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Executive Summary **EIGHTMILE DAM REBUILD AND RESTORATION**

SEPA Draft Environmental Impact Statement

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Contact Information

Office of Columbia River

Central Regional Office
1250 W Alder St
Union Gap, WA 98903-0009
Phone: 509-575-2490

Website¹: [Washington State Department of Ecology](http://www.ecology.wa.gov)

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EXECUTIVE SUMMARY

This Executive Summary was prepared as standalone document to summarize the contents of the full analysis in the Eightmile Dam Rebuild and Restoration Environmental Impact Statement (EIS). The full EIS is available at Ecology's website: <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Icicle-Creek-strategy/Eightmile-Dam>.

Introduction

In January 2019, the Washington State Department of Ecology (Ecology) and Chelan County issued a Final Programmatic Environmental Impact Statement (FPEIS), evaluating the Icicle Creek Water Resource Management Strategy (Icicle Strategy), culminating nearly 6 years of evaluating strategies within the Icicle Creek Subbasin to improve instream flows, improve sustainability of the Leavenworth National Fish Hatchery (LNFH), protect tribal and non-tribal fish harvest, improve municipal and domestic water supply and agricultural reliability, enhance habitat in Icicle Creek, and comply with state and federal law, including the Wilderness Act. The FPEIS evaluated five program alternatives, and the State Environmental Policy Act (SEPA) non-project action was the adoption of the program called the Icicle Strategy. The Icicle Strategy is intended to provide a program of integrated long-term water resource management and habitat restoration actions to achieve reliable water supplies and improve instream flows in the Icicle Creek Subbasin.

The Eightmile Dam Rebuild and Restoration Project is one of several early actions to be implemented as part of the Icicle Strategy, and as such is the subject of the first project-level environmental impact statement (EIS) undertaken in this phased review process under SEPA. The project proponent is the Icicle and Peshastin Irrigation Districts (IPID). The more than 90-year old Eightmile Dam structure has been damaged by numerous natural events over the years, raising safety concerns and reducing the reservoir's active storage capacity. In 2018, Ecology determined that the dam is not consistent with dam safety requirements, creating a threat to downstream residents and properties. This determination has accelerated the need to rebuild the dam to current design safety standards.

IPID is proposing to rebuild the dam in the same location as the existing dam. Ecology's Office of Columbia River (OCR) determined that this proposal to rebuild and restore the dam is likely to have a significant adverse impact on the environment, and accordingly, this EIS has been prepared under Revised Code of Washington (RCW) 43.21C.030. Ecology OCR is the lead agency under SEPA and is leading the development of the EIS for the project in accordance with Washington Administrative Code (WAC) 197-11, SEPA Rules.

Project Background

Eightmile Lake is a reservoir lake in the Icicle Creek Subbasin in Water Resource Inventory Area (WRIA) 45 (Wenatchee River Basin) in Eastern Washington. It is an alpine lake located in the Alpine Lakes Wilderness of the Okanogan-Wenatchee National Forest, at an elevation of approximately 4,600 feet above sea level. Water supply in this area is heavily dependent on snowpack in the upper reaches.

A small dam, low-level outlet pipeline, and slide gate at the outlet of Eightmile Lake (Eightmile Dam) allow for controlled releases of stored water into Eightmile Creek, which flows into Icicle Creek. These releases supplement flows in Icicle Creek and provide water for irrigation during low-flow periods, typically during late summer. Icicle Creek also supports the domestic water supply for the City of

Leavenworth, other agricultural irrigation users, hatchery fish raised at the Leavenworth National Fish Hatchery (LNFH), streamflows and natural aquatic habitat for wild fish, and recreation.

Eightmile Lake was altered to increase the storage capacity to provide irrigation water supply in 1929. In 1976, the area was designated as the Alpine Lakes Wilderness because of the natural beauty of the alpine lakes complex and relatively easy public access.

Eightmile Lake is one of four lakes in the Wilderness managed by IPID for water storage. The IPID has an agreement with the U.S. Forest Service that grants IPID limited privileges, including the ability to maintain and repair its reservoirs within the Alpine Lakes Wilderness. In the 1990s, the IPID exchanged land that is now within the Alpine Lakes Wilderness for a deeded area, called the Special Warranty Deed Area. This area includes two parcels on which IPID retains rights related to the Eightmile Dam (**Figure 1**, presented at the end of this Executive Summary). Eightmile Creek and most of Icicle Creek are also within the Okanogan-Wenatchee National Forest. Land abutting Icicle Creek includes numerous private parcels for roughly the final 6 miles, which is approximately 5 miles downstream from the dam. The proposed project (including access to the site) is entirely on lands managed by the Forest Service.

The 2017 Jack Creek Fire in the Alpine Lakes Wilderness burned several hundred acres in the Eightmile drainage. In spring of 2018, increased runoff filled the dam to the level that water began flowing over the earthen portion of the dam, resulting in an emergency declaration and immediate repairs at the dam. In the spring of 2018, floodwaters and runoff overtopped Eightmile Dam.

As a result of these events, Ecology's Dam Safety Office (DSO) evaluated the dam and determined the condition of the dam was unsatisfactory. Additionally, the dam is considered a High Hazard Dam, with an estimated 150 residences along Icicle Creek downstream of the dam. This hazard classification means that a dam failure would threaten human lives and/or cause substantial economic or environmental damage. Because of these concerns, IPID and Chelan County declared an emergency at Eightmile Dam on March 13, 2018. The emergency repairs have temporarily increased safety, making it possible to lower the reservoir level and provide additional spill capacity, but the infrastructure does not currently meet DSO's requirements for dam safety or IPID's water supply needs. As a result of these ongoing safety concerns, DSO currently requires that the dam's outlet gate be kept open to reduce the volume of water stored and thus reduce risk of failure during the winter and early spring until permanent repairs can be made to the dam.

Project Objectives

IPID is proposing to rebuild the dam to comply with DSO safety standards. IPID's proposed rebuild and restoration of the Eightmile Dam has three objectives:

- Restore the storage capacity of Eightmile Lake so that it meets IPID's storage and irrigation needs under its existing water rights.
- Comply with DSO regulations for a High Hazard Dam.
- Provide additional water to enhance instream flow volumes in Icicle Creek and, to the extent possible, time dam outflows to meet fish utilization needs.

IPID holds a state water right that authorizes it to store water at Eightmile Lake. Erosion of the earthen embankment portion of the dam structure has reduced the active storage available for release by gravity without pumping or siphoning to less than 1,400 acre-feet under current conditions, which is less than the quantity recognized for IPID's water right in an adjudication decree issued in 1929. Rebuilding the dam would restore the storage capacity to meet IPID's existing irrigation needs and could provide additional water to enhance instream flows.

Eightmile Dam would be one of the first of several projects implemented under the Icicle Creek Water Resource Management Strategy at the direction of the Icicle Work Group (IWG). The IWG comprises a diverse set of stakeholders representing local, state, and federal agencies, tribes, irrigation and agricultural interests, municipal/domestic water managers, and environmental organizations. The proposed Eightmile Dam Rebuild and Restoration Project helps meet the Guiding Principles of the Icicle Strategy. The Guiding Principles are a set of objectives that all members of the IWG agreed were in their mutual best interest to collaborate on and achieve as they develop a strategy to meet the needs of the various stakeholders in the subbasin.

Alternatives

The EIS for the Eightmile Dam Rebuild and Restoration Project evaluates three dam design alternatives (i.e., “action alternatives”). The alternatives, along with operational considerations, are described in Chapter 2 of the EIS. After considering stakeholder input and other factors, proposals that extended outside the Special Warranty Deed Area have been eliminated from consideration in the EIS.

Four alternatives are analyzed in this Draft EIS:

No Action Alternative (as required by SEPA)

Under the No Action Alternative, the existing dam would be left as is (**Figure 2**), and it would continue to operate in its current state and manner. The outlet elevation would remain at the current elevation of 4,667 feet. The DSO considers the dam vulnerable in the event of a large storm. Operation of the dam under existing conditions is not consistent with DSO regulations and does not meet the DSO’s safety requirements for a High Hazard Dam. The DSO could eventually exercise enforcement actions in accordance with WAC 173-175-620 (3) to reduce the downstream risks. However, it is not possible to predict with certainty what that action or its effects would be. DSO currently requires IPID to leave the low-level outlet gate open during the winter and early spring to reduce the risk of a dam failure. Consequently, for purposes of the EIS analysis, it is assumed that the existing state of the dam and its operation would remain unchanged.

The No Action Alternative does not meet IPID objectives for water storage capacity for operations and irrigation water delivery. It would not contribute to the IWG Guiding Principle related to streamflow improvements, and would pose a potential risk to downstream residents.

Alternative 1: Narrow Spillway with Gates

Alternative 1 includes replacement of the existing dam with an earthen embankment and reinforced concrete dam structure equipped with three 4-foot high, 20-foot long automated control gates over the primary spillway (**Figures 3 and 4**). The gates would control the water level within the top 4 feet of the lake. When additional water supply is needed, IPID would raise the gates in the late spring or early summer to raise the lake to elevation 4,671 feet prior to releasing the water in the late summer. The gates would automatically lower if the lake level gets too high to protect the dam and prevent overtopping. This design would allow for a narrow primary spillway (60 feet wide) and therefore a smaller dam footprint compared to the Wide Spillway Alternative (Alternative 2, described below).

Two 15-foot wide intermediate spillways on either side of the primary spillway would provide additional spillway width to accommodate extreme storm flows (**Figure 3**). A secondary spillway would be created in a low spot south of the main dam structure by using rock and riprap to harden an existing channel. The spillways would provide capacity to pass the design storm event required by DSO (a storm that has the probability of occurring once in 1,000,000 years) while maintaining the

freeboard (the vertical distance of the crest of the dam above the maximum lake water level) in the lake.

Water would be released from the lake through a new 30-inch diameter low-level outlet pipe/siphon, submerged in the lake west of the new dam structure to an outlet in the Eightmile Creek channel downstream of the new dam structure. This would allow the lake to be drawn down to a low-water surface elevation of 4,636 feet, which would allow access to stored water without pumping. The low-level outlet pipe would be located entirely within the Special Warranty Deed Area. IPID would release water during the late summer using an automated plug valve to maintain the water supply available for irrigation use and instream flows in Icicle Creek. IPID would have the ability to adjust the valve remotely to release the flows needed to meet downstream IPID water supply needs and instream flow needs.

The primary spillway gates and low-level outlet valve at the lake would be powered by batteries charged by a solar panel. Lake levels, gate and valve positions, and other controls would be monitored remotely, and the equipment would be operated via radio signal, requiring an antenna, which would be located at the dam site. The controls and monitoring equipment would be concealed as much as possible. Automation would require a repeater station in a separate and appropriate location on Icicle Ridge. The proposed repeater station would be co-located with the Forest Service's local repeater station on National Forest System lands on Icicle Ridge.

Alternative 2: Wide Spillway without Gates

Alternative 2 includes replacement of the existing dam with an earthen embankment and reinforced concrete dam with a primary spillway length of 180 feet (**Figures 5 and 6**). The primary spillway would be fixed and completely passive, without using gates or automated equipment. This would require a wider spillway and a larger footprint than the Narrow Spillway Alternative (Alternative 1). There would be no intermediate spillways. The primary spillway would have a hard spillway crest at an elevation of 4,671.0 feet.

During extreme storm events, the lake would flow over the entire length of the primary spillway. A secondary spillway, the same as Alternative 1, would be created in a low spot south of the main dam structure. The spillways would provide enough capacity to pass the design storm event while maintaining the freeboard in the lake, as required by DSO.

As with Alternative 1, water would be released from the lake through a new 30-inch diameter low-level outlet pipe/siphon. The operation and configuration of the low-level outlet pipe would be the same as described for Alternative 1, with the low-level outlet pipe located entirely within the Special Warranty Deed Area.

As with Alternative 1, the low-level outlet valve at the lake would be powered by batteries charged by a solar panel. Lake levels, valve positions, and other controls would be monitored remotely, and the equipment would be operated via radio signal, requiring an antenna, which would be located at the dam site. The controls and monitoring equipment would be concealed as much as possible. As described for Alternative 1, a repeater station would be co-located with the Forest Service's local repeater station on National Forest System lands on Icicle Ridge.

Alternative 3: Narrow Spillway without Gates

Alternative 3 was developed as a result of comments received during scoping suggesting that the EIS should include an alternative dam design that meets the existing spillway elevation of 4,667 feet.

Under Alternative 3, the dam type and configuration would be almost identical to that of Alternative 1, having a narrow spillway and a concrete spillway apron, but with no mechanical gates (**Figures 7 and 8**). Alternative 3 would be designed to store water up to a maximum water surface elevation of

4,667 feet. This alternative would have the same footprint as Alternative 1. Because Alternative 3 would not have mechanical gates, the primary spillway would include one continuous 60-foot-wide primary spillway section (**Table 1**). The intermediate and secondary spillways for Alternative 3 would be identical to that described for Alternative 1.

The maximum volume of water that could be stored for release by the dam would be less with Alternative 3 than for the other two action alternatives, and would not meet all of IPID's objectives because there would be less potential water storage available for release to ensure against drought conditions. Because there would be less potential water available during drought conditions, this alternative would require pumping from the lake to meet IPID needs.

As with Alternatives 1 and 2, the low-level outlet valve at the lake would be powered by batteries charged by a solar panel. Lake levels, valve positions, and other controls would be monitored remotely, and the equipment would be operated via radio signal, requiring an antenna, which would be located at the dam site. The controls and monitoring equipment would be concealed as much as possible. As with Alternatives 1 and 2, a repeater station would be co-located with the Forest Service's local repeater station on National Forest System lands on Icicle Ridge.

A Comparative Summary of the alternatives is included in Table 1.

Table 1. Alternative Comparison

	Existing Conditions / No Action Alternative	Alternative 1 Narrow Spillway with Gates ²	Alternative 2 Wide Spillway without Gates ²	Alternative 3 Narrow Spillway without Gates ²
Lake Full WSEL (feet) ¹	4,667	4,671	4,671	4,667
Total Lake Area at Maximum WSEL (acres)	76.6	81.4	81.4	76.6
Total Lake Volume at Maximum WSEL (acre-feet)	2,698	3,010	3,010	2,698
Active Storage Volume (acre-feet)	~1,151	2,000	2,000	1,698
Primary Spillway length (feet)	65	60	180	60
Primary Spillway Elevation (feet)	4,667	4,667 (4,671 with gate up)	4,671	4,667
Intermediate Spillway	No	Yes	No	Yes
Secondary Spillway Length (feet)	12	24	24	24
Secondary Spillway Elevation (feet)	4,671	4,673	4,673	4,673
Low WSEL Without Pumping ³ (feet)	~4,640	4,636	4,636	4,636
Total Lake Area at Low WSEL (acres)	~41.2	38.7	38.7	38.7
Total Lake Volume at Low WSEL (acre-feet)	~1,158	1,010	1,010	1,010

	Existing Conditions / No Action Alternative	Alternative 1 Narrow Spillway with Gates ²	Alternative 2 Wide Spillway without Gates ²	Alternative 3 Narrow Spillway without Gates ²
Invert Elevation at Pipe Intake in Lake (feet)	4,648.65	4,632.0	4,632.0	4,632.0

WSEL = Water Surface Elevation.

