Final Biological Evaluation
Project: Ross Powerhouse Rockslide Stabilization and Facilities Replacement
Applicant's Name: Seattle City Light (SCL)
Date: 10 August 2011

I. ***Location***: The proposed Rockslide Stabilization and Facilities Replacement project is located along the northeast shore of Diablo Reservoir (also known as Diablo Lake), in Whatcom County, Washington. The property is part of Seattle City Light's (SCL) Skagit River Hydroelectric Project (No. 553) which is licensed by the Federal Energy Regulatory Commission (FERC). The Skagit Project consists of Gorge, Diablo, and Ross dams and their associated reservoirs, structures, and facilities. The project site is within the Skagit River Project boundary, as designated by the FERC. It is also within the Ross Lake National Recreation Area (NRA), which is administered by the National Park Service (NPS) as part of the North Cascades National Park Complex (NOCA). The site is accessible only by boat.

II. ***Project Description***: On March 15, 2010 an estimated 16,000 cubic yards (CY) of rock and debris slid from a steep rock cliff along east side of Diablo Lake downstream of the Ross Powerhouse (see photo below and Appendix A, Drawing A-5204, for more detail). This event and subsequent smaller landslide events buried several SCL and NPS facilities including the following:

- A section of the Ross Lake Service Road, which provides the only vehicle access between Ross powerhouse and dam;
- 100-ton barge landing;
- 80-ton barge landing;
- East Diablo Ferry Landing, which provides recreational access between Diablo and Ross lakes to NRA visitors and Ross Lake Resort guests;
- NPS's Floating Dock, which is used by recreational boaters.

SCL began stabilization activities in the rockslide area almost immediately after the event occurred in March 2010. Work was authorized under an emergency permit issued by the Army Corps of Engineers (ACOE) on May 11, 2010. Early actions involved developing an Upper Access Road to the top of the rock scarp and establishing a staging area; performing rock bolting and scaling. This work involved the removal of 99 trees. To reestablish recreational access SCL relocated and reconstructed the East

Diablo Ferry Landing, and the NPS relocated and reconstructed the floating dock and developed a trail connecting the Ferry Landing to the Ross Service Road. These projects were authorized under a permit issued by the Washington Department of Fish and Wildlife (WDFW) on May 26, 2010. A temporary barge landing and associated access road were constructed in November 2010 to allow delivery of equipment and materials to Ross Powerhouse until a road across the slide area could be designed. Permits authorizing this work were issued on October 22 and 28, 2010 by the WDFW and ACOE, respectively.

Additional work is needed to manage unstable rock cliffs above Ross Service Road and to replace structures damaged by the March 2010 rockslide and restore areas impacted by stabilization and construction activities. The proposed project consists of 5 major phases:

- Phase I: Blast/Rockslide Stabilization – Conduct blasting and stabilization operations (scaling and bolting) to manage unstable rock above the Ross Service 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). The proposed timeframe for Phase I of the project is August 15-November 15, 2011. If Phase I cannot be implemented during this time, it will be conducted between March and June, 2012.

- Phase II: Road Construction – Re-establish vehicle access between Ross Powerhouse and Dam 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 to comply with FERC safety regulations; (b) designing and constructing a permanent road. Rock from blasting and scaling and fill for the new roads will completely cover the existing temporary barge landing (built in fall 2010). Construction of the temporary road would occur in late 2011 if the blasting is complete; otherwise it will be scheduled for June-July 2012. The permanent road would be built later in 2012 or in the first half of 2013.

- Phase III: Barge Landing Construction – Replace the 100-ton barge landing which was destroyed by the rock slide and reconstruct the 80-ton barge landing which was damaged and will need to be aligned with the new road. SCL is investigating designs for a single, combined barge landing to accommodate both the 80-ton and 100-ton barges, which have different docking mechanisms and presently require separate landings. Construction of the barge landing(s) is targeted to occur in 2012 or 2013.

- Phase IV: Ferry Landing and Recreation Structures – Evaluate the recreation-related structures (e.g. ferry landing and NPS floating dock) constructed shortly after the rockslide to determine whether the location and configuration are adequate for long-term recreation needs. This phase will be addressed in a separate permit application focusing on recreational structures. It is noted in this document to provide context for the site. Any changes to recreational structures would likely be scheduled for 2012 or 2013.

