Ross Powerhouse Rockslide Stabilization
Environmental Assessment

March 15, 2012

North Cascades National Park Service Complex
810 State Route 20
Sedro-Woolley, WA 98284

Chapter 1. Purpose of and Need for Action

1.1. Purpose and Need of the Proposed Action

A rock slide in March 2010 destroyed various facilities used by Seattle City Light (SCL) to operate and maintain the Ross Dam (dam) and Ross Powerhouse (powerhouse). The rock slide left a complex mass of overhanging and unstable cliffs that continue to threaten the area with additional large-scale and unpredictable rock slides. This creates a hazardous condition for SCL personnel, NPS staffs and park visitors. Further rock slides could compromise SCL's access to the dam and powerhouse, and cause substantial impacts to hydroelectric operations.

The purpose of this proposed action is to reestablish safe administrative access to Ross Powerhouse for Seattle City Light personnel and motor vehicles, including very heavy equipment that is periodically needed to service the hydroelectric facility. This proposed action (project) is needed because heavy equipment access to the powerhouse is presently compromised, conditions are unsafe for Seattle City Light staff due to the threat of further rockfall, and there is no safe means of motor vehicle ingress or egress in accordance with Seattle City Light's Emergency Access Plan.

1.2. Objectives

The specific objectives of the proposed project are to:

- re-establish emergency evacuation routes for SCL personnel working at the powerhouse;
- restore motor vehicle access between the dam and powerhouse for routine maintenance;
- re-establish access for large equipment and supplies necessary for major maintenance and rehabilitation work at Ross Powerhouse;
- reduce response times for emergency operations;
- improve safety in the vicinity of the rockslide; and
- restore public trail access between Diablo and Ross lakes.

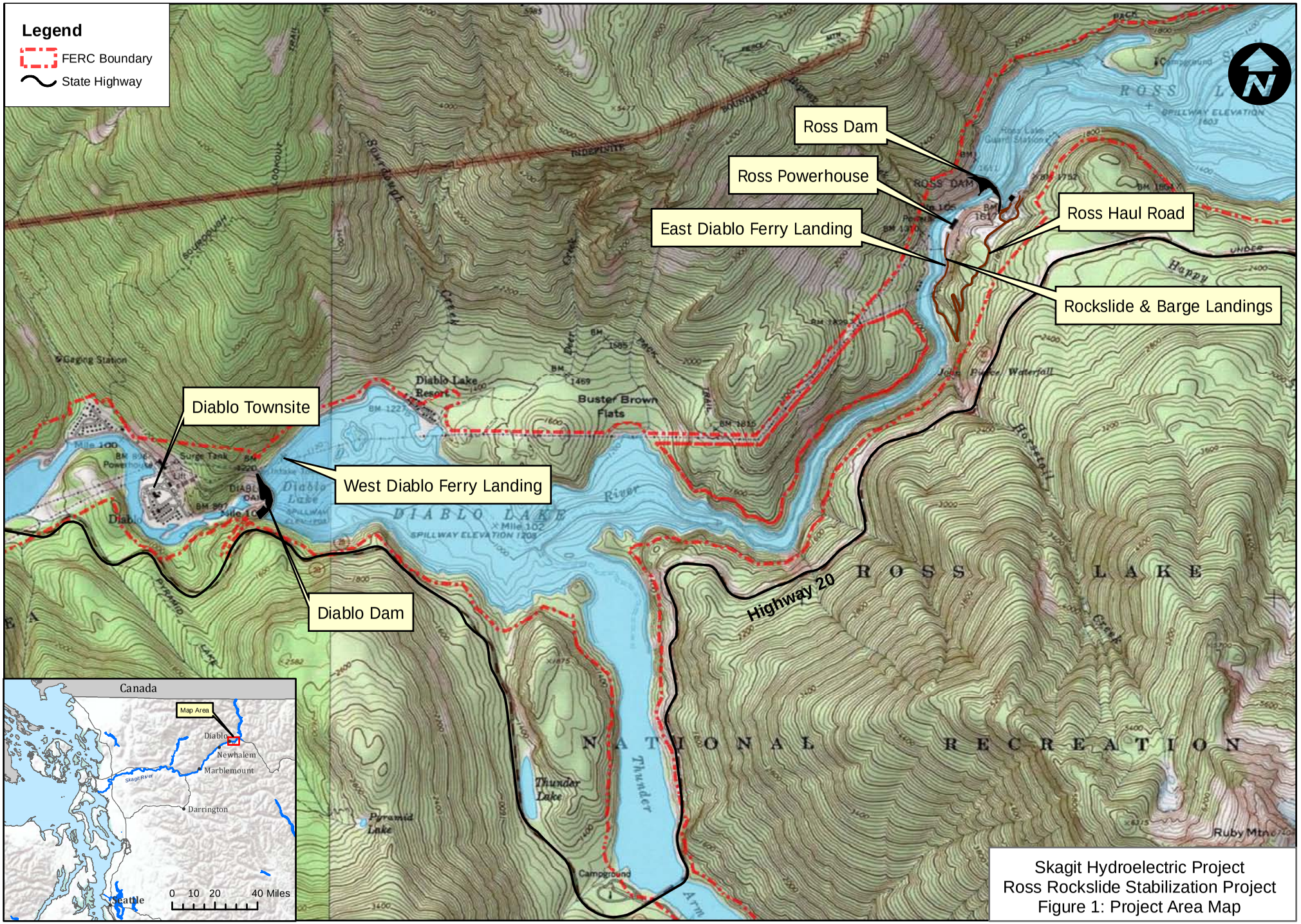
1.3. Decision to be Made

The Enabling Legislation for Ross Lake National Recreation Area (NRA), as amended by the Washington Parks Wilderness Act of 1988, provides for hydroelectric operations and maintenance activities. The Federal Energy Regulatory Commission (FERC) has already authorized this project to proceed due to its importance for power generation and public safety (FERC, 2011). This decision focuses on selecting an alternative that best achieves the purpose of this project while minimizing and mitigating impacts to the resources and values of the NRA.

In accordance with National Park Service (NPS) regulations and policies regarding implementation of the National Environmental Policy Act (NEPA), the NPS would decide whether or not to authorize the proposed action. The Superintendent, North Cascades National Park Service Complex (NOCA), would be the recommending official. The Regional Director, NPS Pacific West Region, would be the deciding official.

1.4. Project Area

The proposed project is located within the NRA on lands owned by the United States and administered by the NPS. The site is also within the jurisdictional boundaries of FERC for



Skagit Hydroelectric Project
Ross Rockslide Stabilization Project
Figure 1: Project Area Map

Imagery: USGS/ESRI

1 in = 1 mile

0 0.25 0.5 1 1.5 2 Miles

power production for the Skagit River Hydroelectric Project (FERC Project 553; Figure 1). Located in Whatcom County, Washington, the proposed project is at the northeast end of Diablo Lake (one of three reservoirs that comprise the Skagit River Hydroelectric Project) near Ross Dam and approximately ¼-mile downstream of Ross Powerhouse. The nearest town is Diablo, which is 3.5 miles southwest of the project area.

Diablo is a town owned by SCL, and consists of administrative and housing facilities for SCL personnel. Diablo is alongside of Gorge Lake, which is the next reservoir downstream of Diablo Lake. The North Cascades Scenic Highway (State Route 20) crosses the Skagit River between Diablo and Gorge Lakes. The geographical location of the proposed project site is in the southwest ¼ of the southeast ¼ of Section 35, Township 38 North, Range 13 East.

Figure 2. View of the project area with debris from March 2010 rockslide.

Lands within the project area are entirely owned by the NPS. Existing land uses within the project area includes SCL operations and maintenance, recreation, and NPS administration (see Chapter 3.2 for further information on recreation and visitor use). Specific uses in the project area are limited to the delivery of SCL staff, equipment, vehicles, and supplies via boat for SCL operations and maintenance activities at Ross Powerhouse. Transmission lines (240kV) are directly overhead and transmission towers are present in the vicinity.

The project area is riverine with steep to nearly vertical rocky shorelines and forests at the top of the rock cliffs. Elevations range from 1,205 ft along the Skagit River to approximately 1,600 ft at the top of the cliff proposed to be blasted. Bathymetric data indicate that the reservoir in the project area is between 40 and 55 ft deep.

The sides and bottom of the reservoir in the project area consist of a large accumulation of bedrock and rock debris from a rockslide that occurred in March 2010 (Figure 2). The biological, visual, and recreational characteristics of the project area are discussed in detail in Chapter 3.

1.5. Background

Ross dam and powerhouse are in a remote location and access is primarily by boat, although it is also possible to hike into the area via a trail from a parking lot off State Route 20. To reach the powerhouse SCL personnel travel about 3 miles via boat from the SCL boathouse near Diablo Dam, to a boathouse near the powerhouse. Two barge landings (100- and 80- ton), located several hundred ft south of the powerhouse, are used to deliver SCL equipment, materials, and vehicles needed for operations. The Ross Haul Road (also known as the "Jeep Road") provides the only vehicle access between the powerhouse and dam.

On March 14, 2010 an estimated 16,000 cubic yards (CY) of rock and debris slid from a steep rock cliff along the east side of Diablo Lake downstream of Ross Powerhouse. This event, and subsequent smaller landslide events, buried or damaged several SCL and NPS facilities including the following:

- a section of the Ross Lake Haul Road, which provides the only vehicle access between the powerhouse and dam;
- a 100-ton barge landing that also served as the East Diablo Ferry Landing for NRA visitors and Ross Lake Resort guests;
- an 80-ton barge landing;
- NPS Floating Dock, which is used by recreational boaters; and
- NPS small boat landing area (see Appendix 1 for photos).

Following the March 2010 rockslide, SCL began stabilization activities as soon as it was safe to do so. Work proceeded under emergency authorization from the NPS and a permit issued by the Army Corps of Engineers (ACOE) on May 11, 2010. Early actions involved developing an Excavation Access Road to the top of the rock face; establishing a staging area; performing rock bolting and scaling; and removing 101 trees.

In spite of these actions the unstable rock cliffs above the docking area remain a hazard to both SCL personnel and NRA visitors. Studies by SCL indicate that a new tension crack has formed in the headscarp where the March 2010 rockslide occurred, and there is on-going displacement of the slope within its boundaries. Rockfall continues to occur, and poses ongoing safety hazards to employees and visitors. To improve dam operations and safety, rock scaling, blasting, and bolting are necessary to stabilize the slopes (Landslide Technology, 2011). After stabilization, the Ross Haul Road would be re-constructed along with new 80 and 100-ton barge landings.

In the present state, the safety of SCL personnel at the powerhouse is compromised if there was a need to evacuate the site quickly. The Ross Haul Road is integral to the SCL's Emergency Action Plan and serves as the only route to higher ground in case of dam failure. Traveling by boat from the powerhouse to the ferry landing and then walking upslope several hundred feet to a vehicle not only increases travel time to a designated safe area, but also places SCL personnel in the immediate path of danger (i.e., the Skagit River during flood stage).

The additional travel time between the powerhouse and the dam would also slow the response of powerhouse operators, who need to be stationed on the dam under high flow conditions. Delays could result in higher flood flows downstream, which would adversely affect communities and landowners. Further, there is no road connection between the existing temporary 100-ton barge landing and the dam, so deliveries to the dam are limited to the 80-ton barge landing, which is inadequate for very large equipment that occasionally will be needed to service the hydroelectric facility.

Aside from actions to operate and maintain hydroelectric facilities, SCL is also responsible for providing certain recreational amenities, including ferry service on Diablo Lake per Chapter 3.3.3. of the 1991 Settlement Agreement on Recreation and Aesthetics and License Article 412. To reestablish temporary recreational access, SCL entered into a Memorandum of Understanding with the NPS, and relocated and reconstructed the East Diablo Ferry Landing to a site

downstream of the slide area. The NPS developed a trail connecting the East Diablo Ferry Landing to the Ross Service Road and relocated their floating dock to a site adjacent to the new Ferry Landing. These projects were authorized under a Hydraulic Project Approval (HPA) permit issued by the Washington Department of Fish and Wildlife (WDFW) on May 26, 2010. A temporary landing for the 100-ton barge and an associated access road were constructed in November 2010 to allow for delivery of equipment and materials to Ross Powerhouse until the section of the Ross Haul Road across the slide area could be rebuilt. Permits authorizing this work were issued on October 22 and 28, 2010 by the WDFW and ACOE, respectively. The HPA requires removal of the temporary access road and temporary barge landing.

Although recreational access has been temporarily restored, administrative access necessary for SCL utility operations, maintenance, and emergency response has not. Currently, the only access from the powerhouse to the dam involves traveling by boat from the powerhouse, docking at the new East Diablo Ferry Landing, walking upslope several hundred feet to a vehicle, and then driving up to the dam via the Ross Haul Road. This adds at least 20 minutes of travel time compared to driving directly from the powerhouse to the dam.

1.6. Issues to be Studied in Detail

Issue statements in NEPA documents prepared by the NPS are used to describe the relationship between the proposed action and an environmental resource or human value likely to be affected. Issues are usually problems that either the "No Action" alternative has caused, or that any of the "action" alternatives might cause. Issues may be questions, concerns, or problems, including beneficial ones. Issues do not predict the degree or intensity of harm (or benefit) the action might cause. Rather, they simply alert the reader as to what the environmental problems might be if action is taken.

Issues and concerns that are considered in detail in this Environmental Assessment (EA) were identified by NPS staff and from public and agency comments received by SCL in the course of permitting and agency consultations (refer to Chapter 5 for consultation and coordination details). The following issues were identified:

- *Impacts to Water Quality.* The proposed action would result in a temporary increase in turbidity due to the discharge of blasted material into Diablo Lake and construction work along the shoreline. These issues are addressed in the Environmental Consequences section under Water Resources.
- *Impacts to Fish and Wildlife.* The proposed action would result in the discharge of blasted material into Diablo Lake and requires work along the shoreline which could impact bull trout habitat, which is a federally threatened species. Blasting and construction could result in temporary noise disturbance to wildlife and some loss of habitat in the immediate vicinity of the proposed project area. These concerns are addressed in the Environmental Consequences section entitled: Fish and Wildlife, Including Rare/Listed Species.
- *Impacts to Vegetation.* The proposed action would require additional removal of vegetation in order to provide access for blasting and scaling activities. Vegetation would also be impacted during scaling and blasting, and some landforms that presently support vegetation would be permanently removed. Following blasting and scaling, the area would be rehabilitated, and an offsite location at Reflector Bar would

be restored to offset the impacts of this action. These issues are addressed in the Environmental Consequences section entitled: Vegetation

- *Impacts to Recreation/Visitor Use*. During blasting and other construction activities, adjacent areas that provide access to the southern end of Ross Lake would be closed temporarily, which may inconvenience some visitors. Noise from blasting and construction activities may also temporarily disturb visitors recreating in the vicinity. These concerns are addressed in the Recreation/Visitor Use impact section.
- *Impacts to Hydroelectric Operations and SCL Personnel safety*. Destruction of the Ross Haul Road by the March 2010 rockslide has substantially limited emergency evacuation access for SCL personnel. The powerhouse is located within a canyon along the Skagit River, and the Ross Haul Road provides the only route to safety in case of dam failure. This route is part of the SCL's Emergency Action Plan for the Skagit Hydroelectric Project, which is a requirement by FERC. At present, the Ross Haul Road is blocked near the powerhouse, so during an emergency, personnel would have to take a boat from the powerhouse, navigate around the slide area, land at the East Diablo Ferry Landing, and then walk upslope several hundred feet to a vehicle. This substantially increases travel time, and requires transit on the Skagit River during flood stage. The extra travel time between the powerhouse and dam also reduces the ability for powerhouse operators to respond to an emergency, which increases the possibility of higher flood flows downstream. In addition to personnel access issues, SCL cannot currently transport heavy equipment or parts requiring the docking mechanisms associated with the former 100-ton barge landing, and if another rockslide occurred and destroyed the limited access that is available now, SCL would be unable to transport any heavy equipment or supplies. Negative consequences would include a loss of power supply to the Seattle area.

1.6.1. Issues Considered but Dismissed

The following issues identified during public scoping have been dismissed by the NPS as relevant to the impact analysis for the proposed project:

- *Cultural resources*. There are three structures near the project site that are listed in the National Historic Register: Ross Dam, Ross Powerhouse, and the Diablo Lake Suspension Bridge (aka NPS suspension bridge, Ross Dam Trail Bridge, and Ross Lake Suspension Bridge) that links the Diablo Lake Trail to the Ross Dam Haul Road and the trails accessing Ross Lake. These structures are approximately 2,300, 1,000, and 500 ft from the project site, respectively. Due to the distance from proposed project activities, and their location well above the full pool elevation of the reservoir, impacts to these structures are not anticipated from rockfall or large waves that may be generated from rockfall into the water. The project site is also not visible from any of these structures to detract from the historical value. Further, surveys were conducted by NPS staff and there were no known landmarks, or evidence of historic, archaeological, scientific, or culturally important sites in or adjacent to the project area. As part of the Skagit Project License, SCL entered into a Memorandum of Agreement with the NPS, Department of Archeology and Historic Preservation (DAHP), the Upper Skagit Indian Tribe, Sauk Suiattle Tribe, Swinomish Tribe and

Nlaka'pamux Nation; all Parties to the MOA were notified of the project via letter transmittal on July 11, 2011 and no concerns were identified.

