Kachess Dam Safety of Dams Modification Project Draft Environmental Assessment

US Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

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Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Kachess Dam Safety of Dams Modification Project
Draft Environmental Assessment

Proposed action:	Reclamation is proposing to reduce the risk of dam failure by performing the following improvements: constructing an access road; preparing the site; developing staging areas to support construction and long-term maintenance; extending and lining the conduit; installing a diaphragm filter around the conduit and a stability berm on top of the filter; and installation of an auxiliary drain below the outlet channel. Temporary disturbance during construction would include approximately 11 acres of surface disturbance. Permanent disturbance would include approximately 4 acres of permanent surface disturbance.
Lead agency:	Bureau of Reclamation, Columbia-Pacific Northwest Region 9
Responsible official:	Regional Director, Bureau of Reclamation, Columbia-Pacific Northwest Region 9
Coordinating agencies:	United States Army Corps of Engineers United States Fish and Wildlife Service Washington Department of Ecology
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Acronyms and Abbreviations

Acronym	Full Phrase
°C	degrees Celsius
°F	degrees Fahrenheit
Act	the Reclamation Safety of Dams Act of 1978
APE	area of potential effect
BA	biological assessment
BMP	best management practice
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO_2e	carbon dioxide equivalents
Colville Tribe	Confederated Tribes of the Colville Reservation
CWA	Clean Water Act of 1972
cy	cubic yards
DAHP	Washington Department of Archaeology and Historic Preservation
DNR	Department of Natural Resources
DOI	Department of the Interior
DSPR	Dam Safety Priority Rating
EA	environmental assessment
Ecology	Washington State Department of Ecology
EO	executive order
ESA	Endangered Species Act of 1973
HPA	Hydraulic Project Approval
KDRPP	Kachess Drought Relief Pumping Plant
ITA	Indian Trust Asset
LOS	level of service
mg/L	milligrams per liter
NEPA	National Environmental Policy Act of 1969
NFS	National Forest System
NHPA	National Historic Preservation Act of 1966
NMFS/NOAA	National Marine Fisheries Service
Reclamation	United States Bureau of Reclamation
SOD	Safety of Dams
SWPPP	stormwater pollution prevention plan

US	United States
USACE	US Army Corps of Engineers
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
VPM	virtual public meeting
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
Yakama Nation	Confederated Tribes and Bands of the Yakama Nation

Chapter 1. Purpose of and Need for Action

1.1 Introduction

The United States (US) Bureau of Reclamation (Reclamation) prepared this Kachess Safety of Dams (SOD) Modification Project, Environmental Assessment (EA) to assess the potential consequences of a proposed modification to Kachess Dam and its appurtenant spillways in the Yakima River basin in west-central Washington.

Reclamation is proposing to modify the dam by extending and lining the conduit, installing a diaphragm filter around the conduit and a stability berm on top of the filter, and installing an auxiliary drain below the outlet channel. Reclamation will also construct an access road and develop staging and construction areas in the course of modifying the dam. Additional details and a description of the Proposed Action can be found in **Chapter 2**, Proposed Action and Alternatives. **Chapter 2** also describes other alternatives that Reclamation considered but eliminated from further study based on risk reductions, constructability reviews, environmental impacts, and economic costs.

This EA has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA) and Reclamation procedures. It is intended to serve environmental review and consultation requirements pursuant to Executive Order (EO) 11988 (Floodplain Management), EO 11990 (Wetlands Protection), EO 12898 (Environmental Justice), Section 106 of the National Historic Preservation Act of 1966 (NHPA), Section 7 of the Endangered Species Act of 1973 (ESA), and Department of the Interior (DOI) and Reclamation Indian Trust Asset (ITA) policies.

1.2 Project Background

Kachess Dam, located about 14 miles northwest of Cle Elum, Washington, was constructed between 1910 and 1912. The dam was completed in 1912 to increase the storage capacity in an existing natural lake (see **Figure 1-1**, Project Area, in **Appendix A**). Along with Keechelus Dam to the west and Cle Elum Dam to the east, Kachess Dam forms one of the upper basin storage reservoirs of the Yakima Project.[1] The reservoir typically fills in the winter and spring and is used for irrigation and fisheries-enhancement purposes in the summer and fall. Reclamation owns and operates the dam; the Yakima Field Office of the Columbia-Cascades Area Office is the entity

[1]In 2013, the Washington legislature authorized funding for the initial development phase of the Yakima Basin Integrated Plan, a consensus-based effort to assure sustainable water supplies for families, farms, and fish in the Yakima River Basin over the next 30 years. Projects and activities outlined in the plan's first phase are designed to quickly improve streamflows, habitat, and fish passage, and secure water for farms, cities, and industry, especially during times of drought and in response to climate change.

responsible for operations. The 115-foot-high, 1,400-foot-long, earth-filled Kachess Dam created a reservoir with an actively managed capacity of 239,000 acre-feet.

Reclamation has identified seepage and internal erosion issues through the dam embankment along the outlet works conduit, which conveys water from the reservoir to the Kachess River downstream. As reservoir water levels rise, water begins to seep in the downstream end of the conduit. The seeping water begins to scour and erode the outlet works, creating voids or holes within the dam. The eroded materials leave the conduit and are deposited into the toe drain—or the "horseshoe"[2] drain—surrounding the downstream end of the conduit or into a large repository formed by continuous existing voids in the conduit.

As erosion intensifies, water continues to seep, and sinkholes appear in the downstream base of the dam. Combined with the pressure of the water in the reservoir behind the dam, these existing voids can crack or expand, further impacting the dam's integrity. In other words, water seeping through the dam embankment and the soils surrounding the conduit carries soil materials with it and leaves behind voids, which impact the dam's stability. This internal erosion creates a risk of potential dam failure.

As a result, Reclamation began investigating Kachess Dam to understand the extent of the safety risk it presents under the Dam Safety Priority Rating (DSPR) system, which provides a means for Reclamation to establish the urgency of risk management activities and the relative priority of these actions within the overall inventory of dams. Kachess Dam was previously designated as a DSPR 3 facility (moderate to high priority). This category is reserved for annualized life loss risks or failure probabilities estimated to be moderate to high with generally moderate to high confidence. Based on Reclamation's recent investigations, the dam is now judged to be in the DSPR 2 category (urgent priority). This category is used for situations where expedited action to reduce the risk of failure may be appropriate. A timely transition into the final design process will help ensure a long-term risk reduction without delay.

With this rating change, Reclamation has determined that, although the estimated risk is high, the overall condition of the dam is good for its age with no significant adverse performance to date; further, the responsible office does a good job of monitoring the dam and responding to any concerns in a timely manner. However, the risk of failure is comparatively high such that timely modification of the dam is necessary. The primary reason is that, while the dam is currently stable, seepage in the areas of concern is both quantifiable and predictable over the normal operating range. The recommended interim risk reduction action is therefore focused on enhanced performance monitoring. The need for additional interim risk reduction actions will be revisited if conditions change prior to the completion of the dam safety modification.

Accordingly, to prevent eroded soils from exiting the dam, Reclamation is proposing this project at this time to filter and monitor the seepage. Reclamation's primary project goals are to limit internal erosion and decrease the risk of dam failure with moderate certainty; its secondary project goal is to limit impacts on fish and irrigation.

[2] "Horseshoe" is a design term based on the shape and configuration of the drain.

1.3 Purpose and Need

The purpose of and need for the proposed project include:

1. Implementing cost-effective measures to reduce risks, per Reclamation's Public Protection Guidelines
2. Maintaining water deliveries to irrigation districts, tribes, and others throughout the Yakima Basin
3. Minimizing impacts on the environment
4. Maintaining water flows for endangered species

As part of its SOD program mission, Reclamation is committed to ensuring its dams do not present unacceptable risk levels to people, property, and the environment. These requirements result in a need for Reclamation to implement corrective action to bring static and hydrologic risks at Kachess Dam below public protection guidelines while minimizing impacts on the environment.

1.4 Authorities

In 1978, Congress passed the Reclamation SOD Act (Act; Public Law 95-578). The Act provides a means to fund the correction of safety problems at Reclamation dams, including the construction, restoration, operation, and maintenance of new or modified features at existing federal dams. Congress amended the Act in 1984 to provide additional funding and also added a clause requiring 15 percent cost sharing by authorized project beneficiaries, such as irrigation, hydropower, and municipal and industrial facilities (Public Law 98-404). The Act was further amended in 2000 (Public Law 106-377), 2002 (Public Law 107-117), 2004 (Public Law 108-439), and 2015 (Public Law 114-113) to provide additional funding authority.

Kachess Dam and Reservoir are part of Reclamation's Yakima Project, which provides irrigation water for approximately 464,000 acres or irrigable lands in south-central Washington. Its primary purpose is for irrigation, but it also includes hydroelectric generation and the preservation and propagation of fish and wildlife.

Phase I of the Yakima River Basin Water Enhancement Project, the construction of fish ladders and fish screens at diversion dams and diversion canals, was authorized by legislature on August 17, 1984 (98 Stat. 1333, Public Law 98-381) and August 22, 1984 (98 Stat. 1379, Public Law 98-396). Phase II of the Yakima River Basin Water Enhancement Project was authorized by the Washington legislature on October 31, 1994 (108 Stat. 4550, Public Law 103-434).

Phase II measures include, among other things, the Yakima River Basin Water Conservation Program, which provides authority to appropriate funds for the acquisition of water for fish and wildlife. Phase II also includes measures to improve the efficiency of water delivery and use, so instream flows for fish and the reliability of the irrigation supply are improved. Also, Phase II provides for a new operating regime for the Yakima Project of specified instream target flows over Sunnyside and Prosser Diversion Dams during April through October of each year, in relation to the total water supply available. This new operating regime was initiated in 1995 (Reclamation 2021a).

1.5 Regulatory Compliance

Various laws, EOs, and secretarial orders apply to the Proposed Action. Compliance with their requirements is summarized below:

- **NEPA**, as amended, requires that the action agencies use a public disclosure process to determine whether there are any environmental impacts associated with proposed federal actions. If there are no significant environmental impacts, a finding of no significant impacts can be signed to complete the NEPA compliance.
- **The ESA**, as amended, requires all federal agencies to ensure their actions do not jeopardize the continued existence of listed species, or destroy or adversely modify their critical habitat. As part of the ESA's Section 7 process, an agency must coordinate with the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NOAA or NMFS) on whether threatened and endangered species exist within or near the action area and evaluate impacts on the species, if present.
- **The NHPA**, as amended, requires federal agencies to consider the effects of their undertakings on historic properties eligible for, or listed on, the National Register of Historic Places. Federal agencies must determine whether there are historic properties in the project area, the effects of the project on those properties, and the appropriate mitigation for adverse effects.
- **The Clean Water Act (CWA) of 1972** requires federal agencies to consider the impact of proposed actions on water quality, particularly potential pollution of surface waters.
- **The Clean Air Act of 1970**, as amended, directs federal agencies to address air quality and emissions of hazardous pollutants from proposed activities.
- **The Migratory Bird Treaty Act of 1918** prohibits the take (killing, capturing, selling, trading, or transport) of protected migratory bird species without prior authorization from the USFWS.
- **EO 11990 (Protection of Wetlands)** requires federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid new construction in wetlands.
- **EO 13007 (Indian Sacred Sites)**,[3] dated May 24, 1996, instructs federal agencies to promote the accommodation of access to and protect the physical integrity of American Indian sacred sites. An Indian tribe or an Indian individual determined to be an appropriately authoritative representative must identify a site as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion.

[3] It requires that sacred sites, environmental justice, and ITAs be addressed in the EA.

- **EO 12898 (Environmental Justice)**, dated February 11, 1994, instructs federal agencies to make, to the greatest extent practicable and permitted by law, achieving environmental justice part of their mission by addressing, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Its purpose is to focus federal attention on federal actions' environmental and human health effects on minority and low-income populations with the goal of achieving environmental protection for all communities.
- **Secretarial Order 3175 (Department Responsibilities for ITAs)** clarifies the responsibility of DOI agencies to ensure ITAs of federally recognized Indian tribes are identified, conserved, and protected. ITAs are legal interests in property held in trust by the United States (with the Secretary of the Interior acting as trustee) for Indian tribes or Indian individuals. Examples of ITAs are lands, minerals, hunting and fishing rights, and water rights. In many cases, ITAs are on a reservation; however, they may also be found off the reservation.

The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and EOs, such as EO 13175 (Consultation and Coordination with Tribal Governments). These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires officials from federal agencies, including Reclamation, to consult with tribal governments and to take all actions reasonably necessary to protect ITAs when administering programs under their control.

Washington law (Chapter 77.55 Revised Code of Washington) requires entities planning hydraulic projects in or near state waters to get a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW). This includes most marine and freshwaters. A HPA ensures construction is done in a manner that protects fish and their aquatic habitats. A hydraulic project is construction or other work activities conducted in or near state waters that will use, divert, obstruct, or change the natural flow or bed of any of the state's salt waters or freshwaters. The state's Hydraulic Code Rules (Chapter 220-660 Washington Annotated Code) identify projects and activities that require an individual HPA (WDFW 2020).

1.6 Public Involvement

Public involvement is a vital and legally required component of the NEPA process. It vests the public in the decision-making process and allows for full environmental disclosure. Guidance for implementing public involvement under NEPA is codified in 40 Code of Federal Regulations (CFR) 1506.6.

On July 26, 2021, Reclamation announced the start of the public comment period for this project to solicit public comments and to identify issues. Reclamation solicited comments from coordinating and participating agencies, tribes, other interested parties, and the public through various meetings, including a web-based virtual public meeting room that was available 24 hours a day during the public scoping period. The public scoping period ended on August 25, 2021. The description and outcomes of the scoping process are summarized in a scoping report (Reclamation 2021a), which was published on Reclamation's project website[4] in September 2021. Additional details on collaboration and outreach activities are provided in **Section 4.2**, Consultation and Coordination, and **Section 4.3**, Public Collaboration and Outreach.

1.7 Issues Addressed in this EA

During public scoping (see **Section 1.6**), Reclamation categorized substantive comments received into nine issue categories. The following summaries highlight a few of the issues identified during public scoping and addressed in this EA. The full list of summaries is available in the final scoping report (Reclamation 2021a):

- **Biological Resources, including Fisheries and Aquatic Ecosystems; Botanical Resources; and Wetlands**:
  - *Fisheries and Aquatic Ecosystems*: Commenters requested that Reclamation examine the impacts on fish life within Kachess Reservoir and Kachess River associated with the project. Particularly, commenters asked if construction timelines would necessitate that dam operations and flow management be different from that of typical operation.
  - *Botanical Resources*: To offset habitat impacts from the project, the WDFW requested that trees, which must be cleared from the site, go to habitat restoration projects, either within the Kachess watershed or to nearby areas, such as those of the upper Yakima River and its tributaries.
  - *Wetlands*: The WDFW expressed concern regarding proposed changes to the dam access route and the impacts construction and excavation would have on nearby wetlands.
- **Geology and Soils**: Commenters requested that Reclamation conduct a geotechnical analysis for inclusion in the EA to demonstrate that the proposed grade modification would not destabilize the hillslope or fill, which could lead to erosion or environmental impacts on both the wetlands and Kachess River.
- **Socioeconomic Resources:** A commenter requested detailed information on whether and which irrigation districts would pay a reasonable portion of the costs of the Kachess Dam repair.

[4] The project website can be accessed at https://www.usbr.gov/pn/programs/sod/kachess/index.html.

1.8 Document Organization

The document is organized as follows:

- *Chapter 1*(Purpose of and Need for Action) introduces the project and the purpose of, and need for, action. The chapter also discusses the project's background and decisions to be made. It also summarizes public involvement and issues addressed in this EA.
- *Chapter 2* (Proposed Action and Alternatives) provides information on how Reclamation developed the project alternatives and includes a description of each alternative being carried forward for analysis. Alternatives and elements considered but eliminated from further consideration are also identified. Chapter 2 concludes with a summary of anticipated impacts on natural and human resources from the project alternatives.
- *Chapter 3* (Affected Environment and Environmental Consequences) characterizes the existing environment, particularly for the natural and human resources most affected by the alternatives carried forward for analysis. The chapter also identifies the impacts that would occur on the resources as a result of project construction, and operation and maintenance.
- *Chapter 4* (Consultation and Coordination) presents a list of the agencies, tribes, and other interested or affected individuals and groups that were contacted during the EA's development. It also contains a summary of the public involvement process for this EA and discusses the consultation and coordination activities that were undertaken with coordinating agencies. A list of Reclamation and consultant staff who prepared this EA is included.
- *Chapter 5* (References) lists the documents and other sources used to prepare this EA.
- *Chapter 6* (Glossary) contains definitions of terms found in this EA.
- *Appendixes* are supplemental documents supporting the descriptions and analysis in this EA.

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Chapter 2. Proposed Action and Alternatives

2.1 Introduction

The No Action Alternative and the Proposed Action are described in detail in this chapter, along with a summary comparison of the differences and common impacts between the alternatives. A summary of the alternatives considered but eliminated from detailed study is also provided.

2.2 Alternatives Development Process

The alternatives development process incorporates a number of guiding principles as provided by relevant laws and guidance, including the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500–1508), the DOI's NEPA regulations (43 CFR 46), Reclamation's NEPA handbook (Reclamation 2012), and the CEQ's Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies(CEQ 2013). These regulations require agencies to:

- Rigorously explore all reasonable alternatives that meet the purpose of and need for the proposed action and, for alternatives that were eliminated from detailed study, briefly discuss the reasons for elimination
- Include the alternative of no action
- Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft EA and identify such alternative in the final EA (40 CFR 1502.14; 43 CFR 46.415(b))

Interdisciplinary collaboration is a critical step in the alternative development process. Agencies should seek to achieve agreement from diverse interests on the goals, purposes, and needs for agency plans and activities as well as on the methods anticipated to carry out those plans and activities (43 CFR 46.110(a)). The alternatives development process involved collaboration with stakeholders, including coordinating and participating agencies, as well as engineering and feasibility analyses. During a scoping period from July 26, 2021, to August 25, 2021, Reclamation asked for public and agency input on the scope of the analysis and for alternatives to be considered. Reclamation analyzed the scoping comments it received and published a scoping report in October 2021. The comments related to alternatives were carried forward into alternatives development.

2.3 Description of the Alternatives

2.3.1 Alternative A—No Action

The No Action Alternative's purpose is to allow decision-makers to compare the impacts of approving the project with the impacts of not approving the project. The No Action Alternative reflects existing and expected future conditions in the project area if no action is taken.

Under the No Action Alternative, there would be no structural or operational changes to Kachess Dam or the spillway. Reclamation would not prepare the site or the access road and would not extend and line the conduit. Reclamation also would not install a filter or a stabilization berm. Accordingly, the dam and spillway would not be improved, and no changes to the operation of Kachess Dam would occur.

Without action, the seepage and internal erosion issues through the dam embankment along the outlet works conduit, which conveys water from the reservoir to the Kachess River downstream, would continue (see **Figure 2-1**, No Action, in **Appendix A**). Soil materials carried by the seepage would leave behind voids within the embankment. This internal erosion would perpetuate a risk of potential complete dam failure.

As part of its SOD program mission, Reclamation is committed to ensuring its dams do not present unacceptable risk levels to people, property, and the environment. These requirements result in a need for Reclamation to implement corrective action to bring static and hydrologic risks at Kachess Dam below public protection guidelines, while minimizing impacts on the environment. Thus, this alternative would not meet the purpose of, or need for, Reclamation's action.

2.3.2 Alternative B—Proposed Action

Reclamation is proposing to reduce the risk of dam failure by performing the following improvements:

- Constructing an access road
- Preparing the site
- Developing staging areas to support construction and long-term maintenance
- Extending and lining the conduit
- Removing the weir
- Installing a diaphragm filter around the conduit and a stability berm on top of the filter
- Installing an auxiliary drain below the outlet channel

Temporary disturbance during construction would include approximately 11 acres of surface disturbance. Permanent disturbance would include approximately 4 acres of permanent surface disturbance.

The modified embankment dam, stability berm, and outlet works would resemble a T-shaped mound.

Reclamation does not anticipate reservoir-level restrictions to occur, and construction of the extension and lining of the outlet works would be timed to avoid major issues with water deliveries. Currently, Reclamation plans to comply with maintaining minimum flows through the dam throughout the project, as established through negotiations with a number of stakeholders, including WDFW, the Yakama Nation, the USFWS, the NMFS, and various irrigation districts. However, in the worst-case scenario, Reclamation is prepared to have four, 12-hour shutoffs for conduit installation, where no water would be provided, unless the reservoir is high enough to use the spillway. Three of these shutoffs would occur between November and March, with the fourth occurring later (outside of April–August).

Shutting off flow from the dam would reduce flow into the Kachess River below the dam. This would potentially reduce water levels in the river for up to 0.9 miles until it reaches the confluence with the Yakima River at Lake Easton. The proposed window for flow shutoff (and thus potential water reductions in Kachess River) would be outside the Bull Trout spawning window, and it would avoid impacts on flows needed for spawning in the Kachess River. Furthermore, Bull Trout are not known to spawn in the project area; therefore, interference with spawning and damage to redds would not occur.

Reclamation does anticipate groundwater unwatering to occur during the main excavation. There is no plan to pump down the groundwater table. Instead, Reclamation will pump water out from the bottom of the well to a discharge point immediately above the excavation site. Water will flow to the same outlet channel as groundwater seepage does.

Over the course of the project, it is anticipated that the maximum disturbance area would be approximately 11 acres, with 4 acres of permanent disturbance as a result of the project. For the other 7 acres that would be reclaimed, all earth areas capable of supporting vegetation, which have been exposed or disturbed by this project, would be graded to a stable grade and revegetated. Where seeding is expected to have a high probability of success, the site would be seeded with a suitable native seed mix and protected from erosion with a weed-free mulch or other suitable biodegradable erosion-control protection. Reclamation would collaborate with the US Forest Service (USFS) on revegetation practices to develop the revegetation plan, with input from WDFW and the US Army Corps of Engineers (USACE).

Construction is expected to occur between April 2023 and July 2025. Construction sequencing would occur as follows:

- Phase 1: During the first phase of construction (April to October 2023), Reclamation would work on the development of the access road and contractor use areas. Accordingly, this phase of construction would involve clearing and grubbing of trees on the site. Reclamation plans to work on tree clearing, chipping, and shredding between May and June 2023. Reclamation would haul trees to a designated USFS lot. Hauling would occur between June and July 2023. Access road construction would occur from July to early October 2023. Contractor use areas would be developed from May to July 2023. The majority of tree clearing would occur after a majority of the road is constructed; this would allow the affected areas to be accessed by heavy equipment and trees to be hauled away without using the crest of the dam. Reclamation would rely on 40-45-foot commercial trucks and trailers to haul trees from the area to a USFS site for stockpiling and would use equipment at the stockpile area to unload trucks. If space is limited at the stockpile area, Reclamation could also employ additional equipment to stack trees at the stockpile area.

- Phase 2: During the second phase of construction (January to June 2023), Reclamation would focus on fabrication and delivery of pipes to the project area.
- Phase 3: During the third and final phase of construction (January 2024 to July 2025), Reclamation would work on the replacement of the outlet works. Excavation of the foundation for the conduit extension would occur between January and February 2024. Reclamation would expect sand delivery to occur in May 2024, but this schedule could be revised closer to actual construction. The remaining elements of phase 3 would occur after May 2024, with refinements to this schedule occurring closer to the actual construction date.

During construction, Reclamation would rely on the following equipment:

- For phase 1: Dozers, forklifts, chainsaws, log chippers and shredders, trucks and trailers, cranes, and screens, motor graders, water trucks, compactors, and front-end loaders
- For Phase 2: Trucks, cranes, and 425 feet of 10-foot-diameter pipe
- For Phase 3: Trucks; front-end loaders; off-road trucks, cranes, and dozers; and concrete trucks

For phase 1, 2100 cubic yards (cy) of gravel would be imported, likely from Cle Elum. This would be done with the following equipment and schedules:

- Street legal, 15-ton trucks, using either a side, belly, or end dump with pups (trailers).
- Delivery would consist of approximately 140 loads, with 3 hours per trip, 3 trips per day per truck on a 10-hour day. Thus, 5 trucks would take 9 workdays.

Phase 2 (pipe fabrication and delivery) would include the following equipment and schedules:

- Pipe would be delivered on 40-45-foot commercial tractor/trailers, with 40 feet of pipe per truck consisting of 11 truckloads over 3 days.

For phase 3 (zone 3 sand delivery), approximately 7,800 cy of sand would be delivered from a commercial source, likely in Cle Elum. This would be done with the following equipment and schedules:

- Street legal, 15-ton trucks, using either a side, belly, or end dump with pups (trailers).
- In order to deliver 520 truckloads in 5 days, it is likely that Reclamation would require 8–10 trucks over 17–21 working days from May to June.

Also, for phase 3 (installation of about 550 cy of concrete around the pipe downstream of the conduit), Reclamation would expect concrete to come from Cle Elum or Ellensburg. This would be done with the following equipment and schedules:

- About 69 trucks would be required for the delivery of concrete.
- Constructing formwork and installing rebar would occur for about 3 months from March 18 to June 9.
- Typically, a contractor may place 100 cy of concrete in a day, usually for 4 hours in the morning. Adjacent placements must be scheduled 7 days apart for proper curing. Accordingly, concrete would be placed on about 6 days during this period. About 13 truckloads would be required.
- Assuming concrete is placed over a 4-hour period, 5 trucks would come from Cle Elum or 8 trucks would come from Ellensburg each day for 6 days over the 3 months.

Further details on the various elements of the Proposed Action can be found below.

- **Downstream Toe Approach Road**
  - Current access to the toe of the dam is via the crest of the dam. Due to the access road approach, it would likely not allow the passage of large, earthmoving equipment.
  - Reclamation would anticipate constructing the downstream toe approach road as part of the first phase of construction. This would include tree clearing and grubbing and establishment of contractor use areas. The new road would be approximately 1,000 feet long with gravel surfacing. There are no plans to pave this road once construction is complete. It would be equipped with a guardrail and would be 24 feet wide at the shoulders. All existing roads would remain, and the downstream toe approach road would be constructed.
  - There are three new and two existing contractor use areas that would be used for this project (see **Figure 2-2**, Proposed Action: Temporary Disturbance, and **Figure 2-3**, Proposed Action: Permanent Infrastructure, in **Appendix A**). Two existing areas are located at the crest of the dam and to right of the existing outlet channel and would remain permanent upon completion of the project. They are labeled Areas 4 and 3, respectively, in **Figure 2-3**. Two new contractor use areas along the left side of the outlet channel and the downstream toe approach road would be constructed, surfaced with gravel, and reclaimed upon completion of the project. They are labeled as Areas 2 and 5 in **Figure 2-2**. In addition to the already existing, permanent contractor use areas, a new contractor use area along the left side of the outlet channel (Area 1, **Figure 2-3**) would be permanent and would be fenced to provide an additional storage yard for the facility. The remaining new contractor use areas (Areas 2 and 5, **Figure 2-2**) would be restored by seeding them. To see where the tree clearing operations would correspond with the contractor use areas, see **Figure 2-4**, Proposed Action: Tree Clearing and Grubbing in **Appendix A**.
  - The slope of the proposed cuts (and the proposed fill) would be more gradual and stable than what is currently in situ. Geotechnical designers would review and approve the stability of both the cut and fill slopes for the entire length of the new access road (including the areas near and above the wetlands). Standard erosion-control measures would be implemented. Example measures include drainage

ditches, culverts, hydro mulch,[5] or similar measures along the cut slope to control turbidity; an energy dissipation cobble-lined area along the groin of the fill slope to control erosion of the existing slope; revegetation; and others. Drainage features would be designed to ensure they do not discharge additional water into any of the designated wetlands.

    - For the portion of the road crossing the wetlands, Reclamation would install a fish passable culvert.

- **Conduit Extension and Liner**
    - Because of the placement of the diaphragm filter and stability berm, the conduit would be extended downstream by about 100 feet from its current position, to accommodate those additions. To place the extension, a 100-foot-long trench would be excavated. The width of the excavation would range from approximately 34 feet at its narrowest point to approximately 250 feet at its widest point. A new concrete encasement would be placed around a 10-foot-diameter liner pipe, and a new transition section would be constructed at the relocated outlet works portal structure.
- **Drainage System and Inspection Well**
    - The filter drain would be installed from the upstream left end of the conduit and extend along the farthest downstream extent to the inspection well.
    - The auxiliary drain would be 12 inches in width with a typical depth of 10 feet below the outlet channel. The drainpipe would be installed near the left side of the outlet channel using trenching methods. Trenching would expand to approximately 35 feet at its widest and approximately 3 feet at its narrowest. At its upstream end, the drain would terminate at an auxiliary inspection well that is being included as part of an effort to improve monitoring in this area. At its downstream end, the drain would discharge into the stilling basin just to the left of the end of the concrete liner.
    - A pair of pumps would be installed at the bottom of the well, about 20–30 feet below the surface, to ensure any collecting seepage is drained properly. They would be triggered at a specified depth of water in the bottom of the well, with one of them designated as the backup.
- **Diaphragm Filter**
    - The current outlet works portal would be demolished and removed via excavation, while a four-sided diaphragm filter[6] would be placed just downstream of the original outlet location. A 12-inch-diamater drainpipe also would be attached. Because of the removal of the existing outlet works structure, no significant excavation into the

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[5] Hydro mulching, which is sometimes also called hydro seeding or hydraulic mulch seeding, is a method of planting grass in which a mixture of water, fiber mulch, tackifier (an adhesive substance), and seeds is sprayed over an area to prevent soil erosion and to promote revegetation. To promote even application, the mixture is applied to the area from a mounted tank and is sprayed through hoses.

[6] A diaphragm filter is a designed zone of filter material constructed around a conduit. It is a standard defensive design measure to prevent problems associated with seepage or internal erosion in earth fill surrounding a conduit. Reclamation would use sand sourced commercially, most likely from Cle Elum, for this filter.

embankment would be necessary to install the new filter. It would extend 10 feet below the base of the extended conduit and partway up the embankment.

- **Stability Berm**
  - A stability berm would be constructed from compacted fill materials (which would consist of a mixture of clay, sand, gravel, and cobbles) sourced from the excavation. It would overlay the filter zone, which consists of sand. There would be enough excavated material to build the stability berm without importing any additional materials from off-site. If there are not enough materials from the road excavation, materials from the existing spoil sites on-site and off-site near the dam would be used to supplement the excavated materials. The stability berm's purpose would be to prevent a blowout of the filter under certain adverse hydraulic conditions. It also would indirectly protect the diaphragm filter from surface erosion.
  - Per Reclamation design standards (Reclamation 2011), the berm height could be up to one-half of the reservoir height.
- **Site Electrical Upgrade**
  - A reliable source of electrical power would be required to power the pumps in the inspection well at the downstream end of the filter drain. Accordingly, the site would receive an electrical upgrade via an in-kind replacement of its current generator. The existing overhead electrical lines would be buried beneath the existing approach road, and the existing engine generator set would be replaced. Additional power capacity would be provided by upgrading from a 240-volt, single-phase system to a 480-volt, three-phase system; however, this change would not include a power capability upgrade. The generator would be used as backup power.

2.4 Alternatives and Alternative Elements Considered but Eliminated from Detailed Study

Federal agencies are required to rigorously explore and objectively evaluate all reasonable alternatives and to discuss the reasons for eliminating any alternatives not analyzed in detail in this EA (40 CFR 1502.14).

While developing the Proposed Action above, Reclamation eliminated several stand-alone alternatives and alternative elements. This is because they did not meet the purpose of and need for action (see **Section 1.3**), or because they would not meet project goals as identified in **Section 1.2**. To determine which alternatives and alternative elements would meet the purpose of and need for action and project goals, Reclamation engaged in collaborative discussions with agency specialists and project cooperators and considered their input. The stand-alone alternatives eliminated from detailed study are described below, along with the rationale for elimination.

2.4.1 Alternatives Considered but Eliminated from Detailed Study

Eliminated Alternative 1

This alternative involved partial replacement of the outlet works conduit with a four-sided filter and berm as well as replacement of 70 feet of the conduit downstream. Reclamation did not consider this alternative further because it did not provide any additional risk reduction and would have resulted in significant operational impacts to implement it. Impacts would have included restricting the reservoir to maintain freeboard[7] with the temporarily reduced crest elevation and shutting down flows during winter for construction, which would have resulted in more extensive dewatering. Further, construction under this alternative would be so extensive that there was a risk that the conduit would not be complete for the following year's irrigation season.

Eliminated Alternative 2

Under this alternative, Reclamation would have constructed a new conduit within the existing conduit, along with a filter and berm. This alternative would have provided a slight operational advantage over the Eliminated Alternative 1 in the sense that a slightly smaller amount of excavation would have been needed. However, with the filter still being embedded within the existing dam, it would likewise have resulted in significant operational impacts, such as those described above. Accordingly, Reclamation eliminated this alternative from further consideration.

Eliminated Alternative 3

Under this alternative, Reclamation would have constructed a new outlet works tunnel with an intake in the inactive pool in partnership with the Kachess Drought Relief Pumping Plant (KDRPP). This alternative also would have included abandonment and filtering of the existing conduit. Reclamation eliminated this alternative from further consideration because the time lines of implementing the two projects as one project would not meet the purpose of and need for the SOD project, which requires more urgent action.

2.5 Summary Comparison of Impacts

Table 2-1, below, briefly describes the impacts on resources and resource uses under each alternative, including Alternative A—No Action. For a detailed analysis of the impacts under each alternative, see **Chapter 3**, Affected Environment and Environmental Consequences.

[7] The height above the recorded high-water mark of the dam

Table 2-1. Summary Comparison of Impacts

Resource Topic	Alternative A—No Action	Alternative B—Proposed Action
Air Quality and Climate	Emissions of fugitive dust, greenhouse gases, and other air pollutants from operations and maintenance would continue to occur. If dam failure were to occur, emissions of fugitive dust, greenhouse gas emissions, and other air pollutants would be generated by the necessary emergency dam stabilization, repairs, and cleanup.	Under the Proposed Action, construction, transportation, and other proposed project actions requiring the use of fossil fuel-powered equipment or disturbing the ground would generate temporary and localized fugitive dust, greenhouse gas emissions, and other air pollutants. These would be minimized using standard dust control and other best management practices (BMPs).
Water Resources	Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. Potential long-term impacts from flooding on downstream water resources would be significant.	Overall, the Proposed Action would require up to 11 acres of surface disturbance for the outlet works modifications, construction of the access road, and development of the construction staging areas. Reclamation's contractor would develop a stormwater pollution prevention plan (SWPPP) and obtain a Washington Construction Stormwater General Permit prior to any surface disturbance. BMPs would be installed as designed in the SWPPP to prevent or mitigate erosion and sedimentation from surface-disturbing activities. This would prevent sediment and other potential pollutants from entering the outlet channel and Kachess River downstream.
Geology and Soils	Under the No Action Alternative, the irretrievable commitment of soil resources due to existing permanent components of the dam structure and facilities would continue. Internal erosion of vulnerable soils surrounding the conduit pipe would continue to occur.	Under the Proposed Action, there would be approximately 11 acres of new disturbance; of those, 7 acres would be a short-term disturbance, which would be reclaimed at project completion. There would be 4 acres that would remain as a long-term disturbance. Soils in the project area have slight or moderate erosion hazard ratings and a moderate K factor (see **Section 3.5.2** for an explanation of K factor). These indicate that simple erosion-control measures are likely to be necessary to protect soils from movement or erosion.

Resource Topic	Alternative A—No Action	Alternative B—Proposed Action
Biological Resources	There would be no change in aquatic or terrestrial ecosystems. Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. As a result, potential long-term impacts on habitats could be significant.	The Proposed Action could potentially remove or modify 0.12 acres of wetland features and 0.22 acres of open water where the permanent access road crosses these features, and an open bottom culvert is installed. The project would require a CWA 404 permit and possibly a CWA 401 water quality permit, as well as an associated dewatering plan, erosion-control plan, replanting plan, and BMPs. Conditions of the CWA permit and these plans would avoid, minimize, or mitigate impacts on wetlands and aquatic habitats. Project activities that modify or remove vegetation would affect terrestrial ecosystems and could impact the terrestrial wildlife that occupy them. The Proposed Action could remove or modify approximately 11 acres of terrestrial vegetation types; this includes 4 acres of permanent disturbance and approximately 7 acres from temporary disturbances.
Noise and Vibration	There would be no change in effects on noise resources. Impacts on noise and vibrations in the event of dam failure would be brief but significant.	Construction of the improvements would create short-term and localized noise impacts. The loudest construction noises would stem primarily from work conducted at the toe of the dam and from the construction of the new access road.
Transportation and Traffic	No change in transportation and traffic patterns is anticipated. Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. As a result, potential impacts on traffic could be significant.	Compared with the No Action Alternative, there would be an increase in heavy vehicle traffic using West Sparks Road and Kachess Dam Road under the Proposed Action. During daytime construction activities and the hauling of construction materials, there could be a temporary decrease in roadway capacity due to an increased volume of vehicles above baseline conditions.

Resource Topic	Alternative A—No Action	Alternative B—Proposed Action
Utilities	No change in utilities is anticipated. Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. Potential impacts on utility services as a result could be significant in both the short and long term.	Emergency services, such as fire, health care, and police, would not be delayed enough for the functionality of these services to be compromised.
Recreation	No change in the use of recreation resources is anticipated. Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. Potential impacts on recreation would be significant in both the short and long term.	Potential impacts on recreation would be temporary and localized along Kachess Dam Road at the access road. This is due to construction vehicle movements. These impacts would end with the project.
Cultural Resources	Reclamation would not perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Therefore, there would be no short-term impacts on the historic Kachess Dam and its associated features or the potential for short-term impacts on other resources in or adjacent to the proposed project area. Since the seepage and internal erosion issues would continue, the threat of dam failure and subsequent catastrophic flooding would increase over time.	Reclamation has determined that the modifications to the dam would have an adverse effect on the Kachess Dam historic property (as defined by the NHPA; 36 CFR 800.5), which requires mitigation. Reclamation is currently consulting with the Washington Department of Archaeology and Historic Preservation (DAHP) on mitigation measures for this adverse effect. No other historic properties would be adversely affected during construction and modification of the Kachess Dam.
ITAs	No ITAs have been identified or are anticipated to be impacted temporarily or permanently by the dam safety construction process or operation of the dam.	No ITAs have been identified or are anticipated to be impacted temporarily or permanently by the dam safety construction process or operation of the dam.
Sacred Sites	Since no sacred site issues have been identified, no impacts are anticipated. However, project-specific coordination and consultation are ongoing.	Since no sacred site issues have been identified, no impacts are anticipated. However, project-specific coordination and consultation are ongoing.

Resource Topic	Alternative A—No Action	Alternative B—Proposed Action
Land Use	The project area is comprised entirely of public lands withdrawn by Reclamation. There are no foreseeable changes to existing easements, campgrounds, recreation infrastructure, or other land entitlements in the area.	The project area is comprised entirely of public lands withdrawn by Reclamation. There are no foreseeable changes to existing easements, campgrounds, recreation infrastructure, or other land entitlements in the area.
Socioeconomic Resources	There would be no impacts on social and economic benefits provided by Kachess Dam and Reservoir unless a dam failure occurred. Should a dam failure occur, the social and economic benefits would be reduced or eliminated. For instance, potential permanent changes to water deliveries to irrigation districts, tribes, and the downstream public could occur.	Construction activities could affect the quality of life for residents through increased traffic, additional noise, visual impacts, and interruptions of recreation access. Impacts on the quality of life could occur during construction and would be short term and localized.
Environmental Justice	There would be no change in the effects on environmental justice communities.	There would be no foreseeable impacts on environmental justice communities as a result of the Proposed Action.
Public Health and Safety	There would be no change in effects on public health and safety. Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. Potential impacts on public health and safety would be significant in both the short and long term.	Under the Proposed Action, Reclamation would not expect to encounter any hazardous materials on-site during excavation or other surface-disturbing activities.
Visual Resources	No impacts on visual resources are anticipated. However, in the event of dam failure, visual resources would be impacted in the short and long term.	Based on the limited public viewpoints of construction areas, the temporary nature of construction, and the limited visibility of acres disturbed in the long term, the Proposed Action would have a minor to moderate short-term effect on the visual character and integrity of the landscape.

Source: Chapter 3, Affected Environment and Environmental Consequences

2.6 Selection of a Preferred Alternative

Reclamation has selected the Proposed Action Alternative as its preferred alternative for modifying the Kachess Dam and reducing the risk of dam failure. Throughout the EA, Reclamation has identified mitigation measures and management actions it is taking or is planning to take to reduce or eliminate impacts on resources in the project area; to comply with applicable laws, regulations, and management objectives; and to meet the purpose and need. The EA details Reclamation's compliance.

Further, throughout its alternatives development process, Reclamation considered, but dismissed, various alternatives and elements of alternatives. This consideration is also summarized in this EA and can also be found in the project record. Additional details on Reclamation's selection of its preferred alternative will be included in Reclamation's forthcoming final EA, finding of no significant impact, and decision record.

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Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter summarizes the current environmental resources and resource uses that could be affected by the range of alternatives discussed in **Chapter 2**, Proposed Action and Alternatives. For a description of the project area, refer to **Chapters 1** and **2**. The project area is designed to determine effects as defined by each resource area. It is discussed in more detail in the resource specialist reports included in **Appendix B**. Different resources may use different analysis areas for their effects analysis. Potential impacts are described in terms of duration, intensity, and context. Definitions of impact terms are provided below.

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The CEQ regulations implementing NEPA include a number of specific categories for use in the analysis of environmental consequences. Several are applicable to the analysis of the Proposed Action and No Action Alternative and form the basis of much of the discussion that follows. They are explained briefly here.

Resources and issues that would not be impacted or only minimally impacted—and were therefore not further analyzed in this EA—are noted and explained in **Table 3-2**, below.

Pursuant to 40 CFR 1500.1(b) and 1500.4, the discussions presented here are summaries of the completed analyses; they form the scientific and analytical basis for the alternatives' comparison. Additional details regarding the affected environment, conclusions about potential effects, applicable regulatory direction, and other supporting documentation are available in the reports compiled in **Appendix B** as well as in the project record.

The project is not likely to have significant effects. It has limited context and intensity (49 CFR 520.5), individually or cumulatively, to the biological, physical, social, or economic components of the human environment. Therefore, Reclamation did not prepare an environmental impact statement.

3.1.1 Analytical Effects

Reclamation has prepared an EA to evaluate the Proposed Action's impacts on the human environment, consistent with the purpose and goals of NEPA (42 United States Code 4321 et seq.) and pursuant to the CEQ's implementing NEPA regulations at 40 CFR 1500–1508. Additionally, this EA was prepared consistent with the DOI's NEPA regulations (43 CFR 46); long-standing federal judicial and regulatory interpretations; and the Biden administration's priorities and policies, including Secretarial Order No. 3399 requiring bureaus and offices to use "the same application or level of NEPA that would have been applied to a proposed action before the 2020 Rule went into effect."

3.1.2 Cumulative Effects

Reclamation analyzed the environmental consequences of each alternative, including the effects of those alternatives when combined with reasonably foreseeable future actions and environmental trends, to determine whether significant impacts on the human environment would occur. **Table 3-1** provides a tabular display of past, present, and reasonably foreseeable future management activities and natural processes in or adjacent to the analysis area. Reclamation resource specialists used this information when conducting the effects analyses for this EA. Each resource specialist established geographic and temporal boundaries for their respective resource analysis, and determined past, present, and reasonably foreseeable future effects that are relevant within their respective boundaries.

The actions described in **Table 3-1** were relevant to most of the resources. Findings regarding effects for each pertinent resource are described in the resource summaries in the following sections.

Table 3-1. Summary of the Potential Effects from Actions in the Analysis Area

Incident or Project Name	Years of Interface within Project Area	Description of Impacts within Project Area	Acres or Areas Affected within the Project Area
		Past and Present Actions	
Interstate 90 Expansion Project	2017–2029	The Interstate 90 Snoqualmie Pass East Project improves 15 miles from Hyak to Easton. Phases 1 and 2 from Hyak to the Stampede Pass interchange are complete. Phase 3, the Easton portion, began in fall 2021 and is part of a 15-mile corridor improvement project to improve safety and reliability and to reduce congestion along Interstate 90. This improvement is expected to be completed in 2025. The project will increase traffic capacity and improve safety by adding a new lane in each direction, replacing concrete pavement, stabilizing rock slopes, building wildlife crossings, improving sight distance and traffic safety, and improving traffic management technology systems.	N/A

Incident or Project Name	Years of Interface within Project Area	Description of Impacts within Project Area	Acres or Areas Affected within the Project Area
Kachess Dam Spillway Repair	2017	Reclamation replaced the concrete bridge deck on the Kachess Dam spillway. Work included the removal of the existing 11-by-52-foot concrete bridge deck, salvaging and reinstalling the existing steel pipe railing, and constructing a new cast-in-place concrete bridge deck.	0.1 acres
		Foreseeable Future Projects	
Interstate 90 Expansion Project	2017–2029	See the discussion above. Construction is expected to be ongoing in 2022 and through 2025, when construction on the dam would be ongoing. Construction will occur on the highway to the west and southwest of Kachess Reservoir, south of Kachess Reservoir, and north of Lake Easton. During this time, eastbound traffic will be diverted along the detour route, and minor delays are expected.	N/A; The time line for construction on Interstate 90 in the Lake Easton vicinity during phase 3 of the project during 2022–2025 may overlap with hauling efforts for the Kachess SOD project in 2024; however, there would be no direct impacts in the project area, and hauling activities would be farther west such that overall indirect impacts on traffic flow should be minimal.
Lake Easton Sno-Park Relocation	To be determined	This recreation area off Kachess Dam Road is a popular, groomed snowmobile route managed by Washington State Parks. The Lake Easton Reload Sno-Park staging area is located at the intersection of Kachess Dam Road and the dam access road. Reclamation has proposed to relocate the sno-park from its current location to a location where Kachess Dam Road and the Bonneville Power Association transmission lines intersect (see the **Recreation** and **Utilities Resource Reports** for more information). Reclamation anticipates the relocation will maintain the current level and type of recreation access.	There would be no direct impacts in the project area. Also, indirect impacts related to traffic due to the changed recreational access to the relocated sno-park would be minimal; this is because much of the activity to be conducted under the Proposed Action would not fall within the sno-park's major season of use (see the **Recreation** and **Utilities Resource Reports** for more information).

Incident or Project Name	Years of Interface within Project Area	Description of Impacts within Project Area	Acres or Areas Affected within the Project Area
Kachess Drought Relief Pumping Plant (KDRPP)	To be determined; project initiated in 2015	The KDRPP is one of several potential surface water supply projects being studied by Reclamation and the Washington State Department of Ecology (Ecology) to improve water resources management in the Yakima River basin. The KDRPP is being evaluated as part of the Yakima Basin Integrated Plan. Reclamation will pursue a tier 2 environmental impact statement to analyze impacts of a floating pumping plant in the reservoir bed with appurtenant structures, including onshore contractor use areas. Support building will likely overlap in the footprint of the Kachess SOD project area.	Staging and contractor use areas for the Kachess SOD project in the east and northeast portion of the project area (**Figures 2-1** and **2-2**) would also be used for the KDRPP. The KDRPP would rely on these areas for construction staging efforts as well as for development of a new substation and two buildings. In addition, the KDRPP would also rely on the access road in the course of project activities, including the burial of power communication lines and conducting road improvements. For a basic demonstration of areas where KDRPP activities may overlap in the Kachess SOD project area, see **Figure 3-1**, Cumulative Effects (**Appendix A**).

Source: Reclamation 2022

For the purposes of this analysis, impact duration is defined as follows:

- Temporary: Impacts that would only occur during construction
- Short-term: Impacts that would be less than 3 years in duration
- Long-term: Impacts that would be 3 years or greater in duration

For the purposes of this analysis, impact intensity is defined as follows:

- Negligible: Changes would not be detectable or measurable. The resource topic would be essentially unchanged or unaltered.
- Minor: Changes would be detectable, localized, and/or measurable and would have a slight change or alteration to the resource topic.
- Moderate or major: Changes would be measurably to clearly or readily detectable, and/or have an appreciable to severe effect on the resource or resource use. The resource or resource use would be notably to substantially changed or altered. Project activities could change the indicator over a small to large area and/or from a moderate to large degree.

For the purposes of this analysis, impact type is defined as follows:

- Adverse: Impacts that would have a detrimental effect on a resource
- Beneficial: Impacts that would have a positive effect on a resource

Context is the setting within which an impact is analyzed:

- Local: Within and immediately adjacent to the project area
- Regional: The area outside the project area but within Kittitas County

3.2 Resource Topics Analyzed

Reclamation's NEPA handbook (Reclamation 2012) identifies supplemental authorities that contain requirements specified by statute or EO and that must be considered in all Reclamation environmental documents. **Table 3-2** identifies the presence or absence of resources or resource uses subject to the supplemental authorities in the project area and the rationale for those that warrant detailed analysis in the EA.

Table 3-2 also documents the potential for the Proposed Action and alternative to affect resources or resource uses other than those subject to the supplemental authorities. Resources or resource uses subject to the supplemental authorities and other resources or resource uses that may be affected by the Proposed Action or the alternative will be further described in the EA, as noted in **Table 3-2**.

Table 3-2. Determination and Rationale for Detailed Analysis by Resource Topic

Resource Topic	Determination and Rationale for Detailed Analysis
Air Resources	See the detailed analysis in **Section 3.3**, Air Resources.
Water Resources	See the detailed analysis in **Section 3.4**, Water Resources.
Geology and Soil Resources	See the detailed analysis in **Section 3.5**, Geology and Soil Resources.
Biological Resources	See the detailed analysis in **Section 3.6**, Biological Resources.
Noise and Vibration	See the detailed analysis in **Section 3.7**, Noise and Vibration.
Transportation and Traffic	See the detailed analysis in **Section 3.8**, Transportation.
Utilities	Emergency services, such as fire, health care, and police, would not be delayed enough for the functionality of these services to be compromised. As a result, a detailed analysis of utilities in this EA is not warranted.
Recreation	Potential impacts on recreation would be temporary and localized along Kachess Dam Road at the access road. This is due to construction vehicle movements. However, these impacts would end with the project; accordingly, a detailed analysis of recreation in this EA is not warranted.

Resource Topic	Determination and Rationale for Detailed Analysis
Cultural Resources	See the detailed analysis in **Section 3.9**, Cultural Resources.
ITAs	No ITAs have been identified or are anticipated to be impacted temporarily or permanently by the dam safety construction process or operation of the dam. As a result, a detailed analysis of ITAs in this EA is not warranted.
Sacred Sites	Since no sacred site issues have been identified, no impacts are anticipated. However, project-specific coordination and consultation are ongoing, and Reclamation will consider and address any issues regarding Indian sacred sites as defined in EO 13007. At this time, however, a detailed analysis of sacred sites in this EA is not warranted.
Land Use,	The project area is comprised entirely of public lands withdrawn by Reclamation. There are no foreseeable changes to existing easements, campgrounds, recreation infrastructure, or other land entitlements in the area. As a result, a detailed analysis of land use in this EA is not warranted.
Socioeconomic Resources	See the detailed analysis in **Section 3.10**, Socioeconomic Resources.
Environmental Justice	There are no foreseeable impacts on environmental justice communities as a result of the Proposed Action. As a result, a detailed analysis of environmental justice in this EA is not warranted.
Public Health and Safety	Under the Proposed Action, Reclamation does not expect to encounter any hazardous materials on-site during excavation or other surface-disturbing activities. As a result, a detailed analysis of public health and safety in this EA is not warranted.
Visual Resources	Based on the limited public viewpoints of construction areas, the temporary nature of construction, and the limited visibility of acres disturbed in the long term, the Proposed Action would have a minor to moderate short-term effect on the landscape's visual character and integrity. As a result, a detailed analysis of visual resources in this EA is not warranted.

Source: Kachess SOD EA Resource Reports are available in **Appendix B**.

3.3 Air Resources

3.3.1 Analysis Area

The analysis area for air quality is Kittitas County, Washington. The analysis area for climate change is broader; impacts on climate are generally based on regional climate scenarios, downscaled from global climate models.

3.3.2 Affected Environment

Air quality in Kittitas County, Washington, the location of the project, generally meets Environmental Protection Agency standards. Exceedances are usually attributable to regional wildfires. Visibility conditions at the nearest Class 1 air quality area, the Alpine Lakes Wilderness, have been showing an improving trend over the last two decades (see **Figure 3-2**, Wilderness Area, in **Appendix A**). In 2018, total greenhouse gas emissions in the state of Washington were estimated to be 99.6 million metric tons of carbon dioxide equivalents (Ecology 2021a).

3.3.3 Environmental Consequences

For a full summary of the environmental consequences for air resources, refer to **Appendix B**.

Indicators and Assumptions

Indicators for air quality are the following:

- Acres of surface disturbance and measures to reduce fugitive dust
- Total vehicle miles traveled by on-road trucks and personal vehicles, and the tons of criteria pollutants resulting from their use
- Total hours of operation of non-road vehicles and equipment, and the tons of criteria pollutants resulting from their use

The indicator for climate change is the following:

- The tons of greenhouse gas emissions resulting from construction and operation

Alternative A—No Action Alternative

Under the No Action Alternative, emissions of fugitive dust, greenhouse gases, and other air pollutants from operations and maintenance would continue to occur. If dam failure were to occur, emissions of fugitive dust, greenhouse gas emissions, and other air pollutants would be generated by the necessary emergency dam stabilization and repairs, and the cleanup of any flood damage downstream of the dam.

Alternative B—Proposed Action

Under the Proposed Action, construction, transportation, and other proposed project actions requiring the use of fossil fuels-powered equipment or disturbing the ground would generate temporary and localized fugitive dust, greenhouse gas emissions, and other air pollutants. These would be minimized using standard dust control and other BMPs. For example, air quality impacts from fugitive dust would be managed with the application of BMPs that would require the contractor to use measures necessary to control and abate fugitive dust on access roads, staging areas, and work areas. These measures would likely include applying gravel to frequently used areas, enacting vehicle speed limits on access roads, using a water truck as needed, and applying stabilizers such as lignin sulfonate, magnesium chloride, or calcium chloride. These BMPs would keep fugitive dust to a minimum during the project.

BMPs to control the release of air contaminants would include a prohibition on operating equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels. BMPs would also include using reasonably available methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants. These BMPs would reduce the chance that air contaminant emissions could exceed estimates. The contribution to global greenhouse gas emissions is expected to be well below 25,000 metric tons of carbon dioxide equivalents per year, which is the greenhouse gas reporting requirement threshold under 40 CFR 98.

The Proposed Action is not expected to cause any air quality measures to exceed Environmental Protection Agency standards. It also is not expected to cause any reduction in the visibility in the Alpine Lakes Wilderness Class 1 area (**Figure 3-2**). The types and amounts of emissions from operations and maintenance following the completion of the Proposed Action would be similar to those described above under the No Action Alternative.

3.4 Water Resources

3.4.1 Analysis Area

The analysis area for water resources (hydrology, groundwater, and water quality) includes the project area and the Kachess River downstream to where it flows into Lake Easton (approximately 0.9 miles downstream of the dam). Wetlands, riparian areas, and wetland function are included in the **Biological Resources Report** in **Appendix B**. A shortened discussion of wetlands and other aquatic resources can be found in **Section 3.6**.

3.4.2 Affected Environment

Hydrology

Most hydrology in the project area originates as snowfall and rainfall in the Cascade Range east of the crest, which collects in Kachess Reservoir via the Kachess River and Mineral Creek. Kachess Reservoir has a drainage area of approximately 63 square miles (Reclamation 2021a).

Below the dam, most hydrology in the project area comes from water releases from Kachess Reservoir via the dam outlet works, which has a capacity of 3,700 cfs, and, periodically, from the spillway, which has a capacity of 4,000 cfs. The outlet works originate from the central portion of the dam. Water released from the outlet works daylights, or surfaces above ground, at the downstream toe of the dam; it is conveyed in a concrete-lined channel for approximately 450 feet before it discharges into a stilling basin. From this point, it continues to flow into the Kachess River.

Water releases from Kachess Reservoir are greatest in September and October, reaching maximum ranges of about 1,200 to 1,500 cfs, depending on supply and demand. After the irrigation season, the release from Kachess Reservoir is reduced to 35 cfs. Kachess Reservoir typically reaches its lowest elevation in October, when the irrigation season ends. In the winter and spring, water is stored in the reservoir for irrigation demands later in the year. The highest reservoir elevations generally occur in May to July, depending on the annual water supply.