1. Historical Lake Full WSEL is approximately 4,671 feet.
2. To comply with DSO’s preferred practice for remote locations, all action alternatives require automated equipment and permanent monitoring equipment. All action alternatives have an automated low-level outlet pipe.
3. This elevation represents the lowest drawdown that would occur without pumping. Under existing conditions, the lake is typically drawn down to the low-level outlet pipe invert elevation (4,648.7 feet) during the late summer. The lake level continues to drop during the late summer due to seepage through the landslide deposits that underlie the dam until precipitation begins to refill the lake. The lowest observed drawdown in recent years is estimated to be approximately 4,640 feet. Under each of the action alternatives, the lake WSEL and drawdown will be monitored and managed by IPID so that the lake WSEL does not fall lower than 4,636 feet, as shown in the table.

Dam Operation

In general, operation of Eightmile Dam would be as follows under all action alternatives:

- The lake would be allowed to fill annually through early- to late-July each year. The timing of the fill period would depend on inflows and downstream irrigation needs.
- IPID would then open the valve remotely via automation on the low-level outlet to start releasing water, as needed to meet downstream needs (e.g., for irrigation and instream flow).
- IPID would close the valve on the low-level outlet pipe at the end of the irrigation season (usually in September or beginning of October).
- The lake would refill through the winter and spring.

Under Alternatives 1 and 2, lake drawdown would be to a minimum elevation of 4,636 feet, resulting in an annual release of up to 2,000 acre-feet of actively stored water from Eightmile Lake (and up to 1,698 acre-feet with Alternative 3). IPID would monitor lake levels and outflows and would regulate the lake so that the annual active storage and release do not exceed the limits of the IPID water right.¹

For Alternatives 1, 2, and 3, IPID would turn over control of the release of up to 600 acre-feet of stored water from the lake for augmentation of instream flows through a separate decision-making process being developed by the IWG and approved by the co-conveners (Ecology and Chelan County). Alternative 3 and the No Action Alternative would result in less releasable water for instream flows than Alternatives 1 and 2.

Under Alternative 1, the water surface elevation would typically be held at WSEL 4,667 feet. In the late spring and early summer, IPID would raise the gates over the primary spillway to capture additional runoff and raise the lake to a maximum WSEL of 4,671 feet. IPID would typically raise the gates in May or June and begin to draw down the lake in July. The gates would be lowered once the lake level is below the bottom of the gates (elevation 4,667 feet). Under Alternative 1, if the gates are raised and the lake fills, the gates would automatically lower to prevent the lake level from rising

¹ This will be accomplished through the development of an Ecology-approved monitoring plan in which IPID will monitor and report to Ecology the total annual volume of water actively stored in the reservoir and the total annual volumes released for both instream flows and for IPID’s irrigation use. The annual monitoring plan will be developed and in place prior to storage and release of water from a repaired dam and reservoir.

above 4,671 feet. During a storm, the gates would lower to provide additional spillway capacity to pass peak storm flows.

Under Alternative 2, there would be no gates or other adjustable controls. The lake would flow over the primary spillway when the lake fills to an elevation above 4,671 feet.

Alternative 3 would be passive like Alternative 2, but the maximum WSEL would be lower, set to 4,667 feet.

Under all action alternatives, an automated release valve would be opened, adjusted, and closed remotely, thereby reducing the need for IPID personnel hiking to and from the site. Under Alternative 1, the dam would also have gates that would be raised remotely and would automatically lower in the event of water rising over the elevation of 4671 feet. Automation would require telemetry equipment at Eightmile Lake and a repeater station in a separate and appropriate location on Icicle Ridge. For Alternative 2, no gates or automated equipment would control the spillway or adjust the spillway crest elevation.

At Eightmile Lake, telemetry equipment would be located on the north side of the dam within the Special Warranty Deed Area; the exact location has not yet been determined. The proposed repeater station would be co-located with the Forest Service's local repeater station on National Forest System lands on Icicle Ridge, approximately 7 miles northeast of the Eightmile Dam site (**Figures 9 and 10**). The type of telemetry equipment (antenna or solar panel) has not been determined yet, but would be similar in scale to the Forest Service's existing repeater station.

Construction

The project would require access by construction personnel and the transport of gear, food and provisions, hand tools, larger mechanical equipment (including an excavator—a small, tracked loader; equipment for mechanically sorting on-site materials; and concrete mixing equipment), cement, pipe, valves, generators, dewatering pumps, trench protection equipment, debris rack, portable latrine, and other construction materials. Rock and earthen material would be sourced from excavations for the new dam and piping. Refer to Chapter 2 of the EIS for further detail.

Transportation of Materials and Equipment

Construction of the dam would require the transport of equipment and materials into and out of the Special Warranty Deed lands within the Alpine Lakes Wilderness. No roads directly access Eightmile Lake; access is on foot via the approximately 4-mile Eightmile Lake Trail (USFS Trail No. 1552), which IPID uses for routine maintenance at the dam. An estimated four to six construction personnel per week would likely access the site on foot. IPID proposes improving and reopening a portion of a currently closed road located outside of the Alpine Lakes Wilderness to bring vehicles closer to the project site. IPID also proposes the use of helicopters. **Figure 10** shows the proposed transportation routes to access the site.

Helicopters would be used to move all equipment and most of the construction materials to and from the site on Special Warranty Deed land. Helicopter use is an allowable activity under IPID's existing authorities. The type of helicopter used depends on the maximum weight that needs to be transported.

Two helicopter options being considered. Option 1 would use a larger heavy-lift helicopter to transport nearly all equipment and material to the site at the beginning of project construction, followed by a limited number of additional trips using a smaller helicopter to bring materials that were not anticipated initially. Option 2 would involve the limited use of the large helicopter to move only the heavy equipment and a portion of the material, followed by periodic delivery of materials as

needed throughout the construction season, using a smaller helicopter. Under both options, the large helicopter would be used for 1 to 2 days to remove equipment and any remaining materials at the end of construction. It is expected that most helicopter trips would occur on weekdays; however, some weekend flights may be needed. **Table 2** compares the two helicopter options.

Table 2. Construction/Helicopter Options

	Option 1. Heavy-lift Helicopter with Limited Use of Small Helicopter Throughout Construction	Option 2. Limited Use of Heavy-lift Helicopter with Small Helicopter Use for the Majority of Materials
With a Heavy-lift Helicopter	Approximately 70 to 105 trips over 3 to 5 days at the beginning of the project, and 11 trips at the end of the project.	Approximately 20 trips over 2 days at the beginning of the project, and 11 trips at the end of the project.
Number of Trips with a Small Helicopter	Approximately 20 trips periodically during construction, as needed for unanticipated supplies.	Approximately 245 trips throughout the project.
Size of Staging Area	Approximately 10,000 square feet.	Approximately 8,500 square feet (approximately 15% smaller).

Equipment would be staged at the existing “fly yard” for transport to the project site and staging area within the Special Warranty Deed Area by helicopter (**Figure 1**). The fly yard is an existing improved site used by IPID adjacent to Icicle Creek Road on National Forest System lands. Helicopters would sling-load material, equipment, and supplies but not touch down at the Eightmile Dam site, except for emergencies and drop off of personnel. The initial drop zone would be on the spillway of the dam; once the staging area is graded, equipment and materials would be dropped at the staging area (**Figure 11**). The helicopter would land at the fish hatchery or at the fly yard (Fromm Field) (**Figure 1**) to fuel and stop for the day.

Access Road Construction

IPID would work with the Forest Service to repair and improve an approximately three-quarter mile section of currently closed road (FSR 7601-116) to temporarily allow vehicular traffic for administrative use only associated with the project; the road would not be open to the general public. This would allow vehicles to bring personnel and supplies closer to the site, cutting off roughly 0.75 mile and roughly 500 feet of elevation gain as compared to using the Eightmile Lake Trail. From this point, personnel would travel by foot to join the Eightmile Lake Trail for the remainder of the route to the dam site. Repairing and improving the road would involve some heavy equipment to remove fallen trees and vegetation rooted in the roadway, as well as minor road repair. Approximately 10 feet of the existing roughly 24-foot-wide road would be cleared for access. The full 24-foot width would be cleared for the last 100 feet to allow for parking, and the last 30 feet of the road would be widened to roughly 30 feet to allow for vehicle turnaround. Following construction, the road would remain locked and closed to public entry, but would be available for occasional use by IPID for maintenance.

Dam Construction

All dam construction activities would occur within the Special Warranty Deed Area, including camping by personnel. Preparation of the site for dam construction would begin in mid-June or as soon as the snow conditions allow. Site preparation would include the installation of temporary erosion controls,

clearing (including removal of up to 30 trees), leveling of the staging area using the existing excavator that was flown in to the dam site in 2018 for the emergency repairs, and removal of wood and debris from the lake edge within the work area. Alternative 2 (with the largest dam footprint) requires the largest volume of materials to be stored on-site and therefore the largest staging area. An approximate 150- to 300-foot segment of the Eightmile Lake Trail located on the Special Warranty Deed parcel would be temporarily re-routed around the active construction and staging area to ensure hiker safety near the active construction zone.

Excavation work to install the new outlet pipe would begin when the lake level is below elevation 4,661 feet, at which point Eightmile Creek would be dry. For the construction year, the low-level outlet pipe will be left open at the lake so that the water level draws down as early in the summer as possible to facilitate construction. The new outlet pipe would be installed once the lake elevation drops below 4,650 feet. Water would exit the lake via the newly installed outlet pipe throughout construction. Once the new outlet pipe is installed, cofferdams would be installed, and the existing dam structure and outlet pipe would be removed. Pumps would be used to dewater work areas as needed. Cofferdams would be constructed using large bulk bags, which would also be used to ferry items up to the lake.

Construction of the dam would take approximately 4 to 5 months, depending on the alternative and weather conditions. Dam construction methods will depend on the contractor and alternative but generally entail excavation for footings, pouring of concrete for the dam structures including the core wall, backfilling and placement of riprap, and installing gates, if applicable.

Blasting with explosives is not expected but may be needed as part of construction if rocks larger than 10 feet in diameter are encountered. Blasting, if necessary, would likely occur over 1 or 2 days. A blasting contractor would be called in to perform the specialized work.

The timing of the construction would depend largely on weather conditions. Construction would need to be managed so that the project is substantially complete before significant snow accumulation or extended freezing weather occurs.

Work to improve and restore FSR 7601-116 may take place somewhat earlier in the year since the improvements would occur at a lower elevation and the snow melts earlier in the year, allowing access to the road for improvements.

Every effort would be made to complete the dam construction in one season. If construction could not be completed in one season, actions would be taken to secure the dam for overwintering. Areas that could be overtopped would be secured and stabilized (hardened) with rock. All equipment would be stored on-site or removed if feasible. The outlet pipe would be in working order, and the lake would be held at the lowest level (elevation 4,632 feet) for the winter.

Should it be needed, a contingency plan for overwintering will be developed by IPID and reviewed by DSO.

Alternatives Considered but Not Carried Forward

As part of the dam design element, several dam alternative configurations and construction methods were initially considered and then removed from consideration. These included design concepts developed during the *Eightmile Lake Storage Restoration Appraisal Study* (prepared by Anchor QEA in 2015), which were determined to likely not be feasible. Subsequent feasibility study included design evaluations for gabion baskets, gate options, and siphons. These options were removed from further consideration due to operational concerns, technical limitations, and in some cases a need to construct outside the Special Warranty Deed Area. Dam removal was suggested in scoping

comments; however, this could cause the lake to be unusable for IPID storage purposes, and would not meet IPID's operational and water delivery needs.

Construction options considered but not carried forward for analysis in the EIS include motorized transport over land through the Alpine Lakes Wilderness, which was determined to have higher impact on the wilderness area than helicopter transport, and use of pack animals to transport construction materials, which was determined to be infeasible due to the amount and bulk of materials needing to be transported.

Summary of Environmental Impacts

Provided below is a brief summary of the main findings that are based on the full analysis described in the EIS. The summary is provided by element of the environment. The full EIS can be viewed on Ecology's website at: <https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Icicle-Creek-strategy/Eightmile-Dam>.

Wilderness

The project area is located within the Alpine Lakes Wilderness of the Okanogan-Wenatchee National Forest. This designation, which occurred in phases from 1946 to 2014, began as 256,000 acres but was expanded in 1976 and 2014, and now includes 414,000 acres. Motorized equipment and vehicles, mechanical transport, temporary roads, and permanent structures are not generally allowed within designated wilderness areas. The project site is located within the Enchantment Permit Area, a portion of the Alpine Lakes Wilderness in which permits are required for overnight camping. IPID constructed Eightmile Dam prior to the designation of the Alpine Lakes Wilderness. Eightmile Dam and some of the inundated bed and shore of Eightmile Lake are on two parcels of land subject to a Special Warranty Deed, which reserves IPID's rights to maintain and operate the dam, and exercise their water rights.

Construction of the rebuilt dam would affect the wilderness character of the area by drawing down the lake, clearing some vegetation, and creating construction-related noise over one summer construction season. Alternatives 1 and 3 have similar construction-related impacts, with Alternative 2 resulting in more material and the longest duration of construction; however, construction for Alternative 2 is still expected to be completed in one construction season. Helicopter transport during construction would create noise impacts, with the use of a larger helicopter requiring a larger staging area but shorter duration. Construction impacts are expected to be **less-than-significant** for all of the action alternatives.

Operation of all of the action alternatives would affect wilderness character by continuing water level manipulation and creating a more "developed" appearance of the dam. Alternatives 1 and 2 would create the highest amount of water level manipulation, and Alternative 2 would have a larger footprint area than the other two action alternatives. Alternative 3 would have the same footprint as Alternative 1, but would have less conspicuous man-made elements and would have a lower degree of water level manipulation than Alternative 1. **None of the action alternatives would result in a significant impact** on wilderness qualities because of the limited scale and severity of the operational impacts compared to existing conditions at Eightmile Lake.

The No Action Alternative would have no construction impacts on the wilderness, but has the highest risk of failure or need for emergency removal. Impacts from the No Action Alternative on wilderness character **would not be significant**. The No Action Alternative would have adverse impacts on the qualities of wilderness character. However, it would not substantially increase the degree of overall impact on the wilderness. If the dam were to fail or be removed, it would reduce trammeling because no further manipulation of water levels would occur, which would result in a **benefit** to wilderness

quality. The operation and maintenance of the existing dam would affect some qualities of the wilderness character as outlined in the Wilderness Act, but is authorized by the Special Warranty Deed. The dam was built and in operation before the designation of the Alpine Lakes Limited Area and Alpine Lakes Wilderness.

