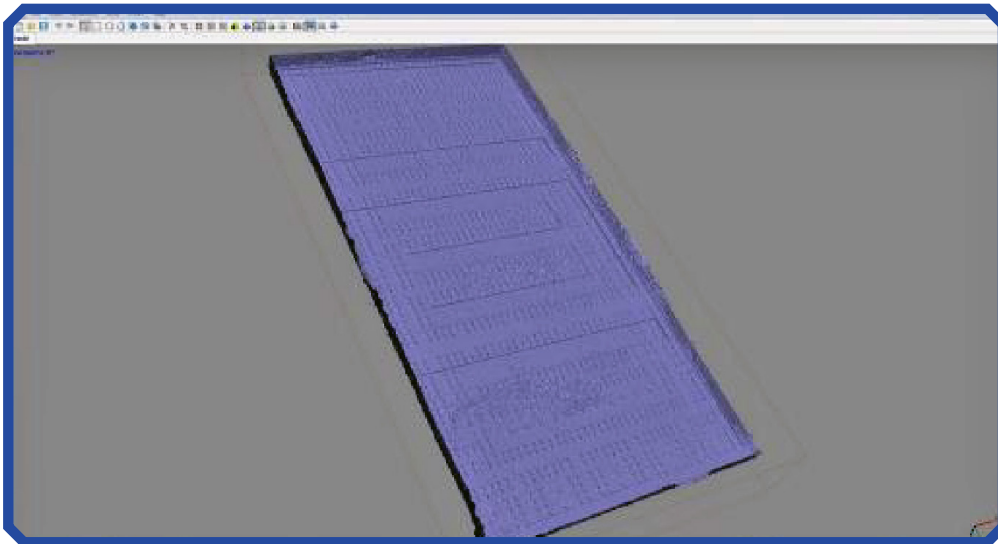


*The Mojave ROV used to perform the underwater intake structure inspection and photogrammetric data collection.*

## Solution

The purpose of this Reclamation Science and Technology Program research project was to determine if data collected from a remotely operated vehicle (ROV) could be used to create a three-dimensional (3D) model that could supplement an underwater condition assessment.

A long-range ROV with the capability to reach the fixed wheel gate at a distance of 1,700 feet and approximately 200 feet underwater was used to inspect the equipment and the intake structure. The ROV had a high-definition camera to record video and a laser scanner to help measure the potential extents of deterioration. The video was post-processed photogrammetrically to build a 3D model of the upstream face of the fixed wheel gate so that the entire gate could be inspected.



A 3D model of the upstream face of the fixed wheel gate at Trinity Dam, California.

## Application and Results

The results of the inspection showed that there was no major deterioration within the structure or mechanical equipment. The inspection showed that a long-range ROV can be used to inspect difficult-to-access features within Reclamation's infrastructure.

## Future Plans

ROV technology can be used to inspect features that are complex or difficult to dewater. In addition, 3D models can be built from the video that ROVs record.

***“Using an ROV and underwater photogrammetry techniques to perform the inspection likely saved hundreds of thousands of dollars or more compared to the cost of a conventional inspection when the structure is dewatered.”***

**Matthew Klein**  
Civil Engineer  
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## Collaborators

Reclamation:

- Northern California Area Office in Mid-Pacific Region
- Technical Service Center

## More Information

[www.usbr.gov/research/projects/detail.cfm?id=7738](http://www.usbr.gov/research/projects/detail.cfm?id=7738)

[www.usbr.gov/research/projects/researcher.cfm?id=2676](http://www.usbr.gov/research/projects/researcher.cfm?id=2676)