- *Air quality*. Air quality in the Ross Lake NRA is currently affected by NPS and SCL operations, maintenance, and administrative activities, as well as visitor and recreational use. These include emissions from vehicles, campfires, and motorized boats. A variety of atmospheric pollutants are also received from urban and rural sources as close by as the Puget Sound Lowlands and from as far away Asia. Visibility monitoring in the NRA over the last six years reflects "stable or improving visibility", both on clear days and hazy days (NPS, 2011). Pertinent to this project, blasting and construction may temporarily create locally dusty conditions and release pollutants such as particulate matter, carbon monoxide and carbon dioxide (a greenhouse gas). However, air quality concerns have been dismissed because impacts to air quality would be temporary and barely detectable beyond the immediate construction area, which would be closed to visitors.
- *Socioeconomics*. Broadly speaking, socioeconomic effects include such things as patterns of consumption, the distribution of incomes and wealth, the way in which people behave (both in terms of purchase decisions and the way in which they choose to spend their time), and the overall quality of life. There may be minor disruptions to visitor access during blasting activities but these would not disrupt patterns of consumption, distribution of incomes and wealth, or patterns in behavior. Impacts to visitors would be temporary, and are addressed in the Recreation and Visitor Use impact section of this EA.

1.7. Laws, Regulations and Policies and Administrative Procedures Guiding this Decision

1.7.1. Introduction

This section identifies legal, regulatory, policy and administrative procedures relevant to this decision. These regulations and policies require the NPS to formally evaluate projects on NPS-managed lands.

1.7.2. National Park Service Organic Act

The Organic Act of 1916 established the NPS and provided the means for the NPS to promote and regulate national parks, monuments, and other reservations. As such, the NPS is required by the Organic Act to protect and preserve unimpaired the resources and values of the National Park System, while providing for public use and enjoyment. The Organic Act provides the fundamental management direction for all units of the National Park System.

1.7.3. Federal Power Act

The Federal Power Act (FPA) created FERC (referred to as the Federal Power Commission in the original FPA) as the licensing authority for hydroelectric projects and interstate electrical transmission, among other responsibilities. Under authority of the the FPA, FERC in 1995 issued a 30-year license for the Skagit River Hydroelectric Project. The 30-year timeframe reflected the importance of the power provided by the project, and the expectation that this power source would continue to support the City of Seattle.

Section 4(e) of the Federal Power Act, 16 U.S. C. § 797(e), requires that licenses for projects located within United States (U.S.) reservations must include all conditions the Secretary of the department under whose supervision the reservation falls shall deem necessary for the adequate protection and utilization of such reservation. In this instance, the Skagit River Project lies within Ross Lake National Recreation Area, which is a reservation under the FPA. During the relicensing process, the NPS affirmed all issues from relicensing the Project, *as currently constructed* (emphasis added), were satisfactorily resolved. At that time the haul road from Ross Powerhouse to the top of the dam existed to provide emergency egress and operational access, and was envisioned to continue to exist to provide these critical and required needs. However, this project was not proposed or considered at the time of relicensing.

This EA is intended to document and disclose the effects of this proposed action in order to comply with the National Environmental Policy Act, the Federal Power Act, and the Enabling Legislation for Ross Lake National Recreation Area.

1.7.4. Enabling Legislation for the Ross Lake National Recreation Area

Title 2, Ross Lake and Lake Chelan National Recreation Areas, provides:

> "…In order to provide for the public outdoor recreation use and enjoyment of portions of the Skagit River and Ross, Diablo, and Gorge Lakes, together with the surrounding lands, and for the conservation of the scenic, scientific, historic, and other values contributing to public enjoyment of such lands and waters, there is hereby established, subject to valid existing rights, the Ross Lake National Recreation Area."

Title 5, Special Provisions, includes:

> "…Nothing in this Act would be construed to superseded, repeal, modify, or impair the jurisdiction of the Federal Power Commission under the Federal Power Act (41 Stat. 1063), as amended (16 U.S.C. 791a et seq.), in the recreation areas."

1.7.5. Public Law 90-544. Sec.505 as amended by Public Law 100-668. Sec. 202 (November 16, 1988)

FERC maintains jurisdiction for power production purposes over the lands and waters within the Skagit River Hydroelectric Project, FERC Project 553, and the Newhalem Project, FERC Project 2705 within the Ross Lake National Recreation Area; and existing hydrologic monitoring stations necessary for the proper operation of the hydroelectric projects listed herein.

1.7.6. Clean Water Act

The Clean Water Act (CWA) is a national policy to restore and maintain the chemical, physical, and biological integrity of waters of the United States; to enhance the quality of water resources; and to prevent, control, and abate water pollution. Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the U.S. Section 404 of the CWA applies to this project because it would involve the discharge of fill material into the Skagit River as a result of blasting and reconstruction of the roadway and barge landings. Section 404 Nationwide Permits (NWPs) 3 and 14 would be required from the ACOE. Section 401 Water Quality Certifications (Certifications) are also required for any federal permit that involves discharges into navigable waters. Certifications may be conditionally certified per the General Conditions of the NWP. Section 402 of the CWA regulates the point and nonpoint source discharge of

pollutants into waters of the U.S. under the National Pollutant Discharge Elimination System (NPDES). If construction activities disturb over one acre of land, an Environmental Protection Agency (EPA) NPDES Construction Stormwater General Permit would be required because the project is on federal land, and a Stormwater Pollution Prevention Plan (SWPPP) would need to be developed.

1.7.7. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) precludes all federal agencies, including the National Park Service, from authorizing, funding, or carrying out any activity that may jeopardize the continued existence of an ESA-listed species.

National Park Service Management Policies

The NPS Management Policies (2006) provides the basic policies of the NPS for managing the national park system. The policies were created to promote the following:

- Compliance with current laws, regulations and executive orders;
- Prevention of impairment of park resources and values;
- Conservation when there is a conflict between the protection of resources and their use;
- Maintenance of NPS responsibility for making decisions and for exercising key authorities;
- Implementation of consultation and cooperation with local/state/tribal/federal entities;
- Pursuance of the best contemporary business practices and sustainability;
- Consistency across the system —"one national park system";
- Reflection of NPS goals and a commitment to cooperative conservation and civic engagement;
- Employment of a tone that leaves no room for misunderstanding the National Park Service's commitment to the public's appropriate use and enjoyment, including education and interpretation, of park resources, while preventing unacceptable impacts; and
- Passage to future generations natural, cultural, and physical resources that meet desired conditions better than they do today, along with improved opportunities for enjoyment.

Relevant to the project, these policies provide for biological resources; scenic resources; water resources; soundscape; geologic resources; visitor use; and recreation.

1.7.8. National Park Service Director's Orders

Director's Order #40: Dam Safety & Security Program

The policies and procedures contained within Director's Order #40 are applicable to all parks and regions that have jurisdiction for dams within their boundaries, or have park resources that could be impacted by non-NPS owned dams inside and outside of park boundaries. This Order states that the NPS has a responsibility to minimize this risk through actions to improve the safety of its dams, remove unnecessary dams, and conduct emergency planning to prevent catastrophic losses in case of dam failure.

Director's Order #47: Soundscape Preservation and Noise Management

The Sound Preservation and Noise Management Director's Order provides for the protection, maintenance, or restoration of the natural soundscape resource and to maintain a condition unimpaired by inappropriate or excessive noise.

Director's Order #65: Explosives Use and Blasting Safety

This Director's Order sets forth the policy and required procedures governing blasting operations within the NPS to ensure a safe workplace and safe work practices. Applicability includes all blasting operations conducted within the boundaries of the NPS, whether conducted by NPS or other Federal personnel, commercial contractors, or others (including utility companies). This Director's Order includes requirements for explosives use, handling, training, and certifications, and describes the responsibilities of various individuals within the NPS during blasting activities.

1.7.9. Ross Lake National Recreation Area Final General Management Plan

The purpose of the 2011 Ross Lake National Recreation Area General Management Plan (GMP) is to articulate a vision and management strategy for Ross Lake NRA over the next 15 to 20 years. The GMP presents management strategies for resource protection and preservation, education and interpretation, visitor use and facilities, land protection and boundaries, and long-term operations and management of Ross Lake NRA. The GMP assigns management zones to different areas of Ross Lake NRA. For each of the management zones, there are specific management goals and objectives for resource management, levels of development, and different types of potential visitors' experiences. The proposed project area lies within the Hydroelectric Zone, in which SCL operations are paramount to resource conditions and visitor experience. Most visitor experiences are linked to learning about hydroelectricity and front-country recreational activities. Most areas within the Hydroelectric Zone will be managed primarily for SCL operations. Applicable management prescriptions for the Hydroelectric Zone include:

- *Natural Resource Conditions.* Wildlife habitat, vegetation, and ecological processes could be altered to achieve other management objectives. While natural resources are not a primary management emphasis, impacts from alterations will be minimized to protect resources and values, and restoration efforts would occur whenever possible. Also, light and human-caused sounds are a common part of the environment. The NPS continues to work with SCL to reduce light and human-caused sounds where possible.
- *Visitor Experience and Use.* Seattle City Light would provide and maintain most of the visitor services in the Hydroelectric Zone. Most visitor experiences would be linked to learning about hydroelectricity and front country recreational activities. Seattle City Light would continue to provide for the visitors services stipulated in the Settlement Agreement and FERC license.
- *Facilities and Access.* A range of facilities and infrastructure accommodate SCL operations and visitor services for both daytime and overnight use. Although not specifically cited in the GMP, appropriate facilities that are necessary for continued SCL operations and visitors services in the Hydroelectric Zone include boat docks

and limited access roads. Public access is available in many areas, but certain areas are restricted for SCL operations.

1.7.10. Recreation and Aesthetics Settlement Agreement

The Recreation and Aesthetics Settlement Agreement was entered in 1991 between SCL and the NPS, in addition to other parties. The Settlement Agreement establishes the Skagit Project Recreation Plan and describes the continuing, mitigative, and enhancement measures that SCL either funds or implements. These measures take the form of recreational facility operation and maintenance, studies, or capital projects. Measures applicable to the proposed project include continuance of the Skagit Tours of the Ross and Diablo hydroelectric facilities, and continuation of the Diablo Lake tugboat/ferry service that provides recreationists access between Diablo and Ross Lakes. This Settlement Agreement also promulgates the Skagit Project Aesthetics (Visual Quality) Mitigation Plan. This Plan describes SCL's mitigation for Skagit hydroelectric facilities improvements; landscaping measures for Newhalem and Diablo; transmission line right-of-ways; and erosion control measures.

1.7.11. Washington State Hydraulic Code

An HPA from the Department of Fish and Wildlife per 75.20 RCW is required for any project that will use, divert, obstruct, or change the natural flow or bed of any fresh or salt water of the state. This includes all construction or other work waterward and over the ordinary high water line, including dry channels, and may include projects landward of the ordinary high water line (e.g., activities outside the ordinary high water line that will directly impact fish life and habitat, falling trees into streams or lakes, etc.).

1.7.12. Shoreline Management Act

The overall goal of the Shoreline Management Act (SMA) is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." The SMA directs each city and county with "shorelines of the state" to prepare and adopt a Shoreline Master Program (SMP). In this case, Whatcom County oversees the SMA. Within the proposed project area, the Skagit River is designated as a "shoreline of the state," and all land within 200 ft from the edge of these waters is protected under the SMA.

1.8. Required Permits and Approvals

1.8.1. Section 404 of the Clean Water Act, ACOE

Authorization to proceed with all phases of the proposed project under a NWP 14 and 3 was provided by the ACOE on September 11, 2011. The authorization noted that the work met the Washington State Department of Ecology's Water Quality Certification and Coastal Zone Management Act requirements.

1.8.2. ESA Section 7 Consultation

ESA Section 7 consultation with USFWS was conducted due to the presence of threatened species in the project area. Thus, a Biological Evaluation (BE) was prepared and submitted to the USFWS. The USFWS concurred that the project would have "no effect" on three species, and "may affect, not likely to adversely effect" on two species. The BE is included as Appendix 2.

1.8.3. Hydraulic Project Authorization, WDFW

WDFW issued an HPA on August 30, 2011 that authorized the blasting/rockslide management portion of the proposed project. Because the proposed road would traverse the fallen rock debris, the final configuration of the road and barge landings cannot be designed until after blasting activities have occurred. Following road design, an additional HPA would be obtained to authorize the latter phases of the project (i.e., reconstructing the barge landings and road).

1.8.4. Shoreline Management Act, Whatcom County

Blasting, scaling, and bolting are outside of Whatcom County's jurisdiction. A Shoreline Development/Conditional Use Permit would be required for reconstruction of the road and barge landings. An application was submitted on June 17, 2011 describing further phases. As part of the Substantial Development permit authorization process for Whatcom County, it is anticipated that a public hearing would be scheduled no later than summer 2012. Road and barge construction would not occur until the Shoreline Development/Conditional Use Permit was obtained.

1.8.5. Construction Stormwater General Permit, EPA

Construction activities associated with the proposed project would disturb over one acre of federal land, so work must be conducted under an EPA NPDES Construction Stormwater General Permit. Therefore, a Notice of Intent would be filed with the EPA at least seven days prior to construction, and a SWPPP would be developed and implemented.

1.8.6. State Environmental Policy Act

SCL issued a State Environmental Policy Act (SEPA) Determination of Significance (DNS), Legal Notice, and environmental checklist for public review and comment on July 15, 2011. The checklist described the various project phases. No comments were received by SCL pursuant to the public notice.

Chapter 2. Management Alternatives

2.1. Alternative A. No Action - Continue Current Hydroelectric Operations

In the No Action alternative, the NPS would not authorize blasting or further rock scaling, bolting and reconstruction of the facilities that were destroyed by the rockslide. The existing facilities would remain unchanged and would be managed and maintained in their present configuration with routine maintenance. Use of the 80-ton barge landing would remain the same, but SCL would be unable to transport supplies and equipment requiring use of the 100-ton barge to the powerhouse and dam. Use of the temporary access road could not continue because the HPA requires removal of the temporary access road and temporary barge landing after two years. Thus, another HPA would be required, and it is unlikely that WDFW would issue a long-term permit for this temporary facility. If WDFW did issue a permit for the long-term use of the temporary barge landing and road, access could be lost in the future by further rock fall.

As a result of Alternative A, if an emergency evacuation was necessary, SCL powerhouse personnel would have to travel by boat to the new floating dock possibly in flood stage waters, then walk to a vehicle, and drive to a designated safe area. Alternatively, personnel could (a) traverse the

base of the rock slide on foot, then access a vehicle on the Ross Haul Road on the opposite side of the rockslide; or (b) cross the Diablo Lake suspension bridge and hike uphill toward high ground. However, all of these options are substantially slower escape routes than a functional Ross Haul Road. Because these are all inefficient evacuation routes, SCL would remain non-compliant with the Emergency Action Plan required by FERC.

Additionally, powerhouse operators would continue to use this same slower route to access the dam, extending the travel time significantly, thereby reducing the operator's ability to expeditiously respond to emergencies.

The cliffs above the former docking station would remain unstable, and it is likely that further rockslides would occur. The area would remain unusable to recreational boaters since the beach is no longer present, and a kayak/canoe/boat landing is not viable due to the large amount of rock debris in the area. Unstable cliffs would continue to pose safety risk to NRA visitors. The connection between the Diablo Lake Trail and Ross Lake that traversed this area prior to 2010 would remain closed at the west end of the suspension bridge. The Skagit Tours would continue according to the present-day schedule, and although for safety reasons, the boat would turn around in the vicinity of the new East Diablo Ferry Landing and there would be no views of the dam or powerhouse as there were before the rockslide.

The No Action Alternative also includes the emergency actions conducted to date to temporarily stabilize the slope and preliminarily ameliorate the effects of the March 2010 rockslide. These initial activities included: rock scaling and bolting, as well as logging on the margins of the slide slope to allow equipment access to perform this work; removal of the East Diablo Ferry Landing and the NPS floating dock from the base of the slide; and building a temporary landing on the upstream side of the slide to allow equipment and supply access to the powerhouse.

2.2. Alternative B. Ross Powerhouse Rockslide Stabilization

Alternative B, the proposed action, would involve stabilizing the rock cliff above Ross Haul Road, replacing the road and barge landings damaged by the March 2010 rockslide, and restoring the areas impacted by stabilization and construction activities. This alternative would consist of 4 major phases:

> *I. Blasting/Rockslide Stabilization.* Conduct blasting and stabilization operations (scaling and bolting) to manage unstable rock above the Ross Haul Road. The purpose of these operations is to (a) improve safety conditions for SCL personnel, NPS personnel, and recreational visitors; and (b) provide conditions necessary to design and construct the permanent replacement structures (i.e. road and barge landings).
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> *II. Ross Haul Road Reconstruction.* Re-establish vehicular access between the dam and powerhouse by (a) designing and constructing a temporary road across the slide area to provide an emergency evacuation route as required by the Skagit River Project Emergency Action Plan; (b) designing and constructing a permanent road.
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> *III. Barge Landing Reconstruction.* Replace the destroyed 100-ton barge landing with a new landing that will accommodate both the 80- and 100-ton barges. The new landing would require alignment with the new road.
>
> *IV. Final Site Restoration.* Develop and implement restoration plans in consultation with the NPS, ACOE, WDFW and Whatcom County.

2.2.1. Blasting/Rockslide Stabilization

The Excavation Access Road would be constructed to access the blasting area, and would stem from the top portion of the Ross Haul Road (Drawings D-46668 and D-46669 in Appendix 3). To the extent practicable, the Excavation Access Road would be constructed primarily over previously disturbed ground, using a portion of the alignment of the previous Upper Access Road used for initial rock stabilization work in 2010. However, about 1 acre of additional area would be impacted as the road would need to be extended after each blast to reach the next blast area.