Hydrology in the project area is also present as a result of seepage under the Kachess Dam. Reclamation channelizes seepage daylighting near the right (eastern) end of the dam during normal dam operations; this channel conveys the seepage to the Kachess River at the stilling basin described above. The upper portions of this channel are wetland communities (see the **Biological Resources Report** in **Appendix B** for more detail); the lower portion is standing water due to a weir that impounds water behind it.

Finally, direct precipitation and snowfall contribute hydrology to the project area. The average annual maximum temperature at the Kachess Reservoir, Washington, National Weather Service Cooperative Network station (454406) is 54.5 degrees Fahrenheit (°F) (12.5 degrees Celsius [°C]), and the average annual minimum temperature is 34.1°F (1.3°C). The average annual total precipitation is 52 inches, and average annual total snowfall is 165 inches. The station has measurable monthly average snow depth from November through April, indicating that portions of the project area are under snow during these months (WRCC 2021).

The Kachess River flows approximately 0.9 miles from the project area into Lake Easton, on the Yakima River. The Yakima River is a tributary to the Columbia River, which flows to the Pacific Ocean.

Groundwater

Groundwater in the Kachess basin occurs in unconsolidated sediments and fractures in the bedrock and is recharged through precipitation discharged to springs, streams, and Kachess Reservoir. South of Kachess Reservoir, alluvial and glacial deposits form a high-permeability, unconfined aquifer up to 90 feet thick (Reclamation 1911). This aquifer is underlain by sandstone bedrock that likely exhibits low permeability and is not likely to convey groundwater. Groundwater likely flows south from the dam within the unconsolidated deposits and discharges into the Yakima River downstream from the dam (Reclamation and Ecology 2019).

Well logs for an area within 2 miles of Kachess Reservoir show that groundwater in the area is used as a potable water supply for seasonal and year-round homes around the reservoir. Well depths range from 15 to 500 feet, with an average depth of 190 feet. The shallower wells (less than 100 feet deep) obtain groundwater from sedimentary deposits. The deeper wells are installed in bedrock (Reclamation and Ecology 2019).

Groundwater-level monitoring was conducted at two domestic wells and four Reclamation monitoring wells to determine whether the wells are hydraulically connected and respond to fluctuations in Kachess Reservoir surface water elevations (Reclamation and Ecology 2019). The following observations and conclusions were drawn from the groundwater-level monitoring:

- The reservoir is hydraulically connected to the aquifer, and groundwater levels near the reservoir are influenced by reservoir elevations. This is especially during the dry time of the year when very little recharge is occurring, and groundwater elevations are dropping because of discharge from the aquifer (Reclamation and Ecology 2019).
- For areas downstream from the reservoir, reservoir elevations likely influence groundwater levels. An impermeable core (or cut-off wall) constructed along the length of the dam impedes the seepage of water from the reservoir through the sedimentary deposits under the dam. This cut-off wall is likely the reason for the small hydraulic response observed in monitoring wells below the dam. Although the groundwater levels show a response to changes in the reservoir level that is reduced in force, if the reservoir elevation were to drop below the current minimum elevation, groundwater levels would likely experience an additional decline as well (Reclamation and Ecology 2019).

Groundwater quality in the analysis area was evaluated by examining water quality records maintained by the Ecology. No records indicating adverse groundwater quality were discovered. However, because wells in the area are used for residential potable supply, because the area is remote, because there is little industrial or commercial land use, and because the aquifer receives a large amount of recharge from precipitation, it is anticipated that groundwater quality in the uppermost aquifers is very good (Reclamation and Ecology 2019).

Surface Water Quality

Reclamation collected water quality data in Kachess River approximately 984 feet downstream from Kachess Dam (station YKA001) during June, July, and August 2021. In addition, based on Environmental Protection Agency database results, 11 samples were collected between 1999 and 2019 (EPA 2021g). Sampling results indicate the water quality in the river is moderate to good. During sampling, the river exhibited low turbidity, low total suspended solids concentrations, and low fecal coliform counts. However, dissolved oxygen and the water temperature exceeded State surface water quality criteria for individual samples. Water temperatures exceeded the State surface water quality criterion of 60.8°F (16.0°C) on three occasions with a highest temperature reading of 65.0°F (18.5°C) in July 2015. Reclamation's sampling of the Environmental Protection Agency database showed that the average water temperature was 56.3°F (13.5°C), which is below the water quality criterion of 60.8°F (16.0°C).

Dissolved oxygen measurements below the State surface water quality criterion were measured on five occasions (the standard set to ensure the dissolved oxygen criterion greater than 9.5 milligrams per liter [mg/L]); the lowest reading was 8.8 mg/L in July 1999. The average dissolved oxygen levels during Reclamation's sampling was 9.8 mg/L, which exceeds the State water quality criterion (EPA 2021b). The Kachess River is listed on Ecology's 303(d) water quality list as Category 2 (waters of concern) for dissolved oxygen (Ecology 2021b).

3.4.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on water resources are the following:

- Changes to the stream geomorphology
- Changes to the downstream flow quantity or timing
- Increase or decrease to the water quality
- Changes to aquifer recharge and groundwater availability

Alternative A—No Action Alternative

Under the No Action Alternative, the outlet works modifications would not occur. This means there would be no construction, no construction equipment, no extension of the outlet works conduit, and no access road. Therefore, there would be no short-term effects on water resources.

Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works—and the subsequent catastrophic flood—would increase throughout time. Potential long-term impacts from flooding on downstream water resources would be significant.

Alternative B—Proposed Action

For the full summary of environmental consequences on water resources under the Proposed Action, refer to the **Water Resources Report** in **Appendix B**.

Under the Proposed Action, construction activities would be timed to avoid major issues with water deliveries and to comply with maintaining minimum flows. This water would be routed around the construction site back into the outlet channel. This would maintain flow downstream in Kachess River and keep the flow isolated from construction activities. Replacing approximately 100 feet of the concrete-lined channel with 10-foot conduit would not remove aquatic habitat, change stream channel features, or affect flows to Kachess River.

Reclamation could need four 12-hour shutoffs for conduit installation, where no water would be provided unless the reservoir is high enough to use the spillway. During the shutoffs, there would be no flow to Kachess River. There would be a temporary impact on streamflows during the shutoffs, but there would be no short- or long-term impacts after each shutoff is complete. The shutoffs would not impact stream features. Flows would be matched by Keechelus Reservoir during the shutoffs to eliminate flow concerns downstream in the Yakima River.

Reclamation would construct a new access road from the current dam access road to the outlet works for construction and maintenance of the outlet works modifications (**Figure 1-1**). This road would traverse a wetland, as well as the seepage channel east of the main outlet works. Reclamation would install a culvert that would allow fish passage and remove the weir that is currently in place. This would allow for possible fish passage during high-flow events and provide for riverine flow conditions, compared with the current impoundment and depressional conditions. There could be temporary interruptions in the flow during construction of the access road, but flow would be restored once the culverts are installed. Reclamation would apply for a CWA permit from the USACE and obtain a HPA from WDFW prior to construction. Reclamation also would follow all BMPs required under those permits.

The Proposed Action would not require any reservoir-level restrictions, and Reclamation would time construction activities to avoid major issues with water deliveries. In addition, groundwater unwatering would occur in the main excavation trench, but there is no plan to pump down to the groundwater table. The lack of reservoir-level restrictions, the continuation of minimum flows during construction, and not pumping down the groundwater table would eliminate the potential for drawdowns of the groundwater table or the reduction in aquifer recharge rates. No short- or long-term impacts on the groundwater's availability downstream of the project area would occur as a result of the Proposed Action.

Overall, the Proposed Action would require up to 7 acres of surface disturbance for the outlet works modifications, construction of the access road, and development of the construction staging areas (**Figure 1-1**). Reclamation's contractor would develop a SWPPP and obtain a Washington Construction Stormwater General Permit prior to any surface disturbance. BMPs would be installed as designed in the SWPPP to prevent or mitigate erosion and sedimentation from surface-disturbing activities. This would prevent sediment and other potential pollutants from entering the outlet channel and Kachess River downstream.

The proper disposal of hazardous materials and implementation of the spill prevention, control, and countermeasure plan (in case of an accidental spill of hazardous materials) would decrease the risk of hazardous material spills during construction of the Proposed Action, provide for the quick cleanup of any spills that could occur, and prevent any impacts on water quality.

Reclamation and its contractor would reduce impacts on water quality both in the short and long term through the implementation of BMPs, as outlined in the SWPPP, and turbidity monitoring for surface disturbance; dewatering; and routing water around the construction area.

3.5 Geology and Soil Resources

3.5.1 Analysis Area

The proposed project may impact the geology and soils in areas where there is ground disturbance and construction. The analysis area includes the existing dam, access roads, buildings, and storage areas, as well as proposed project components under the Proposed Action. These project components include storage and contractor use areas, new roads, excavations, and expansions of existing dam elements (see **Figure 3-3**, Geologic Hazards, in **Appendix A** for a map of the relevant analysis area).

3.5.2 Affected Environment

Kachess Dam was constructed in a breach of a glacial moraine. Prior to the dam's construction, a natural lake existed behind the moraine; it was created by glacial drift and outwash deposits associated with the retreat of the Yakima Valley glacier. This moraine extends across the Kachess River Valley with a length of just over 6,000 feet in the area of Kachess Dam. The 1,400-foot-long Kachess Dam filled the breach in the moraine that had been created by the Kachess River to increase the water storage capacity of the natural lake (Lockhart 1989).

The glacial till is composed of a heterogeneous mixture of clay, silt, sand, gravel, cobbles, and boulders. The glacial moraine forms the foundation and abutments upon which Kachess Dam rests. This moraine was also used as the borrow source for the impervious and pervious zones of the dam. The thickness of the moraine in the dam area is about 100 feet. Laboratory analyses of samples collected during a 2019 field investigation conducted by Reclamation (Reclamation unpublished), as well as data collected in previous studies and during construction, determined that the moraine foundation's composition consisted of silty sand with gravel with lenses or stringers of a well-graded gravel with silt and sand, well-graded sand with silt and gravel, poorly graded sand with silt and gravel, and poorly graded sand with silt (Historic American Engineering Record 2003; Reclamation 2021b, 2021c).

The project area is located in the impact risk area of the Cascadia subduction zone earthquake. In a simulation of a Cascadia subduction zone earthquake, the Kachess Dam area was projected to have a shaking intensity value of 6[8] on the Modified Mercalli Intensity Scale[9] (Washington Geological Survey 2017). Earthquake shaking can also cause ground liquefaction, which is a phenomenon in which the soil's strength and stiffness are reduced by shaking, causing drastic increases in water pressure in saturated soils. Liquefaction decreases the soil's ability to support foundations for buildings, bridges, and dams. The Washington State Department of Natural Resources (DNR) Geologic Hazard Map of Liquefaction Susceptibility shows that most of the area around Kachess Dam is rated moderate to high susceptibility; the rest of the area is rated very low to low (Palmer et al. 2004). The ongoing internal erosion of soils within the dam has not been identified as a risk factor that would contribute to the possibility of dam failure during a seismic event in the project area.

Three soil units are present in the project area. These are Kachess gravelly ashy sandy loam, xerofluvents,[10] and Kladnick[11] ashy sandy loam (see the **Geology, Soils, and Seismic Resources Report** in **Appendix B**). **Table 3-3**, below, shows key soil attributes for soils in the project area.

Table 3-3. Key Soil Attributes in the Kachess Dam Project Area

Unit Name	Approximate Percentage of the Analysis Area	Erosion Hazard Rating	K Factor,[1] Whole Soil	Soil Restoration Potential
Kachess gravelly ashy sandy loam, 5 to 25 percent slopes	36.7	Moderate	.17	High potential
Xerofluvents, 0 to 5 percent slopes	25.5	Slight	.24	High potential
Kladnick ashy sandy loam, 0 to 3 percent slopes	19.6	Slight	.20	High potential
Other (dam and water)	18.2	N/A	N/A	N/A

Source: Web Soil Survey 2021

[1] A measure that indicates the susceptibility of a soil to sheet and rill erosion by water

The erosion hazard rating is a measure that indicates the hazard of soil loss from unsurfaced areas, roads, and trails. The ratings are based on soil erosion factor K, the slope, and the content of rock fragments. A rating of slight indicates that little or no erosion is likely; moderate indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion-control measures are needed. The K factor indicates the susceptibility of a soil to sheet and rill

[8] A value of 6 (strong) means objects fall. The shaking is felt by all. People walk unsteadily, and many are frightened. Windows crack. Dishes, glassware, knickknacks, and books fall off shelves. Pictures fall off walls. Furniture moves or is overturned. Weak plaster, adobe buildings, and some poorly built masonry buildings crack. Trees and bushes shake visibly.

[9] The Modified Mercalli Intensity Scale is a seismic scale used for measuring the intensity of an earthquake. It measures an earthquake's effects on the earth's surface, humans, objects in nature, and the building environment. The scale ranges from 1 (not felt) to 12 (total destruction).

[10] A fluvent soil with a xeric moisture regime

[11] The Kladnick series consists of deep, well, or somewhat excessively drained soils formed in glacial outwash with a mantle of volcanic ash.

erosion by water. Values of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The soil restoration potential rates each soil for its inherent ability to recover from degradation, which is often referred to as soil resilience. The ability to recover from degradation means the ability to restore functional and structural integrity after a disturbance. Soil resilience is dependent on adequate stores of organic matter, good soil structure, low salt and sodium levels, adequate nutrient levels, microbial biomass and diversity, adequate precipitation for recovery, and other soil properties. High potential indicates that the soil has features that are very favorable for recovery, and good performance can be expected.

3.5.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on geology and soil resources are the following:

- Soil loss (substantial loss of topsoil or damage to the soil condition through construction or erosion due to the project). The unit of measure is the acres of erodible soils disturbed.
- The presence of soils vulnerable to seepage and internal erosion issues, or other unstable soil types. The unit of measure is the tons of unstable soils replaced or mitigations to address these soil types.

Alternative A—No Action Alternative

Under the No Action Alternative, the irretrievable commitment of soil resources due to existing permanent components of the dam structure and facilities would continue. Internal erosion of vulnerable soils surrounding the conduit pipe would continue to occur. In the long term, the internal erosion of soils around the conduit would continue; dam failure could occur as a result. In the event of a dam failure due to an internal failure of the dam, flooding would be likely to cause severe soil erosion and changes to the area's geomorphology (**Figure 3-3**). The extent and severity of these impacts would depend on the method and extent of the dam failure.

Alternative B—Proposed Action

Under the Proposed Action, Reclamation would undertake the following actions relevant to this analysis: tree clearing and grubbing, clearing an access road, developing contractor use areas for staging project materials, constructing a stability berm, and modifying the outlet works. Some contractor use areas would be reclaimed and represent a short-term disturbance of soils. Areas occupied by new permanent project components, such as the expanded outlet works, the new electric building, and the access road, would remain as a long-term disturbance to soils.

Under the Proposed Action, there would be approximately 11 acres of new disturbance; of those, 7 acres would be a short-term disturbance, which would be reclaimed at project completion. There would be 4 acres that would remain as a long-term disturbance.

Soils in the project area have slight or moderate erosion hazard ratings, and a moderate K factor. These factors indicate that simple erosion-control measures are likely to be necessary to protect soil from movement or erosion.

Construction of the access road and the downstream toe approach road are the areas of highest concern for soil erosion. This is because of their proximity to the Kachess River and adjacent wetlands. The road construction would require cut and fill of existing slopes. The access road would require the reduction of an existing steep slope to an approximately 10 percent grade for the road base. Side slopes would be constructed to a 2:1 slope. The cut and fill would disturb approximately 0.64 acres. Geotechnical engineers would review and approve the stability of both the cut and fill slopes for the entire length of the new access road. Additionally, the proposed slopes of the new cut and fill areas are more gradual than existing slopes.

To reduce impacts, Reclamation would employ standard erosion-control measures, such as drainage ditches, culverts, silt fences, hydro mulching, or similar measures along the cut slope to control turbidity; an energy dissipation cobble-lined area along the groin of the fill slope to control the erosion of the existing slope; and monitoring of revegetation. Drainage features would be designed so they would not discharge additional water into any of the designated wetlands. Road surfaces would be surfaces with gravel to provide long-term stability and to reduce the risk of soil erosion. New contractor use and storage areas would be surfaced with gravel; the gravel would be removed from temporary contractor use areas as part of the site rehabilitation at the completion of the project.

The stability berm would employ similar erosion-control measures to those used for the road cut areas during construction. Riprap or prepared cobbles, or both, would be placed on the finished stability berm as a slope protection layer. This would provide protection against soil erosion.

Excavation for the conduit extension would also employ erosion-control measures, including trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment. To reduce the amount of sediment-laden water being generated during work, Reclamation would employ a cofferdam composed of a temporary earth fill with a geomembrane liner to prevent water in the river channel from flowing back into the excavation. Reclamation would control flows through the dam to avoid overtopping the cofferdam and construction areas during the project.

Applying standard erosion-control measures, such as those discussed above, would limit soil movement in disturbed areas. All soils in the project area have a high soil restoration potential rating, so short-term disturbance areas should be effectively returned to a functional condition following site rehabilitation. Approximately 4 acres of soil would be disturbed in the long term due to the placement of permanent project elements.

Under the Proposed Action, Reclamation would undertake the corrective actions described in the **Geology, Soils, and Seismic Resources Report** in **Appendix B**. The installation of a steel conduit liner pipe would prevent further soil loss from conduit weep holes. Extension of the conduit and the installation of a diaphragm filter would prevent soil scour and loss from around the exterior of the conduit. The installation of a drainage system and a seepage inspection well would reduce the force of internal seepage and allow for improved monitoring. These measures would effectively stop or drastically slow internal erosion of the dam. This system would mitigate the risk created by unstable soils in the Kachess Dam structure and reduce the risk of internal erosion leading to dam failure.

3.6 Biological Resources

3.6.1 Analysis Area

The analysis area for aquatic ecosystems and aquatic species includes the water features in the project area and extends 0.9 miles in Kachess River downstream of the dam to the confluence with Lake Easton. This analysis area would consider impacts on aquatic species from reduced flows during water shutoff periods. The analysis area for terrestrial ecosystems and plants includes the project area where project activities could remove or modify vegetation. The analysis area for terrestrial wildlife and special status species is the project area plus a 0.25-mile buffer around the project area to account for disturbance impacts on wildlife species.

3.6.2 Indicators and Assumptions

The indicators for identifying impacts on biological resources are the following:

- Changes in aquatic species occurrence or abundance
- Changes in the available aquatic habitat (acres) during shutoff periods (see also hydrology)
- Changes in aquatic habitat quality, including temperature, sedimentation, erosion, and invasive species (see also water quality)
- Acres of removal or modification of delineated wetlands
- The level and duration of noise and vibration disturbances in aquatic and terrestrial habitats
- Changes (temporary or permanent) in available terrestrial wildlife habitats (acres)
- Disturbance of northern spotted owl during the breeding season
- Removal of northern spotted owl habitat elements, such as large trees and canopy cover
- The potential risk of harm or mortality to listed fish from reduced flows, entrainment, relocation handling, and earthmoving

3.6.3 Affected Environment

Aquatic Ecosystems and Aquatic Species

Reclamation conducted a wetland delineation for the project area in August 2020 with an addition to the survey area delineated in July 2021 (see the Aquatic Resources Delineation Report; Reclamation 2021d). The wetland delineation identified a total of 0.76 acres in five individual wetland features (Reclamation 2021d). Of those wetlands, four are presumed to have developed as a result of Kachess Dam's construction and its associated works.

Five other aquatic resources in the project area (totaling approximately 11.9 acres) were also delineated. These include Kachess Reservoir, the spillway and outlet works, a standing pond, and

Kachess River. Wetlands delineated in the project area were assessed for function following the Washington State Wetland Rating System for Eastern Washington (Reclamation 2021d). Wetlands and other aquatic resources are subject to CWA permitting under Section 404.

The historical lakes and tributaries of the upper Yakima River basin formerly supported anadromous spring Chinook Salmon (*Oncorhynchus tshawytscha*), summer steelhead (*Oncorhynchus mykiss*), Coho Salmon (*Oncorhynchus kisutch*), and Sockeye Salmon (*Oncorhynchus nerka*). However, the construction of dams and irrigation storage reservoirs has precluded anadromous fish access. Kachess Dam is a passage barrier for returning anadromous fish, and no anadromous fish species are present in the reservoir or in tributaries upstream of the dam (Reclamation 2019). Downstream from the dam, the Yakima River watershed supports anadromous runs of salmon and steelhead, as well as resident species.

The following are some of the fish species known to occur in Kachess Reservoir: Kokanee Salmon (*Oncorhynchus nerka*), Mountain Whitefish (*Prosopium williamsoni*), Pygmy Whitefish (*Prosopium coulterii* [Washington State sensitive species]), Cutthroat Trout (*Oncorhynchus clarkii*), Rainbow Trout (*Oncorhynchus mykiss*), Brook Trout (*Salvelinus fontinalis* [nonnative]), and Bull Trout (*Salvelinus confluentus*). Other fish species potentially present are described in the **Biological Resources Report** in **Appendix B**. Bull Trout, Middle Columbia River steelhead, and Pygmy Whitefish are discussed under special status species.

Terrestrial Ecosystems and Wildlife

The analysis area is located in the North Cascades Highland Forests ecoregion (Reclamation 2019). This ecoregion encompasses the headwaters of the Yakima River to its confluence with the Kachess River at Lake Easton. It is characterized by glaciated valleys, narrow-crested ridges, and high-relief peaks approaching an elevation of 8,000 feet.

Vegetation in the project area downstream from Kachess Dam consists of mature mixed-coniferous and deciduous forest dominated by Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*). Additional trees in the canopy are lodgepole pine (*Pinus contorta*), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and western white pine (*P. monticola*). Black cottonwoods (*Populus trichocarpa*) are present in more mesic slopes and draws in the forest. Additional species and LANDFIRE terrestrial ecosystem types for the project area are summarized in the **Biological Resources Report** in **Appendix B**.

Forest habitats are used by elk and deer, small mammals, raptors, owls, grouse, and a wide range of songbirds. Riparian areas and wetland complexes are used by many species, including bear, ungulates, small mammals, reptiles, amphibians, cavity-nesting birds, raptors, and songbirds. The reservoir and shoreline's fringe vegetation are used by multiple waterfowl and shorebird species. Habitat fragmentation near the reservoir ranges from moderate to severe because of Interstate 90, transmission lines, residential areas, and timber harvest.

Special Status Species

ESA consultation would be needed for northern spotted owl, Bull Trout, and steelhead effects, including effects on designated critical habitat. ESA consultation for the project is in progress and would be completed prior to project implementation. For details, see the biological assessment (BA) for the project (Reclamation 2021e).

In June 1998, the USFWS listed the Columbia River Basin distinct population segment of Bull Trout as threatened under the ESA. WDFW also recognizes the Kachess Reservoir Bull Trout stock as critical status. The Bull Trout inhabits Kachess Reservoir above the dam and Kachess River below the dam, though these populations are isolated from each other. NOAA listed the Middle Columbia River steelhead as threatened on March 25, 1999 (64 *Federal Register* 14517) and January 5, 2006 (71 *Federal Register* 833) then updated on April 14, 2014 (79 *Federal Register* 20802). This distinct population segment includes naturally spawned anadromous steelhead originating below natural and human-made impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River.

The Pygmy Whitefish is a Washington State sensitive species and a species of greatest conservation need under the State Wildlife Action Plan. The Pygmy Whitefish is most commonly found in cool lakes and streams of mountainous regions. In lakes, the Pygmy Whitefish is frequently found in deep, unproductive waters. The Pygmy Whitefish, particularly in smaller lakes, is vulnerable to exotic fish species' introductions and declining water quality (Hallock and Mongillo 1998; WDFW 2012). Pygmy Whitefish is documented in Kachess Reservoir and downstream of the dam.

Kachess Dam has no fish passage facilities. The lack of passage has isolated local populations of Bull Trout, Pygmy Whitefish, and other native fish. This has reduced or eliminated interconnectedness and the exchange of genetic material among populations. It also has prevented the recolonization of populations diminished by catastrophic natural events (Reclamation 2019).

The northern spotted owl was listed as threatened under the ESA in 1990. This was due to widespread habitat loss and inadequacy of existing regulatory mechanisms to provide for its conservation (50 CFR 17; USFWS 1990). Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the northern spotted owl can be found in the revised recovery plan (USFWS 2011).

Baseline surveys were conducted during the 2021 breeding season (Harris Environmental Group 2021). No northern spotted owls were detected. Individual barred owls were detected on the April 14, 2021, and May 26, 2021, survey visits. However, these detections and a lack of subsequent detections at the same survey points would indicate barred owls were not nesting in the area; these owls were likely dispersing through the analysis area. A primary threat to the northern spotted owl is competition for habitat with barred owls; the presence of larger and more aggressive barred owls in potential habitat reduces the likelihood of northern spotted owl breeding occupancy.

Two Washington State sensitive vascular plant species—western ladies' tresses (*Spiranthes porrifolia*) and water awlwort (*Subularia aquatica*)—have been recorded near Kachess and Keechelus Reservoirs (DNR 2014a). Western ladies' tresses grow along streams, but the mapped location for this species in the Kachess Reservoir basin is outside the analysis area. Water awlwort is a submerged aquatic plant that exists near the margins of freshwater lakes and ponds and on streambanks. It has been documented near Lake Easton south of Kachess Reservoir (DNR 2014b). One sensitive nonvascular plant—luminous moss—is documented in the Swamp Lake wetland complex near

Kachess Lake Road. Neither of these sensitive plants or the moss is anticipated to occur in the areas of project disturbance. No other sensitive species are likely to exist in the analysis area (DNR 2014a).

3.6.4 Environmental Consequences

Alternative A—No Action Alternative

Under the No Action Alternative, there would be no change in aquatic or terrestrial ecosystems. Plant and animal species in the analysis area would not be affected. No trees or vegetation would be removed, and wetlands would not be removed or modified. For the purposes of this analysis, it is assumed the No Action Alternative would result in no changes to the baseline conditions for aquatic and terrestrial ecosystems or species, including special status species, in the analysis area.

Alternative B—Proposed Action

The proposed project could potentially remove or modify 0.12 acres of wetland features and 0.22 acres of open water where the permanent access road crosses these features, and an open bottom culvert is installed. The project would require a CWA 404 permit and an associated dewatering plan, erosion-control plan, replanting plan, and BMPs. As noted in **Section 3.4**, above, Reclamation would apply for a CWA permit from the USACE and obtain a HPA from WDFW prior to construction. Reclamation also would follow all BMPs required under those permits. The project possibly would also require a CWA 401 water quality permit. Conditions of the CWA permits and these plans would avoid, minimize, or mitigate impacts on wetlands and aquatic habitats.

Project activities occurring in or near aquatic ecosystems could degrade aquatic habitats or directly affect aquatic species. Impacts could include construction disturbances, changes in aquatic habitat connectivity, and habitat degradation. There may be temporary interruptions in flow and fish passage during construction, but flow and fish passage would be restored once the culvert is installed. Reclamation does not anticipate reservoir-level restrictions to occur, and construction of the extension and lining of the outlet works would be timed to avoid major issues with water deliveries. Reclamation plans to comply with maintaining minimum flows through the dam throughout the project, as established through discussions with stakeholders, including WDFW, the Yakama Nation, the USFWS, the NMFS, and various irrigation districts. Impacts on aquatic species would largely be dependent on the timing of construction activities, the presence of the aquatic species, and the implementation of BMPs. Project design features to minimize impacts on fish would also avoid, minimize, or mitigate impacts on aquatic species (see the **Biological Resources Report** in **Appendix B**).

Project activities that modify or remove vegetation would affect terrestrial ecosystems and could impact terrestrial wildlife that occupy them. The Proposed Action could remove or modify approximately 11 acres of terrestrial vegetation types; this includes 4 acres of permanent disturbance and approximately 7 acres from temporary disturbances. The approximate 7 acres would be regraded and revegetated with native seed mix and native plants. The total approximate 11 acres subject to disturbance are a small portion of available suitable habitat surrounding the project area. Due to the small portion of removed or disturbed vegetation, revegetation of temporary disturbance areas, and implementation of project design features and BMPs (see the **Biological Resources**

Report in **Appendix B**), the proposed project is not anticipated to have significant adverse impacts on terrestrial ecosystems and wildlife.

ESA consultation would be needed for northern spotted owl, Bull Trout, and steelhead effects, including effects on designated critical habitat. ESA consultation for the project is in progress and would be completed prior to project implementation. For details, see the BA for the project (Reclamation 2021e). No sensitive plants or moss are anticipated to exist in the areas of project disturbance; therefore, they would not be impacted. Impacts on Pygmy Whitefish would be avoided or minimized through project design features, BMPs, and ESA consultation mitigation measures for listed fish (see the **Biological Resources Report** in **Appendix B**).

In consultation with the USFWS, NMFS, and WDFW, mitigation measures would be developed, where appropriate, to minimize adverse impacts on special status species and their habitats. Clearing and grubbing of trees during the first phase of the project between April and October 2023 could result in disturbance effects on northern spotted owls, if they are present. Fulfilling Section 7 ESA consultation requirements with the USFWS and implementing conservation measures would address adverse effects on northern spotted owls and the removal of potential habitat (see Reclamation 2021e).

There is the potential for a disruption to fish behavior and a temporary modification to fish and aquatic habitat during flow shutoff periods. Most fish and some aquatic species would be able to move to deeper water as flows begin to lower; however, there may be some species that become isolated in pools. As part of the project and ESA Section 7 consultation, Reclamation would work with the NMFS, USFWS, WDFW, Yakama Nation, and others to coordinate fish salvage efforts. This would ensure fish that could become stranded due to low-flow conditions in the downstream portion of Kachess River could be salvaged and relocated to appropriate deep water. Fish salvage and handling could still result in some harm and possible mortality of aquatic species.

Implementation of project design features, BMPs, and ESA Section 7 consultation measures would address impacts on federally recognized species in the project area (see the **Biological Resources Report** in **Appendix B;** Reclamation 2021e).

3.7 Noise and Vibration

3.7.1 Analysis Area

The analysis area is the Kachess SOD project area footprint. This includes the proposed downstream toe approach road, areas slated for tree clearing and grubbing, and contractor use areas along the west side of the outlet channel (**Figure 1-1**). In addition, because vibrations and sound waves that create noise propagate outward from their source, the analysis area also includes the lands surrounding the project area out to 0.25 miles. This includes the small, unincorporated community of Easton, Washington, located 0.2 miles south of the dam's toe.

3.7.2 Affected Environment

The predominant baseline community noise sources in the analysis area involve traffic noise from four-lane Interstate 90 and the two-lane frontage West Sparks Road, air traffic related to the use of Easton State Airport, and rural residential activities in and around the community of Easton. There are also sparse, single lane, paved and unpaved roads used for access within the analysis area. Interstate 90 is heavily used by truck traffic year-round. The Washington State Department of Transportation (WSDOT)-managed Easton State Airport is generally open from June 1 to October 1 and is visited by roughly 30 aircraft per month during these months (WSDOT 2021).

The unincorporated community of Easton does not have its own sound ordinances. For this analysis, the Board of County Commissioners County of Kittitas, State of Washington, Ordinance No. 2016-002, Sections 9.45.030 and 0.45.040 will be apply to any implementation actions for this project.

Vibrations from construction equipment and activity can cause windows, doors, and items on shelves to rattle in buildings near active construction. Vibrations also have the potential to cause damage to buildings (OSHA 2020).

There are no sources of ongoing vibration in the analysis area. Occasional construction activities, however, may involve vibration, depending on the type of equipment, construction methods, and ground conditions. Vibrations can spread through the ground and will diminish in strength with distance from the source of the vibrations. Ground vibrations from construction activities can be audible and felt. Vibrations may have a low amplitude and long duration, such as vibrations from excavation equipment, bulldozing and grading equipment, and tree clearing and grubbing (California Department of Transportation 2013).

3.7.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on noise and vibration are the following:

- Changes to the ambient community sound level from construction machine and equipment noise
- Changes to the ambient traffic sound level from construction traffic noise
- Changes to the vibration

Alternative A—No Action Alternative

Under the No Action Alternative, Reclamation would not conduct the Proposed Action. Accordingly, the dam and spillway would not be improved, and no changes to the operation of the Kachess Dam would occur. Therefore, the No Action Alternative would result in noise and vibration conditions that are the same as those currently experienced.

Alternative B—Proposed Action

Under the Proposed Action, Reclamation would perform improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction of the improvements would create short-term and localized noise impacts. The loudest construction noises would stem primarily from work conducted at the toe of the dam and from the construction of the new access road.

Reclamation anticipates that large bulldozers and excavators used in the construction of the access road would be the two loudest types of equipment used in the implementation of this project. In accordance with Kittitas County's ordinances, noises generated by this project would fall under exemption 9.45.040(4), which states, "Sounds created by emergency equipment and emergency work necessary in the interests of law enforcement or of the health, safety or welfare of the community" (Kittitas County 2021). The dam improvements are necessary to reduce the risk of dam failure and to ensure the health, safety, and welfare of the community. Therefore, even though the Proposed Action would create noise, the project would fall under the exemption.

3.8 Transportation and Traffic

3.8.1 Analysis Area

The analysis area for transportation and traffic includes East Kachess Road to Kachess Dam and West Sparks Road from its intersection with East Kachess Road to its intersection with Interstate 90 (**Figure 3-4**, Transportation Features, in **Appendix A**). This analysis area encompasses residential, commercial, and recreation access that could be affected by construction haul routes used during dam construction.

3.8.2 Affected Environment

Transportation

The southern portion of the Kachess Reservoir and the dam is bounded to the east and west by two USFS-maintained roads. These are National Forest System (NFS) Road 4828 on the west side and NFS Road 4818 on the east side, which turns into Kachess Dam Road. These roads intersect West Sparks Road south of the dam, which parallels Interstate 90 (**Figure 3-4**). Kachess Dam Road continues for approximately 0.75 miles north of West Sparks Road and ends before the dam at the southeast side. In addition to providing dam access via Kachess Dam Road, West Sparks Road provides access to two residential areas on either side of Kachess Dam Road and to Interstate 90. An on-ramp to Interstate 90 is located on West Sparks Road approximately 0.6 miles southeast from the Kachess Dam Road and West Sparks Road intersection.

Kachess Dam Road is approximately 4.25 miles and parallels the eastern side of the Kachess Reservoir. It is used for access to Kachess Dam and recreation access to the Kachess Ridge Trailhead, East Kachess Group Site campground, and USFS lands. West Sparks Road is used for residential and commercial access and has a speed limit of 35 miles per hour. It is a two-lane road with narrow shoulders and is approximately 1.2 miles between NFS Road 4828 and the on-ramp to Interstate 90.

Traffic

The level of service (LOS) is used in traffic analyses to rate roadway segment operations using a ratio of traffic volume to road capacity. The LOS is also used to determine how well a transportation facility is operating from a traveler's perspective (WSDOT 2017). LOS ratings for the state of Washington range from A to F, with A being the most free flowing and F being the least free flowing (WSDOT 2017). As shown in **Table 3-4**, the LOS rating decreases as a result of higher traffic volumes, decreased road capacity, or both, which result in greater delays.

All roads in the analysis area are in Kittitas County. The Kittitas County LOS policy for rural roads is LOS C or better (Kittitas County 2016). There are no existing traffic analyses for the analysis area. The closest analyses are the Marrian Meadows Environmental Impact Statement Traffic Impact Study, approximately 1.8 miles southeast of the project area, and the Love's Travel Stop Traffic Impact Analysis, which studies an area adjacent to the West Sparks Road on-ramp to Interstate 90. In both analyses, West Sparks Road near the Interstate 90 on-ramp had an estimated LOS of A, with average peak hour delays between 8.7 and 9.3 seconds (TENW 2016; SCJ Alliance 2019). Since traffic is likely greater near the on-ramp than the project area, it can be assumed that Kachess Dam Road also has a baseline LOS of A.

Table 3-4. LOS Descriptions

LOS	Description	Un-signalized Average Delay Range (seconds)
A	Free-flowing conditions	Less than 10
B	Reasonably unimpeded conditions	11–15
C	Stable operating conditions, but individual motorists are affected by the interaction with other motorists	15–25
D	Less stable operating conditions where a small increase in traffic flow may cause substantial increases in delay and decreases in traffic speed	25–35
E	Unstable operation and significant delay	35–50
F	Over capacity, with delays	Greater than 50

Sources: TENW 2016; WSDOT 2017

3.8.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on transportation and traffic are the following:

- Changes in the LOS on roads
- Changes in access within the analysis area

Alternative A—No Action Alternative

Under the No Action Alternative, there would be no change in the LOS on roads. Drivers would not experience delays or frustrations while accessing commercial or residential areas near the dam related to construction activities at the dam. No planned construction activities would occur; however, the existing dam operations would continue to operate and require routine maintenance. Operation and maintenance activities would involve pickup trucks entering and leaving the project area on the days when maintenance occurs.

Given the current internal erosion of the dam, its failure is expected to occur in the future and would be an emergency situation. Reclamation and other agency staff responding to the situation would have an immediate and potentially sustained impact on traffic both during the emergency and until repairs are made. The timing and extent of potential impacts on transportation and traffic from extraordinary emergency cleanup and repairs would depend on the nature, extent, and timing of these activities. For the purposes of this analysis, it is assumed the No Action Alternative would result in no changes to the baseline LOS or access in the analysis area.

Alternative B—Proposed Action

Under the Proposed Action, Reclamation would construct an access road between the dam and Kachess Dam Road, which becomes NFS Road 4818, as shown in **Figure 3-4**. This access road would serve two haul routes. One route would be used for hauling trees during tree clearing, and the other route would be used for construction vehicles and hauling of construction materials. From the end of the access road, the tree haul route would use West Sparks Road to the Interstate 90 west on-ramp and would end at the WSDOT Stampede Pass stockpile location. This location is on USFS land; the WSDOT uses the land through a special-use permit. From the end of the access road, the construction vehicle route would use West Sparks Road to the Interstate 90 east on-ramp to access areas in Cle Elum or Ellensburg, Washington.

Reclamation would need to apply for a special-use permit and a road permit from the USFS to use Kachess Dam Road, where it becomes NFS Road 4818. In addition, Reclamation is in negotiation with the USFS and Washington State Parks for a permit to relocate the snow park lot at the gate of the dam access road to a location where Kachess Dam Road intersects with the Bonneville Power Administration power line (see the **Utilities Resources Report** in **Appendix B** for the location of this power line).

Compared with the No Action Alternative, there would be an increase in heavy vehicle traffic using West Sparks Road and Kachess Dam Road under the Proposed Action. During daytime construction activities and the hauling of construction materials, there could be a temporary decrease below LOS A; this would be due to an increased volume of vehicles above baseline conditions. The LOS likely would not decrease below LOS C; this is because construction vehicle access on the haul routes would not require non-construction vehicles to stop. Where construction vehicles ingress and egress to and from the project area using Kachess Dam Road, delays could be 15 to 25 seconds or less, which equates to LOS C or better. Drivers accessing commercial and residential areas from West Sparks Road could experience delays when encountering heavy construction vehicles.

Construction activities would occur up to 10 hours a day, 5 days per week. Nighttime work would not occur except in instances of delay, such as from inclement weather, and would also not exceed 10 hours per day unless a major delay occurs. The construction schedule would include:

- Tree clearing and hauling from May 31 to July 26, 2023
- Construction of contractor use areas from May 31 to July 11, 2023
- Construction of the access road between late June and late July 2023
- Steel pipe delivery from May 31 to June 6, 2023

- Excavation of the conduit extension from January 10 to February 6, 2024
- Pipe installation and concrete delivery from March 18 to June 9, 2024
- Sand delivery for the conduit extension between mid-May and mid-June 2024

The most noticeable impacts on access and traffic would be during the hauling of imported materials to the project site. Less severe impacts would result from the transportation of heavy construction vehicles, such as excavators, dozers, and fuel trucks, to and from the project area. This is because they would not be used for hauling and would remain in contractor use areas, as needed, during construction activities. These time lines may have some overlap with construction efforts on the I-90 Highway Expansion Project (see **Table 3-1**), but most of the construction on the highway would be sufficiently west of the traffic routes needed for this project. Therefore, the cumulative effects on traffic patterns in the region should be minimal.

Tree hauling would require a 40- to 45-foot commercial truck with a trailer to haul 500 trees off-site to the WSDOT Stampede Pass stockpile location. Since only one or two trees would be hauled at a time, this would require at least 250 round trips, or at least eight trips per day. At this time, Reclamation does not anticipate any changes in the LOS as a result of tree hauling.

Construction for the access road would require less than eight construction vehicles, including a dozer; front-end loader; and water, fuel, and 40-ton, off-road trucks. In addition, two roller compactors would be used for road fill and gravel surfacing. Reclamation would use similar equipment to construct the contractor use areas. The equipment would remain in the project area until the completion of the access road.

Impacts on traffic and access would be limited to the times when these construction vehicles and equipment are transported to and from the project area. During these times, the LOS could be reduced below A (but no less than C), and drivers could be frustrated by delays for access to residential, commercial, and recreation areas accessed from West Sparks Road. After completion of the project, the access road would remain as a permanent road, which would provide improved future access to the west side of the dam, near where the spillway is located.

Phase 1 and phase 2 of construction would occur between January and October 2023 and would include delivery of the steel pipe, the construction of the contractor use areas and access road, and the tree hauling. All these activities would occur between May 31 and July 6, 2023, which would be the greatest overlap of construction activities during the construction schedule and would have the greatest impact on traffic and access in the analysis area. During phases 1 and 2 of construction, 5 to 22 haul trips could occur per day, and 1 to 18 pickup trucks could access the project area per day. With a greater volume of construction vehicles used per day, there would be more traffic delays. and the LOS would decrease. However, the use of construction vehicle trips during phases 1 and 2 would not cause a decrease in the LOS below level C. This is because, as mentioned above, access for the construction vehicles would not require non-construction vehicles to stop.

Phase 3 of construction would occur between January 2024 and July 2025 and would include excavation of the conduit, sand delivery, and concrete delivery. During phase 3 of construction, 5 to 18 haul trips could occur per day, and 1 to 30 pickup trucks could access the project area per day.

Similar to the overlapping construction activities and hauling mentioned above, overlapping sand and concrete haul trips would cause a noticeable increase in traffic. However, the LOS would not decrease below C. This is because, as mentioned above, access for the construction vehicles would not require non-construction vehicles to stop.

The weights of trucks used for trips to and from commercial sources would not exceed the maximum gross weights required under Revised Code of Washington 46.44.041. However, it is likely that damage to Kachess Dam Road would occur after the almost 3-year construction period, due to the high volume and consistent use of heavier-than-average vehicles. This damage could include potholes, ruts, or broken pavement. Deteriorated roadway surfaces can lead to passenger vehicle damage and a diminished driving experience. Kachess Dam Road would be rehabilitated after construction and repaired as needed during construction.

3.9 Cultural Resources

For a detailed discussion of cultural resources in the project area, see the **Cultural Resources Survey Report** (Reclamation 2021f).

3.9.1 Analysis Area

The analysis area for cultural resource is equivalent to the area of potential effect (APE) determined via consultation between Reclamation and the DAHP. The APE encompasses the area where potential direct or indirect impacts on archaeological or architectural resources could occur. In this instance, the APE is the project area footprint where ground disturbance or visual changes, or both, could impact cultural resources.

3.9.2 Affected Environment

Pursuant to Section 106 of the NHPA (36 CFR 800), Reclamation is required to identify historic properties that may be impacted by federal undertakings. Cultural resources are broadly defined as the remains of past human activity. Cultural resources may include resources such as archaeological sites, historic buildings and structures, and places of traditional importance and use by Native American groups. Those cultural resources eligible for or listed on the National Register of Historic Places (NRHP) are historic properties.

In compliance with NHPA Section 106, Reclamation completed several studies to identify cultural resources in the project area. These studies determined that there are no known sacred sites or ITAs (see **Appendix B**), but there is the potential for impacts on archaeological resources and the built environment.

Native American groups have occupied Washington's Yakima River basin since at least 12,000 before the present. Rivers served as a focal point for habitation and resource collection from the region's earliest occupation to the present day. Archaeological sites dating from the precontact period (12,000 to 4500 before the present) to contact between Native Americans and Euro-Americans in the nineteenth century reflect this long-term focus on riverine environments and resources. Early sites are relatively small, reflecting the highly mobile lifestyle of Native Americans during the precontact period. Over time, habitation sites became larger, and permanent villages were established along rivers, particularly at confluences. When Euro-Americans arrived in the Yakima River basin, Native American groups primarily resided in large, permanent villages during the winter and dispersed to smaller habitations during the summer months.

In the early nineteenth century, fur traders were some of the first Euro-Americans to travel through what is now Kittitas County. However, the discovery of gold in 1854 brought a rush of settlers to the Pacific Northwest. The influx of Euro-Americans, coupled with dissatisfaction with treaty terms, resulted in conflict between Native Americans and settlers. The Yakama Indian Wars started in 1855 and continued until the Yakama Nation was forced onto its reservation in 1859. The Kachess Reservoir area is ceded territory under the Yakama 1885 treaty. Accordingly, local tribes have continued to use the area for traditional uses under treaty rights.

Almost immediately upon arrival to the Kachess Reservoir area, Euro-Americans began transforming the landscape through the extraction of natural resources. Mining, railroads, and road development expanded to facilitate the timber industry, which was in turn driven by increasing settlement of the region. A farmers' cooperative incorporated as the Cascade Canal Company. In 1904, it built a timber crib dam at the south end of Kachess Reservoir to support irrigation. Reclamation purchased the Cascade Canal Company in 1907 and constructed a new, much larger Kachess Dam in 1912, inundating the prior dam. Reclamation has installed and repaired features of the dam since its original construction.

Previous cultural resource investigations completed in the project area's vicinity, as well as surveys completed specifically for this undertaking, have identified two cultural resources that are eligible for listing on the NRHP: a large, multicomponent archaeological site (45KT1014) and Kachess Dam itself (DAHP 700865). Two other cultural resources are located within the project area but have been determined not eligible for listing on the NRHP. These include a historic artifact scatter likely dating to the construction of Kachess Dam and the Kachess Reservoir generator, bathroom, and storage building. The storage building is less than 50 years old and therefore not considered a historic property under the NHPA.

Site 45KT1014 is a large, multicomponent archaeological site of tribal importance. It consists of precontact materials consistent with a village site and historic artifacts and features associated with the original crib dam (1904) and later construction of the current Kachess Dam. The site boundary encompasses artifacts and features within the drawdown zone, inundated much of the year, and the project area. A 1912-era gravel pit associated with site 45KT1014 was documented as part of the cultural resource investigation completed for this proposed project, and a precontact isolate originally recorded as a separate site (45KT4384) was identified. No artifacts or features associated with the site were identified during subsurface testing within the site boundary and project area.

Kachess Dam (DAHP 700865) has previously been determined eligible for listing on the NRHP due to its association with the Yakima Project, one of the early regional irrigation projects undertaken by Reclamation, and its design and construction qualities. The earthfill embankment dam remains largely unchanged, although the original outlet works, including the wing walls, headwall, and outlet channel, have been altered during prior maintenance and repair efforts. Despite previous modifications, the dam's design and materials remain largely intact; it also maintains the historic use and association with Reclamation's Yakima Project.

3.9.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on cultural resources are the following:

- The extent and location(s) of activities that may be incompatible with maintaining the physical integrity or setting of sensitive cultural resources and traditional-use areas

Alternative A—No Action Alternative

Under the No Action Alternative, Reclamation would not perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Therefore, there would be no short-term impacts on the historic Kachess Dam and its associated features. There also would not be the potential for short-term impacts on other resources within or adjacent to the proposed project area.

Since the seepage and internal erosion issues would continue, the threat of dam failure and subsequent catastrophic flooding would increase over time. The failure of the dam itself would result in major impacts on the historic Kachess Dam, which would likely mean it would no longer retain integrity for eligibility to the NRHP. Additionally, downstream flooding could impact other cultural resources, including cultural deposits and the 1912 gravel pit associated with 45KT1014.

Alternative B—Proposed Action

Under the Proposed Action, Reclamation would modify the dam through several improvements, construct an access road, and develop staging and construction areas during the dam's modification. The modifications and improvements would directly impact features of the dam that make it eligible for listing on the NRHP. The existing wing walls and headway would be removed and replaced. The outlet conduit would be extended approximately 100 feet, and fill would be added over the extension. While the wing walls and headwalls have been previously modified, much of the original historic material used during construction is present.

These elements of the dam contribute to the overall historic fabric and integrity for NRHP eligibility. Reclamation has determined that the modifications to the dam would have an adverse effect on the Kachess Dam historic property (as defined by the NHPA; 36 CFR 800.5), which requires mitigation. Reclamation is currently consulting with the DAHP on mitigation measures for this adverse effect.

No other historic properties would be adversely affected during construction and modification of the Kachess Dam. A cultural resource investigation determined that no artifacts or features associated with 45KT1014 are present within the project area. Additionally, the 1912 borrow pit associated with 45KT1014 would be avoided during project activities. No other cultural resources eligible for listing on the NRHP are present within the project area.

3.10 Socioeconomic Resources

3.10.1 Analysis Area

The socioeconomic analysis area consists of Kittitas and Yakima Counties in Washington. While the project area occurs in Kittitas County, Yakima County, located directly south of Kittitas County, is included for the socioeconomic analysis due to the hydrologic ties (see the **Water Resources Report** in **Appendix B**) with the area and the resulting social and economic ties. This analysis presents county-level data to describe social and economic conditions. The economic component of this analysis relies on Reclamation's Kachess Dam Safety of Dams Economic Benefit Analysis Report (Reclamation 2021g).

3.10.2 Affected Environment

Population

In 2019, the total population was 45,897 for Kittitas County and 249,697 for Yakima County (Headwaters Economics 2021). From 2010 to 2019, both counties experienced population growth; the population increased 15.1 percent in Kittitas County and 5.6 percent in Yakima County (Headwaters Economics 2021).

Income and Employment

In 2019, the largest Kittitas County employment sectors were accommodation and food services, government, retail trade, construction, and health services (BEA 2019). Kittitas County's economy has been focused on state and local education, with Central Washington University being a large employer in the local economy. However, construction was the industry adding the second-highest number of jobs after state and local government education. Irrigated agriculture has been historically important and remains important in the region. In 2019, agriculture and the wholesale trade of nondurable goods (primarily Timothy hay) provided 7.0 percent and 4.3 percent, respectively, of total covered employment in Kittitas County (Employment Security Department 2020a).

In Yakima County in 2019, the largest employment sectors were agriculture, forestry and fishing, health services, government, retail trade, and manufacturing (BEA 2019). Agriculture has been the staple of the economy over the last 100 years. In 2019, agriculture provided 27.3 percent of all jobs countywide, but it supplied only 21.8 percent of total wage income. This is due to the seasonal nature of agricultural jobs (Employment Security Department 2020b). In addition, construction employment was the eight-largest sector, providing 5,481 jobs (BEA 2019).

Social and Economic Benefits from Kachess Dam

Water infrastructure plays an important role in the local social and economic conditions. A wide range of economic activities, such as those associated with irrigation, agricultural use, and domestic and commercial use, is supported by water infrastructure, including Kachess Dam and Reservoir. Social and economic benefits provided by Kachess Dam include supporting irrigation, recreation, fish and wildlife, power, municipal and industrial water supply, and flood control, in various direct and indirect ways.

Reclamation performed a Kachess Dam SOD economic benefit analysis to quantify the total economic benefits to the nation, by category, provided by Kachess Dam and Reservoir (Reclamation 2021g). A summary of the detailed benefits can be found in the **Socioeconomic Resources Report** in **Appendix B**.

3.10.3 Environmental Consequences

Indicators and Assumptions

The indicators for identifying impacts on socioeconomic resources are the following:

- Employment, expenditures, and income levels and anticipated employment demands
- The social and economic benefits from Kachess Dam
- Construction impacts on quality-of-life factors

Alternative A—No Action Alternative

Under the No Action Alternative, Reclamation would not perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction activities would not occur, and short-term, localized increases in employment and expenditures would not occur.

There would be no impacts on social and economic benefits provided by Kachess Dam and Reservoir, unless dam failure occurs. Should dam failure occur, social and economic benefits would be reduced or eliminated. For instance, potential permanent changes to water deliveries to irrigation districts, tribes, and the downstream public could occur. The specific level of impacts on the benefits cannot be determined here; it would depend on the level to which the remaining water supply would provide for existing uses.

In addition to lost benefits following dam failure, damages from flooding would occur. **Table 3-5**, below, provides total estimated property damages in millions of 2018 dollars (rounded to the nearest $100,000). The figures provided were generated by using inundation boundary geographic information system data and software developed by the Federal Emergency Management Agency. The Federal Emergency Management Agency's HAZUS tool is a nationally applicable standardized methodology and damage assessment software program for analyzing potential losses from floods, hurricane winds, and earthquakes. The figures below are only estimates, but they provide a sense of the magnitude of damages expected to occur in the event of a catastrophic failure.

While these figures provide an idea of damage, they do not quantify the cost of emergency services, environmental damages, disruption of government services, cleanup, disruption of people's lives, or other categories of loss that would follow a Kachess Dam failure. Data constraints prevent such quantification. More information on potential impacts can be found in the **Public Health and Safety Resources Report** in **Appendix B.**

Table 3-5. Quantified Damage (millions)

Property Category	Damages in 2018 Dollars
Building-related losses	$9,049.80
Transportation	$3,101.00
Essential facilities	$74.10
Utilities and other infrastructure	$325.60
Vehicles	$216.50
Agriculture	$181.00
Total	**$12,948.00**

Source: Reclamation 2021g

Alternative B—Proposed Action

Under the Proposed Action, Reclamation would modify the dam through several improvements, construct an access road, and develop staging and construction areas during the course of modifying the dam.

Construction activities would occur up to 10 hours a day, 5 days per week. Work would not exceed 10 hours per day unless a major delay occurs. Nighttime work also would not occur except in instances of delay, such as from inclement weather. The construction schedule would include:

- Tree clearing and hauling and construction of contractor use areas from May to July 2023
- Construction of the access road between late June and late July 2023
- Steel pipe delivery from May to June 2023
- Excavation of the conduit extension from January to February 2024
- Pipe installation and concrete delivery from March to June 2024
- Sand delivery for the conduit extension between May and June 2024

Construction activities could affect the quality of life for residents through increased traffic, additional noise, visual impacts, and interruptions of recreation access. Impacts on the quality of life could occur during construction and would be short term and localized.

Compared with the No Action Alternative, proposed construction would result in direct, short-term increases in employment and the associated economic contributions to the local economy. This would be due to spending on project materials and employment. Total person-years employment directly supported by the project is estimated at 44. Direct employment by Reclamation is not considered in this estimate; it would represent support for additional employment. The project would support an estimated additional 99 indirect jobs. The creation of jobs and any expenditures related to the project would result in direct, short-term potential increases in employment and the associated economic contribution to the local economy.

Reclamation performed a Kachess Dam SOD economic benefit analysis to quantify the total economic benefits to the nation, by category, provided by Kachess Dam and Reservoir (Reclamation 2021g). The report identifies five categories of economic benefits: irrigation, recreation, power generation, municipal and industrial, and fish and wildlife. It is estimated that these categories provide an estimated total of $61.47 million annually. Because of the timing and design of construction activities, Kachess Dam would remain at its current capacity throughout construction, and it would continue to provide most of the social and economic benefits.

Under the Proposed Action, there would be socioeconomic benefits associated with a long-term increase in the reliability of the dam. These include continued water deliveries to irrigation districts, tribes, and the downstream public; long-term public health and safety risk reduction; and associated cost savings from avoiding erosion and dam failure.

Chapter 4. Consultation and Coordination

4.1 Introduction

This chapter describes the consultation and coordination among Reclamation and other federal, state, and local agencies; Native American tribes; and the public in preparing this EA. Reclamation followed the public involvement requirements documented in the CEQ regulations implementing NEPA (40 CFR 1501.9 for scoping, and 1506.6 for public involvement). NEPA and associated laws, regulations, and policies require Reclamation to make diligent efforts to involve the public in preparing and implementing their NEPA procedures. In other words, the public should be involved as much as possible, on a continuing basis throughout project planning, to build consensus for the final decision.

The requirement for public notice varies by the level of NEPA compliance. Public notice of the availability of EAs and findings of no significant impact is required, though the requirements depend on the proposed action, potential issues, and public interest. Public notice may include posting to a regional website, posting to community bulletin boards, direct mailings, or other methods (Reclamation 2012). As summarized in the public scoping report (Reclamation 2021a), Reclamation involved the public, tribes, and other agencies through news releases, the virtual public meeting room, a live question-and-answer video teleconference session, and updates on Reclamation's project website.[12]

4.2 Consultation and Coordination

Federal laws require Reclamation to consult with certain federal and state agencies, other entities, and Native American tribes during the NEPA decision-making process (40 CFR 1502.24). Reclamation is also directed to integrate NEPA requirements with other environmental review and consultation requirements to reduce paperwork and delays (40 CFR 1500.4-5).