Surface Water

Construction of the action alternatives requires the lake to be lowered and the construction area dewatered, so that work can be completed in the dry. Eightmile Lake and Eightmile Creek would have lower-than-usual water levels during construction; however, the magnitude and duration of the reductions are **not expected to impact** aquatic life or water rights holders, unless extreme drought conditions occur.

Implementation of the action alternatives would increase IPID's ability to manage reservoir storage and outflow during both drought and non-drought years. The project would **improve** IPID's ability to adaptively operate the reservoir in response to seasonal changes in inflow timing and magnitude, including changes caused by drought and climate change.

Under the action alternatives, maximum summer flow releases could be increased over 20 percent from existing conditions, and useable storage would increase over 30 percent. Drawdown volume would increase by approximately 30 percent. Summer minimum flows are not expected to substantively change.

Under the No Action Alternative, flows into Eightmile Creek would be entirely dependent on direct inflow from the surrounding basin, which would not allow IPID to adaptively manage flows from Eightmile Lake. This reduced management ability would make it more difficult to predict flows in Eightmile Creek for downstream users. A dam failure could cause massive erosion downstream that could cause large-scale channel erosion downstream. These changes would result in **significant adverse impacts** on both lake storage and downstream flow releases. Dam failure or removal would result in **significant adverse impacts** on water quality from suspended sediments and mobilization of pollutants.

Groundwater

Natural groundwater flows through the sediments underneath Eightmile Dam, largely originating from Eightmile Lake. The groundwater discharges into Eightmile Creek a short distance east of the dam. This groundwater flow is a continual source of baseflow to Eightmile Creek.

Impacts on groundwater flow are expected to occur in the vicinity of the dam site during construction, associated with dewatering. These impacts would be localized and temporary, occurring only during the construction period. The reduction in groundwater discharge to Eightmile Creek would be offset by the discharge of dewatering flows to the creek.

During operation of the rebuilt dam under any of the action alternatives, seasonal impacts on groundwater flow could occur from lake drawdown (both naturally and through lake operations). However, resultant decreases in groundwater discharge to Eightmile Creek represent a small percentage of total flow in the creek due to operational discharges from the dam.

There would be **no unavoidable adverse impacts** on groundwater resources from operation of any of the action alternatives.

There would be no construction-related impacts associated with the No Action Alternative; however, should the dam be removed, breached, or fail, reductions in groundwater contributions to streamflow may increase the number of days when instream flows are not met and decrease the ability of surface water rights holders to divert water from Icicle Creek.

Water Rights

The issue of water rights is a complex topic. It has been simplified here, but more details can be found in the EIS and Appendix B to the EIS. Water use in Washington State requires a water right. Water rights in Washington State follow the “first-in-time, first-in-right” doctrine, meaning whoever first uses water and establishes a water right has a senior right to water and, in times of scarcity, more junior water right holders must curtail their use if it would negatively affect the senior user’s ability to use water. In no case can a water right holder, including IPID, legally divert or withdraw² more water than is authorized by their water right. Therefore, while water rights records can serve as a proxy for legal water use, they only represent an upper limit on legal water use as most water rights are not fully exercised year-to-year. Additionally, some water rights are no longer used (and thus may have been relinquished or partially relinquished) but no action has triggered a determination of their validity and extent, so they are still listed in state records as being active. As a result, compilations of quantities from water right documents possibly over-estimate the actual total quantities of water authorized for use under rights that are actually valid.

IPID holds a water right on Eightmile Lake authorizing the storage and use of 25 cubic feet per second (cfs) of water (with no maximum annual quantity specified on the water right certificate) for irrigation purposes. While the certificate does not indicate a maximum annual authorized quantity, an adjudication of the right in Chelan County Superior Court determined that the maximum annual quantity is 2,500 acre-feet.³ However, the current active (single-fill) storage capacity is estimated at approximately 1,151 acre-feet.⁴ When accounting for refilling of the lake during the summer, IPID estimates that it stores a cumulative total of approximately 1,464 to 2,228 acre-feet of water in the lake under a range of dry, wet, and average conditions. IPID has indicated that, based on current water use and conservation practices by irrigators within the District, it needs 1,400 acre-feet of storage capacity at Eightmile Lake going forward. Operationally, IPID indicates that any excess storage capacity above 1,400 acre-feet can be used for augmentation of instream flows.

IPID intends to gain an authorization for the use of water for instream flow purposes through a donation to the State Trust Water Rights Program of the portion of the right above 1,400 acre-feet, with the annual quantities that would be retained by IPID for irrigation use and donated for instream flows to be ascertained through the Trust Water Right Program process for trust donations. The alternatives are designed for active storage capacities of 2,000 and 1,698 acre-feet. However, the amount of water that is stored cannot exceed the storage quantity authorized by the water right, and following IPID’s potential request for Trust donation, this quantity will be determined through the process for donation of a portion of the water right into the Trust. Should that process indicate an

² When discussing water rights, a diversion involves diverting water from a surface water source, while a withdrawal involves using a well to produce groundwater. While occasionally the two terms are used interchangeably, within this summary, the words “divert” and “diversion” always refer to surface water, and “withdraw” and “withdrawal” always to groundwater.

³ The 1929 adjudication decree states that this annual quantity of 2,500 acre-feet is “inchoate.” Inchoate water rights have not yet been used, and are, therefore, not perfected. However, since the dam was completed in 1929, IPID has been storing water. Thus some, if not all, of this 2,500 acre-feet has been used and, therefore, is perfected and no longer inchoate. That said, the perfected amount has not been determined by Ecology or by a court through an adjudication of water rights.

⁴ This represents the current active, physical storage capacity at the dam with the flash boards in place at the control notch and the gate closed. Following the Jack Creek Fire, and requirements by the DSO that the flash boards remain out and that the gate remains open, the actual current active storage is less than 1,151 acre-feet, and will remain so until the dam is repaired and safety risks are addressed.

amount less than 2,000 or 1,698 acre-feet, the storage allowed under the alternatives will be reduced, as would the maximum active storage capacity for the final design.

Significant impacts on senior water rights would only potentially occur during construction of any of the action alternatives and only in the case of a very severe drought, particularly if it were preceded by another drought year that might prevent IPID from completely filling their other lake reservoirs.

Under the No Action Alternative, in dry years, IPID may not be able to fully exercise their diversionary rights due to lack of capacity to fulfill their storage water right on Eightmile Lake. This may affect junior water rights holders and instream flows. Should the dam fail under the No Action Alternative, while curtailment of junior water rights may occur, **significant unavoidable impacts will only possibly occur**, in the form of impairment of rights senior to IPID's most junior right, during severe drought years.

All of the action alternatives would increase single-fill active storage volume capacity in Eightmile Lake from current conditions; however, none of the alternatives exceed IPID's water right for storage in Eightmile Lake. There are **no significant unavoidable adverse operational impacts** under any of the action alternatives.

Geology

Eightmile Dam is an earthen embankment, constructed between 1927 and 1929. The natural embankment around the lake was replaced by fill, mostly consisting of surficial cobble and boulder-sized riprap underlain by gravel with clay or silt and sand. The fill is derived from on-site landslide deposits and is largely cobble and boulders.

Site-specific geotechnical investigations were conducted to evaluate dam stability, seepage, and liquefaction susceptibility. The geology of the area below the dam is considered to be non-liquefiable under typical design earthquakes.

For all of the action alternatives, the main construction-related impact on the geology of the site would be from the excavation of the new dam core wall, embankment, and pipe trench. All the action alternatives would require extending the foundation for the core wall into the underlying landslide deposits, which would serve as the bearing material for the dam. This material would be re-used to construct the dam embankments. The deepest impact would be from the construction of the outfall pipe structure below the core wall and dam embankment, extending to approximately elevation 4,647 feet. The depth of the excavation, if conducted without appropriate shoring, could reduce the overall stability. Appropriate shoring methods in accordance with applicable construction requirements would maintain stability, and **avoid potentially significant impacts**.

Alternative 2 would result in the largest dam footprint and the largest volume of earthwork and potential impact on geology. Alternatives 1 and 3 have similar footprints, and both are less than Alternative 2. **No significant adverse impacts** from construction are expected for any of the alternatives.

Operational impacts from the dam are largely related to potential erosion along the edges of the lake caused by fluctuating lake levels. These impacts are expected to be largely similar for all of the action alternatives, and **not expected to have a significant impact**, because the shore of the lake is largely talus and bedrock outcrops that are relatively resistant to erosion.

If the No Action Alternative results in failure or breach of the dam, significant impacts on geology could occur, caused by the sudden erosive/scouring effect from a rapid lake drawdown, as well as significant sediment deposition in Icicle Creek. The No Action Alternative has the highest risk of dam failure. **Unavoidable adverse impacts** could occur under the No Action Alternative if regulatory enforcement requires that enforcement action occur in accordance with WAC 173-175-620(3).

Emergency repair work following a breach could require excavation cuts into existing native material, and stockpiling of existing fill material on-site.

Plants & Animals

Resident fish utilize Eightmile Lake, while salmonids (including three species listed under the Endangered Species Act) use fish habitat in the lower reaches of Eightmile Creek and the mainstem of Icicle Creek. The Leavenworth National Fish Hatchery (LNFH), an important component of mid-Columbia River fisheries, is located on Icicle Creek. Extremely low summer streamflow conditions reduce the quantity of accessible fish habitat and can limit fish passage and increase water temperatures.

Construction of all action alternatives may result in minor impacts on individual fish within Eightmile Lake and Eightmile Creek, but impacts would be temporary. None of the action alternatives would affect populations of fish; construction impacts on fish species and habitat would be **less-than-significant**.

Construction would affect wetlands; however, the impacts would be related to shifting the distribution and size of the wetland features, but would not fundamentally change their type or function. Helicopter use would disturb avian species and terrestrial mammals, including bat species, but widespread impacts are not expected. Noise from road construction would also disturb wildlife in the area and remove wildlife habitat.

The increase in reservoir storage capacity under operation of all the action alternatives would potentially provide more water for summer instream flow supplementation, which would benefit fish downstream of the lake in Eightmile and Icicle creeks. There are **no significant unavoidable adverse impacts** from the operation of any of the action alternatives.

Operation of the alternatives would have minimal effects on plants and animals because the area would largely return to pre-construction conditions when the project is completed.

The No Action Alternative has the highest potential for dam failure; if the dam were removed, breached, or failed, there is a **high potential for significant unavoidable adverse impacts**, including large-scale fish mortality, habitat destruction, and long-term effects on summer flows. These effects would also affect the LNFH.

Noise

The study area is located within the Alpine Lakes Wilderness, and is subject to noise thresholds defined within the Alpine Lakes Area Management Plan, as well as a variety of other federal, state, and local noise regulations, policies, and plans. The Alpine Lakes Area Management Plan establishes guidelines within each of four wilderness soundscape zones, which range from Transition Zone, Semi-Primitive, Primitive, to Trailless Zone. The Eightmile Lake area is generally quiet, with existing sources of noise including occasional overhead air traffic and traffic on area roads and trailheads. The Enchantment Permit Area is considered a sensitive soundscape.

The Special Warranty Deed allows IPID to maintain and repair Eightmile Dam. Small, low-flying planes are currently used in early spring for inspection, and helicopters are used to transport personnel and equipment for maintenance.

Noise from heavy construction equipment would create unavoidable noise-related impacts under all of the action alternatives. Because of the limited scale and duration of construction, these impacts are considered less-than-significant. Noise from helicopters would be audible during the daytime hours along trails, lakes, and campsites in the Enchantment Permit Area zones. Two options for helicopter transport are being considered; the heavy lift helicopter would emit higher noise levels; however, the number of trips would be fewer than for the smaller payload helicopter option. Visitors

may consider this noise a nuisance, but because of the timing and limited duration of construction, it is considered a **less-than-significant impact**. Noise from operation of heavy equipment and blasting with explosives (if needed) would be audible nearby; however, noise caused by blasting would be temporary and used sporadically; therefore, the impact would be less-than-significant.

Operation of the rebuilt dam would result in noise levels similar to those currently experienced and would not create any adverse impacts.

Operation of the No Action Alternative would result in continued practices for operation and maintenance, with no change from existing conditions. However, if the dam fails and requires repair or replacement, **noise impacts similar to the action alternatives** would result, associated with emergency repair work.

Recreation

The Alpine Lakes Wilderness provides substantial recreational opportunities, and the Enchantment Permit Area where the project is located in is a popular hiking and camping area that draws people from across the state and beyond. Recreation in the area includes, but is not limited to, hiking, backpacking, fishing, rock climbing, and stock use. Permits via lottery system are required for overnight stay in the Enchantment Permit Area from mid-May to the end of October, because of the demand for recreational use in this area.

Recreational use of Eightmile Lake includes camping, fishing, swimming, and watching nature, and Icicle Creek and its watershed provide numerous recreational opportunities.

The 15- to 20-week construction period would occur concurrently with the high summertime use period. Noise from construction would be noticeable to recreational users in the area. Noise levels from helicopter use would be loudest at Eightmile Lake during equipment drop-off early in the construction period. The heavy-lift helicopter would create louder noise levels, but would be less frequent than the smaller payload helicopter option, which would require more trips for equipment drop-off. Because the impacts would be limited to the construction period, and highest noise levels would occur for periods of several minutes or less, these impacts are considered **less-than-significant**.

Operation of the rebuilt dam under Alternatives 1 and 2 would result in seasonally higher lake levels than currently occur, which could seasonally inundate some informal lake access routes and reduce the shoreline area available for recreation by approximately 4 feet. Hiking trails and camping areas would not be affected. The lake could be drawn down further than currently occurs during drought years, which could expand the shoreline area. Alternative 3 would result in lower lake levels during drought years, which would result in an expanded shoreline. Operational impacts from all three action alternatives would be **less-than-significant**.

The No Action Alternative would not result in construction-related impacts on recreation, unless a dam failure occurs or abatement requirements from DSO result in the removal or lowering of the dam. Substantial lowering of the lake level could create inaccessible areas for some recreational uses. The No Action Alternative has the highest probability of dam failure; should a dam failure occur, impacts on Eightmile Lake recreation areas, as well as downstream recreation areas, would be **significant**. Access to recreational areas would likely be limited due to road, trail, and campsite washouts, scour, and debris flows.

Visual Resources

Visual quality refers to how well the visual environment meets a viewer's preferences for the natural and built environment, and can vary depending on the viewer's sensitivity. Because the dam is within the Alpine Lakes Wilderness, viewer sensitivity to man-made features in the area is high. Visitors

come to the wilderness to experience pristine nature, and the visual experience is a large part of that. Sensitive viewers in the area include hikers, campers, climbers, and backcountry skiers/snowboarders.

Eightmile Lake sits in a basin with steep mountains on all sides. The shoreline of the lake is lined with downed trees and sparse vegetation, consisting mostly of grasses. The 2017 Jack Creek Fire burned most of the trees around the lake, and the area is now dominated by snags and small clusters of trees. The current dam is small in scale relative to the size of the lake, and is most prominent when the lake water level is low.