- Phase V: Restoration – Develop and implement restoration plans in consultation with the NPS, ACOE, WDFW and Whatcom County that address all elements of the project. On-site restoration is expected to include bank stabilization and planting native vegetation in areas that have been disturbed. Additionally, restoration of one or more areas off-site, but nearby, may also be considered. Restoration is expected to occur in 2013.

III. ***Construction Methods and Materials:*** Construction methods are described below for each phase. Equipment and Best Management Practices (BMPs) for the entire project follow in Sections IV and V.

A. Phase I: Blast/Rockslide Stabilization. The blast/rockslide stabilization phase includes two major tasks: 1) developing the staging area; and 2) blasting, rock scaling and rock bolting. Specific methods for each are described below; drawings are provided in Attachment A.

1. Staging Area Development. A staging area of about 32,000 sq ft was established on top of the rock scarp for initial rock stabilization work in 2010 as part of the emergency actions. This area will be expanded by 1,200 sq ft for the blasting work for a total area of about 44,000 sq ft (1 ac). Trees and shrubs will need to be removed in the expanded portion of the staging area. Additional trees will be cut in the excavation area for the Upper Access Road (see Drawing A-5205). Two equipment staging areas will also be established below the rock scarp, one on either side of the rock debris pile; these will be 24,000 sq ft and 10,000 sq ft, up- and downstream, respectively, for a total of 34,000 sq ft (0.8 acre). Both of these lower staging areas are in locations

associated with either Ross Powerhouse or the existing Jeep Road and are in sites that are relatively disturbed (see Drawing A-5205).

2. Blasting, Rock Scaling, and Rock Bolting. The unstable scarp (see photo to right) will be removed using a combination of rock scaling and blasting. The main area to be blasted measures approximately 90 ft wide x 90 ft long and will be about 90 ft deep at its deepest point. Blasting will extend into the "talus bowl" beneath the rock scarp (Figure 1), and will involve an area approximately 100 ft long by 50 ft wide. To maintain access to the blast area and the talus bowl the Upper Access Road will also need to be excavated and blasted to lower elevations with each successive blast (Figures 1, 2). Ultimately, the Upper Access Road will be about 90 ft long and 45 ft deep at its lowest point. The sides of the road will be sloped and will be approximately 12 ft wide at the bottom of the road cut and 54 ft wide at the top. See Figure 1 for a schematic of view of the area and Drawing A-5205 for details.