4.2.1 Participating Agencies

At the outset of the EA process, Reclamation, as the lead agency, asked federal, state, and local agencies and tribes if they would like to be a part of the NEPA process. Entities that desired to participate in the design and EA process became participating agencies, because they have been engaged with the project's design and planning since its inception. Reclamation will continue coordinating with each agency and tribe throughout the NEPA process. Agency and tribal status are as follows:

[12] The project website can be accessed at https://www.usbr.gov/pn/programs/sod/kachess/index.html.

Participating Agencies

- USACE
- USFWS
- Kittitas County
- Confederated Tribes and Bands of the Yakama Nation (Yakama Nation)
- Confederated Tribes of the Colville Reservation (Colville Tribe)
- NMFS/NOAA
- DAHP
- Ecology
- WDFW
- DNR

Reclamation has sent correspondence to and held meetings with the cooperating and participating agencies throughout the project design and EA development process and will continue through development of the finding of no significant impact. The purpose of these outreach efforts was to inform and receive input from cooperating and participating agencies respective to their jurisdiction, special expertise, or interests. **Table 4-1** summarizes the outreach with the cooperating and participating agencies throughout the project design and EA development process.

Table 4-1. Participating Agency Meetings

Meeting Purpose	Date	Participating Agency Representation
BA Coordination	November 2021	USFWS, NMFS, Ecology
CWA Permitting Coordination	November 2021	USACE
CWA Permitting Coordination	November 2021	Ecology
CWA Permitting Coordination	December 2021–January 2022	WDFW
CWA Permitting Coordination	December 2021–January 2022	WDFW
CWA Permitting Coordination	December 2021	USACE, Ecology

4.2.2 Government-to-Government Consultation

EO 13175 requires federal agencies to coordinate and consult on a government-to-government basis with sovereign Native American tribal governments whose interests may be directly and substantially affected by activities on government-administered lands. Coordination and consultation with Native American tribes is part of the NEPA scoping process. To date, Reclamation has not received a request for formal government-to-government consultation from the tribes.

Outreach and coordination will continue throughout the EA development process. Continued coordination will help ensure that management actions are consistent with rights retained by tribes and that the concerns of tribal groups are considered. Reclamation will engage in formal government-to-government consultation if and when either tribe requests it.

4.2.3 State and Tribal Historic Preservation Office Consultation

Reclamation, acting as the lead agency for the NHPA compliance for the project, consulted with the Washington DAHP, Yakama Nation Cultural Resource Program, and Colville Tribal Historic Preservation Officer. In December 2021, Reclamation sent its findings to DAHP and requested concurrence with the determination that the Proposed Action would have an adverse effect on historic properties (36 CFR 800.5(a)). DAHP concurred with Reclamation's determination, with a request for an updated description of the generator building at the dam site.

In December 2021, the Colville Tribe sent comments concurring with Reclamation's determination and accepting the invitation to participate in development of a memorandum of agreement. In December 2021, the Yakama Nation sent comments and questions to Reclamation on the project. Consultation with the Yakama Nation to ensure Reclamation addresses its feedback is ongoing at this time. In January 2022, Reclamation sent a letter to the Advisory Council on Historic Preservation inviting them to participate in the development of a memorandum of agreement on the project.

4.2.4 Consultation with the NMFS and USFWS

To comply with ESA Section 7(a)(2) and 50 CFR 402, Reclamation is preparing a BA to determine the potential impacts of the Proposed Action on the threatened Bull Trout (*Salvelinus confluentus)*, steelhead trout (*Oncorhynchus mykiss*), northern spotted owl (*Strix occidentalis caurina*), and their designated critical habitat. Prior to delivery of the BA to the agencies, Reclamation met with the NMFS and USFWS, as noted in **Table 4-1**, to discuss project design elements and potential impacts on the species.

4.2.5 USACE

Reclamation has held meetings with the USACE and Ecology to assess potential permitting requirements for the project (See **Table 4-1**, above). In accordance with Section 404 of the CWA, the USACE intends to issue the following Nationwide Permits for the project: Nationwide Permit 27, Aquatic Habitat Restoration, Enhancement, and Establishment Activities, and Nationwide Permit 14, Linear Transportation Projects. Reclamation has been coordinating with the staff of Okanagan-Wenatchee National Forest to develop revegetation plans for incorporation into these permits. Reclamation would apply for a CWA permit from the USACE and obtain a HPA from WDFW prior to construction. Reclamation would also follow all BMPs required under those permits.

4.3 Public Collaboration and Outreach

Public involvement allows interested and affected individuals, organizations, agencies, and other governmental entities to be consulted and included in the decision-making process. To help shape the alternatives considered in this document and the analysis of the impacts, Reclamation solicited comments from the public on the proposed project through the NEPA scoping process.

4.3.1 Scoping Process

As required by NEPA and its public involvement guidance, Reclamation solicited comments from coordinating and participating agencies, consulting parties, other interested parties, and the public. Then, Reclamation organized and analyzed all comments received. Reclamation evaluated each comment's position statement and extracted the overarching issue or issues to address during the NEPA process. These issues define the scope of analysis for the EA and were used to develop the project alternatives.

Reclamation announced the start of the comment period through various outreach materials (a press release, newspaper advertisements, and emails to interested parties) on July 26, 2021. For the 30-day period between July 26 and August 25, 2021, Reclamation sought public comments to determine relevant issues that could influence the scope of the environmental analysis, including alternatives development, and guide the process for developing the EA. The comment period ended on August 25, 2021.

The public had an opportunity to participate in the scoping process and provide input through a web-based virtual public meeting (VPM) room that was available 24 hours a day during the comment period and remains available at https://www.virtualpublicmeeting.com/kachess-dam-safety-ea-scoping. The VPM is structured around stations, which were modeled on the topics typically seen at open house public scoping meetings. The website provides access to information and materials, including project background, the purpose of and need for the project, the Proposed Action, project diagrams, and project area maps. Additionally, the VPM provided the public an opportunity to submit their comments and questions for Reclamation's consideration during the scoping comment period.

Each VPM station is a single web page that the public could view and interact with. The welcome station provides a place for website visitors to sign in and add themselves to the project mailing list. The welcome station also contains a link that visitors could use to download all maps and documents in the VPM room. A commenting station allowed visitors to submit written comments directly through the VPM comment form and provided information on how to submit comments via mail or email during the comment period. Reclamation also hosted a live question-and-answer video teleconference on August 10 and 12 from 4:00 p.m. to 6:00 p.m. Pacific daylight time. Reclamation provided a short presentation, followed by the question-and-answer session, during which Reclamation management and resource specialists were available to discuss project information and answer questions from teleconference participants. Recordings of these meetings are available on the VPM website.

In accordance with NEPA, Reclamation must document the public scoping results. The scoping report (Reclamation 2021a) summarizes the scoping process and the comments received during the formal scoping period, including those provided during the agency scoping meeting.

4.3.2 Draft EA Distribution

The draft EA was distributed to the parties identified in **Table 4-2**.

Table 4-2. Draft EA Distribution List

Draft EA Recipient	Date Distributed	Method of Distribution
Yakama Nation	February 2022	Digital, Physical Mailing
Confederated Tribes of the Colville Reservation	February 2022	Digital, Physical Mailing
USACE	February 2022	Digital
USFWS	February 2022	Digital
NMFS	February 2022	Digital
Ecology	February 2022	Digital
WDFW	February 2022	Digital
DNR	February 2022	Digital
DAHP	February 2022	Digital
Individuals	February 2022	Digital

4.4 Preparers and Contributors

Table 4-3. List of Preparers

Name	Role/Responsibility
Reclamation Interdisciplinary Team	
Keenan Arnold	Project Manager; Contracting Officer Representative; Geology and Soil Resources; Air Resources and Climate; Water Resources—Surface Water; Groundwater; Watershed Hydrology and Water Quality; Utilities and Service Systems
Jonathan Penman-Brotzman	NEPA Management Team; Environmental Justice; Socioeconomic Resources; Land Use and Planning; Recreation and Public Access; Visual Resources; Noise; Transportation; Public Health and Safety; Wetland Resources
Marit Bovee	Cultural Resources; Traditional Cultural Properties; Indian Sacred Sites; Indian Trust Assets; Tribal Liaison
Kaitlyn Hovanes	Historic Structures
Shannon Archuleta	Biological Resources; Special Status Species; Noise
EMPSi (Environmental Management and Planning Solutions, Inc.)	
Becky Boyle	Project Manager
Katie Patterson	NEPA Specialist and Quality Assurance Lead
Alli Yamnitsky	Assistant Project Manager; Recreation; Land Use and Planning
Francis Craig	Air Quality and Climate; Geology and Soil Resources
Amy Cordle	Air Quality and Climate
Megan Stone	Environmental Justice; Socioeconomics
Zoe Ghali	Environmental Justice; Socioeconomics
Julie Remp	Biological Resources—Terrestrial Wildlife; Special Status Species
Lindsay Chipman, PhD	Biological Resources—Fish and Aquatic Species; Special Status Species

Name	Role/Responsibility
Peter Gower, AICP, CEP	Recreation; Land Use and Planning; Utilities and Service Systems; Transportation and Access
Adam Young	Noise
Derek Holmgren	Noise; Water Resources—Surface Water; Groundwater; Watershed Hydrology and Water Quality
Matthew Smith	Public Health and Safety; Water Resources—Surface Water; Groundwater; Watershed Hydrology and Water Quality; Wetland Resources
Kirstin Settas	Transportation and Access; Utilities and Service Systems
Amanda Biedermann	Visual Resources
Marcia Rickey, GISP	GIS Lead
Kim Murdock	Technical Editing
Cindy Schad	Word Processing
Historical Research Associates, Inc.	
Brent Hicks	Cultural Resources; Traditional Cultural Properties; Indian Sacred Sites; Historic Structures
Matthew Sneddon	Cultural Resources; Traditional Cultural Properties; Indian Sacred Sites; Historic Structures
Brian Durkin	Cultural Resources; Traditional Cultural Properties; Indian Sacred Sites; Historic Structures

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Chapter 6. Glossary

Glossary terms relevant to this EA are listed below. Additional glossary terms for all resources analyzed in this EA can be found in the resource reports compiled in **Appendix B**.

Access—The ability of a particular transportation mode, such as a vehicle, bicycle, or pedestrian, to enter or use a portion of the transportation network.

Climate—The collective typical weather conditions in a region averaged over a series of years.

Climate change—A change in global or regional climate patterns, particularly a change apparent from the mid- to late twentieth century onward and attributed largely to the increased levels of atmospheric carbon dioxide.

Kladnick—A soil series that consists of deep, well-drained, or somewhat excessively drained soils formed in glacial outwash with a mantle of volcanic ash.

Level of service—A metric that describes the operating conditions of a roadway based on factors such as the physical roadway capacity, speed, maneuverability, safety, and traffic volume.

Hydro mulch—A mixture of water, fiber mulch, fertilizer, seed, and an adhesive binding agent. It is sprayed on exposed soils to prevent erosion and to promote revegetation.

Pollutants (pollution)—Unwanted chemicals or other materials found in the environment. Pollutants can harm human health, the environment, and property. Air pollutants occur as gases, liquid droplets, and solids. Once released into the environment, many pollutants can persist, travel long distances, and move from one environmental medium—air, water, or land—to another.

Riprap—Angular, crushed stone ranging in size from 4 inches to over 2 feet, depending on the specification; it is used to protect soils and shoreline structures against scour and water erosion.

Sensitive noise receptors—Individuals who would be affected by noise levels. Examples are individuals recreating in the area, such as hiking, biking, fishing, boating, snowshoeing, and cross-country skiing.

Xerofluvents—A fluvent (fine-textured) soil with a xeric (dry) moisture regime.

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Appendix A

Figures

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Appendix A. Figures

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BUREAU OF RECLAMATION

Figure 1-1
Project Area

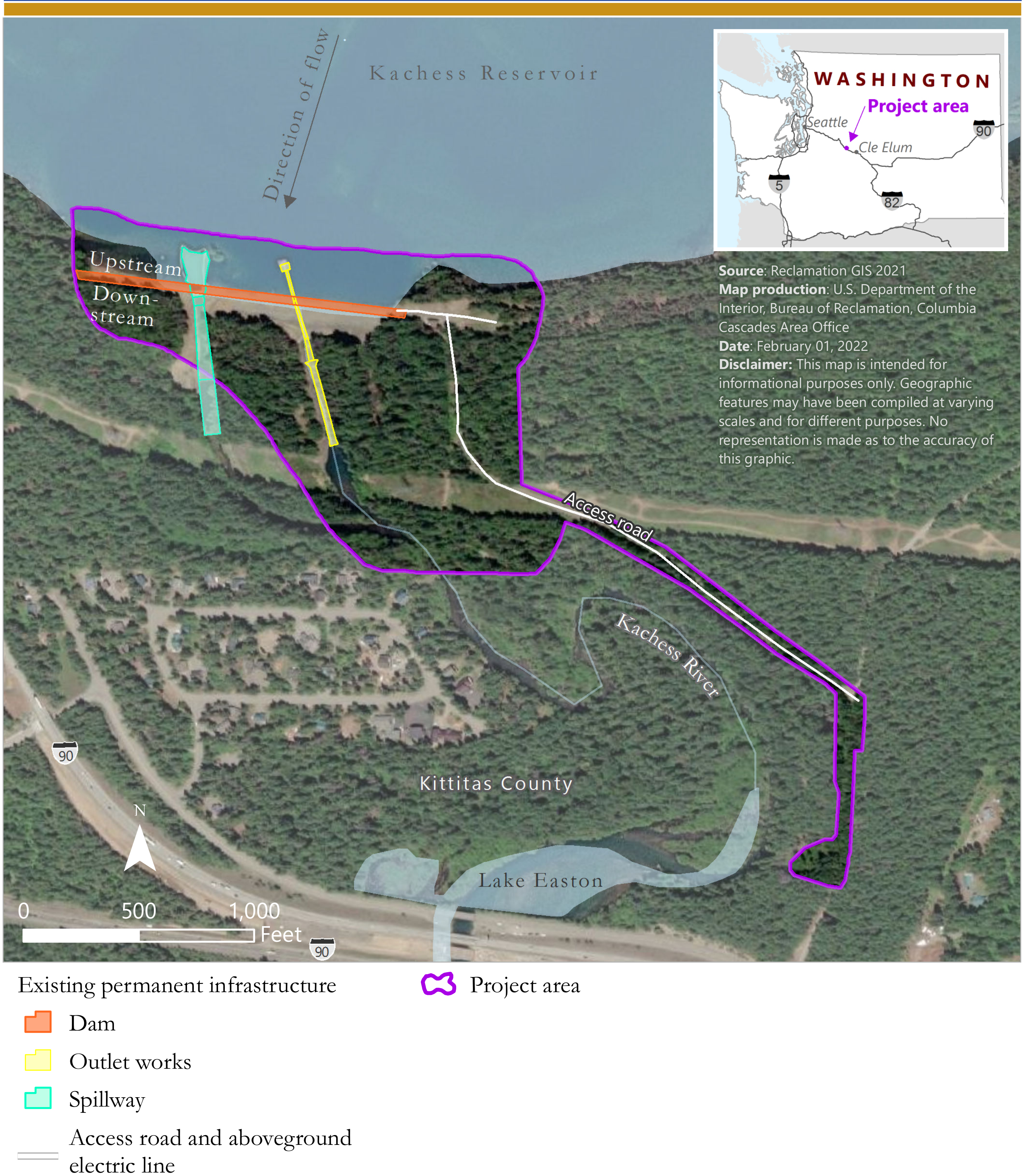
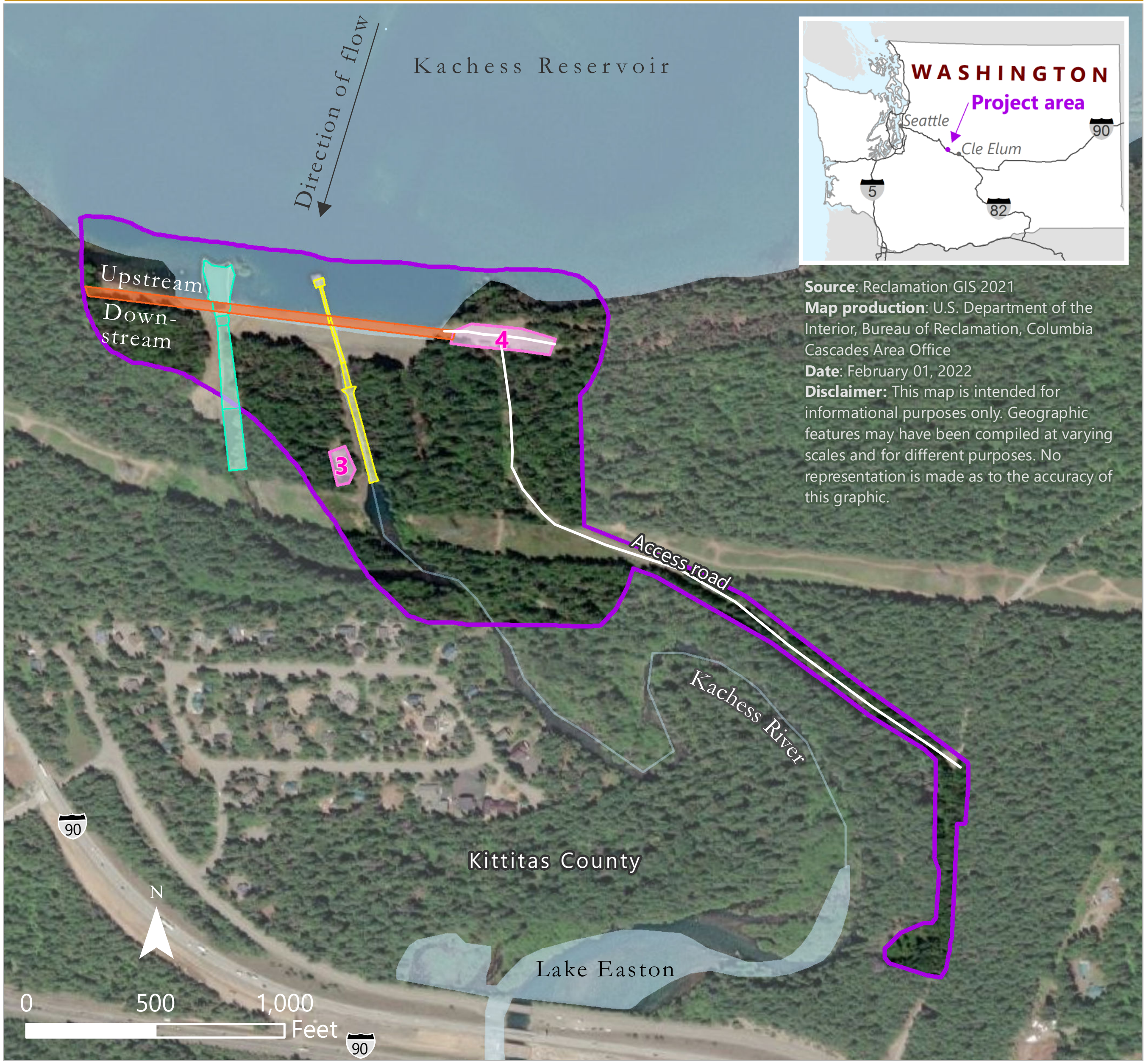


Figure 2-1
No Action



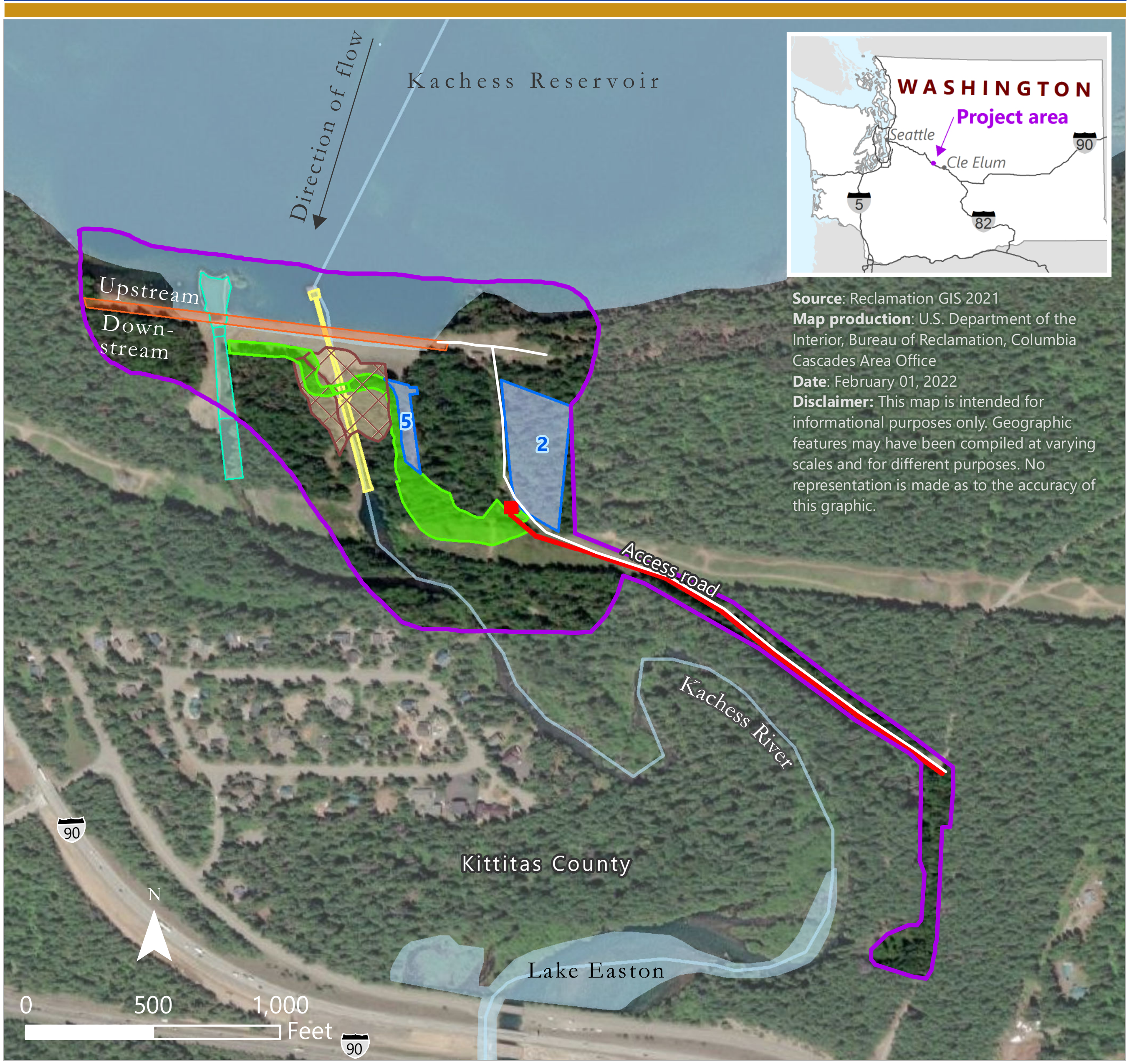
Existing permanent infrastructure

- Dam
- Outlet works
- Spillway
- Operation and maintenance area
- Access road and aboveground electric line

Project area

BUREAU OF RECLAMATION

Figure 2-2
Proposed Action: Temporary Disturbance



Source: Reclamation GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: February 01, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

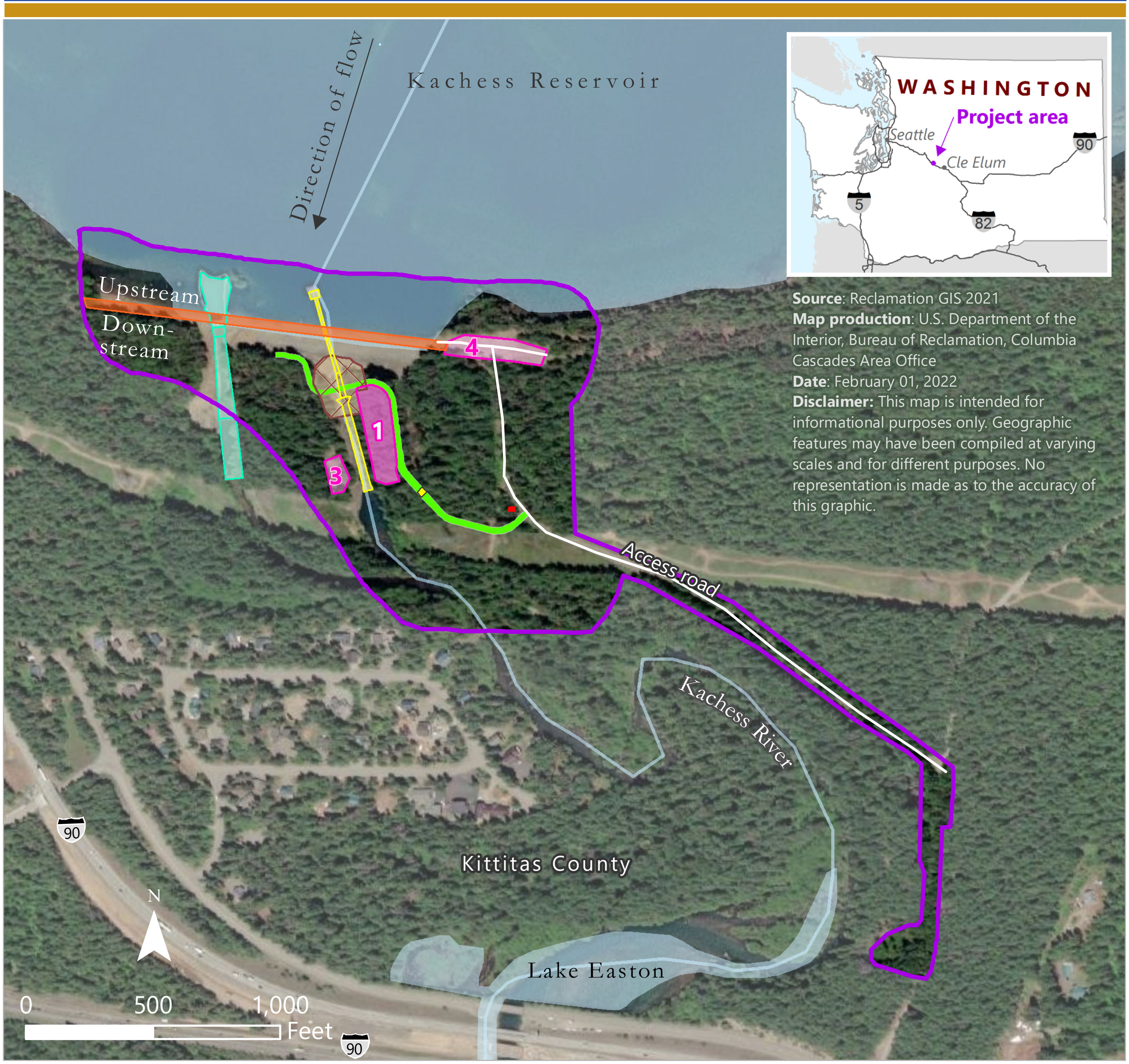
Proposed temporary infrastructure
- Outlet works (extend and line the conduit)
- Access road
- Contractor use area
- Excavation
- Buried electric line

Existing permanent infrastructure, no structural or operational changes
- Dam
- Spillway
- Access road

Project area

BUREAU OF RECLAMATION

Figure 2-3
Proposed Action: Permanent Infrastructure



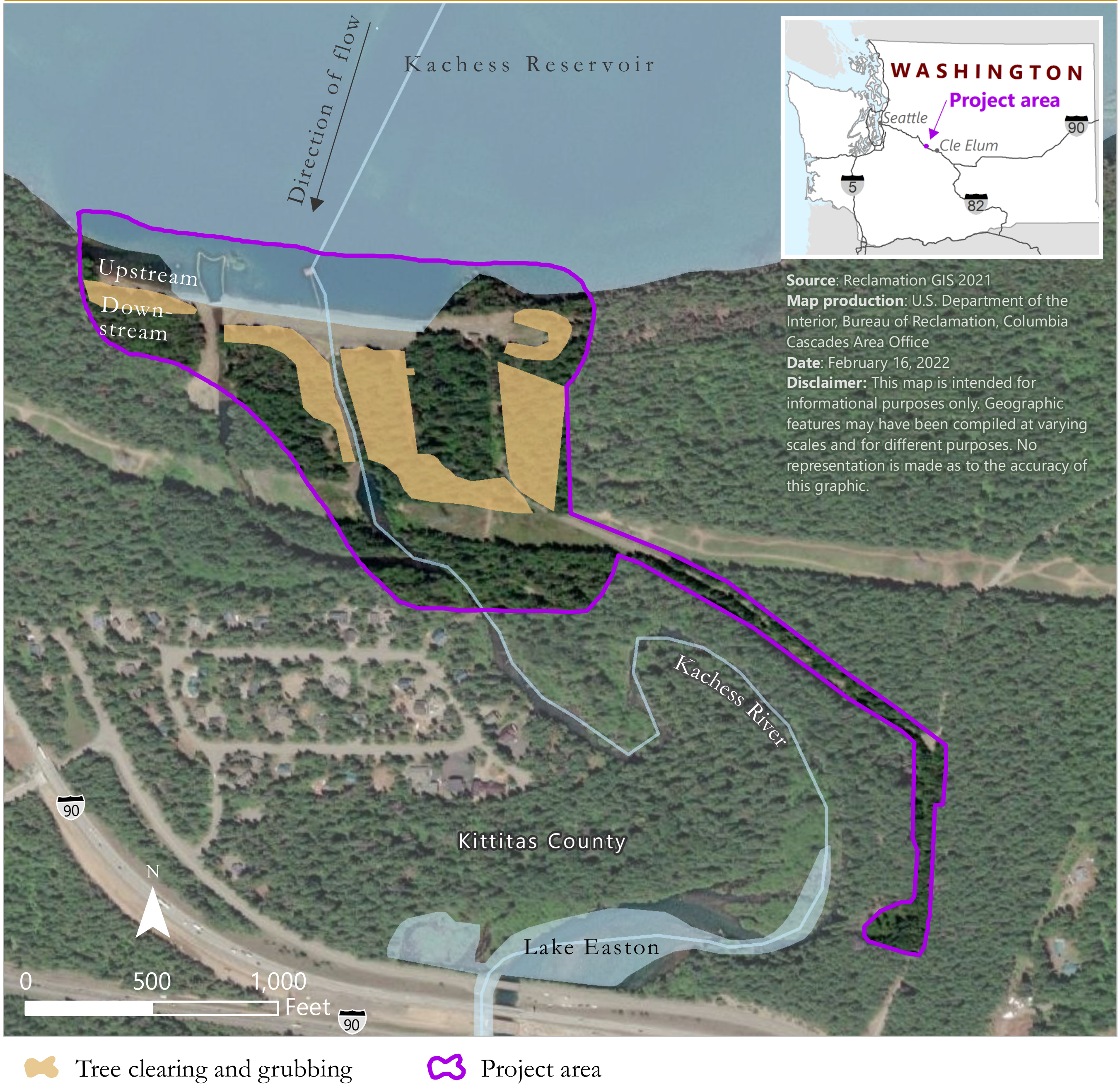
Proposed permanent infrastructure

- Fish passable culvert
- Electric building
- Access road
- Outlet works
- Operation and maintenance area
- Stability berm
- Buried belowground electric line (location shared with existing access road)

Existing permanent infrastructure, no structural or operational changes

- Dam
- Spillway
- Operation and maintenance area
- Access road
- Project area

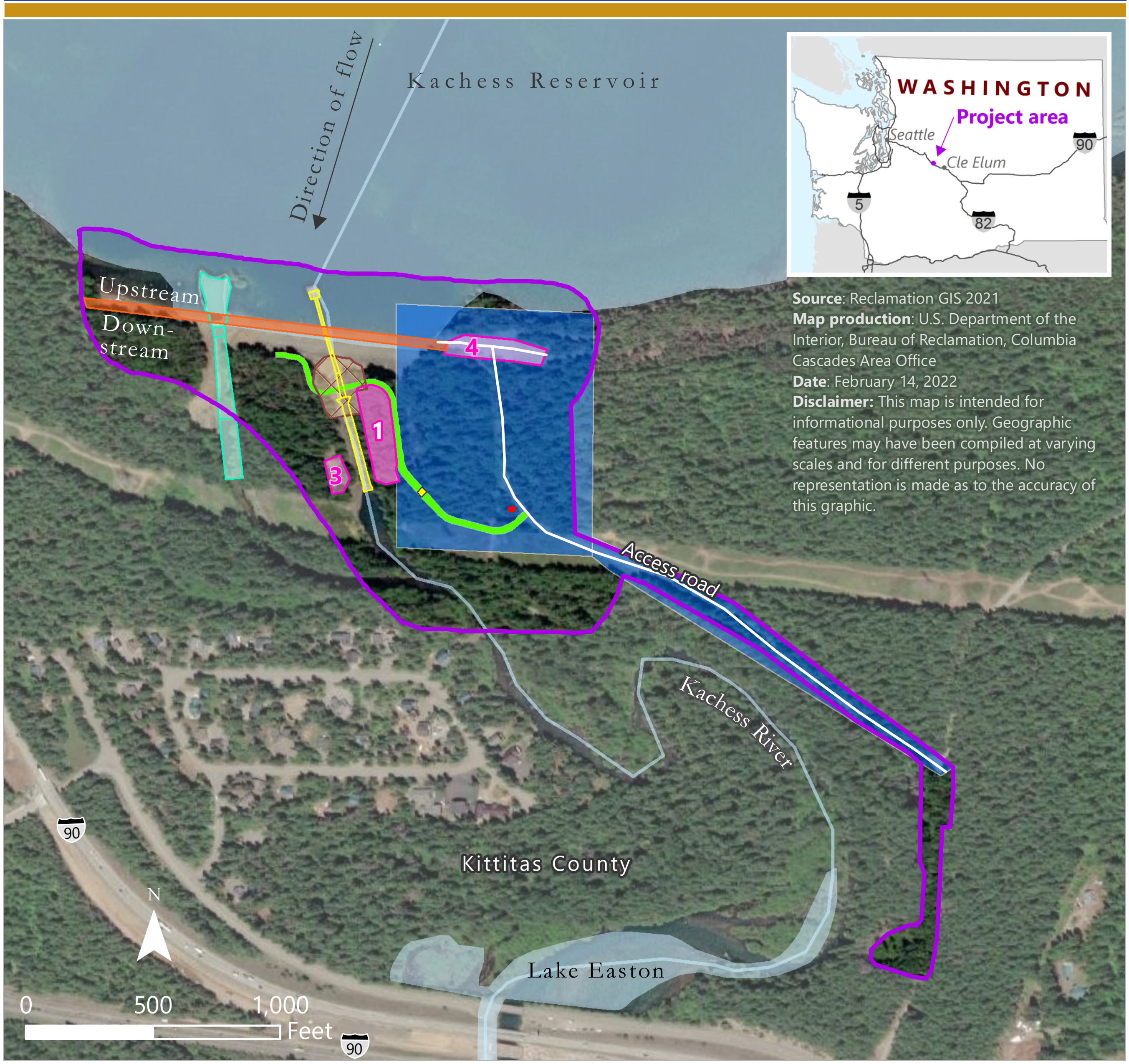
Figure 2-4
Proposed Action: Tree Clearing and Grubbing



Source: Reclamation GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: February 16, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

— BUREAU OF —
RECLAMATION

Figure 3-1
Cumulative Effects



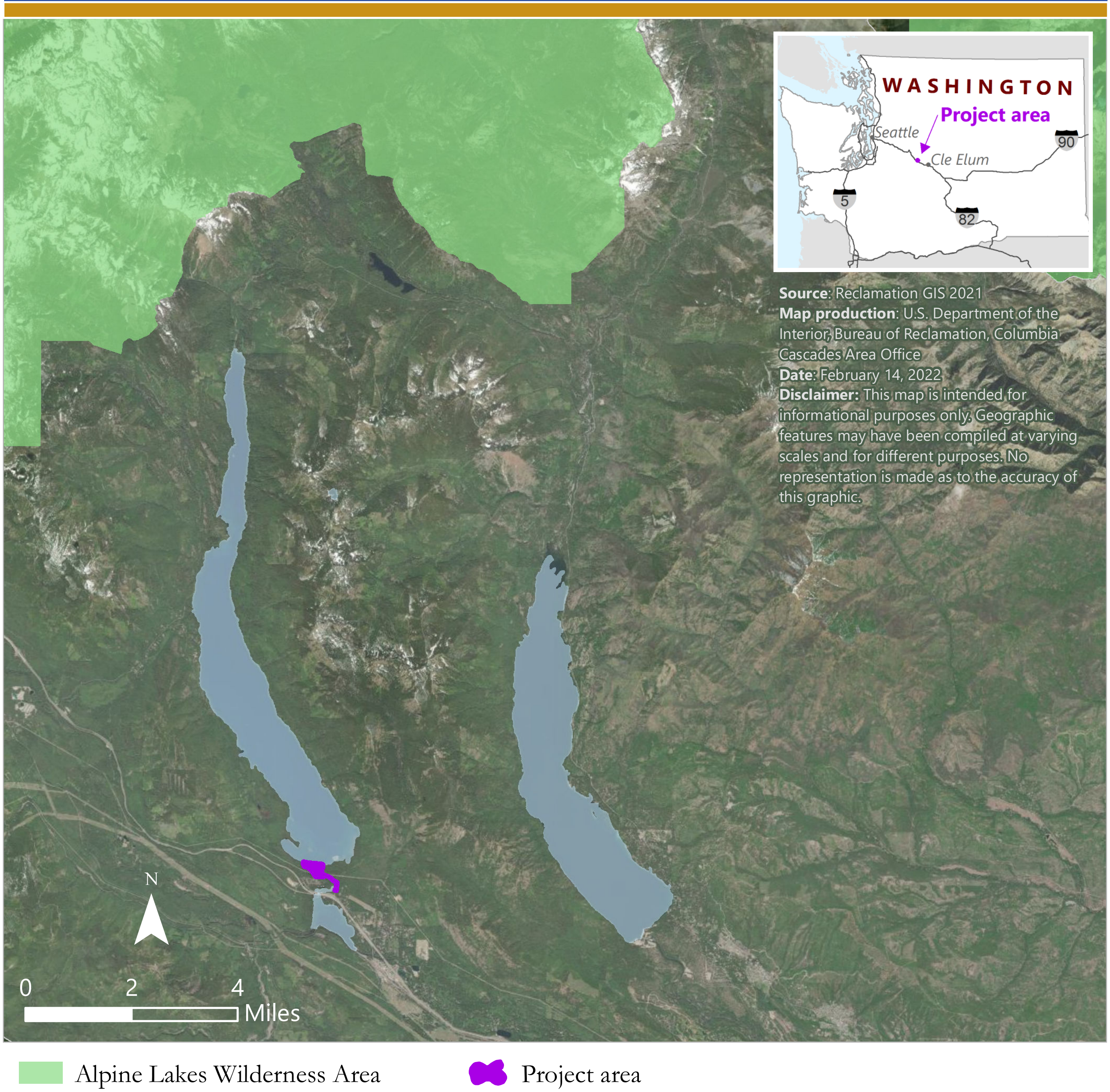
Proposed permanent infrastructure

- Fish passable culvert
- Electric building
- Access road
- Outlet works
- Operation and maintenance area
- Stability berm
- Buried belowground electric line (location shared with existing access road)
- Kachess Drought Relief Pumping Plant potential proposed project area

Existing permanent infrastructure, no structural or operational changes

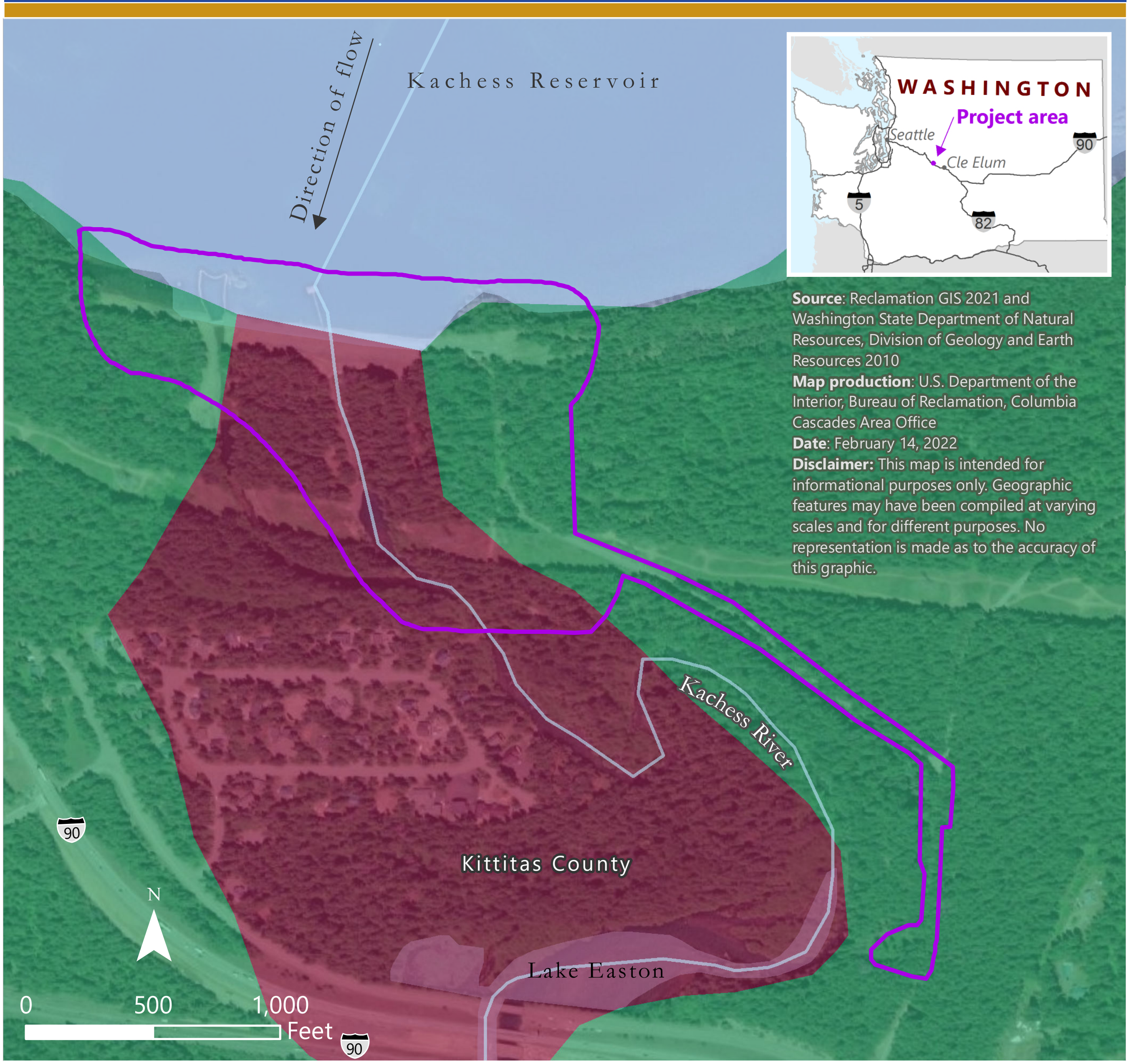
- Dam
- Spillway
- Operation and maintenance area
- Access road
- Project area

Figure 3-2 Wilderness Area



BUREAU OF RECLAMATION

Figure 3-3
Geologic Hazards



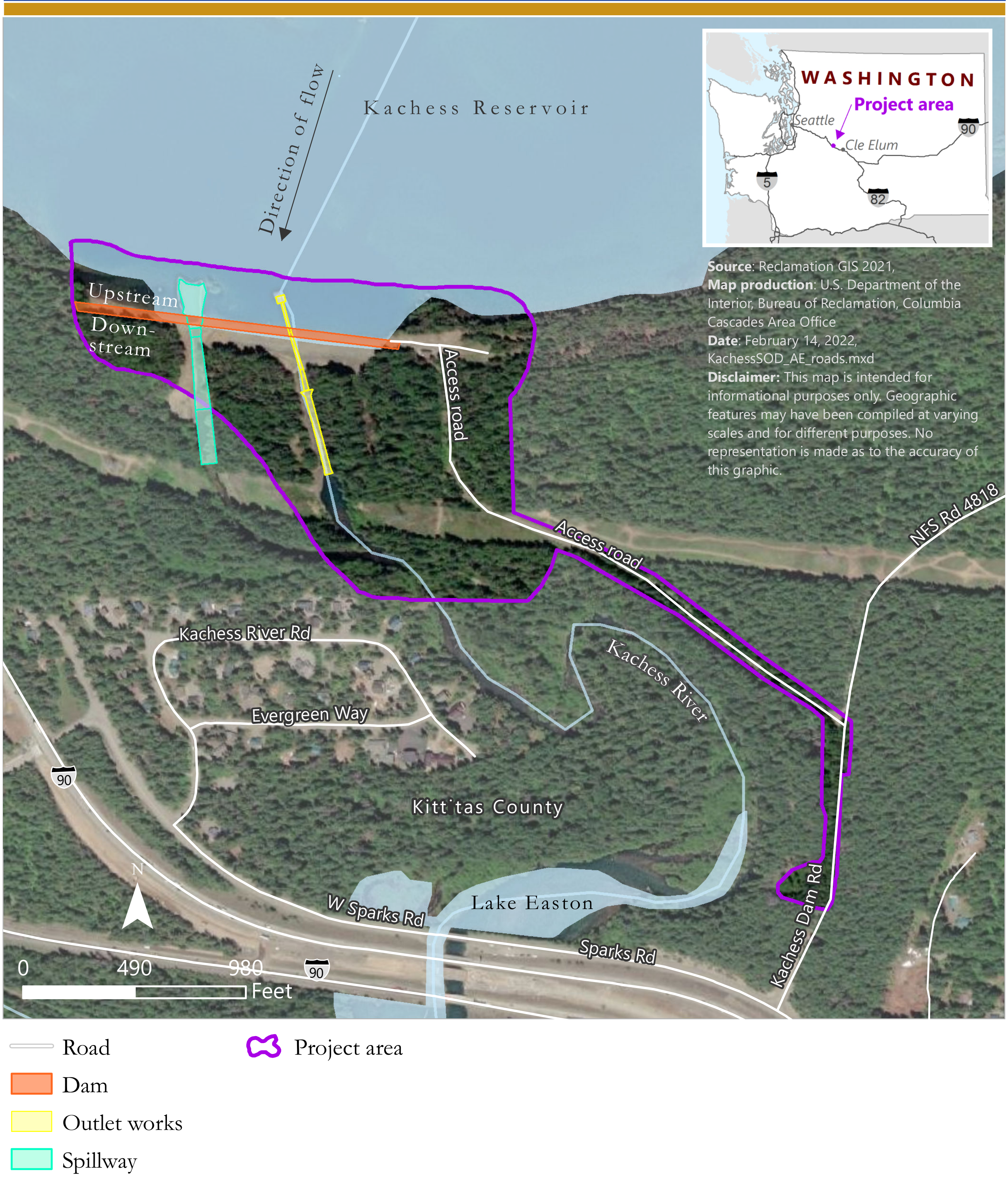
Liquefaction susceptibility

- Not applicable (water)
- Very low to low
- Moderate to high

Project area

BUREAU OF RECLAMATION

Figure 3-4
Transportation Features



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Appendix B

Resource Reports

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Appendix B. Resource Reports

Air Quality and Climate Resource Report
Biological Resource Report
Environmental Justice Resource Report
Geology, Soils, and Seismic Resources Report
Hazardous Materials and Public Health and Safety Resource Report
Indian Trust Assets Resource Report
Land Use Resource Report
Noise and Vibration Resource Report
Public Services and Utilities Resource Report
Recreation Resource Report
Sacred Sites Resource Report
Socioeconomic Resources Report
Transportation Resources Report
Visual Resources Resource Report
Water Resources Report

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Kachess Dam Safety of Dams Modification Environmental Assessment

Air Quality and Climate Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Air quality in Kittitas County, Washington, the location of the project, generally meets Environmental Protection Agency standards. Exceedances are usually attributable to regional wildfires. Visibility conditions at the nearest Class 1 air quality area, the Alpine Lakes Wilderness, have been showing an improving trend over the last two decades. In 2018, total greenhouse gas emissions in the state of Washington were estimated to be 99.6 million metric tons of carbon dioxide equivalents (CO_2e; Ecology 2021).

Under the Proposed Action, construction, transportation, and other proposed project actions requiring the use of fossil fuel-powered equipment or disturbing the ground would generate temporary and localized fugitive dust, greenhouse gas emissions, and other air pollutants. These would be minimized using standard dust control and other best management practices (BMPs). The contribution to global greenhouse gas emissions is expected to be well below 25,000 metric tons of CO_2e per year, which is the greenhouse gas reporting requirement threshold under 40 Code of Federal Regulations (CFR) 98. The Proposed Action is not expected to cause any air quality measures to exceed Environmental Protection Agency standards. It also is not expected to cause any reduction in the visibility in the Alpine Lakes Wilderness Class 1 area. The types and amounts of emissions from operations and maintenance following the completion of the Proposed Action would be similar to those described below under the No Action Alternative.

Under the No Action Alternative, emissions of fugitive dust, greenhouse gases, and other air pollutants from operations and maintenance would continue to occur. If dam failure were to occur, emissions of fugitive dust, greenhouse gas emissions, and other air pollutants would be generated by the necessary emergency dam stabilization and repairs, and the cleanup of any flood damage downstream of the dam.

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Appendix

Acronyms and Abbreviations

Acronym	Full Phrase
AQI	air quality index
BMP	best management practice
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
EPA	United States Environmental Protection Agency
NAAQS	national ambient air quality standards
$PM_{2.5}$	fine particulate matter 2.5 micrometers or smaller
PM_{10}	large particulate matter less than 10 micrometers
ppm	parts per million
ppb	parts per billion
SO_2	sulfur dioxide
$\mu g/m^3$	micrograms per cubic meter

Chapter 1. Analysis Area

The analysis area for air quality is Kittitas County, Washington. The analysis area for climate change is broader; impacts on climate are generally based on regional climate scenarios, downscaled from global climate models.

Chapter 2. Indicators

Indicators for air quality are the following:

- Acres of surface disturbance and measures to reduce fugitive dust
- Total vehicle miles traveled by on-road trucks and personal vehicles, and the tons of criteria pollutants resulting from their use
- Total hours of operation of non-road vehicles and equipment, and the tons of criteria pollutants resulting from their use

The indicator for climate is the following:

- The tons of greenhouse gas emissions resulting from construction and operation

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- Clean Air Act (42 United States Code 7401 et seq.)—This act is administered by the United States Environmental Protection Agency (EPA). The EPA is mandated to set standards on air emissions considered harmful to public health (primary standards) and public welfare (secondary standards). These national ambient air quality standards (NAAQS) are set for six criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide, ozone, particulate matter (fine particulate matter 2.5 micrometers or smaller [$PM_{2.5}$] and large particulate matter less than 10 micrometers [PM_{10}]), and sulfur dioxide (SO_2). While the EPA is the primary regulatory authority for air quality in the United States, the Clean Air Act is largely implemented by the states and local and tribal authorities. The Washington State Department of Ecology's Central Regional Office is responsible for air quality control in Kittitas County, Washington.
- Clean Air Act amendments—These include provisions to maintain scenic vistas in mandatory Class I areas. Class I areas include national parks larger than 6,000 acres and national wilderness areas larger than 5,000 acres that were established before 1977. The project area is approximately 10 miles south of the Alpine Lakes Wilderness Class I area. The

Washington State Department of Ecology has developed a regional haze state implementation plan to comply with requirements to minimize impacts on visibility in Class I areas.

- Executive Order 14008, Tackling the Climate Crisis at Home and Abroad—This executive order lays out a government-wide approach to addressing climate change, including increasing resiliency in infrastructure.

There are no federal laws or regulations related to greenhouse gas emissions. Greenhouse gas reporting requirements under 40 Code of Federal Regulations (CFR) 98 would not pertain to this project.

3.2 State and Local Laws

The Washington State Department of Ecology has identified state ambient air quality standards for the protection of human health (primary standards). These supplement the national standards and include limits for emissions of total suspended particulates, lead, particulate matter, SO_2, carbon monoxide, ozone, and nitrogen dioxide (Chapter 70.94 Revised Code of Washington). Several state regulations also apply to regulating air emissions from such operations as stationary facilities and construction, consistent with these standards (Chapter 173-400 Washington Administrative Code).

There are no state laws or regulations related to climate change or limiting or reporting greenhouse gases that pertain to this project.

3.3 Policies

No policies related to air quality and climate have been identified.

3.4 Memoranda of Understanding

No memoranda of understanding related to air quality and climate have been identified.

3.5 Other

No other laws or regulations related to air quality and climate have been identified.

Chapter 4. Affected Environment

4.1 Air Quality Conditions

State and some federal agencies operate air monitoring stations to measure concentrations of criteria pollutants and to determine compliance with national and state air quality standards (see **Table 1**). Kittitas County is in attainment for all national and state air quality standards (EPA 2021a).

Table 1. National and Washington Ambient Air Quality Standards

Pollutant	Averaging Time	National Standards			Washington Standard
		Primary	Secondary	Form	
Ozone	8 hours	0.070 ppm[1]	Same as primary	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	0.70 ppm
Carbon monoxide	8 hours	9 ppm[1]	—	Not to be exceeded more than once per year	9 ppm
	1 hour	35 ppm[1]	—		35 ppm
Nitrogen dioxide	Annual (arithmetic mean)	53 ppb[2]	Same as primary	Annual mean	53 ppb
	1 hour	100 ppb[2]	—	98th percentile of 1-hour daily maximum concentration, averaged over 3 years	100 ppb
Sulfur dioxide	Annual (arithmetic mean)	—	—	—	0.02 ppm
	24 hours	—	—	—	0.14 ppm
	3 hours	—	0.5 ppm[1]	Not to be exceeded more than once per year	0.50 ppm
	1 hour	75 ppb[2]	—	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	—
PM_{10}	24 hours	150 µg/m^3	Same as primary	Not to be exceeded more than once per year on average over 3 years	—
$PM_{2.5}$	Annual (arithmetic mean)	12 µg/m^3	15 µg/m^3	Annual mean averaged over 3 years	—
	24 hours	35 µg/m^3	Same as primary	98th percentile, averaged over 3 years	—
Lead[3]	Rolling 3-month average	0.15 µg/m^3	Same as primary	Not to be exceeded	—

Source: EPA 2021b; Chapter 70.94 Revised Code of Washington

Cells with a dash (—) indicate there is no standard for that pollutant or averaging time.

[1]ppm—parts per million. The final rule was signed October 1, 2015, and effective December 28, 2015. The previous (2008) ozone standards additionally remain in effect in some areas. Revocation of the 2008 ozone standards and transitioning to the 2015 standards will be addressed in the implementation rule for the current standards.

[2]ppb—parts per billion. The final rule was signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards (0.03 ppm annual and 0.14 ppm 24-hour) were revoked in that same rulemaking; however, these standards remain in effect until 1 year after an area is designated for the 2010 standard. One exception is in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

[3]µg/m^3—micrograms per cubic meter. The final rule was signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3) remains in effect until 1 year after an area is designated for the 2008 standard. The one exception is in areas designated nonattainment for the 1978 standard, where the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

There is one air quality monitoring station in the vicinity of the general project area. It is located in Ellensburg, approximately 40 miles southeast of the project location. It is operated by Washington State Department of Ecology and used to monitor $PM_{2.5}$ levels. The three most recent years of monitoring data available for the Ellensburg monitoring station are shown in **Table 2**. The monitor has complied for the annual average standard of 12.0 $\mu g/m^3$, but it is in exceedance of the 98th percentile 24-hour average standard of 35.0 $\mu g/m^3$. However, the monitor is located approximately 40 miles from the project location in a significantly more developed area, so it is likely not representative of the conditions at Kachess Dam.

