Bow River Reservoir Options

Phase 2: Feasibility Study

Activity Description Sheet – Geophysical Surveys

Overview

Alberta Environment and Parks (AEP) continues to explore options to build additional reservoir capacity on the Bow River upstream of Calgary to reduce the impacts of flood and drought on Albertans and the economy. The Bow River Reservoir Options (BRRO) initiative is being approached in phases. The Phase 1: Conceptual Assessment was completed in spring 2020 and identified three reservoir options: Morley, Relocated Ghost Dam and Glenbow East. The Phase 2: Feasibility Study is now underway and will further evaluate the three reservoir options. As part of the feasibility study, AEP's consultant, Wood Environment & Infrastructure Solutions, and its subconsultant Tetra Tech, Canada Inc., will be completing geophysical surveys.

Why do geophysical surveys?

Geophysical surveys are undertaken to **obtain continuous information of subsurface soils present (e.g., to distinguish sands versus clays), groundwater levels and depth to bedrock** between, and beyond, a limited number of geotechnical boreholes. The ground-based geophysical surveys will consist of seismic refraction lines (seismic) and Electrical Resistivity Tomography (ERT).

Geophysical surveys are one part of the overall geotechnical site investigation program which will also include desktop studies, geotechnical drilling, geological field mapping and general site reconnaissance. Only the geophysical survey component is described in this sheet.

Photo: Tetra Tech

Photo: Typical underbrush clearing requirements for seismic or ERT lines.

Photo: Tetra Tech

Photo: Typical seismic geophone placement.

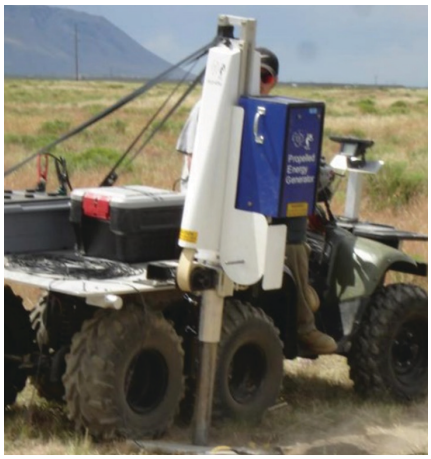
What does a geophysical survey consist of?

Site Access and Disturbance

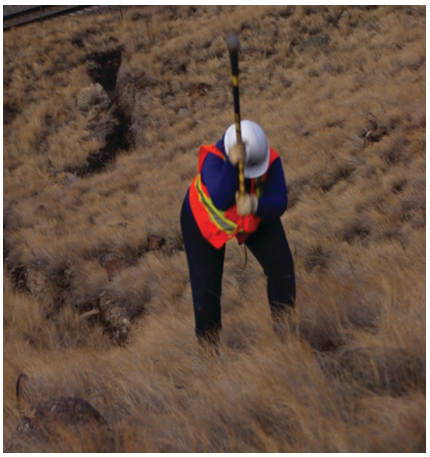
- The geophysical surveys (seismic and ERT) will be low impact and can be carried out on foot from nearby vehicular access.
- Ideally, access will be by vehicle or all-terrain vehicle (ATV) to within 500 m of the geophysical line location. However, the work could still be completed by walking a farther distance.
- The geophysical surveys will be done on the ground surface. Some minimal clearing of brush may be required in vegetated areas so that cables can be laid out and the field crew can walk the line. Disturbance to mature trees will be minimized and limited to the hand removal of the occasional lower tree limb that is obstructing the line.
- The geophysical survey lines will be walked prior to the fieldwork to assess:
  - Access to and along the lines;
  - Vegetative cover and locations requiring limited brush clearing;
  - Areas with steep slopes, cliffs and other obstructions such as minor water crossings like small creeks;
  - Intersections with infrastructure such as fence lines, roads and rail lines; and
  - High noise-level locations.

For more information, visit: https://www.alberta.ca/bow-river-reservoir-options.aspx
Questions? Contact us today at aep.bowbasin@gov.ab.ca or call 310-3773.

Typical shotgun source.



Typical drop weight source.



Typical hammer source.

Photo: Tetra Tech

Survey Methodology

- The survey methodology for both the seismic and ERT surveys consists of three fundamental steps:
  1. Laying out an initial length of cables and inserting the sensors – geophones for seismic surveys and electrodes (2 ft stainless steel pins) for ERT surveys. The sensors detect signals transmitted through the ground from the source (see below). The way the signals travel through the ground is affected by the types of soil and bedrock present and the groundwater conditions.
  2. Setting up the source – energy for seismic and electrical for ERT (see below) and taking readings at the sensors.
  3. Removing part of the cable and re-laying (or rolling) the cables and sensors farther along the line.

Steps 2 and 3, above, are repeated until the geophysical survey line is complete.

Seismic Cable Layout and Energy Source

- Minimal line clearing is required to allow the field crew to walk the line and place the cable and geophones.
- The geophones are placed into the ground using a 3" steel spike. All cables and geophones are removed after data collection.
- Three potential energy sources will be used. The selected source will depend on ground terrain and local geology.
  1. Shot gun energy source – 1" diameter hole is augered about 3 ft into the ground and a firing rod with a 12-gauge or 8-gauge shotgun shell blank at the end is inserted into the hole and fired. The spent shell is then removed, and the hole tamped.
  2. Drop weight energy source – a strike plate is placed on the ground and is struck with a drop weight system mounted on an all-terrain vehicle or tandem wheel dolly.
  3. Hammer energy source – a strike plate is placed on the ground and is struck with a steel hammer to generate the sound.
- The steel strike plate used for the seismic drop weight and hammer sources is moved between locations, leaving minimal impact.

ERT Cable Layout and Electrical Source

- ERT cable layouts are like those required for seismic layouts in that they require laying out cables along cleared lines and inserting electrodes at least 1 ft into the ground.
- After taking ERT readings, the electrodes and cables are removed, leaving minimal impact to the ground.
- The electrical source and measurement equipment for the ERT survey is hand portable and battery operated. It is placed at intervals along the cable layout and is moved as the cables are rolled out or moved.

Cable Options at Road and Rail Crossings

- For road crossings, protective mats are placed over the cables and suitable traffic control measures are implemented. Traffic control plans are registered and approved by the owning road authority.
- For rail crossings, cables can be run under the rails, on top of the ballast and between the sleepers. Once the cables are in place, no activity is required within the rail right of way until the cables are removed. Access and authorization would be obtained from the owning rail authority.

Will the results be shared with landowners?

The final Bow River Reservoir Options – Phase 2: Feasibility Study report will be made available to the public following the completion of the feasibility study in spring 2023. The report will include the findings of the geophysical surveys.

For more information, visit: https://www.alberta.ca/bow-river-reservoir-options.aspx
Questions? Contact us today at aep.bowbasin@gov.ab.ca or call 310-3773.