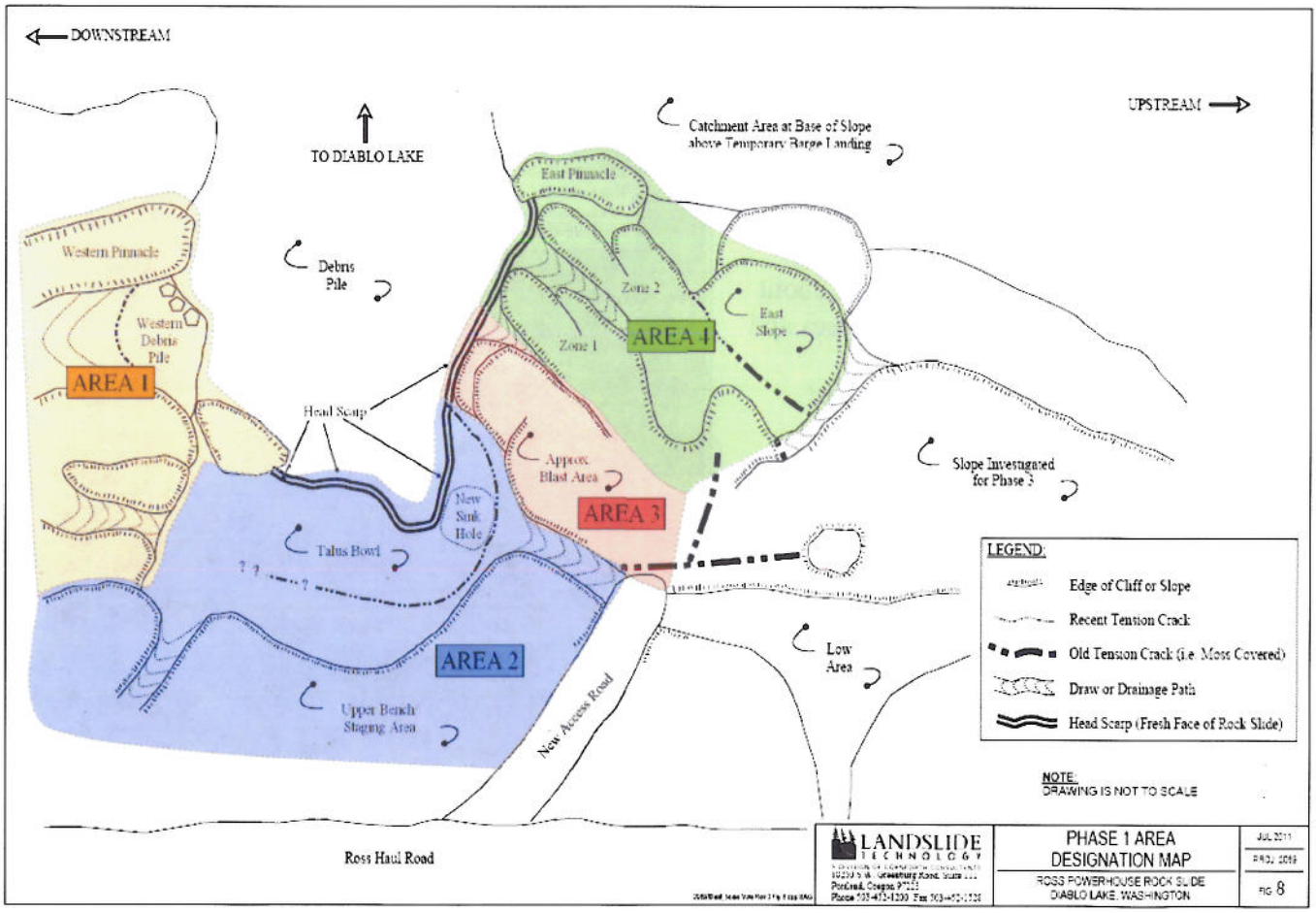


Figure 1. Schematic showing the blast area, talus bowl, Upper Access Road, and work areas.