Table 2. Ellensburg Pass Monitoring Site $PM_{2.5}$ Data (2017–2020)

Monitoring Station	Year	24-hour 98th Percentile Average $PM_{2.5}$ Concentration	Percentage of NAAQS (35.0 $\mu g/m^3$)	Annual Average $PM_{2.5}$ Concentration	Percentage of NAAQS (12.0 $\mu g/m^3$)
Ellensburg – Ruby St.	2017	47.8	136.57	11.05	92.08
Ellensburg – Ruby St.	2018	46.5	132.86	7.16	59.67
Ellensburg – Ruby St.	2019	18.8	54.30	6.99	58.25
Ellensburg – Ruby St.	2020	50.3	143.71	9.86	82.17

Source: EPA 2021c

The EPA's air quality index (AQI) is used for reporting daily air quality. It describes how clean or polluted the air is by geographic area and what the associated health effects may be. **Table 3** shows the annual AQI data for Kittitas County for the past 5 years.

Table 3. AQI Summary Report for Kittitas County (2016–2020)

Year	Number of Days with AQI Data	Good Days[1]	Moderate Days[2]	Unhealthy for Sensitive Groups Days[3]	Unhealthy Days[4]	Very Unhealthy Days[5]	Hazardous Days[6]
2016	366	310	50	6	0	0	0
2017	355	274	65	11	3	2	0
2018	358	310	36	5	7	0	0
2019	365	305	60	0	0	0	0
2020	365	320	34	2	3	3	3

Source: EPA 2021c

[1] **Good**—The AQI is 0 to 50. Air quality is considered satisfactory, and air pollution poses little or no risk.

[2] **Moderate**—The AQI is 51 to 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.

[3] **Unhealthy for sensitive groups**—The AQI is 101 to 150. Although the general public is not likely to be affected at this AQI range, people with lung disease, older adults, and children are at a greater risk from exposure to ozone. People with heart and lung disease, older adults, and children are at greater risk from the presence of particles in the air.
[4] **Unhealthy—**The AQI is 151 to 200. Everyone may begin to experience some adverse health effects, and members of the sensitive groups may experience more serious effects.
[5] **Very Unhealthy**—The AQI is 201 to 300. This would trigger a health alert, signifying that everyone may experience more serious health effects.
[6]**Hazardous**—The AQI is over 301. Health warning of emergency conditions: everyone is more likely to be affected.

As shown from the data above, air quality trends in the county show that the air quality is generally good. Very unhealthy days in 2017 and 2020, and hazardous days in 2020 were likely associated with fire activity in those years.

4.2 Air Pollutant Emission Sources

4.2.1 Air Pollution Sources

Major air pollution sources in the analysis area include outdoor burning (year-round, except during summer fire-safety burn bans), wildfires, agricultural burning (spring and fall burn seasons), orchard heaters, smudge pots (oil-burning devices used to prevent frost on fruit trees), silvicultural burning, and woodstoves. Smoke from some burns may become entrained in evening downslope flow and settle in sheltered valleys, though this is a rare occurrence (Ecology 2015).

The EPA prepares a national emissions inventory every 3 years to provide a comprehensive and detailed estimate of emissions from all air emission sources in the country. Emissions in the inventory are provided down to the county level. **Table 4** shows the emissions in Kittitas County for 2011, 2014, and 2017, the three most recent inventory years. As shown in this table, emission levels in the county depend largely on the amount of fire (agricultural burning, prescribed burning, and wildfire) in a given year.

Table 4. Kittitas County, Washington, Criteria Pollutant Emissions by Source Category (2011, 2014, and 2017) (Tons/Year)

Source Category[1]	PM_{10}	$PM_{2.5}$	Sulfur Dioxide	CO	Lead	Volatile Organic Compounds	Nitrogen Oxides
2011							
Stationary	223	200	10	1,073	—	783	56
Mobile	223	179	11	18,567	0	1,802	5,346
Fire	702	597	47	6,909	—	1,610	86
Fugitive Dust	1,213	214	—	—	—	—	—
Total	*2,360*	*1,190*	*68*	*30,619*	*0*	*23,014*	*5,771*

Source Category[1]	PM_{10}	$PM_{2.5}$	Sulfur Dioxide	CO	Lead	Volatile Organic Compounds	Nitrogen Oxides
2014							
Stationary	278	368	12	1,390	—	867	88
Mobile	169	133	10	15,291	0	1,520	4,034
Fire	6,097	5,166	417	60,992	—	14,348	703
Fugitive Dust	1,147	219	—	—	—	—	—
Total	*7,783*	*5,799*	*439*	*82,786*	*10*	*38,711*	*5,094*
2017							
Stationary	254	169	5	958	—	834	67
Mobile	123	90	8	13,157	341	1,074	2,749
Fire	38,031	32,231	2,401	388,387	—	91,165	3,623
Fugitive Dust	1,846	312	—	—	—	—	—
Total	*40,255*	*32,802*	*2,414*	*406,116*	*341*	*115,714*	*7,100*

Source: EPA 2015, 2018, 2020

— = not applicable

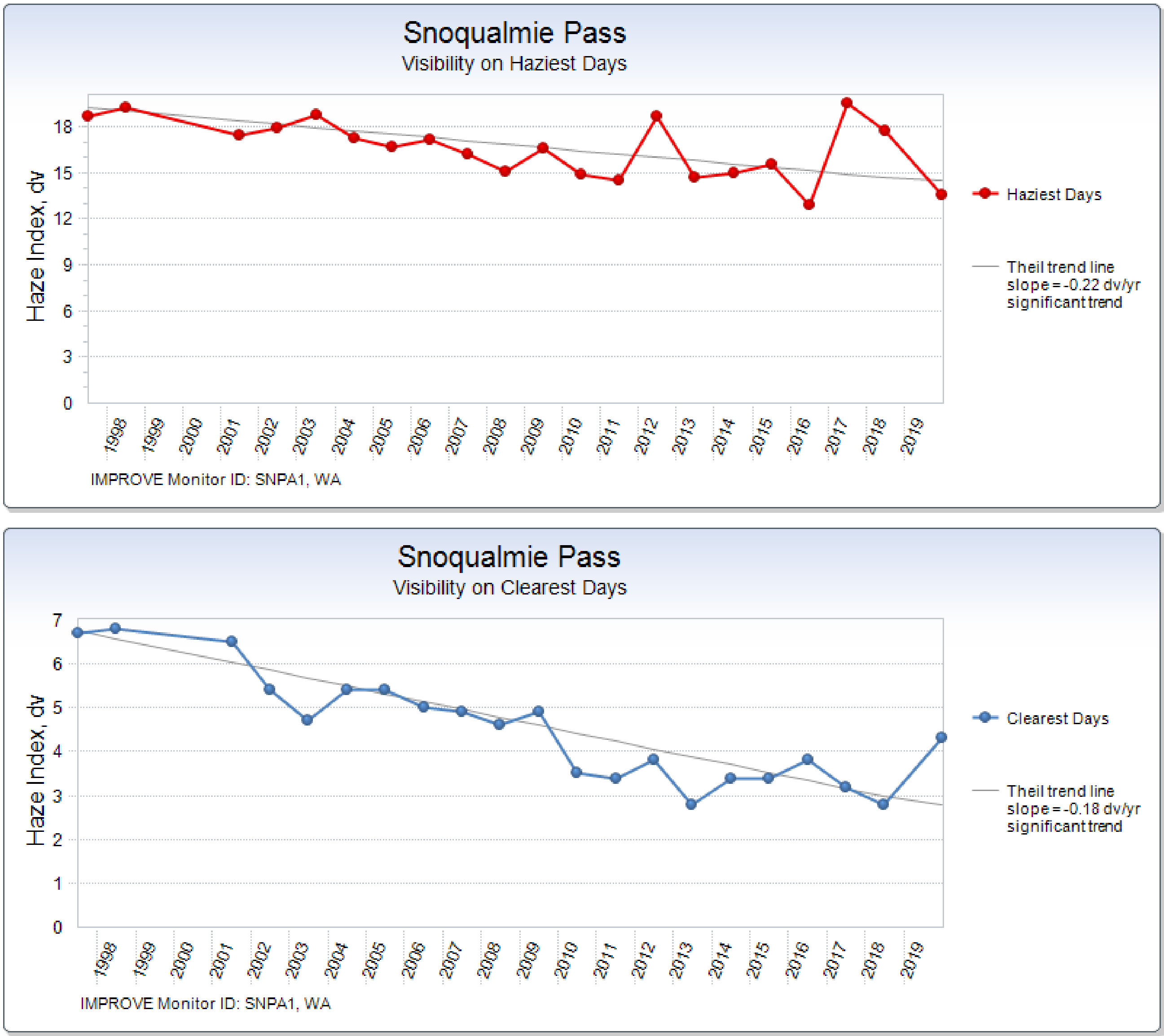
4.3 Sensitive Receptors

Air quality is an environmental concern primarily because it can affect human health. A secondary concern is its potential effects on vegetation and wildlife and on visibility in Class I areas, including the nearby Alpine Lakes Wilderness. In addition, some air pollutants can damage structures, reduce visibility, or contribute to climate change. Potentially sensitive receptors are any groups or individuals who are particularly vulnerable to air pollution. These typically are children, the elderly, or any other persons with health complications. Potentially sensitive receptors in and near the project area are residences or businesses in the vicinity of the project or along travel routes, such as the residents of Easton. For additional information regarding sensitive receptors, see the **Noise and Vibration Resource Report**.

Visibility

Haze in the Alpine Lakes Wilderness affects the views that visitors to the lakes experience. An air quality monitor was established at Snoqualmie Pass (elevation 3,000 feet) in 1993 to assess visibility impairment in the surrounding area. This monitor is approximately 14 miles northwest of the project area. As shown on **Figure 1**, visibility on the 20 percent clearest days and 20 percent haziest days improved at similar rates between 1998 and 2019 (Federal Land Managers Environmental Database 2021).

Figure 1. Visibility Trends at Snoqualmie Pass, Washington (1998–2019)



Source: Federal Land Managers Environmental Database 2021

Based on the monitoring data, ammonium sulfate (typically associated with power plants and industrial sources) was the largest contributor to visibility impairment on the clearest days, followed by ammonium nitrate (typically associated with power plants and mobile pollution), organic carbon (typically associated with wildfire smoke), and elemental carbon (associated with road dust and soot). Organic carbon was the largest contributor to visibility impairment on the haziest days, followed by ammonium sulfates, nitrates, organic carbon, and elemental carbon (Federal Land Managers Environmental Database 2021).

4.4 Climate

Climate in the Pacific Northwest is influenced by the interactions and seasonal variation of atmospheric circulation patterns, especially the seasonal migrations of the Aleutian low-pressure system and the North Pacific (Hawaii) high-pressure system (CIG 2009). These patterns generally lead to cold, wet winters and warm, dry summers, with local variation based on marine influences and elevation. Average precipitation over the past 20 years is approximately 41 inches per year (Weather.gov 2021a). The average monthly temperature over the past 20 years ranges from 29.7 degrees Fahrenheit (-1.3 degrees Celsius) in January to 64 degrees Fahrenheit (17.8 degrees Celsius) in July (Weather.gov 2021b).

4.4.1 Projected Future Climatic Conditions and Climate-Induced Changes to Kachess Reservoir and the Upper Yakima Watershed

The earth's climate since the Industrial Revolution has been warming. This has been observed to coincide with widespread effects throughout the earth-atmosphere system, including reductions in the extent and duration of mountain winter snowpack, increases in mean nighttime minimum temperatures, shifts in historical rainfall patterns, and changes in the frequency, severity, and duration of weather events. These effects, in turn, have affected natural and human systems regardless of cause, linking the sensitivity of natural and human systems to changing climate (IPCC 2013).

During the past 100 years, the Pacific Northwest has become warmer and wetter (Mote and Salathé 2010). Global climate models indicate a continuation of this trend. Temperatures are projected to continue to increase in the Pacific Northwest region, along with small increases in precipitation, shifts in the seasonality of precipitation, and increased high precipitation events; however, to what degree depends on projections based on low, medium, or high greenhouse gas emission scenarios (CIG 2009).

Climatic changes are expected to result in earlier snowmelt runoff and reduced summer flows in the Yakima River Basin (Vano et al. 2010). The Climate Impact Group indicated in its 2009 Washington Climate Change Impacts Assessment that probable impacts are a decreased April 1 snowpack by as much as 40 percent in the 2040s, reduced reservoir storage, and increased stream temperatures. These climate changes could result in the Upper Yakima watershed transitioning from a snow-dominant watershed to a rain/snowmelt transient watershed by the 2040s. There would be less snowpack, earlier run off, and more precipitation falling as rain (Tohver 2016).

4.5 Greenhouse Gas Emissions

Greenhouse gas emissions are a concern because greenhouse gases trap heat in the atmosphere, which warms the climate. Most studies indicate the earth's climate has warmed over the past century, due to increased emissions of greenhouse gases, and that human activities affecting emissions to the atmosphere are likely an important contributing factor. In the United States, most greenhouse gas emissions are attributed to energy use. Such emissions result from the combustion of fossil fuels used for electricity generation, transportation, industry, and heating.

The primary greenhouse gases emitted through human activities are carbon dioxide (CO_2), methane, nitrous oxide, and fluorinated gases. The first three of these are the greenhouse gases evaluated in this analysis; this is because they would be produced through fuel combustion in on-road and off-road vehicles and equipment used during construction.

Annual greenhouse gas emission estimates are available at the state, country, and global scales. The World Resource Institute's Climate Watch tool provides data on greenhouse gas emissions from 186 countries and all 50 states. For 2018, the most recent year for which data are provided, global emissions were 48,939 million metric tons of carbon dioxide equivalents (CO_2e).[1] US emissions were 5,794 million metric tons of CO_2e, and Washington's emissions were 99.6 million metric tons of CO_2e (Climate Watch 2020; Ecology 2021). A comparison of values reported in other sources, such as the EPA's annual Inventory of Greenhouse Gas Emissions and Sinks[2] (EPA 2021d), show slight differences in annual emissions. However, they are comparable in magnitude.

The EPA Facility Level Information on Greenhouse Gases tool (EPA 2021e) database reports annual greenhouse gas emissions from facilities emitting more than 25,000 metric tons of CO_2e per year that are subject to the EPA's Greenhouse Gas Reporting Program under 40 CFR 98. This includes emissions from most large, stationary sources of greenhouse gases (smaller emitters are not required to report) and emissions from most end uses of fossil fuels. Nationally, this reporting program accounts for 85 to 90 percent of total greenhouse gas emissions in the EPA's Inventory of Greenhouse Gas Emissions and Sinks (EPA 2021d). The EPA Facility Level Information on Greenhouse Gases tool database shows no reporting facilities in Kittitas County in the past 5 years (EPA 2021e).

Chapter 5. Environmental Consequences

5.1 Analysis Indicators

Indicators for air quality are the following:

- The acres of surface disturbance and measures to reduce fugitive dust
- The total vehicle miles traveled by on-road trucks and personal vehicles, and the tons of criteria pollutants resulting from their use
- The total hours of operation of non-road vehicles and equipment, and the tons of criteria pollutants resulting from their use
- Impacts on visibility in nearby Class 1 airsheds

[1] CO_2e is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same climate warming potential, when measured over a specified timescale.
[2] Greenhouse gas "sinks" remove CO_2 from the atmosphere through the uptake of carbon and storage in forests, vegetation, and soils (EPA 2021d). Carbon sinks lower the concentration of CO_2 from the atmosphere because more carbon is absorbed than released.

The indicator for climate is the following:

- The tons of greenhouse gas emissions resulting from construction

5.2 Assumptions

- Construction emissions estimates are based on preliminary design information for the Proposed Action. Actual emissions may differ, based on final detailed construction plans. Assumptions used in the calculations are described in **Appendix A**.
- Operational and maintenance emissions under the Proposed Action would be similar to or less than current conditions (no action), once construction is complete. This is because personnel levels and emission sources are not anticipated to change.
- Greenhouse gas emissions from construction are compared with the greenhouse gas reporting requirement threshold under 40 CFR 98 (25,000 metric tons of CO_2e per year) to provide context for the scale of emissions. Dam operations are not a large source of emissions and therefore not one of the 41 source categories required to report greenhouse gas emissions under this program (EPA 2021e).
- Odors were not identified as an issue of concern and are not analyzed.

5.2.1 No Action Alternative

Air quality

Under the No Action Alternative, air pollutant emissions related to operation and maintenance of the dam would continue. These include emissions from vehicles and equipment, road dust from travel on unpaved portions of access roads, and emissions from sediment removal and other maintenance operations.

Climate

Under the No Action Alternative, greenhouse gas emissions related to operation and maintenance of the Kachess Dam would continue. These emissions include vehicle and equipment operations associated with Kachess Dam operations. Emissions would continue to be below 25,000 metric tons per year.

Historical trends and future climate projections showing increased warming and shifts in the seasonality of precipitation are projected to continue, as described under the *Affected Environment* section for climate.

5.2.2 Proposed Action

Air quality

The Proposed Action to reduce the risk of dam failure would have short-term impacts on air quality from site preparation, conduit extension and lining, installation of a diaphragm filter, construction of the stability berm and slope protection, and site reclamation. These activities would generate fugitive dust during surface-disturbing activities and from travel on unpaved portions of access roads and staging areas. They would also emit criteria pollutants and hazardous pollutants through the combustion of fuel in commute vehicles, trucks, construction equipment, and pumps and generators.

Sources of temporary and localized fugitive dust emissions would be from the following:

- Direct impacts from tree clearing and grubbing and site grading to construct the access road and staging areas
- Direct impacts from soil disturbance associated with construction of the access road, conduit extension, and stability berm
- Direct impacts from construction equipment, commute vehicles, delivery trucks, and water trucks on unpaved surfaces
- Indirect impacts from wind erosion of disturbed surfaces
- Indirect impacts from entrained dust caused by commute vehicles and delivery trucks on paved roads

The emissions of fugitive dust would be greatest during site grading activities. Emissions would vary over the course of construction, based on the level of activity during each construction phase. Dust from travel on unpaved access roads and staging areas would occur over the duration of construction. The amount of fugitive dust emissions would depend on the type of activity, weight of equipment, area disturbed, vehicle speed, and wind speed. Emissions would be localized to the area surrounding any given construction activity; they would cease when construction ends and any temporary disturbance areas are revegetated. Under the Proposed Action, approximately 8 acres would be disturbed temporarily.

Dust abatement best management practices (BMPs) and conservation measures similar to the following would be implemented to minimize air quality impacts during construction:

- Provide dust control and abatement during performance of work
- Prevent, control, and abate dust pollution on access roads and staging areas
- Place speed limits on unpaved access routes to minimize dust entrainment from vehicle movement
- Provide labor, equipment, and materials, and use efficient methods wherever and whenever required to prevent dust nuisance or damage to persons, property, or activities

Implementing fugitive dust control measures would minimize impacts on local air quality and on the sensitive receptors described in the *Affected Environment* section. These measures would be further defined in construction contracts, construction permits, and stormwater pollution prevention and dust control plans.

Combustion of fuel in commute vehicles, trucks, construction equipment, and pumps and generators would emit criteria air pollutants regulated under the Clean Air Act and small amounts of hazardous air pollutants (diesel particulate matter, acetaldehyde, benzene, and formaldehyde). These emissions would occur for the duration of construction. Sources of combustion emissions would include the following:

- Gas- and diesel-powered construction equipment and power tools
- Generators
- Delivery trucks and tractor trailers to bring in and move out materials and supplies
- Water trucks for dust suppression
- On-site light-duty trucks
- Commute vehicles for construction personnel

An estimate of combustion-related emissions by construction element was prepared. This estimate was based on preliminary estimates of the number of commute and delivery trips and vehicle miles traveled for on-road equipment (cars and trucks) and the types of equipment and operational hours for non-road (construction) equipment and generators that would be required to construct the various components of the Proposed Action, including the access road, storage areas, filter, conduit, and stability berm. **Table 5**, below, shows these emission estimates. The estimates are based on a current understanding of equipment requirements for construction activities. Actual emissions could differ from those shown as more detailed construction plans are developed and finalized.

Table 5. Estimated Equipment-Related Emissions by Proposed Work Component, Proposed Action

		Criteria Pollutants (tons)						Greenhouse Gases (metric tons)
Element[1] *(Timing)*	**Emission Source**	**Volatile Organic Compounds**	**CO**	**Nitrogen Oxides**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO_2e**
Phase 1: Access Road and Contractor Use Area Construction	On-road commute	0.037	0.373	0.021	0.000	0.004	0.002	18.18
	On-road trucks	0.010	0.039	0.060	0.000	0.007	0.002	17.23
	Non-road equipment	0.226	1.124	1.281	0.004	0.050	0.050	400.17
April to October 2023	*Subtotal*	*0.272*	*1.536*	*1.361*	*0.005*	*0.061*	*0.054*	*435.57*
Phase 2: Pipe Fabrication and Delivery	On-road commute	0.017	0.173	0.010	0.000	0.002	0.001	8.42
	On-road trucks	0.001	0.007	0.012	0.000	0.001	0.001	2.49
	Non-road equipment	0.002	0.008	0.012	0.000	0.000	0.000	0.000
January to June 2023	*Subtotal*	*0.020*	*0.187*	*0.034*	*0.000*	*0.004*	*0.002*	*10.907*

Element[1] *(Timing)*	Emission Source	Criteria Pollutants (tons)						Greenhouse Gases (metric tons)
		Volatile Organic Compounds	CO	Nitrogen Oxides	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Phase 3: Construction	On-road commute	0.307	3.111	0.175	0.001	0.035	0.013	151.48
	On-road trucks	0.012	0.046	0.069	0.000	0.008	0.003	20.53
	Non-road equipment	0.234	2.571	3.077	0.009	0.118	0.118	893.28
January 2024 to July 2025	*Subtotal*	*0.553*	*5.728*	*3.322*	*0.011*	*0.161*	*0.134*	*1065.28*
Total Emissions (tons)		**0.845**	**7.451**	**4.716**	**0.016**	**0.225**	**0.189**	**1,511.76**
% Comparison to the 2017 National Emissions Inventory Stationary and Mobile Emissions		0.044%	0.053%	0.167%	0.121%	0.060%	0.073%	—
% Comparison to the Greenhouse Gases Reporting Rule 25,000-metric Ton Threshold		—	—	—	—	—	—	**6%**

Source: Environmental Management and Planning Solutions Inc. staff analysis (see **Appendix D**)
[1] Construction activities will occur over a 2- to 3-year period; however, the analysis assumes that construction emissions will occur in the same year solely for the purposes of comparing project emissions with the National Emissions Inventory and Greenhouse Gases reporting rule comparison thresholds.

The following BMPs and conservation measures could be implemented to minimize combustion-related emissions:

- Use reasonably available methods and devices to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants
- Do not operate equipment and vehicles that show excessive exhaust gas emissions until corrective repairs or adjustments reduce such emissions to acceptable levels

Emissions associated with operations and maintenance would be similar in nature to those described for the No Action Alternative.

Climate

Under the Proposed Action, site preparation, construction, transportation, and site closeout would result in short-term emissions of greenhouse gases (CO_2, nitrous oxide, and methane) through the combustion of fuels in on-road and non-road equipment, as described above under air quality. In addition to directly emitted greenhouse gas emissions, minor amounts of carbon in soils and vegetation would be released during surface-disturbing activities. Estimated combustion-related emissions, shown in **Table 5**, would be below 25,000 metric tons per year. BMPs and conservation measures that reduce combustion-related criteria pollutant emissions would also reduce greenhouse gas emissions.

Greenhouse gas emissions associated with operations and maintenance following the completion of construction would be similar in nature to those described for the No Action Alternative.

5.3 Short-Term Uses and Long-Term Productivity

As described above, the Proposed Action would have temporary impacts on air quality and climate through the emission of criteria and hazardous pollutants, greenhouse gases, and the generation of fugitive dust. These emissions would end upon the completion of project construction.

Because there would be little to no change in operational or maintenance activities over the long term compared with current conditions, there would be no effect, positive or negative, on the long-term productivity of air quality or climate in the analysis area.

5.4 Unavoidable Adverse Impacts

The No Action Alternative would have no unavoidable adverse effects on air quality and climate. The Proposed Action would have the temporary adverse impacts described above. While these impacts would be minimized through BMPs and conservation measures, unavoidable adverse impacts, specifically the emissions of greenhouse gases and air pollutants, would still occur over the duration of the construction period.

5.5 Irreversible and Irretrievable Commitment of Resources

There would be no irreversible or irretrievable commitment of resources related to air quality or climate under either alternative.

Chapter 6. Glossary

Climate—The collective typical weather conditions in a region averaged over a series of years.

Climate change—A change in global or regional climate patterns, in particular a change apparent from the mid- to late twentieth century onward, and attributed largely to the increased levels of atmospheric carbon dioxide.

Climate normal—Three-decade averages of climatological variables, including temperature and precipitation.

Particulate matter (PM)—Tiny particles or liquid droplets suspended in the air that can contain a variety of chemical components. Larger particles are visible as smoke or dust, and they settle relatively rapidly. The tiniest particles can be suspended in the air for long periods; they are the most harmful to human health because they can penetrate deep into the lungs. Some particles are directly emitted into the air. They come from a variety of sources, such as cars, trucks, buses, factories, construction sites, tilled fields, unpaved roads, stone crushing, and wood burning. Other particles are formed in the atmosphere by chemical reactions.

Pollutants (pollution)—Unwanted chemicals or other materials found in the environment. Pollutants can harm human health, the environment, and property. Air pollutants occur as gases, liquid droplets, and solids. Once released into the environment, many pollutants can persist, travel long distances, and move from one environmental medium—air, water, or land—to another.

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Appendix A

Calculations Assumptions

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Assumptions

On-Road Commute Traffic

	Phase 1	Phase 2	Phase 3
No. of Employees:	15	3	30
No. of Inspectors:	1	1	2
Days of construction:	90	130	376

Construction Worker Commute Distance: 15 miles one-way (Distance to Che Elum)
Reclamation Inspector Commute Distance: 40 miles one-way (Distance to Ellensberg)

On-Road Non-Commute

	Mobilization/Demobilation Trips[2]	miles/ round trip	Other Tractor Trailer Trips	miles/ round trip	Total Tractor Trailer VMT	Material Haul Trips[3]	miles/ round trip	Water Trucks[3,4]	miles/day	Water Truck Days	Total Haul Truck VMT	Notes
Phase 1: Access Road and Contractor Use Area Construction												
Tree clearing and grubbing, shred trees, prepare trees for reuse	4	80	2	80	480	0	0	0	0	0	0	
Load and haul trees	4	80	2	80	480	250	40	0	0	0	10,000	Trees hauled to Stampede Pass (20 miles one way)
Construct access road/staging[1]	20	80	10	80	2,400	140	30	2	5	80	5,000	Assumes all fill is sourced onsite; gravel is sourced from Cle Elum
Phase 1 Total					*3,360*						*15,000*	
Phase 2: Pipe Fabrication and Delivery												
Fabricate/deliver pipes	2	80	11	200	2,360	0	0	0	0	0	0	Pipe hauled on tractor trailers; assumes pipe delivered from Seattle (100 miles one way)
Phase 3: Construction												
Excavate foundation	14	80	7	80	1,680	0	0	0	0	0	0	
Sand delivery	0	80	0	80	0	520	30	0	0	0	15,600	Assumes sand is sourced in Cle Elum
Concrete delivery	0	80	0	80	0	35	30	0	0	0	1,050	Assumes half of concrete is sourced in Cle Elum
Concrete delivery	0	80	0	80	0	35	80	0	0	0	2,800	Assumes half of concrete is sourced in Ellensberg
Install pipe in conduit	6	80	3	80	720	0	0	0	0	0	0	
Concrete placement	2	80	1	80	240	0	0	0	0	0	0	
Phase 3 Total					*2,640*						*19,450*	

[1]Assumes construction equipment brought in for access road is used for staging areas

[2]Trips associated with transporting nonroad equipment to and from the construction site; tractor trailer emission factors used

[3]Haul Truck emission factors used

[4]Assumes water trucks will be filled onsite

NonRoad Equipment

	ConstructionDays	D8 Dozer	Long-reach Forklift	Chainsaws	Log Chippers	Crane	Front End Loader	Off-Road Trucks	Blade	Compactor	Excavator
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred trees, prepare trees for reuse	18	1	1	1	1	-	-	-	-	-	-
Load and haul trees	24	-	1	-	-	1	-	-	-	-	-
Construct access road/staging	80	1	-	-	-	-	1	3	1	2	-
Phase 2: Pipe Fabrication and Delivery											
Fabricate/deliver pipes	5	-	-	-	-	1	-	-	-	-	-
Phase 3: Construction											
Site Prep/Excavate foundation	60	-	-	-	-	-	1	3	-	-	3
Install pipe in conduit	30	1	-	-	-	1	-	-	-	-	-
Concrete placement	170	-	-	-	-	1	-	-	-	-	-

*Electric pumps would be used; therefore, no emissions are calculated

Summary of Emissions

Element *(Timing)*	Emission Source	Criteria Pollutants (Tons)						GHGs (Metric Tons)
		VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2e
Phase 1: Access Road and Contractor Use Area Construction	On-road commute	0.037	0.373	0.021	0.000	0.004	0.002	18.18
	On-road trucks	0.010	0.039	0.060	0.000	0.007	0.002	17.23
	Non-road equipment	0.226	1.124	1.281	0.004	0.050	0.050	400.17
April to October 2023	*Subtotal*	*0.272*	*1.536*	*1.361*	*0.005*	*0.061*	*0.054*	*435.57*
Phase 2: Pipe Fabrication and Delivery	On-road commute	0.017	0.173	0.010	0.000	0.002	0.001	8.42
	On-road trucks	0.001	0.007	0.012	0.000	0.001	0.001	2.49
	Non-road equipment	0.002	0.008	0.012	0.000	0.000	0.000	0.000
January to June 2023	*Subtotal*	*0.020*	*0.187*	*0.034*	*0.000*	*0.004*	*0.002*	*10.907*
Phase 3: Construction	On-road commute	0.307	3.111	0.175	0.001	0.035	0.013	151.48
	On-road trucks	0.012	0.046	0.069	0.000	0.008	0.003	20.53
	Non-road equipment	0.234	2.571	3.077	0.009	0.118	0.118	893.28
January 2024 to July 2025	*Subtotal*	*0.234*	*2.571*	*3.077*	*0.009*	*0.118*	*0.118*	*893.28*
Total Emissions (tons)		**0.527**	**4.294**	**4.472**	**0.014**	**0.182**	**0.173**	**1,339.75**
% Comparison to 2017 NEI Stationary and MobileEmissions		**0.028%**	**0.030%**	**0.159%**	**0.109%**	**0.048%**	**0.067%**	**—**
% Comparison to the GHG Reporting Rule 25,000-metric ton threshold		**—**	**—**	**—**	**—**	**—**	**—**	**5%**

On-Road Commute Vehicles Emissions

Calculation Method:

The emission factors for on-road equipment are given in lb/miles

Emissions (tons) = [Emission Factor (lb/travel mile)] X [travel mile/2000 (lb/U.S. ton)]

CO2e equals the GHG times global warming potential ([CO2 * 1] + [CH4 * 28]+[N2O*265]); GWPs taken from IPPC 5th Assessment Report (IPCC 2014)

Assumptions:

Assumed an average driving distance of 15 miles one-way for worker commute traffic (distance to Cl Elum)

15 personnel per day in Phase 1, 3 in Phase 2, and 30 in Phase 3

1 Reclamation inspector per day in Phase 1 and 2, and 2 inspectors in Phase 3 traveling 40 miles per day

Emission factors derived from EPA's MOVES 2014 model, on-road emissions, 2020

Emission Factors (lb/mile)								
VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N2O
0.0015432	0.0156529	0.0008819	0.0000066	0.0001764	0.0000661	0.7614365	0.0000220	0.0000004

Description	Personnel	Days	miles/ day	Total VMT	Emissions (tons)									
					VOC	CO	NOx	SOx	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N2O	CO2e
Phase 1: Access Road and Contractor Use Area Construction														
Construction personnel	15	90	30	40,500	0.0313	0.3170	0.0179	0.0001	0.0036	0.0013	15.4191	0.0004	0.00001	15.43
Reclamation inspector trip	1	90	80	7,200	0.0056	0.0564	0.0032	0.0000	0.0006	0.0002	2.7412	0.0001	0.00000	2.74
Subtotal					*0.037*	*0.373*	*0.021*	*0.000*	*0.004*	*0.002*	*18.160*	*0.001*	*0.000*	*18.178*
Phase 2: Pipe Fabrication and Delivery														
Construction personnel	3	130	30	11,700	0.0090	0.0916	0.0052	0.0000	0.0010	0.0004	4.4544	0.0001	0.00000	4.46
Reclamation inspector trip	1	130	80	10,400	0.0080	0.0814	0.0046	0.0000	0.0009	0.0003	3.9595	0.0001	0.00000	3.96
Subtotal					*0.017*	*0.173*	*0.010*	*0.000*	*0.002*	*0.001*	*8.414*	*0.000*	*0.000*	*8.422*
Phase 3: Construction														
Construction personnel	30	375	30	337,500	0.2604	2.6414	0.1488	0.0011	0.0298	0.0112	128.4924	0.0037	0.00007	128.62
Reclamation inspector trip	2	375	80	60,000	0.0463	0.4696	0.0265	0.0002	0.0053	0.0020	22.8431	0.0007	0.00001	22.87
Subtotal					*0.307*	*3.111*	*0.175*	*0.001*	*0.035*	*0.013*	*151.336*	*0.004*	*0.000*	*151.481*
TOTAL					**0.361**	**3.657**	**0.206**	**0.002**	**0.041**	**0.015**	**177.910**	**0.005**	**0.00010**	**178.08**

On-Road Non-Commute Vehicle Emissions

Calculation Method:

The emission factors for on-road equipment are given in lb/miles

Emissions (tons) = [Emission Factor (lb/travel mile)] X [travel mile/2000 (lb/U.S. ton)]

CO2e equals the GHG times global warming potential ([CO2 * 1] + [CH4 * 28]+[N2O*265]); GWPs taken from IPPC 5th Assessment Report (IPCC 2014)

Assumptions:

See assumptions page for input data

Emission factors derived from EPA's MOVES2014 model, on-road emissions, 2020

	Emission Factors (lb/mile)								
	VOC	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N2O**
Material Delivery/Haul	0.00110232	0.00396834	0.00573205	0.00002205	0.00066139	0.00022046	1.82292379	0.00006614	0.00000088
Tractor-Trailer	0.00110232	0.00551159	0.00992085	0.00004409	0.00110232	0.00044093	2.10181000	0.00006614	0.00000882

Element	**VMT**	**Emissions (tons)**									
		VOC	**CO**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**	**CH_4**	**N2O**	**CO2e**
Phase 1: Access Road and Contractor Use Area Construction											
Material Delivery/Haul	15,000	0.008	0.030	0.043	0.000	0.005	0.002	13.672	0.000	0.000	13.69
Tractor-Trailer	3,360	0.002	0.009	0.017	0.000	0.002	0.001	3.531	0.000	0.000	3.54
Subtotal	*18,360*	*0.010*	*0.039*	*0.060*	*0.000*	*0.007*	*0.002*	*17.203*	*0.001*	*0.000*	*17.23*
Phase 2: Pipe Fabrication and Delivery											
Material Delivery/Haul	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00
Tractor-Trailer	2,360	0.001	0.007	0.012	0.000	0.001	0.001	2.480	0.000	0.000	2.49
Subtotal	*2360*	*0.001*	*0.007*	*0.012*	*0.000*	*0.001*	*0.001*	*2.480*	*0.000*	*0.000*	*2.49*
Phase 3: Construction											
Material Delivery/Haul	19,450	0.011	0.039	0.056	0.000	0.006	0.002	17.728	0.001	0.000	17.75
Tractor-Trailer	2,640	0.001	0.007	0.013	0.000	0.001	0.001	2.774	0.000	0.000	2.78
Subtotal	*22,090*	*0.012*	*0.046*	*0.069*	*0.000*	*0.008*	*0.003*	*20.502*	*0.001*	*0.000*	*20.53*
TOTAL	***42,810***	***0.024***	***0.091***	***0.140***	***0.001***	***0.016***	***0.006***	***40.185***	***0.001***	***0.000***	***40.24***

Non-Road Equipment Emissions

Calculation Method:

The emission factors for off-road equipment are given in lb/hr

Emissions (tons) = [Emission Factor (lb/hr)] X [hours/2000 (lb/U.S. ton)]

Assumptions:

EMFAC Off-Road Emission Factor for 2021; composite emission factor for each equipment type used

Type and number of equipment obtained from Reclamation preliminary; construction days by activity based on preliminary schedule

Construction: Conservatively assume 8 hr/day of equipment use

Non-Road Equipment

Description	Criteria Pollutant Emissions (tons)						GHG (tons)		
	VOC	CO	NOx	SOx	PM10	PM2.5	CO_2	CH_4	CO2e
Phase 1: Access Road and Contractor Use Area Construction									
Tree clearing and grubbing, shred	0.0160	0.1072	0.0930	0.0003	0.0039	0.0039	31.1137	0.0014	31.1541
Load and haul trees	0.0109	0.0577	0.0719	0.0002	0.0027	0.0027	17.5706	0.0010	17.5983
Construct access road/staging	0.1986	0.9586	1.1158	0.0037	0.0429	0.0429	350.9128	0.0179	351.4145
Subtotal	*0.2255*	*1.1235*	*1.2807*	*0.0042*	*0.0496*	*0.0496*	*399.5971*	*0.0203*	*400.1669*
Phase 2: Pipe Fabrication and Delivery									
Pipe Delivery	0.0017	0.0077	0.0121	0.0000	0.0005	0.0005	2.5726	0.0002	0.0000
Phase 3: Construction									
Site Prep/Excavate foundation	0.1659	0.2628	0.4103	0.0009	0.0155	0.0155	87.4695	0.0052	87.6148
Install pipe in conduit	0.0106	2.3079	2.6671	0.0085	0.1024	0.1024	804.4987	0.0415	805.6606
Concrete placement	0.0575	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Subtotal	*0.2340*	*2.5708*	*3.0774*	*0.0094*	*0.1179*	*0.1179*	*891.9682*	*0.0467*	*893.2754*

Non-Road Equipment Emissions

Calculation Method:

The emission factors for off-road equipment are given in lb/hr

Emissions (tons) = [Emission Factor (lb/hr)] X [hours/2000 (lb/U.S. ton)]

Assumptions:

EMFAC Off-Road Emission Factor for 2021; composite emission factor for each equipment type used

Type and number of equipment obtained from Reclamation preliminary; construction days by activity based on preliminary schedule

Construction: Conservatively assume 8 hr/day of equipment use

Emission factors:

Emission Factors (lb/hr)							
VOC	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2**	**CH4**
0.086078	0.57471999	0.52129966	0.001496	0.024746	0.024746	132.743	0.007767

Non-Road Equipment

Description	**Criteria Pollutant Emissions (tons)**						**GHG (tons)**		
	VOC	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2**	**CH4**	**CO2e**
Phase 1: Access Road and Contractor Use Area Construction									
Tree clearing and grubbing, shred trees, prepare trees for reuse	0.016	0.10720528	0.09296255	0.000333	0.003934	0.003934	31.1137	0.001444	31.15412
Load and haul trees	0.010941	0.05772892	0.07192603	0.00019	0.002731	0.002731	17.57063	0.000987	17.59827
Construct access road/staging	0.198591	0.95857502	1.11584677	0.003698	0.04291	0.04291	350.9128	0.017919	351.4145
Subtotal	*0.225532*	*1.12350922*	*1.2807354*	*0.004221*	*0.049575*	*0.049575*	*399.5971*	*0.020349*	*400.1669*
Phase 2: Pipe Fabrication and Delivery									
Pipe Delivery	0.001692	0.00773029	0.01206676	2.75E-05	0.000457	0.000457	2.572632	0.000153	0
Phase 3: Construction									
Site Prep/Excavate foundation	0.165906	0.26282988	0.41026994	0.000936	0.015539	0.015539	87.46949	0.00519	87.61481
Install pipe in conduit	0.010592	2.30794796	2.66712812	0.008499	0.102404	0.102404	804.4987	0.041498	805.6606
Concrete placement	0.057522	0	0	0	0	0	0	0	0
Subtotal	*0.23402*	*2.57077785*	*3.0773981*	*0.009436*	*0.117943*	*0.117943*	*891.9682*	*0.046688*	*893.2754*

	Earth Mover/Dozer			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	1	8	18	0.006198	0.04138	0.037534	0.000108	0.001782	0.001782	9.557495	0.000559
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	1	8	40	0.013772	0.091955	0.083408	0.000239	0.003959	0.003959	21.23888	0.001243
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0	0	0	0	0	0	0	0
Install pipe in conduit	1	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Excavator			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	0	0	80	0	0	0	0	0	0	0	0
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	3	8	60	0.049479	0.368108	0.257533	0.000947	0.011407	0.011407	86.09717	0.004464
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Motor Grader			Emissions (tons)							

	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shre(	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	1	8	80	0.027545	0.18391	0.166816	0.000479	0.007919	0.007919	42.47775	0.002485
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0	0	0	0	0	0	0	0
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Compactor			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shre(	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	2	8	80	0.003214	0.016857	0.020126	4.3E-05	0.000786	0.000786	2.760834	0.00029
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0	0	0	0	0	0	0	0
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Forklift			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shre(	1	8	18	0.002115	0.015468	0.010504	4.34E-05	0.000403	0.000403	3.916495	0.000191

Load and haul trees	1	8	24	0.00282	0.020624	0.014006	5.79E-05	0.000538	0.000538	5.221993	0.000254
Construct access road/staging	0	0	80	0	0	0	0	0	0	0	0
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0.000881	0	0	0	0	0	0	0
Install pipe in conduit	0	0	30	0.000441	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Crane			**Emissions (tons)**							
	No.	**hr/day**	**Days**	**VOC**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2**	**CH4**
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	1	8	24	0.008121	0.037105	0.05792	0.000132	0.002194	0.002194	12.34863	0.000733
Construct access road/staging	0	0	80	0	0	0	0	0	0	0	0
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	1	8	5	0.001692	0.00773	0.012067	2.75E-05	0.000457	0.000457	2.572632	0.000153
Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0	0	0	0	0	0	0	0
Install pipe in conduit	1	8	30	0.010151	0.046382	0.072401	0.000165	0.002742	0.002742	15.43579	0.000916
Concrete placement	1	8	170	0.057522	0.26283	0.41027	0.000936	0.015539	0.015539	87.46949	0.00519

	Wheeled Loader			**Emissions (tons)**							
	No.	**hr/day**	**Days**	**VOC**	**CO**	**NOx**	**SOx**	**PM10**	**PM2.5**	**CO2**	**CH4**
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	1	8	80	0.022561	0.140191	0.136799	0.000384	0.006602	0.006602	34.7555	0.002036

Phase 2: Pipe Fabrication and Delivery										
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction										
Site Prep/Excavate foundation	1	8	60	0.016921	0.105143	0.1026	0.000288	0.004951	0.004951	26.06662	0.001527
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Off-Highway Trucks Composite			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	0	0	18	0	0	0	0	0	0	0	0
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	3	8	80	0.131499	0.525661	0.708698	0.002552	0.023644	0.023644	249.6798	0.011865
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0
Phase 3: Construction											
Site Prep/Excavate foundation	3	8	60	0.098625	0.394246	0.531523	0.001914	0.017733	0.017733	187.2599	0.008899
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

	Composite			Emissions (tons)							
	No.	hr/day	Days	VOC	CO	NOx	SOx	PM10	PM2.5	CO2	CH4
Phase 1: Access Road and Contractor Use Area Construction											
Tree clearing and grubbing, shred	2	8	18	0.007687	0.050358	0.044925	0.000182	0.001749	0.001749	17.63971	0.000694
Load and haul trees	0	0	24	0	0	0	0	0	0	0	0
Construct access road/staging	0	0	80	0	0	0	0	0	0	0	0
Phase 2: Pipe Fabrication and Delivery											
Pipe Delivery	0	0	5	0	0	0	0	0	0	0	0

Phase 3: Construction											
Site Prep/Excavate foundation	0	0	60	0	0	0	0	0	0	0	0
Install pipe in conduit	0	0	30	0	0	0	0	0	0	0	0
Concrete placement	0	0	170	0	0	0	0	0	0	0	0

Emission factors derived from EPA's MOVES2014 model, on-road emissions, 2020

Passenger Car/Truck		
Pollutant	**(g/mile)**	**lb/mi**
VOC	0.70	0.00154324
CO	7.10	0.01565290
NOx	0.40	0.00088185
SOx	0.00	0.00000661
PM10	0.08	0.00017637
PM2.5	0.03	0.00006614
CO2	345.38	0.76143654
CH4	0.01	0.00002205
N20	0.00	0.00000044

Material Delivery & Dirt Haul Trucks		
Pollutant	**(g/mile)**	**lb/mi**
VOC	0.50	0.00110232
CO	1.80	0.00396834
NOx	2.60	0.00573205
SOx	0.01	0.00002205
PM10	0.30	0.00066139
PM2.5	0.10	0.00022046
CO2	826.86	1.82292379
CH4	0.03	0.00006614
N20	0.00	0.00000088

Tractor Trailers		
Pollutant	**(g/mile)**	**lb/mi**
VOC	0.50	0.00110232
CO	2.50	0.00551159
NOx	4.50	0.00992085
SOx	0.02	0.00004409
PM10	0.50	0.00110232
PM2.5	0.20	0.00044093
CO2	953.36	2.10181000
CH4	0.03	0.00006614
N20	0.00	0.00000882

Non-Road EFs

		VOC	CO	NOx	SOx	PM_{10}	PM2.5	CO_2	CH_4
		(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)	
Equipment	**MaxHP**	**VOC**	**CO**	**NOX**	**SOX**	**PM**	**CO2**	**CH4**	
Air Compressors Composite		0.0442	0.3051	0.2928	0.0007	0.0158	63.6	0.0040	
Bore/Drill Rigs Composite		0.0460	0.5007	0.3219	0.0017	0.0053	165	0.0042	
Cement and Mortar Mixers Composite		0.0086	0.0415	0.0535	0.0001	0.0021	7.2	0.0008	
Concrete/Industrial Saws Composite		0.0444	0.3761	0.3176	0.0007	0.0171	58.5	0.0040	
Cranes Composite		0.0846	0.3865	0.6033	0.0014	0.0229	129	0.0076	
Crawler Tractors Composite		0.0988	0.5208	0.6239	0.0013	0.0343	114	0.0089	
Crushing/Proc. Equipment Composite		0.0872	0.6224	0.5412	0.0015	0.0270	132	0.0079	
Dumpers/Tenders Composite		0.0092	0.0314	0.0581	0.0001	0.0022	7.6	0.0008	
Excavators Composite		0.0687	0.5113	0.3577	0.0013	0.0158	120	0.0062	
Forklifts Composite		0.0294	0.2148	0.1459	0.0006	0.0056	54.4	0.0027	
Generator Sets Composite		0.0363	0.2708	0.2978	0.0007	0.0131	61.0	0.0033	
Graders Composite		0.0861	0.5747	0.5213	0.0015	0.0247	133	0.0078	
Off-Highway Tractors Composite		0.1394	0.6413	0.9902	0.0017	0.0459	151	0.0126	
Off-Highway Trucks Composite		0.1370	0.5476	0.7382	0.0027	0.0246	260	0.0124	
Other Construction Equipment Composite		0.0534	0.3497	0.3120	0.0013	0.0121	122	0.0048	
Other General Industrial Equipmen Composite		0.0915	0.4479	0.5887	0.0016	0.0227	152	0.0083	
Other Material Handling Equipment Composite		0.0860	0.4392	0.5748	0.0015	0.0218	141	0.0078	
Pavers Composite		0.0928	0.4878	0.5089	0.0009	0.0325	77.9	0.0084	
Paving Equipment Composite		0.0710	0.4062	0.4462	0.0008	0.0288	68.9	0.0064	
Plate Compactors	15	0.0050	0.0263	0.0314	0.0001	0.0012	4.3	0.0005	
Plate Compactors Composite		0.0050	0.0263	0.0314	0.0001	0.0012	4.3	0.0005	
Pressure Washers Composite		0.0079	0.0543	0.0625	0.0001	0.0027	9.4	0.0007	
Pumps Composite		0.0344	0.2652	0.2637	0.0006	0.0128	49.6	0.0031	
Rollers Composite		0.0540	0.3816	0.3483	0.0008	0.0206	67.0	0.0049	
Rough Terrain Forklifts Composite		0.0497	0.4454	0.3193	0.0008	0.0172	70.3	0.0045	
Rubber Tired Dozers	175	0.1432	0.8097	0.9278	0.0015	0.0522	129	0.0129	
Rubber Tired Dozers Composite		0.2015	0.7661	1.4661	0.0025	0.0582	239	0.0182	
Rubber Tired Loaders Composite		0.0705	0.4381	0.4275	0.0012	0.0206	109	0.0064	
Scrapers Composite		0.1815	0.7745	1.2263	0.0027	0.0492	262	0.0164	
Signal Boards Composite		0.0125	0.0911	0.0863	0.0002	0.0039	16.7	0.0011	
Skid Steer Loaders Composite		0.0212	0.2119	0.1544	0.0004	0.0042	30.3	0.0019	
Surfacing Equipment Composite		0.0779	0.3860	0.5953	0.0017	0.0216	166	0.0070	
Sweepers/Scrubbers Composite		0.0536	0.4882	0.3225	0.0009	0.0151	78.5	0.0048	
Tractors/Loaders/Backhoes Composite		0.0407	0.3606	0.2506	0.0008	0.0113	66.8	0.0037	
Trenchers Composite		0.0874	0.4226	0.4327	0.0007	0.0309	58.7	0.0079	
Welders Composite		0.0280	0.1788	0.1635	0.0003	0.0088	25.6	0.0025	

Kachess Dam Safety of Dams Modification Environmental Assessment

Biological Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Biological resources include aquatic ecosystems and aquatic species, terrestrial ecosystems and wildlife, and special status species, including Endangered Species Act (ESA) recognized species.

The Army Corps of Engineers regulates jurisdictional waters, and modification to jurisdictional waters would require permits under the Clean Water Act (CWA). A wetland delineation report was completed for the project in July 2021. This report identified 0.76 acres of wetland features and approximately 11.9 acres of other waters of the United States (see Aquatic Resources Delineation Report; Reclamation 2021). The proposed project could potentially remove or modify 0.12 acres of wetland features and 0.22 acres of open water where the permanent access road crosses these features, and an open bottom culvert is installed. The project would require a CWA 404 permit, possibly a 401 water quality permit, and an associated dewatering plan, erosion control plan, replanting plan, and best management practices (BMPs). Conditions of the CWA permit and these plans would avoid, minimize, or mitigate impacts on wetlands and aquatic habitats.

Project activities occurring in or near aquatic ecosystems could degrade aquatic habitats or directly affect aquatic species. Impacts could include construction disturbances, changes in the aquatic habitat connectivity, and habitat degradation. There could be temporary interruptions in flow and fish passage during construction, but flow and fish passage would be restored once the culvert is installed. The US Bureau of Reclamation (Reclamation) does not anticipate reservoir-level restrictions, and construction of the extension and lining of the outlet works would be timed to avoid major issues with water deliveries. Reclamation plans to comply with maintaining minimum flows through the dam throughout the project, as established through negotiations with a number of stakeholders, including the Washington Department of Fish and Wildlife (WDFW), Yakama Nation, US Fish and Wildlife Services (USFWS), the National Marine Fisheries Service (NMFS), and various irrigation districts.

Impacts on aquatic species would largely depend on the timing of construction activities, the presence of the aquatic species, and the implementation of BMPs. Project design features to minimize impacts on fish would also avoid, minimize, or mitigate impacts on aquatic species (see Section 6.0).

The majority (31.7 acres of the total 49.1 acres of the project area) of terrestrial ecosystems in the project area are classified as East Cascades Mesic Montane Mixed-Conifer Forest and Woodland. The remaining habitat includes Northern Rocky Mountain Dry-Mesic Montane Mixed-Conifer Forest, North Pacific Montane Riparian Woodland and Shrubland, Unconsolidated Shore, Open Water, and Developed (USGS GAP GIS 2011). Forest habitats are used by elk and deer, small mammals, raptors, owls, grouse, and a wide range of songbirds. Riparian areas and wetland complexes are used by many species, including bears, ungulates, small mammals, reptiles, amphibians, cavity-nesting birds, raptors, and songbirds. The reservoir and shoreline fringe vegetation are used by multiple waterfowl and shorebird species. Habitat fragmentation near the reservoir ranges from moderate to severe because of Interstate 90, transmission lines, residential areas, and timber harvest.

Project activities that modify or remove vegetation would affect terrestrial ecosystems and could impact the terrestrial wildlife that inhabit these ecosystems. The Proposed Action could remove or modify approximately 11.1 acres of terrestrial vegetation types; this includes 4.1 acres of permanent disturbance and approximately 7 acres from temporary disturbances. The approximate 7 acres would be regraded and revegetated with native seed mix. The total acreage (approximately 11 acres) subject to disturbance is a small portion of the available suitable habitat surrounding the project area. Due to the small portion of removed or disturbed vegetation, the revegetation of temporary disturbance areas, and the implementation of project design features and BMPs (see Section 6.0), the proposed project is not anticipated to have significant adverse impacts on terrestrial ecosystems and wildlife.

ESA consultation would be needed for the effects on northern spotted owl, Bull Trout, and steelhead, including effects on designated critical habitat. ESA consultation for the project is in progress and would be completed prior to project implementation. See the project's biological assessment for details (Reclamation 2021). Washington State sensitive species include Pygmy Whitefish, two sensitive plants, and a sensitive moss that could potentially exist in the project area. However, no sensitive plants or moss are anticipated to exist in the areas of project disturbance; therefore, the project would not impact them. Impacts on Pygmy Whitefish would be avoided or minimized through project design features, BMPs, and the ESA consultation mitigation measures for the listed fish (see below).

In consultation with the USFWS, NMFS, and WDFW, Reclamation would develop mitigation measures, where appropriate, to minimize adverse impacts on special status species and their habitats. Clearing and grubbing of trees during the first phase of the project between April and October 2023 could result in disturbance effects on northern spotted owls, if they are present. Fulfilling Section 7 ESA consultation requirements with the USFWS and implementation of conservation measures would minimize adverse effects on northern spotted owls and the removal of potential habitat (see the project biological assessment; Reclamation 2021).

There is the potential for disruption to fish behavior and a temporary modification to fish and aquatic habitat during flow shutoff periods. Most fish and some aquatic species would be able to move to deeper water as flows begin to lower; however, there may be some species that become isolated in pools. As part of the project and ESA Section 7 consultation, a fish salvage and relocation plan would be implemented during flow shutoff periods. This would ensure fish that could become stranded due to low flow conditions in the downstream portion of Kachess River could be salvaged and relocated to appropriate deep water. Fish salvage and handling could still result in some harm and possible mortality of aquatic species. Implementation of project design features, BMPs, and the ESA Section 7 consultation measures would minimize impacts on federally recognized species in the project area (see the Biological Assessment).

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
BMP	best management practice
CWA	Clean Water Act
ESA	Endangered Species Act
NOAA Fisheries, NMFS	National Marine Fisheries Service
Reclamation	US Bureau of Reclamation
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

Chapter 1. Analysis Area

The analysis area for aquatic ecosystems and aquatic species includes the water features in the project area and extends 0.9 miles in Kachess River downstream of the dam to the confluence with Lake Easton. This analysis area would consider impacts on aquatic species from reduced flows during water shutoff periods. The analysis area for terrestrial ecosystems and plants includes the project area where project activities could remove or modify vegetation. The analysis area for terrestrial wildlife and special status species is the project area plus a 0.25-mile buffer around the project area to account for disturbance impacts on wildlife species.

Chapter 2. Indicators

- Changes in aquatic species occurrence or abundance
- Changes in available aquatic habitat (acres) during shutoff periods (see also hydrology)
- Changes in aquatic habitat quality including temperature, sedimentation, erosion, and invasive species (see also water quality)
- Acres of removal or modification of delineated wetlands
- Level and duration of noise and vibrations disturbances in aquatic and terrestrial habitats
- Changes (temporary or permanent) in available terrestrial wildlife habitats (acres)
- Disturbance of northern spotted owl during the breeding season
- Removal of northern spotted owl habitat elements, such as large trees and canopy cover
- Potential risk of harm or mortality to listed fish from reduced flows, entrainment, relocation handling, and earthmoving

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

3.1.1 Clean Water Act

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredge and fills material into waters of the United States, including wetlands. The Army Corps of Engineers evaluates applications for Section 404 permits. Permit review and issuance follows a sequential process that encourages avoidance of impacts, followed by minimizing impacts and, finally, requiring mitigation for unavoidable impacts on the aquatic environment. This sequence is described in the guidelines at Section 404(b)(1) of the CWA.