Upper staging areas would be established on either side of the Excavation Access Road near the blasting area. One stockpiling location would be located at the top of the Ross Haul Road near the dam, within an area currently used for equipment and supply storage. A portable office trailer for the construction phase would be placed at the side of the Ross Haul Road near the junction with the Upper Access Road. Two other equipment staging areas would also be located below the rock scarp, one on either side of the rock debris pile. Both of these lower staging areas are in locations that are relatively disturbed (Drawing D-46667 in Appendix 3).

Prior to construction, trees within the construction limits would be flagged by SCL biologists for removal. Smaller diameter trees would be stockpiled on site and used for area rehabilitation. Lager diameter trees would be removed from the area and used by the NPS for administrative purposes. Construction fencing would be installed to clearly delineate the staging areas, blast/construction zones, and Excavation Access Road excavation area in order to confine the construction limits. Vegetation would be cleared within the construction zone and then the Excavation Access Road would be excavated. To the extent possible, vegetation and topsoil would be salvaged and used to rehabilitate the area after blasting and completion of scaling. The Excavation Access Road would range between 250 ft long, and 16 ft wide at the bottom of the rock cur (Drawings D-46668 and D-46669 in Appendix 3).

Blasting

The area to be blasted includes Area 3 (Drawings D-46668 and D-46669 in Appendix 3, and Figure 3). The designated Blast Control Specialist (BCS) would initially lay out the location, depth and diameter of holes to be drilled to achieve the targeted blast excavation area. Each blast event would be analyzed separately by the Blast Consultant.

Figure 3. Red and yellow areas display Area 3 that would be blasted. The area that is colored brown was under evaluation but would not be blasted as part of the proposed action.

Pre-split lines would be marked by the BCS to define the margins of the blast. A pre-split line is used to control overbreak of rock adjacent to the targeted blast areas and to create a uniform back slope subsequent to blasting and excavation. The line of pre-split holes would be drilled at approximately 2.5-ft centers. An array of production holes would be drilled within the arc of the pre-split line, at approximately 9-ft centers. These holes would be approximately 30 ft deep (range 8-50 ft). Explosives would then be packed into the pre-split and production bore holes. The detonator line numbers represent the detonation delays at each hole, which ranges from about 5-15 milliseconds. The detonation delays are set to direct shot rock away from SCL transmission lines, which are located below the blast area, and to assist with controlling noise levels.

Blasting would begin at the top of the scarp and progress downward in layers or "lifts". Removing the entire rock scarp is expected to require up to 8 blast lifts which would occur at 1 - 2 week intervals over a period of 3 to 4 months. Each lift would be up to 30 ft deep. Each blast would be evaluated, documented and subsequent blasts adjusted by the BCS. Only one blast lift would be detonated on any given day and blast lifts would not be detonated on consecutive days.

The blasts are designed to break rock into blocks less than 5 ft square; however, blocks up to 25 ft are possible. A range of grain sizes, from clay-sized particles to large boulders, would be produced. The majority of the excavated material is expected to be cobble- to boulder-size (less than 5 ft square) with a relatively small percentage of clay- to sand-size material. Rock material

generated by each blast would be excavated and pushed over the sides of the talus bowl into the rockslide debris pile below the cliffs. Access to the talus bowl by equipment and crews would be via the Excavation Access Road. However, if access to the talus bowl from the Excavation Access Road cannot be maintained because of unsafe conditions, crews would use the "downstream gully" on the west end of the site (Drawings D-46668 and D-46669 in Appendix 3). This area would only be used if necessary and no trees would be removed from the gully prior to making this determination. If it is necessary to use the gully, the area would be surveyed by a SCL ecologist who would mark any trees that need to be removed and flag construction zone limits.

An estimated total of 27,500 CY of blasted material is expected. Of the total 27,500 CY of material, an estimated 3,900 CY may be incidentally discharged into Diablo Lake. Past and future scaling activities may have generated an estimated total of 8,200 CY of rock, with about 200 CY of that amount incidentally entering the lake. Blasted rock that falls into Diablo Lake and blocks water access to the remaining barge landings would be removed from the lake using a hydraulic excavator. The excavator would work from the barge landing or from a barge and would not be positioned in the water. The lake elevation may be drawn down to facilitate this action.

The construction time period is proposed for July through October 2013. Equipment used for blast preparation and excavation would include:

- Tracked drill rig, such as an Ingersoll-Rand Hydraulic Air-Trac drill in conjunction with a 600 cfm (cubic ft per minute) compressor
- Caterpillar 320 hydraulic excavator
- "Spider excavator" (hydraulic excavator with articulating front legs) to reach more inaccessible spots and to clear shot rock
- Hand tools may be required to reach areas inaccessible to mechanized equipment.

Explosives and Detonation

Explosives such as ammonium nitrate with fuel oil (ANFO) would be the primary explosive agent for the blasting. Detonation materials include blast detonation cord, non-electric and delay electric caps. Explosive materials would be handled and detonated per manufacturer's recommendations and under the supervision of the Blaster-in-Charge.

Explosive materials would be delivered to the site by barge in a U.S. Department of Transportation (USDOT) -certified truck by the explosive supplier. A more detailed description of explosive transportation and handling is provided below. If significant fracturing, large voids, and/or wet conditions are encountered in the drill holes, the explosives such as WR ANFO cartridges would be utilized. In addition, decking (i.e. placement of stemming material or an air gap at specific locations within a drill hole to bypass potentially problematic zones) may be used to increase blast effectiveness.

Explosive Weight

Approximately 85 lbs of explosive is planned per drill hole. The explosive weight of ANFO is approximately 0.30 pound/foot. The plan for each blast event would be adjusted according to encountered subsurface conditions and performance of prior blast events. Factors that contribute to a blast design include dimensions (i.e. length, width, and thickness) of the targeted excavation

area, geologic conditions such as: rock type, degree of fracturing, number of encountered voids, location of structures, and allowable vibration limits among others. If a wet environment is encountered, WR ANFO cartridges would be used. Blasting would not occur in severe water or if standing water conditions are encountered.

Ground Vibration

Vibrations that leave the blast area through the ground are known as ground vibration (as measured by particle velocity [inches/sec]). Magnitude of vibrations is dependent upon the amount of explosive detonated at any one time. Research by U. S. Bureau of Mines (USBM) shows that detonations > 8 milliseconds apart do not result in additive vibration impacts (NPS, 1999). ANFO is characteristically a low frequency implosion; low frequency sounds travel much farther in most rock and therefore have the potential for greater vibration effect (L. Magnoni, Washington State Department of Transportation [WSDOT], pers. comm.).

The BCS would measure ground vibrations using a seismograph to record longitudinal (horizontal), transverse (perpendicular to longitudinal) and vertical (up and down direction perpendicular to longitudinal) components. Peak particle velocity for the blast would be limited to 2.0 inches/second when the ground vibration frequency limit is ≥40 Hz and to 0.75 inches/second when the frequency is <40 Hz. If during blasting, peak particle velocities exceed 2.0 inches/second, blasting operations would cease immediately. Particle velocities less than 2.0 inches per second show little probability of causing structural damage (NPS, 1999).

Noise and Air Overpressure

Vibrations leaving the blast area through the air are known as air overpressure or noise. Factors such as cloud cover may affect air pressure, which is measured in pounds per square inch (psi) and reported in decibels (dB). It is caused by three factors: (1) an air pressure pulse which is the displacement of air by the moving mass of shot rock; (2) rock pressure pulse which is the vibrating ground at some distance from the blast; and (3) gas release pulse which is the venting of gas at the blast hole due to improper confinement. Because of the large amount of low frequency sound component in blasting the sound level is typically weighted in the C-weighted scale rather than A weighted scale. However, A-weighted levels are generally used to evaluate impacts on humans.

Noise generated from blasting depends on the distance, size of charges, delays between the charges, depth of the changes, and thickness of stemming used (i.e. sand or gavel backfill in the drill holes). Decking (i.e. placement of stemming material or an air gap at specific locations within a drill hole to bypass potentially problematic zones) would be used to increase blast effectiveness and reduce noise levels. Each blast would be subdivided into many smaller blasts, separated by a few milliseconds to reduce noise impacts.

Based on the weight of ANFO proposed by the contractor, sound levels from the blast at the rockslide site are expected to vary from 115 to 150 dB at 10 ft (L. Magnoni, WSDOT, pers. comm.). However, if noise levels measured from any one blast event exceed 130 dBL at 10 ft, adjustments would be made to subsequent blast plans. Noise would be measured during each blasting event at a designated location approximately 200 ft south of the Ross Powerhouse.

Decibel levels associated with blasting and construction equipment are presented in Table 1 below.

Table 1. Estimated sound levels for blasting and equipment types for the Ross Powerhouse Rockslide Stabilization and Facilities Replacement Project

Phase	Equipment Type	Measured Average Maximum Sound Level (dBA) at 50 ft[1,2]
I	Blasting	130 dBA at 10 ft
I	Warning Horn	83
I, II	Rock Drill (i.e. Joy Air-Trac)	81
I, II	Air Compressor (i.e. Ingersoll-Rand Hydraulic 900 CFM)	78
I, II, III	Excavator (i.e. Caterpillar 320, 330, spider)	81
I	Chain saw	84
I, II, III	Generator	81
II, III	Bulldozer (i.e. Caterpillar D6)	82
II, III	Dump truck (i.e. Peterbuilt 10 CY)	76
II, III	Compactor	83
II, III	Front end loader (i.e. Caterpillar 938)	79
III	Concrete mixer	79

[1] WSDOT 2011
[2] Except where noted.

Topography and vegetation serve to dampen noise levels more than flat, hard surfaces such as concrete, rock, and water. While the project site itself consists of bare rock, the surface area of adjacent water is small (the reservoir is only about 200 ft wide) and most of the surrounding area is forested and steeply sloped. These features are expected to provide a dampening effect of 7.5 dB per doubling distance from the noise source (WSDOT, 2011). Using this dampening factor, noise from the blast will attenuate to the ambient level (46 dBA) at 4.3 miles from the project site; equipment noise will attenuate to ambient levels at about 1,990 ft (see Biological Evaluation in Appendix 2 for calculations).

The 46 dBA threshold was chosen because as part of the Natural Sounds Program, the NPS measured this noise level in the vicinity of the Gorge Powerhouse. Like the proposed project area, noise sources at the Gorge Powerhouse include the nearby powerhouse, traffic from SR 20, and flowing water (NPS, 2009).

Rock Drilling

Drilling is likely to occur daily for up to 8 hours per day to prepare the site for each blast event. Noise levels from rock drills range from about 82 to 97 dBA. The Ingersoll-Rand Hydraulic Air-Trac (ECM 660) rock drill, which may be one of the drills used for blast hole drilling at the Ross rockslide site, has an estimated noise level of 83 dBA (Pratt and Sons, 2012).

Miscellaneous Rock Scaling

Approximately three boulders would be scaled in Area 6. These boulders were identified by blast consultants to be precarious and could create hazards to visitors or SCL personnel below on the Ross Haul Road.

Transportation and Handling of Explosive Materials.

Transportation of explosives would be in accordance with U.S. Department of Transportation Hazardous Materials Transportation Regulations (49 CFR 171-180) and Washington State Department of Labor and Industries *Safety Standards for the Possession and Handling of Explosives*, Washington Administrative Code (WAC) 296-52, part D.

The explosive supplier would transport the products to and from the jobsite. The products would arrive on the day of the blast via SCL barge and leave the same day. Explosive products would not be stored on-site unless stored in an Explosive Magazine that is designed and constructed to meet Title 27 Code of Federal Regulations and Sec.55.11 of the Bureau of Alcohol, Tobacco and Firearm (ATF) Regulations for storage, and IME recommendations.

Explosive materials would be handled, transported. stored, and used per manufacturer's recommendations and in compliance with all applicable regulations, including ATF, Washington Industrial Safety and Health Act (WISHA), the NPS Explosives Manual (1999), and USDOT, under the supervision of a designated BCS. If explosives are stored on-site, the Contractor would use an approved magazine placed at a location that meets all the requirements set forth in Chapter 70.74 RCW.

Explosive materials would be delivered to the site by barge in a USDOT-certified truck by the explosive supplier. Upon arriving at the jobsite, the driver would be the only one with the keys to unlock the doors to the truck. The driver would also guard the vehicle at all times whenever any explosive materials are on board. The BCS would direct the driver as to what products would be needed for the blast. Any unused product that is not immediately placed in the approved magazine for later use would be immediately stored and inventoried and returned to the explosives supplier.

Boat Exclusion Zone

During blasting, boats would be prevented from coming within 1,000 feet of the project area. When blasting was not occurring, boat traffic control would consist of two zones adjacent to the rock slide: A "Boat Passage Zone" and an "Exclusion Zone." The Boat Passage Zone would be set from the west shore of Diablo Lake to approximately 50 ft off shore. The remaining width of Diablo Lake in the area adjacent to the rock slide would comprise the Exclusion Zone. Diablo Lake is approximately 155 ft wide at its narrowest point through this reach. Accordingly, the Exclusion Zone would be a minimum of approximately 105 ft wide. Transit of the Boat Passage Zone or Exclusion Zone by the general public would be prohibited.

Spill and Containment

A spill prevention and containment plan would be developed and implemented. Spill clean up kits would be kept at all staging areas. Explosives would be transported over water by boat in a compatible spill-proof container in accordance with applicable regulations, including ATF, Occupational Safety and Health Administration (OSHA), and USDOT. Explosives would not be used if it is raining or if standing water is present. ANFO would be poured carefully into each bore hole. Small spills around the bore hole would be consumed by the blast. Spill material that

would not be consumed by blast would be cleaned up immediately and placed back into the appropriate container.

Sediment and Erosion Control/Turbidity

A SWPPP would be developed and implemented for the project. In addition to upland sediment and erosion control measures, a sediment curtain would be installed to intercept and mitigate turbidity at the rock fall site. A turbidity monitoring plan would be developed and implemented during each blast event.

2.2.2. Ross Haul Road Reconstruction

Following blasting, scaling, and bolting, a road over the blasted materials would be designed and constructed. Because the design of the road depends on how the rock falls, only conceptual preliminary designs are presented in this EA.

The staging area for temporary and permanent road construction would be identified and flagged on site. Construction of the temporary and permanent roads would not require the removal of any additional vegetation. Construction BMPs would be designed along with the road.

Temporary Road

This task is necessary to re-establish both emergency and operational access between Ross powerhouse, the 80-ton barge landing, and the dam while a permanent road and barge landing are being designed and constructed. The temporary road would be "notched" into the rock debris pile. Since the exact topography of the area would not be known until blasting work is done, the road design provided in this EA (Drawing A-5221 in Appendix 3) reflects a conceptual design; road geometry across the rock debris pile would be finalized and cut/fill quantities would be updated at final design. The temporary road would serve as a rough road bed for the permanent roadway.

The construction zone limits would be marked prior to any ground disturbing activities, and SWPPP measures, best management practices (BMPs), and monitoring equipment (if applicable) would be installed. Construction would begin with breaking up large boulders, located on the landward side of the road, into rocks approximately 6 inch or less in diameter that can be efficiently excavated and filled across the rock slope to form a level road bed. Some boulders would be broken into smaller sizes using Betonamite, a non-explosive expansive grout. Holes for the Betonamite would be drilled using a rock drill powered by an air compressor, such as an Ingersoll-Rand 600.

The temporary road dimensions would measure approximately 14 ft wide and 466 ft long; road grade would be approximately 8%. The portion of the temporary road across the debris pile would be constructed by breaking down large boulders (up to 25 ft in diameter) to smaller sizes of about 6 inches or less. After the boulders are broken down, a hydraulic excavator would be used to form the roadbed. Generally, rock would be excavated from the landward side of the road, and placed on the waterward side. Total estimated cut, including the portion upstream of the rock debris pile, is approximately 1,600 CY. The road would require approximately 1,500 CY fill, of which approximately 1,200 CY may be discharged into the Skagit River (Drawings A-5221 to A-5223 in Appendix 3).

A small amount of excavation would be required (5 CY) and fill (5 CY) below the ordinary high water mark to remove geotextile material and recontour the shoreline in the vicinity of the

temporary barge landing. Any slope stabilization and revegetation work necessary to restore the temporary barge landing area would be conducted per the approved Restoration Plan. The Restoration Plan would be developed during the design process in consultation with the NPS, WDFW, ACOE and Whatcom County (see Final Restoration section below).

Equipment that would used for road construction may include the following, and noise would be similar to that described previously in Table 1:

- Bulldozer
- Rock drills
- Excavator
- Dump trucks
- Front end loader
- Compactor
- Barge
- Rock crusher
- Compressor
- Generator
- Hand tools

Permanent Road

A permanent replacement road across the rock slide would be undertaken after the blasting is complete and a temporary road is installed. Surveys from the post-blast area would be used to develop the permanent road design. Dimensions for the permanent road are expected to be similar to the temporary road, approximately 466 ft long and 16 ft wide. An additional 75 CY of fill would be needed to construct the permanent road. An estimated 60 CY may be discharged incidentally into the Skagit River.

The permanent road would be constructed on approximately the same alignment as the temporary road (Drawings 5221 to A-5223 in Appendix 3). This would be accomplished using fill material to raise the roadway several ft. Raising the roadway would enable widening the road in order to accommodate a protective structure such as ecology blocks on the uphill side to protect from future rock fall, and a mechanically stabilized earth (MSE) wall on the low side to stabilize the road for large loads. The MSE wall would be faced with rock or materials resembling rock in order to blend in with the surrounding environment. Fill material would be loaded into dump trucks using a loader, of which only certified weed free materials would be used, and would be used to raise the roadbed. Native gravel material would be obtained from the rockslide debris pile. A dump truck would deposit crushed rock onto the road in approximately 12 inch layers, a bulldozer would move the crushed rock into position, and a vibratory compactor would compact the materials.