Impacts on visual resources from construction activity, including the visual impacts associated with lake drawdown and helicopter use for all action alternatives, would be adverse in the short term and would occur during peak hiker and overnight camper usage in the area; however, these impacts would be temporary (lasting for only one construction season) and are therefore considered **less-than-significant**. Even if construction extended into a second season, impacts **would not be considered significant**.

Construction of the dam would cause moderate adverse impacts on the visual quality of the area surrounding the dam, because viewer sensitivity to any type of construction involving heavy machinery in the wilderness would be high and the construction would be conspicuous, particularly near the dam. Lower water levels, helicopter activity, and tree removal would further reduce the visual appeal of the lake. However, impacts are considered **less-than-significant** because construction activities would be temporary. However, if construction spanned more than two full seasons, construction impacts on the visual quality of the area would be considered significant.

Operational impacts for the action alternatives would largely be the result of water level changes that would be visible during the summer and fall, when recreational use of the lake is highest. The lake level would be higher later into the summer, and lower during low water conditions. These fluctuations are not expected to generally alter view quality. Operational impacts from the action alternatives would be similar, and are expected to be **less-than-significant** because the dam and associated features would not become dominant in views from Eightmile Lake Trail, campsite area, or surrounding shorelines, and the lake would not be reduced in size by more than 10 percent.

Under the No Action Alternative, dam failure is more likely to occur than with the action alternatives. This would result in a high water level reduction of 47 percent, and damage to infrastructure downstream, which would be a **significant** adverse impact.

Public Safety

The more-than 90-year-old Eightmile Dam was classified by Ecology's DSO with a downstream hazard classification rating of "High Hazard" to describe the potential for loss of human life and property damage if the dam were to fail and release water in the reservoir into downstream areas. The DSO considers the dam vulnerable in the event of a large storm due to changed conditions in the watershed above and below the dam, as well as damage to the dam itself. The dam does not meet dam safety standards and is considered to be in an unsatisfactory condition. Should a catastrophic dam failure occur, downstream flooding would occur in Icicle Creek, potentially affecting up to 150 downstream residences, as well as any hikers or recreational users who happen to be in the area during a catastrophic failure.

Construction impacts for the action alternatives would be **less-than-significant**, due to construction safety requirements that would be imposed on the project.

All the action alternatives would be designed to withstand a storm with a recurrence probability of once every one million years, and would comply with all applicable safety requirements for design, construction, operation, and maintenance. This represents an improvement over existing conditions.

The No Action Alternative presents the highest risk of dam failure of all alternatives, and does not meet the DSO safety standards. As such, the No Action Alternative has potentially **significant** adverse impacts on public safety.

Cultural Resources

The area is known to have been heavily utilized by Indigenous people throughout the precontact, ethnographic, and modern periods. There are likely unrecorded archaeological sites and Traditional Cultural Properties in the study area. However, the project area is almost entirely confined to previously disturbed areas, which significantly lowers the likelihood of inadvertently encountering such resources during construction.

No recorded archaeological sites potentially eligible for or listed in local, state, or federal registers are within or adjacent to the project area.

Eightmile Lake Dam is a historic-age built environmental resource, but is recommended as Not Eligible for listing in local, state, or federal registers due to multiple modifications over the years since construction. One historic-period archaeological site (a circa 1970 double track road prism) is within the project area and has been recommended as Not Eligible for listing in the National Register of Historic Places.

Construction of any of the action alternatives is **not expected to result in significant** impacts on cultural resources. Operation and maintenance of the rebuilt dam is not expected to result in impacts on cultural resources because the project is located within previously disturbed areas, which are unlikely to contain unrecorded cultural resources.

The No Action Alternative would likely result in **significant** impacts on cultural resources. If the dam were to fail, the resulting high-energy downstream flows would erode and scour the banks of Eightmile and Icicle creeks, which have a very high probability of containing precontact and historic period archaeological sites.

Tribal Resources

The term “tribal resources” refers to the collective rights and access to traditional areas and times for gathering resources associated with a tribe’s sovereignty since time immemorial. Tribal resources may also include archaeological or historic sites, elements of the built environment, and Traditional Cultural Properties (TCPs) associated with tribal use, and sites considered sacred by tribes. Eightmile Lake, Eightmile Creek, Icicle Creek, and the surrounding areas are part of the study area for tribal resources.

For this EIS, tribal resources were identified through review of publicly available published literature, scoping comments, and information provided by tribal governments from the Confederated Tribes and Bands of the Yakama Nation and the Confederated Tribes of the Colville Nation.

The project area is within the Yakama Ceded Lands, to which the Yakama Nation exercises its Treaty Reserved Rights, and traditional use area of the Confederated Tribes of the Colville Reservation for hunting, fishing, and gathering resources. Construction of the action alternatives has the potential to impact fish, wildlife, and use for subsistence and cultural practices, as well as result in removal of existing trees and disruption of avian species and terrestrial mammals. These impacts would be temporary and mitigated according to applicable regulatory requirements. Construction is **not expected to affect** known TCPs.

Operation of any of the action alternatives would result in **no significant impacts** on tribal resources and would result in benefits to downstream summer flows to fish species in Eightmile and Icicle creeks. Dam removal or a catastrophic failure of the dam would present a **significant risk** to tribal resources.

Economics and Agriculture

While economics is not a required element for evaluation under SEPA, Ecology has included this analysis to describe the economic effects in terms of regional economic productivity as well as values of economic activities, as these are important decision-making considerations.

Agriculture, development, recreation, and fisheries and hatchery production are the primary economic activities that rely upon water from Eightmile Lake and Icicle Creek and the related natural resources that may be affected, either directly or indirectly, by the project alternatives. Water supply from Eightmile Lake is important to the substantial agricultural activities in the region. Led by the production of fruit including pears and apples, production costs can exceed revenues in certain years. Although the water supply currently available to the City of Leavenworth and the growth areas outside of the city limits is sufficient to meet current demand, it is not expected to meet the demands anticipated under long-term population growth projections, and may limit development in the future. Recreation and tourism are regional economic drivers, with tourists and recreationists drawn to the natural beauty of the area. Water from Eightmile Lake eventually flows into Icicle Creek via Eightmile Creek, supporting a fishery of great cultural and subsistence importance to the Yakama Nation and the Confederated Tribes of the Colville Reservation. Icicle Creek water also provides a substantial portion of the water needed for fish production at the LNFH, with fish production supporting both tribal ceremonial and subsistence, as well as recreational fishing. These economic activities could be directly or indirectly affected by the alternatives, to the extent that the alternatives impair or curtail water rights, or in the loss of property. IPID is the only entity legally entitled to use water released from Eightmile Lake. The City of Leavenworth and the LNFH have junior water rights, and are secondary beneficiaries of the water right but are not legally entitled to that water.

Construction of the action alternatives, if occurring during severe drought conditions, could result in impairment of IPID's water rights, which could in turn result in **potentially significant** adverse impacts on the agriculture industry. Junior water rights holders, including the City of Leavenworth and LNFH, could also be affected, with less-than-significant impacts.

No significant adverse impacts are expected under operation of the action alternatives. The improvements in lake water storage quantity and controlled release capability due to the reduction in dependence on uncertain precipitation rates to fulfill water needs would result in benefits to the agriculture industry. Increases in instream flow may **benefit** survival of hatchery-produced fish.

Should the dam fail under the No Action Alternative, IPID's water rights would be impaired, and potentially significant adverse impacts on the agriculture industry could occur during severe drought years. Additional **severe economic impacts** could occur to residents downstream of the dam, recreationists, tribal fisheries, damage to residences and hatchery facilities, fish kills that impact tribal fishing, and closures of recreational areas.

Environmental Justice

The study area includes communities of color, low-income communities, and overburdened communities (communities experiencing environmental health disparities), none of which are located directly adjacent to the project site. The study area also includes tribal populations that rely on resources potentially affected by the project alternatives.

Neither transportation of construction materials nor dam construction activities would cause significant adverse impacts on communities of color, low-income communities, or tribal populations. Construction activities would occur outside the census tracts identified as low-income, communities of color, or overburdened communities, and construction would not affect resources (primarily fish) used by tribal populations. Operational impacts associated with the action alternatives **would not result in adverse impacts** on communities of color, low-income communities, overburdened

communities, or tribal populations. These communities would benefit from improved instream flow in Icicle Creek, and reliability of water supply to the agriculture industry, City of Leavenworth, and the LNFH.

If dam failure were to occur under the No Action Alternative, **significant adverse impacts** would occur to communities of color, low-income communities, overburdened communities, and tribal communities. Steep declines in fish populations would adversely affect tribal populations who exercise fishing rights in Icicle Creek, and damage to the LNFH could adversely affect tribal members employed there. Reduced water availability for IPID would adversely affect members of low-income communities and communities of color employed in the agricultural industry.

Summary of Impacts and Mitigation Measures

Table 3 summarizes the construction (short-term) impacts expected to occur on each element of the environment, as well as proposed mitigation measures. The No Action Alternative is not included in this table because there are no construction activities associated with the No Action Alternative.

Table 4 summarizes the operational (long-term) impacts anticipated to occur on each element of the environment, as well as proposed mitigation measures.

Table 3. Summary of Construction (Short-term) Impacts and Proposed Mitigation Measures.

The No Action Alternative is not included in this table because no construction activities are associated with the No Action Alternative.

Element of the Environment	Alternative 1: Narrow Spillway with Gates (Construction)	Alternative 2: Wide Spillway without Gates (Construction)	Alternative 3: Narrow Spillway without Gates (Construction)
Wilderness	<p>Would affect wilderness character by drawing down the lake, reducing vegetation, and creating construction-related noise including helicopter and equipment.</p> <p>Construction impacts would last one season and be less-than-significant.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Minimize clearing area and establish clear construction zone boundaries. • Restore disturbed areas to Forest Service standards. <ul style="list-style-type: none"> ○ Notify trail users, including people seeking permit reservations, and signage at trailhead and ranger station. • Should blasting with explosives be needed, schedule to minimize impact on trail users and post notices about potential trail closures. 	<p>The same impacts as Alternative 1, but would have the longest construction time and largest staging area. Construction would occur within one season.</p> <p>Same mitigation measures as Alternative 1.</p>	Same as Alternative 1.
Surface Water	<p>Would require the lake to be lowered and construction areas dewatered, so that work may be completed in a dry area. Eightmile Lake and Creek would have lower-than-usual water levels during construction, but the magnitude and duration of the reductions would be less than significant to surface waters, unless extreme drought conditions occur.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Implement in-water construction and demolition BMPs. • Restore cleared upland areas. • Isolate work area to prevent concrete spillage and releases of other construction materials. • Conform to DSO requirements. 	Same as Alternative 1.	Same as Alternative 1.
Groundwater	<p>Impacts expected to occur in the vicinity of the project site during construction from dewatering. Impacts would be localized and temporary and only occur during the construction period, and be less-than-significant.</p> <p>No mitigation planned, but the reduction in groundwater discharge to Eightmile Creek could be offset and mitigated by the discharge of dewatering flows to the creek.</p>	Same as Alternative 1.	Same as Alternative 1.
Water Rights	<p>Active storage of water during the construction period would be minimal and IPID's storage right on Eightmile Lake would not be available. Without the storage of water in, and the release of that storage from, Eightmile Lake, flows in Icicle Creek would be reduced during the construction. This has the potential to lead to curtailment of junior diversionary rights (considered a less-than-significant impact in a water-rights sense because only IPID has the right to rely on the release of their stored water), and a lesser potential for impairment of more senior rights (a significant impact – see below).</p> <p>Only in the case of a very severe drought, particularly if it were preceded by another drought year that might prevent IPID from completely filling their other lake reservoirs, would short-term significant impacts on senior water rights potentially occur.</p>	Same as Alternative 1.	Same as Alternative 1.
Geology	<p>Construction-related impacts would occur from excavation of the new dam core wall, embankment, and pipe trench. Would require extending the foundation for the core wall into the underlying landslide deposits, which would serve as the bearing material for the dam. Material would be re-used to construct the dam embankments. Deepest impact would be from the construction of the outfall pipe structure below the core wall and dam embankment, extending to approximately elevation 4,647 feet. The depth of the excavation, if</p>	<p>Largest dam footprint and the largest volume of earthwork and potential impact on geology.</p> <p>Same mitigation measures as Alternative 1.</p>	Same as Alternative 1.

Element of the Environment	Alternative 1: Narrow Spillway with Gates (Construction)	Alternative 2: Wide Spillway without Gates (Construction)	Alternative 3: Narrow Spillway without Gates (Construction)
	<p>conducted without appropriate shoring, could reduce the overall stability. Appropriate shoring methods would maintain stability, and avoid potentially significant impacts.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Reuse excavated material to construct the new dam embankment structure, which avoids having to dispose of the material elsewhere. • Minimize the use of FSR 7601 to avoid erosion and close the road after project construction. 		
Plants & Animals	<p><u>Fish:</u> Minor impacts would occur to individual fish within Eightmile Lake and Eightmile Creek, but would be temporary and less-than significant.</p> <p><u>Wetlands:</u> Construction would not fundamentally change wetland type or function, but could alter distribution and size of wetland features. Less-than-significant impact.</p> <p><u>Wildlife:</u> Temporary disturbance to wildlife due to construction noise. Noise from road construction would disturb wildlife in the area and remove wildlife habitat, but would be less-than significant.</p> <p><u>Helicopter Use:</u> Helicopters could disturb avian species and terrestrial mammals, including protected bat species, but impacts would be less-than significant.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Implement standard in-water constructions and demolition BMPs in accordance with permit requirements. • Use cofferdams or other measures to isolate in-water work area. • Revegetate disturbed areas with native vegetation following construction. 	Same as Alternative 1.	Same as Alternative 1.
Noise	<p>Noise from heavy equipment would be audible during the daytime hours along trails, lakes, and campsites in the Enchantment Permit Area zones. Helicopter noise may be considered a nuisance by visitors in the area. The heavy-lift helicopters are louder but would create fewer trips than the smaller payload helicopter. Because of the timing and limited duration of construction, construction noise would be less-than-significant.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Require equipment to be fitted with mufflers and in good working order. • Post anticipated construction hours at trailheads near construction sites. • Prohibit unnecessary idling of internal combustion engines and use “quiet” models where available. 	Same as Alternative 1.	Same as Alternative 1.
Recreation	<p>Construction noise would be noticeable to recreation users in the area. Noise levels would be loudest early in the construction season when equipment is dropped off. Heavy lift helicopter would create louder noise levels, but would be less frequent than the smaller payload helicopter, which would be quieter (but require more trips for equipment drop off). Impacts would be less-than-significant because they would be limited to the construction period and limited to a few minutes when equipment is being dropped off.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Notify trail users of potential construction through signage, and alert recreationists that are awarded permits. • Reduce impacts from blasting with explosives (if needed) by scheduling for mid-week and avoiding full-day closures. 	Same as Alternative 1.	Same as Alternative 1.
Visual Resources	<p>Moderate adverse impacts on area surrounding the dam during construction due to viewer sensitivity in the wilderness area. Lower water levels, helicopter activity, and tree removal would reduce the visual appeal of the lake. But impacts would be less-than-significant because construction activities would be temporary.</p>	Same as Alternative 1.	Same as Alternative 1.