3.1.2 Endangered Species Act

The Endangered Species Act (ESA) requires all federal agencies to ensure their actions do not jeopardize the continued existence of ESA-listed species, or destroy or adversely modify their critical habitat. As part of the ESA's Section 7 process, an agency must request a list of species from the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NOAA Fisheries) that identifies threatened and endangered species within or near the action area. The agency then must evaluate impacts on those species. If the action may impact any ESA-listed species, the agency must consult with the USFWS or NOAA Fisheries, or both.

3.1.3 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act provides for equal consideration of wildlife conservation in coordination with other features of water resource development programs. This requires that any plans to impound, divert, control, or modify any stream or other body of water must be coordinated with the USFWS and state wildlife agencies through consultation directed toward prevention of fish and wildlife losses and development or enhancement of these resources.

3.2 State and Local Laws

The Washington Natural Area Preserves Act (Revised Code of Washington 79.70) established the Washington Natural Heritage Program within the Department of Natural Resources to identify which species and ecosystems are priorities for conservation.

The Kittitas County critical areas ordinance, developed under the Growth Management Act, requires the county to designate and protect critical areas. Critical areas are defined as wetlands, aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas.

Chapter 4. Affected Environment

4.1 Aquatic Ecosystems and Aquatic Species

A wetland delineation was conducted for the project area in August 2020 with an addition to the survey area delineated in July 2021 (Reclamation 2021). The wetland delineation identified a total of 0.76 acres in five individual wetland features (see Aquatic Resources Delineation Report; Reclamation 2021). Of those wetlands, four are presumed to have developed as a result of Kachess Dam construction and its associated works. One wetland (W4) is presumed to be naturally occurring and likely predates construction of Kachess Dam.

Five other waters of the United States in the project area (totaling approximately 11.9 acres) were also delineated. These include Kachess Reservoir, the spillway and outlet works, a standing pond, and Kachess River. Wetlands delineated in the project area were assessed for function following the Washington State Wetland Rating System for Eastern Washington. See the wetland delineation report for full details (Reclamation 2021). Wetlands and other waters of the United States are subject to CWA permitting under Section 404.

The historical lakes and tributaries of the upper Yakima River basin formerly supported anadromous spring Chinook (*Oncorhynchus tshawytscha*), summer steelhead (*Oncorhynchus mykiss*), Coho Salmon (*Oncorhynchus kisutch*), and Sockeye Salmon (*Oncorhynchus nerka*). However, the construction of dams and irrigation storage reservoirs has precluded anadromous fish access. Kachess Dam is a passage barrier for returning anadromous fish, and no anadromous fish species are present in the reservoir or in tributaries upstream of the Dam (Reclamation 2019). Downstream from the dam, the Yakima River watershed supports anadromous runs of salmon and steelhead, as well as resident species.

The following are fish species with potential occurrence in Kachess Reservoir: Kokanee Salmon (*Oncorhynchus nerka*), Mountain Whitefish (*Prosopium williamsoni*), Pygmy Whitefish (*Prosopium coulterii*; Washington State sensitive species), Cutthroat Trout (*Oncorhynchus clarkii*), Rainbow Trout (*Oncorhynchus mykiss*), Brook Trout (*Salvelinus fontinalis*; nonnative), Longnose Dace (*Rhinichthys cataractae*), Leopard Dace (*Rhinichthys falcatus*), Speckled Dace (*Rhinichthys osculus*), Chiselmouth (*Acrocheilus alutaceus*), Redside Shiner (*Richardsonius balteatus*), Peamouth (*Mylocheilus caurinus*), Northern Pikeminnow (*Ptychocheilus oregonensis*), Largescale Sucker (*Catostomus macrocheilus*), Mountain Sucker (*Catostomus platyrhynchus*), Bridgelip Sucker (*Catostomus columbianus*), Burbot (*Lota lota*), Threespine Stickleback (*Gasterosteus aculeatus*), Paiute Sculpin (*Cottus beldingii*), Torrent Sculpin (*Cottus rhotheus*), Mottled Sculpin (*Cottus bairdii*), and Bull Trout (*Salvelinus confluentus*). Bull Trout, Middle Columbia River steelhead, and Pygmy Whitefish are discussed under special status species.

4.2 Terrestrial Ecosystems and Wildlife

The analysis area is located in the North Cascades Highland Forests ecoregion (Reclamation 2019). This ecoregion encompasses the headwaters of the Yakima River to its confluence with the Kachess River at Lake Easton. It is characterized by glaciated valleys, narrow-crested ridges, and high-relief peaks approaching an elevation of 8,000 feet.

Vegetation in the project area downstream from Kachess Dam consists of mature mixed coniferous and deciduous forest dominated by Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*). Additional trees in the canopy are lodgepole pine (*Pinus contorta*), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and western white pine (*P. monticola*). Black cottonwoods (*Populus trichocarpa*) are present in more mesic slopes and draws in the forest. Vine maple (*Acer circinatum*), beaked hazelnut (*Corylus cornuta*), oceanspray (*Holodiscus discolor* var. *discolor*), and mountain ash (*Sorbus sitchensis*) are common understory to midstory shrubs (Reclamation 2021). LANDFIRE terrestrial ecosystem types are summarized in **Table 1**, below, for the project area.

An approximately 130-foot-wide transmission line right-of-way traverses the project area from east to west, below Kachess Dam. Within the right-of-way, overstory vegetation is presumably periodically removed, opening the surface to increased sunlight, relative to the adjacent dense conifer forest. In response, a different suite of herbaceous and low-shrub species has become established in this area. They include snowbush ceanothus (*Ceanothus velutinus*), western brackenfern *Pteridium aquilinum*), silky lupine (*Lupinus sericeus*), common dogbane (*Apocynum cannabinum*), kinnikinnik (*Arctostaphylos uva-ursi*), and others.

Table 1. LANDFIRE National Terrestrial Ecosystem Types for Washington State in the Project Area

Ecosystem Type	Acres
East Cascades Mesic Montane Mixed-Conifer Forest and Woodland	31.7
Northern Rocky Mountain Dry-Mesic Montane Mixed-Conifer Forest	1.4
North Pacific Montane Riparian Woodland and Shrubland	0.9
Unconsolidated Shore	2.1
Open Water (Fresh)	5.7
Developed, Open Space	0.2
Developed, Low Intensity	7.1
Total	**49.1**

Source: USGS GAP GIS 2011

Forest habitats are used by elk and deer, small mammals, raptors, owls, grouse, and a wide range of songbirds. Riparian areas and wetland complexes are used by many species, including bear, ungulates, small mammals, reptiles, amphibians, cavity-nesting birds, raptors, and songbirds. The reservoir and shoreline fringe vegetation are used by multiple waterfowl and shorebird species. Habitat fragmentation near the reservoir ranges from moderate to severe because of Interstate 90, transmission lines, residential areas, and timber harvest.

4.3 Special Status Species

ESA consultation would be needed for northern spotted owl, Bull Trout, and steelhead effects, including effects on designated critical habitat. ESA consultation for the project is in progress and would be completed prior to project implementation. See the biological assessment for the project for details (Reclamation 2021).

In June 1998, the USFWS listed the Columbia River Basin distinct population segment of Bull Trout as threatened under the ESA. The Washington Department of Fish and Wildlife (WDFW) also recognizes the Kachess Reservoir Bull Trout stock as critical status. Bull Trout inhabit Kachess Reservoir above the dam as well as Kachess River below the dam, though these populations are isolated from each other. The Middle Columbia River steelhead was listed by NOAA Fisheries as threatened on March 25, 1999 (64 *Federal Register* 14517) and January 5, 2006 (71 *Federal Register* 833) then updated April 14, 2014 (79 *Federal Register* 20802). This distinct population segment includes naturally spawned anadromous steelhead originating below natural and human-made impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River.

The Pygmy Whitefish is a Washington State sensitive species and a species of greatest conservation need under the State Wildlife Action Plan. The Pygmy Whitefish is most commonly found in cool lakes and streams of mountainous regions. Streams it inhabits are of moderate to swift current and may be silty or clear. In lakes, Pygmy Whitefish is frequently found in deep, unproductive waters. The Pygmy Whitefish, particularly in smaller lakes, is vulnerable to exotic fish species introductions and declining water quality (Hallock and Mongillo 1998; WDFW 2012).

Specific to Washington, there have been no populations identified as completely river populations. Only lake-dwelling or lake-dwelling with stream spawning populations have been documented in Washington (Pyle 2015). They are documented in Kachess Reservoir and downstream of the dam. A 2010 Kachess entrainment report documented 165 captured Pygmy Whitefish; 75 percent were dead, with the majority in the 60- to 79-millimeter-length range. This report shows the Pygmy Whitefish gets entrained through Kachess Dam with the majority being killed, but a small portion survive and appear to be able to persist downstream even with high mortality (Reclamation 2010).

Kachess Dam has no fish passage facilities. The lack of passage has isolated local populations of Bull Trout, Pygmy Whitefish, and other native fish. This has reduced or eliminated interconnectedness and the exchange of genetic material among populations, and prevented the recolonization of populations diminished by catastrophic natural events (Reclamation 2019).

The northern spotted owl was listed as threatened under the ESA in 1990 due to widespread habitat loss and inadequacy of existing regulatory mechanisms to provide for its conservation (50 Code of Federal Regulations 17; USFWS 1990). Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the northern spotted owl can be found in the revised recovery plan (USFWS 2011).

Baseline surveys were conducted during the 2021 breeding season (Harris Environmental Group 2021). No spotted owls were detected. Individual barred owls were detected on the April 14, 2021, and May 26, 2021, survey visits. However, these detections and a lack of subsequent detections at the same survey points would indicate barred owls were not nesting in the area; these owls were likely dispersing through the analysis area. A primary threat to northern spotted owls is competition for habitat with barred owls, and the presence of larger and more aggressive barred owls in potential habitat reduces the likelihood of northern spotted owl breeding occupancy.

Two Washington State sensitive vascular plant species—western ladies' tresses (*Spiranthes porrifolia*) and water awlwort (*Subularia aquatica*)—have been recorded near Kachess and Keechelus Reservoirs (DNR 2014a). Western ladies' tresses grow along streams, but the mapped location for this species in the Kachess Reservoir basin is outside the analysis area.

Water awlwort is a submerged aquatic plant that occurs near the margins of freshwater lakes and ponds and on streambanks. It has been documented near Lake Easton south of Kachess Reservoir (DNR 2014b). One sensitive nonvascular plant—luminous moss—is documented in the Swamp Lake wetland complex near Kachess Lake Road. This moss occurs on fine textured mineral soil in shaded pockets of overturned tree roots that are typically adjacent to shallow pools of standing water at the base of the root wad (DNR 2014b).

None of these sensitive plants or moss are anticipated to occur in the areas of project disturbance. No other sensitive species are likely to occur in the analysis area (DNR 2014a).

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, there would be no change in aquatic or terrestrial ecosystems. Plant and animal species in the analysis area would not be affected. No trees or vegetation would be removed, and wetlands would not be removed or modified. For the purposes of this analysis, it is assumed the No Action Alternative would result in no changes to the baseline conditions for aquatic and terrestrial ecosystems or species, including special status species, in the analysis area.

5.2 Proposed Action

5.2.1 Aquatic Ecosystems and Aquatic Species

Project activities occurring in or near aquatic ecosystems could degrade aquatic habitats or directly affect aquatic species, including fish. Impacts could include disturbances such as construction noise, vibrations, large equipment movement and use, or human presence. Changes in aquatic habitat connectivity during construction access can impair aquatic species movement and behavior, especially during breeding or spawning periods. Habitat degradation could result from increased sedimentation related to earthmoving, destruction of usable habitat features such as spawning substrate and vegetation cover, or pollutants from in-water work or nearby spills (see also water quality).

The Proposed Action could potentially remove or modify 0.12 acres of wetland features (W1 and W2) and 0.22 acres of open water (PS2) where the permanent access road crosses these features, and an open bottom culvert is installed (see Aquatic Resources Delineation Report; Reclamation 2021). There may be temporary interruptions in flow and fish passage during construction of the access road and installation of the culvert, but flow and fish passage would be restored once the culvert is installed. The outlet work modifications would not reduce the seepage that supports these side channel wetland features as it is primarily from the steep hillside and not the dam. The project would require a CWA 404 permit and possibly a 401 water quality permit and an associated dewatering plan, erosion control plan, replanting plan, and best management practices (BMPs). Conditions of the CWA permit and these plans would avoid, minimize, or mitigate impacts on wetlands and aquatic habitats.

Impacts on aquatic species would largely be dependent on the timing of construction activities, the presence of the aquatic species, and the implementation of BMPs. Project design features to minimize impacts on listed fish (see the special status species section below and the project biological assessment) would also avoid, minimize, or mitigate impacts on other aquatic species.

The US Bureau of Reclamation (Reclamation) does not anticipate reservoir-level restrictions to occur, and construction of the extension and lining of the outlet works would be timed to avoid major issues with water deliveries. Reclamation plans to comply with maintaining minimum flows through the dam throughout the project, as established through negotiations with a number of stakeholders, including the WDFW, Yakama Nation, USFWS, NMFS, and various irrigation districts. However, in the worst-case scenario, Reclamation is prepared to have four, 12-hour shutoffs for conduit installation, where no water would be provided unless the reservoir is high enough to use the spillway. Three of these shutoffs would occur between November and March. The fourth would occur later (outside April–August).

5.2.2 Terrestrial Ecosystems and Wildlife

Project activities that modify or remove vegetation would affect terrestrial ecosystems and could impact the terrestrial wildlife that occupy these ecosystems. Most project impacts would be temporary and localized during construction activities. Construction impacts may include disturbance or harm to wildlife and removal or modification to habitat. Most terrestrial wildlife would be able to move away from disturbance activities with little disruption to behavior. However, project activities could cause harm, mortality, or reduced reproductive success for less mobile species, such as salamanders. Also, disturbance during breeding periods, such as nesting birds, could cause harm, mortality, or reduced reproductive success. Tree clearing and grubbing during phase one (April through October 2023) could directly impact nesting birds. Project design features to conduct a nesting bird survey and establish buffers around identified nests would avoid or reduce impacts.

The Proposed Action could remove or modify approximately 11.1 acres of terrestrial vegetation types; this includes 4.1 acres of permanent disturbance but does not include 3.6 acres of existing permanent disturbance. The proposed permanent acres are 4.1 acres with 4.0 acres of East Cascades Mesic Montane Mixed-Conifer Forest and Woodland and the remaining 0.1 acre is Developed, Low Intensity. These 4.1 acres make up a small portion of available wildlife habitat in the area and would have minimal impact to reduce terrestrial wildlife habitat. The Proposed Action could also modify approximately 7 acres from temporary disturbances from project activities: 4.7 acres of East Cascades Mesic Montane Mixed-Conifer Forest and Woodland; 1.1 acres of Developed, Low Intensity; 0.9 acres of Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer; and 0.2 acres of North Pacific Montane Riparian Woodland and Shrubland. These approximate 7 acres would be regraded and revegetated with native seed mix.

5.2.3 Special Status Species

In consultation with the USFWS, NMFS, and WDFW, mitigation measures would be developed, where appropriate, to minimize adverse impacts on special status species and their habitats. These may include northern spotted owl spot checks prior to disturbance, conducting water shutoffs with appropriate mitigations to reduce impacts on fish, fish salvage and relocations, nesting bird surveys, and retaining removed trees for wildlife habitat improvements off-site. Clearing and grubbing of trees during the first phase of the project between April and October 2023 could result in disturbance effects on northern spotted owls, if they are present. Fulfilling Section 7 ESA consultation requirements with the USFWS and implementation of conservation measures would account for adverse effects on northern spotted owls and the removal of potential habitat (see the project biological assessment).

There is the potential for disruption to fish behavior and temporary modification to fish and aquatic habitat during flow shutoff periods. Reduced flows could change the water temperature and depth, fragment pools, and restrict aquatic species movement. Most fish and some aquatic species would be able to move to deeper water as flows begin to lower; however, there may be some species that become isolated in pools. The stilling basin at the end of the outlet is not anticipated to drop in water level significantly and would provide a temporary refuge for aquatic species during the 12-hour shutoff periods. In addition, as part of the project and ESA Section 7 consultation, a fish salvage and relocation plan would be implemented during flow shutoff periods. This would ensure fish that could become stranded due to low flow conditions in the downstream portion of Kachess River could be salvaged and relocated to appropriate deep water. Fish salvage and handling could still result in some harm and possible mortality of aquatic species.

Chapter 6. Glossary

None.

Chapter 7. Project Design Features and BMPs

7.1 Biological Resources General

- Conduct an environmental awareness training for all employees, contractors, and site visitors to educate on-site personnel about sensitive biological resources and relevant measures and regulations that protect biological resources.

7.2 Aquatic Ecosystems and Aquatic Species

- Consult all local, state, and federal regulations for the development of an appropriate buffer distance between the development site and any wetland or waterway.
- Prepare and carry out a temporary erosion and sediment control plan and a spill prevention control and containment plan, commensurate with the size of the project, to prevent pollution caused by surveying or construction operations (NOAA Fisheries 2017).
- Perform construction activities by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources.
- When not in use, store vehicles and equipment containing oil, fuel, or chemicals in a staging area. For staging and construction areas, comply with all permits received through the Army Corps of Engineers and other relevant agencies and accordingly employ sediment control and other mitigation measures identified through consultation and permitting.
- Do not stockpile or deposit excavated materials or other construction materials near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the watercourse.
- Take measures to ensure that no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the United States.
- Do not permit the use of acids for cleaning or preparing concrete surfaces for repair.

- Ensure spill prevention and cleanup kits are on-site when heavy equipment is operating within 25 feet of the water.
- Check equipment daily for leaks and complete any necessary repairs prior to commencing work activities around the water (NOAA Fisheries 2017).
- Have a supply of emergency erosion control materials on hand and install and maintain temporary erosion controls in place until site restoration is complete (NOAA Fisheries 2017).
- Control pollutants by the use of sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls, including state and local control requirements.
- Establish methods for controlling sediment and erosion that address vegetation practices, structural control, silt fences, straw dikes, sediment controls, and operator controls as appropriate.
- Institute stormwater management measures as required, including velocity dissipators, and solid waste controls that address controls for building materials and off-site tracking of sediment.
- Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials that include prevention measures to control silting and erosion, and that would intercept and settle any runoff of sediment-laden waters.
- Prevent wastewater from general construction activities, such as drain water collection, aggregate processing, concrete batching, drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.
- Divert stormwater runoff from upslope areas away from disturbed areas.
- Mark boundaries of clearing limits associated with site access and construction to avoid or minimize disturbance of riparian vegetation, wetlands, and other sensitive sites (NOAA Fisheries 2017).
- Conduct three to four water shutoffs between November through March to avoid potential effects with steelhead and Bull Trout spawning. The last water shutoff would occur after March but would not have adverse flow effects because this shutoff would be scheduled when the stilling basin is full enough to still provide minimum flows from the spillway. Shutoff flow periods would not exceed 12 hours at a time.
- Follow the Washington Department of Transportation's Fish Exclusion Protocols and Standards (WSDOT 2016) during reduced flow shutoff periods, fish salvage, and relocation. Ensure a fisheries biologist oversees fish removal from unwatered work sites. Follow the most recent NMFS guidelines for electrofishing for fish relocation and work area isolation (NMFS 2000). Record all incidents of listed fish being observed, captured, handled, and released.

7.3 Terrestrial Ecosystems and Vegetation

- Preserve and protect natural landscape and existing vegetation not required or otherwise authorized to be removed.
- Minimize, to the greatest extent practicable, clearings and cuts through vegetation.
- Do not use trees for anchorages except in emergency cases or as approved by Reclamation. Where approved, wrap the trunk with a sufficient thickness of approved protective material before a rope, cable, or wire is placed.
- Before bringing construction equipment on-site, clean it to remove dirt, vegetation, and other organic material to prevent introduction of noxious weeds, and invasive plant and animal species.
- Implement contractor cleaning procedures to at least the level described in Reclamation Cleaning Manual (Reclamation 2010). Ensure Reclamation inspects construction equipment following procedures described in Reclamation Cleaning Manual before allowing the equipment on-site.
- Regrade and reclaim temporary contractor use areas with an appropriate native seed mix according to a revegetation plan. Develop the revegetation plan in collaboration with the US Forest Service (USFS) and consistent with the USFWS project biological opinion.

7.4 Wildlife and Special Status Species

- Implement all measures for listed species from the project biological opinion.
- Collaborate with the USFS for the stockpiling of removed trees and vegetation for the USFS to use for wildlife habitat improvement. Should the WDFW have input on this plan, accept and consider this input for inclusion. Notably, Reclamation supports the reuse in a habitat project, but would have no role in the placement of salvaged trees in specific projects.
- Schedule all necessary vegetation removal, trimming, and grading of vegetated areas outside of the bird breeding season (generally March 1 to August 31), to the maximum extent practicable.
- Avoid construction activities during the bird breeding season (generally March 1 to August 31), to the extent practicable. When project activities cannot occur outside the bird nesting season (March 1 to August 31), conduct pre-disturbance surveys prior to the scheduled activity to determine whether active nests are present within the wildlife analysis area and buffer any active nesting locations found during surveys. Ensure a qualified biologist conducts the surveys no more than 7 days prior to disturbance activities. If active nests are detected during these surveys, have a qualified biologist establish a no-activity buffer zone around the nest based on species, project disturbance level, topography, existing disturbance levels, and habitat type until fledging has occurred. During ongoing project activities if a bird establishes a new nest, do not remove or modify the nest vegetation, but do not require a buffer zone. If there is a pause in project activities greater than 7 days, conduct an additional nesting bird survey.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Environmental Justice Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

The analysis area for environmental justice consists of Kittitas and Yakima Counties in Washington. Although the project area occurs in Kittitas County, Yakima County, located directly south of Kittitas County, is included for the socioeconomic analysis due to the hydrologic, social, and economic ties.

Census Bureau data were examined at the county level, as well as for census tracts within Kittitas County. There were no racial or ethnic minority populations that met Council on Environmental Quality (CEQ) criteria for further environmental justice consideration. Census tract 9754.01, located near Ellensburg, meets the criteria for potential environmental justice consideration as a low-income population. However, this tract is located over 30 miles from where construction activities would occur. As such, no direct construction-related impacts on this community, such as noise or traffic, would result. Further, while members of the Yakama Nation live in the project area and Native American reservations exist in the project area counties, these reservations are not close to the project area.

Under the Proposed Action, the US Bureau of Reclamation (Reclamation) would modify Kachess Dam through several improvements, construct an access road, and develop staging and construction areas during the course of modifying the dam.

Because of the timing and phased design of construction activities, impacts on water deliveries would be avoided, and the reservoir level would remain the same throughout construction. The Proposed Action would allow for continued water deliveries to downstream users, including tribal members; as such, the Proposed Action would avoid any impacts on these communities who may rely more on subsistence uses provided by the reservoir.

Construction activities could affect the quality of life for residents (see the **Socioeconomic**, **Noise**, **Transportation**, and **Recreation Resource Reports**); however, potential short-term impacts would affect all populations and would not be disproportionately focused on low-income, minority, or tribal populations. Impacts would be concentrated in the area immediately surrounding construction activities. Reclamation would not anticipate any disproportionate adverse impacts on low-income or minority populations under the Proposed Action.

The Proposed Action would reduce the potential for flooding and the related adverse impacts on all populations in the long term. Improving the safety of Kachess Dam and reducing the long-term risk for dam failure would allow continued support of social and economic benefits from the dam, as described in the **Socioeconomic Resources Report**. Residents near the dam, including potential environmental justice communities, would benefit.

Under the No Action Alternative, Reclamation would not perform the various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Residents near the dam would have a continued risk for experiencing adverse impacts associated with a potential dam failure.

Social and economic benefits provided by Kachess Dam include supporting irrigation, recreation, fish and wildlife, power, municipal and industrial water supply, and flood control, in various direct and indirect ways. These benefits would continue to be supported until a dam failure. Should a dam failure occur, the social and economic benefits would be reduced or eliminated. Benefits up to $61.47 million could be lost (see Section 4.3 of the **Socioeconomic Resources Report**).

Members of the Yakama Nation and other tribes outside the project area may currently use natural resources in the Kachess Reservoir and may do so in the future. Compared with the total population, they may use these resources disproportionately. As such, a potential dam failure could result in disproportionate impacts for these communities, should a dam failure result in elimination of benefits provided by the dam.

There could be additional losses that are not quantified in the **Socioeconomic Resources Report**. For instance, areas with agriculture impacted by downstream flooding would not be captured in estimations. A potential dam failure could disproportionately affect minority communities that have been historically employed in the agricultural sector and migrant farmers.

As described in the **Socioeconomic** and **Public Health and Safety Resources Reports**, dam failure could result in damages to property and the loss of life. Implementation of the No Action Alternative could have a disproportionate adverse impact on low-income and minority populations. For instance, low-income populations could find it more difficult to recover from the cost of damages.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
CEQ	Council on Environmental Quality
Reclamation	US Bureau of Reclamation

Chapter 1. Analysis Area

The analysis area for environmental justice consists of Kittitas and Yakima Counties in Washington. While the project area occurs in Kittitas County, Yakima County, located directly south of Kittitas County, is included for the socioeconomic analysis due to the hydrologic ties (see the **Water Resources Report)** with the area and the resulting social and economic ties (see the **Socioeconomic Resources Report**).

Census Bureau data were examined at the county level, as well as for census tracts within Kittitas County. Census tract-level data are provided for Kittitas County because this is the county that overlaps directly with where construction would occur. In addition, Native American populations in the area are discussed.

Chapter 2. Indicators

- Impacts on human health—These impacts are measured by identifying disproportionately high or adverse human health effects on minority or low-income populations from project activities.
- Environmental impacts—These are disproportionately high or adverse environmental effects that would impact minority or low-income populations from project activities.

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

Executive Order 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects, including social and economic effects, from their programs, policies, and activities on minority populations and low-income populations.

Chapter 4. Affected Environment

This section will identify environmental justice communities in the analysis area based on the following criteria:

- The minority population of the affected area exceeds 50 percent or is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997). "Meaningfully greater," for the purpose of the analysis in this environmental assessment, is defined as more than 10 percent higher than the comparison population at the county level.

- Low-income populations are defined relative to the annual statistical poverty thresholds from the US Census Bureau (CEQ 1997). The Council on Environmental Quality (CEQ) guidance does not provide criteria for determining low-income populations as specifically as it does for minority populations; therefore, for this analysis, low-income populations are defined as 50 percent or more of the population in the affected area being below the poverty level, or populations with at least 10 percent more people at or below the poverty level, relative to the county's average level in poverty.
- Federally recognized tribes are considered environmental justice populations in and of themselves; when possible, they are included in the analysis as separate minority populations.

4.1 Low-Income Populations

The CEQ guidance on environmental justice (CEQ 1997) defines low-income populations based on the US Census Bureau's annual statistical poverty thresholds. Because Census Bureau data collected for this analysis are from 2019, the annual poverty threshold from 2019 is used. The 2019 poverty level is based on total income of $13,011 for an individual and $26,172 for a family of four (Census Bureau 2019a).

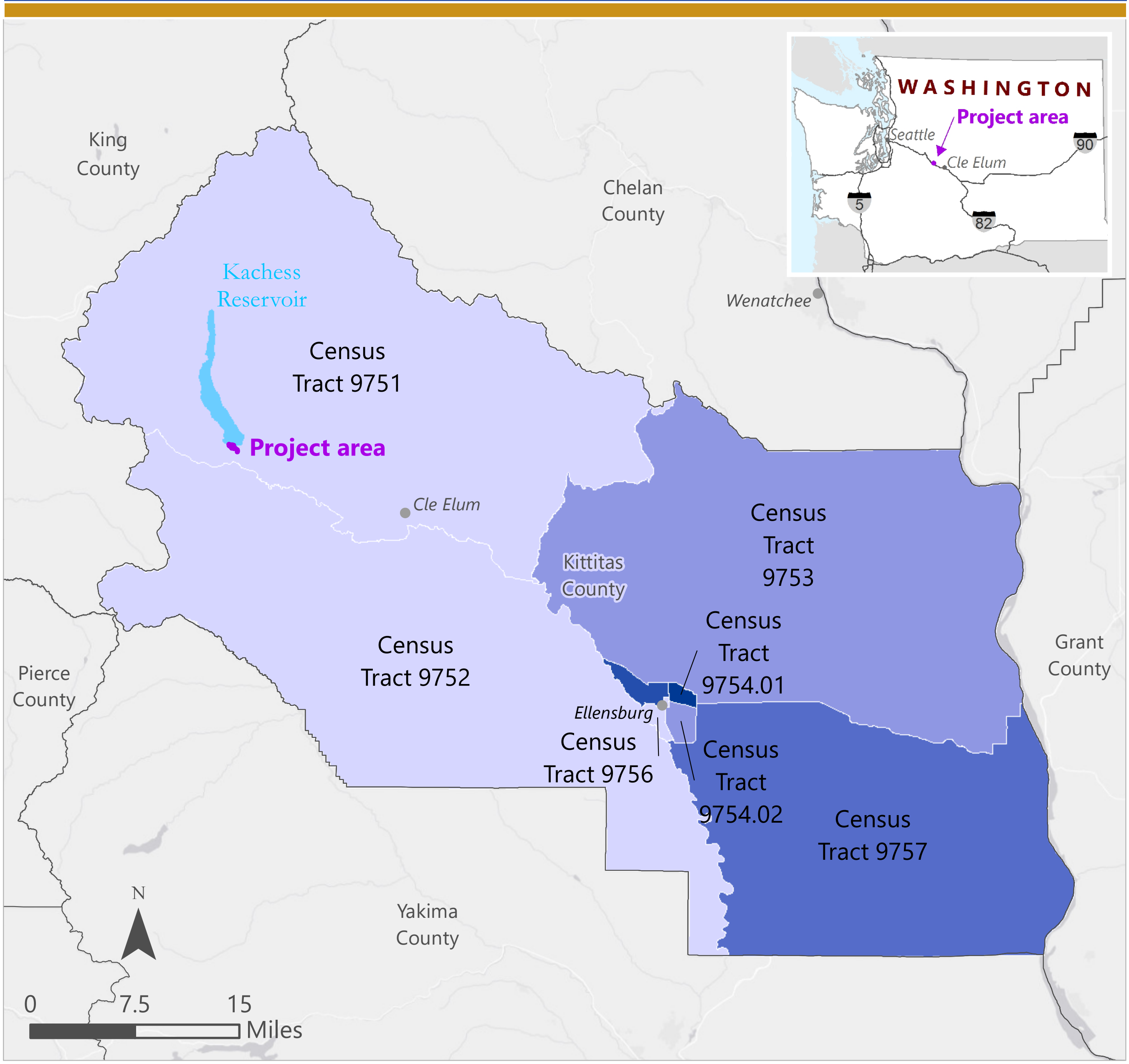
The project area would occur in census tract[1] 9751 in Kittitas County. In this census tract, 13.9 percent of the population (for whom poverty status is determined) falls below the poverty level. Directly south of the project area, census tract 9752 has a lower population (4.2 percent) below the poverty level. As such, there are no low-income populations directly in or next to the project area that meet the criteria for further environmental justice consideration. However, based on best available data, census tract 9754.01 within Kittitas County, located in Ellensburg, meets the criteria for potential environmental justice consideration with 46.8 percent of the population below the poverty level. This is because the percentage of the population below the poverty level is higher than it is in Kittitas County, which is used as the reference population.

Map 1 shows the percentage of the population below poverty by census tract.

[1] Census tracts are small, relatively permanent statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census as part of the Census Bureau's Participant Statistical Areas Program.

Map 1
Populations below Poverty for Environmental Justice Concern

BUREAU OF RECLAMATION



Percent of the population under the poverty level at the census tract level

- 0 - 10%
- 10.1 - 15%
- 15.1 - 20%
- 20.1 - 25%
- 25.1 - 26%

- Project area
- Kachess Reservoir

Source: Reclamation GIS 2021, US Census GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: December 02, 2021
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

Table 1. Percentage of the Population below Poverty Level

County	Percentage of Population below Poverty Level
Kittitas Census Tracts	
Census tract 9751	13.9
Census tract 9752	4.2
Census tract 9753	10.0
Census tract 9754.01	46.8
Census tract 9754.02	18.4
Census tract 9755	21.8
Census tract 9756	7.6
Census tract 9757	13.4
Kittitas County	**18.0**
Yakima County	**17.4**

Source: Census Bureau 2019b

Note: Census tracts were provided for Kittitas County because this is the county that overlaps directly with where construction would occur.

4.2 Minority Populations

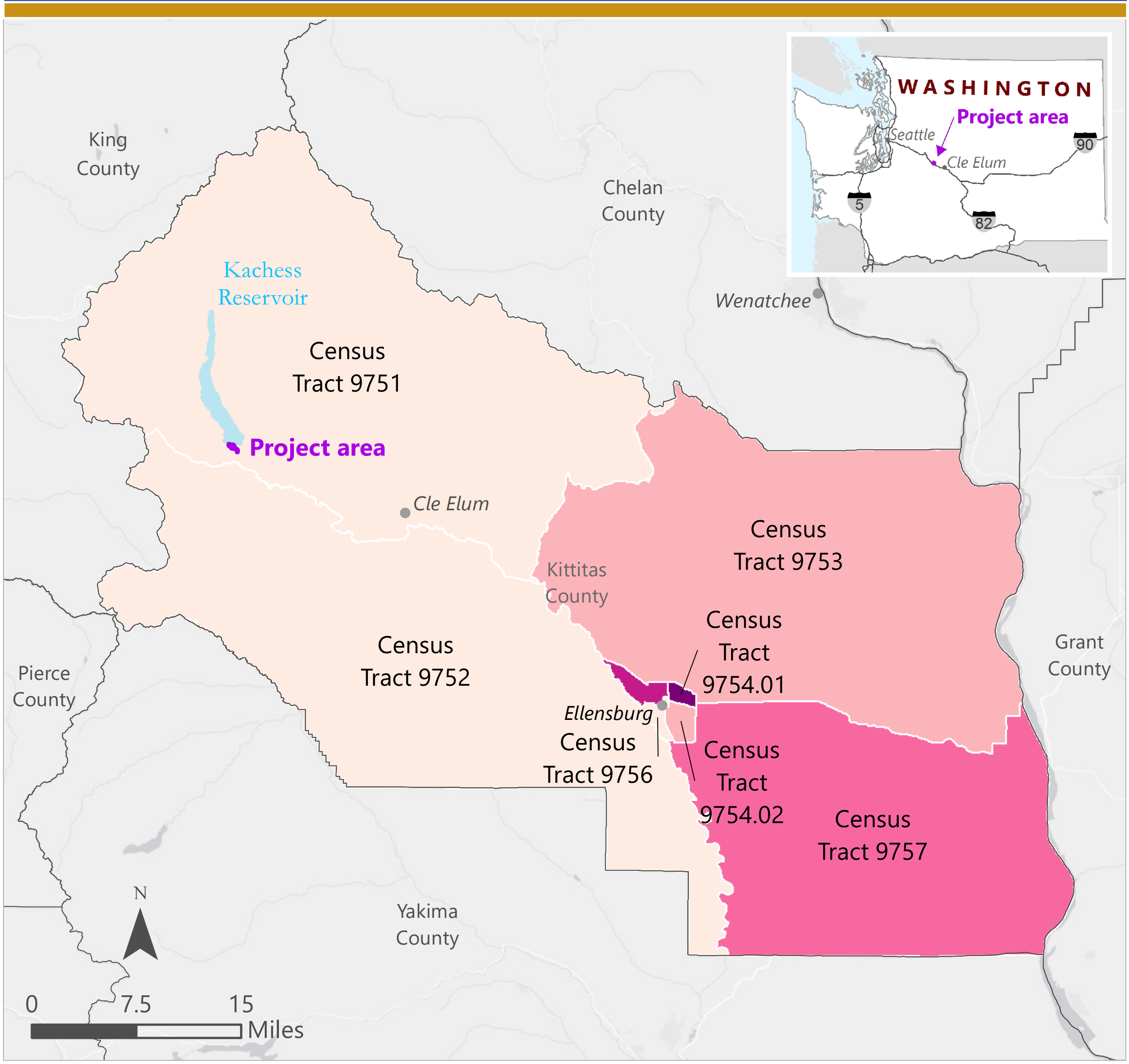
Table 2 shows the percentage of minority population by census tract. Much of the minority population is farm workers who rely on produce grown from the Yakima Project and Kachess Reservoir irrigation. All census tracts within Kittitas County have a lower percentage of minority population than the Kittitas County aggregate minority population of 16 percent. The exceptions are census tracts 9754.01 and 9755 (26 percent and 25 percent, respectively). However, minority populations within the two tracts do not exceed 50 percent of the total population for each tract. They also do not exceed 10 percentage points of the reference location, Kittitas County. As a result, no racial or ethnic minority populations have been identified for further environmental justice consideration.

Map 2, below, shows the minority population as a percentage of the total population by census tract.

4.3 Native American Populations

Federally recognized tribes are considered environmental justice populations in and of themselves. Members of the Yakama Tribe live in Yakama County, and the Yakima Indian Reservation is located south of the Kachess Dam. **Map 3**, below, shows Native American reservations near the project area. As shown in the map, the reservations are not close to the project area.

Map 2
Minority Populations for Environmental Justice Concern



Percent of the population identifying as a racial and/or ethnic minority at the census tract level

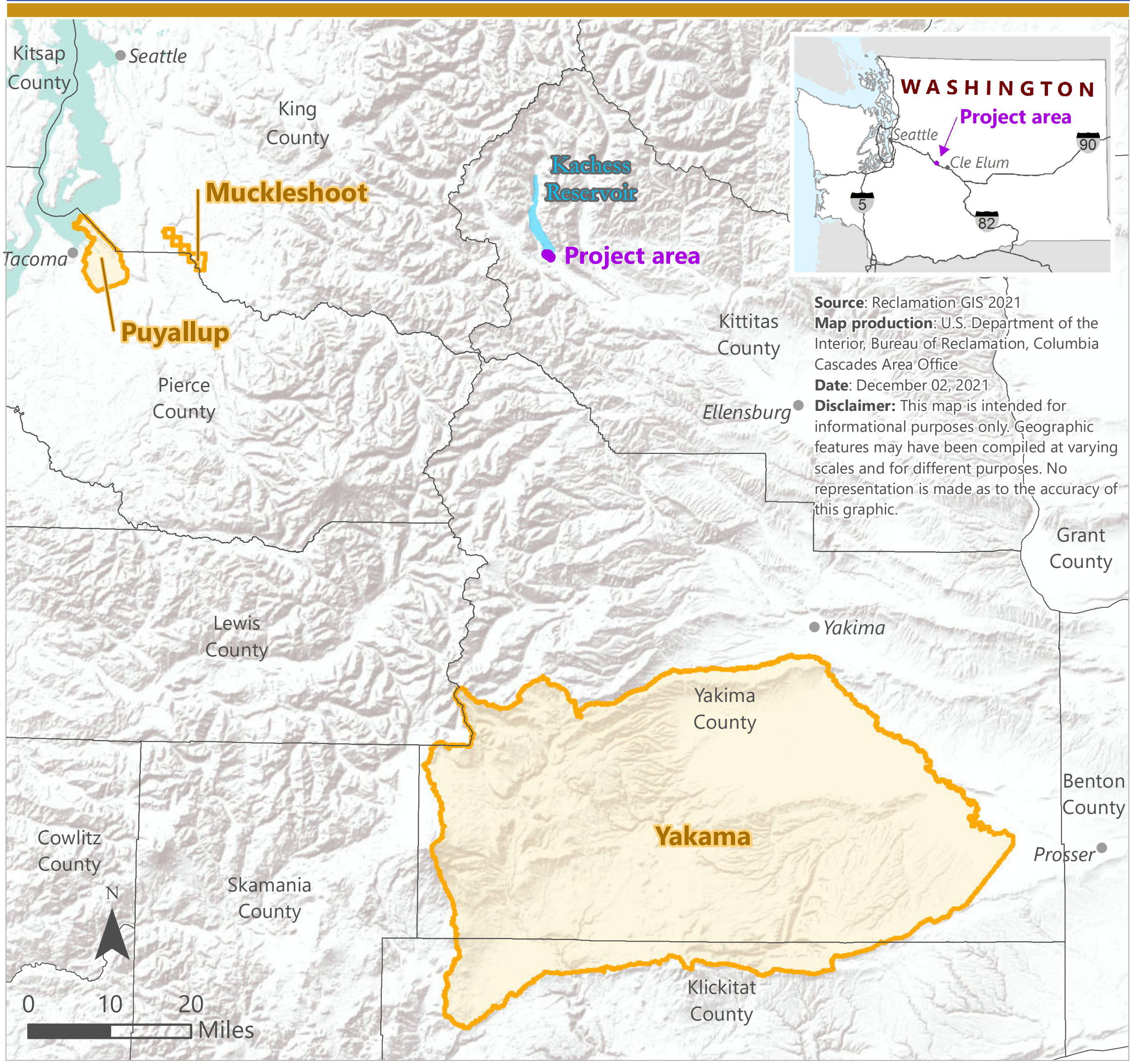
- 0 - 10%
- 10.1 - 15%
- 15.1 - 20%
- 20.1 - 25%
- 25.1 - 26%

- Project area
- Kachess Reservoir

Source: Reclamation GIS 2021, US Census GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: December 02, 2021
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

BUREAU OF RECLAMATION

Map 3
Native American Reservations



Native American Reservation

Project area

Kachess Reservoir

Table 2. Percentage of Minority Population

County	Percentage of Minority Population*
Kittitas Census Tracts	
Census tract 9751	6
Census tract 9752	10
Census tract 9753	13
Census tract 9754.01	26
Census tract 9754.02	14
Census tract 9755	25
Census tract 9756	10
Census tract 9757	16
Kittitas County	**16**
Yakima County	**57**

Source: Census Bureau 2019b
*The minority population is calculated by subtracting the white alone (not Hispanic or Latino) population from total population.
Note: Census tracts were provided for Kittitas County because this is the county that overlaps directly with where construction would occur.

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, the US Bureau of Reclamation (Reclamation) would not perform the various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Residents near the dam would have a continued risk for experiencing adverse impacts associated with a potential dam failure.

As described in Section 4.3 of the **Socioeconomic Resources Report**, social and economic benefits provided by Kachess Dam include supporting irrigation, recreation, fish and wildlife, power, municipal and industrial water supply, and flood control, in various direct and indirect ways. Social and economic benefits provided by Kachess Dam would continue until a dam failure. Should a dam failure occur, the social and economic benefits would be reduced or eliminated. For instance, potential permanent changes to water deliveries to irrigation districts, tribes, and the downstream public could occur. The specific level of impacts on these benefits cannot be determined here; it would depend on the level to which the remaining water supply would provide for existing uses.

More information on the quantified benefits provided by Kachess Dam and the quantified damages in property loss associated with a potential dam failure are provided in Sections 4.3 and 5.1 of the **Socioeconomic Resources Report**, respectively. Benefits up to $61.47 million could be lost (see Section 4.3 of the **Socioeconomic Resources Report**). There could be additional losses that are not quantified in the **Socioeconomic Resources Report**. For instance, areas with agriculture impacted by downstream flooding would not be captured in estimations. A potential dam failure could disproportionately affect minority communities that have been historically employed in the agricultural sector and migrant farmers.

As described in the **Socioeconomic** and **Public Health and Safety Resources Reports**, dam failure could result in damages to property and the loss of life. Implementation of the No Action Alternative could have a disproportionate adverse impact on low-income and minority populations. For instance, low-income populations could find it more difficult to recover from the cost of damages.

Members of the Yakama Nation and other tribes outside the project area may currently use natural resources in the Kachess Reservoir and may do so in the future. Compared with the total population, they may use these resources disproportionately. The subsistence use of renewable natural resources (such as fish, wildlife, and vegetation) by tribes or other populations in the reservoir area has not been quantified. As such, a potential dam failure could result in disproportionate impacts for these communities, should a dam failure result in elimination of benefits provided by the dam.

Recreational users of the area could potentially include minority populations, but no information is available on the demographics of recreationists. Because the exact timing and location of such impacts cannot be determined, the potential for dam failure to result in disproportionate adverse impacts on these communities cannot be determined.

5.2 Proposed Action

Because of the timing and phased design of construction activities, impacts on water deliveries would be avoided, and the reservoir level would remain the same throughout construction. The dam would continue to support water deliveries to irrigation districts, tribes, and the downstream public for all populations. The Proposed Action would allow for continued water deliveries to downstream users, including tribal members; as such, the Proposed Action would avoid any impacts on these communities who may rely more on subsistence uses provided by the reservoir.

Construction activities could affect the quality of life for residents (see the **Socioeconomic**, **Noise**, **Transportation**, and **Recreation Resource Reports**). Although there could be short-term impacts on all populations, including area low-income and minority populations, they would not be disproportionately focused on these populations under the Proposed Action. Impacts would be concentrated in the area immediately surrounding construction activities. No low-income or minority populations were identified in the immediate project area for further environmental justice consideration.

As described above, census tract 9754.01, located near Ellensburg, meets the criteria for potential environmental justice consideration as a low-income population. However, this tract is located over 30 miles from where construction activities would occur. As such, no direct construction-related impacts on this community, such as noise or traffic, would result.

The Proposed Action would reduce the potential for flooding and the related adverse impacts on all populations in the long term. Improving the safety of Kachess Dam and reducing the long-term risk for dam failure would allow continued support of social and economic benefits from the dam, as described in the **Socioeconomic Resources Report**. Residents near the dam, including potential environmental justice communities, would benefit.

For the reasons described above, Reclamation would not anticipate any disproportionate adverse impacts on low-income or minority populations under the Proposed Action.

Chapter 6. Glossary

Census tract—Census tracts are small, relatively permanent statistical subdivisions of a county or equivalent entity that are updated by local participants prior to each decennial census as part of the Census Bureau's Participant Statistical Areas Program. The Census Bureau delineates census tracts in situations where no local participant existed or where state, local, or tribal governments declined to participate. The primary purpose of census tracts is to provide a stable set of geographic units for the presentation of statistical data.

Low-income populations—The CEQ guidance on environmental justice (CEQ 1997) defines low-income populations based on the US Census Bureau's annual statistical poverty thresholds.

Minority populations—CEQ guidance defines a minority population as one where an individual group or the aggregate population of all minority groups combined exceeds 50 percent of the total population, or if the percentage of the population comprising all minority groups is meaningfully greater than the minority population percentage in the broader region.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Geology, Soils, and Seismic Resources Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Kachess Dam was constructed in a breach of a glacial moraine in order to expand an existing lake. The glacial till that makes up the moraine is composed of a heterogeneous mixture of clay, silt, sand, gravel, cobbles, and boulders. The glacial moraine forms the foundation and abutments upon which Kachess Dam rests. This moraine was also used as the borrow source for the impervious and pervious zones of the dam.

Construction methods used resulted in an alternating sequence of finer and coarser grained, poorly consolidated backfill materials, which were not well compacted or erosion resistant. As a result, poorly consolidated soils, which are prone to erosion, surround the conduit that is internal to the Kachess Dam. Ongoing erosion in these soils caused by water seeping through the dam and scouring along the exterior of the conduit has created voids within the dam. This has raised the risk of dam failure.

Under the Proposed Action, construction would result in localized effects on soils and geology from ground disturbance and movement of geologic materials used in construction. Best management practices to minimize surface disturbance, control erosion, and reclaim temporarily disturbed areas would reduce impacts. The proposed measures undertaken in the Proposed Action to protect erodible soils within the dam would stop or drastically reduce internal erosion of vulnerable soils. This would reduce the risk of dam failure created by eroding soils within the dam structure. The construction of new permanent facilities would result in the irretrievable commitment of the soil resources beneath those facilities.

Under the No Action Alternative, the irretrievable commitment of soil resources due to existing permanent components of the dam structure and facilities would continue. Internal erosion of vulnerable soils surrounding the conduit pipe would continue to occur. In the event of a dam failure due to an internal failure of the dam, flooding would be likely to cause severe soil erosion and changes to the area geomorphology. The extent and severity of these impacts would depend on the method and extent of the dam failure.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
Reclamation	US Bureau of Reclamation

Chapter 1. Analysis Area

The proposed project may impact geology and soils in areas where there is ground disturbance and construction. The analysis area includes the existing dam, including existing access roads, buildings, and storage areas, as well as proposed project components under the Proposed Action. These project components include storage and contractor use areas, new roads, excavations, and expansions of existing dam elements.

Chapter 2. Indicators

- Soil loss (substantial loss of topsoil or damage to the soil condition through construction or erosion due to the project). The unit of measure is the acres of erodible soils disturbed.
- The presence of soils vulnerable to seepage and internal erosion issues, or other unstable soil types. The unit of measure is the tons of unstable soils replaced or mitigations to address these soil types.

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- Clean Water Act (33 United States Code 1251 et seq.)—This act regulates discharges of dredged or fill material and pollutants into waters of the United States.

3.2 State and Local Laws

- Construction Stormwater General Permit and Stormwater Pollution Prevention Plan—This plan establishes standards for construction stormwater management and pollution prevention plans.
- Washington State Department of Transportation's Temporary Erosion and Sediment Control Manual 3109—This manual establishes standards for temporary erosion and sediment control measures.
- Washington State Department of Ecology's Stormwater Management Manual for Western Washington—This manual establishes standards for stormwater management.

3.3 Policies

No specific policies applicable to soils and geology are available.

3.4 Memoranda of Understanding

No memoranda of understanding address this project's soils and geology.

3.5 Other

Dam and impoundment design standards apply to this project.

Chapter 4. Affected Environment

Kachess Dam was constructed in a breach of a glacial moraine. Prior to the dam's construction, a natural lake existed behind the moraine; it was created by glacial drift and outwash deposits associated with the retreat of the Yakima Valley glacier. This moraine extends across the Kachess River Valley with a length of just over 6,000 feet in the area of Kachess Dam. The 1,400-foot-long Kachess Dam filled the breach in the moraine that had been created by the Kachess River to increase the water storage capacity of the natural lake (Engineering Geology in Washington 1989).

The glacial till is composed of a heterogeneous mixture of clay, silt, sand, gravel, cobbles, and boulders. The glacial moraine forms the foundation and abutments upon which Kachess Dam rests. This moraine was also used as the borrow source for the impervious and pervious zones of the dam. The thickness of the moraine in the dam area is about 100 feet. Laboratory analyses of samples collected during a 2019 field investigation conducted by the US Bureau of Reclamation's (Reclamation; unpublished), as well as data collected in previous studies and during construction, determined that the moraine foundation's composition consisted of silty sand with gravel with lenses or stringers of a well-graded gravel with silt and sand, well-graded sand with silt and gravel, poorly graded sand with silt and gravel, and a poorly graded sand with silt (Historic American Engineering Record 2003; Reclamation 2021a, 2021b).

The project area is located in the impact risk area of the Cascadia subduction zone earthquake. In a simulation of a Cascadia subduction zone earthquake, the Kachess Dam area was projected to have a shaking intensity value of 6[1] on the Modified Mercalli Intensity Scale[2] (Washington Geological Survey 2017). Earthquake shaking can also cause ground liquefaction, which is a phenomenon in which the strength and stiffness of a soil are reduced by shaking, causing drastic increases in water pressure in saturated soils. Liquefaction decreases the ability of a soil to support foundations for buildings, bridges, and dams. The Washington State Department of Natural Resources Geologic Hazard Map of Liquefaction Susceptibility shows that most of the area around Kachess Dam is rated moderate to high susceptibility; the rest of the area is rated very low to low (Palmer et al.

[1] A value of 6 (strong) means objects fall. The shaking is felt by all. People walk unsteadily, and many are frightened. Windows crack. Dishes, glassware, knickknacks, and books fall off shelves. Pictures fall off walls. Furniture moves or is overturned. Weak plaster, adobe buildings, and some poorly built masonry buildings crack. Trees and bushes shake visibly.

[2] The Modified Mercalli Intensity Scale is a seismic scale used for measuring the intensity of an earthquake. It measures an earthquake's effects on the earth's surface, humans, objects in nature, and the building environment. The scale ranges from 1 (not felt) to 12 (total destruction).

2004). The ongoing internal erosion of soils within the dam has not been identified as a risk factor that would contribute to the possibility of dam failure during a seismic event in the project area.

Three soil units are present in the project area. These are Kachess gravelly ashy sandy loam, xerofluvents,[3] and Kladnick[4] ashy sandy loam (Web Soil Survey 2021). **Table 1**, below, shows key soil attributes for soils in the project area.

Table 1. Key Soil Attributes in the Kachess Dam Project Area

Unit Name	Approximate Percentage of the Analysis Area	Erosion Hazard Rating	K Factor,[1] Whole Soil	Soil Restoration Potential
Kachess gravelly ashy sandy loam, 5 to 25 percent slopes	36.7	Moderate	.17	High potential
Xerofluvents, 0 to 5 percent slopes	25.5	Slight	.24	High potential
Kladnick ashy sandy loam, 0 to 3 percent slopes	19.6	Slight	.20	High potential
Other (dam and water)	18.2	N/A	N/A	N/A

Source: Web Soil Survey 2021

[1] A measure that indicates the susceptibility of a soil to sheet and rill erosion by water

The erosion hazard rating is a measure that indicates the hazard of soil loss from unsurfaced areas, roads, and trails. The ratings are based on soil erosion factor K, the slope, and the content of rock fragments. A rating of slight indicates that little or no erosion is likely; moderate indicates that some erosion is likely, that the roads or trails may require occasional maintenance, and that simple erosion control measures are needed. The K factor indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

The soil restoration potential rates each soil for its inherent ability to recover from degradation, which is often referred to as soil resilience. The ability to recover from degradation means the ability to restore functional and structural integrity after a disturbance. Soil resilience is dependent on adequate stores of organic matter, good soil structure, low salt and sodium levels, adequate nutrient levels, microbial biomass and diversity, adequate precipitation for recovery, and other soil properties. High potential indicates that the soil has features that are very favorable for recovery, and good performance can be expected.

4.1 Trends

No major trends were identified for soils or geology in the project area.

[3] A fluvent soil with a xeric moisture regime

[4] The Kladnick series consists of deep, well, or somewhat excessively drained soils formed in glacial outwash with a mantle of volcanic ash.

None of the proposed project actions would result in significant changes to the site geology or seismic risks.

Chapter 5. Environmental Consequences

5.1 Soil Erosion and Loss

Clearing ground and existing vegetation to create space for construction, materials storage, and roads exposes soils to wind and water, which are the predominant sources of soil erosion. Soil erosion can be mitigated with best management practices, such as the use of erosion control measures, revegetation, and regular maintenance of cleared areas.

5.1.1 No Action Alternative

Under the No Action Alternative, there would be no structural or operational changes to the Kachess Dam or spillway. There would be no need to clear any contractor use areas or expand the access road. Accordingly, there would be no new impacts on geology, soils, and seismic resources related to this project. However, as conditions at the dam continue as described, there would be the potential for impacts on these resources in the event of a dam failure, where flooding would cause soil erosion, changes to the area geomorphology, and destruction of surrounding resources.

5.1.2 Proposed Action

Under the Proposed Action, Reclamation would undertake the following actions relevant to this analysis: tree clearing and grubbing, clearing an access road, developing contractor use areas for staging project materials, constructing a stability berm, and modifying the outlet works. Some contractor use areas would be reclaimed and represent a short-term disturbance of soils. Areas occupied by new permanent project components, such as the expanded outlet works, the new electric building, and the access road, would remain as a long-term disturbance to soils.

Under the Proposed Action, there would be approximately 11 acres of new disturbance; of those, 7 acres would be a short-term disturbance, which would be reclaimed at project completion. There would be 4 acres that would remain as a long-term disturbance.

As discussed in **Section 4**, above, soils in the project area have slight or moderate erosion hazard ratings, and a moderate k factor. These factors indicate that simple erosion control measures are likely to be necessary to protect soil from movement or erosion.

Construction of the access road and the downstream toe approach road are the areas of highest concern for soil erosion. This is because of their proximity to the Kachess River and adjacent wetlands. The road construction would require cut and fill of existing slopes. The access road would require the reduction of an existing steep slope to an approximately 10 percent grade for the road base. Side slopes would be constructed to a 2:1 slope. The cut and fill would disturb approximately 0.64 acres. Geotechnical engineers would review and approve the stability of both the cut and fill slopes for the entire length of the new access road. Additionally, the proposed slopes of the new cut and fill areas are more gradual than existing slopes.

To reduce impacts, Reclamation would employ standard erosion control measures, such as drainage ditches, culverts, silt fences, hydro mulching, or similar measures) along the cut slope to control turbidity; an energy dissipation cobble-lined area along the groin of the fill slope to control the erosion of the existing slope; and monitoring of revegetation. Drainage features would be designed so they would not discharge additional water into any of the designated wetlands. Road surfaces would be surfaces with gravel to provide long-term stability and to reduce the risk of soil erosion. New contractor use and storage areas would be surfaced with gravel; the gravel would be removed from temporary contractor use areas as part of the site rehabilitation at the completion of the project.