Once the road sub-grade is brought to the appropriate elevation and alignment, a MSE retaining wall would be constructed on the downhill side of the fill, utilizing geotextile fabric. Rock protection measures for the new roadway may include a catchment swale, and/or an ecology block wall (Drawing A-5222 in Appendix 3).

If possible, the MSE wall for the permanent road would be vegetated and/or designed to blend in with the surrounding landscape. The final restoration plan for the permanent road and other

project elements would be developed in consultation with the NPS, ACOE, WDFW and Whatcom County (see the Restoration Section below).

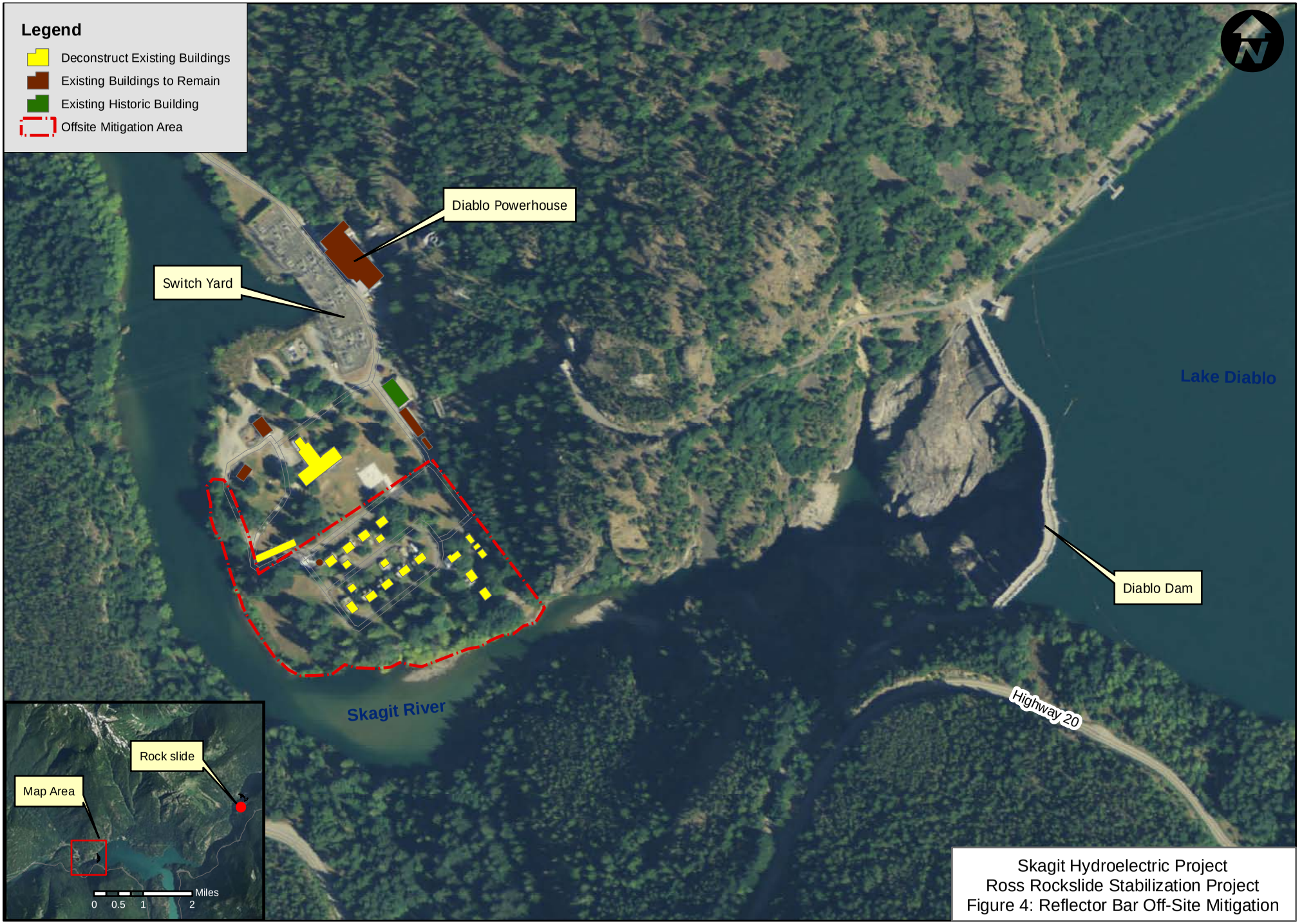
2.2.3. Barge Landing Reconstruction

Barge landing design and reconstruction depends upon the final arrangement of the rock after blasting, so only conceptual plans are evaluated in this EA. Final designs would be developed following the blasting phase.

SCL requires two barge landings (80-ton and 100-ton) due to different docking mechanisms associated with each. Consideration of a single new landing that would accommodate both docking mechanisms would also be evaluated. Some cut and fill activities would be expected in order to construct the new barge landing(s). However, the amount depends upon the final design. A concrete bulkhead may also be constructed, consistent with depth needs for barge usage. Reinforcing bars would be drilled and grouted into solid rock in the foundation area. Once the bulkhead was constructed, fill would be required to connect to the shoreline. A barge landing superstructure could be constructed from structural steel fitted with an adjustable ramp that could be used to accommodate a variety of lake levels.

2.2.4. Final Site Restoration

The restoration design depends on the final layout of the road, and the final layout of the road would depend on how the rock falls. Thus, only conceptual restoration plans are evaluated in this EA. Final restoration plans would be developed in consultation with the NPS, ACOE, WDFW and Whatcom County, and would account for all construction and blasting activities related to this project since March 2010. Restoration would include removing any temporary fill materials from the shoreline to original bank location, reconstructing the bank the bank where possible, stabilizing the bank, and planting native vegetation. An off-site location, Reflector Bar in Diablo, has been identified as a possible site to mitigate the loss of upland habitat and shoreline functions and values that cannot be restored in the project area. Most of the structures currently occupying Reflector Bar are slated for demolition, and the approximate 8 to 10-acre area represents an opportunity to reestablish native forest and riparian plant communities adjacent to a short stretch of the Skagit River before it enters the reservoir of Gorge Lake (Figure 4). A detailed plan for this area would be developed in collaboration with the NPS.


Legend
Deconstruct Existing Buildings
Existing Buildings to Remain
Existing Historic Building
Offsite Mitigation Area
Diablo Powerhouse
Switch Yard
Lake Diablo
Diablo Dam
Skagit River
Highway 20
Rock slide
Map Area
Miles
0 0.5 1 2
Skagit Hydroelectric Project
Ross Rockslide Stabilization Project
Figure 4: Reflector Bar Off-Site Mitigation
Imagery: NAIP 2011
Feet
0 500 1,000 2,000

2.2.5. Best Management Practices

A number of BMPs would be implemented to reduce project impacts on the environment. In addition to those described in the previous section, BMPs used for the proposed project would include the following:

- All equipment used for the project would be staged above full pool in the equipment staging area.
- Bio-based oils would be used in all equipment.
- Equipment and vehicles would be well maintained and in good repair to prevent petroleum products or hydraulic fluid from entering the lake.
- Measures to reduce or control environmental health hazards would include compliance with regulations for handling fuels.
- Equipment would be kept free of external petroleum-based products.
- All diesel and gasoline-powered vehicles and equipment with hydraulic components would be inspected regularly to ensure proper working condition and no leakage. Any necessary repairs would be promptly made at an off-site location.
- A Spill Response and Containment Plan would be developed prior to construction and implemented as needed. Spill containment materials and cleanup kits would be present on all equipment at all times.
- Containment booms would be available for immediate response in case a spill occurs and the material enters the water. Prior to and during construction, booms would be deployed and maintained downstream as a precautionary measure.
- Equipment and vehicles would be refueled in designated upland staging areas or off-site and would not occur on the shoreline.
- Vehicles and equipment used for construction activities would be cleaned and washed off-site; no washwater or deleterious material would be allowed to enter the reservoir.
- Vehicle engines would be turned off when not in use instead of allowing them to idle.
- Construction materials would be stockpiled away from the shoreline/stream areas. Stockpiles would be covered when not actively being used to prevent erosion or contamination from weed sources.
- All construction equipment and all vehicles that enter and exit the site would be washed and free of soil and plant materials prior to entering and leaving the site. All wash water would be captured and contained for proper off-site disposal.

2.3. Alternatives Considered but Rejected

2.3.1. Permanent Barge Landing and Access Road

SCL considered making the existing temporary barge landing and access road permanent so they could be used over the long term to deliver equipment and materials to the powerhouse. Some construction would be required to stabilize, widen, or moderate the road grade; ensure side slope

stability; and prevent erosion at the barge landing. This alternative was rejected because vehicle access between the powerhouse and the dam would still be lacking and the rock scarp would remain unstable. In addition, SCL is required by permits previously obtained from Whatcom County and ACOE to remove the barge landing and restore the shoreline and road.

2.3.2. Pontoon Bridge Installation

SCL considered building a pontoon-type bridge around the rock slide area to provide vehicle access between the powerhouse and dam without stabilizing the slope. This alternative was rejected because of uncertain feasibility and high estimated design/construction costs, and because it would not address the safety issues associated with the unstable rock slope.

2.4. Environmentally Preferred Alternative

NPS policies regarding implementation of the National Environmental Policy Act require the identification of the Environmentally Preferred Alternative. The Council of Environmental Quality recommends the following criteria for determining the Environmentally Preferred Alternative:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
2. Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings.
3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.
4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.
5. Achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities.
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Alternative A generally avoids the impacts to the biological and physical environment as it does not involve the discharge of material into surface waters or result in temporary noise disturbances to the soundscape. However, Alternative A limits the beneficial uses of the park, such as recreation, because the Diablo Lake Trail would remain unconnected to Ross Lake, and paddle boaters would not be able to access the Ross Lake safely. Alternative A also does not promote safe surroundings for SCL staff working at the powerhouse or NRA visitors who might be in the area as rock cliffs would remain unstable. This alternative additionally does not allow a safe evacuation route for SCL personnel.

In the short term, Alternative B would have minor adverse impacts to surface waters and the soundscape, as well as to recreation, fish, and wildlife. In the long term, though, Alternative B is critical for dam safety and would minimize the risk of flood events that could cause substantial environmental degradation, property damage, and destruction of visitor facilities downstream. Flooding could also create unsafe conditions to people downstream of the dam. For these reasons, Alternative B would be the Environmentally Preferred Alternative.

Chapter 3. Affected Environment

3.1. Biological and Physical Environment

The physical and biological environment that would be affected includes the area of immediate physical disturbance where the blasting and construction activities would occur. The biological environment extends beyond this area to include adjacent resources and habitats for vegetation and wildlife. This section describes the current conditions of these resources, and establishes a baseline for the impact analysis in Chapter 4.

3.1.1. Geology and Soils

Bedrock in the area has been mapped as an orthogneiss by Haugerud and Tabor (2009) and Tabor et al. (2003). The orthogneiss is a metamorphic rock and is part of the Skagit Gneiss Complex. This rock is medium hard to hard, slightly weathered to visually fresh, slightly to highly jointed, and foliated. Some faulting is present and there are some local zones comprised of softer rock. Subsurface jointing has been observed to be open but some joints are infilled with soil or fault gouge material. Locally, more recent igneous rocks have intruded into the metamorphic rock as dikes.

Geological mapping identifies several tectonic features to the north and northeast of the project area including the Ross Lake Fault Zone, Pumpkin Mountain Shear Zone and Jack Mountain Thrust (Haugerud and Tabor, 2009; Tabor et al., 2003; Kriens and Wernicke, 1990). The Thunder Lake Fault is located to the southwest (Haugerud and Tabor, 2009; Tabor et al., 2003). Foliation and several other lineations plunge anywhere from 20° to vertical in a variety of directions.

The near surface geology consists of organic topsoil and colluvium overlying bedrock. In general, the area appears to have avoided extensive glaciation. Valley side slopes tend to be steep and V-shaped, which is the result of down cutting (erosion) by the Skagit River. Removal of rock has reduced lateral support for the exposed slopes, which has allowed the formation of some stress relief fractures. The rock contains wide tension crack separations and exhibits mass inflation and discontinuities, such as fractures, joints, and loose foliation planes. Rock that fell from the cliffs during the March 2010 landslide further reduced lateral support of the adjacent slopes, which promoted the formation of more stress relief fractures.

Within the region, rock falls are intermittent, and rock slides are less common, but both are characteristic of the region. Regional structural mapping identifies several repeating joint sets. The primary jointing has a dip of 60° and a general dip direction of 310°. A secondary joint set has a dip of about 50° and a dip direction of 30°. A less persistent tertiary joint set was reported as dipping on the order of 30° with a dip direction between 120° and 165°. Structural mapping for the project area has confirmed the presence of three primary joint sets that are roughly consistent with those reported from the regional mapping. These include two steeply dipping conjugate sets and a third discontinuity formed along the bedrock foliation. Together, these three sets of discontinuities form large orthogonal blocks that are prominently exposed in the headscarp of the proposed blasting area. The foliation forms the base of the blocks and the overhanging steps in the upper headscarp area. These overhanging features, as shown in Figure 5, are targeted for removal using blasting techniques.

Locally, joint set one has an average dip of 70° and dip direction of 35°, the second set has an average dip of 63° and dip direction of 310°, and the bedrock foliations have an average dip of 20° and dip direction of 197°. The spacing of these discontinuities has formed rectangular blocks or tabular slabs that vary in size up to 25-foot; however, most have a maximum dimension on the order of eight to 15 ft.

Figure 5. This composite photographic image depicts the unstable overhanging rock features in proposed rockslide stabilization area.

Tension cracks within the rockmass are common and vary from 6-inches to over 2 ft wide. Reconnaissance surveys in 2011 identified that most of these cracks are covered with thick moss growth, indicating that they have been open and exposed to the elements for many years. However, one newly formed tension crack was observed approximately 20 ft behind the headscarp and regular measurements indicated on-going displacement of the slope area within its boundaries (Landslide Technology, 2011).

The topsoil consists of very loose organic silt and is typically less than 2 ft thick. Where present, overburden materials are composed of forest duff and talus/colluvium. The talus/colluvium consists of varying percentages of clay, silt, and sand with gravel- to large boulder-sized blocks of gneiss. It is typically very loose to loose with a thickness on the order of one to 15 ft. The slopes in the project area vary from overhanging/vertical (cliffs) at the head scarp to an approximate 67% slope on the rock debris pile to relatively flat at the top of the scarp (Excavation Access Road) and on either side of the bottom of the debris pile.

3.1.2. Water Resources

Diablo Lake is the middle of the three reservoirs that comprise the Skagit River Hydroelectric Project. The water levels in the lake are managed in accordance with the terms of the hydroelectric license issued by the FERC in May 1995 to SCL. The reservoir has a surface area of 770 acres and is used primarily for daily and weekly re-regulation of the discharge from Ross powerhouse, which ranges from 2,500 cubic ft per second (cfs) to 7,400 cfs, and averages 4,400 cfs. Under normal operations the water surface elevation of Diablo Lake fluctuates between 1,201.5 and 1,205 ft. Drawdown of the reservoir normally does not exceed 10 ft (elevation 1,195 ft) to maintain boat dock operations and avoid navigation hazards exposed at lower elevations. Based on bathymetric data collected by the NPS, the reservoir adjacent to the proposed project is between 40 and 55 ft deep.

Diablo Lake in the vicinity of the proposed project is in a narrow bedrock canyon, approximately 200 ft wide. The canyon reach extends for about 1.9 miles downstream. The reservoir then widens significantly and is joined by Thunder Creek in another 0.4 miles. Thunder Creek is a large tributary to Diablo Lake with a mean discharge of 617 cfs (about 16% of the average 3,850 cfs inflow into the reservoir). This tributary also contributes large quantities of suspended sediment during the summer, carried by melt water from 51 glaciers in the watershed. Discharge from Ross Lake is another source of suspended sediment from glacial melt. There are no other significant sources of sediment input to Diablo Lake. Although wind driven waves are common, there is very little shoreline erosion because the lake is in a bedrock basin.

The water quality of the streams and lakes in the NRA, including Diablo Lake, is considered to be in excellent condition and support beneficial uses identified by the Washington State Department of Ecology (NPS, 2011). SCL facilities are, however, the source of occasional pollutant discharge to the lake. In 2008, for example, 150 gallons of transformer oil with a trace amount of polychlorinated biphenyl (PCB) leaked from Ross Powerhouse into Diablo Lake. SCL takes measures to prevent such PCB spills from occurring, but the possibility for a release sill exists anywhere pollutants are in use.

3.1.3. Vegetation

The project area is within the North Pacific Maritime Dry-Mesic Douglas-Fir Western Hemlock Ecological System, as defined by the Washington Natural Heritage Program (WNHP; Rocchio and Crawford, 2009). This ecosystem, typical of interior western Washington lowlands (<2,000 foot elevation), is characterized by mild, moist maritime climate, with more precipitation occurring as rain than snow; fire is a major natural disturbance. Vegetation is dominated by Douglas-fir with western hemlock (*Tsuga heterophylla*) co-dominant or occasional in the canopy; sword fern is usually a major component of the understory (Rocchio and Crawford, 2009).

The project area consists of an unstable rock face (scarp), a rock debris pile below the scarp, rocky reservoir shorelines with steep banks, a forested area above the top of the scarp, and a disturbed/developed area near Ross Powerhouse. Most of the vegetation on the rock scarp was removed by the rock slide in March 2010 and subsequent emergency access and stabilization actions. Vegetation below the rock scarp was buried by debris from the slide. The nearly vertical slopes immediately up- and downstream of the rock scarp and debris pile are covered with mosses and lichens. A few large Douglas-fir trees grow in some of the vertical rock fractures. The downstream rock face moderates into a steep rocky slope which supports an open

stand of young (<50 yrs) Douglas-fir. Scattered red alder and young Douglas-fir occur at the base of the slope and along the reservoir shoreline on either side of the debris pile.