Element of the Environment	Alternative 1: Narrow Spillway with Gates (Construction)	Alternative 2: Wide Spillway without Gates (Construction)	Alternative 3: Narrow Spillway without Gates (Construction)
	<p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Notify trail users of potential construction through signage, and alert recreationists that are awarded permits. • Minimize clearing area for staging and construction activities. • Revegetate areas following construction. 		
Public Safety	<p>Potential impacts on construction workers involved in building the new dam, or on members of the public who could be affected directly or indirectly during construction. Impacts would be less-than-significant due to the construction safety requirements.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Adhere to DSO requirements, WA L&I requirements, and BMPs. • Construction monitoring as required by Ecology and conducted in accordance with the conditions of the Dam Safety Construction Permit. • Train construction workers to work in remote areas. • Notify trail users of potential construction through signage, and alert recreationists that are awarded permits. • If blasting with explosives is needed, notification would be publicized at least 10 days in advance. 	Same as Alternative 1.	Same as Alternative 1.
Cultural Resources	<p>Construction activities, including demolition of the existing facility, would result in the destruction of the existing Eightmile Dam. Construction activities are anticipated to result in less-than-significant impacts to known cultural resources.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Focus the project impacts from construction and operations within previously disturbed areas to the extent possible. • Have a Cultural Resources Inadvertent Discovery Plan (IDP) in place during construction to protect yet-unknown resources that may be encountered during project construction. 	Same as Alternative 1.	Same as Alternative 1.
Tribal Resources	<p>Dam construction would disturb wildlife throughout the construction period in an area surrounding the east end of Eightmile Lake, and may extend to the Eightmile Lake basin. Alternative 1 would require in-water work to construct the earthen dam and spillways, potentially affecting the resident trout in the lake. The shoreline work area will be isolated in the lake by construction of a cofferdam consisting of bulk bags placed by an excavator. Dewatering the isolated work area using pumps may be necessary. Construction activities are expected to result in less-than-significant impacts to tribal resources.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Focus the impacts from construction and operations within previously disturbed areas to the extent possible. • Fully restore access to all areas following the completion of construction. 	Same as Alternative 1.	Same as Alternative 1.
Economics	<p>Construction during a severe drought year could impair IPID's water rights, which could result in potentially significant adverse impacts on the agriculture industry. Junior water rights holders (including the City of Leavenworth and LNFH) could also be affected, with less-than-significant impacts.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Construct project during a year with higher-than-average precipitation and stream flow, where possible. 	Same as Alternative 1.	Same as Alternative 1.
Environmental Justice	No changes to baseline impacts are expected; therefore, no impacts are expected .	Same as Alternative 1.	Same as Alternative 1.

Table 4. Summary of Operational (Long-term) Impacts and Proposed Mitigation Measures.

Element of the Environment	No Action Alternative (Long-Term)	Alternative 1: Narrow Spillway with Gates (Long-Term)	Alternative 2: Wide Spillway without Gates (Long-Term)	Alternative 3: Narrow Spillway without Gates (Long-Term)
Wilderness	<p>The No Action Alternative could have adverse impacts on the qualities of wilderness character if the dam failed and damaged or destroyed downstream habitat resources in the wilderness. However, it would not substantially increase the degree of overall impact on the wilderness. If the dam were to fail or be removed, it would reduce trammeling, a benefit to wilderness quality. Therefore, impacts would be less-than-significant.</p> <p>No mitigation measures are proposed.</p>	<p>Continued water level manipulation and creation of a more “developed” looking dam.</p> <p>Would create the highest amount of water level manipulation and appear more conspicuously man-made, due to the gates.</p> <p>No significant impacts on wilderness character from operation of the project.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Design the dam with materials and colors that visually blend with the landscape around the dam, to the extent feasible, to minimize visual impacts. • Use the quietest available motor for inflatable gates. • Avoid using the motor to inflate the gates at night or on weekends or holidays, to the extent feasible. 	<p>Continued water level manipulation and creation of a more “developed” looking dam.</p> <p>Larger footprint than the other two action alternatives.</p> <p>No significant impacts on wilderness character from operation of the project.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Design the dam with materials and colors that visually blend with the landscape around the dam, to the extent feasible, to minimize visual impacts. 	<p>Same footprint as Alternative 1, but would have less conspicuous man-made elements due to the lack of gates.</p> <p>Same high-water level as the current dam.</p> <p>No significant impacts on wilderness character from operation of the project.</p> <p><u>Mitigation Measures:</u></p> <ul style="list-style-type: none"> • Design the dam with materials and colors that visually blend with the landscape around the dam, to the extent feasible, to minimize visual impacts.
Surface Water	<p>Flows would continue to be entirely dependent on direct inflow from the surrounding basin, which would not allow IPID to adaptively manage flows from Eightmile Lake. This reduced management ability would make it more difficult to predict flows in Eightmile Creek for downstream users. A dam failure could cause massive erosion downstream, which could cause large-scale channel erosion downstream. These changes would result in significant adverse impacts on lake storage and flow releases. Dam failure or removal would result in significant adverse impacts on water quality from suspended sediments and mobilization of pollutants.</p>	<p>Would increase IPID’s ability to manage reservoir storage and outflow during both drought and non-drought years, providing significant benefits to surface water resources.</p> <p>Maximum summer flows could be increased by over 20 percent from existing conditions, and usable storage would increase by over 30 percent. Drawdown volume would increase by approximately 30 percent.</p> <p>No substantive change in summer minimum flows.</p> <p>No mitigation proposed as operation of the dam would improve streamflows, flooding risk, and better adaptive management compared to existing conditions.</p>	<p>Same impacts as Alternative 1.</p>	<p>Similar to Alternatives 1 and 2, in that it would be an improvement over existing conditions for IPID and instream flows, but would to a lesser degree due to the lower level of water stored in the lake.</p>
Groundwater	<p>Should the dam be removed, be breached, or fail, reductions in groundwater contributions to streamflow may increase the number of days when instream flows are not met and decrease the ability of surface water rights holders to divert water from Icicle Creek, result in significant impacts in drought years.</p>	<p>Seasonal impacts on groundwater flow could occur from lake drawdown (both naturally and through lake operations). This impact cannot be avoided unless the proposed dam structures are changed. However, the slight decrease in groundwater discharge is relatively minor and a less-than-significant impact within the overall flow regime of Icicle Creek.</p> <p>No mitigation proposed.</p>	<p>Same impacts as Alternative 1.</p>	<p>Same impacts as Alternative 1.</p>
Water Rights	<p>Under the No Action Alternative, in dry years, IPID may not be able to fully exercise their diversionary rights due to lack of capacity to meet their storage water right on Eightmile Lake. This may affect junior water rights holders (a less-than-significant impact) and instream flows. Should the dam fail, while curtailment of junior water rights may occur, significant unavoidable impacts will only possibly occur, in the form of impairment of rights senior to IPID’s most junior right, during severe drought years.</p>	<p>Alternative 1 would increase single-fill active storage volume capacity in Eightmile Lake from current conditions.</p> <p>Alternative 1 would have an active storage capacity of up to 2,000 acre-feet. This would be sufficient to meet IPID’s stated minimum need of 1,400 acre-feet and allow up to 600 acre-feet to be used to supplement instream flows if IPID donates some of the right to the Trust.</p>	<p>Same as Alternative 1.</p>	<p>Similar to Alternative 1. Alternative 3 would have an active storage volume of up to 1,698 acre-feet. This is sufficient to meet IPID’s stated minimum need of 1,400 acre-feet and would still allow up to almost 300 acre-feet to be used to supplement instream flows if IPID donates some of the right to the Trust.</p>

Element of the Environment	No Action Alternative (Long-Term)	Alternative 1: Narrow Spillway with Gates (Long-Term)	Alternative 2: Wide Spillway without Gates (Long-Term)	Alternative 3: Narrow Spillway without Gates (Long-Term)
Geology	Failure or breach of the dam could result in significant impacts from sudden erosive/scouring effect from a rapid lake drawdown, as well as significant sediment deposition in Icicle Creek.	Potential for erosion along the edges of the lake from fluctuating lake levels. Not expected to have a significant impact because the shore of the lake is largely talus and bedrock outcrops that are relatively resistant to erosion. No mitigation proposed.	Same impacts as Alternative 1.	Same impacts as Alternative 1.
Plants and Animals	Potential significant unavoidable adverse impacts from dam removal, failure, or breach, including large-scale fish mortality, habitat destruction, and long-term effects on summer flows. LNFH could also be impacted.	Increase in storage capacity could provide more water for summer instream flow supplementation, which could provide benefits to fish in Eightmile and Icicle creeks. No detectable changes in fish abundance, species composition, or lake water quality would occur, compared to existing conditions, resulting in less-than-significant adverse impacts on fish and fish habitat. Minimal effects on plants and animals because the project area would largely return to preconstruction conditions; no mitigation proposed.	Same impacts as Alternative 1.	Least benefit of the action alternatives to fish habitat and water quality in downstream reaches of Eightmile and Icicle creeks due to lower water storage. Would also likely require pumping to access additional water, which would result in small increase in the potential for spills of hazardous materials. Less-than-significant impact. Minimal effects on plants and animals because the project area would largely return to preconstruction conditions.
Noise	Current maintenance activities, including the use of helicopters several times a year, would continue. Dam would eventually require repair or replacement, or fail. During this, noise levels would be similar to those described for construction of the action alternatives.	No long-term impacts.	No long-term impacts.	No long-term impacts.
Recreation	Dam abatement or removal would substantially lower the lake level and could create inaccessible areas for some recreational uses, resulting in potentially significant impacts at Eightmile Lake and downstream areas.	Would result in higher lake level, which could seasonally inundate some informal lake access routes and reduce the recreation areas available by approximately 4 feet. No trails or camping areas inundated. The lake could also be drawn down further than currently occurs, which would result in lower lake levels during drought years. Recreational opportunities would remain substantively the same, with no net loss of recreational access or facilities impacts would be less-than-significant from operation. No mitigation proposed as impacts would be less-than-significant .	Same impacts as Alternative 1.	Lower Lake levels during drought years, which would result in an expanded shoreline area. No mitigation proposed as impacts are would be less-than-significant .
Visual Resources	Under a DSO enforcement order, the dam structure and outlet pipe would likely be removed. This would result in the high-water level of the lake being lowered to the level of the bottom of the outlet pipe where it crosses under the dam. Dam failure would result in a high water level reduction of 47 percent in Eightmile Lake, and damage to infrastructure downstream, which would result in significant impacts on visual resources.	Water level changes would occur in summer and fall when recreation use is the highest. Lake level would be higher into summer and lower, during low-water conditions, in fall. These changes would result in less-than-significant impacts as water level fluctuations are not expected to generally alter view quality; the dam and associated features would not become dominant in views from Eightmile Lake Trail, campsite area, or surrounding shorelines; and lake would not be reduced in size by more than 10 percent. Alternative 1 would result in a slightly taller dam when gates are raised; however, it would remain a subdominant visual feature. No mitigation proposed as impacts from completed project would have less-than-significant impacts .	Impacts generally the same as Alternative 1. Alternative 2 would result in the largest dam, but it would be a subdominant visual feature, resulting in less-than-significant impacts .	Impacts generally the same as Alternative 1. Alternative 3 would not have the automated gate, so would be less visually intrusive. Impacts would be less than significant .

Element of the Environment	No Action Alternative (Long-Term)	Alternative 1: Narrow Spillway with Gates (Long-Term)	Alternative 2: Wide Spillway without Gates (Long-Term)	Alternative 3: Narrow Spillway without Gates (Long-Term)
Public Safety	Potential significant adverse impacts on approximately 150 downstream residences if dam failure occurs.	Improved dam safety as dam would be designed to withstand a storm with a probability of once every one million years and would comply with safety requirements for design, construction, and maintenance. Considerable benefit to public safety over existing conditions.	Same impacts as Alternative 1.	Same impacts as Alternative 1.
Cultural Resources	Dam failure would likely result in significant impacts on cultural resources from the resulting high-energy downstream flows that would erode and scour the banks of Eightmile and Icicle creeks, which have a very high probability of containing precontact and historic period archaeological sites.	Operation and maintenance of the rebuilt dam is not expected to result in impacts on cultural resources.	Same impacts as Alternative 1.	Same impacts as Alternative 1.
Tribal Resources	Dam removal or a catastrophic failure of the dam would present a significant risk to tribal resources.	Operation of Alternative 1 would result in no significant impacts on tribal resources and would result in benefits to downstream summer flows for fish species in Eightmile and Icicle creeks.	Same impacts as Alternative 1.	Same impacts as Alternative 1.
Economics	Dam failure could result in the impairment of IPID's water rights, and potentially significant adverse impacts on the agriculture industry could occur during severe drought years. Additional severe economic impacts could occur to residents downstream of the dam, recreationists, and tribal fishing, as well as damage to residences and hatchery facilities.	No long-term impacts.	No long-term impacts.	No long-term impacts.
Environmental Justice	Potential significant adverse impacts on communities of color, low-income communities, overburdened communities, and tribal communities in the event of dam failure. Steep declines in fish populations would adversely affect tribal populations who exercise fishing rights in Icicle Creek, and damage to the LNFH could adversely affect tribal members employed there. Reduced water availability for IPID would adversely affect members of low-income communities and communities of color employed in the agriculture industry.	No long-term impacts.	No long-term impacts.	No long-term impacts.

