MEMORANDUM

Amendment to Bradley Lake Hydroelectric Project (FERC No. 8221), Bradley Lake Expansion Project – Bradley Lake Shoreline Erosion Observations and Analysis

Date:	November 24, 2025
Author:	Kathy Dubé (Watershed GeoDynamics geomorphologist)
Purpose	Describe existing conditions of the Bradley Lake shoreline erosion and assess potential future shoreline conditions with proposed dam raise.

1.0 BACKGROUND

The proposed Bradley Lake Expansion Project includes a proposal to raise the normal maximum operating pool elevation of Bradley Lake by approximately 16 feet from Elevation (El.) 1,180 feet to El. 1,196 feet (all elevations reference the Bradley Lake Vertical Datum). This pool raise would increase the total surface area from 3,817 acres to 4,033 acres. The effects of the increased pool elevation on geology and soil resources would be to inundate an additional 216 acres of upland soils and change shoreline erosion patterns.

2.0 METHODS

To evaluate the effects of the proposed increased pool elevation on geology and soils, an assessment of current areas of shoreline erosion was made using 2022 aerial photographs and light detection and ranging (LiDAR) hillshade coverages (NV5 Global, Inc. 2023). Areas of shoreline erosion were mapped in a Geographic Information Systems (GIS) environment and field checked visually during a helicopter circumnavigation of Bradley Lake on October 3, 2025.

3.0 RESULTS

Bradley Lake is located in a remote part of the southern Kenai Peninsula southeast of Homer, Alaska. The lake is part of the Bradley Lake Hydroelectric Project and is impounded by a 125-foot-high dam. Bradley Lake Hydroelectric Project operation began in 1991. Current operation of the reservoir results in pool elevations varying seasonally between El. 1,080 feet and El. 1,180 feet. The proposed new operating range would be between El. 1,080 feet and El. 1,196 feet.

The shoreline of Bradley Lake is underlain by Mesozoic to Cenozoic rocks of the McHugh Complex and the younger Valdez Group. These rocks are a mélange of intensely deformed and faulted marine sedimentary and volcanic rocks. Overlying the bedrock units are varying thicknesses of glacial till, outwash, and colluvium. In some areas, bedrock has been scraped clean by glacial erosion. Shoreline areas are generally steep on the western (downstream) half of the reservoir and gentler on the eastern (upstream) half of the reservoir. Soils in the area have not been mapped but are young and of varying thickness.

The current shoreline is 28 miles long at El. 1,180 feet. Mapping of eroding shoreline areas using remote sensing and aerial observations suggest approximately 10 percent of the shoreline is eroding under current operations. Mapped areas of erosion are shown on Figure 3-1 and include areas of bank erosion (approximately 1.7 miles of shoreline) and taller, shallow rapid landslides (approximately 1.2 miles of shoreline). Most eroding shorelines occur on the western half of the lake. The gentler sloping eastern half of the lake has fewer areas of erosion (Figure 3-2).

Areas classified as bank erosion have relatively shorter (less than 20 feet tall) eroding slopes with generally uniform bank heights (Figure 3-3). Areas classified as shallow rapid landslides have an arcuate eroding bank shape with heights up to 100 feet tall, and these areas appear to be primarily in colluvial deposits on very steep slopes (Figure 3-4 and Figure 3-5).

Erosion mechanisms for both the bank erosion and shallow rapid landslide areas are presumed to be similar: erosion of unconsolidated material (till or colluvium) along shoreline areas by wave action that removes material from the base of the slope. In areas of bank erosion, removal of material from the base of the slope results in an undercut slope followed by toppling and/or raveling of overlying material. In areas of shallow rapid landslides, removal of material from the base of the slope destabilized the slope and has resulted in sliding of overlying material. In both cases, continued erosion of the base of the slope by wave action keeps the slopes unstable and unvegetated.

The proposed increase in reservoir elevation will move the location of wave action and the base of the slope 16 vertical feet up the sides of the reservoir. This will result in continued erosion of the existing eroding areas and further destabilization of areas of shallow rapid landsliding. It is possible that additional areas of erosion will occur if new areas of unconsolidated colluvium or till are encountered by the new shoreline, but based on LiDAR mapping, it does not appear that there are substantial new areas of colluvium or till that will be encountered by the new shoreline position.