The area at the top of the rock scarp is relatively flat and is dominated by Douglas-fir mostly between 5 and 18 inches diameter-at-breast height (dbh); a few are 28-30 inches dbh. This area also supports a few lodgepole pine trees. Understory vegetation cover is moderate and consists primarily of dull Oregon grape, oceanspray, kinnickkinnick, salal, and a variety of herbaceous species (Table 2). The area between Ross Powerhouse and the debris pile includes an expanse of non-native grasses, a road, an equipment/material storage site, and a young Douglas-fir stand.

No rare plants have been documented in the project area, and their presence is unlikely given past development and habitat modifications.

Table 2. Plants found within the Ross Rockslide Stabilization project area.

Common Name	Scientific Name	Common Name	Scientific Name
Trees		**Shrubs**	
Douglas-fir	*Pseudotsuga menziessii*	Black gooseberry	*Ribes lacustre*
Lodgepole pine	*Pinus contorta*	Common juniper	*Juniperus communis*
Red alder	*Alnus rubra*	Douglas maple	*Acer glabrum*
Big-leaf maple	*Acer macrophyllum*	Dull Oregon grape	*Mahonia nervosa*
Forbs		Huckleberry sp.	*Vaccinium sp.*
Brandegeei's desert parsley	*Lomatium brandegeei*	Kinnikinnick	*Arctostaphylos uva-ursi*
Broadleaf starflower	*Trientalis latifolia*	Oceanspray	*Holodiscus discolor*
Common polypody	*Polypodium hesperium*	Oregon box wood	*Pachistima myrsinites*
Davidson's penstemon	*Penstemon davidsonii*	Red-flowering currant	*Ribes sanguineum*
Dogbane	*Apocynum androsaemifolium*	Salal	*Gaultheria wouldon*
Menzie's pipsissewa	*Chimaphila menziesii*	Serviceberry	*Amelanchier alnifloria*
Rattlesnake-plantain	*Goodyera oblongifolia*	Shinny-leaf spirea	*Spirea betulifolia*
Redstem springbeauty	*Claytonia rubra*	Snowberry	*Symphoricarpus albus*
Smooth alumroot	*Heuchera glabra*	Tall Oregon grape	*Mahonia aquifolium*
Spotted saxifrage	*Saxifraga bronchialiD*	Trailing blackberry	*Rubus ursinus*
Stonecrops	*Sedum sp.*	Twinflower	*Linaea borealis*
Wild strawberry	*Fragaria* sp.	Wood rose	*Rosa gymnocarpa*

3.1.4. Fish and Wildlife, Including Rare/Listed Species

The North Cascades is one of the most diverse ecosystems in North America and supports 75 mammal, over 200 bird, 10 reptile, 13 amphibian, and at least 28 fish species (NPS, 2012 and NOCA, 2012). Far fewer species would be expected to occur within project area, as the 5-acre

site provides limited wildlife habitat, and has been substantially influenced by the rock slide, a road, and proximity to other human development. Species observed in and near the project area include black bear (*Ursus americanus*), black-tailed deer (*Odocoileus hemionus columbianus*), Douglas squirrel (*Tamiasciurus douglasii*), Canada goose (*Branta canadensis*), and common merganser (*Mergus merganser*). There is an incidental report from summer 2011 of pikas (*Ochotona princeps*) in the debris pile. Other wildlife inhabiting the project area likely include some of the more common species that are tolerant of human disturbance or those that can use relatively small habitat patches.

There are eight species that are federally or state listed as threatened or endangered for which there is suitable habitat in the North Cascades west of the crest (Table 3). There are an additional nine species potentially occurring in this area that are state sensitive or candidates for federal or state protection. Of these 17 species only 5 would be expected to use habitats in or around the project area. These include the bald eagle, peregrine falcon, pileated woodpecker, common loon, and bull trout.

Table 3. Washington state and federal Endangered (E), Threatened (T), Candidate (C) and other Sensitive (S) species for which there is suitable habitat in the North Cascades ecosystem west of the crest.

Common Name[1]	Scientific Name	Status[2]	
		Federal	State
Mammals			
Gray wolf*	*Canus lupus*	E	E
Grizzly bear*	*Ursus arctos*	T	E
Canada lynx*	*Lynx canadensis*	T	T
Pacific fisher*	*Martes pennanti pacifica*	C	E
California wolverine*	*Gulo gulo luteus*		C
Townsend's big-eared bat*	*Corynorhinus townsendii*		C
Birds			
Bald eagle	*Haliaeetus leucocephalus*		S
Common loon	*Gavia immer*		S
Marbled murrelet*	*Brachyramphus marmoratus*	T	T
Northern goshawk*	*Accipiter gentilis*		C
Northern spotted owl*	*Strix occidentalis caurina*	T	E
Peregrine falcon	*Falco peregrinis*		S
Pileated woodpecker	*Dryocopus pileatus*		C
Vaux's swift*	*Chaetura vauxi*		C
Amphibians & Fish			
Bull trout	*Salvelinus confluentus*	T	

Western toad*	*Bufo boreas*		C
Oregon spotted frog*	*Rana pretoisa*	C	E

[1] **S**pecies unlikely to be present in the project area. These species are not tolerant of human activity (e.g. developments, motorized vehicle use) or there is a lack sufficient habitat in or near the project area.
[2] Status is from WDFW 2012 (http://wdfw.wa.gov/conservation/endangered/All/; accessed February 8, 2012).

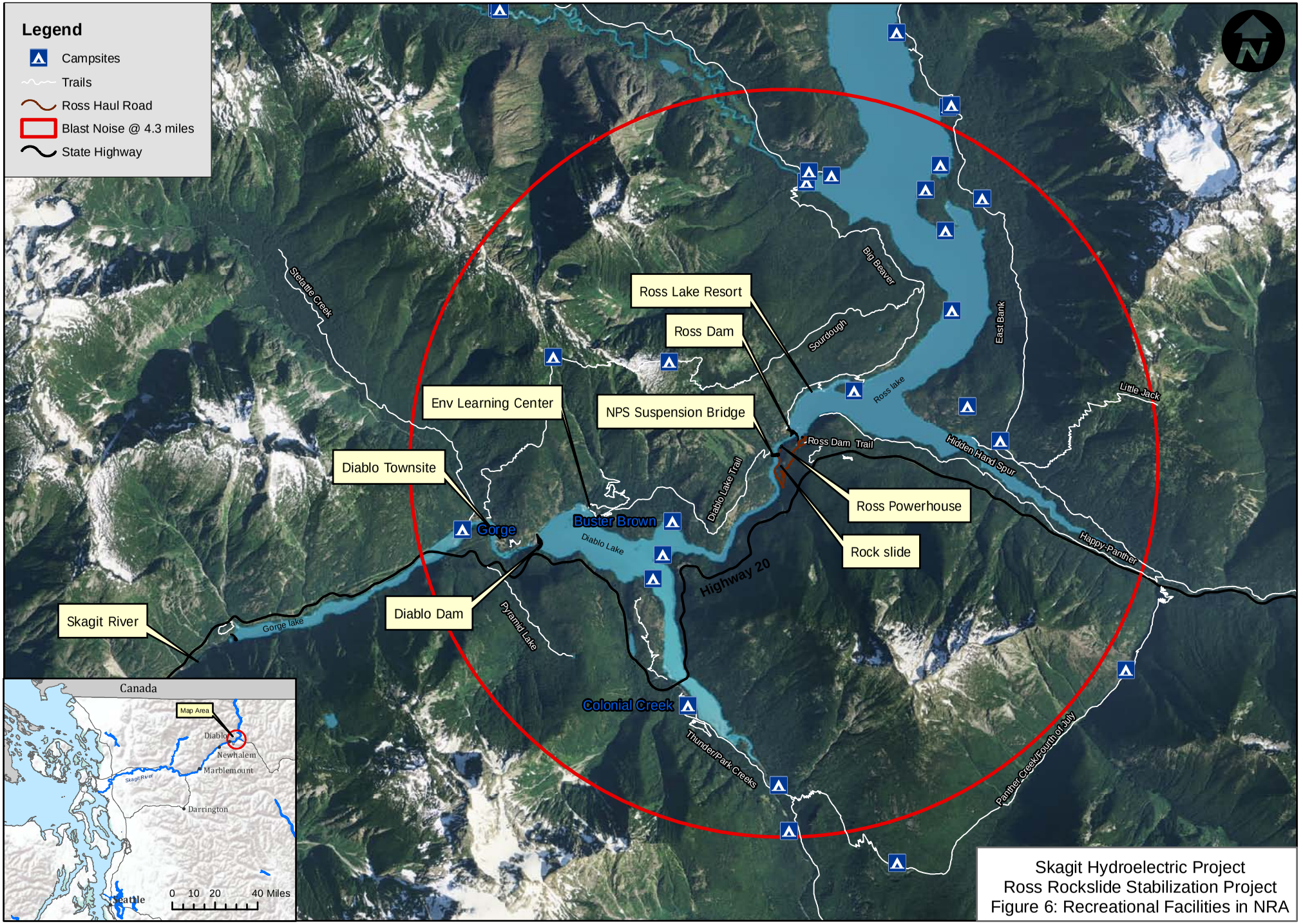
3.2. Recreation and Visitor Use

The Ross Lake National Recreation Area offers a variety of recreational opportunities to visitors that vary from wilderness experiences in remote mountainous areas dominated by natural conditions to overlooks where visitors can enjoy dramatic viewsheds from various points along the State Route 20 corridor.

Recreational activities available to visitors to Diablo Lake include kayaking, canoeing, fishing, swimming, camping, and hiking. The North Cascades Environmental Learning Center, on the north shore of Diablo Lake, offers educational programs about the North Cascades ecosystem. SCL operates the Skagit Tours as well as the Diablo Lake Ferry Service (Fisherman's Ferry) which is used by fishermen, hikers, boaters and visitors to reach Ross Lake. The Fisherman's Ferry transports visitors and supplies from the West Diablo Ferry Landing on the west side of Diablo Lake to the East Diablo Ferry Landing on the east side of Diablo Lake near the project area (Figure 1).

Prior to the rockslide visitors were able to unload directly from the ferry to a waiting shuttle from Ross Resort that would take them, along with their gear and supplies, up the Ross Haul Road (about one mile) to Ross Lake. From there they could continue to Ross Resort or to trails and campgrounds located along Ross Lake. Similarly, recreational boaters on Diablo Lake could land at the NPS floating dock or small boat landing area and have their boats and gear transported via the shuttle to Ross Lake. After the rockslide, the East Diablo Ferry Landing and NPS floating dock were rebuilt and temporarily relocated to a site downstream of the rockslide. Now visitors disembark the ferry or their own boats and hike up a short, steep trail to the waiting shuttle. Gear that can't be carried is transported in a trailer pulled by a small tractor from the dock to the shuttle. The NPS's small boat landing area could not be relocated and remains buried by rock slide debris. Also due to public safety concerns from continued rockfall, a boating exclusion zone was established after the March 2010 rockslide and recreational boat traffic is not allowed beyond the site of the East Diablo Ferry Landing/NPS floating dock.

The primary recreation area along Diablo Lake is Colonial Creek Campground, which is located on Thunder Arm. This campground is accessible by vehicle and also includes a picnic area, boat launches, interpretive trails, an amphitheater, and fishing dock. It is open for use from mid-April through October. There are also two boat-in campgrounds along the Diablo Lake shoreline and several hiking trails, including the Diablo Lake Trail which starts near the Environmental Learning Center. Prior to the March 2010 rockslide, this trail crossed the NPS suspension bridge near the powerhouse and connected to the Ross Haul Road, allowing hikers to reach Ross Lake. The trail is now closed at north side of the suspension bridge (Figure 5).



Skagit Hydroelectric Project
Ross Rockslide Stabilization Project
Figure 6: Recreational Facilities in NRA

3.3. Visual/Aesthetics

Figure 7. Project area showing the viewshed along with the rockslide debris pile and rock scarring on cliffs.

The proposed project occurs within a scenic portion of the NRA that provides recreational opportunities to visitors. The project area is characterized by dramatic visual relief, consisting of Diablo Lake that is a noticeably turquoise-green in color in the summer, and is surrounded by nearly vertical rock cliffs, with conifer forests on the adjacent highlands. From higher vantages, the surrounding peaks can be seen. The project also lies within the FERC jurisdictional boundaries of the Skagit Hydroelectric Project, in which SCL infrastructure is generally compatible with the landscape and provides a certain attraction due to the historical and educational components (Figure 7).

From the Diablo Trail, which is currently closed at the north side of the suspension bridge, the Ross Dam can be seen. Throughout the project vicinity, SCL's 240 kV transmission lines are visible overhead. Similarly, transmission towers are visible to each side. Boat ramps, barge landings, a road and a historic suspension bridge are components of the viewshed in the immediate project area. Since March 2010, a large pile of rock debris extends from the cliffs into the Skagit River, and fresh scars from the rockslide and recent scaling activities can be seen on the cliffs above. Overall, the project area provides contrast and strong visual interest.

3.4. Hydroelectric Operations

Construction on the Skagit Hydroelectric Project began in 1921 and power was delivered to Seattle in 1924. After several phases, construction was finalized in 1961. The North Cascades National Park and the Ross Lake National Recreation Area were established in 1968, with the enabling legislation (see Chapter 1.7.4) providing for development and operation of certain hydroelectric projects. Most of the project area, except for some land owned by SCL in the towns of Diablo and Newhalem, is within the Ross Lake National Recreation Area.

The Skagit Hydroelectric Project is owned and operated by SCL, which is a department of the City of Seattle. SCL provides electricity to approximately 780,800 customers within the greater Seattle area. The Skagit Hydroelectric Project supplies 18.4% of this power, a total of 711 megawatts. A series of three developments on the Upper Skagit River comprises the Skagit Hydroelectric Project, including the Ross, Diablo, and Gorge dams and powerhouses, from upstream to downstream. Refer to Chapter 1.5, "Background," for detailed information on the affected environment for hydroelectric operations in the project area.

Chapter 4. Environmental Consequences

4.1. Introduction

This chapter describes the direct, indirect and cumulative environmental impacts, or consequences, of the management alternatives under consideration in this EA. The scope of the

analysis, and the impact topics selected for analysis, are based upon the ecosystem functions, natural and cultural resources and human values described in Chapter 3, Affected Environment.

4.2. Definitions and Methods for Evaluating Impacts

This EA describes the nature, duration and intensity of impacts according to the following definitions and criteria:

4.2.1. Nature of Impact

Adverse Impact: Moves the system away from the desired condition .

Beneficial Impact: Moves the system toward the desired condition

4.2.2. Duration of Impact

Short-term: During construction or up to one year.

Long-term: Longer than one year.

4.2.3. Intensity of Impact

Negligible: Imperceptible, not measurable, or undetectable.

Minor: Slightly perceptible or measurable and limited in extent. Without further actions, impacts would reverse and the resource would return to the previous condition.

Moderate: Readily apparent and measurable but limited in extent. Without further actions, impacts would eventually reverse and the resource would return to the previous condition. Individuals of a species would be harmed or killed, with slightly measurable impacts to the population or surrounding community.

Major: Substantial and measurable, highly noticeable, and affecting a large area. Changes would not reverse without active management. Entire communities of species would be measurably affected.

This EA uses the following terminology to describe potential effects to federally listed species of wildlife:

No effect: When a proposed action would not affect a listed species or designated critical habitat.

May affect / not likely to adversely affect: Effects on federally listed species are discountable (i.e., extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated) or are completely beneficial.

May affect / likely to adversely affect: When an adverse impact to a federally listed species may occur as a direct or indirect result of proposed actions and the effect is not discountable or beneficial.

Is likely to jeopardize a species and/or adversely modify critical habitat: The appropriate conclusion when the NPS or the U.S. Fish and Wildlife Service identifies situations in which the proposal would jeopardize the continued existence of a proposed species or adversely modify critical habitat to a species within or outside the North Cascades Complex boundaries.

4.2.4. Cumulative Impacts

The analysis also includes a discussion of cumulative impacts for each proposal. Cumulative effects are the "additive" impacts from past, present or reasonably foreseeable future management actions. To determine potential cumulative impacts, projects in the general vicinity of the rock slide and the Skagit River Hydroelectric Project were identified. Projects included in this analysis were identified from the NPS GMP and other relevant documents, SCL capital improvement project lists, and information from state agencies (e.g., WSDOT). Specific projects that were considered in the cumulative effects analysis include the following:

SCL operation and maintenance of the Skagit River Hydroelectric Project. SCL continues to operate the Ross, Diablo and Gorge dams adhering to the FERC license. Dam operations result in variable reservoir water levels and river flows. Some of the common SCL maintenance activities include access road maintenance; vegetation management near dams and powerhouses, and in the towns of Diablo and Newhalem and along transmission lines; cleaning trash racks at water intakes in the three reservoirs; painting dam infrastructure; and maintenance of log booms on the reservoirs. Some of the planned projects for the purpose of operations and/or maintenance include:

- Upgrading existing electrical infrastructure at Ross Dam.
- Redeveloping Diablo including demolition of select houses and buildings, renovation of some buildings, building a storage building, and restoration of open space and native habitats.
- Improving boat facilities on Diablo Lake jointly with the NPS.
- Creating a second tunnel between Gorge Dam and Gorge powerhouse.
- Dredging a gravel bar in Gorge Lake (that has formed following a landslide upstream on Stetattle Creek) to restore hydroelectric capacity.