Figure 1. Project Area

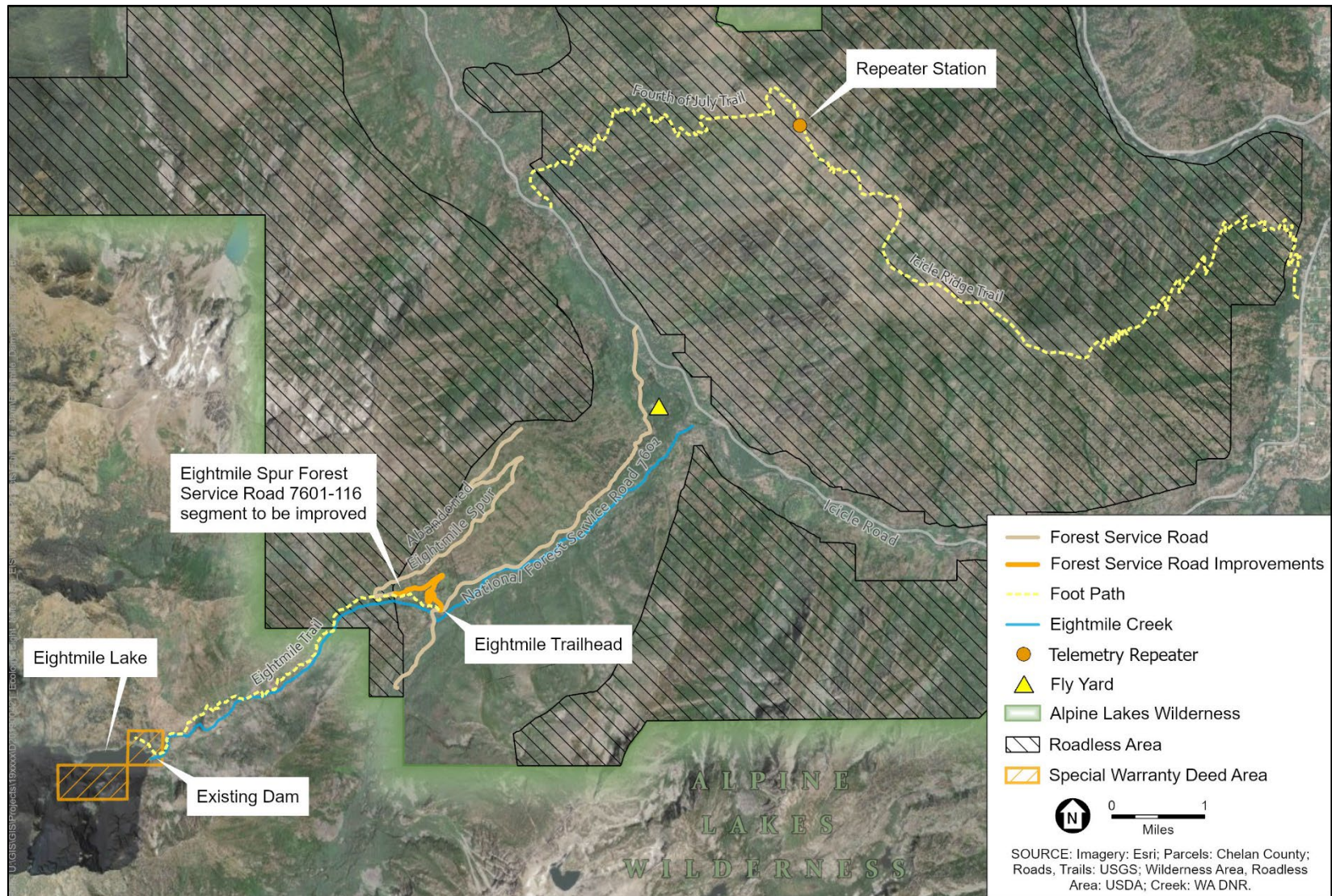


Figure 2. Existing Dam / No Action Alternative

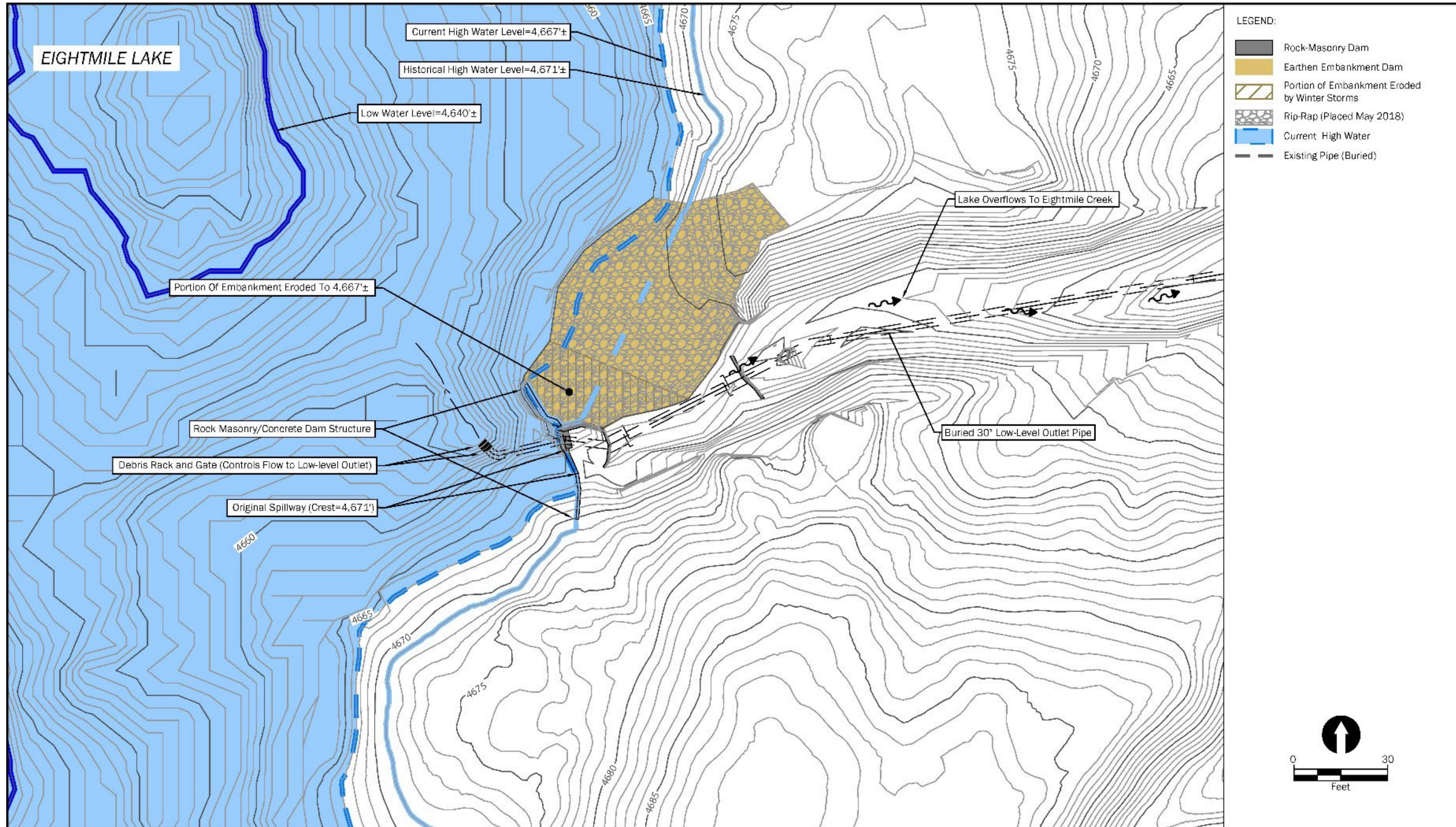
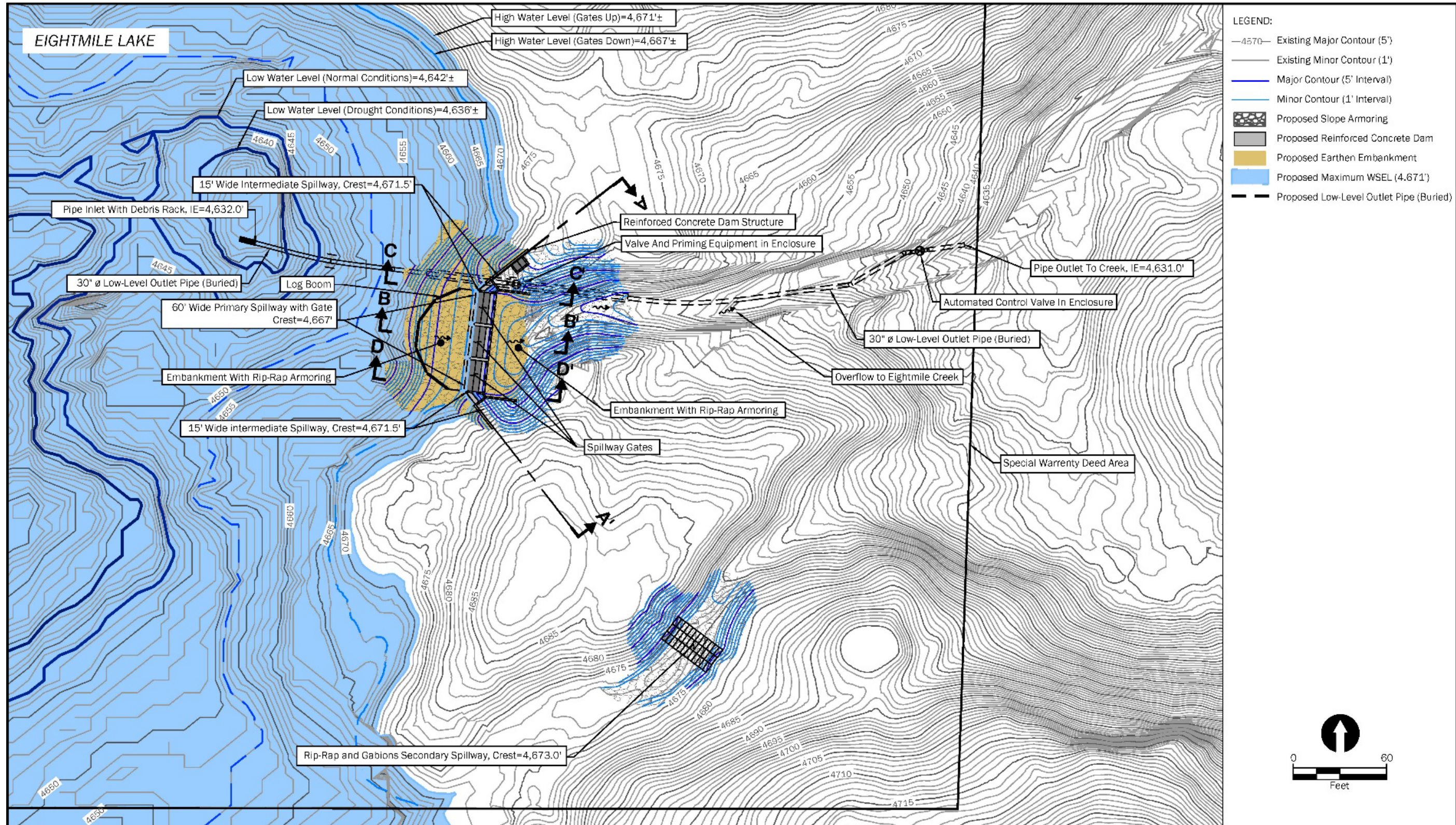
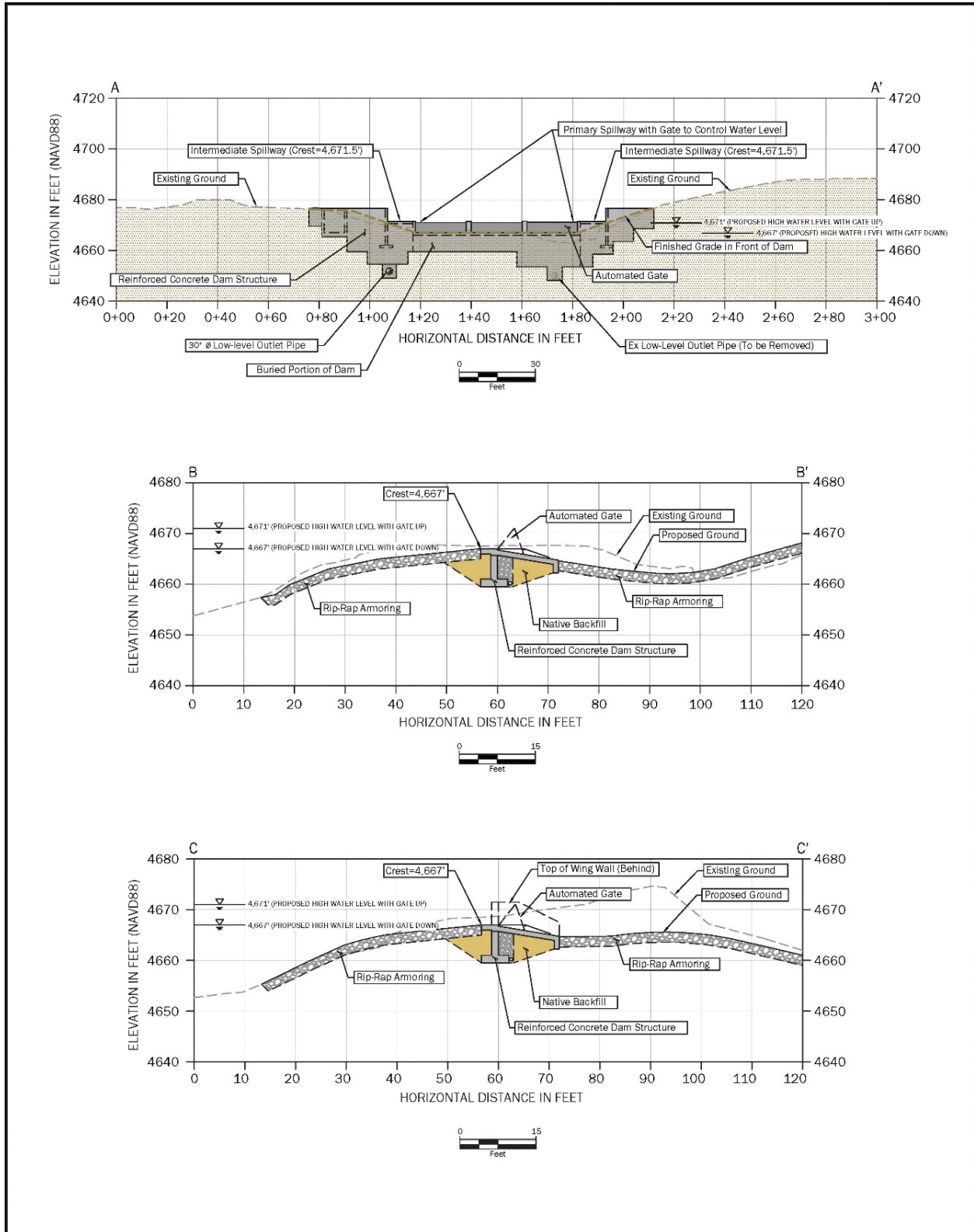