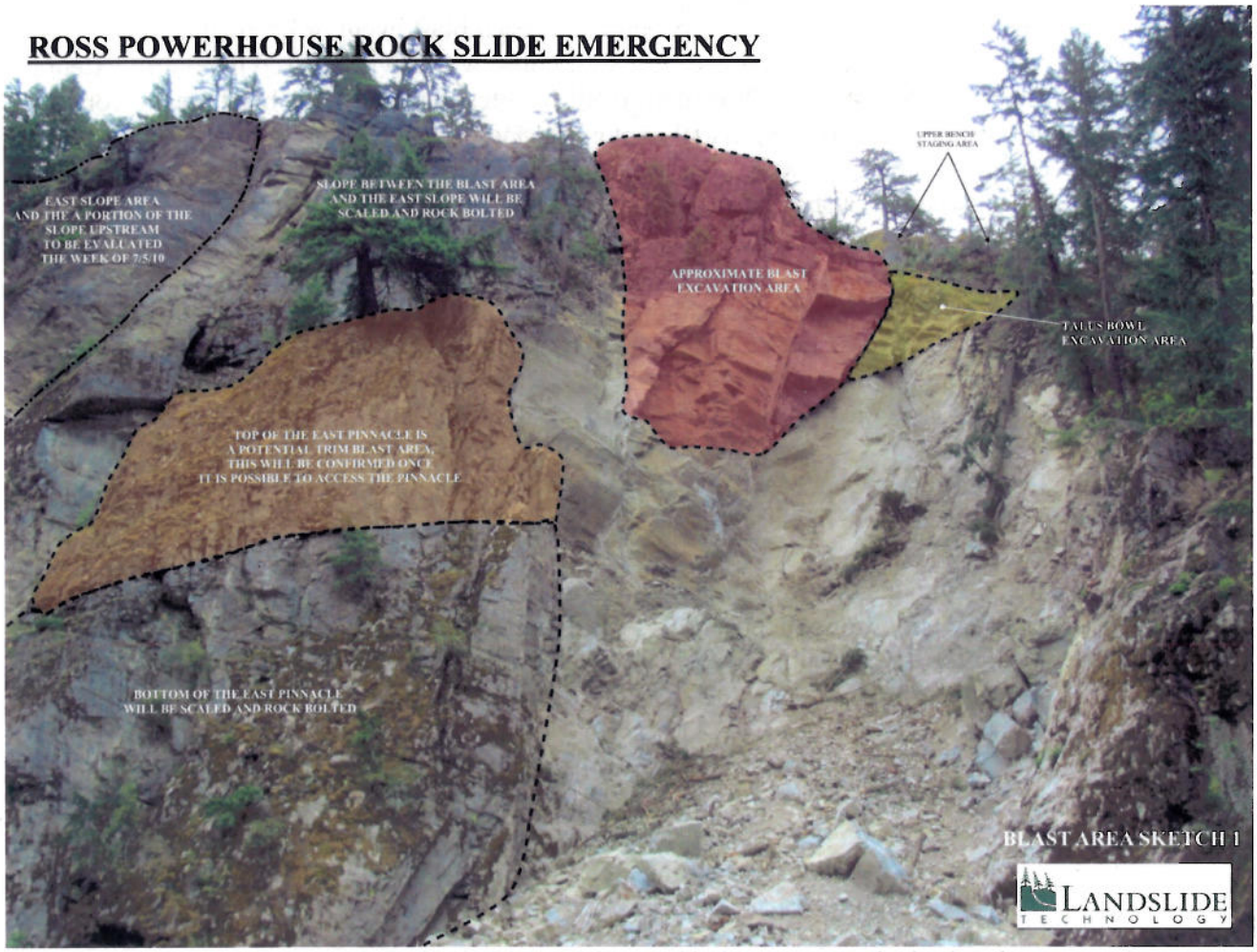


Figure 2. Annotated photograph depicting blast, scaling and bolting areas and talus bowl.

It is anticipated that blasting the rock scarp will produce approximately 15,000 CY of rock, swelled volume; blasting in the talus bowl and Upper Access Road will generate 5,100 to 5,600 CY of material, swelled volume. Of the total 20,600 CY, an estimated 3,600 CY may be incidentally discharged into Diablo Lake below ordinary high water (OHW).

Previous work conducted in 2010 and 2011 included extensive rock scaling and bolting to stabilize the rock cliffs as much as possible prior to blasting; improve safety conditions in the area; and limit the amount of material that would need to be blasted. Some additional scaling and bolting will occur prior and subsequent to blasting operations. Past and future scaling activities have or may generate an estimated total of 8,100 CY of rock (swelled volume), with about 200 CY of that amount incidentally entering the reservoir below OHW.

a. *Blast Procedures.* General procedures for each blast event or lift include the following: (1) drill an array of pre-split holes, which will be used to control extent of the targeted blast area; (2) drill production holes in the targeted blast area to conduct the main excavation; (3) install explosives and detonators into the drilled holes; (4) complete safety checks to clear the blast area of personnel; (5) delayed-detonation of the blast to direct shot material away from the lake and SCL transmission lines; (6) post-blast assessment by the Blaster-in-Charge to review effectiveness of detonation and slope conditions to approve safe entry of other personnel into the blast area; (7) scale shot rock that may remain in the blast area and excavate an access road into the next targeted blast area; and (8) install rock bolts as needed to secure key rock-blocks during the scaling and excavation work. These steps will be repeated up to 8 times until the unstable portions of the scarp are removed and cliff is stabilized.

The Blaster-in-Charge will lay out the location, depth and diameter of holes to be drilled to achieve the targeted blast excavation area. Each blast event will be analyzed separately by the Blaster-in-Charge. Factors influencing blast design include dimensions (i.e. length, width, and thickness) of the targeted excavation area; geologic conditions such as rock type, degree of fracturing, and number of encountered voids; presence of water in the drill holes; location of structures; and allowable vibration limits. Evaluation of the factors will be used to:

- prevent flyrock into the nearby powerlines and into the reservoir,
- comply with U. S. Bureau of Mines (USBM) guidelines,
- fragment rock into desired dimensions,
- displace rock to facilitate excavation,
- minimize fracturing of rock adjacent to blast area,
- minimize damage to adjacent forested areas, and
- maintain a safe working area.