NPS implementation of the GMP. NPS conducts similar activities to maintain access roads and recreational facilities such as campgrounds, campsites, trails, and trailheads. Some of the specific proposed actions identified in the GMP include:

- *NPS expansion of the Ross Dam Trailhead.* The proposed project would result in an increase of approximately one acre of disturbance to provide additional parking and safe ingress/egress from the North Cascades highway.
- *North Cascades Environmental Learning Center Expansion*. The proposed project would involve additional outdoor learning structures and possibly additional campsites at Buster Brown Campground and Diablo Gorge.

NPS boat dock relocation. The temporary dock used as a replacement for the dock destroyed in the Ross Powerhouse Rockslide, would be relocated to a more suitable location after the Ross Powerhouse Rockslide project is completed.

WSDOT routine maintenance of State Route 20. Routine maintenance of SR20 includes periodic resurfacing, vegetation clearing, and culvert maintenance.

4.3. Impacts of Alternative A. No Action

4.3.1. Biological and Physical Environment

Geology and Soils

Direct and Indirect Impacts

Alternative A would not involve further scaling or rock bolting activities. There would be no blasting. The existing area of construction disturbance created during the initial emergency response to stabilize the rockslide would be rehabilitated.

Slopes would continue to be unstable, and tension cracks would increase in width. Further uncontrolled rockslides are likely. Rockslides could continue to retrogress up the slope and create larger slides, and slide limits may expand and become larger outside of the project area. At a minimum, more rock fall would occur. Actions conducted to date have adversely impacted geology and soils, thus impacts of Alternative A would be moderate in intensity and long-term.

Cumulative Impacts

Impacts to geology and soils have resulted from past NPS, SCL, and WSDOT activities primarily due to ground disturbing activities such as construction and maintenance of roads, hydroelectric infrastructure, transmission lines, campgrounds, trails, and structural facilities. Future ground-disturbing activities by these parties will utilize BMPs such as erosion control and revegetation.

Rockslides that would result from implementation of Alternative A would be a natural occurrence, similar to other natural rockslides in the area; therefore, Alternative A would not result in measurable cumulative impacts on geology and soils except for the limited steps that have been taken to date to reestablish facilities that were damaged by the slide.

Water Resources

Direct and Indirect Impacts

Alternative A would not involve additional scaling, blasting, or rock bolting activities. Further uncontrolled rockslides are likely. Rockslides could continue to retrogress up the slope and create larger slides, and slide limits may expand and become larger outside of the project area. Debris from rock slides would create a temporary spike in turbidity. Runoff from the temporary barge landing during major storm events would likely contribute small amounts of sediment to the lake, slightly adversely affecting water quality. Therefore, Alternative A would have minor and intermittent impacts on water quality.

Cumulative Impacts

Historic impacts to hydrology and water quality include upstream logging and mining activities, removal of large woody debris from waterways, hydroelectric development and operation, NRA recreational developments and activities (e.g., boating and camping), run-off from State Route 20 and other roads, and SCL boat operations. Despite these impacts, water quality in the project area is generally excellent.

Some foreseeable projects as identified in Chapter 4.2.4 would cause moderate to major adverse impacts to water quality, although most of these projects are downstream and would not

contribute to cumulative water quality degradation in the immediate project area. Upstream projects may involve minor, temporary, adverse impacts to water quality but would not contribute to significant water quality degradation. Both down- and upstream projects would be conducted either by SCL, NPS, or WSDOT, and would include appropriate BMPs and restoration. Although rock fall would continue to discharge into Diablo Lake under implementation of Alternative A, these occurrences are natural and cumulative impacts on water resources would be negligible.

Vegetation

Direct and Indirect Impacts

Emergency stabilization actions in 2010 disturbed about 1 acre at the top of the rock scarp to create a staging area and the Excavation Access Road. These actions, as well as initial stabilization work on the rock scarp itself, resulted in the removal of 100 trees and other vegetation. The staging area and Upper Road area would be restored once the entire rock stabilization project is complete. Under the No Action Alternative this area would not be restored but would be left to recover naturally.

Construction of the existing temporary barge landing and access road removed 101 trees, including 82 Douglas-fir, 15 red alder, and 4 big-leaf maples, as well as shrubs and forbs (Figure 8). About 0.5-acre was impacted but only a portion of this area was vegetated, the remainder being landslide debris. Whatcom County and ACOE permits for this work included a requirement to replace the functions and values of the shoreline vegetation impacted by the temporary landing and access road once these facilities were removed and the entire rock stabilization project was complete. Under the No Action Alternative, however, these temporary facilities would remain and shoreline vegetation would not be restored.

Figure 8. Temporary barge landing and access road constructed after the rockslide to enable heavy equipment access to Ross Powerhouse via barge from Diablo Lake.

Adverse impacts to vegetation from the No Action Alternative would be moderate and would vary from short-term (for grasses, forbs and shrubs) to long term (for trees). Weed establishment would not be expected to be a major concern since the general area is currently weed free. Over time, vegetation on the rock scarp and in the staging and access road areas would largely recover. Some vegetation may also establish along the edge of the debris pile near reservoir. The continued existence of temporary barge landing and access road would preclude the restoration of shoreline vegetation in this area.

Cumulative Impacts

Past actions in the region include clearing vegetation for logging, mining, grazing, settlement, gravel pits, hydroelectric operations, and U.S. Forest Service and NPS developments. Vegetation in the project area is not diverse compared with other areas of the NRA, and no rare or sensitive species are known to occur here. Implementation of Alternative A would result in continued rockfall, which is a natural occurrence. Further rockfall and mass wasting would only result in a temporary loss of common species, and would not contribute to a downward trend in plant diversity Projects identified in Chapter 4.2.4 are typically restricted to disturbed areas and would be conducted either by SCL, NPS, or WSDOT. These parties would utilize appropriate BMPs and restoration for every project. Therefore, implementation of Alternative A, along with foreseeable activities identified in Chapter 4.2.4, would not contribute to cumulative adverse impacts on vegetation.

Fish and Wildlife, Including Rare/Listed Species

Direct and Indirect Impacts

Continued use of the temporary barge landing and access road would result in occasional short term disturbance to wildlife in the area when equipment or materials are delivered. Runoff from barge landing during major storm events might periodically contribute small amounts of sediment to the lake, with temporary, minor adverse impacts to fish habitat. Overall, the No Action Alternative would have negligible adverse impacts on fish and wildlife and would not affect bull trout or critical habitat for bull trout.

Cumulative Impacts

Past impacts to fish and wildlife include fish harvest; fish stocking (introduction of non-native fish species and other aquatic species); water quality degradation from logging and mining activities; large woody debris removal from waterways; habitat loss from hydroelectric development; and increased noise from hydroelectric operations, highway construction/maintenance, and traffic.

Despite impacts from past activities, the Upper Skagit River basin, including the project area, contains a healthy fish population (including the ESA-threatened bull trout) and a diversity of wildlife. Fish and wildlife kills are not anticipated as part of Alternative A. Future projects as identified in Chapter 4.2.4 may contribute to minor, short-term adverse impacts to habitat, but these planned projects would likely be localized and primarily restricted to disturbed corridors. Habitat encroachment and disturbances beyond existing levels are not anticipated. Therefore, the the No Action Alternative would not contribute to cumulative impacts to fish, wildlife, and rare or listed species.

4.3.2. Recreation and Visitor Use

Direct and Indirect Impacts

Under the No Action Alternative hiking access between Diablo and Ross lakes would continue to be disconnected and the suspension bridge closed to visitors. Also, boaters and the Skagit Tours would continue to be prohibited upstream of the slide area to view the dam and powerhouse. Although the rockslide area has been marked with signs and buoys to prohibit public access, it is not possible to patrol the area all the time and some people could enter the project area. The No

Action Alternative would result in the continuance of unstable slope conditions and a potential risk to public safety.

The East Diablo Ferry Landing and the NPS floating dock would remain in their current locations. The small boat landing area would not be rebuilt due to the lack of a suitable site in the steep gorge. Kayakers and canoeists seeking access to Ross Lake would therefore continue to disembark at the NPS floating dock or ferry landing. Safely disembarking onto a dock, as opposed to a beach, can be difficult for some boaters, particularly novices. Aside from paddlers, people, gear, and supplies would not be able to be transferred directly from the ferry to the Ross Haul Road shuttle. Instead, they would continue to use the temporary facility constructed downstream of the slide, which is steep and not easily accessed by persons with limited mobility. For these reasons access to Ross Lake would remain less than ideal for most visitors and prohibitive for some.

Overall, the No Action Alternative would result in a long-term, moderate intensity impact to recreation in the Diablo Lake area, in particular, and the NRA in general.

Cumulative Impacts

The project area prior to the March 2010 rockslide contained a variety of unique and publicly-valued recreational opportunities. Implementation of Alternative A would result in moderate adverse impacts to these recreational activities because these activities would not be restored. However, Fisherman's Ferry and the Skagit Tours would continue to operate with the same efficiency as before the rockslide, and the NPS has several projects planned to improve recreational opportunities. Other planned projects as identified in Chapter 4.2.4 are not anticipated to adversely impact recreational or visitor access. Therefore, implementation of Alternative A would have only negligible adverse cumulative impacts on recreation and visitor use.

4.3.3. Visual/Aesthetics

Direct and Indirect Impacts

Alternative A would not involve scaling, blasting, or rock bolting activities. The cliff faces would still have visible scarring from the March 2010 rockslide and subsequent scaling activities. These adverse impacts would be long term but minor because over a very long time, lichen would begin to cover surfaces and vegetation would likely begin to grow within the cracks. The unstable slope would continue to fall and create new fresh scars, further masking the visual impacts of the emergency stabilization work.

Reconstruction of a new road across the debris pile and barge landings would not be part of the No Action Alternative. The site would be kept in the current condition, in which the large debris pile from the March 2010 rockslide is the predominantly visible feature in the project area. The beneficial impacts of Alternative A are minor yet long-term.

Cumulative Impacts

Prior to the March 2010 rockslide, the project area contained steep, weathered rock walls similar to other areas along the Upper Skagit River. The rockslide created fresh scarring on the rock face and a large debris pile below. Implementation of Alternative A would allow the slope to further

degrade and the rock debris to continue to pile below, but this is a natural occurrence and the aesthetics would be similar to other slopes in the region. Projects identified in Chapter 4.2.4 are primarily along disturbed corridors and would not degrade pristine viewsheds. Therefore, implementation of Alternative A would not contribute to visual/aesthetic adverse cumulative impacts.

4.3.4. Hydroelectric Operations

Direct and Indirect Impacts

Implementation of Alternative A would result in highly unstable slopes above the lower portion of Ross Haul Road, and further uncontrolled rockslides are likely. Rockslides could continue to retrogress up the slope, creating larger slides, and slide limits may expand outside of the project area. As a result, the temporary 100-ton barge landing and the 80-ton barge landing would continue to remain at risk. If these landings were destroyed by further rockfall, then moving equipment and supplies to and from the dam and powerhouse would be completely lost. Since a permanent 100-ton barge landing would not be reconstructed as part of this alternative, the existing temporary landing could only be used for a short while longer because it was constructed and permitted for short-term term use only. This would inhibit transporting large equipment and parts that will be necessary to continue operations in the near future. Further, because a road connection between the existing temporary 100-ton barge landing and the dam would not be reconstructed, deliveries to the dam would be limited to the 80-ton barge landing. The eventual inability to transport large equipment and parts to the dam and powerhouse could lead to a loss of power generation, adversely affecting the greater Seattle area. Also, the inability to transport equipment and supplies for emergency work could lead to downstream flooding, affecting public and private property along a considerable portion of the Skagit River.

Lastly, because Alternative A would not result in reconstruction of the Ross Haul Road, emergency response time by operators would increase, potentially leading to higher flows downstream if an emergency occurred. Further, SCL personnel would not have a safe and rapid emergency evacuation route, which could result in loss of life should an evacuation be necessary. Considering all of the aforementioned impacts, implementation of Alternative A could result in major long-term adverse impacts.

Cumulative Impacts

Considering the foreseeable projects described in Chapter 4.2.4, cumulative impacts to hydroelectric operations are not anticipated.

4.3.5. Conclusions

Implementation of Alternative A would result in a varying range of direct and indirect impacts to the biological and physical environment, recreation and visitor use, aesthetics, and public safety. Because the slope would not be stabilized, further rockfall and rockslides would occur, and debris would be discharged into Diablo Lake, creating a hazard to NRA visitors, NPS staff, and SCL personnel. Rockslides would likely cause the slope to retrogress; thus, the debris pile would build, reducing the visual/aesthetic quality of the area. The continuing discharge of rock debris into Diablo Lake would result in minor, temporary impacts to water quality, although rockslides are a normal occurrence and turbidity created from these events is natural. Water quality and

habitat impacts would have negligible adverse impacts on fish and wildlife and would not affect bull trout or critical habitat for bull trout. Vegetation would not be restored as part of Alternative A, so there would be moderate and long term impacts to vegetation. Vegetation and geological resources have also been moderately adversely impacted by past emergency actions.

Most significantly, Alternative A would result in major, long term, adverse impacts to hydroelectric operations, which is an important energy source for the greater Seattle area. Alternative A would also result in a long-term, moderate intensity impacts to recreation because small boats would not be able to access the project area safely and hikers would be blocked from reaching Ross Lake from the Diablo Lake Trail. Cumulative impacts would be either non-existent or minimal, ranging in intensity from negligible to minor.

4.4. Impacts of Alternative B. Rockslide Stabilization

4.4.1. Biological and Physical Environment

Geology and Soils

Direct and Indirect Impacts

A total of 27,500 CY of blasted rock would be removed as part of Alternative B. Alternative B would result in long-term moderate adverse impacts because the proposed rock scaling, blasting, and bolting activities would be permanent changes to the natural topography. Future rockfall and slides in the targeted areas would be less likely to occur in the project area.

It should be noted that rockfall and rockslides would continue to occur outside of the project area, perhaps even in the immediate vicinity. Although unlikely, blast work could trigger further movement, and unforeseen material could be mobilized in adjacent areas (e.g., rock falls, and/or rock or soil slides). If this should happen, adverse impacts would be long-term and of moderate intensity, similar to those that occurred in March 2010.

Cumulative Impacts

Impacts to geology and soils have resulted from past NPS, SCL, and WSDOT activities primarily due to ground disturbing activities such as construction of the hydroelectric facilities, which extensively manipulated the area in the vicinity of this project. Since then, activities such as maintenance of roads, hydroelectric infrastructure and transmission line maintenance, campgrounds, trails, and structural facilities have also been constructed in the vicinity of the area. Future ground-disturbing activities by these parties will implement BMPs such as erosion control and revegetation.

Implementation of Alternative B would result in beneficial impacts due to stabilization of the rock wall. Other past and planned foreseeable projects as outlined in Chapter 4.2.4 involve adverse impacts to soils, mostly resulting from ground disturbance, but soil stabilization and vegetation restoration activities would accompany most projects. Overall, there are as many planned projects that involve restoration activities than those projects that would impact geology or soils. Therefore, implementation of Alternative A would result in negligible cumulative impacts on geology and soils.

Water Resources

Direct and Indirect Impacts

Direct impacts to water quality would result from the discharge of rock and sediment into Diablo Lake from blasting activities. Suspended sediments would be temporarily elevated. The blasts are designed to break rock into blocks less than 5 ft square, but blocks up to 25 ft square are possible. A range of grain sizes, from clay-sized particles to large boulders, will be produced. The majority of the material is expected to be cobble- to boulder- size (less than 5 ft square) with a relatively small percentage of clay-to sand- size material.

A variety of BMPs would be employed during blasting. These BMPs include the installation of a sediment curtain (during non-blasting events, as the curtain would be destroyed) to contain turbidity in Diablo Lake to the greatest extent practicable during all construction activities. The sediment curtain would be removed during the blast because it would otherwise be destroyed. Coir logs/wattles or compost socks will be installed perpendicular to the slope to reduce surface flow and encourage surface terracing. As well, the rock blast would be directed to the talus slope and not directly into the lake.

Sedimentation may also result from construction of road and barge landings. BMPs would include lowering the reservoir water level as appropriate, installing silt fence at the downslope limits of the work above the water level, and geotextile blanketing. A sediment curtain would be installed around the edge of the work area to provide double containment should the silt fence/geotextile blanket not suffice. A Turbidity Monitoring Plan for the blast phase has been developed whereby turbidity would be monitored following each blast event to ensure compliance with Water Quality Standards.

Turbidity associated with the blast is expected to dissipate quickly as the canyon widens into the main portion of the reservoir and is joined by inflow from Thunder Creek. The impact is expected to be temporary and of low to medium intensity.

Cumulative Impacts

Historic impacts to hydrology and water quality include upstream logging and mining activities, removal of large woody debris from waterways, hydroelectric development and operation, NRA recreational developments and activities (e.g., boating and camping), run-off from State Route 20 and other roads, and SCL boat operations. Despite these impacts, water quality in the project area is generally excellent.

Implementation of Alternative B would result in temporary, minor adverse impacts to water quality. Some foreseeable projects as identified in Chapter 4.2.4 would cause moderate to major adverse impacts to water quality, although most of these projects are downstream and would not contribute to cumulative water quality degradation in the immediate project area. Upstream projects may involve minor, temporary, adverse impacts to water quality but would not contribute to significant water quality degradation. Both down- and upstream projects would be conducted either by SCL, NPS, or WSDOT, and would include appropriate BMPs and restoration. Due to the relatively small impact associated with the proposed project, only negligible cumulative impacts on water resources are anticipated as a result of Alternative B.