Figure 3. Alternative 1: Narrow Spillway with Gates



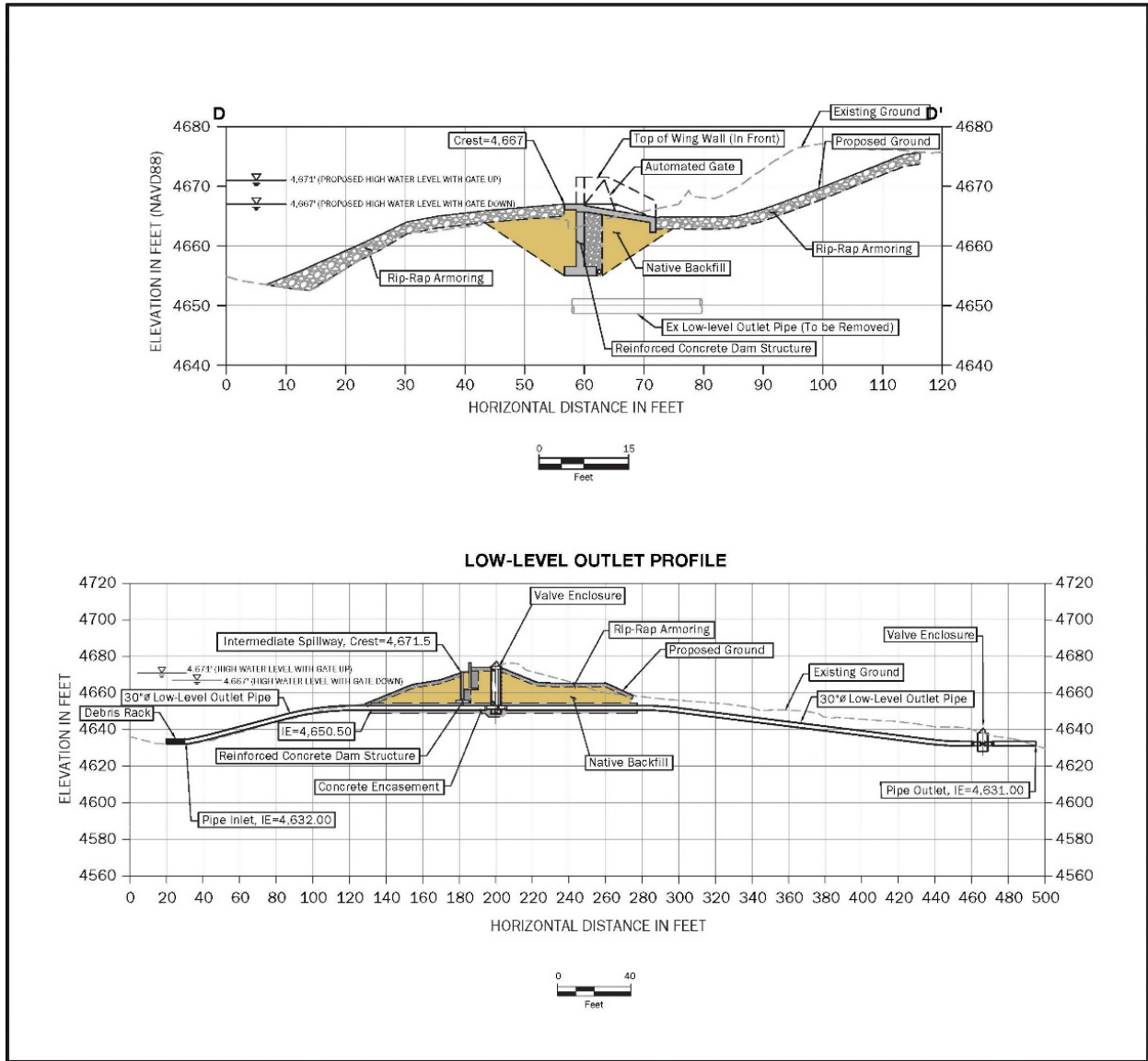
Source: Provided by Anchor QEA

Figure 4. Alternative 1: Narrow Spillway with Gates – Profile



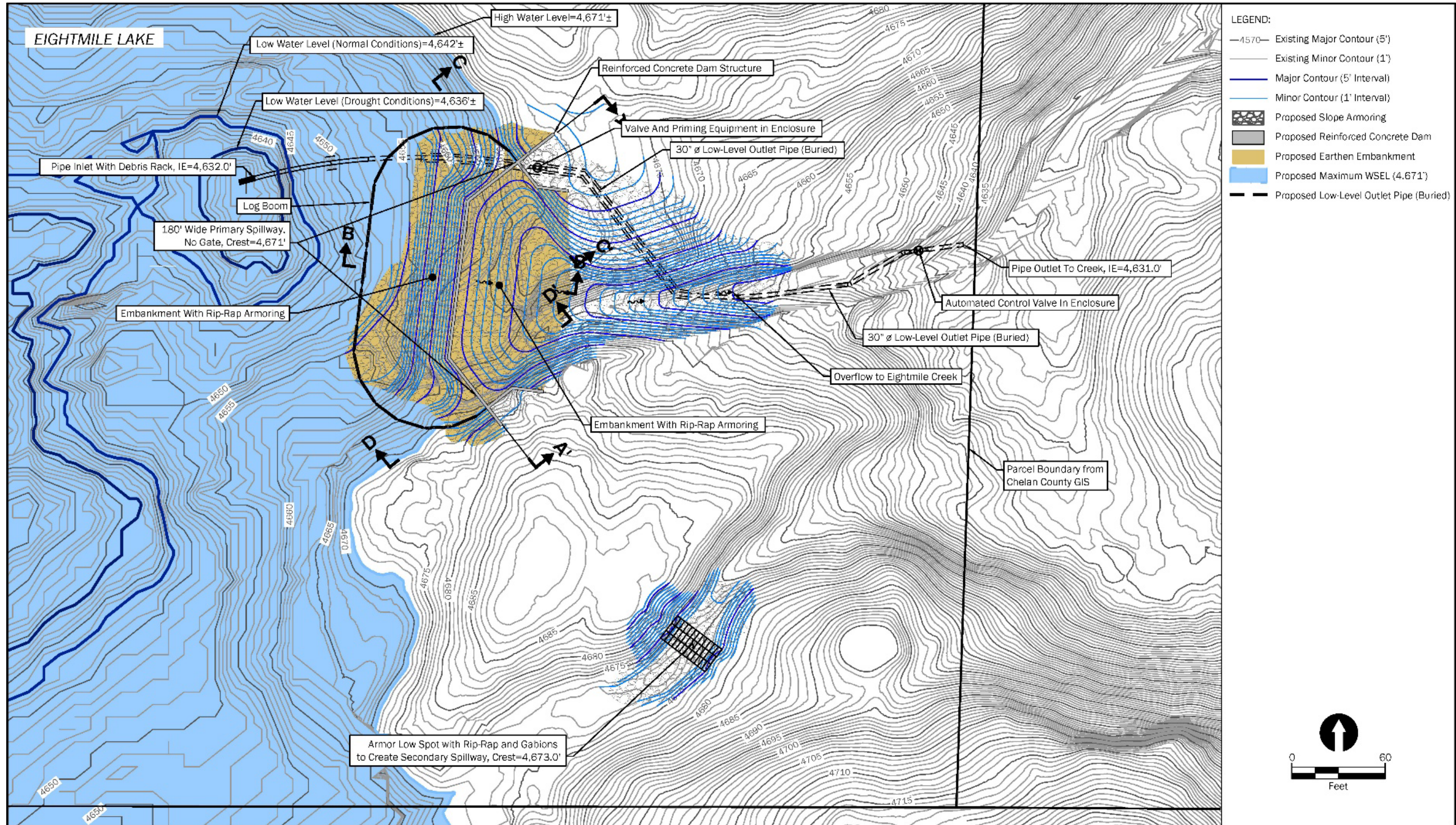
Source: Provided by Anchor QEA

Figure 4. Alternative 1: Narrow Spillway with Gates – Profile (continued)