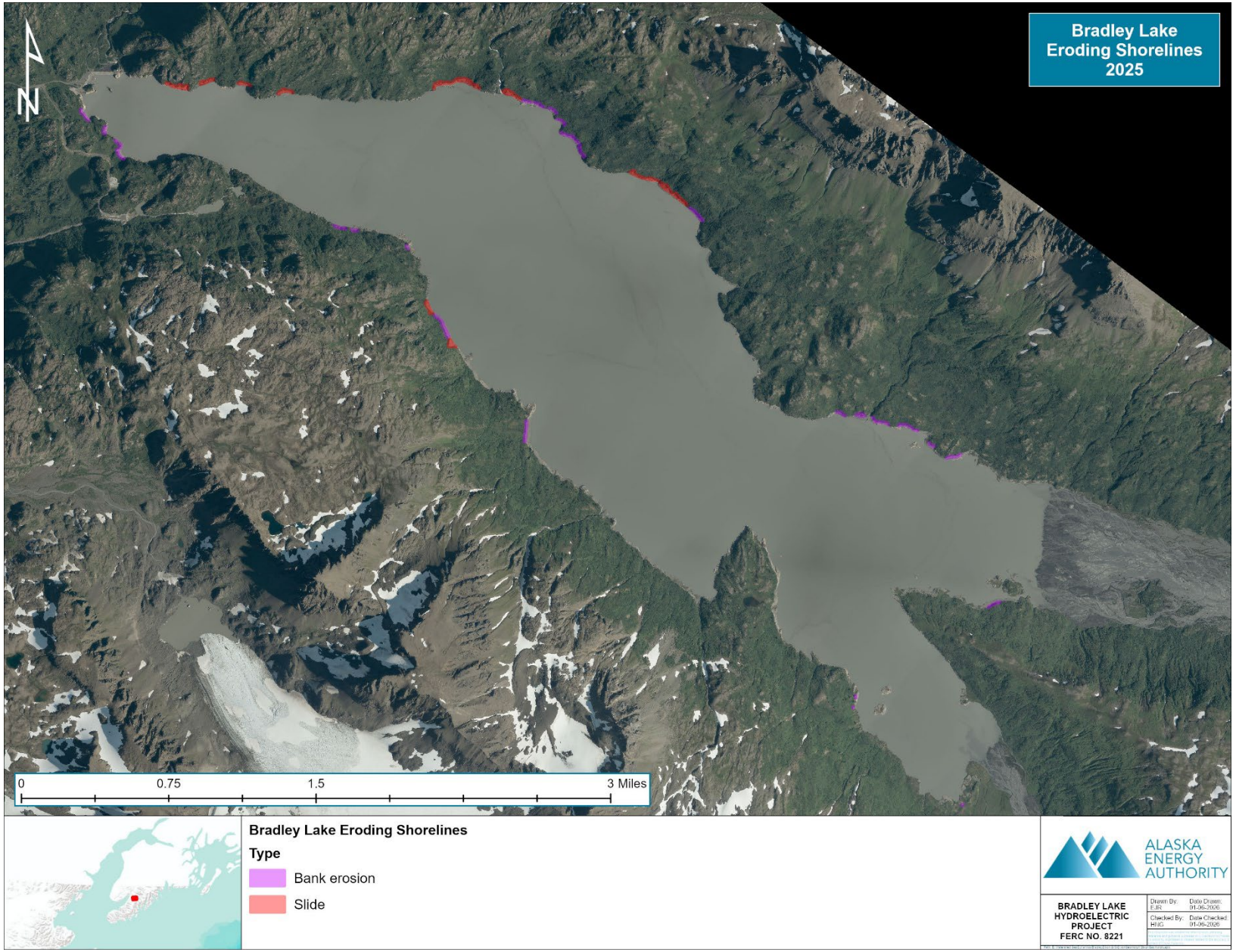

Figure 3-1 Mapped areas of Bradley Lake shoreline erosion.

Figure 3-2 Example of stable, gently sloping area of Bradley Lake shoreline.

Figure 3-3 Areas of bank erosion.

Figure 3-4 Example 1 of shallow rapid landslides in colluvium.

Figure 3-5 Example 2 of shallow rapid landslides in colluvium.

4.0 REFERENCES

NV5 Global, Inc. 2023. Dixon, Alaska 2022 LiDAR and imagery technical data report. Report prepared for DOWL. February 16, 2023.