Vegetation

Direct and Indirect Impacts

Under Alternative B the area impacted on the top of the rock scarp by construction related to blasting would double from 1 acre to about 2 acres. The expanded site is needed to accommodate a larger staging area; a longer, reconfigured Excavation Access Road to reach the blast sites; and an alternative access route if needed. An additional 30 to 40 Douglas-fir trees (5-18 inches dbh), as well as other vegetation such as moss, lichen, forbs, grasses and shrubs, would be removed. SCL would mark the limits of excavation to prevent damage to trees and other vegetation on the rock scarp outside the staging area and Excavation Access Road.

SCL and the NPS would collaborate on a restoration plan for the top of the rock scarp at the completion of the first phase. The plan would provide details on replanting the staging area and a portion of the Excavation Access Road with native trees and shrubs from locally sourced seed or stock, as well as site preparation. The establishment of non-native plants is not expected to be a major concern since the entire area is relatively weed-free and equipment would be washed before it is brought on site. Nonetheless, the area would be monitored for 5 years to control weeds and replace dead plants. Restoration of the entire Excavation Access Road would not be possible because much of this steep road would be cut through solid rock and may be needed for stabilization actions in the future. Shrubs would be planted near the junction with the Ross Haul Road to provide screening and some vegetation would be established in the mulched sites associated with the logs placed in the road cut.

The other equipment staging areas, stockpile location, and construction trailer site for the project would not impact any native vegetation because they are in areas that are already disturbed. However, work to remove two unstable boulders near the Ross Haul Road tunnel would result in some additional disturbance to vegetation on the slope below the debris pile. Some shrubs and forbs, but no trees, would be removed or disturbed.

Most of the temporary barge landing and the connecting road would be obliterated by the new road across the debris pile. The new access road across the rock debris would not impact vegetation as this area does not currently support a notable abundance of plant life due to the instability of the area. Similarly, the new barge landing(s) would be constructed in areas that are already disturbed and would not impact vegetation.

Whatcom County and ACOE permits require SCL to mitigate the shoreline vegetation impacted by construction of the temporary barge landing and access road and the other project phases. Preliminary plans submitted to the ACOE in April 2011 identified some possible planting sites for trees and shrubs at the edges of the debris pile and between the debris pile and powerhouse. However, mitigation for project impacts to vegetation would likely be off-site at Reflector Bar and would involve planting trees and shrubs on about 8 acres of land, including over 2,000 ft of shoreline. A detailed mitigation plan would be developed by SCL in collaboration with NPS.

Overall, Alternative B would result in adverse impacts to vegetation in the project area that are limited to a few acres but are considered moderate and long term. With restoration and time, vegetation in the staging area would recover, but vegetation would not readily establish in the blast zone, Excavation Access Road, or the debris pile. Restoration at Reflector Bar would mitigate for the loss of the riparian vegetation from the approximately 300 ft of shoreline impacted by the debris pile and temporary barge landing, as well as the loss of about 1 acre of upland vegetation impacted by the staging area and Excavation Access Road.

Cumulative Impacts

Past actions in the region include clearing vegetation for logging, mining, grazing, settlements, gravel pits, hydroelectric development and operations, roads and NRA recreational developments. Past actions have also promoted the introduction and spread of invasive weeds in some locations, although the project area is relatively weed-free.

Vegetation in the project area is not diverse compared to other areas of the NRA, and no rare or sensitive species are known to occur here. Implementation of Alternative B would result in a loss of individual plants of common species, but would not contribute to a downward trend in plant diversity. Future projects as identified in Chapter 4.2.4 are typically restricted to disturbed areas and would be conducted by SCL, NPS, or WSDOT. These agencies would use appropriate BMPs to prevent erosion and the spread of invasive weeds, as well as the incorporation of vegetation restoration for every project. Implementation of Alternative B, along with other foreseeable activities as identified in Chapter 4.2.4, may contribute to negligible cumulative adverse impacts on vegetation.

Fish and Wildlife, Including Rare/Listed Species

Direct impacts from Alternative B to fish and wildlife include noise, habitat loss and the possible mortality of a few individual animals, such as small mammals with limited mobility who could not temporarily avoid the area. Mortality and habitat loss would only occur during the first phase, while noise impacts would be associated with all phases.

Direct and Indirect Impacts

Mortality and Habitat Disturbance

Alterative B, in combination with the work done previously, would impact about 1 acre of forested habitat on the top of the rock scarp for the staging area and expanded Excavation Access Road needed for the Phase I work. Sedentary wildlife in this area may be killed as trees are cut and equipment mobilized; other species would be displaced. Although the rock scarp and debris pile provide very limited habitat, any wildlife in these areas would certainly be killed by the blast and subsequent rock fall. If present, pikas and other small mammals would be the species most impacted by the actual blast. An airhorn would be sounded prior to blasting and should drive larger mammals and birds from the area that would be directly impacted by the blast.

Blasting would discharge about 3,900 CY of rock and sediment to Diablo Lake that would reach the bottom of the reservoir; roughly equal amounts of material would be removed per blast (pers. comm., L. Pierson and B. George, Geologists, Landslide Technology, 2011). Since the main sensory organ in fish is the lateral-line system, which detects low-frequency (<100 Hz) particle motion in water (WSDOT, 2011), the vibration and sound pressure from each blast would likely cause most fish to move out of the aquatic habitat immediately adjacent to the project site. It is likely that there would be time for fish to move away from the area because there would be a delay between the blast and rock entering the reservoir. The blasts are designed to direct rock away from the reservoir and into the talus bowl; rock not captured by the talus bowl would need to travel the length of the existing 200-ft long debris pile before entering the water. There would not be a solid mass of rock, as would occur from a landslide, rapidly entering the water. Therefore, the likelihood that fish would be entrapped by the rock entering the reservoir from the blast is expected to be very small.

About 5,170 CY of rock would enter the aquatic habitat in the project area from the combined actions of blasting, rock scaling, and constructing the road and barge landings. Based on information collected during the bathymetry surveys done by the NPS, this area currently consists of bedrock and rock debris, similar to the slope above the shoreline. The added rock from the project activities may cover approximately 32,400 sq ft (0.75 acre) of lake bottom to a depth of up to 3 ft (L. Pierson and B. George, pers. comm., 2011). This fill material would decrease the water depth slightly and result in the conversion of an estimated 2,802 sq ft (0.06 acre) of aquatic habitat to terrestrial habitat. This represents a small decrease in fish habitat.

Noise-related Disturbance

Alternative B would also result in noise-related disturbance from blasting and associated rock drilling, scaling, and excavation, as well as from construction of the road and barge landings. Wildlife within a 37,176-acre (58 sq miles) area centered on the rock scarp would be subjected to noise above ambient levels for a few seconds during each of up to 8 blast events. While the area impacted by blast noise extends 4.3-miles out from the project area, levels would attenuate to 92 dBA at 331 ft, 70 dBA at 2,512 ft, and 57 dBA at 8,318 ft. These are the noise levels used by the Olympic National Forest and adopted by WSDOT (2011) as the "harassment/injury", "disturbance behavior", and "alert behavior" thresholds, respectively, for spotted owls. The area where blast noise would be greater than 92 dBA is about 7.9 acres centered on the rock scarp (see Appendix 2, Biological Evaluation, and Figure 6).

Not all species respond to noise in the same way and not all individuals within a species respond the same (WSDOT, 2011). A variety of factors (e.g., time of day, hearing sensitivity, previous exposure to noise, etc.) all influence animal response. Owls have particularly sensitive hearing (WSDOT, 2011). However, most animals subjected to >100 dBA (equivalent to fire crackers) would flee or at least exhibit disturbed behavior for a short period of time. Blast noise would attenuate to 100 dBA at 158 ft from the blast. At about 0.5-mile, noise levels would be in the range of 70 dBA (equivalent to freeway traffic) and would probably elicit alert behavior in most mammal and bird species.

Noise associated with rock drilling and road/barge landing construction activities would be up to 86 dBA within 50 ft of operating equipment and would attenuate to 70 dBA at 218 ft, 57 dBA at 723 ft, and ambient (46 dBA) at 5,000 ft (see BE and Figure 6). While considerably lower than blasting, equipment noise would be much more pervasive, lasting up to 8 hours a day over the course of the entire rock stabilization period (July to October 2012), and spring through fall in 2013 while the road across the debris pile and barge landing is being constructed. While some wildlife would be expected to adapt to the noise from equipment, others would abandon the area. It is likely that birds would avoid nesting in the forest stands near the project area and mammals would alter movement patterns over the two construction seasons.

Most of the studies on noise impacts to fish have evaluated the effects of underwater pile driving, which creates impulsive noise in the range of 180 to 220 dBpeak and 170 to 202 dBRMS (WSDOT, 2011). Impulsive noises are of short duration, are repeated over and over, and consist of a broad range of frequencies. dBpeak is the instantaneous maximum overpressure while dBRMS is a measure of both sound energy and duration. WSDOT (2011) uses 180 dBpeak for injury and 150 dBRMS for behavioral effects as the thresholds for protecting salmon. Noise from the blast would not be impulsive and the peak level would be far less than 180 dB and very brief. In addition, the reservoir is about 385 vertical ft below the rock scarp to be blasted; at this

distance, noise would have attenuated to about 90 dB. Further, noise propagation in water is limited by the sinuosity of the system; noise from the blast would not propagate past the curve in the reservoir downstream of the project site (WSDOT, 2011). Noise from the blast is not expected to injure fish or cause behavioral effects beyond a startle response.

The exact schedules for the all phases of the project are estimates at this time and contingent on permitting. Nonetheless, it is likely that all or part of construction would occur outside the approved work window for fish protection in freshwater. For the Skagit River in Whatcom County, the work window is set as June 15 to July 31 for the year 2011, and is likely to be the same in 2012.

Sedimentation

Some amount of sediment would also enter the reservoir with each blast. The portion of Diablo Lake in the action area is in a canyon, about 200 ft wide, and is more characteristic of a river than a reservoir. Flows through this area range from 2,500 cfs to 7,400 cfs, and average of 4,400 cfs, so suspended sediment would be moved through the project area quickly. Turbidity should dissipate quickly as the canyon widens into the main portion of the reservoir and is joined by inflow from Thunder Creek. While the amount of sediment entering Diablo Lake from each blast is unknown, the area of the reservoir potentially impacted by turbidity is expected to be small (188 acres) and turbidity is expected to have a negligible impact on fish.

Impacts on Federal and State-Listed Species

A BE was prepared that addressed the impacts from Alternative B on the marbled murrelet, spotted owl, grizzly bear, gray wolf, Canada lynx, bull trout, and bull trout critical habitat (Appendix 2). The USFWS concurred that Alternative B would have no effect on the marbled murrelet, grizzly bear, gray wolf, or Canada lynx. The no effect determinations were based largely on the lack of documented occurrence or suitable habitat for these species within 4.3 miles of the project area. The USFWS further concurred that Alternative B may affect, not likely to adversely affect the northern spotted owl, bull trout, and bull trout habitat.

Impacts on the four state-listed sensitive species that may use habitats in or near the project area are summarized below:

The **common loon** is typically seen on Diablo Lake in the winter, which is outside the construction and blasting periods. Diablo Lake does not provide breeding habitat for this species due to water level fluctuations. The nearest breeding habitat is at Hozomeen Lake near the north end of Ross Lake and well outside the area impacted by noise from blasting or construction. Noise could disturb loons using Diablo Lake for foraging or loafing during the blast; impacts from construction noise would be limited to the Diablo Lake canyon area.

Bald eagles are not common upstream of Newhalem but are occasionally observed perched along or flying over Diablo Lake. The only known bald eagle nest in the NRA is on the west side of Ross Lake; this site is outside the area that would be impacted by blast or construction noise. However, bald eagles foraging in Ross Lake south of Big Beaver or on Diablo Lake could be disturbed by blast noise. Bald eagles in the vicinity of the project area could also be disturbed by construction noise.

The **pileated woodpecker** has not been observed in or near the project area but there is nesting and foraging habitat for this species throughout lower elevations in the NRA. The proposed project would not result in the loss of habitat for this species or individuals. Blasting and rock

scaling in 2012 would not start until approximately July, and would probably not disturb any nesting because this species breeds relative early in the season and the young have typically fledged by mid-June. However, noise from blasting and construction may preclude the use of forage habitat in the canyon area of Diablo Lake for the remainder of the season.

Known **peregrine falcon** nest sites occur just downstream of Diablo Dam and north of Big Beaver Creek on the west site of Ross Lake. These sites are about 3 and 4 miles, respectively, from the project area, and would not be impacted by construction noise. Noise from blasting would be slightly above ambient but unlikely to result in disturbance. Both of these sites are subjected to noise from traffic (Diablo) and boats (Ross).

Conclusion

Alternative B would have moderately adverse impacts on some fish and wildlife species in the immediate vicinity of the project area. Revegetation of the staging area at the top of the rock scarp would eventually restore wildlife habitat values at this site. Over time small mammals would recolonize the rock scarp and debris pile. Birds would return to use the adjacent forests for nesting after the construction is complete. Mitigation in adjacent areas would improve riparian and upland habitat and provide additional habitat for a greater variety of native wildlife in this area.

Cumulative Impacts

Past impacts to fish and wildlife (including rare species) have resulted from fish harvest; fish stocking (introduction of non-native fish species and other aquatic species); water quality degradation from logging and mining activities; large woody debris removal from waterways; habitat loss from hydroelectric development; and noise from hydroelectric operations, highway construction, recreational activities, and traffic.

Despite impacts from past activities, the Upper Skagit River basin including the project area, contains a healthy fish population (including the ESA-threatened bull trout) and a diversity of wildlife. Fish kills are not anticipated as part of Alternative B, although some fish may be temporarily disturbed. Individuals of a few common wildlife species may be killed or injured, but sensitive or listed wildlife species are not expected to be impacted. Foreseeable projects as identified in Chapter 4.2.4 are likely to have similar impacts, and would primarily be restricted to common wildlife species. These projects are not likely to jeopardize a population or contribute to a downward trend in species diversity. For the most part, impacts would involve minor, temporary adverse impacts, and would be localized and restricted to disturbed corridors. Habitat encroachment and long-term disturbances beyond existing levels are not anticipated. Therefore, Alternative B would only contribute to negligible cumulative impacts to fish, wildlife, and rare or listed species.

4.4.2. Recreation and Visitor Use

<u>Direct and Indirect Impacts</u>

Alternative B would result in beneficial impacts to recreation and visitor use by restoring the facilities that became unavailable to visitors due to the March 2010 rockslide. Hikers would be able to access Ross Lake from Diablo Lake (and visa versa) by using the suspended bridge once the segment of the road across the rockslide is restored. Boaters and the Skagit Tours would be able to resume travel to view the dam and powerhouse.

Alternative B would cause intermittent interruptions of recreational and visitor use. Blasting would involve up to 8 events over an approximate 4 month period (July through October 2012). Only one blast would be detonated on any given day and not on consecutive days. Each blast would be of short duration. Rock drilling is likely to occur daily for up to 8 hours per day prior to prepare the site for each blast event. Signs would be posted at each trailhead and at the West Ferry Landing to warn visitors of upcoming closures due to blasting. Two hours before each blasting event, blasting safety professionals would be stationed within 1,000 ft of the project area (i.e., the blasting zone) along each trailhead, road, or other access point to prevent visitors from entering the blasting zone. Also, for approximately two hours prior to each blast, boat traffic would be excluded from entering the blasting zone. As a result, interruptions to visitor use would be for approximately two hours, for 8 days interspersed between July and October. However, this should not preclude visitors from continuing on with their planned activities, or prevent them from seeing attractions on the west end of Diablo Lake of continuing on to Ross Lake.

Recreationists in the NRA may also be disturbed by noise from blasting and construction activities. Blasting would cause a single loud explosion (for each of the 8 events), while noise from excavation and rock drilling activities, and the construction of the road and barge landings, would generate noise up to 8 hours a day during spring through fall in 2012 and 2013. Noise from blasting would attenuate to ambient levels approximately 4.3 miles from the project area, affecting visitors using trails, campgrounds, and backcountry campsites (Figure 6). Noise from construction would attenuate to ambient levels at about 1,990 ft. Using the assumptions and noise attenuation calculations described in the BE (Appendix 2), Table 4 provides the noise levels at major recreational facilities within range of blasting and construction activities.

Table 4. Sensitive noise receptors in project vicinity.

			Noise Level (dBA)	
Visitor Noise Receptor	**Distance from slide (ft)**		**Blast**	**Construction**
Ross Dam	1,800		74	47
State Route 20	1,820		73	47
Ross Lake Trailhead	2,000		72	46
Ross Resort	4,950		63	46
Buster Brown Campground	7,600		58	46
Environmental Learning Center	12,000		53	46
Colonial Creek Campground	14,700		51	46
Diablo Dam	15,200		50	46
Gorge Campground	19,700		48	46

Visitors at the Ross Dam, along the State Route 20 corridor, Ross Lake Trailhead, and Ross Resort would be exposed to the greatest amount of blasting noise. Noise experienced at these locations would range from the sound of a conversation (60 dBA) to a vacuum cleaner (75 dBA;

OSHA, 2011). Construction noise would attenuate to ambient levels before reaching most recreation sites. However, NRA visitors in the vicinity of the ferry landing and NPS floating dock or on the Ross Haul Road may experiences slightly elevated noise levels from rock scaling and construction activities.