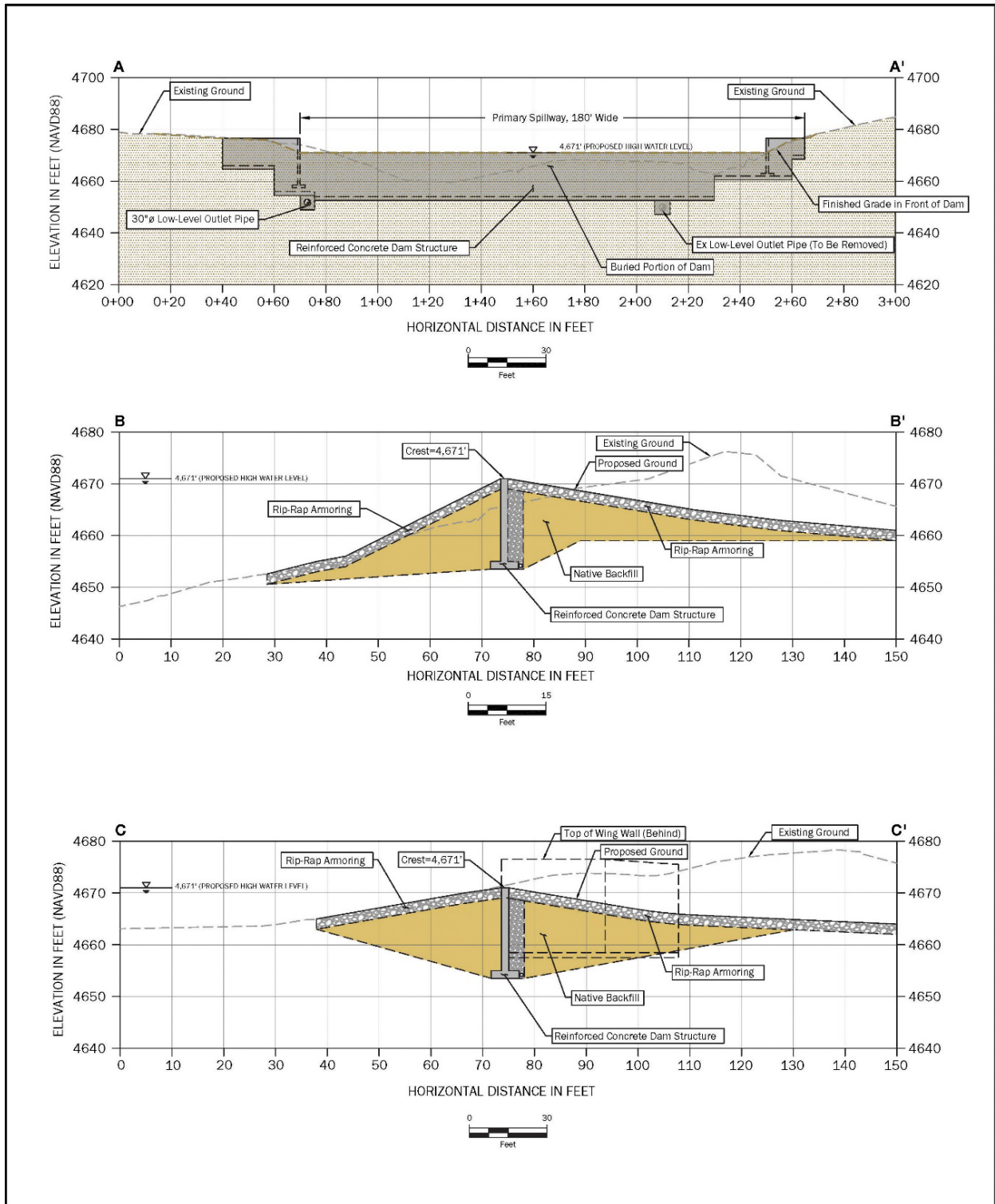
Source: Provided by Anchor QEA

Figure 5. Alternative 2: Wide Spillway without Gates



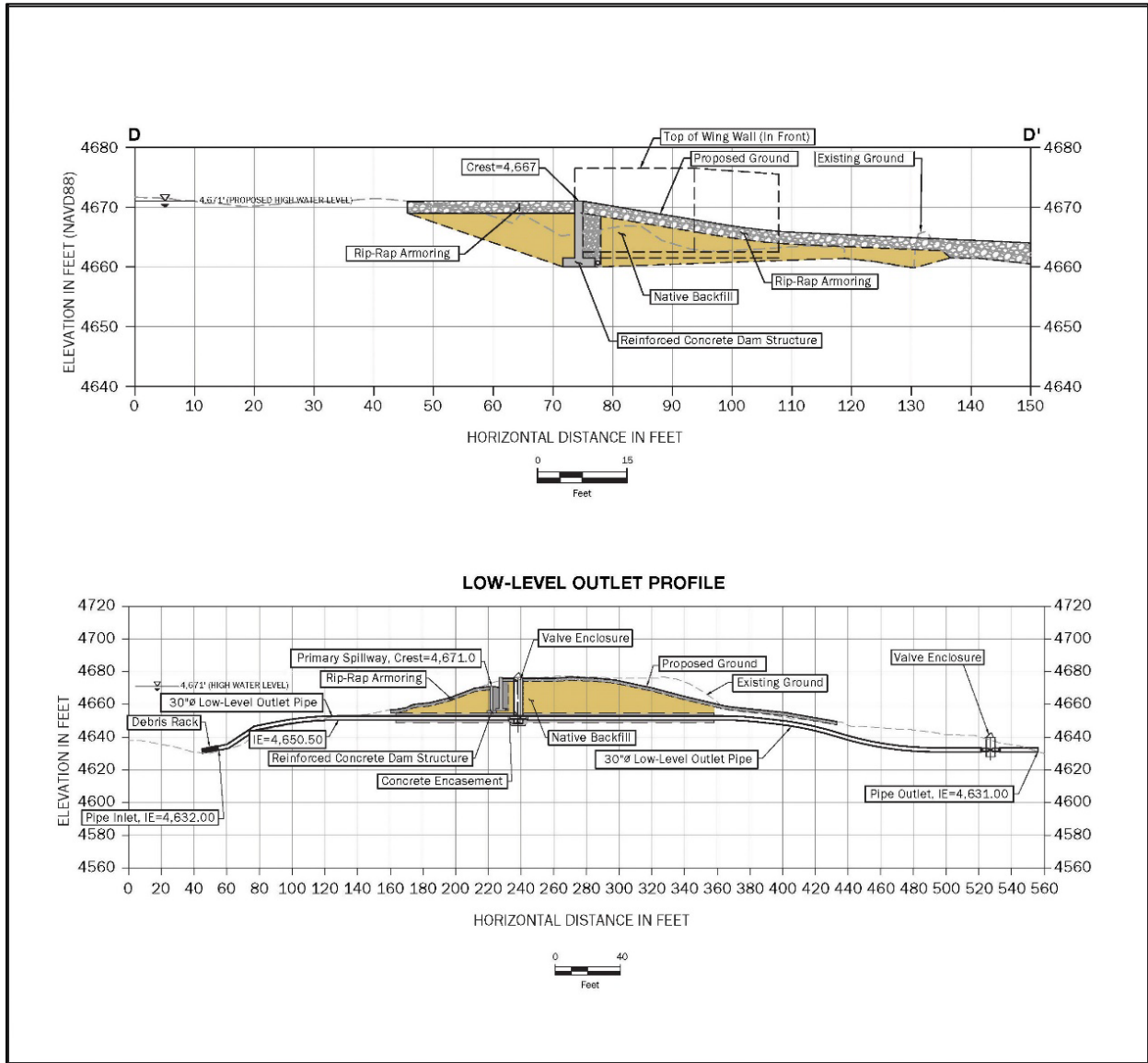
Source: Anchor QEA

Figure 6. Alternative 2: Wide Spillway without Gates – Profile



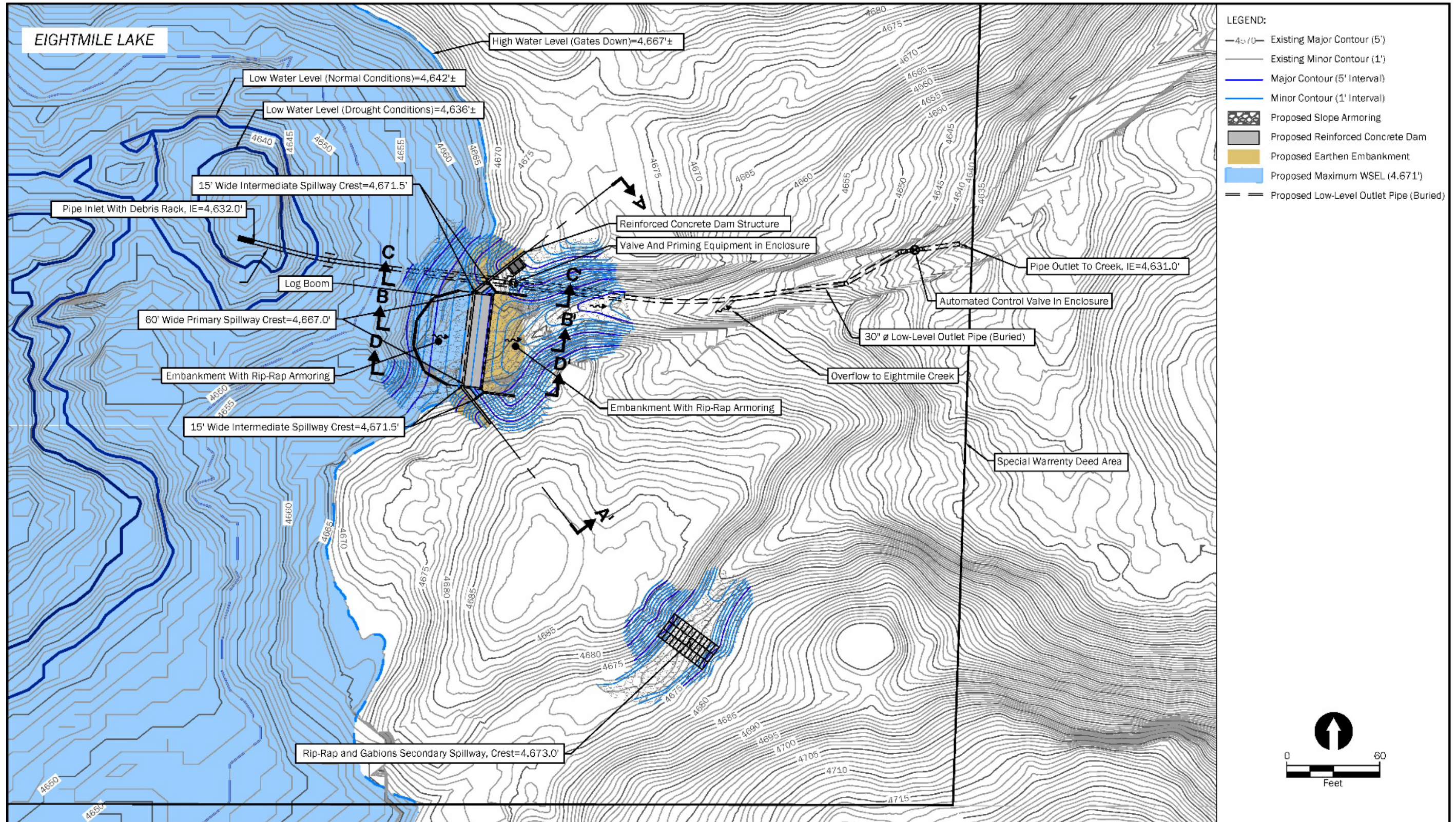
Source: Anchor QEA

Figure 6. Alternative 2: Wide Spillway without Gates – Profile (continued)



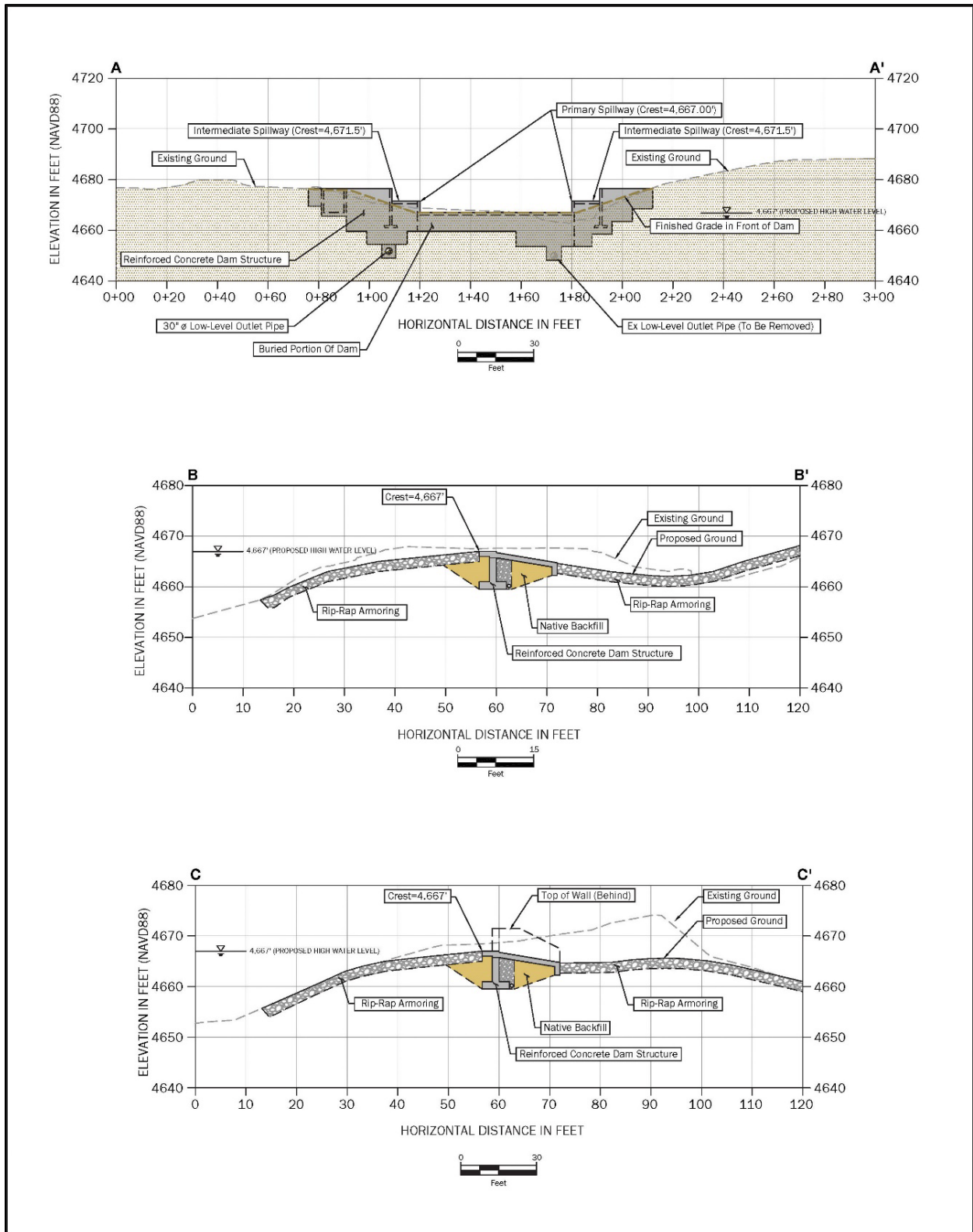
Source: Anchor QEA

Figure 7. Alternative 3: Narrow Spillway without Gates



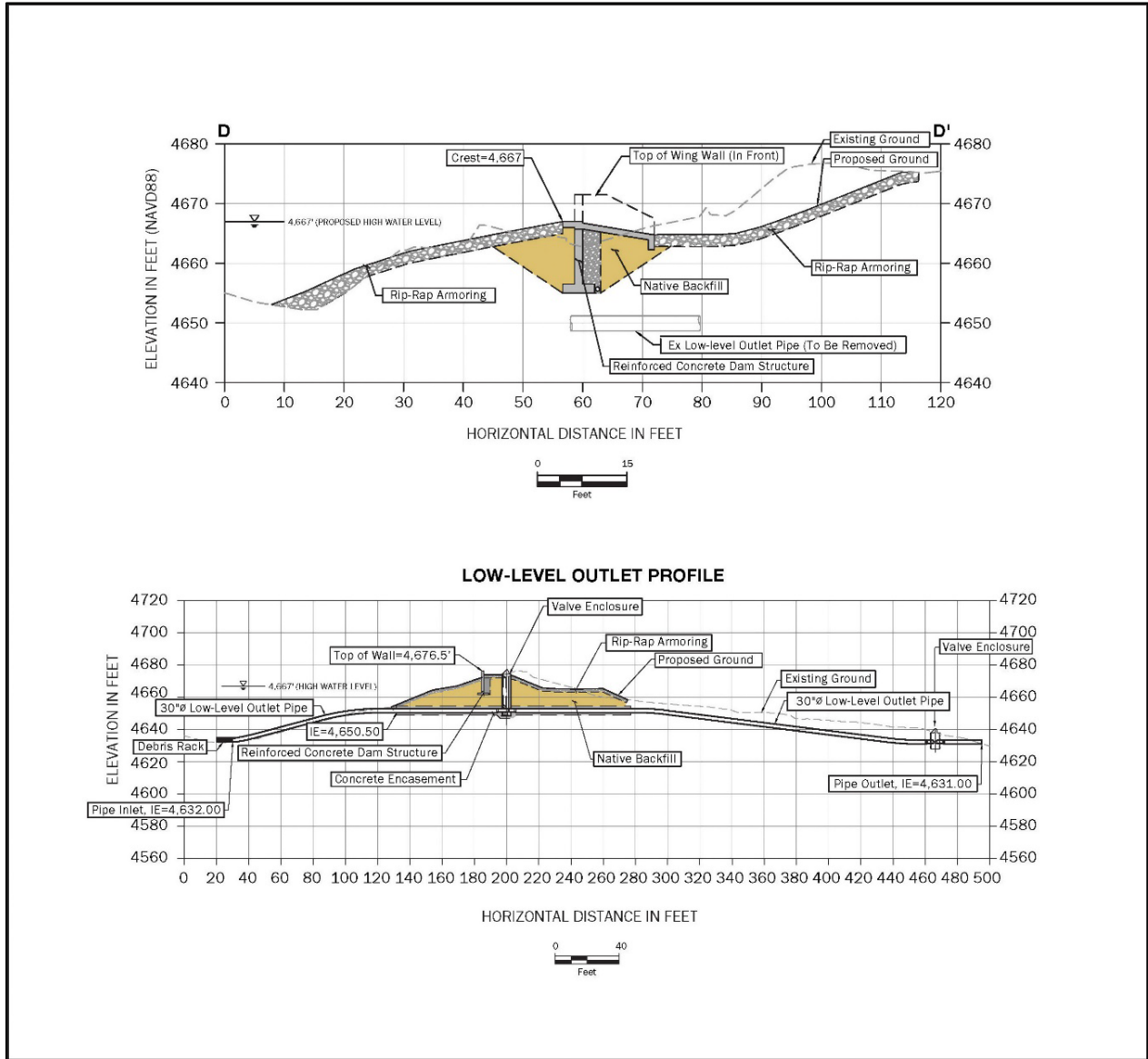
Source: Anchor QEA

Figure 8. Alternative 3: Narrow Spillway without Gates – Profile



Source: Anchor QEA

Figure 8. Alternative 3: Narrow Spillway without Gates – Profile (continued)



Source: Anchor QEA

Figure 9. Forest Service Icicle Repeater Station



Figure 10. Transportation Routes

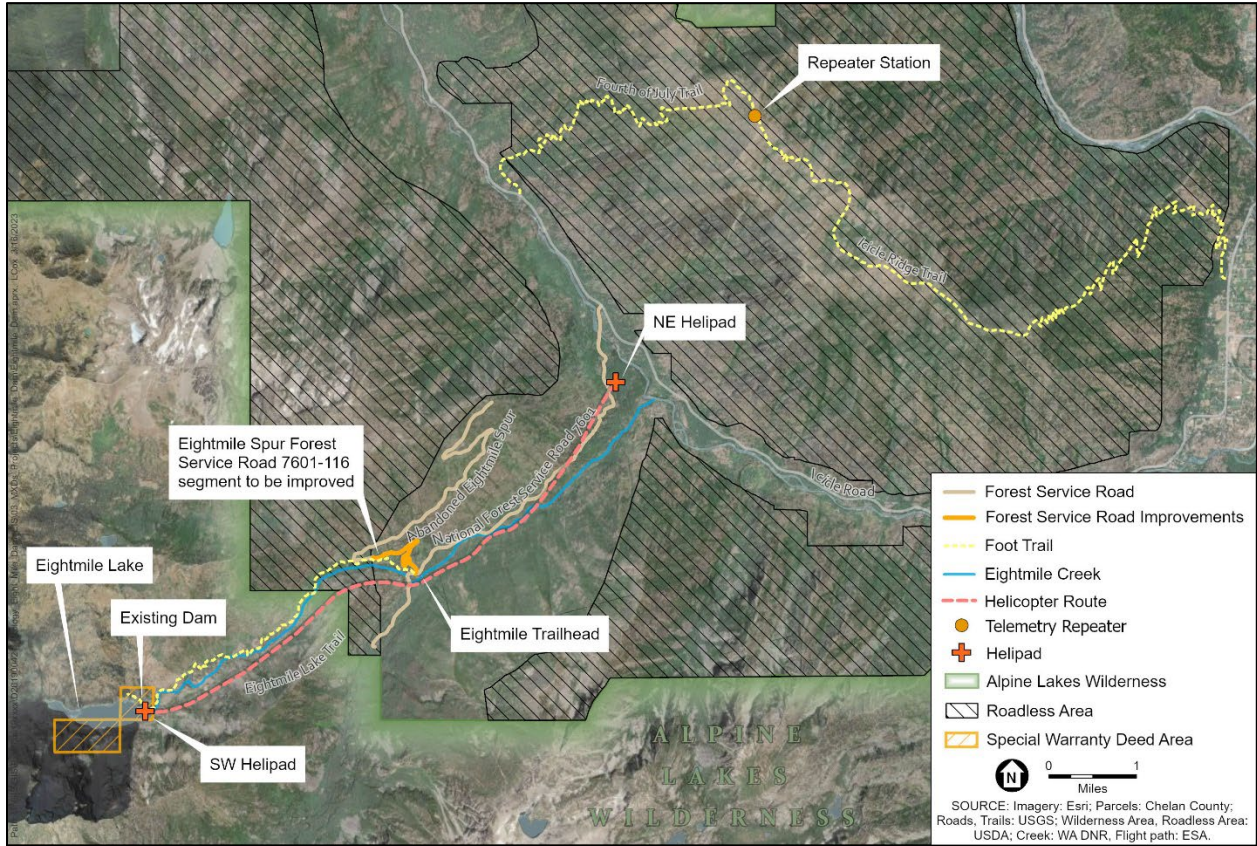


Figure 11. Dam Construction Staging Area