Blasting will begin at the top of the scarp and progress downward in layers or "lifts". Removing the entire rock scarp will be require up to 8 blast lifts that will occur at 1 - 2 week intervals over a period of 3 to 4 months. This assumes a 2 week period for mobilization and a 2 week period for unforeseen contingencies. Each lift will be up to 30 ft deep. Each blast will be evaluated, documented and subsequent blasts adjusted by the blaster-in-charge. Only one blast lift will be detonated on any given day and blast lifts will 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, will 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 (pers. comm., B. George, Geologist, Landslide Technology, 2011). Rock material generated by each blast will be

excavated and pushed over the sides of the talus bowl into the rockslide debris pile below the cliffs (Figure 1, 2). Access to the talus bowl by equipment and crews will be via the Upper Access Road. However, if access to the talus bowl from the Upper Access Road cannot be maintained because of unsafe conditions, crews will use the "downstream gully" on the west end of the site (see Drawing A-5205). This area will only be used if necessary and no trees will be removed from the gully prior to making this determination. If it is necessary to use the gully the area will be surveyed by a SCL ecologist who will mark any trees that need to be removed and flag construction zone limits.

b. *Explosives and Detonation.* Ammonium nitrate with fuel oil (ANFO) has been selected as the primary explosive agent for the blast; Dynosplit AP will be used in the pre-split holes. Neither of these products contains perchlorate. Perchlorate, which is present in many explosives, is a drinking water contaminant that has been shown to disrupt the thyroid's ability to produce hormones needed for normal growth and development in humans, wildlife, and fish.

Detonation materials include blast detonation cord, non-electric and delay electric caps. Perchlorate, hexavalent chromium, and lead may be present in the blasting caps but at extremely low levels. Explosive materials will be handled and detonated per manufacturer's recommendations and under the supervision of the Blaster-in-Charge.

Ground Vibration. Vibrations that leave the blast area through the ground are known as ground vibration (as measure by particle velocity [inches/sec]). Magnitude of vibrations is dependent upon the amount of explosive detonated at any one time. Research by 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 geologic conditions and therefore have the potential for greater vibration effect (pers. comm., L. Magnoni, Washington State Department of Transportation [WSDOT], Biologist, 2011).

The Blaster-in-Charge will measure ground vibrations using a seismograph located at Ross Powerhouse to record longitudinal (horizontal), transverse (perpendicular to longitudinal) and vertical (up and down direction perpendicular to longitudinal) components. Peak particle velocity for the blast will 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 peak particle velocities from any one blast event exceed 2.0 inches/second adjustments will be made to subsequent blast plans. Particle velocities less than 2.0 inches per second show little probability of causing structural damage (NPS 1999). Vibrations from the blast are not expected to impact surrounding rock features.

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). 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 (pers. comm., L. Magnoni, Biologist, WSDOT, 2011). However, if noise levels measured from any one blast event exceed 130 dBA at 10 ft, adjustments will be made to subsequent blast plans. Sound levels are measured with a seismograph (Mini-Seis II), which includes a microphone to measure air pressure, as well as a sensor for ground vibration. The seismograph will be located at Ross Powerhouse, which is about 842 ft from the rock scarp.

c. *Rock Drilling.* Drilling is likely to occur daily for up to 8 hours per day over a 3-4 month period to prepare the site for each blast event. Pre-split and production holes will be drilled using a rock drill (Joy Air-Trac rock drill) with an air compressor (Ingersoll-Rand 900).

d. *Transportation and Handling of Explosive Materials.* Transportation of explosives will 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 will transport the products to and from the jobsite. The products will arrive on the day of the blast via SCL barge and leave the same day. No products will be stored on-site. Upon arriving at the jobsite, the driver will be the only one with the keys to unlock the doors to the truck. The driver will also guard the vehicle at all times. The Blaster in Charge will direct the driver as to what products will be needed for the blast. Any unused product after the shot is loaded will be immediately stored and inventoried into the delivery truck and returned to the explosives supplier.

e. *Clearing Barge Landings and Reservoir.* Blast rock that falls into Diablo Lake and blocks water access to the remaining barge landings will be removed using a hydraulic excavator. The excavator will work from the barge landing or from a barge and will not be positioned in the water. The lake elevation may be drawn down 5-8 ft (from OHW elevation 1,205 ft [NAVD 29] to elevation 1,197-1,200 ft) to facilitate this action.