The typical soundscape within the area of impact varies depending on the location within the NRA. Much of the NRA is associated with recreational use and hydroelectric operations due to the FERC jurisdictional boundaries within the NRA. Thus, the soundscape within the zone affected by blasting or construction contains sounds associated with vehicular and boat traffic; off-loading and loading from barges, boats, and vehicles; SCL and NPS operations and maintenance projects; buzzing from transmission lines (240 kV); and the low constant hum at the powerhouse. Signs would be posted ahead of time at NPS and SCL recreational facilities to warn visitors. Regardless, blasts may startle and may be objectionable to visitors, particularly visitors in the more remote areas of the NRA. Compared with the typical sounds associated with the NRA, though, the noise from blasting would only have a minor and short term adverse impact on visitors.

Noise from blasting would have a minor to moderate and very short term adverse impacts on visitors to the NRA depending on their location. Construction-related noise would have negligible to minor adverse impacts that are relatively short-term (2 to 3 months), albeit steadier in duration than the blasting activities. The interruption of recreational activities and the transport of visitors during blasting would result in temporary, minor adverse impacts

Cumulative Impacts

The project area prior to the March 2010 rockslide hosted a variety of unique and publicly valued recreational opportunities. Implementation of Alternative B would restore these opportunities, although there would be temporary minor adverse impacts during construction and blasting. Fisherman's Ferry and the Skagit Tours would continue to operate with the same efficiency as before the rockslide. Many of the future NPS projects as identified in Chapter 4.2.4 improve recreational and visitor opportunities, while other projects are not anticipated to adversely impact recreational or visitor access. Therefore, implementation of Alternative B would have a beneficial cumulative impact on recreation and visitor use.

4.4.3. Visual/Aesthetics

Direct and Indirect Effects

A total of 27,500 CY of blasted rock would be removed as part of Alternative B. This would result in visible scarring on the cliff face, noticeable by a brighter color than the weathered and lichen-encrusted rock typical of the area. However, for the most part the proposed actions would not be removing weathered rock that had not already been impacted from the March 2010 rockslide. Other visible impacts include less vertical slopes and fewer overhanging rocks.

Following the proposed blasting, the debris pile would spread along the lateral edges, but would not build substantially greater than the current height. Also part of this alternative includes the re-construction of two (or possibly only one) barge landings and a reconnection of the existing Ross Haul Road. The MSE wall associated with the reconstructed roadway would be faced with rock or material resembling rock in order to blend in with the existing environment. The barge landings would not have a roof or any other standing structure, so they would be relatively low

profile, and flush with the water level. Likewise, the reconstructed road would follow the contours of the rock debris pile (that would be similar in shape to the debris pile prior to the proposed blasting). Final restoration of the site would include revegetation of the main staging area and a portion of Excavation Access Road, and in the vicinity of the Ross Haul Road reconnection below, although vegetation is not expected to establish in the debris rock pile.

Addition of the barge landings and boat docks would not substantially contrast with the surrounding environment, and would be similar to the conditions that existed prior to the March 2010 rockslide. Similarly, the scarring of the rock face as a result of proposed blasting would not be substantially different than the present day visible conditions. Reconstruction of the proposed facilities would not significantly detract from the setting that currently contains existing visible hydroelectric facilities, such as 240kV transmission lines and towers. The proposed action would be consistent with NPS management goals in the Hydroelectric Zone, as outlined in the GMP. Therefore, the adverse impacts as a result of Alternative B would be minor and long-term, although to an important resource.

Cumulative Impacts

Prior to the March 2010 rockslide, the project area contained steep, weathered rock walls similar to other areas along the Upper Skagit River. The rockslide scarred the rock face and created a large debris pile below. Blasting activities planned as part of Alternative B would not result in visual impacts to the rock surface that would be substantially different from the natural event, and the restoration of the barge landings and road would only result in minor impacts as these structures were present previously. Future projects as identified in Chapter 4.2.4 are primarily within disturbed corridors and are not anticipated to degrade viewsheds. Therefore, implementation of Alternative A would not contribute to adverse cumulative visual/aesthetic impacts.

4.4.4. Hydroelectric Operations

Direct and Indirect Impacts

Implementation of Alternative B would stabilize the slopes above the lower portion of the Ross Haul Road. Transportation of all equipment and supplies would be restored because the temporary barge landing (although this would eventually be removed) and the 80-ton barge landing would no longer be at risk, and a permanent 100-ton barge landing would be reconstructed. Consequently, operations and maintenance would resume to levels prior to March 2010 and the risk to uninterrupted power delivery to the Seattle area would be reduced. The possibility for downstream flooding would be minimized due to these restored operations and because reconstruction of the Ross Haul Road would allow more rapid response by operators needing to travel between the dam and powerhouse during an emergency. Further, SCL personnel would have a safe and rapid emergency evacuation route such as before March 2010, reducing the chance of lost lives if an evacuation was necessary. Therefore, implementation of Alternative A would result in major long-term beneficial impacts for hydroelectric operations.

Cumulative Impacts

Considering the foreseeable projects described in Chapter 4.2.4, cumulative impacts to hydroelectric operations are not anticipated.

4.4.5. Conclusions

Alternative B would result in moderate to major, long-term, beneficial impacts. Implementation of Alternative B would improve safety for NPS staff, SCL employees, and NRA visitors because future rock fall and rockslides in the targeted areas would be less likely to occur. The SCL Emergency Action Plan would be restored, allowing more adequate escape routes for SCL personnel in case of emergency. Alternative B would also re-establish immediate access between the powerhouse and dam to enable expeditious response in emergency situations, and large equipment could be transported for operations and maintenance. The risk of interrupted power delivery to the Seattle area would be reduced, and Skagit River flows could be efficiently managed to reduce the possibility of downstream flooding.

Blasting activities would adversely impact water quality, by contributing to turbidity, but would be localized, temporary, and of low to moderate intensity. Turbidity monitoring along with the use of proper BMPs would limit adverse impacts. Impacts to vegetation would be moderate and long term because lack of soils in the project area renders vegetation reestablishment difficult. Off-site restoration would mitigate for any lost nearshore functions and values and upland habitats. Direct impacts to fish and wildlife include minimal habitat loss and the possible mortality of a few individual common animals, as well as disturbance from noise. Noise from blasting would be loud but limited to 8 discrete events with construction noise between, while noise from rebuilding the barge landing (s) and road would be less but constant for the summer of 2013. Noise during the blasting phase would result in moderate, relatively short-term adverse impacts on NRA visitors (depending on their location in relation to the blast), while impacts during road and barge construction phases would be negligible to minor and last for several months.

Adverse impacts to the viewshed would be minor and long-term. The viewshed subsequent to road and barge reconstruction would be similar to the viewshed prior to March 2010, and rock face scarring would be no different than scarring from other nearby natural events. The interruption of recreational activities and visitor access during blasting would result in temporary, minor intensity impacts, but weighed with the benefits of restoration of unique recreational opportunities and improvement of public safety, adverse impacts to recreational activities would be insignificant.

Implementation of Alternative B would result in either no cumulative impacts or only negligible adverse cumulative impacts, except for those related to recreation and visitor use. Alternative B would provide beneficial impacts to recreation and visitor use because the project would restore a variety of unique and publicly-valued recreational opportunities that were lost as a result of the March 2010 rockslide. This, along with other planned projects in the NRA, provides a cumulative beneficial impact to recreation and visitor use.

Chapter 5. Consultation and Coordination

5.1. History of the Planning and Public Scoping Process

Approximately 20,000 CY of rock and debris fell from the rock cliff above the barge landings and NPS dock on March 14, 2010. Subsequent smaller events occurred on March 15th and 21st.

SCL notified the NPS and initiated an immediate reconnaissance of the area to evaluate existing conditions and establish any immediate emergency procedures. Principals from the NPS and

SCL conducted a field reconnaissance and meeting on March 17, 2010. Discussions included short-and long-term access to NPS facilities on Ross Lake, access for Ross Lake Resort personnel and visitors, the need to restrict public access from Ross Dam for safety reasons, possible use of downed trees, and the development of a plan of action. NPS and SCL agreed to closely coordinate on short term and long-term solutions.

A Plan of Action was developed by SCL and discussed with NPS in April 2010. Immediate rock scaling and stabilization work included the removal of the East Diablo Ferry Landing and the NPS floating dock from the base of the slide, logging on the margins of the slide slope, and building a temporary landing at the upstream side of the slide. An NPS archeologist was scheduled to inspect the site and a project meeting was held for the NPS Temporary Trail and Dock project on April 8, 2010.

SCL issued a SEPA DNS, Legal Notice, and environmental checklist for public review and comment on July 15, 2011. The checklist described the various project phases and noted that final plans were available for the Blast/Rockslide Stabilization Phase and that preliminary designs for road and barge landing reconstruction were available. No comments were received by SCL pursuant to the public notice.

SCL also notified several non-governmental organizations that are active in the NRA (North Cascades Conservation Council and the National Park Conservation Association) of plans for rock stabilization and road/barge reconstruction.

From March 2010 through the present, NPS has reviewed environmental and planning documents developed by SCL, in addition to attending site visits to discuss components of the project and potential mitigation measures. NPS reviews included the SEPA Environmental Checklist, BE, and additional application materials provided for federal and state permits, including the JARPA.

Upon the opening of the public comment period, the following agencies and organizations will be provided a notice of the availability of this EA for an opportunity to comment:

- District 39 State Representative, Dan Kristiansen
- District 39 State Representative, Kirk Pearson
- District 39 Senator, Val Stevens
- U.S. National Forest, Mt. Baker Ranger District
- National Parks & Conservation Association
- National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- North Cascades Conservation Council
- North Cascades Institute
- Office of Archaeology & Historic Preservation
- Office of the Regional Solicitor
- Ross Lake Resort
- Seattle City Light

- Skagit Environmental Endowment Commission – British Columbia
- United States House of Representatives, Rick Larsen
- United States Senate, Maria Cantwell
- United States Senate, Patty Murray
- U.S. Army Corp of Engineers
- U.S. Fish and Wildlife Service - Western WA
- WA State Department of Transportation
- Seattle City Council
- City of Seattle Mayor
- Wilderness Society
- Whatcom County Planning and Development Services
- Whatcom County Sheriff
- FERC
- U.S. Customs and Border Patrol
- WA Water Trails Assn, Seattle
- WA Kayak Club, Seattle
- WA Kayak Club, University of Washington, Seattle
- Paddle Trails Canoe Club, Seattle
- Seattle Public Library
- WDFW
- Upper Skagit Indian Tribe
- Sauk-Suiattle Indian Tribe
- Swinomish Indian Tribal Community
- Nlaka'pamux Nation Tribal Council
- Washington Department of Ecology

5.2. Agency Consultation

5.2.1. U.S. Army Corps of Engineers

Preliminary conversations began in March 2010 with the agency representative, Randal Perry, to discuss emergency work necessary to restore SCL and NPS site safety and administrative functions disrupted by the March 2010 rockslide. Work proceeded under emergency authorization from the NPS and a permit issued by the ACOE on May 11, 2010. Immediate debris clean-up work was undertaken to enable SCL crew to utilize the 80-ton barge landing.

Potential designs were also provided for relocating and reconstructing the East Diablo Ferry Landing prior to the start of the recreation season. A permit authorizing SCL to construct a temporary landing for the 100-ton barge and an associated access road was issued by the ACOE October 28, 2010. Discussions have continued concerning the four phases of the project proposal.

In a September 11, 2011 letter authorizing SCL to proceed with the blasting/rockslide management phase under a Nationwide Permit (NWP) 14 and 3, the ACOE noted that USFWS concurred with a finding of "may affect, not likely to adversely affect" ESA listed species. The September 11, 2011 ACOE authorization noted that the authorized work met the Washington State Department of Ecology's Water Quality Certification and the Coastal Zone Management Act requirements.

Subsequent permit modifications were submitted and approved to account for updated designs, new quantities and revised construction schedules. The current authorization was issued by the ACOE on February 3, 2012.

5.2.2. United States Fish and Wildlife Service

Section 7 consultation, in accordance with the ESA, was necessary due to the presence of bull trout in the Diablo Lake and the potential effects of the proposed project. A BE was submitted to USFWS on August 10, 2011. The USFWS concurred with a finding of "may affect, not likely to adversely affect."

5.2.3. Washington Department of Fish and Wildlife

Preliminary conversations began in March 2010 with the agency representative, Wendy Cole, to discuss the need to engage in emergency work to restore site safety and vital functions disrupted by the March 2010 rockslide. The agency issued an HPA to enable SCL crew to clear debris from the 80-ton barge landing. Construction of the temporary 100-ton barge landing was authorized under an HPA issued on October 20, 2010. Preliminary designs for further actions were subsequently reviewed and discussed. An HPA to cover the blasting/rockslide management portion of the project was issued on August 30, 2011. Subsequent permit modifications were submitted and approved to account for updated designs, new quantities and revised construction schedules. The current authorization was issued by WDFW on January 5, 2012.

5.2.4. Whatcom County Shoreline Management Program

Preliminary conversations began in March 2010 with Whatcom County representatives. These conversations included the destruction caused by the rockslide, and the immediate need to restore site safety and restore functions vital to SCL and NPS operations. In February 2012, SCL was informed by Whatcom County that the County does not have jurisdiction for the blasting/rockslide management phase of the proposed project. However, SCL was required to submit a Whatcom County Shoreline Master Application for Shoreline Development and Conditional Use permits for the subsequent phases of the project. An application was submitted to Whatcom County on June 17, 2011 for a Substantial Development permit to authorize road and barge landing reconstruction. It is anticipated that a public hearing, as part of the permitting process, would be scheduled no later than summer 2012.

5.2.5. Federal Energy Regulatory Commission

On October 7, 2011 the FERC informed the NPS that the proposed action was essential for continued safe operation of the Skagit Hydroelectric Project, and that the recovery actions were necessary, authorized, and considered critical to public safety (FERC, 2011).

5.3. List of Preparers and Contributors

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Chapter 7. Glossary

Bathymetric data. Contour lines showing underwater relief and depth.

Blast control specialist. The person authorized to act on behalf of the blasting contractor, and licensed by the State of Washington or local regulatory agency, to possess, transport, and use explosives.

Blast Consultant. Responsible for blast designs provided by the blasting contractor, and a recognized expert in the field of drilling and blasting. The Blast Consultant is not an employee of the blasting contractor, or an explosive manufacturer or distributor.

Blasting contractor. The contractor to SCL that would be performing the rock drilling, blasting, and scaling operations,

Blast lift. The rock material removed from a blasting event.

Bolting. A steel or fiberglass bolt that is used to stabilize rock by anchoring in a hole drilled in the rock.

Boulder. Sediment with a grain size greater than 256 millimeters; the largest of sediment sizes.

Catchment swale. Pertinent to the proposed project, a trench used to collect falling rock.

Clay. Sediment with a grain size greater than 256 millimeters; the smallest of sediment sizes.

Cobble. Sediment with a grain size greater than 256 millimeters; second to boulders in largest sediment size.

Colluvium. Loose debris that accumulates at the foot of a steep slope.

Draw down. Lowering the water level behind the dam.

Ecology block. A large concrete block used for creating retaining walls. They are often stacked in an offset fashion and fit together via tongue and groove.

Foliation. The parallel arrangement of rocks in layers or sheets.

Forest duff. Partly decayed plant matter on the forest floor.

Glaciation. Passage of a glacier, during an ice age, causing glacial erosion.

Head scarp. The main scarp (see "scarp" definition below) at the upper edge of a landslide.

Joint. A plane or surface that divides a rock where movement has not been observed parallel to the plane or surface.

Lineations. Linear structural features within rocks formations.

Listed species. Fish, wildlife, or plant species that are protected, and listed as "threatened" or "endangered," by the Endangered Species Act.

Rock scaling. Removal of loose rock from the surface (e.g., cliffs).

Orthogneiss. Gneiss originating from igneous rock. In the NRA, most older orthogneiss is composed of tonalite, whereas the younger orthogneiss tpically has a composition resembling granite.

Overbreak. Rock that caves in or loosens as a result of a blast, in excess of the intended line of cut.

Overburden. Rock or soil overlying a mineral deposit.

Pre-split lines. Holes that are drilled along lines as part of the presplit blasting technique.

Pre-split blasting. A controlled blasting technique where the presplit holes are detonated prior the detonation of any production holes.

Production Blasting. A blasting technique that results in rock fragmentation that facilitates the excavation of in-place rock. Production blasting utilizes more widely spaced blast holes drilled throughout the main rock slope area, adjacent to the controlled blast line. Production holes are detonated in a controlled delay sequence towards a free face.

Sand. Sediment with a grain size between 1 millimeter (very coarse sand) and1/16 millimeter (very fine sand); a medium-sized sediment.

Scarp. Also known as an "enscarpment" scarp, a scarp is a cliff or scar of exposed soil formed from the movement of a geologic fault or landslide.

Shot rock. Blasted rock.

Stemming material. Noncombustible, inert material (sand, clay, drilled rock, etc.) used to confine or separate explosives in a drill hole.

Stress relief fractures. Fractures caused by accumulated potential energy that is released by fracturing along a plane.

Talus bowl. The area in which talus (rock fragments) has accumulated at the foot of a slope.

Tectonic. Refers to the characteristics and configurations of rock and land forms, such as folding and faulting.

Chapter 8. Appendix

8.1. Photos

Photo 1. View from water looking east at the new Ross Haul Road debris avalanche taken on the morning of March 15th 2010.

Photo 2. A similar view of the site taken on April 17th 2008 before the landslide occurred.

Photo 3. Another view of the debris avalanche looking east.

Photo 4. View of the debris covering the Ross Haul Road looking toward the tunnel.

Photo 5. View of pick-up truck entrained in landslide debris.

Photo 6. View of dock debris (tires and Styrofoam) floating downstream of the landslide.