The stability berm would employ similar erosion measures as the road cut areas during construction. Riprap or prepared cobbles, or both, would be placed on the finished stability berm as a slope protection layer. This would provide protection against soil erosion.

Excavation for the conduit extension would also employ erosion control measures, including trench wall support, as needed, and a filtered dewatering pump to extract groundwater and precipitation without sediment. Flows through the dam would be controlled to avoid overtopping excavation areas.

Mitigation measures could be expected to effectively limit soil loss through erosion. All soils in the project area have a high soil restoration potential rating, so short-term disturbance areas should be effectively returned to a functional condition following site rehabilitation. Approximately 4 acres of soil would be disturbed in the long term due to the placement of permanent project elements.

5.2 Kachess Dam Internal Vulnerable Soils

During initial construction of the Kachess Dam, backfill material was placed around the concrete internal conduit. In order to create an easy-to-place backfill local borrow materials were mixed with water and allowed to settle before being placed. This resulted in an alternating sequence of finer and coarser grained poorly consolidated backfill material; none were particularly well compacted or erosion resistant. As a result, poorly consolidated soils, which are prone to erosion, surround the conduit that is internal to the Kachess Dam. Erosion in these soils is caused by water seeping through the dam and scouring along the exterior of the conduit.

In the 1920s, a misguided attempt to reduce pressure on the concrete conduit by drilling weep holes through the conduit accelerated the erosion by providing drains for eroded soils from the backfill material to escape into the conduit. If allowed to continue, this erosion could undermine the conduit and dam structure, and potentially result in dam failure.

5.2.1 No Action Alternative

Under the No Action Alternative, current management would continue. Current management consists of monitoring the toe drains and other areas at the conduit terminus for signs of internal erosion. In the long term, internal erosion of soils around the conduit would continue; dam failure could occur as a result.

5.2.2 Proposed Action

Under the Proposed Action, Reclamation would undertake the corrective actions described in **Chapter 2**. The installation of a steel conduit liner pipe would prevent further soil loss from conduit weep holes. Extension of the conduit and the installation of a diaphragm filter would prevent soil scour and loss from around the exterior of the conduit. The installation of a drainage system and seepage inspection well would reduce the force of internal seepage, and allow for improved monitoring. These measures would effectively stop or drastically slow internal erosion of the dam. This system would mitigate the risk created by unstable soils in the Kachess Dam structure and reduce the risk of internal erosion leading to dam failure.

Chapter 6. Glossary

Hydro mulch—A mixture of water, fiber mulch, fertilizer, seed, and an adhesive binding agent. It is sprayed on exposed soils to prevent erosion and to promote revegetation.

Riprap—Angular crushed stone ranging in size from 4 inches to over 2 feet, depending on specification; it is used to protect soils and shoreline structures against scour and water erosion.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Hazardous Materials and Public Health and Safety Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Kachess Dam is an active site, where employees are exposed to weather and other safety concerns during daily operations. However, there are no activities that would put workers in an unsafe situation. This would not change during construction of the Proposed Action or during the operations afterward.

Kachess Dam Road is the only access point to Kachess Dam and would be used for all construction access to the construction area. Local residents and recreationists use this road to access the east side of Kachess Reservoir, multiple campgrounds, boat ramps, and trailheads (see the **Transportation Resources Report** for additional information).

Under the No Action Alternative, the outlet works modifications would not occur; this alternative would have no short-term effects on public health and safety. Potential long-term impacts on public health and safety could occur under the No Action Alternative. The threat of dam failure would increase throughout time. A United States Bureau of Reclamation (Reclamation) study determined that dam failure would lead to the significant loss of life, property, and infrastructure within the inundation area.

Under the Proposed Action, Reclamation does not expect to encounter any hazardous materials on-site during excavation or other surface-disturbing activities. However, various hazardous materials would be required during construction. Proper disposal of hazardous materials would decrease the risk of hazardous material spills during construction of the Proposed Action. Any spills would be quickly handled according to the contractor's spill prevention, control, and countermeasure plan.

Under the Proposed Action, traffic would increase on Kachess Dam Road during the construction period (see the **Transportation Resources Report** for additional details). The increase in construction traffic could result in a slightly increased risk of accidents. However, all construction traffic would occur during daylight, and best management practices, such as adhering to speed limits and postings signs, would decrease the potential for accidents to almost current conditions.

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Figure

Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
RCW	Revised Code of Washington
Reclamation	United States Bureau of Reclamation
USC	United States Code

Chapter 1. Analysis Area

The analysis area for hazardous materials and public health and safety includes the project area along with Kachess Dam Road south to its intersection with Sparks Road (**Figure 1**).

Chapter 2. Indicators

- The presence of hazardous materials over reportable quantities that are used, stored, or potentially released
- Increased traffic on Kachess Dam Road due to construction activities and hauling materials
- Direct encounters between recreationists and construction activities or vehicles
- Increased risk of dam failure due to internal erosion along the conduit

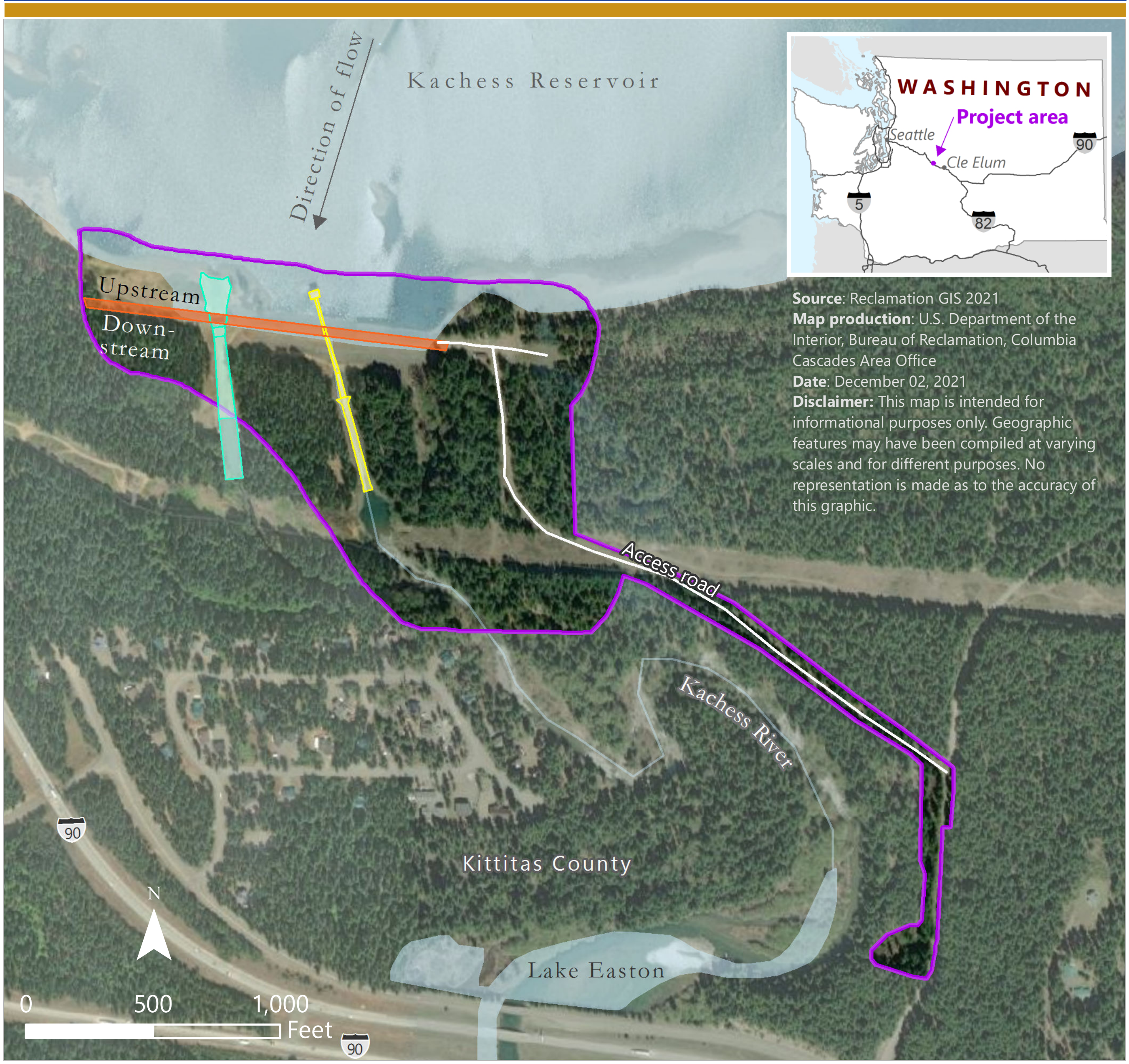
Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- National Ambient Air Quality Standards (40 Code of Federal Regulations [CFR] 50.4–50.12)
- Clean Air Act and amendments (42 United States Code [USC] 7401)
- Safe Drinking Water Act (42 USC 300f et seq.)
- The Clean Water Act (33 USC 1251 et seq.)
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; 42 USC 103 and 9601 et seq.)
- National Emission Standards for Hazardous Air Pollutants (40 CFR 61)
- Occupational and Safety and Health Act of 1970, as amended (84 USC 1590 et seq.)
- Resource Conservation and Recovery Act (42 USC 6901 et seq.)
- Toxic Substances Control Act of 1976 (15 USC 2601 et seq.)
- National Oil and Hazardous Substances Pollution Contingency Plan (43 CFR 300)
- Hazardous Waste Management regulations (40 CFR 260)
- Surface Management Regulations (43 CFR 3809)

BUREAU OF RECLAMATION

Figure 1
Project Area



Existing permanent infrastructure

- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

3.2 State and Local Laws

- Water Pollution Control (Chapter 90.48 Revised Code of Washington [RCW])
- Washington Clean Air Act (Chapter 70.94 RCW)
- Controls for New Sources of Toxic Air Pollutants (Chapter 173-460 Washington Administrative Code)
- Dangerous Waste Regulations (Chapter 173-303 Washington Administrative Code)
- Hazardous Waste Cleanup—Model Toxics Control Act (Chapter 70.105D RCW)

Chapter 4. Affected Environment

4.1 Hazardous Materials

The term "hazardous materials" is defined by CERCLA. There are thousands of hazardous materials; in general, they can be categorized as ignitable, corrosive, reactive, or toxic. Release, as defined by CERCLA, means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a hazardous substance, including abandonment.

The project area consists of the dam face, the outlet channel, the slope adjacent to Kachess River, and the dam access road. The United States Bureau of Reclamation (Reclamation) does not expect to encounter any hazardous materials on-site during excavation or other surface-disturbing activities. However, Reclamation could use hazardous materials, as defined by CERCLA, during construction activities.

4.2 Public Health and Safety

Kachess Dam is an active site, where employees are exposed to weather and other safety concerns during daily operations. However, there are no activities that would put workers in an unsafe situation. This would not change during construction in the Proposed Action or during operations afterward.

Kachess Dam Road is the only access point to Kachess Dam and would be used for all construction access to the construction area. Local residents and recreationists use this road to access the east side of Kachess Reservoir, multiple campgrounds, boat ramps, and trailheads (see the **Transportation Resources Report** for additional information).

4.3 Dam Failure

Kachess Dam was constructed in 1912 as part of the Yakima Project. Over the life of the dam, several observations of potential seepage along the conduit have led to concerns of an increased risk for dam failure. Based on the high risk estimated for internal erosion along the conduit and the years of monitoring seepage along the conduit, Reclamation decided to develop a corrective action study for Kachess Dam. Based on this study, Reclamation proposed to modify the dam to rectify these seepage issues.

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, the outlet works modifications would not occur. This means there would be no construction, no construction equipment, no increase in traffic, and no hazardous materials on-site. Therefore, this alternative would have no short-term effects on public health and safety.

Potential long-term impacts on public health and safety could occur under this alternative. Since the seepage and internal erosion issues would continue, the threat of dam failure from internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. A Reclamation study determined that dam failure would lead to the significant loss of life, property, and infrastructure within the inundation area.

5.2 Proposed Action

5.2.1 Hazardous Materials

Under the Proposed Action, various hazardous materials would be required during construction; these materials could include used oil, hydraulic fluid, diesel fuel, solvent-based paints, and cleaning chemicals. Hazardous materials would be removed from the site and recycled whenever possible. Hazardous materials that are not recycled would be disposed of at appropriately permitted treatment or disposal facilities. These materials would be transported in accordance with 49 CFR 171–179 and the Hazardous Waste Management regulations (40 CFR 260).

Any accidental release of hazardous materials would be cleaned up according to the contractor's spill prevention, control, and countermeasure plan and reported to the proper agencies, including the Washington State Department of Ecology. Proper disposal of hazardous materials and implementation of the spill prevention, control, and countermeasure plan, in case of an accidental spill of hazardous materials, would decrease the risk of hazardous material spills during construction of the Proposed Action and provide for quick cleanup of any spills that may occur.

5.2.2 Public Health and Safety

Under the Proposed Action, Occupational Safety and Health Administration regulations for worker safety would be followed during construction, which would minimize the potential for injury. The proposed access road would be permanent and provide better access to the outlet works to address any emergencies in a timely manner.

Under the Proposed Action, traffic would increase on Kachess Dam Road during the construction period for the movement of personnel and materials, including conduit, fill materials, and concrete (see the **Transportation Resources Report** for additional details). All construction vehicles would be able to turn around and off load materials within a construction staging area; Kachess Dam Road would only be used to access the site. Signs would be posted to notify local traffic of the increase in construction traffic, but no traffic control would be necessary. The increase in construction traffic could result in a slightly increased risk of accidents. However, all construction traffic would be during daylight, and best management practices, such as adhering to speed limits and postings signs, would decrease the potential for accidents to almost current conditions.

No work would occur on the dam crest or on Kachess Reservoir, nor would Reclamation require any reservoir-level restrictions that would impede recreational use of the reservoir or its amenities. The Proposed Action would not pose a safety risk to recreationists on Kachess Reservoir.

5.2.3 Dam Failure

The Proposed Action would add a diaphragm filter and filter drain around the conduit. These corrective actions would greatly reduce the risk of dam failure due to internal erosion along the outlet works.

Chapter 6. Glossary

No glossary terms are defined.

Chapter 7. References Cited

None.

Kachess Dam Safety of Dams Modification Environmental Assessment

Indian Trust Assets Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

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Executive Summary

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States (US) for federally recognized Indian tribes or individuals. An ITA has three components: the trustee, the beneficiary, and the trust asset. ITAs can include land, minerals, federally reserved hunting and fishing rights and water rights, and in-stream flows associated with trust land. The US Bureau of Reclamation (Reclamation) assesses the effect of its programs and projects on tribal trust resources and federally recognized tribal governments.

Reclamation, working with the Bureau of Indian Affairs (BIA), has not identified any known ITAs within a 25-mile radius of the project area (Penman-Brotzman 2021). Reclamation also engages with relevant tribes on an ongoing basis, and no ITAs have been previously identified. Therefore, since no ITAs have been identified to date, Reclamation does not anticipate that any would be impacted temporarily or permanently by the dam safety construction process or operation of the dam.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
BIA	Bureau of Indian Affairs
DM	Departmental Manual
ITA	Indian Trust Asset
NEPA	National Environmental Policy Act
Reclamation	United States Bureau of Reclamation
US	United States

Chapter 1. Analysis Area

The project area does not include tribal lands. However, tribal water rights, tribal treaty rights, or tribal economic interests downstream may be present in areas that are not in the immediate vicinity. A 25-mile analysis area was used to identify any potential Indian Trust Assets (ITAs).

Chapter 2. Indicators

ITAs are primarily identified by consulting with the Bureau of Indian Affairs (BIA) and the appropriate tribes or individual trustees on the affected lands, resources, or economic interests where there may be aboriginal claims or interests. If ITAs are identified, indicators specific to those assets would be developed. For example, if a federal action may affect a protected priority tribal water right or a water right asserted through the Winters Doctrine (Brougher 2011; *Winters v. United States* 1908), an indicator would be developed to assess the context and intensity of the impact.

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

National Environmental Policy Act (NEPA; 42 United States Code 4321 et seq.) and its implementing regulations found at 40 Code of Federal Regulations 1500

Executive Order 13175—Consultation and Coordination with Indian Tribal Governments

Winters Doctrine (*Winters v. United States*, 207 US 564, 28 S. Ct. 207, 52 L. Ed. 340) and other court decisions

Treaty with the Yakama, 1855. June 9, 1855. 12 Stat. 951. Ratified March 8, 1859. Proclaimed April 18, 1859

Secretarial Order 3175 (incorporated into the Departmental Manual [DM] at 512 DM 2) requires that the potential impacts of US Department of the Interior's actions on ITAs must be addressed in planning and decision documents.

Other treaties or agreements applicable to the project area

3.2 State and Local Laws

None

3.3 Policies

DM, Series 5, Part 303, Indian Trust Responsibilities

DM, Series 30 Part 512, American Indian and Alaska Natives Programs

Departmental Responsibilities for Indian Trust Resources and Indian Sacred Sites on Federal Lands Office of Environmental Policy and Compliance (PEP) – Environmental Compliance Memorandum No. ECM97-2, May 8, 1997

Secretarial Order 3335—Reaffirmation of the Federal Trust Responsibility to Federally Recognized Indian Tribes and Individual Indian Beneficiaries, August 10, 2014

Secretarial Order 3206—American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act, June 5, 1997

Joint Secretarial Order 3403—Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters, November 15, 2021

Indian Trust Asset Policy Memorandum (and Attachment) from the Commissioner, July 2, 1993

NEPA Handbook Procedures to Implement Indian Trust Asset Policy Memorandum (and Attachment) from Daniel P. Beard, Commissioner, November 29, 1993

US Bureau of Reclamation (Reclamation) Manual—Indian Policy of the Bureau of Reclamation NIAP10

Chapter 4. Affected Environment

ITAs are legal interests in property held in trust by the United States (US) for federally recognized Indian tribes or individuals. An ITA has three components: the trustee, the beneficiary, and the trust asset. ITAs can include land, minerals, federally reserved hunting and fishing rights and water rights, and in-stream flows associated with trust land.

Beneficiaries of the ITA relationship are federally recognized Indian tribes with trust land. The US is the trustee of these assets. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the US. The characterization and application of the US trust relationship have been defined by case law that interprets congressional acts, executive orders, and historic treaty provisions. Tribal lands are those that have been deeded to tribes or those to which tribes have a historical claim, as well as lands held by the US in trust for the exclusive benefit of a tribe or pueblo.

Reclamation assesses the effect of its programs and projects on tribal trust resources and federally recognized tribal governments. The agency engages federally recognized tribal governments and consults with such tribes on a government-to-government level when its actions affect ITAs.

Reclamation, along with all bureaus within the Department of the Interior, is responsible for, among other things, the following:

- Identifying any impact of their plans, projects, programs, or activities on ITAs
- Ensuring that potential impacts are explicitly addressed in planning, decision, and operational documents
- Consulting with recognized tribes who may be affected by proposed activities

Consistent with this, Reclamation's ITA policy states that it will carry out its activities in a manner that protects ITAs and avoids adverse impacts when possible or, when it is not possible, provides appropriate mitigation or compensation. To carry out this policy, Reclamation's NEPA compliance procedures require evaluating the potential effects of its proposed actions on ITAs (Reclamation 2012).

4.1 Research to Determine Potential Indian Trust Assets

Reclamation, working with the BIA, has not identified any known ITAs within a 25-mile radius of the project area (Penman-Brotzman 2021). Reclamation also engages with relevant tribes on an ongoing basis, and no ITAs were previously identified.

Typically, Reclamation considers this a required section of NEPA documentation, but the need for a separate resource report is probably redundant in cases where no ITAs are identified.

Chapter 5. Environmental Consequences

Since no ITAs have been identified to date, Reclamation does not anticipate that any would be impacted temporarily or permanently by the dam safety construction process or operation of the dam.

Chapter 6. Glossary

Indian trust assets—Legal interests in property held in trust by the US for federally recognized Indian tribes or individuals.

Chapter 7. References Cited

Brougher, Cynthia. 2011. US Congressional Research Service. Indian Reserved Water Rights Under the Winters Doctrine: An Overview (RL32198). Washington, DC. June 8, 2011.

Penman-Brotzman, J. 2021. Kachess Reservoir Indian Trust Assets, Review of BIA Data and Mapping. September 9.

Reclamation. 2012. Reclamation's NEPA Handbook. February 2012. Internet website: https://www.usbr.gov/nepa/docs/NEPA_Handbook2012.pdf.

Treaty with the Yakama Nation, 12 Stat. 951. 1855. 2 Kappler 698. Internet website: https://goia.wa.gov/tribal-government/treaty-yakama-1855.

Winters v. United States, 207 US 564, 28 S. Ct. 207, 52 L. Ed. 340 (1908) Internet website: https://casetext.com/case/winters-v-united-states-3.

Kachess Dam Safety of Dams Modification Environmental Assessment

Land Use Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Under the Proposed Action, an access road and several contractor use staging areas would be constructed on US Bureau of Reclamation (Reclamation)-withdrawn lands. There would be no changes to the terms and conditions of the withdrawn lands administered by Reclamation. Under the No Action Alternative, there would be no changes to the terms and conditions of the withdrawn lands administered by Reclamation. However, without action, the seepage and internal erosion issues through the dam embankment along the outlet works conduit, which conveys water from the reservoir to Kachess River downstream, would continue. This internal erosion would perpetuate a risk of potential complete dam failure. Effects on downstream land uses would last for an unknown duration and depend on the timing and severity of the failure.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
Reclamation	US Bureau of Reclamation

Chapter 1. Analysis Area

The geographic scope of the analysis area and any potential effects on the existing and proposed land uses would be restricted to the project area.

Chapter 2. Indicators

The primary indicator of impacts on land use is any change in the assigned land use.

Chapter 3. Relevant Laws, Regulations, and Policies

The section below outlines laws, regulations, and policies that are applicable to land use. It provides a brief description of these authorities.

3.1 Federal Laws, Regulations, Statutes, and Orders

- Reclamation Act of 1902—This act allows the disposal of federal lands for the development of public works projects to irrigate arid lands.
- National Environmental Policy Act of 1969—This act provides the basis for evaluating potential effects on the environment.

3.2 State and Local Laws

- State of Washington Growth Management Act—This act provides the basis for coordinated land use planning.
- Washington State Environmental Policy Act of 1971—This act directs state and local governments to identify probable impacts of projects and potential measures to mitigate impacts.
- Kittitas County Shoreline Management Plan—This plan addresses planning issues in the land-water interface.

3.3 Policies

None

3.4 Memoranda of Understanding

None

3.5 Other

None

Chapter 4. Affected Environment

The project area is located in Kittitas County, near the towns of Easton and Cle Elum, Washington, and within the Okanogan-Wenatchee National Forest. The project area is comprised completely of US Bureau of Reclamation (Reclamation)-withdrawn lands (see **Figure 1**). Withdrawn lands are used to transfer jurisdiction over federal land from one agency to another. In this case, the lands are managed by the Bureau of Reclamation. There are no foreseeable changes to existing easements or other land entitlements in the project area (USFS 1990).

4.1 Land Use

The project area is comprised entirely of public lands withdrawn by Reclamation. There are no foreseeable changes to existing easements, campgrounds, recreation infrastructure, or other land entitlements in the area.

4.2 Shoreline

There are over 20 miles of shoreline on Kachess Reservoir. There are no foreseeable changes to the existing shoreline.

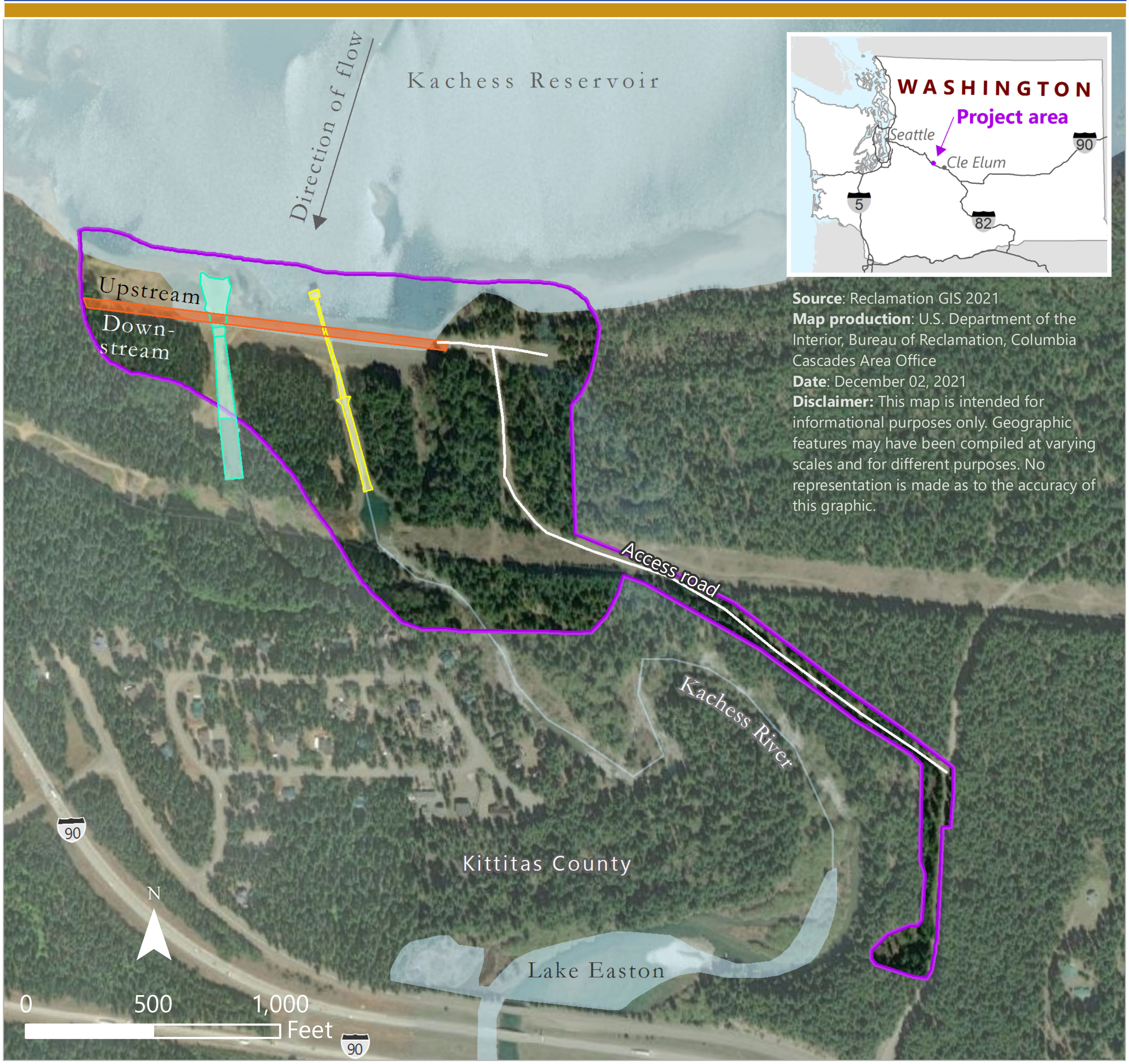
Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, there would be no changes to the dam and therefore no construction of contractor use areas and the access road. The lands surrounding the dam would remain withdrawn. There would be no change in the current land use or landownership. However, without action, the seepage and internal erosion issues through the dam embankment along the outlet works conduit, which conveys water from the reservoir to Kachess River downstream, would continue. This internal erosion would perpetuate a risk of potential complete dam failure.

While a dam failure would not alter land use or ownership, it could compromise the ability of downstream uses to realize the highest and best use of the property (for example, if part of a property is deemed unsafe for development). These effects would last for an unknown duration and would depend on the timing and severity of the failure. Any future improvements would be subject to compliance with applicable laws, regulations, and policies, including the National Environmental Policy Act.

Figure 1
Project Area



Source: Reclamation GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: December 02, 2021
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

Existing permanent infrastructure
- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

5.2 Proposed Action

Under the Proposed Action, the access road and contractor use staging areas would be constructed on Reclamation-withdrawn lands. There would be no changes to the terms and conditions of the withdrawn lands administered by Reclamation. The effects on land use would be the same as they would be under the No Action Alternative. There would be no change in the current land uses or landownership as a result of the Proposed Action. Two of the contractor use areas would not be reclaimed, while the remaining three contractor use areas would be reclaimed by seeding. Repairs performed on the dam would avoid the potential effects on downstream land uses from a dam failure.

Chapter 6. Glossary

None.

Chapter 7. References Cited

USFS (US Forest Service). 1990. Wenatchee National Forest Plan. Internet website: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5314997.pdf.

Kachess Dam Safety of Dams Modification Environmental Assessment

Noise and Vibration Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

The US Department of the Interior, Bureau of Reclamation (Reclamation) has prepared an environmental assessment for the Kachess Safety of Dams project. The purpose of this specialist report is to provide a comprehensive environmental baseline and analysis of the potential impacts of the Kachess Safety of Dams project under two separate alternatives, the No Action Alternative and the Proposed Action.

The analysis area is the Kachess Safety of Dams project area footprint. This includes the proposed downstream approach road at the toe, or base, of the dam ("the toe approach road"), areas slated for tree clearing and grubbing, and contractor use areas along the west side of the outlet channel. In addition, because sound waves that create noise propagate outward from their source, the analysis area also includes sensitive noise receptors on the lands surrounding the project area out to 0.25 miles (**Figure 1**). This includes the small, unincorporated community of Easton, Washington, located 0.2 miles south of the dam.

The indicators for identifying impacts on noise and vibration are the following:

- Changes to the ambient community sound level from construction machine and equipment noise
- Changes to the ambient traffic sound level from construction traffic noise
- Changes to the vibration

Under the No Action Alternative, Reclamation would not conduct the Proposed Action. The dam and spillway would not be improved, and no changes to the operation of the Kachess Dam would occur. Noise and vibration conditions would remain unchanged under the No Action Alternative.

Under the Proposed Action, Reclamation would perform improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction of the improvements would create short-term and localized noise impacts. The loudest construction noises would stem primarily from work conducted at the toe of the dam and from the construction of the new access road. Reclamation anticipates that large bulldozers and excavators used in the construction of the access road would be the two loudest types of equipment used in the implementation of this project. In accordance with Kittitas County's ordinances, noises generated by this project would fall under exemption 9.45.040(4), which states, "Sounds created by emergency equipment and emergency work necessary in the interests of law enforcement or of the health, safety or welfare of the community" (Kittitas County 2021). The dam improvements are necessary in the interest of reducing the risk of dam failure and ensuring the health, safety, and welfare of the community.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
dBA	decibels A-weighted
Reclamation	US Department of the Interior, Bureau of Reclamation

Chapter 1. Analysis Area

The analysis area is the Kachess Safety of Dams project area footprint. This includes the proposed downstream toe approach road, areas slated for tree clearing and grubbing, and contractor use areas along the west side of the outlet channel (**Figure 1**). In addition, because vibrations and sound waves that create noise propagate outward from their source, the analysis area also includes the lands surrounding the project area out to 0.25 miles. This includes the small, unincorporated community of Easton, Washington, located 0.2 miles south of the dam's toe.

Chapter 2. Indicators

The indicators for identifying impacts on noise and vibration are the following:

- Changes to the ambient community sound level from construction machine and equipment noise
- Changes to the ambient traffic sound level from construction traffic noise
- Changes to the vibration

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

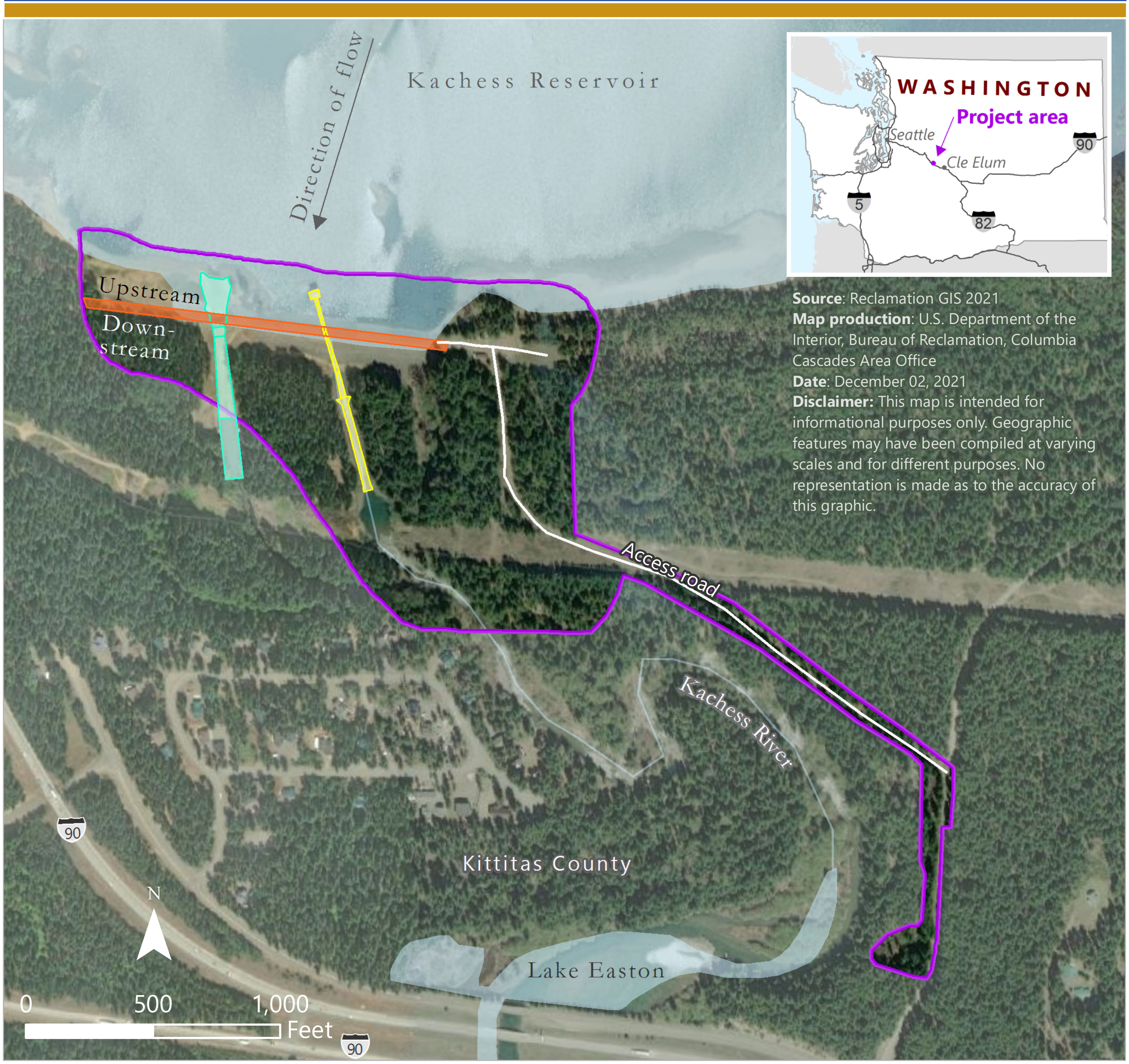
There are no relevant federal laws, regulations, statutes, or orders that apply to noise resources in this project.

3.2 State and Local Laws

The Board of County Commissioners County of Kittitas, State of Washington, Ordinance No. 2016-002, Section 9.45 Noise Control applies to this project. Specifically:

9.45.030 Public Disturbance—Noise Unlawful When.
(1) It is unlawful for any person to make, continue, or cause to be made or continued or any person owning or in possession of property to make, continue, or cause to be made or continued or allow to originate from the property any sound which: (a) Is plainly audible within any dwelling unit which is not the source of the sound or is generated within two hundred feet of any dwelling unit, and;
(b) Either reasonably annoys, disturbs, injures or endangers the comfort, repose, health, peace or safety of others.

Figure 1
Project Area



Source: Reclamation GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
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Existing permanent infrastructure
- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

(2) Sound which is "plainly audible" is sound that can be understood or identified.
(3) It shall be a rebuttable presumption that sounds created between 6:00 a.m. and 10:00 p.m. do not unreasonably annoy, disturb, injure, or endanger.

9.45.040 Exemptions.
The following sounds are exempt from the provisions of this chapter:
(1) Sounds originating from aircraft in flight and sounds which originate at airports and are directly related to flight operations;
(2) Sounds created by safety and protective devices, such as relief valves, where noise suppression would defeat the safety release intent of the device;
(3) Sounds created by fire alarms;
(4) Sounds created by emergency equipment and emergency work necessary in the interests of law enforcement or of the health, safety or welfare of the community;
(5) Sounds created by the discharge of firearms in the course of lawful hunting or target practice activities;
(6) Sounds created by natural phenomena;
(7) Sounds originating from [lawful] forest harvesting and silviculture activity, and from agriculture and livestock (not including sounds created by dogs);
(8) Sounds created by auxiliary equipment on motor vehicles used for highway maintenance;
(9) Sounds created by off-highway vehicles while being used in officially designated off-road vehicle parks. Such off-road vehicles are nevertheless subject to the provisions of [Revised Code of Washington] Chapter 46.09;
(10) Sounds created by warning devices not operated continuously for more than thirty minutes per incident (Kittitas County 2021).

3.3 Polices, Memoranda of Understanding, and Others

There are no other policies, memoranda of understanding, or other guidance relevant to noise resources at issue for this project.

Chapter 4. Affected Environment

Noise is defined as unwanted sound and can be intermittent or continuous, steady or impulsive. Humans' response to noise is extremely diverse and varies according to the type of noise source, the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source and the receptor. Sound is measured in decibels. Decibels A-weighted (dBA) is one of the most frequently used sound measurements because it best matches the range of human hearing. Low and very high frequencies are given less weight on this scale than on the standard decibel scale (OSHA 2020).

Sensitive noise receptors are individuals who would be affected by noise levels. Examples are individuals recreating in the area for such activities as hiking, biking, fishing, boating, snowshoeing, and cross-country skiing. They also include permanent and seasonal residents. The closest sensitive noise receptors to the Kachess Dam are the residents of Easton, a small, unincorporated community (population of 478 as of the 2010 census) located 0.2 miles south of the dam's toe and proposed project footprint (US Census Bureau 2010).

The predominant baseline community noise sources in the analysis area involve traffic noise from four-lane Interstate 90 and the two-lane frontage West Sparks Road, air traffic related to the use of Easton State Airport, and rural residential activities in and around the community of Easton. There are also sparse, single-lane, paved and unpaved roads used for access within the analysis area. Interstate 90 is heavily used by truck traffic year-round. The Washington State Department of Transportation-managed Easton State Airport is generally open from June 1 to October 1 and is visited by roughly 30 aircraft per month during these months (WSDOT 2021).

The unincorporated community of Easton does not have its own sound ordinances. For this analysis, the Board of County Commissioners County of Kittitas, State of Washington, Ordinance No. 2016-002, Section 9.45.030 and 0.45.040 will be apply to any implementation actions for this project.

Vibrations from construction equipment and activity can cause windows, doors, and items on shelves to rattle in buildings near active construction. Vibrations also have the potential to cause damage to buildings (OSHA 2020).

There are no sources of ongoing vibration in the analysis area. Occasional construction activities, however, may involve vibration, depending on the type of equipment, construction methods, and ground conditions. Vibrations can spread through the ground and will diminish in strength with distance from the source of the vibrations. Ground vibrations from construction activities can be audible and felt. Vibrations may have a low amplitude and long duration, such as vibrations from excavation equipment, bulldozing and grading equipment, and tree clearing and grubbing (California Department of Transportation 2013).

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, Reclamation would not conduct the Proposed Action. Accordingly, the dam and spillway would not be improved, and no changes to the operation of the Kachess Dam would occur. Therefore, the No Action Alternative would result in noise and vibration conditions that are the same as those currently experienced.

5.2 Proposed Action

Under the Proposed Action, Reclamation would perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction of the improvements would create short-term and localized noise impacts. The loudest construction noises would stem primarily from work conducted at the toe of the dam and from the construction of the new access road. Reclamation anticipates construction work Monday through Friday generally for 8 hours during the day. However, in the instance of delay (due to weather or unforeseen postponements), there could be the need for evening work or weekend work. Around-the-clock work would not be anticipated; yet, in the event of severe delays there would be a possibility of using a 24 hours per day, 7 days per week construction schedule until project completion.

Reclamation anticipates that large bulldozers and excavators used in the construction of the access road would be the two loudest types of heavy equipment used in the implementation of this project. Large bulldozers may have a sound level up to 120 dBA when operating. Large excavators operated as part of the construction of the access road could be expected to produce continuous sound up to 105 dBA (Serin and Akay 2010).

Additionally, there could be less, but likely perceivable, noise or vibration impacts from tree clearing and grubbing, transporting the conduit pipe, and the import of sand and filter material using public roads and the new access road to the toe of the dam. Also, the operation of pumps during construction would be located 20 to 30 feet below the surface and near the toe of the dam. Reclamation would not anticipate construction activities to produce enough vibration to affect buildings, but they could cause short-term and localized annoyance.

As defined in the purpose of and need for the proposed project, the construction associated with this project is designed to implement cost-effective measures to reduce the risks of dam failure, per Reclamation's public protection guidelines (see **Chapter 1, Purpose and Need**). As part of its Safety of Dams Program mission, Reclamation is committed to ensuring its dams do not present unacceptable risk levels to people, property, and the environment. These requirements result in a need for Reclamation to implement corrective action to bring static and hydrologic risks at Kachess Dam below public protection guidelines, while minimizing impacts on the environment.

As such, in accordance with Kittitas County's ordinances, noises generated by this project fall under exemption 9.45.040(4), which states, "Sounds created by emergency equipment and emergency work necessary in the interests of law enforcement or of the health, safety or welfare of the community." The sensitive noise receptors who reside in the unincorporated community of Easton, located 0.2 miles south of the dam's toe, would experience short-term and localized noise impacts as a result of this project. However, the dam improvements are necessary in the interest of reducing the risk of dam failure and ensuring the health, safety, and welfare of the community (Kittitas County 2021).

Chapter 6. Glossary

Sensitive noise receptors—Individuals who would be affected by noise levels. Examples are individuals recreating in the area for such activities as hiking, biking, fishing, boating, snowshoeing, and cross-country skiing.

Chapter 7. References Cited

California Department of Transportation. 2013. Transportation and Construction Vibration Guidance Manual. Internet website: https://www.cityofdavis.org/home/showdocument?id=4521.

Kittitas County (Kittitas County Code). 2021. Title 9—Public Peace, Safety and Morals. Kittitas County, Washington. Internet website: https://www.co.kittitas.wa.us/boc/countycode/title09.aspx.

OSHA (Occupational Safety and Health Administration). 2020. Section III: Chapter 5. Internet website: https://www.osha.gov/dts/osta/otm/new_noise/.

Serin, H., and A. Akay. 2010. "Noise level analysis of a bulldozer used in constructing a forest road in Mediterranean region of Turkey." *African Journal of Agricultural Research* 5(19): 2624–2628.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Public Services and Utilities Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

The Washington Utilities and Transportation Commission owns and operates the electrical, gas, and telecommunications utility infrastructure in Kittitas County (Kittitas County 2016). Water services near the project area are provided by the Easton Water District in Easton. Kittitas County provides police, fire, and solid waste services.

There are typically fewer municipal-level utility needs in unincorporated areas, such as the project area, because the land pattern is more dispersed. Water and wastewater needs, for example, are mostly fulfilled at the individual parcel level through well and septic systems, rather than by municipal infrastructure. There is less demand for service systems compared with more urbanized areas.

The standard level of service for solid waste disposal in Kittitas County is 4 pounds per capita, per day (Kittitas County 2016).

Utility and service system trends in and surrounding the project area are expected to remain largely unchanged because the area has experienced little population growth (Kittitas County 2021).

There are no underground utilities in the project area, but there are two overhead power lines that cross the project area. Bonneville Power Association (BPA) owns and operates one power line that parallels Interstate 90 and crosses the project area south of the dam. This line provides power to residential areas near the project area. Another power line starts at the eastern side of the dam and parallels Kachess Dam Road. The United States Bureau of Reclamation (Reclamation) is the only user for this power line.

Under the Proposed Action, part of the power line not operated by the BPA would cross the proposed access road. To allow safe transportation for large construction vehicles, the current overhead power line would be buried next to the west side of Kachess Dam Road. To ensure sufficient power is available during construction activities, the current on-site generators would be replaced with similar generators. Also, the system would be upgraded from a 240-volt, single-phase system to a 480-volt, three-phase system. This would not affect public power services because the power line does not serve other users.

Increased traffic from construction vehicles during the construction period could delay emergency and solid waste services for residential and commercial areas accessed by West Sparks Road. Traffic delays for solid waste services would not prevent the standard level of service for waste in Kittitas County. Reclamation would not expect traffic delays to be worse than 15 to 25 seconds (see the **Transportation Resources Report**); therefore, traffic delays for emergency services such as fire, health care, and police would not be delayed enough for the functionality of these services to be compromised.

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Acronyms and Abbreviations

Acronym	Full Phrase
BPA	Bonneville Power Administration
Reclamation	United States Bureau of Reclamation

Chapter 1. Analysis Area

The analysis area for utilities and service systems is West Sparks Road from Interstate 90 to East Kachess Road, leading to the Kachess Dam; the Kachess River; and residential areas within 1 mile of the dam. This area encompasses public service areas and potential utilities that could be affected by construction activities.

Chapter 2. Indicators

- Change in the number, type, or functionality of utilities and service systems in the project area

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- Safe Water Drinking Act of 1974—This act includes protections for reservoir drinking water.
- Resource Conservation and Recovery Act—This act gives the Environmental Protection Agency authority to control the generation, transportation, treatment, storage, and disposal of hazardous waste.
- Reclamation Act of 1902—This act allows the disposal of federal lands for the development of public works projects to irrigate arid lands.

3.2 State and Local Laws

- State of Washington Growth Management Act (Revised Code of Washington 36.70A.070 and Washington Administrative Code 356-195-320)—This act provides the basis for coordinated land use and infrastructure planning between local governments and utility purveyors.
- Washington State Environmental Policy Act of 1971—This act directs the state and its local governments to identify probable impacts of projects and potential measures to mitigate impacts.
- Shoreline Management Act (Revised Code of Washington 90.58)—This act directs local governments to develop shoreline master programs to address planning issues in the land-water interface.
- Revised Code of Washington Chapter 80.28—This governs gas, electric, and water utilities in the state.

- Kittitas County Comprehensive Plan 2019—This plan includes goals, policies, and objectives for utilities and municipal services in Kittitas County.
- Kittitas County Public Health Department Emergency Operation Plan 2017—This plan provides guidelines for coordinated preparedness and response to emergency incidents that affect public health in Kittitas County.
- Kittitas County Shoreline Master Program 2016—This provides direction for shoreline management of the Kachess River.
- Kittitas County Hazard Mitigation Plan 2019—This plan includes mitigation actions for dam failures.

Chapter 4. Affected Environment

4.1 Utilities and Service Systems

Utilities include infrastructure such as electrical power lines, water and wastewater pipelines, natural gas pipelines, and fiber-optic cables that serve a group of end users. They are typically associated with a utility district, municipal boundary, or other utility service area. Service systems are those related to municipal police, fire, health care, transportation, and education services and solid waste disposal. The Washington Utilities and Transportation Commission owns and operates the electrical, gas, and telecommunications utility infrastructure in Kittitas County (Kittitas County 2016). Water services near the project area are provided by the Easton Water District in Easton. Kittitas County provides police, fire, and solid waste services.

There are typically fewer municipal-level utility needs in unincorporated areas, such as the project area, because the land pattern is more dispersed. Water and wastewater needs, for example, are mostly fulfilled at the individual parcel level through well and septic systems, rather than by municipal infrastructure. There is less demand for service systems compared with more urbanized areas.

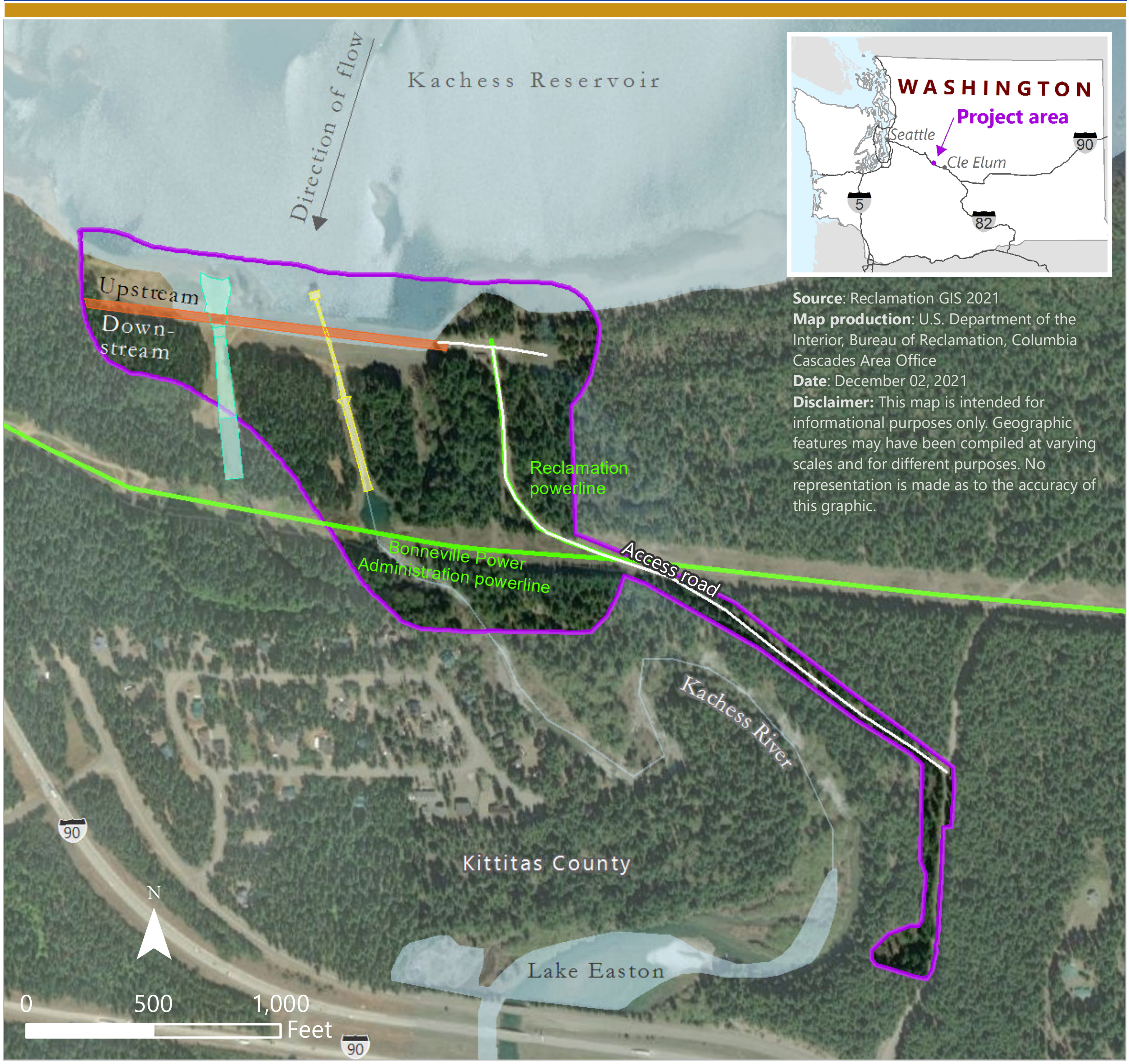
The standard level of service for solid waste disposal in Kittitas County is 4 pounds per capita, per day (Kittitas County 2016).

Utility and service system trends in and surrounding the project area are expected to remain largely unchanged. In Cle Elum, the largest city near the Kachess Dam, the population increased by three people from 2010 to 2017 (Kittitas County 2021). The Kittitas County Comprehensive Plan (Kittitas County 2016) specifies that rural governmental services should be provided at a level that is normally associated with rural areas; examples of these services are domestic water, fire and police protection services, and other public utilities that are not associated with urban areas. The service should be provided at such a level that is appropriate for rural development, and it should not promote growth (Kittitas County 2016).

There are no underground utilities in the project area, but there are two overhead power lines that cross through the project area. Bonneville Power Administration (BPA) owns and operates one power line that parallels Interstate 90 and crosses the project area south of the dam (see **Figure 1**).

BUREAU OF RECLAMATION

Figure 1
Powerlines



Source: Reclamation GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
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Powerline

Existing permanent infrastructure
- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

This line provides power to residential areas near the project area. Another power line starts at the eastern side of the dam and parallels Kachess Dam Road (see **Figure 1**). The United States Bureau of Reclamation (Reclamation) is the only user for this power line.

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, there would be no change to existing utilities and service systems in the project area. Potential long-term impacts on public health and safety could occur under this alternative. Since the seepage and internal erosion issues would continue, the threat of dam failure from internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. Dam failure which would result in extensive flooding that could affect power lines and potentially divert emergency services from other areas to respond to the failure. For the purposes of this analysis, it is assumed that there would be no changes to baseline conditions for utilities and service systems.

5.2 Proposed Action

Under the Proposed Action, to allow for safe transportation for large construction vehicles on the access road, part of the existing overhead power line not operated by the BPA would be buried next to the west side of Kachess Dam Road. To ensure sufficient power is available during construction activities, the current on-site generators would be replaced with similar generators. Also, the system would be upgraded from a 240-volt, single-phase system to a 480-volt, three-phase system. This would not affect public power services because the power line does not serve other users.

Increased traffic from construction vehicles during the construction period (see the **Transportation Resources Report**) could delay emergency and solid waste services for residential and commercial areas accessed by West Sparks Road. Traffic delays for solid waste services would not prevent the standard level of service for waste in Kittitas County, as described under the affected environment. Reclamation would not expect traffic delays to be worse than 15 to 25 seconds (see the **Transportation and Traffic Report**); therefore, traffic delays for emergency services such as fire, health care, and police would not be delayed enough for the functionality of these services to be compromised.

Chapter 6. Glossary

None

Chapter 7. References Cited

Kittitas County. 2016. Kittitas County Comprehensive Plan. Internet website: https://www.co.kittitas.wa.us/uploads/documents/cds/comp-plan/2016/2016%201206%20Comp%20Plan%20per%20Kittitas%20Co%20Ord%202016-023.pdf.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Recreation Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Kachess Reservoir is popular for water-based activities, such as boating, swimming, fishing, and tubing. There are two public boat launches for access to Kachess Reservoir; these are located at the south and north ends. These provide access to water-based activities. Due to irrigation demands and seasonal inflows, fluctuating lake levels influence the availability, extent, and timing of recreational activities.

Recreation opportunities around the reservoir include Kachess Campground on the northwest shore of the reservoir, with approximately 150 sites, and the smaller East Kachess Group site, on the eastern shore of the reservoir. The 394,000-acre Alpine Lakes Wilderness, a popular recreation area with 615 miles of trails, can be accessed via Kachess Dam Road and Salmon la Sac Road.

In the winter, Kachess Dam Road is a popular, groomed snowmobile route managed by Washington State Parks. The Easton Reload Sno-Park staging area is located at the intersection of Kachess Dam Road and the dam access road. The US Bureau of Reclamation (Reclamation) has proposed to the US Forest Service to relocate the Easton Reload Sno-Park from its current location to a location where Kachess Dam Road and the Bonneville Power Association transmission lines intersect (see the **Utilities Resource Report** for more information). Reclamation anticipates the relocation will maintain the current level and type of recreation access.

Indicators identified for the analysis of potential impacts on recreation include:

- Changes in the accessibility of local recreation areas, such as trail systems and fishing areas
- Changes in the quality or quantity of recreation opportunities
- Changes in the level of service (LOS), a function of roadway capacity and traffic volume, on local roadways that provide visitor access to recreation opportunities

Under the No Action Alternative, current Kachess Dam operations would continue. In the near term, seasonal fluctuations in the reservoir levels would continue to affect the quality, quantity, and accessibility of existing recreation opportunities. In the long term, seepage and internal erosion issues would increase the threat of a dam failure and subsequent flood. Such a failure would result in a substantial decline in the reservoir's water level, which would eliminate access to water-dependent recreation opportunities until the dam could be repaired and water levels restored. Other activities, such as camping and hiking, would be indirectly affected by the altered recreation setting.

Under the Proposed Action, an access road would be constructed between the dam and Kachess Dam Road, which becomes National Forest System Road (NFS) 4818. Construction equipment and material deliveries would cause short-term traffic delays on Kachess Dam Road. Visitors accessing areas upstream of the dam would experience intermittent traffic delays resulting from trucks exiting and reentering the highway. Delays may lead some people to avoid the area, which would decrease visitation to recreation opportunities in the project area and increase visitation to surrounding areas.

Limiting construction activity to weekdays would avoid access-related impacts on recreation during the weekend when visitation is generally highest.

While contractor use areas and the associated access routes would maintain visitor access, construction-associated noise and the presence of construction equipment would alter the recreation setting at nearby recreation areas, such as the Kachess Ridge Trailhead and Kachess Reservoir. The intensity of the impact would depend on the type and location of the recreational activity relative to the noise source. Where construction activities are visible, there could be a short-term reduction in the quality of the recreation setting from the activity, compared with the No Action Alternative. Limiting construction activity to weekdays would avoid impacting the quality of the recreation setting during the weekend when visitation is generally highest.

The project would result in temporary, localized congestion along Kachess Dam Road at the access road. During daytime construction activities and the hauling of construction materials, there could be delays of up to 25 seconds. When combined with recreation traffic, the construction-related traffic would increase the length and frequency of delays for recreation visitors. The greatest potential for delays would be during the peak visitation season (May to September) and on weekends.

Table of Contents

Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
LOS	level of service
Reclamation	US Bureau of Reclamation

Chapter 1. Analysis Area

Lands containing access to recreation opportunities in the project area and the surrounding landscape comprise the analysis area for recreation. This analysis area includes all areas accessed by Kachess Dam Road. Recreation opportunities accessed by Kachess Dam Road stretch from trailheads at the southern end of the reservoir, campgrounds and wilderness access points at its northern end, and boating, tubing, and fishing on the reservoir itself.

Chapter 2. Indicators

Indicators identified for the analysis of potential impacts on recreation include visitation levels and recreational quality, which project activities could disrupt over the short or long term. Specifically, these indicators are as follows:

- Changes in the accessibility of local recreation areas, such as trail systems and fishing areas
- Changes in the quality or quantity of recreation opportunities
- Changes in the level of service (LOS), a function of roadway capacity and traffic volume, on local roadways that provide visitor access to recreation opportunities

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- The Wilderness Act of September 3, 1964 (16 United States Code 1131–1136)—This act provides direction to protect federally designated wilderness areas. The primary mandate of the Wilderness Act is to preserve wilderness character, which is the natural, untamed, undeveloped, and primitive aspects that make wilderness worthy of its name. This means that uses within wilderness areas that directly degrade wilderness character are prohibited for both land managers and the public. These uses include structures or installations; temporary roads; and the use of motor vehicles, motorized equipment, and mechanical transport.
- The Wild and Scenic Rivers Act of October 2, 1968 (16 United States Code 1271)—This act provides for the designation of rivers by Congress or, if certain requirements are met, the Secretary of the Interior to allow for the preservation of certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition. Rivers are classified as wild, scenic, or recreational. Regardless of the classification, each river in the National Wild and Scenic Rivers System is administered with the goal of protecting and enhancing the values that caused it to be designated. This is done through voluntary stewardship by

landowners and river users and through federal, state, local, or tribal government regulations and programs.

3.2 State and Local Laws

- State of Washington statutes regarding public recreational lands (Revised Code of Washington, Title 79A) have been established with the intent to reform and improve access to and management of state lands on a sustainable basis for the recreating public.
- State of Washington statutes establish a program for managing publicly owned land on rivers included in the state's scenic river system (Revised Code of Washington, Title 79A, Section 55). This program indicates the river segments to be initially included in that system and prescribes procedures for adding additional components to the system.

3.3 Policies

- The US Bureau of Reclamation (Reclamation) manual consists of a series of policy, directives, and standards, including the recreation management policy (LND PO4), which defines Reclamation's overall responsibilities and establishes the basic principles for planning, developing, managing, and protecting public recreation resources on Reclamation lands and waters. This policy compels Reclamation to give full consideration for the inclusion of outdoor recreation opportunities in project planning that is commensurate with public needs and Reclamation's responsibilities, objectives, and authorities.
- Implementation of the Cost-Sharing Authorities for Recreation and Fish and Wildlife Enhancement (LND 01-01) establishes Reclamation's approach to implementing the cost-sharing authorities contained in the Federal Water Project Recreation Act of 1965 (Public Law 89-72), as amended, as well as Reclamation's project-specific authorities.
- Reclamation's Recreation Program Management, Directive and Standard (LND 01-03) sets forth the requirements to ensure effective management of public outdoor recreation on Reclamation lands and waterbodies.

3.4 Memoranda of Understanding

None.

3.5 Other

None.

Chapter 4. Affected Environment

4.1 Kachess Reservoir Recreation

There is no recreation management plan developed by Reclamation for Kachess Reservoir, however in the absence of project-specific legislation or a managing partner, Reclamation is limited by the Federal Water Project Recreation Act of 1965, Public Law 89-72, to provide only "minimum basic" facilities.

Kachess Reservoir is popular for boating, swimming, fishing, and tubing. There are two public boat launches for access to Kachess Reservoir; these are located at the south and north ends. These provide access to activities such as fishing, power boating, water skiing, and sailing. Due to irrigation demands and subject to seasonal inflows, fluctuating lake levels influence the availability, extent, and timing of recreational activities. For example, low water levels can preclude access to the reservoir via the boat launches in late summer (USFS 2021a). While there is no visitation data specific to the project area, data from other similar recreation areas in Washington indicate that visitation is highest between May and September (Washington State Parks 2020). In general, outdoor recreation activity is higher on the weekends.

Campgrounds include Kachess Campground on the northwest shore of the reservoir with approximately 150 sites, and the smaller East Kachess Group site, on the eastern shore of the reservoir.

4.2 Public Access

Kachess Dam Road and National Forest System Roads 49 (Kachess Lake Road), 4818 and 4828 (Via Kachess Road) are the primary access routes to the campgrounds, boat ramps, and trailheads surrounding the reservoir. Other access roads around the reservoir include National Forest System Road 124 and Bakers Lane. Some road segments are paved, while others are unpaved.

4.3 Okanogan-Wenatchee National Forest System Lands

National Forest System land in the Kachess Reservoir area is a regional destination for recreation in the Cle Elum area. There are several trailheads and both dispersed and developed camping sites, such as the East Kachess Group site, that surround Kachess Reservoir and are accessed by Kachess Dam Road. The area provides year-round recreation opportunities with camping and hiking in the summer, and a multitude of snowshoeing and groomed snowmobiling trails during the winter (State of Washington 2021).

4.4 Alpine Lakes Wilderness

The Alpine Lakes Wilderness is a popular recreation area in the Pacific Northwest. The Alpine Lakes Wilderness encompasses approximately 394,000 acres in the Central Cascades region and is accessed by 47 trailheads and 615 miles of trails. The wilderness is visited by nearly 150,000 people each year. The wilderness can be accessed via Kachess Dam Road and Salmon la Sac Road (USFS 2021b).

4.5 Wild and Scenic Rivers

There are no wild and scenic rivers in the analysis area. The closest designated rivers are the Pratt and Middle Fork of the Snoqualmie, which are approximately 23 miles from the analysis area. While Icicle Creek and the Wenatchee River are closer in distance and have been found suitable under the current forest plan for inclusion in the National Wild and Scenic Rivers System, neither has been designated.

4.6 Other Local Recreation and Public Access

4.6.1 Recreational Fishing and Boating

Kachess Reservoir is a regional destination for boating and fishing. Primary access to the lake for watercraft is via the two public boat launches. The reservoir is open year-round for fishing. The primary fish species if kokanee salmon. The Washington Department of Fish and Wildlife does not stock the lake (Washington Department of Fish and Wildlife 2021).

4.6.2 Local Recreation

In the winter, Kachess Dam Road is a popular, groomed snowmobile route managed by Washington State Parks. The Easton Reload Sno-Park staging area is located at the intersection of Kachess Dam Road and the dam access road. Grooming typically begins in December, or when there is sufficient snow accumulation, and ends once snow coverage no longer supports the activity (State of Washington 2021). Reclamation has proposed to the US Forest Service to relocate the Easton Reload Sno-Park from its current location to a location where Kachess Dam Road and the Bonneville Power Association transmission lines intersect (see the **Utilities Resource Report** for more information). A permit will be required for this action. Reclamation anticipates the relocation will maintain the current level and type of recreation access.

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, current Kachess Dam operations would continue. In the near term, seasonal fluctuations in the reservoir levels would continue to affect the quality, quantity, and accessibility of existing recreation opportunities.

In the long term, seepage and internal erosion issues would increase the threat of a dam failure and subsequent flood. Such a failure would result in a substantial decline in reservoir water level, which would eliminate access to water-dependent recreation opportunities until the dam could be repaired and water levels restored. Other activities, such as camping and hiking, would be indirectly affected by the altered recreation setting.

5.2 Proposed Action

Changes in the accessibility of local recreation areas, such as trail systems, campgrounds, sno-parks, and fishing areas

Construction equipment and material deliveries would cause short-term traffic delays on Kachess Dam Road. Visitors accessing areas upstream of the dam would experience intermittent traffic delays resulting from trucks exiting and reentering the highway. Delays would be temporary and occur up to 10 hours per day, 5 days per week. Nighttime work would not occur except in instances of delay, such as from inclement weather, and would also not exceed 10 hours per day unless a major delay occurs. Overall, as a result of the above-described construction-related delays, some people may choose to avoid the area, which would decrease visitation to recreation opportunities in the project area and increase visitation to surrounding areas. Limiting construction activity to weekdays would avoid access-related impacts on recreation during the weekend when visitation is generally highest.

Changes in the quality or quantity of recreation opportunities

While contractor use areas and the associated access routes would maintain visitor access, construction-associated noise and the presence of construction equipment would alter the recreation setting at nearby recreation areas, such as the Kachess Ridge Trailhead and Kachess Reservoir. Recreationists could consider the temporary and localized noise from vehicle traffic and construction a nuisance, which would temporarily diminish the quality of the recreation setting. The intensity of the impact would depend on the type and location of the recreation activity relative to the noise source. Impacts would occur up to 10 hours per day, 5 days per week. Where construction activities are visible, there could be a short-term reduction in the quality of the recreation setting from the activity, compared with the No Action Alternative. Limiting construction activity to weekdays would avoid impacting the quality of the recreation setting during the weekend when visitation is generally highest.

Changes in the LOS on local roadways providing visitor access to recreation opportunities

The project would result in temporary, localized congestion along Kachess Dam Road at the access road. This is due to construction vehicle movements. The LOS is used to determine the segment operations using a traffic volume to road capacity ratio. During daytime construction activities and the hauling of construction materials, there could be a temporary decrease below LOS A (delays less than 10 seconds); however, the LOS likely would not decrease below LOS C (delays of 15–25 seconds). See the **Transportation Resource Report** for additional information. When combined with recreation traffic, the construction-related traffic would increase the length and frequency of delays for recreation visitors. The greatest potential for reduced LOS and associated delays would be during the peak visitation season (May to September) and on weekends.

Chapter 6. Glossary

Level of service—A metric that describes the operating conditions of a roadway based on factors such as the physical roadway capacity, speed, maneuverability, safety, and traffic volume.

Chapter 7. References Cited

State of Washington. 2021. Lake Easton Sno-Park Map. Internet website: https://parks.state.wa.us/DocumentCenter/View/152/Lake-Easton-Sno-Park-PDF.

USFS (United States Forest Service). 1990. Wenatchee Forest Plan. Internet website: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5314997.pdf.

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State of Washington. 2021. Visitation Reports. Internet website: https://parks.state.wa.us/1165/Visitation-reports

Washington Department of Fish and Wildlife. 2021. Statewide Trout and Kokanee Stocking Plan. Internet Website: https://wdfw.wa.gov/sites/default/files/publications/02227/wdfw02227.pdf.

Kachess Dam Safety of Dams Modification Environmental Assessment

Sacred Sites Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Indian sacred sites are defined in Executive Order 13007 as "specific, discrete, narrowly delineated locations on Federal land that are identified by an Indian tribe, or... authoritative representative of an Indian religion, as sacred by virtue of their established religious significance to, or ceremonial use by, an Indian religion."

Sacred sites are identified by consulting with the tribes that ascribe value to them, not through field surveys. Whether sacred sites are present in the area and could be impacted by a proposed action and alternatives is not known, but the location, extent, and current condition of such resources may be learned at the discretion of the tribes.

The project area is within the traditional territory of the Wenatchi. The Wenatchi are one of the tribes making up the Confederated Tribes of the Colville Reservation. The project area is also the ceded territory of the Yakama Nation. The ceded territory is a vast region of central Washington occupied historically by the constituent bands and tribes who are now, through the Treaty with the Yakama, 1855, recognized as the Confederated Tribes and Bands of the Yakama Nation.

The United States Bureau of Reclamation (Reclamation) engages with relevant tribes on an ongoing basis regarding a variety of issues, including tribal treaty rights, Indian Trust Assets, traditional-use areas, traditional cultural properties, economic development, and sacred sites. As part of the National Environmental Policy Act (NEPA) process and compliance with the National Historic Preservation Act of 1966 (NHPA), tribal letters have been sent regarding this project. While past consultations have indicated general areas of cultural sensitivity, no discrete sacred site locations or cultural landscapes have been identified to date.

Since no sacred site issues have been identified, no impacts are anticipated. However, project-specific coordination and consultation are ongoing. Reclamation will consider and address any issues regarding Indian sacred sites as defined in Executive Order 13007.

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Chapter Page

Acronyms and Abbreviations

Acronym	Full Phrase
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
Reclamation	United States Bureau of Reclamation
USC	United States Code

Chapter 1. Analysis Area

The primary analysis area consists of the construction footprint, the dam, the reservoir, and the immediate vicinity. The analysis area for the setting and downstream effects may be larger for the No Action Alternative because this alternative anticipates the potential for a catastrophic dam failure.

Chapter 2. Indicators

This qualitative assessment was developed in consultation with the tribes that ascribe value to sacred sites. The following are the indicators:

- The extent and location(s) of activities that may be incompatible with maintaining the physical integrity or setting of sensitive cultural resources and traditional-use areas
- Changes in access to traditional-use areas, sacred sites, or culturally important locations
- The loss of vegetation, topographical features, and other important landscape elements that may define an area of traditional use, sacred sites, or cultural importance

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- Treaty with the Yakama, 1855. June 9, 1855. 12 Stat. 951. Ratified March 8, 1859. Proclaimed April 18, 1859
- Executive Order 13007—Indian Sacred Sites (May 24, 1996), 61 *Federal Register* 26771
- Native American Graves Protection and Repatriation Act of October 1990
- American Indian Religious Freedom Act (16 United States Code [USC] 1996)
- Executive Order 13175—Consultation and Coordination with Indian Tribal Governments
- Executive Order 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 16, 1994)
- National Historic Preservation Act of 1966 (NHPA)
- Migratory Bird Treaty Act of 1918 (16 USC 703–711)
- National Environmental Policy Act (NEPA) (42 USC 4321 et seq.) and its implementing regulations found at 40 Code of Federal Regulations 1500

3.2 State and Local Laws

- State of Washington, Executive Order 21-02, Archaeological and Cultural Resources Policies

3.3 Policies

- Departmental Responsibilities for Protecting/Accommodating Access to Indian Sacred Sites, Departmental Manual, Series 30, Part 512, Chapter 3, June 5, 1998
- Joint Secretarial Order 3403—Fulfilling the Trust Responsibility to Indian Tribes in the Stewardship of Federal Lands and Waters, November 15, 2021
- Protection and Enhancement Plan – Environmental Compliance Memorandum No. ECM97-2, May 8, 1997
- Bureau of Reclamation (Reclamation) Guidance for Implementing Indian Sacred Sites Executive Order (No. 13007) Bureau of Reclamation Guidance, September 16, 1998
- Memorandum of Understanding for the Coordination and Collaboration for the Protection of Indian Sacred Sites, 2016
- Policy Statement on the Confidentiality of Information about Indian Sacred Sites
- Native American Sacred Sites and the Federal Government

Chapter 4. Affected Environment

Indian sacred sites are defined in Executive Order 13007 as "specific, discrete, narrowly delineated locations on Federal land that are identified by an Indian tribe, or... authoritative representative of an Indian religion, as sacred by virtue of their established religious significance to, or ceremonial use by, an Indian religion."

This definition of sacred sites clearly focuses on the places that are more important than others for worshipping the sacred or conducting religious ceremonies. It is those special places that federal agencies are directed to consider under the executive order. However, in addition to the more specifically defined locations, cultural landscapes and values also should be addressed as human environment elements through the NEPA analysis.

Sacred sites are identified by consulting with the tribes that ascribe value to them, not through field surveys. Whether sacred sites are present in the area and could be impacted by a proposed action and alternatives is not known.

The location, extent, and current condition of such resources may be learned at the discretion of the tribe. This would happen through consultation about proposed actions or policies that could restrict access to sacred sites or ceremonial use of those sites, or that would physically harm those sites.

The project area is within the traditional territory of the Wenatchi. The Wenatchi are one of the tribes making up the Confederated Tribes of the Colville Reservation. These tribes include the Colville, Chelan, Entiat, Methow, Okanogan, Lake, San Poil, Nespelem, Moses-Columbia, Nez

Perce, Palouse, Sinkayuse, and Wenatchi Tribes and Bands. Constituent tribes of the Colville Confederated Tribes belong to what anthropologists call the Plateau Culture Area based on similarities in language and culture. While culturally distinct and diverse, there are a great deal of shared general social and cultural practices and teachings (Colville Tribes 2021).

The project area is also the ceded territory of the Yakama Nation. The ceded territory is a vast region of central Washington occupied historically by the constituent bands and tribes who are now, through the Treaty with the Yakama (1855), recognized as the Confederated Tribes and Bands of the Yakama Nation. After violations of the treaty and much conflict, these tribes and bands of the original homeland were moved to the reservation. Tribal leaders reserve the right to fish, hunt, and gather all of the tribe's traditional foods on the reservation as well as in the ceded area. The treaty also provided for the Wenatchi Reservation around traditional fishing locations, but the federal government never recognized the boundaries of this agreement (Yakama Nation 2020).

4.1 Coordination and Consultation Status

Reclamation engages with relevant tribes on an ongoing basis regarding a variety of issues, including tribal treaty rights, Indian Trust Assets, traditional-use areas, traditional cultural properties, economic development, and sacred sites. As part of the NEPA process and NHPA compliance, tribal letters have been sent regarding this project.

4.2 Locations

While past consultations have indicated general areas of cultural sensitivity, no discrete sacred site locations or cultural landscapes have been identified to date (Miller 2018).

Chapter 5. Environmental Consequences

Since no sacred site issues have been identified, no impacts are anticipated. However, project-specific coordination and consultation are ongoing, and Reclamation will consider and address any issues regarding Indian sacred sites as defined in Executive Order 13007.

Chapter 6. Glossary

Sacred sites—Discrete, narrowly delineated locations identified as sacred by an Indian tribe or by an authoritative representative of an Indian religion.

Cultural landscape—A geographic area that includes both cultural and natural resources associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

Chapter 7. References Cited

Colville Tribes (Confederated Tribes of the Colville Reservation). 2021. A Brief History. Nespelem, Washington. Internet website: www.colvilletribes.com.

Miller, Crystal. 2018. Traditional Cultural Property (TCP) Resource Study in the Upper Yakima River Basin for the Confederated Tribes of the Colville Reservation. Confidential Report for the Confederated Tribes of the Colville Reservation, Nespelem, Washington.

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Yakama Nation (Confederated Tribes and Bands of the Yakama Nation). 2020. Yakama Nation History. Toppenish, Washington. Internet website: www.yakama.com/about/.

Kachess Dam Safety of Dams Modification Environmental Assessment

Socioeconomic Resources Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
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December 2021

Mission Statements

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Under the Proposed Action, the United States Bureau of Reclamation (Reclamation) would modify the dam through several improvements, construct an access road, and develop staging and construction areas during the course of modifying the dam.

Construction activities would occur up to 10 hours a day, 5 days per week. Work would not exceed 10 hours per day unless a major delay occurs. Nighttime work also would not occur except in instances of delay, such as from inclement weather. The construction schedule would include:

- Tree clearing and hauling from May 31 to July 26, 2023
- Construction of contractor use areas from May 31 to July 11, 2023
- Construction of the access road between late June and late July 2023
- Steel pipe delivery from May 31 to June 6, 2023
- Excavation of the conduit extension from January 10 to February 6, 2024
- Pipe installation and concrete delivery from March 18 to June 9, 2024
- Sand delivery for the conduit extension between mid-May and mid-June 2024

Construction activities could affect the quality of life for residents through increased traffic, additional noise, visual impacts, and interruptions of recreation access. Impacts on the quality of life could occur during construction and would be short term and localized.

Compared with the No Action Alternative, proposed construction would result in direct, short-term increases in employment and the associated economic contributions to the local economy. This would be due to spending on project materials and employment. Total person-years employment directly supported by the project is estimated at 44. Direct employment by Reclamation is not considered in this estimate; it would represent support for additional employment. The project would support an estimated additional 99 indirect jobs. The creation of jobs and any expenditures related to the project would result in direct, short-term potential increases in employment and the associated economic contribution to the local economy.

Reclamation performed a Kachess Dam safety of dams economic benefit analysis to quantify the total economic benefits to the nation, by category, provided by Kachess Dam and Reservoir (Reclamation 2021). The report identifies five categories of economic benefits: irrigation, recreation, power generation, municipal and industrial, and fish and wildlife. It is estimated that these categories provide for an estimated total of $61.47 million annually. Because of the timing and design of construction activities, Kachess Dam would remain at its current capacity throughout construction, and it would continue to provide most of the social and economic benefits.

Under the Proposed Action, there would be socioeconomic benefits associated with a long-term increase in the reliability of the dam. These include continued water deliveries to irrigation districts, tribes, and the downstream public; long-term public health and safety risk reduction; and associated cost savings from avoiding erosion and dam failure.

Under the No Action Alternative, there would be no modifications to the dam. The proposed access road would not be constructed, and staging and construction areas would not be developed. Construction activities would not occur, and short-term, localized increases in employment and expenditures would not occur. Potential socioeconomic impacts include those associated with a long-term reduction in the reliability of the dam.

Given the current internal erosion of the dam, its failure is expected to occur in the future and would be an emergency situation. There would be no impacts on social and economic benefits provided by Kachess Dam and Reservoir, unless dam failure occurred. Should dam failure occur, the social and economic benefits provided by the dam (an estimated total of $61.47 million annually) would be reduced or eliminated. In addition to lost benefits following dam failure, damages from flooding would occur.

Under the No Action Alternative, the quantified damage to property alone (transportation, essential facilities, utilities, vehicles, agriculture, and building-related losses) due to dam failure is estimated to exceed $12.9 million. While this estimate provides an idea of damage, it does not quantify the cost of emergency services, environmental damages, the disruption of government services, cleanup, disruption of people's lives, or other categories of loss that would follow a Kachess Dam failure.

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Tables

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
Reclamation	United States Bureau of Reclamation

Chapter 1. Analysis Area

The socioeconomic analysis area consists of Kittitas and Yakima Counties in Washington. While the project area occurs in Kittitas County, Yakima County, located directly south of Kittitas County, is included for the socioeconomic analysis due to the hydrologic ties (see the **Water Resources Report**) with the area and the resulting social and economic ties. This analysis presents county-level data to describe social and economic conditions. The economic component of this analysis relies on the United States Bureau of Reclamation's (Reclamation's) Kachess Dam Safety of Dams Economic Benefit Analysis Report (Reclamation 2021).

Chapter 2. Indicators

- Employment, expenditures, and income levels and anticipated employment demands
- The social and economic benefits from Kachess Dam
- Construction impacts on quality of life factors

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

None.

Chapter 4. Affected Environment

Kittitas County is in the center of Washington. It is 100 miles east of Seattle across the Cascade Range. The county is bordered by Chelan, Grant, and Yakima Counties. With 2,297 square miles, it is one of the largest counties in the state. Major cities in the county (and the estimated population in 2019) include Ellensburg (19,960 residents), Cle Elum (1,915 residents), and Kittitas (1,530 residents). Yakima County is composed of primarily rural communities (14 cities and towns) in central Washington.

The following discussion provides socioeconomic information selected to provide an overview of current demographic and economic conditions and to highlight components of the local economy or social setting that Reclamation's management decisions may affect. It should be noted that data presented in this discussion include annual averages for the most recent reporting periods. As such, not all data reflect the recent widespread economic effects of the recession caused by the 2020 global COVID-19 pandemic or the recent record-breaking wildfires that resulted in severe and widespread effects on the population and local economies. These events affected local and regional economies in the study area through severe short-term changes to employment and industrial output. The effects of these changes are still ongoing and not evenly distributed across industries.

4.1 Population

In 2019, the total population was 45,897 for Kittitas County and 249,697 for Yakima County (Headwaters Economics 2021). From 2010 to 2019, both counties experienced population growth; the population increased 15.1 percent in Kittitas County and 5.6 percent in Yakima County (Headwaters Economics 2021).

4.2 Income and Employment

In 2019, the largest Kittitas County sectors in terms of employment were accommodation and food services, government, retail trade, construction, and health services (BEA 2019). Kittitas County's economy has been focused on state and local education, with Central Washington University being a large employer in the local economy. However, construction was the industry adding the second-highest number of jobs after state and local government education. Irrigated agriculture has been historically important and remains important in the region. In 2019, agriculture and the wholesale trade of nondurable goods (primarily Timothy hay) provided 7.0 percent and 4.3 percent, respectively, of total covered employment[1] in Kittitas County (Employment Security Department 2020a).

In Yakima County in 2019, the largest sectors in terms of employment were agriculture, forestry and fishing, health services, government, retail trade, and manufacturing (BEA 2019). Agriculture has been the staple of the economy over the last 100 years. Agriculture provided 27.3 percent of all jobs countywide, but it supplied only 21.8 percent of total wage income. This is due to the seasonal nature of agricultural jobs (Employment Security Department 2020b). In addition, construction employment was the eight-largest sector, providing 5,481 jobs (BEA 2019).

4.3 Social and Economic Benefits from Kachess Dam

Water infrastructure plays an important role in the local social and economic conditions. A wide range of economic activities, such as those associated with irrigation, agricultural use, and domestic and commercial use, are supported by water infrastructure, including Kachess Dam and Reservoir. Social and economic benefits provided by Kachess Dam include supporting irrigation, recreation, fish and wildlife, power, municipal and industrial water supply, and flood control, in various direct and indirect ways.

[1] Covered employment refers to agricultural and nonagricultural employment and wages for firms, organizations, and individuals whose employees are covered by the Washington State Employment Security Act. Also included are data for federal government agencies covered by 5 United States Code 85. Types of jobs not covered under the unemployment compensation system, and hence not included in Bureau of Labor Statistics data, include casual laborers not performing duties in the course of the employer's trade or business.

Reclamation performed a Kachess Dam safety of dams economic benefit analysis to quantify the total economic benefits to the nation, by category, provided by Kachess Dam and Reservoir (Reclamation 2021). While this economic benefit analysis report is sensitive, portions of the report are summarized throughout this analysis. The report identifies five categories of economic benefits: irrigation, recreation, power generation, municipal and industrial, and fish and wildlife. For the purpose of this environmental assessment analysis, the Economic Benefit Analysis Report helps provide information on current conditions through estimated annual benefits under the baseline scenario. A summary of estimated annual benefits is provided in **Table 1**, below. Details of the valuation of each resource are included following the table.

Table 1. Summary of Baseline Annual Benefits

Benefit	Annual Benefit (millions)
Irrigation	$49.02
Recreation	$2.12
Fish and wildlife	$0.60
Power	$3.52
municipal and industrial	$3.94
Flood control	$2.27

Reclamation 2021

4.3.1 Irrigation Benefits

The major purpose of most Reclamation dams and reservoirs is to deliver water to farms for agricultural production. Collectively, the three irrigation districts and the water user entity average annual diversions totaling 990,107 acre-feet. Of the benefits provided by Kachess Dam, irrigation provides the greatest current value and annual benefits. The analysis estimated irrigation benefits from storing and delivering water to the lands within the three irrigation districts and the one water user entity. Kittitas Reclamation District, Roza Irrigation District, Sunnyside Valley Irrigation District, and the Wapato Irrigation Project comprise the majority of irrigated acreage and irrigation water use from the dam.

Irrigation benefits were estimated using Reclamation's Farm Budget Tool, which estimates net farm returns under two scenarios: with the dam and without the dam. After net farm returns per acre are estimated under both scenarios, the difference in net farm returns per acre is calculated to yield the benefit per acre provided by the dam. Annual benefits for irrigation are estimated at $49.02 million.

4.3.2 Recreation Benefits

Information on recreation in the project area is provided in the **Recreation Resources Report**. Kachess Reservoir receives 35,000 annual visitors. Primary recreation at Kachess Reservoir includes camping, swimming, boating (motorized and nonmotorized), fishing, picnicking, and hiking. **Table 1**, above, provides recreation economic benefits provided by Kachess Reservoir. This was calculated by multiplying the estimates of economic values per visit by recreation activity by estimates of annual visitation. Recreation use values per person per day by primary activity vary for the Kachess Reservoir. They range from $22.5 per day for picnicking to $124.83 per day for nonmotorized boating. Freshwater fishing had the second-highest recreation use value with $90.08 per day (Rosenberger 2017). Annual benefits for recreation are estimated at $2.12 million.

4.3.3 Fish and Wildlife Benefits

According to the Yakima Basin Study Integrated Plan, there are nine high-priority reach conditions on the Yakima River; eight of these are impacted by Kachess Dam operations. However, the 0.9-mile stretch of the Kachess River from the Kachess Dam to Lake Easton is considered a lesser priority for improving river flow.

The annual benefit for fish and wildlife in **Table 1** presents the economic value of Chinook and coho salmon in the Yakima River. This economic value is based on the estimated number of fish, pounds per fish, and the commercial value per pound. Fish and wildlife also contribute to the baseline value for recreation benefits.

4.3.4 Power Generation Benefits

Water operations at Kachess Dam affect two hydroelectric power plants in the Yakima Basin. The average annual net generation from 2009 to 2018 for the two plants totaled 116,711 megawatt hours. The economic value of energy varies; it is difficult to gauge due to a number of external factors. However, prices for electricity generated during 2009–2018 for the Pacific Northwest, east of the Cascade Range, were used to estimate an average price of electricity. **Table 1** shows that the average annual value of power generation is estimated to be over $3.5 million.

4.3.5 Municipal and Industrial Water

Water from Kachess Dam and Reservoir contributes to municipal and industrial supplies for the cities of Cle Elum, Ellensburg, and Yakima. The economic value of municipal and industrial water uses involves assessing the volume of water and the representative rate for water, based on water transfer data collected and published by the *Water Strategist Journal*. The average annual price per acre-foot (2018 dollars) is then used to estimate the baseline economic value of municipal and industrial supplies.

4.3.6 Flood Control

Kachess Dam provides flood control and prevents associated damages. The Kachess Dam average annual flood damages prevented were estimated using estimates of damages prevented in the Yakima Reservoir system from 1965 to 2015, as provided by the US Army Corps of Engineers. The average flood control provided is $2.27 million annually.

Chapter 5. Environmental Consequences

5.1 No Action Alternative

Under the No Action Alternative, Reclamation would not conduct dam safety improvements, and there would be a potential for dam failure. Potential socioeconomic impacts include those associated with a long-term reduction in the reliability of the dam, as described below.

5.1.1 Income and Employment

Under the No Action Alternative, Reclamation would not perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction activities would not occur, and short-term, localized increases in employment and expenditures would not occur.

5.1.2 Social and Economic Benefits of Kachess Dam

Under the No Action Alternative, there would be no impacts on social and economic benefits provided by Kachess Dam and Reservoir, unless dam failure occurred. Should dam failure occur, the impacts on social and economic benefits would be reduced or eliminated. For instance, potential permanent changes to water deliveries to irrigation districts, tribes, and the downstream public could occur. The specific level of impacts on the benefits cannot be determined here; it would depend on the level to which the reaming water supply would provide for existing uses.

In addition to lost benefits following dam failure, damages from flooding would occur. **Table 2**, below, provides total estimated property damages in millions of 2018 dollars (rounded to the nearest $100,000). The figures provided were generated by using inundation boundary geographic information system data and software developed by the Federal Emergency Management Agency. The Federal Emergency Management Agency's HAZUS tool is a nationally applicable standardized methodology and damage assessment software program for analyzing potential losses from floods, hurricane winds, and earthquakes. The figures below are only estimates, but they provide a sense of the magnitude of damages expected to occur in the event of a catastrophic failure.

Table 2. Quantified Damage (millions)

Property Category	2018 Damages
Building-related losses	$9,049.80
Transportation	$3,101.00
Essential facilities	$74.10
Utilities and other infrastructure	$325.60
Vehicles	$216.50
Agriculture	$181.00
Total	**$12,948.00**

Reclamation 2021.

While these figures provide an idea of damage, they do not quantify the cost of emergency services, environmental damages, disruption of government services, cleanup, disruption of people's lives, or other categories of loss that would follow a Kachess Dam failure. Data constraints prevent such quantification. More information on potential impacts can be found in the **Public Health and Safety Resources Report.**

5.2 Proposed Action

5.2.1 Income and Employment

Under the Proposed Action, Reclamation would perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Proposed construction would result in direct, short-term increases in employment and associated economic contributions to the local economy, compared with the No Action Alternative. This would be due to spending on project materials and employment.

For each phase of construction, employment would occur over only a portion of the year (see **Chapter 1, Proposed Action**). As a result, employment is examined in terms of person-years; one person-year is a seasonal job multiplied by the months of employment, divided by 12. One person-year of employment can represent one worker employed for 12 months or multiple workers employed for a portion of the year.

The majority of construction work performed would be completed by contractor workforces. The construction would take approximately 27 months. For the access road construction during phase 1, approximately 15 employees would work for 4 months. For pipe delivery during phase 2 of construction, approximately three employees would work for 6 months. For the outlet works replacement and conduit extension during phase 3 of construction, approximately 30 employees would work for a total duration of 17 months. Total person-years employment over the course of the project were estimated based on personnel, equipment, and time lines, as described in **Chapter 1**. Estimates reflect contracted work under the access road construction (July–October 2023), pipe delivery (January–June 2023), and outlet works replacement and conduit extension (January 2024–July 2025). Total person-years employment directly supported by the project is estimated at 44. Direct employment by Reclamation is not considered in this estimate and would represent support for additional employment.

Indirect impacts occur when related industries gain from purchases by the directly affected businesses. Examples include the purchase of construction equipment from local firms and spending by employees in local businesses. It is likely construction materials would be purchased locally, potentially creating additional employment opportunities and local spending. The construction workforce would be from local sources or possibly regional sources. The creation of jobs and any expenditures related to the project would result in direct, short-term potential increases in employment and the associated economic contribution to the local economy. This would represent an economic benefit.

According to the Economic Policy Institute, for every one direct job in the construction industry, an estimated additional 2.26 indirect jobs are supported (Economic Policy Institute 2021). Based on this multiplier, this project would support an additional 99 indirect jobs.

5.2.2 Social Setting

Construction activities could affect the quality of life for residents through increased traffic, additional noise, visual impacts, and interruptions of recreation access. More information on the aforementioned impacts can be found in the **Noise**, **Transportation**, and **Recreation Resources Reports**. Construction would occur Monday through Friday during normal business hours; however, some work could occur on weekends or at night. Impacts on the quality of life could occur during construction and would be short term and localized.

5.2.3 Social and Economic Benefits of Kachess Dam

Because of the timing and design of construction activities, Kachess Dam would remain at its current capacity throughout construction and continue to provide most of the social and economic benefits described in the *Affected Environment* section, above.

Under the Proposed Action, there would be socioeconomic benefits associated with a long-term increase in the reliability of the dam. Projected benefits of the Proposed Action include continued water deliveries to irrigation districts, tribes, and the downstream public; long-term public health and safety risk reduction; and associated cost savings from avoiding erosion and dam failure.

Irrigation Benefits

Because of the timing and phased design of construction activities, impacts on water deliveries would be avoided, and the reservoir level would remain the same throughout construction. During construction of the extension and lining of the outlet works, there would be potential for four 12-hour shutoffs. These temporary shutoffs would not affect the overall delivery of water downstream because most users do not require water during these time periods. As described in the **Water Resources Report**, there would be no long-term adverse impacts on the hydrology, groundwater, or surface water quality. Kachess Dam would remain at its current capacity and continue to provide the current level of benefits supported by water deliveries, such as irrigation of agricultural land.

Fish and Wildlife Benefits

Because reservoir level restrictions are not anticipated to occur, the Proposed Action would not impact the ability of Reclamation to change flows in the Yakima Basin in early September to aid in salmon spawning. The benefits associated with these species would not be impacted.

Recreation Benefits

As described in the **Recreation Resources Report**, impacts on recreational visitors would occur. This is because of the short-term access constraints along Kachess Dam Road associated with traffic delays due to construction equipment and deliveries. This would result in an estimated 5 percent decline in recreational visits during construction. However, these impacts would be localized and temporary; therefore, Reclamation anticipates that the overall changes to recreation benefits would be negligible.

Power Generation Benefits

The current level of power generation benefits would continue. The Proposed Action would not impact the two hydroelectric power plants described in the *Affected Environment*, above.

Municipal and Industrial Water

Water from Kachess Dam and Reservoir would continue to contribute to municipal and industrial supplies for the cities of Cle Elum, Ellensburg, and Yakima. No change to the benefits discussed under the *Affected Environment* section would occur.

Flood Control

Under the Proposed Action, modifications would improve the safety and reliability of the dam, which would allow continued flood control benefits.

Chapter 6. Glossary

None

Chapter 7. References Cited

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Kachess Dam Safety of Dams Modification Environmental Assessment

Transportation Resources Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Under the Proposed Action, an access road would be constructed between the dam and Kachess Dam Road, which becomes National Forest System (NFS) Road 4818, as shown in **Figure 1**. This access road would serve two haul routes. One route would be used for hauling trees during tree clearing, and the other route would be used for construction vehicles and hauling of construction materials. From the end of the access road, the tree haul route would use West Sparks Road to the Interstate 90 west on-ramp and would end at the Washington State Department of Transportation (WSDOT) Stampede Pass stockpile location. This location is on US Forest Service land; the WSDOT uses the land through a special-use permit. From the end of the access road, the construction vehicle route would use West Sparks Road to the Interstate 90 east on-ramp to access areas in Cle Elum or Ellensburg, Washington.

Reclamation would need to apply for a special-use permit and a road permit from the US Forest Service to use Kachess Dam Road, where it becomes NFS Road 4818. In addition, Reclamation is in negotiation with the US Forest Service for a permit to relocate the snow park lot at the gate of the dam access road to a location where Kachess Dam Road intersects with the Bonneville Power Administration power line (see the **Utilities Resources Report** for the location of this power line).

The level of service (LOS) is used in traffic analyses to rate roadway segment operations using a ratio of traffic volume to road capacity. The LOS is also used to determine how well a transportation facility is operating from a traveler's perspective (WSDOT 2017). LOS ratings for the state of Washington range from A to F, with A being the most free flowing and F being the least free flowing (WSDOT 2017). The LOS rating decreases as a result of higher traffic volumes, decreased road capacity, or both, which result in greater delays. The Kittitas County LOS policy for rural roads is C or better (Kittitas County 2016).

The typical LOS is A near West Sparks Road near the Interstate 90 on-ramp, with average peak hour delays between 8.7 and 9.3 seconds (TENW 2016; SCJ Alliance 2019). Since traffic is likely greater near the on-ramp than for the project area, it can be assumed that Kachess Dam Road also has a baseline LOS of A.

Under the No Action Alternative, there would be no change in the LOS on roads, and drivers would not experience delays or frustrations while accessing commercial or residential areas near the dam. No planned construction activities would occur; however, the existing dam operations would continue to operate and require routine maintenance. Operation and maintenance activities would involve one or two pickup trucks entering and leaving the project area on the days when maintenance occurs.

Given the current internal erosion of the dam, its failure is expected to occur in the future and would be an emergency situation. Reclamation staff responding to the situation would have an immediate and potentially sustained impact on traffic both during the emergency and until repairs are made. The timing and extent of potential impacts on transportation and traffic from extraordinary emergency cleanup and repairs would depend on the nature, extent, and timing of these activities. For the purposes of this analysis, it is assumed the No Action Alternative would result in no changes to the baseline LOS or access in the analysis area.

Compared with the No Action Alternative, there would be an increase in heavy vehicle traffic using West Sparks Road and Kachess Dam Road under the Proposed Action. During daytime construction activities and hauling of construction materials, there could be a temporary decrease below LOS A; this would be due to an increased volume of vehicles above baseline conditions. The LOS likely would not decrease below LOS C because construction vehicle access on the haul routes would not require stopping of non-construction vehicles. Where construction vehicles ingress and egress to and from the project area using Kachess Dam Road, delays could be 15 to 25 seconds or less, which equates to LOS C or better. Drivers accessing commercial and residential areas from West Sparks Road could experience delays when encountering heavy construction vehicles.

Construction activities would occur up to 10 hours a day, 5 days per week. Nighttime work would not occur except in instances of delay, such as from inclement weather, and would also not exceed 10 hours per day unless a major delay occurs. The construction schedule would include:

- Tree clearing and hauling from May 31 to July 26, 2023
- Construction of contractor use areas from May 31 to July 11, 2023
- Construction of the access road between late June and late July 2023
- Steel pipe delivery from May 31 to June 6, 2023
- Excavation of the conduit extension from January 10 to February 6, 2024
- Pipe installation and concrete delivery from March 18 to June 9, 2024
- Sand delivery for the conduit extension between mid-May and mid-June 2024

The most noticeable impacts on access and traffic would be during hauling of imported materials to the project site. Less severe impacts would result from the transportation of heavy construction vehicles, such as excavators, dozers, and fuel trucks, to and from the project area. This is because they would not be used for hauling and would remain in contractor use areas, as needed, during construction activities.

Tree hauling would require a 40- to 45-foot commercial truck with a trailer to haul 500 trees off-site to the WSDOT Stampede Pass stockpile location. Since only one or two trees would be hauled at a time, this would require at least 250 round trips, or at least eight trips per day. There would be no change in the LOS because only one truck and trailer would be used for each trip.

Construction for the access road would require less than eight construction vehicles, including a dozer; front-end loader; and water, fuel, and 40-ton, off-road trucks. In addition, two roller compactors would be used for road fill and gravel surfacing. Similar equipment would be used to construct contractor use areas. The equipment would remain in the project area until the completion of the access road.

Impacts on traffic and access would be limited to the times when these construction vehicles and equipment are transported to and from the project area. During these times, the LOS could be reduced below A (but no less than C), and drivers could be frustrated by delays for access to residential, commercial, and recreation areas accessed from West Sparks Road. After completion of the project, the access road would remain as a permanent road, which would provide improved future access to the west side of the dam, near where the spillway is located.

Phase 1 and phase 2 of construction would occur between January and October 2023 and would include delivery of the steel pipe, the construction of the contractor use areas and access road, and the tree hauling. All these activities would occur between May 31 and July 6, 2023, which would be the greatest overlap of construction activities during the construction schedule and would have the greatest impact on traffic and access in the analysis area. During phases 1 and 2 of construction, 5 to 22 haul trips could occur per day, and 1 to 18 pickup trucks could access the project area per day. With a greater volume of construction vehicles used per day, there would be more traffic delays and the LOS would decrease. However, the use of construction vehicle trips during phases 1 and 2 would not cause a decrease in the LOS below level C. This is because, as mentioned above, access for the construction vehicles would not require stopping of non-construction vehicles.

Phase 3 of construction would occur between January 2024 and July 2025 and would include excavation of the conduit, sand delivery, and concrete delivery. During phase 3 of construction, 5 to 18 haul trips could occur per day, and 1 to 30 pickup trucks could access the project area per day. Similar to the overlapping construction activities and hauling mentioned above, overlapping sand and concrete haul trips would cause a noticeable increase in traffic. However, the LOS would not decrease below C because, as mentioned above, access for the construction vehicles would not require stopping of non-construction vehicles.

The weights of trucks used for trips to and from commercial sources would not exceed the maximum gross weights required under Revised Code of Washington 46.44.041. However, it is likely that damage to Kachess Dam Road would occur after the almost 3-year construction period due to the high volume and consistent use of heavier-than-average vehicles. This damage could include potholes, ruts, or broken pavement. Deteriorated roadway surfaces can lead to passenger vehicle damage and a diminished driving experience. Kachess Dam Road would be rehabilitated after construction and repaired as needed during construction.

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Acronyms and Abbreviations

Acronym	Full Phrase
LOS	level of service
NFS	National Forest System
RCW	Revised Code of Washington
WSDOT	Washington State Department of Transportation

Chapter 1. Analysis Area

The analysis area for transportation and traffic includes East Kachess Road to the Kachess Dam and West Sparks Road from its intersection with East Kachess Road to its intersection with Interstate 90 (see **Figure 1**). This analysis area encompasses residential, commercial, and recreation access that could be affected by construction haul routes used during dam construction.

Chapter 2. Indicators

- Changes in the level of service (LOS) on roads
- Changes in access within the analysis area

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

- Columbia Basin Project Act of March 1943—This act reauthorized the Columbia Basin Project, bringing it under the provisions of the Reclamation Project Act of 1939.
- Moving Ahead for Progress in the 21st Century Act (MAP-21 Act)—This act provides guidance for traffic and motor vehicle safety on highways and highway arterials.

3.2 State and Local Laws

- Revised Code of Washington (RCW) Title 46.44, Size, Weight, Load—This law includes standards for the size, weight, and load of motor vehicles and the use of special permits for oversized vehicles.
- RCW Title 47.52, Limited Access Facilities—This law includes standards for restricting or closing access on highways or streets designated for through traffic.
- Kittitas County Comprehensive Plan 2019—This plan includes a description of the existing transportation system in the county and the goals, objectives, and policies for the LOS.
- Kittitas County Long Range Transportation Plan 2008—This is a 20-year transportation plan that provides strategies and guidance for the county's transportation investments, including roads and recreational access.

3.3 Other

- Washington Transportation Plan—This plan establishes a 20-year vision for the development of the statewide transportation system. The Washington Transportation Plan is based on the six transportation system policy goals established by the state legislature: preservation, safety, mobility, environment, stewardship, and economic vitality (RCW 47.04.280).

- Forest Service Handbook 7709.59, Road System Operations and Maintenance Handbook—This handbook provides guidance for conducting planning, traffic management, investment sharing (cost share), highway safety, traffic studies, road maintenance, and other road system operations and maintenance activities.

Chapter 4. Affected Environment

4.1 Transportation

The southern portion of the Kachess Reservoir and the dam is bounded to the east and west by two Forest Service-maintained roads. These are National Forest System (NFS) Road 4828 on the west side and NFS Road 4818 on the east side, which turns into Kachess Dam Road. These roads intersect West Sparks Road south of the dam, which parallels Interstate 90 (see **Figure 1**). Kachess Dam Road continues for approximately 0.75 miles north of West Sparks Road and ends before the dam at the southeast side. In addition to providing dam access via Kachess Dam Road, West Sparks Road provides access to two residential areas on either side of Kachess Dam Road and to Interstate 90. An on-ramp to the interstate is located on West Sparks Road approximately 0.6 miles southeast from the Kachess Dam Road and West Sparks Road intersection.

Kachess Dam Road is approximately 4.25 miles and parallels the eastern side of the Kachess Reservoir. It is used for access to the Kachess Dam and recreation access to the Kachess Ridge Trailhead, East Kachess Group Site campground, and Forest Service lands. West Sparks Road is used for residential and commercial access and has a speed limit of 35 miles per hour. It is a two-lane road with narrow shoulders and is approximately 1.2 miles between NFS Road 4828 and the on-ramp to Interstate 90.

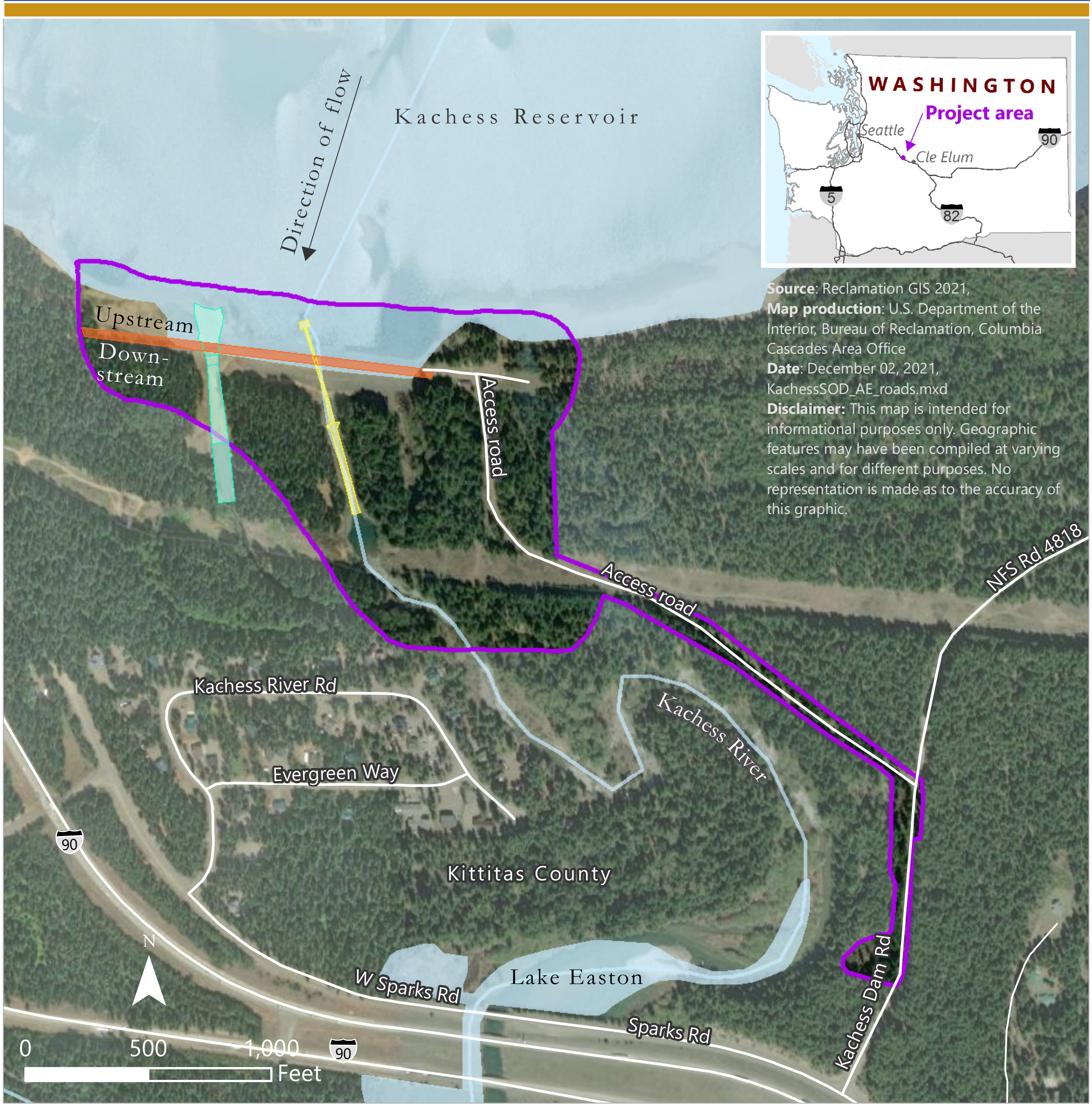
4.2 Traffic

The LOS is used in traffic analyses to rate roadway segment operations using a ratio of traffic volume to road capacity. The LOS is also used to determine how well a transportation facility is operating from a traveler's perspective (WSDOT 2017). LOS ratings for the state of Washington range from A to F, with A being the most free flowing and F being the least free flowing (WSDOT 2017). As shown in

Table 1, the LOS rating decreases as a result of higher traffic volumes, decreased road capacity, or both, which result in greater delays.

BUREAU OF RECLAMATION

Figure 1
Transportation Features



Source: Reclamation GIS 2021,
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: December 02, 2021,
KachessSOD_AE_roads.mxd
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

Road Project area

Table 1. LOS Descriptions

LOS	Description	Un-signalized Average Delay Range (seconds)
A	Free-flowing conditions	Less than 10
B	Reasonably unimpeded conditions	11–15
C	Stable operating conditions, but individual motorists are affected by the interaction with other motorists	15–25
D	Less stable operating conditions where a small increase in traffic flow may cause substantial increases in delay and decreases in traffic speed	25–35
E	Unstable operation and significant delay	35–50
F	Over capacity, with delays	Greater than 50

Sources: TENW 2016; WSDOT 2017

All roads in the analysis area are in Kittitas County. The Kittitas County LOS policy for rural roads is LOS C or better (Kittitas County 2016). There are no existing traffic analyses for the analysis area. The closest analyses are the Marrian Meadows Environmental Impact Statement Traffic Impact Study, approximately 1.8 miles southeast of the project area, and the Love's Travel Stop Traffic Impact Analysis, which studies an area adjacent to the West Sparks Road on-ramp to Interstate 90. In both analyses, West Sparks Road near the Interstate 90 on-ramp had an estimated LOS of A, with average peak hour delays between 8.7 and 9.3 seconds (TENW 2016; SCJ Alliance 2019). Since traffic is likely greater near the on-ramp than the project area, it can be assumed that Kachess Dam Road also has a baseline LOS of A.

Chapter 5. Environmental Consequences

5.1 Assumptions

- West Sparks Road has a LOS of A under baseline conditions. The same LOS can be assumed for Kachess Dam Road.
- On a daily basis, traffic volumes are greatest during daylight hours.
- On a seasonal basis, traffic volumes are greatest during summer months.
- All impacts on transportation and traffic would be temporary.

5.2 No Action Alternative

Under the No Action Alternative, there would be no change in the LOS on roads. Drivers would not experience delays or frustrations while accessing commercial or residential areas near the dam related to construction activities at the dam. No planned construction activities would occur; however, the existing dam operations would continue to operate and require routine maintenance. Operation and maintenance activities would involve pickup trucks entering and leaving the project area on the days when maintenance occurs.

Given the current internal erosion of the dam, its failure is expected to occur in the future and would be an emergency situation. Reclamation and other agency staff responding to the situation would have an immediate and potentially sustained impact on traffic both during the emergency and until repairs are made. The timing and extent of potential impacts on transportation and traffic from extraordinary emergency cleanup and repairs would depend on the nature, extent, and timing of these activities. For the purposes of this analysis, it is assumed the No Action Alternative would result in no changes to the baseline LOS or access in the analysis area.

5.3 Proposed Action

During daytime construction activities and the hauling of construction materials, the LOS could temporarily decrease below A; however, the LOS likely would not decrease below C. Drivers accessing commercial, residential, and recreation areas from West Sparks Road could also experience delays when encountering heavy construction vehicles.

Construction activities would occur up to 10 hours a day, 5 days per week. Nighttime work would not occur except in instances of delay, such as from inclement weather, and would also not exceed 10 hours per day unless a major delay occurs. The schedule for construction activities includes:

- Tree clearing and hauling from May 31 to July 26, 2023
- Construction of contractor use areas from May 31 to July 11, 2023
- Construction of the access road between late June and late July 2023
- Steel pipe delivery from May 31 to June 6, 2023
- Excavation of the conduit extension from January 10 to February 6, 2024
- Pipe installation and concrete delivery from March 18 to June 9, 2024
- Sand delivery for conduit extension between mid-May and mid-June 2024

The most noticeable impacts on access and traffic would be during the hauling of imported materials to the project site. Less severe impacts would result from the transportation of construction vehicles, such as excavators, dozers, and fuel trucks, to and from the project area. This is because they would not be used for hauling and would remain in contractor use areas, as needed, during construction activities.

5.3.1 Tree Hauling

Tree hauling would take place between June 23 and July 26, 2023. It would require a 40- to 45-foot commercial truck with a trailer to haul 500 trees off-site to the Washington State Department of Transportation (WSDOT) Stampede Pass stockpile location. Since only one or two trees would be hauled at a time, at least 250 round trips, or at least eight trips per day, would be required. There would be no change in the LOS because only one truck and trailer would be used for each trip.

5.3.2 Access Road

Under the Proposed Action, an access road would be constructed between the dam and Kachess Dam Road, as shown in **Figure 1**. This access road would serve two haul routes. One route would be used for hauling trees during tree clearing, and the other route would be used for construction vehicles and hauling of construction materials. From the end of the access road, the tree haul route would use West Sparks Road to the Interstate 90 west on-ramp and would end at the WSDOT Stampede Pass stockpile location. This location is on US Forest Service land. The WSDOT uses the land through a special-use permit. From the end of the access road, the construction vehicle route would use West Sparks Road to the Interstate 90 east on-ramp to access areas in Cle Elum or Ellensburg, Washington.

Reclamation would need to apply for a special-use permit and a road permit from the US Forest Service to use Kachess Dam Road, which becomes NFS Road 4818. In addition, Reclamation is in negotiation with the US Forest Service for a permit to relocate the snow park lot at the gate of the dam access road to a location where Kachess Dam Road intersects with the Bonneville Power Administration power line (see the **Utilities Resources Report** for the location of this power line).

The access road would be constructed between late June and late July 2023. Up to 15 contractors would access the project area with pickup trucks during this time. This would take place after the trees are cleared and would overlap with construction of the contractor use areas from May 31 to July 11, 2023. Construction would require less than eight construction vehicles, including a dozer; front-end loader; and water, fuel, and 40-ton, off-road trucks. In addition, two roller compactors would be used for road fill and gravel surfacing. Similar equipment would be used to construct contractor use areas. The equipment would remain in the project area until the completion of the access road.

Impacts on traffic and access would be limited to the times when these construction vehicles and equipment are transported to and from the project area. During these times, there could be a reduction below LOS A due to an increased volume of vehicles above baseline conditions. The LOS would not decrease below C because construction vehicle access on the haul routes would not require stopping of non-construction vehicles. Where construction vehicles ingress and egress to and from the project area using Kachess Dam Road, delays could be 15 to 25 seconds or less, which equates to LOS C or better. Drivers may be frustrated by delays for access to residential, commercial, and recreation areas accessed from West Sparks Road. After completion of the project, the access road would remain as a permanent road. This would provide improved future access to the west side of the dam, near where the spillway is located.

5.3.3 Construction Material Hauling

Construction of the contractor use areas would require 2,100 cubic yards of imported gravel from an area near Cle Elum. This would require up to 140 round trips, or three trips per day, using five trucks.

Steel pipe to be installed inside the conduit would be delivered from May 31 to June 6, 2023. There would be 425 feet of pipe, which would require commercial tractors or trailers that hold 40 feet at a time. This would amount to 11 truckloads, which would likely be hauled over 2 or 3 days. In addition, three pickup trucks would be used per day to access and leave the project area during the pipe delivery period.

Phases 1 and 2 of construction would occur between January and October 2023 and would include delivery of the steel pipe, the construction of the contractor use areas and access road, and the tree hauling. All these activities would occur between May 31 and July 6, 2023, which would be the greatest overlap of construction activities during the construction schedule and would have the greatest impact on traffic and access in the analysis area. During phases 1 and 2 of construction, 5 to 22 haul trips could occur per day, and 1 to 18 pickup trucks could access the project area per day. With a greater volume of construction vehicles used per day, there would be more traffic delays and the LOS would decrease. However, the use of construction vehicle trips during phases 1 and 2 would not cause a decrease in the LOS below level C. This is because, as mentioned above, access for the construction vehicles would not require stopping of non-construction vehicles.

Phase 3 of construction would occur between January 2024 and July 2025 and would include excavation of the conduit, sand delivery, and concrete delivery. To prepare the foundation for the conduit extension, less than three excavators, one front-end loader, and three 40-ton, off-road trucks would be used and transported to the project area by January 10, 2024. Impacts on traffic and access from the transport of these vehicles would be similar to those described for the construction of the access road. From this time and until project completion, up to 30 contractors would access the project with pickup trucks.

Approximately 7,800 cubic yards of imported sand from a commercial area near Cle Elum would be required for the construction work on the conduit extension. This would require 520 truckloads in total, or 8 to 10 trucks per day, for 17 to 21 days between mid-May and mid-June 2024.

During pipe installation, concrete would be used to encase the pipe. Approximately 550 cubic yards of concrete would be required. One truck can carry 8 cubic yards, so a total of 69 trucks would be required for concrete delivery. Depending on when the concrete is ready to be placed between March 18 and June 9, 2024, it would either come from Cle Elum, approximately 15 miles east of the project area, or from Ellensburg, approximately 40 miles east of the project area. If the concrete comes from Cle Elum, five trucks would be required; if the concrete comes from Ellensburg, eight trucks would be required.

During phase 3 of construction, 5 to 18 haul trips could occur per day, and 1 to 30 pickup trucks could access the project area per day. Similar to the overlapping construction activities and hauling mentioned above, overlapping sand and concrete haul trips would cause a noticeable increase in traffic. However, the LOS would not decrease below C. This is because, as mentioned above, access for the construction vehicles would not require stopping of non-construction vehicles.

The weights of trucks used for trips to and from commercial sources would not exceed the maximum gross weights required under RCW 46.44.041. However, it is likely that damage to Kachess Dam Road would occur after the almost 3-year construction period due to the high volume and consistent use of heavier-than-average vehicles. This damage could include potholes, ruts, or broken pavement. Deteriorated roadway surfaces can lead to passenger vehicle damage and a diminished driving experience. Kachess Dam Road would be rehabilitated after construction and repaired as needed during construction.

Chapter 6. Glossary

Access—The ability of a particular transportation mode, such as a vehicle, bicycle, or pedestrian, to enter or use a portion of the transportation network.

Level of service—A metric that describes the operating conditions of a roadway based on factors such as physical roadway capacity, speed, maneuverability, safety, and traffic volume.

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Kachess Dam Safety of Dams Modification Environmental Assessment

Visual Resources Resource Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Under the No Action Alternative, there would be no structural or operational changes to the Kachess Dam or spillway. The No Action Alternative would maintain the existing range of landscape character and scenic integrity conditions within the primary study area (the project area). Therefore, the No Action Alternative would result in visual quality conditions that are the same as those currently experienced. No construction or changes in the reservoir level would occur, and the landscape character would be largely unchanged from baseline conditions.

However, potential long-term impacts on visual resources could occur under this alternative. This is because the seepage and internal erosion issues would continue; therefore, the threat of dam failure from internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. A dam failure would alter the existing range of landscape character and scenic integrity conditions within the primary study area.

Under the Proposed Action, the US Bureau of Reclamation (Reclamation) would perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure. Construction of the improvements would create short-term and localized visual impacts, with a temporary disturbance of approximately 8 acres of surface disturbance. Construction activities would be concentrated on the east shore of the southeast portion of Kachess Reservoir. This portion of the east shore is part of a contiguous segment of undeveloped, forested shoreline that supports a perceived “natural” setting. The temporary construction equipment and staging areas would be highly visible from the southeast portion of the reservoir and surrounding shorelines.

However, while Kachess Reservoir is used for recreational boating and provides views of the shoreline, there are no developed recreational facilities or residential areas along this portion of the reservoir with views toward the construction area. Portions of construction areas could be visible from Kachess Dam Road, but intervening trees would limit viewpoints and obstruct views of the Proposed Action activities. Additionally, public access to this area is generally limited, which would reduce the magnitude of visual impacts from the project.

Based on the limited public viewpoints of construction areas, the temporary nature of construction, and the limited visibility of acres disturbed in the long term, the Proposed Action would have a minor to moderate short-term effect on the landscape’s visual character and integrity. The Proposed Action would meet the intent of the high/retention and moderate/partial retention scenic integrity levels and visual quality objectives established by the 1990 Wenatchee National Land and Resource Management Plan for Kachess Reservoir.

Additionally, the implementation of mitigation measures would help reduce the impacts from the project on the visual quality in and around the project area.

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Acronyms and Abbreviations

Acronyms and Abbreviations	Full Phrase
BLM	Bureau of Land Management
ISA	scenic attractiveness
KOP	key observation point
Reclamation	US Bureau of Reclamation
SIL	scenic integrity level
USFS	United States Department of Agriculture, Forest Service
VQO	visual quality objective

Chapter 1. Analysis Area

The analysis area for visual resources includes the immediate area disturbed by the proposed improvements and an outward buffer of approximately 200 feet to consider potential disturbance effects on visual resources during construction and operation and maintenance of the project. This area was chosen because impacts on visual resources would be localized. The analysis area is confined by the valleys and high ridge lines that characterize the region, as well as the thick vegetation surrounding the project area, which restricts the distances by which sound can travel and activities can be seen.

To further assess the potential impacts of the alternatives on visual resources, key observation points (KOPs) within the visual analysis area were selected. KOPs are specific locations where the casual observer would be able to see visual resources changes. The magnitude of an impact depends on viewing times, distance, and individual expectations. The KOPs selected for this analysis include (1) at the Kachess Dam (east end of dam facing west), (2) the east shore of Kachess Reservoir, and (3) at the Kachess Reservoir road portal (see **Figure 1**, Key Observation Points).

Chapter 2. Indicators

The indicator for the visual resources analysis is the degree of contrast (i.e., changes to the form, line, color, composition, and texture of the landform, vegetation, and water) introduced into the viewshed as seen from the KOPs.

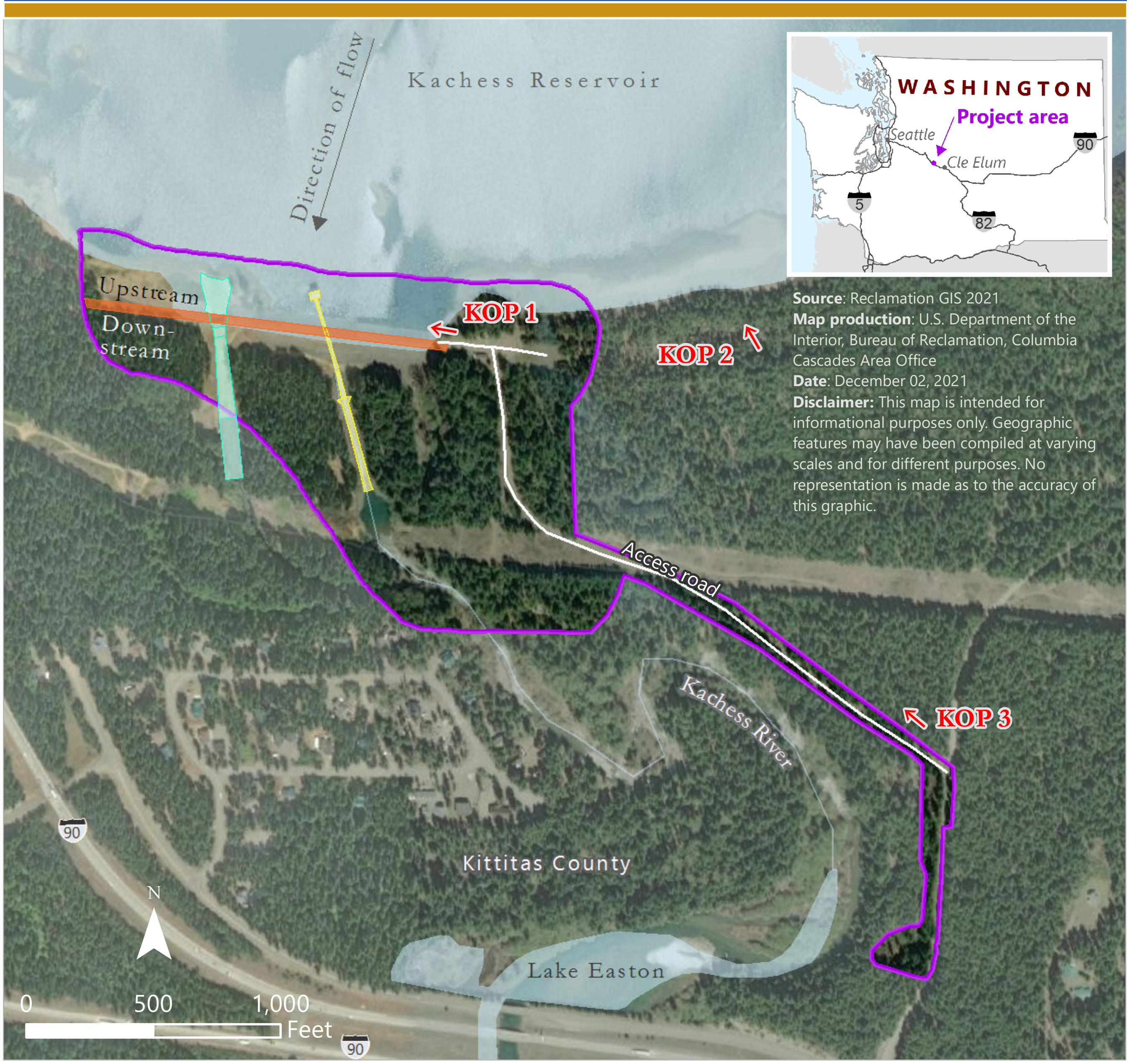
Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Laws and Regulations

The National Environmental Policy Act of 1969, 43 United States Code 4321 et. seq. states:

- Section 101 (b). Requires measures be taken to "...assure for all Americans...esthetically pleasing surroundings...."
- Section 102. Requires agencies to "Utilize a systematic, interdisciplinary approach which will ensure the integrated use of...Environmental Design Arts in the planning and decision-making...."

Figure 1
Key Observation Points



Key observation point

Existing permanent infrastructure
- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

3.2 Policies

The US Bureau of Reclamation (Reclamation) does not have any policy direction specific to visual resources. However, methods of characterizing and analyzing visual resources often draw from policy and direction of other bureaus. This includes analysis guidelines outlined in Bureau of Land Management (BLM) Manual 8431 – Visual Contrast Rating (BLM 1986). The methodology compares the basic elements of form, line, color, and textures found within the characteristic landscape and the Proposed Action. The visual class objectives (significance criteria) are set during the resource management planning process. Because Reclamation does not strictly adhere to the BLM's visual resource management policies, the visual objectives are determined by researching relevant planning documents, land management designations, and scoping comments. However, the BLM's definitions relating to visual resources have been incorporated into this analysis.

Likewise, the US Department of Agriculture Forest Service (USFS) Scenery Management System is used to inventory and analyze scenery in national forests, to assist in establishment of overall resource goals and objectives, and to monitor scenic resources. Much of the Scenery Management System process is devoted to visual resource inventory. Scenic attractiveness (ISA) classes are developed to determine the relative scenic value of lands within a particular landscape character. The three ISA classes are: Class A, Distinctive; Class B, Typical; Class C, Indistinctive. The landscape elements of landform, vegetation, rocks, cultural features, and water features are described in terms of their line, form, color, texture, and composition for each of these classes.

In 1995, the USFS developed the Scenery Management System for integrating scenic values and landscape aesthetics in forest plans (USFS 1995). The scenic integrity or intactness of National Forest land is the means by which proposed alterations to the land are evaluated. The Scenery Management System established scenic integrity levels (SILs) for each management area ranging from very high, meaning the landscape is unaltered, to low, meaning moderate alterations are apparent on the landscape.

The USFS management direction for scenic viewsheds containing dams and reservoirs is described in terms of visual quality objectives (VQOs). The VQOs describe the degree of acceptable alteration of the undisturbed landscape. The USFS applies zoning designations to its land as part of its forest planning process, termed land allocation.

3.3 Relevant Forest Plans

The Okanogan and Wenatchee National Forest Plans (USFS 1989; USFS 1990) outline visual quality management on the forests and describe management actions to protect and preserve VQOs for the forests.

Chapter 4. Affected Environment

Visual resources are the accumulation of features on a landscape—landform, water, vegetation, animals, and structures, as well as the sights and sounds experienced by the viewer. The relative position and unique combination of these features craft the character of the landscape. The character refers to the overall feel or nature of the location. Visual quality refers to the relative attractiveness of a given landscape and is scored based on differing combination of features within it. The viewshed is defined by the visible area seen from KOPs by which the contrast introduced by the Proposed Action is measured.

Kachess Dam consists of an earth fill embankment with a penetrating outlet works conduit and has a nominal structural height of 115 feet. Kachess Dam is surrounded by high ridge lines that characterize the region and thick vegetation within a highly forested area. The vegetation in the project area includes Douglas fir, Pacific silver fir, and alder trees, with an understory of sword fern, English ivy, common snowberry, Oregon grape, trailing blackberry, and Himalayan blackberry.

Figure 2. Kachess Dam – East End (at Dam) Facing West (Reclamation 2015)

The Kachess Dam is located at the southernmost end of Kachess Reservoir, approximately 2 miles north of the City of Easton, Washington. The Kachess Dam is viewable from shorelines along the southeast portion of the reservoir. However, the Kachess Dam is set back away from the view of major roadways, namely Interstate 90, as well as residential roads, namely Kachess River Road. Numerous trees soften the lines of many of the surrounding human-made features and add natural coloring. The area around the Kachess Dam is characterized by sloped forest, which provides significant visual screening of existing dam components.

The dominant feature of the primary study area (the project area) is the Kachess Reservoir. Prior to dam construction in 1910–1912, the reservoir was a natural glacial lake. The natural lake was smaller, with a consistent year-round water level. There was little evidence of human influence along the lake shoreline, although historical accounts reported extensive Native American use of the area. Views from the lake were of undisturbed forested areas. Today, the reservoir is a managed system with a seasonally fluctuating water level. The reservoir is generally full in late spring and early summer, but it is drawn down for irrigation starting in June. During drawdown, much of the exposed shoreline is devoid of vegetation. The relatively gradual slope to the reservoir bottom results in a relatively large area of exposed reservoir bed with lower water levels, with the upper portion of the reservoir being exposed year-round. The reservoir does not refill until the following spring and may not completely refill in drought years.

The Kachess Reservoir is located between the north–south-trending Keechelus Ridge to the west and Kachess Ridge to the east. Background views are forested, with views of valley walls, ridges, and mountains beyond. Development is generally limited to USFS roads on the east and west shores, boat launches, and other recreational facilities, with increasing residential development on the south and west shores.

Although the reservoir was created for water supply, the resulting reservoir setting affords visitors dramatic panoramas of the reservoir and the surrounding natural landscape, which remains largely forested. Together, the reservoir shoreline and hilly topography provide significant variety in viewpoint orientation. These resources include a combination of panoramic views in which the reservoir forms the dominant foreground element and the surrounding forested landscape forms the background, with Kachess Dam as the most prominent human-made feature.

Figure 3. Typical Forested Condition on East Shore (Reclamation 2015)

The characteristic landscape, as seen from Kachess Dam, can be described as a natural setting within a steep-sloped area with thick vegetation. The vegetation provides natural screening from human-made features in the area, which defuses the impact of the visual intrusions caused by these features. Modern development in the immediate project area includes the Kachess Dam facilities (which consist of the spillway and control tower), several unnamed access roads, and a transmission line. The Kachess Dam facilities include the dam, a concrete-lined outlet channel and tunnel where water flows into the Kachess River, and a small building. The transmission line is located south of the dam. The surface of the transmission line has been cleared of vegetation, and the surface has been heavily disturbed by the construction of the transmission line. The access road near the dam runs north–south, and the surface has been graded and well maintained.

Because visual quality is intertwined with viewer sensitivity, it is a contributing factor when analyzing the impacts to visual resources. It helps to define the threshold for acceptable visual intrusions upon the landscape. The project area has low sensitivity for these intrusions, given the significant existing development in the area and fewer sensitive viewer groups. Sensitive viewer groups for the analysis include recreational visitors on Kachess Reservoir and residents along Kachess River Road. However, public access to the site where the greatest impacts would occur (below the dam) is generally limited.

In general, the overall sensitivity of different viewer groups depends on individual attitudes and the associated strength of social connections to a given landscape. The circumstances in which the casual observer views the characteristic landscape is another important factor that contributes to overall viewer sensitivity. Static viewers have longer viewing times and, therefore, have generally stronger connections to the landscapes.

Static viewing locations include residences along Kachess River Road. Numerous trees soften the lines of many of the human-made features and add natural coloring to the site. Dynamic viewers include people recreating on Kachess Reservoir and people traveling along roads near the project area, namely Interstate 90 and Kachess River Road.

Figure 4. Kachess Reservoir Road Portal Location – Forested Condition (Reclamation 2015)

The USFS manages a high proportion of federal land around the project area and Kachess Reservoir. This federal land is part of the Okanogan-Wenatchee National Forest and is managed for multiple objectives, including resource production, habitat, ecological connectivity, and recreation. **Table 1** describes the relationship between VQOs and SIL as contained in the Scenery Management System (USFS 1995).

Table 1. Relationship between Visual Quality Objectives and Scenic Integrity Levels

SIL/VQO	Condition	Perception, Degree of Deviation
Very High/Preservation	Unaltered	The valued landscape character is intact with only minute, if any, deviations.
High/Retention	Appears Unaltered	Not evident. Deviations may be present but must repeat form, line, color, and texture of characteristic landscape in scale.
Moderate/Partial Retention	Slightly Altered	Appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
Low/Modification	Moderately Altered	Appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings.
Very Low/Maximum Modification	Heavily Altered	Appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect, and pattern of natural openings.
Unacceptably Low (Not a management objective, used for inventory only)	Unacceptable Modification	Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character.

Source: USDA 1995

According to the 1990 Wenatchee National Forest Plan (USFS 1990), the USFS manages the land principally as a scenic viewshed. The USFS's land allocation for the Kachess Reservoir is Developed Recreation (RE-1) Retention VQO, and Scenic Travel 1 Retention VQO and Partial Retention VQO, depending on the middle-ground and foreground view context of management activities.

The SIL for land around Kachess Reservoir includes both high—meaning the landscape appears intact—and moderate—meaning the landscape appears slightly altered (Reclamation 2015). Foreground views from areas most often used by the public, such as campgrounds and boat launches, are managed according to the SIL/VQO of high/retention (management activities in the foreground view provide an unaltered appearance), and middle-ground views are managed according to the moderate/partial retention SIL/VQO (management activities in the middle ground provide a slightly altered appearance). Bonneville Power Administration transmission lines are located south of the Kachess Reservoir and north of I-90. The USFS considers the landscape appearance around Bonneville Power Administration transmission lines as very low, meaning it appears heavily altered.

Chapter 5. Environmental Consequences

5.1 Methods

Reclamation assessed impacts by identifying and describing changes to the visual quality of the landscape. The changes relative to the existing landscape may occur in visual contrast introduced by the project elements and in overall landscape character. Elements in a project that have contrast are those that are unlike or in opposition to the forms, lines, colors, and textures that combine in the native landscape to form a visual pattern. The greater the visual contrast introduced by a project element, the greater the adverse impact on the aesthetic quality of the setting. Landscape character refers to the visual and cultural image of a geographic area. It reflects the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. This assessment emphasizes the potential relationship between the project and sensitive receptors associated with recreation areas, roadways, and residential development. The most sensitive areas are those that can be viewed by travelers moving to or from recreational activities or along designated scenic corridors. Stationary views from relatively moderate- to high-use recreation areas and residential areas are also considered to be sensitive.

5.2 Impact Indicators

Visual impact indicators and criteria for determining impact significance are shown in **Table 2**. Reclamation assessed all criteria relative to the No Action Alternative. Adverse visual impacts are modifications to the environment that substantially contrast with or change the overall landscape character or detract from the area's visual quality. In the context of reservoir management, adverse visual impacts are changes in pool levels that render the reservoir a less dominant element on the landscape and result in a shoreline of unnatural appearance, making the area less desirable for recreation. Under the USFS Scenery Management System (USDA 1995), the landscape is composed of diverse landforms, rock forms, and vegetative colors and textures. The potential impacts were evaluated by examining the extent to which project elements would contribute to or conflict with relevant federal visual management plans, which include visual resource management classes, SILs, and VQOs from KOPs.

Table 2. Impact Indicators and Significance Criteria for Visual Resources

Impact Indicator	Significance Criteria
Introduction of new facilities or modifications to existing facilities	Modifications to the environment having more than a moderate effect in that they substantially contrast with or interrupt the visual character and integrity of the landscape
Consistency with relevant federal visual quality management plans	Conflict with SIL/VQO established in the 1990 Wenatchee National Forest Plan and the USFS Scenery Management System

Source: USDA 1995

5.3 No Action Alternative

Under the No Action Alternative, there would be no structural or operational changes to the Kachess Dam or spillway. Therefore, the No Action Alternative would result in visual quality conditions that are the same as those currently experienced. No construction or changes in the reservoir level would occur, and the landscape character would be largely unchanged from baseline conditions. The No Action Alternative would maintain the existing range of landscape character and scenic integrity conditions within the primary study area.

Potential long-term impacts on visual resources could occur under this alternative, however. Since the seepage and internal erosion issues would continue, the threat of dam failure from internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. A dam failure would alter the existing range of landscape character and scenic integrity conditions within the primary study area.

5.4 Proposed Action

Under the Proposed Action, Reclamation would perform various improvements on the Kachess Dam and spillway to reduce the risk of dam failure.

Construction of the improvements would create short-term and localized visual impacts, with a temporary disturbance of approximately 8 acres of surface disturbance. Construction activities would be concentrated on the east shore of the southeast portion of the Kachess Reservoir. This portion of the east shore is part of a contiguous segment of undeveloped, forested shoreline that supports a perceived "natural" setting. The temporary construction equipment and staging areas would be highly visible from the southeast portion of the reservoir and surrounding shorelines.

However, while Kachess Reservoir is used for recreational boating and provides views of the shoreline, there are no developed recreational facilities or residential areas along this portion of the reservoir with views toward the construction area. Portions of construction areas could be visible from Kachess Dam Road, but intervening trees would limit viewpoints and obstruct views of the Proposed Action activities. Additionally, public access to this area is generally limited, which would reduce the magnitude of visual impacts from the project.

Those looking at the construction area would notice mechanized equipment, grading and dredging activity, material movement and stockpiling, construction of infrastructure, and human activity, all of which would detract visually from the setting. Although the temporary construction areas would be restored post-construction with native vegetation, the appearance of some areas would change from forested to cleared land. Permanent disturbance would include approximately 3.5 acres of permanent surface disturbance as a result of the proposed improvements.

Based on the limited public viewpoints of construction areas, the temporary nature of construction, and the limited visibility of acres disturbed in the long term, the Proposed Action would have a minor to moderate short-term effect on the landscape's visual character and integrity. Therefore, the Proposed Action would meet the intent of the high/retention and moderate/partial retention SIL and VQO established by the 1990 Wenatchee National Land and Resource Management Plan for Kachess Reservoir.

5.5 Mitigation Measures

Under the Proposed Action, Reclamation would restore temporary access and staging areas through revegetation and replant these areas with native species. Reclamation would coordinate with the USFS on appropriate design and landscaping. Reclamation would also design facilities to blend with the surrounding areas by burying or partially burying new facilities where feasible and appropriate, and by painting visible portions of infrastructure in flat, nonreflective, dark, earth-tone colors.

Chapter 6. Glossary

Key observation point—One or more a series of points on a travel route or at a use area or a potential use area where the view of a management activity would be most revealing.

Landscape character—The arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements of form, line, color, and texture. These factors give the area a distinctive quality that distinguishes it from its immediate surroundings (BLM 1984).

Scenic attractiveness classes—Developed to determine the relative scenic value of lands within a particular landscape character. The three ISA classes are: Class A, Distinctive; Class B, Typical; Class C, Indistinctive. The landscape elements of landform, vegetation, rocks, cultural features, and water features are described in terms of their line, form, color, texture, and composition for each of these classes.

Scenic quality—The relative worth of a landscape from a visual perception point of view (BLM 1984).

Viewshed—The landscape that can be directly seen, under favorable atmospheric conditions, from a viewpoint or along a transportation corridor (BLM 1984).

Visual quality objective—Describes the degree of acceptable alteration of the undisturbed landscape.

Visual resources—The visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features [BLM 1984]).

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Kachess Dam Safety of Dams Modification Environmental Assessment

Water Resources Report

U.S. Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

December 2021

Mission Statements

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Executive Summary

Most hydrology in the project area originates as snowfall and rainfall in the Cascade Range east of the crest. Below the dam, most hydrology in the project area comes from water releases from Kachess Reservoir through the outlet works. Released water is conveyed in a concrete-lined channel for approximately 450 feet before it discharges into a stilling basin. From this point, it continues to flow into the Kachess River. Hydrology in the project area is also present as a result of seepage under Kachess Dam. The US Bureau of Reclamation (Reclamation) channelizes seepage that conveys the seepage to the Kachess River at the stilling basin. Finally, direct precipitation and snowfall contribute hydrology to the project area.

The Kachess River flows approximately 0.9 miles from the project area into Lake Easton, on the Yakima River. The Yakima River is a tributary to the Columbia River, which flows to the Pacific Ocean.

Groundwater in the Kachess basin occurs in unconsolidated sediments and fractures in the bedrock. It is recharged through precipitation discharged to springs, streams, and Kachess Reservoir. Groundwater-level monitoring showed that Kachess Reservoir is hydraulically connected to the aquifer. Reservoir elevations influence the groundwater levels near the reservoir and areas downstream of the reservoir (Reclamation and Ecology 2019). Reclamation anticipates that the groundwater quality in the uppermost aquifers is very good (Reclamation and Ecology 2019).

Reclamation collected water quality data in Kachess River that indicate the water quality in the river is moderate to good. During sampling, the river exhibited low turbidity, low total suspended solids concentrations, and low fecal coliform counts. However, dissolved oxygen and water temperature exceeded State surface water quality criteria for individual samples.

Under the No Action Alternative, the outlet works modifications would not occur; therefore, no short-term effects on water resources would be expected. The threat of dam failure due to internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. Potential long-term impacts from flooding to downstream water resources would be significant.

Under the Proposed Action, construction activities would be timed to avoid major issues with water deliveries and comply with maintaining minimum flows. This water would be routed around the construction site back into the outlet channel. This would maintain flow downstream in Kachess River and keep the flow isolated from construction activities. Replacing approximately 100 feet of the concrete-lined channel with 10-foot conduit would not remove aquatic habitat, change stream channel features, or affect flows to Kachess River.

Reclamation may need four 12-hour shutoffs for conduit installation, where no water would be provided unless the reservoir is high enough to use the spillway. During the shutoffs, there would be no flow to Kachess River. There would be a temporary impact on stream flows during the shutoffs,

but there would be no short- or long-term impacts after each shutoff is complete. The shutoffs would not impact stream features. Flows would be matched by Keechelus Reservoir during the shutoffs to eliminate flow concerns downstream in the Yakima River.

Reclamation would construct a new access road from the current dam access road to the outlet works for construction and maintenance of the outlet works modifications (**Figure 1**, Project Area). This road would traverse a wetland, as well as the seepage channel east of the main outlet works. There may be temporary interruptions in flow during construction of the access road, but flow would be restored once the culverts are installed.

The Proposed Action would not require any reservoir-level restrictions, and Reclamation would time construction activities to avoid major issues with water deliveries. In addition, groundwater unwatering would occur in the main excavation trench, but there is no plan to pump down to the groundwater table. The lack of reservoir-level restrictions, the continuation of minimum flows through the dam during construction, and not pumping down the groundwater table would eliminate the potential for drawdowns of the groundwater table or the reduction in aquifer recharge rates. No short- or long-term impacts on groundwater's availability downstream of the project area would occur as a result of the Proposed Action.

Overall, the Proposed Action would require up to 8 acres of surface disturbance for the outlet works modifications, construction of the access road, and development of the construction staging areas (**Figure 1**). Reclamation's contractor would develop a stormwater pollution prevention plan (SWPPP) and obtain a Washington Construction Stormwater General Permit prior to any surface disturbance. Best management practices would be installed as designed in the SWPPP to prevent or mitigate erosion and sedimentation from surface-disturbing activities. This would prevent sediment and other potential pollutants from entering the outlet channel and Kachess River downstream.

The proper disposal of hazardous materials and implementation of the spill prevention, control, and countermeasure plan (in case of an accidental spill of hazardous materials) would decrease the risk of hazardous material spills during construction of the Proposed Action, provide for the quick cleanup of any spills that could occur, and prevent any impacts on water quality.

Reclamation and its contractor would reduce impacts on water quality both in the short and long term through the implementation of best management practices, as outlined in the SWPPP, and turbidity monitoring for surface disturbance; dewatering; and routing water around the construction area.

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Acronyms and Abbreviations

Acronym	Full Phrase
°C	degrees Celsius
cfs	cubic feet per second
CWA	Clean Water Act
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
°F	degrees Fahrenheit
HPA	Hydraulic Project Approval
mg/L	milligrams/liter
NPDES	National Pollutant Discharge Elimination System
Reclamation	US Bureau of Reclamation
SWPPP	stormwater pollution prevention plan
TMDL	total maximum daily load(s)
WAC	Washington Administrative Code

Chapter 1. Analysis Area

The analysis area for water resources (hydrology, groundwater, and water quality) includes the project area and the Kachess River downstream to where it flows into Lake Easton (approximately 0.9 miles downstream of the dam). Wetlands, riparian areas, and wetland function are included in the **Biological Resources Report**.

Chapter 2. Indicators

- Changes to stream geomorphology
- Changes to downstream flow quantity or timing
- Increase or decrease to water quality
- Changes to aquifer recharge and groundwater availability

Chapter 3. Relevant Laws, Regulations, and Policies

3.1 Federal Laws, Regulations, Statutes, and Orders

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the CWA, the Environmental Protection Agency (EPA) has implemented pollution control programs, such as setting wastewater standards for industry. The EPA has also developed national water quality criteria recommendations for pollutants in surface waters. The CWA made it unlawful to discharge any pollutant from a point source into navigable waters unless a permit was obtained. The EPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges. Point sources are discrete conveyances such as pipes or human-made ditches. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters (EPA 2021a).

Section 303(d) of the CWA requires states to identify waters where current pollution control technologies alone cannot meet the water quality standards set for that waterbody. These waters are called impaired waters. Every 2 years, states are required to submit a list of impaired waters, along with any that may soon become impaired, to the EPA for approval. The list is called the 303(d) list. States must establish the total maximum daily load(s) (TMDL[s]) of the pollutant(s) in the waterbody for impaired waters on their list. The impaired waters are prioritized based on the severity of the pollution and the designated use of the waterbody (EPA 2021b). Designated uses are sometimes called "beneficial uses" or "designated beneficial uses." Designated uses mentioned in the CWA include public water supply; protection of fish, shellfish, and wildlife; recreation; and navigation.

States have also adopted other designated uses, such as agriculture, industry, and aesthetics. The Water Quality Standards Regulation (40 Code of Federal Regulations 131) establishes the requirements for states and Tribes to review, revise, and adopt water quality standards. It also establishes the procedures for the EPA to review, approve, disapprove, and promulgate water quality standards pursuant to Section 303 (c) of the CWA (EPA 2021c). The National Toxics Rule (40 Code of Federal Regulations 131.36) describes the chemical-specific, numeric criteria for priority toxic pollutants. This was necessary to bring all states into compliance with the requirements of Section 303(c)(2)(B) of the CWA (EPA 2021d).

Under Section 401 of the CWA, a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into waters of the United States, unless a state or authorized tribe where the discharge would originate issues a CWA Section 401 water quality certification verifying compliance with existing water quality requirements or waives the certification requirement (EPA 2021e).

Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), and infrastructure development. For most discharges that will have only minimal adverse effects, a general permit may be suitable. General permits are issued on a nationwide, regional, or state basis for particular categories of activities. The US Army Corps of Engineers enforces CWA Section 404 permit provisions (EPA 2021f).

3.2 State and Local Laws

Under the CWA, states perform water quality assessments and track the cleanliness of rivers, lakes, and marine waters. Assessed waters are placed in one of the following five categories that describe the water quality status (Ecology 2021a, 2021b):

Category 1: Meets tested standards for clean waters

Category 2: Waters of concern

Category 3: Insufficient data

Category 4: Impaired waters that do not require a TMDL analysis

Category 5: Polluted waters that require a water improvement project

Washington Administrative Code (WAC) Chapter 173-201A contains water quality standards for surface waters of the state of Washington. Waters whose designated uses (listed in WAC Sections 173-201A-200, 173-201A-600, and 173-201A-602) that are impaired by pollutants are placed in the polluted water category (Category 5) of the water quality assessment (Ecology 2021a). The 303(d) list contains waters in the polluted water category. Total maximum daily loads or other approved water quality improvement projects are required for waterbodies with Category 5 impairments (Ecology 2021b). A TMDL is a numerical value that represents the highest amount of a pollutant a surface water body can receive and still meet the water quality standards (Ecology 2021c).

Sections 303(d) and 305(b) of the CWA require states to identify and characterize waters that do not meet, or are not expected to meet, applicable water quality standards. The Kachess River exceeds water quality standards for dissolved oxygen (Ecology 2021a).

Washington law (Chapter 77.55 Revised Code of Washington) requires people planning hydraulic projects in or near state waters to get a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife. This law includes most marine and fresh waters. An HPA ensures that construction is done in a manner that protects fishes and their aquatic habitats. A hydraulic project is construction or other work activities conducted in or near state waters that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh waters of the state. The state's Hydraulic Code Rules (Chapter 220-660 WAC) identify projects and activities that require an individual HPA (Washington Department of Fish and Wildlife 2021).

3.3 Surface Water Permits and Approvals

3.3.1 Construction Stormwater National Pollutant Discharge Elimination System Permit

The Washington State Department of Ecology (Ecology) administers the NPDES construction general permit. Coverage for this permit is obtained by submitting a Notice of Intent to Ecology. Coverage under this general permit is required for construction activities that disturb at least 1 acre of land and discharge stormwater into surface waters of the State. In addition, coverage under this permit is required if construction activity of any size discharges into waters of the State and Ecology either determines the site to be a significant contributor of pollutants or reasonably expects the construction to cause a violation of any water quality standard.

The general permit requirements include implementation of the following measures during construction: preparation and implementation of a stormwater pollution prevention plan (SWPPP) for all construction activity, water quality monitoring, and record-keeping and reporting protocols. For certain construction projects with a higher risk of surface water quality impairment, Ecology requires an individual NPDES permit for construction activity. Individual NPDES construction stormwater permits typically require a greater extent of water quality monitoring, but otherwise the conditions are similar to those of the general permit.

3.3.2 Section 401 Water Quality Certification and Section 404 Authorization

Clean Water Act Section 401 requires that actions subject to federal permits that result in a discharge of pollutants into waters of the United States obtain a State certification that the action complies with all applicable water quality standards. Ecology issues Section 401 Water Quality Certifications in Washington. A CWA Section 404 permit or authorization is required for certain types and amounts of discharges of dredged, excavated, or fill materials into waters of the United States. This permit or authorization is issued by the US Army Corps of Engineers. Typically, projects affecting waters of the State (including water bodies and wetlands) trigger the need for a Section 404 permit, which in turn triggers applicability of a Section 401 Water Quality Certification. The Section 401 Water Quality Certification outlines requirements to ensure that water-related elements of the project do not affect water quality. In addition, the Section 401 Water Quality Certification for a project affecting waters listed as impaired under CWA Section 303(d) (Category 5) may include conditions or a compliance plan to address the project's impacts on the impairment of the water resource.

Chapter 4. Affected Environment

4.1 Hydrology

Most hydrology in the project area originates as snowfall and rainfall in the Cascade Range east of the crest, which collects in Kachess Reservoir via the Kachess River and Mineral Creek. Kachess Reservoir has a drainage area of approximately 63 square miles (Reclamation 2021).

Below the dam, most hydrology in the project area comes from water releases from Kachess Reservoir via the dam outlet works, which has a capacity of 3,700 cubic feet per second (cfs), and, periodically, from the spillway, which has a capacity of 4,000 cfs. The outlet works originate from the central portion of the dam. Water released from the outlet works daylights at the downstream toe of the dam; it is conveyed in a concrete-lined channel for approximately 450 feet before it discharges into a stilling basin. From this point, it continues to flow into the Kachess River.

Water releases from Kachess Reservoir are greatest in September and October, reaching a maximum ranges of about 1,200 to 1,500 cfs, depending on supply and demand. The release from Kachess Reservoir is reduced after irrigation season to 35 cfs. Kachess Reservoir typically reaches its lowest elevation in October, when the irrigation season ends. In the winter and spring, water is stored in the reservoir for irrigation demands later in the year. The highest reservoir elevations generally occur in May to July, depending on the annual water supply.

Hydrology in the project area is also present as a result of seepage under the Kachess Dam. The US Bureau of Reclamation (Reclamation) channelizes seepage daylighting near the right (eastern) end of the dam during normal dam operations; this channel conveys the seepage to the Kachess River at the stilling basin described above. The upper portions of this channel are wetland communities (see the **Biological Resources Report** for more detail); the lower portion is open water due to a weir that impounds water behind it.

Finally, direct precipitation and snowfall contribute hydrology to the project area. The average annual maximum temperature at the Kachess Reservoir, Washington, National Weather Service Cooperative Network station (454406) is 54.5 degrees Fahrenheit (°F) (12.5 degrees Celsius [°C]), and the average annual minimum temperature is 34.1°F (1.16°C). The average annual total precipitation is 52 inches, and average annual total snowfall is 165 inches. The station has measurable monthly average snow depth from November through April, indicating that portions of the project area are under snow during these months (WRCC 2021).

The Kachess River flows approximately 0.9 miles from the project area into Lake Easton, on the Yakima River. The Yakima River is a tributary to the Columbia River, which flows to the Pacific Ocean.

4.2 Groundwater

Groundwater in the Kachess basin occurs in unconsolidated sediments and fractures in the bedrock and is recharged through precipitation discharged to springs, streams, and Kachess Reservoir. South of Kachess Reservoir, alluvial and glacial deposits form a high-permeability, unconfined aquifer up to 90 feet thick (Reclamation 1911). This aquifer is underlain by sandstone bedrock that likely exhibits low permeability and is not likely to convey groundwater. Groundwater likely flows south from the dam within the unconsolidated deposits and discharges into the Yakima River downstream from the dam (Reclamation and Ecology 2019).

Well logs for an area within 2 miles of Kachess Reservoir show that groundwater in the area is used as a potable water supply for seasonal and year-round homes around the reservoir. Well depths range from 15 to 500 feet, with an average depth of 190 feet. The shallower wells (less than 100 feet deep) obtain groundwater from sedimentary deposits and the deeper wells are installed in bedrock (Reclamation and Ecology 2019).

Groundwater-level monitoring was conducted at two domestic wells and four Reclamation monitoring wells to determine whether the wells are hydraulically connected and respond to fluctuations in Kachess Reservoir surface water elevations (Reclamation and Ecology 2019). The following observations and conclusions were drawn from the groundwater-level monitoring:

- The reservoir is hydraulically connected to the aquifer, and groundwater levels near the reservoir are influenced by reservoir elevations, especially during the dry time of the year when very little recharge is occurring and groundwater elevations are dropping because of discharge from the aquifer (Reclamation and Ecology 2019).
- For areas downstream from the reservoir, groundwater levels are also likely to be influenced by reservoir elevations. An impermeable core (or cut-off wall) constructed along the length of the dam impedes the seepage of water from the reservoir through the sedimentary deposits under the dam. This cut-off wall is likely the reason for the small hydraulic response observed in monitoring wells below the dam. Although the groundwater levels show an attenuated response to changes in the reservoir level, if the reservoir elevation were to drop below the current minimum elevation, groundwater levels would likely experience an additional decline as well (Reclamation and Ecology 2019).

Groundwater quality in the analysis area was evaluated by examining water quality records maintained by the Washington State Department of Health and Ecology. No records indicating adverse groundwater quality were discovered. However, because wells in the area are used for residential potable supply, because the area is remote, because there is little industrial or commercial land use, and because the aquifer receives a large amount of recharge from precipitation, it is anticipated that groundwater quality in the uppermost aquifers is very good (Reclamation and Ecology 2019).

4.3 Surface Water Quality

Reclamation collected water quality data in Kachess River approximately 984 feet downstream from Kachess Dam (station YKA001) during June, July, and August. Based on EPA database results, 11 samples were collected between 1999 and 2019 (EPA 2021g). Sampling results indicate that water quality in the river is moderate to good. During sampling, the river exhibited low turbidity, low total suspended solids concentrations, and low fecal coliform counts. However, dissolved oxygen and water temperature exceeded State surface water quality criteria for individual samples. Water temperatures exceeded the State surface water quality criterion of 16°C (60.8°F) on three occasions with a highest temperature reading of 18.5°C (65°F) in July 2015. During sampling, the average water temperature was 13.5°C (56.3°F), which is below the water quality criterion of 16°C (60.8°F).

Dissolved oxygen measurements below the State surface water quality criteria were measured on five occasions (standard set to ensure dissolved oxygen criterion greater than 9.5 milligrams/liter [mg/L]); the lowest reading was 8.8 mg/L in July 1999. The average dissolved oxygen levels during sampling was 9.8 mg/L, which exceeds the State water quality criteria (EPA 2021g). The Kachess River is listed on Ecology's 303(d) water quality list as Category 2 (waters of concern) for dissolved oxygen (Ecology 2021a).

Chapter 5. Environmental Consequences

For the purposes of this analysis, impact duration is defined as follows:

- Temporary: impacts that would only occur during construction.
- Short-term: impacts that would be less than 3 years in duration.
- Long-term: impacts that would be 3 years or greater in duration.

5.1 No Action Alternative

Under the No Action Alternative, the outlet works modifications would not occur. This means there would be no construction, no construction equipment, no extension of the outlet works conduit, and no access road. Therefore, there would be no short-term effects on water resources.

Since the seepage and internal erosion issues would continue, the threat of dam failure due to internal erosion along the outlet works and the subsequent catastrophic flood would increase throughout time. Potential long-term impacts from flooding to downstream water resources would be significant.

5.2 Proposed Action

5.2.1 Hydrology

Under the Proposed Action, Reclamation would install a diaphragm filter and a drainage filter that would require extending the outlet works conduit approximately 100 feet from the current outlet.

The extension and lining of the outlet works would be timed to avoid major issues with water deliveries and to comply with maintaining minimum flows through the dam throughout the project, as established through negotiations with a number of stakeholders, including the Washington Department of Fish and Wildlife, the Yakama Nation, the United States Fish and Wildlife Service, the National Marine Fisheries Service, and various irrigation districts. This water would be routed around the construction site back into the outlet channel. This would maintain flow downstream in Kachess River and keep the flow isolated from construction activities.

Currently, the conduit discharges into a concrete-lined channel that continues for 450 feet before emptying into the stilling basin. From this point, it begins to flow in the Kachess River. The Proposed Action would remove approximately 100 feet of the concrete-lined channel and replace it with a 10-foot conduit. This would not remove any aquatic habitat or stream channel features, as it is currently a concrete-lined channel. It also would not affect the conveyance of flows to Kachess River downstream as the flow would continue another 350 feet in the concrete-lined channel before discharging into the stilling basin.

Reclamation would maintain required minimum flows for the low-flow season as during normal operations. Reclamation may need four 12-hour shutoffs for conduit installation, where no water would be provided unless the reservoir is high enough to use the spillway. Three of these shutoffs would occur between November and March. The last shutoff would occur after this time frame; however, it would not have flow effects because this work would be scheduled when the pool is full enough to provide minimum flows from the spillway. These temporary shutoffs would not affect the overall delivery of water downstream, as most users do not require water during these time periods. During the shutoffs, there would be no flow to Kachess River. There would be a temporary impact on stream flows during the shutoffs, but there would be no short- or long-term impacts after each shutoff is complete. The shutoffs would not impact stream features. Flows would be matched by Keechelus Reservoir during the shutoffs to eliminate flow concerns downstream in the Yakima River.

Reclamation would install a filter drain below the conduit extension that would collect any additional seepage and route it to an inspection well located next to the new concrete headwall and wingwalls. Pumps would drain the inspection well when it reaches a certain level and discharge the water into the outlet channel. This water currently seeps out into the outlet channel, so there would be no change in downstream water flows.

Further, the filter drain would be installed from the upstream left end of the conduit and extend along the furthest downstream extent to the inspection well.

The auxiliary drain would be 12 inches wide with a typical depth of 10 feet below the outlet channel. The drainpipe would be installed near the left side of the outlet channel using trenching methods. Trenching would expand to approximately 35 feet at its widest and approximately 3 feet at its narrowest. At its upstream end, the drain will terminate at an auxiliary inspection well that is being included as part of an effort to improve monitoring in this area. At its downstream end, the drain will discharge into the stilling basin just to the left of the end of the concrete liner.

A pair of pumps would be installed at the bottom of the well, about 20 to 30 feet below the surface, to ensure any collecting seepage is drained properly. The pumps would be triggered at a specified depth of water in the bottom of the well, and one of them would be designated as the backup pump.

Reclamation would construct a new access road from the current dam access road to the outlet works for construction and maintenance of the outlet works modifications (**Figure 1**, Project Area). This road would traverse a wetland, as well as the seepage channel east of the main outlet works. Reclamation would install a fish passable culvert to convey flow under the new access road and remove the weir that currently impounds water. This would remove the impoundment and allow for unrestricted flow through this area.

There may be temporary interruptions in flow during construction of the access road, but flow would be restored once the culverts are installed. The outlet work modifications would not reduce the seepage that supports this side channel as it is primarily from the steep hillside and not the dam. The access road would be designed not to discharge additional water into any of the designated wetlands or the side channel.

As part of the Proposed Action, Reclamation would also replace the conduit under the dam as the current concrete conduit is showing signs of failure. This would occur during the four 12-hour shutoffs and would not include any short- or long-term impacts on hydrology.

5.2.2 Groundwater

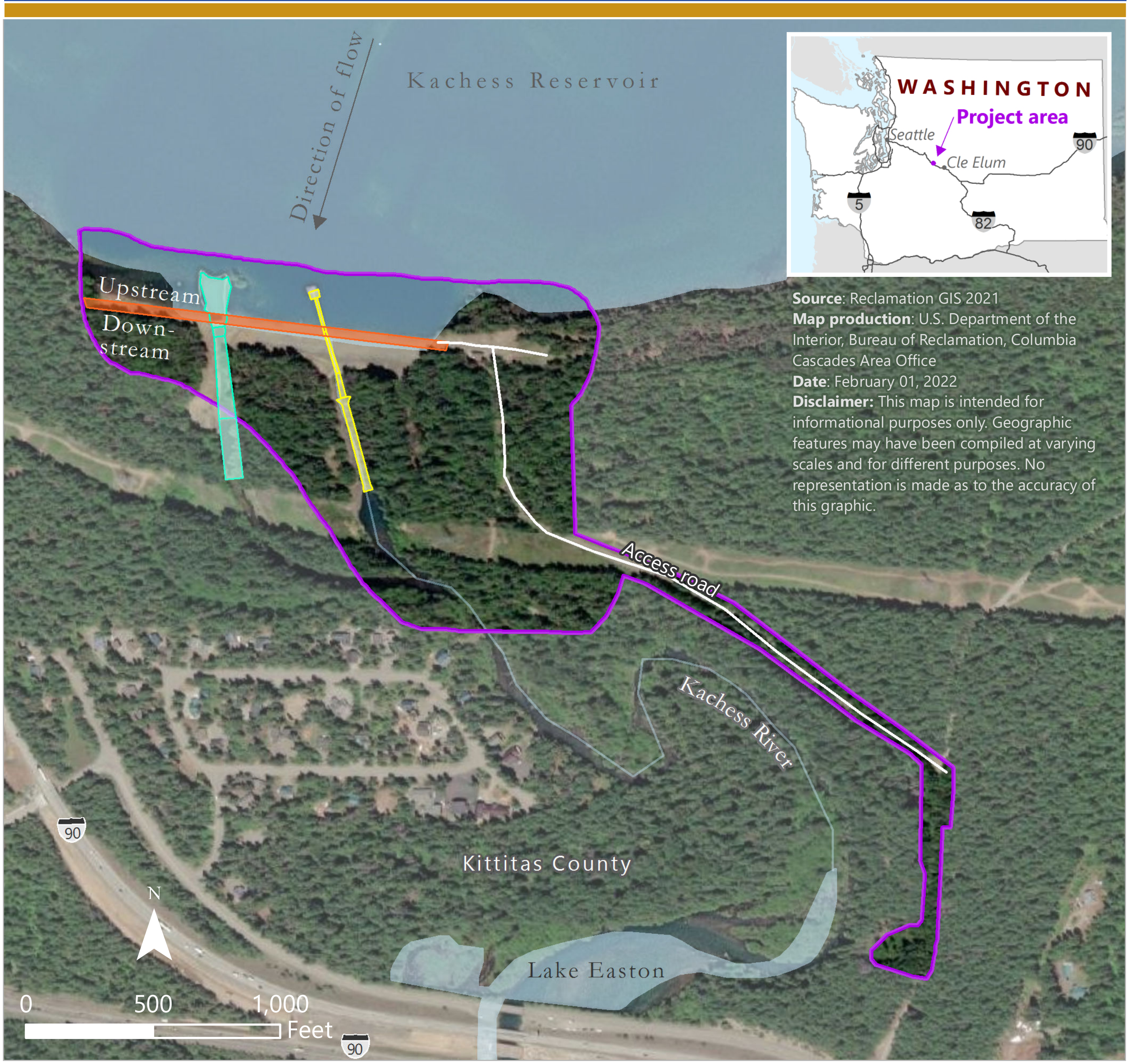
The Proposed Action would not require any reservoir level restrictions, and Reclamation would time construction activities to avoid major issues with water deliveries. While there would be four potential water shutoffs, they would be timed to avoid May through August when water is used for agricultural purposes downstream. These shutoffs would not be long enough to affect aquifer recharge downstream of the project area and would not affect downstream well water availability.

Groundwater unwatering would occur in the main excavation trench, but there is no plan to pump down to the groundwater table. Instead, Reclamation would pump water out from the bottom of the trench to a discharge point immediately above the excavation site. Water would flow to the outlet channel as groundwater seepage currently does. There would be no impacts on aquifer recharge from the unwatering as this water currently discharges to the outlet channel as seepage from around the conduit works.

The lack of reservoir level restrictions and continuation of minimum flows through the dam during construction would eliminate the potential for drawdowns of the groundwater table or aquifer recharge rates. No short- or long-term impacts on groundwater availability downstream of the project area would occur as a result of the Proposed Action. In addition, there would be no impacts on groundwater quality as any water discharged during groundwater unwatering would be treated prior to discharge back into the outlet channel.

BUREAU OF RECLAMATION

Figure 1
Project Area



Existing permanent infrastructure

- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

5.2.3 Surface Water Quality

The Proposed Action would require up to 8 acres of surface disturbance for the outlet works modifications and construction of the new access road. During excavation and modification of the outlet works, Reclamation would continue to release minimum flows from the dam with up to four 12-hour shutoffs as described above. Reclamation would route the water around the excavation site, and the water would not come into contact with any sediment or other potential contaminants from the construction site. This water would discharge into the outlet channel downstream of the construction site, and the discharge would not increase sedimentation or water temperatures for Kachess River.

Reclamation would pump water that collects at the bottom of the excavation trench through a well. This water would be pumped to a discharge point outside of the construction area. Reclamation's contractor would control this dewatering in compliance with its Washington Construction Stormwater General Permit and develop a dewatering plan to ensure that the water is free of sediment and that the treatment system does not increase water temperatures prior to discharging back into the outlet channel.

In addition to the construction dewatering, Reclamation would install an inspection well with pumps that would drain any seepage that collects from the filter drain. This water would be pumped to the surface and discharged into the outlet channel. This water would flow through the filter drain and would be free of sediment and other contaminants when discharged back to the outlet channel. After construction is complete, Reclamation's contractor would confirm the quality and temperature of the water in the inspection well prior to discharging into the outlet channel.

Reclamation's contractor would conduct turbidity monitoring when turbidity-generating construction takes place in accordance with WAC 173-201A-200(1)(e)—Aquatic life turbidity criteria. If turbidity exceeds the criteria, then Reclamation would alter the construction methods to decrease turbidity.

Overall, the Proposed Action would require up to 8 acres of surface disturbance for the outlet works modifications, construction of the access road, and development of the construction staging areas (**Figure 1**). Reclamation's contractor would develop a SWPPP and obtain a Washington Construction Stormwater General Permit prior to any surface disturbance. Best management practices would be installed as designed in the SWPPP to prevent or mitigate erosion and sedimentation from surface-disturbing activities. This would prevent sediment and other potential pollutants from entering the outlet channel and Kachess River downstream.

Any accidental release of hazardous materials would be cleaned up according to the contractor's spill prevention, control, and countermeasure plan and reported to the proper agencies, including Ecology. Proper disposal of hazardous materials and implementation of the spill prevention, control, and countermeasure plan in case of an accidental spill of hazardous materials would decrease the risk of hazardous material spills during construction of the Proposed Action, provide for quick cleanup of any spills that may occur, and prevent any impacts on water quality.

Reclamation and its contractor would reduce impacts on water quality both in the short and long term through the implementation of best management practices as outlined in the SWPPP for surface disturbance, dewatering, and routing water around the construction area.

Chapter 6. Glossary

No glossary terms are defined.

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