B. Phase II: Road Construction. Equipment and materials for construction of the temporary and permanent roads will make use of the staging areas on either side of the debris pile that were developed for the blast. Any additional staging areas will be identified and flagged on site. Construction of the temporary and permanent roads will not require the removal of any additional vegetation. Preliminary drawings and general descriptions for road construction are attached for reference (Drawings A-5220 to A-5223); final drawings and detailed descriptions for will be provided as soon as they are available.

1. Design and Construct Temporary Road Across Slide Area. 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 will be "notched" into the top of the rock debris pile. Since the exact topography of the area will not be known until blasting work is done, the road design provided (Drawing A-5221) reflects a conceptual design; road geometry across the rock debris pile will be finalized and cut/fill quantities will be updated at final design. The temporary road will serve as a rough road bed for the permanent roadway.

   The temporary road will be approximately 14 ft wide and 466 ft long; road grade will be approximately 8%. The portion of the temporary road across the debris pile will be constructed by breaking down large boulders (up to 25 ft in diameter) to smaller sizes of about 6 inches or less. Some boulders will be broken into smaller sizes using Betonamite, a non-explosive expansive grout. Holes for the Betonamite will be drilled using a rock drill powered by an air compressor, such as an Ingersoll-Rand 600.

   After the boulders are broken down, a hydraulic excavator (such as a Caterpillar 330) will be used to form the roadbed. Generally, rock will be excavated (cut) from the landward (high) side of the road, and placed (fill) on the waterward (low) side below OHW. Total estimated cut, including the portion upstream of the rock debris pile, is approximately 1,600 CY. The road will require approximately 1,500 CY fill; with about 1,200 CY deposited below OHW (Drawings A-5221 to A-5223). The reservoir will be drawn down for work on the temporary road, so any fill material below Ordinary High Water (OHW) will be placed in the dry.

   The temporary barge landing and associated access road that was constructed in 2010 (see Drawing A-5205) is expected to be completely buried by the material from the blast and by fill for the temporary road across the slide. However, there will be small amount of

excavation (5 CY) and fill (5 CY) below OHW to remove geotextile material and recontour the shoreline in the vicinity of the temporary barge landing. Any slope stabilization and revegetation work needed to restore the temporary barge landing area will be done per the approved Restoration Plan that will be developed during the design process in consultation with the NPS, WDFW, ACOE and Whatcom County (Phase V).

The general sequence for temporary road construction is given below.

1) Delineate the construction zone limits with particular attention to areas below OHW prior to any ground disturbing activities.
2) Install TESC measures, BMPs, and monitoring equipment, if any, prior to construction activities.
3) Delineate temporary road alignment.
4) Begin rock crushing and splitting.
5) Construct the temporary roadbed by moving rock material from the uphill side of the roadbed and constructing fill with that material on the downhill side.
6) Remove geotextile below OHW where the temporary barge landing was constructed.
7) Cut and fill to accommodate the alignment of the reconstructed road upstream of the debris pile.
8) Lay down temporary road fill using coarse crushed rock for the base and finer crushed rock fill for the surface.
9) Evaluate TESC measures and BMPs at each stage.
10) Demobilize.

2. Permanent Replacement of the Ross Jeep Road. A permanent replacement road across the rock slide will be designed and constructed after the blasting is complete and a temporary road is installed. Survey from the post-blast area will be used to develop the permanent road design. Final plans will be submitted prior to construction. 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 will be needed to construct the permanent road. No fill below OHW is planned for the permanent road but an estimated 60 CY may be discharged incidentally. The reservoir will be drawn down for work on the permanent road, so most of the material incidentally discharged below OHW would be in the dry.

   The permanent road will be constructed on the same alignment of the temporary road (Drawings A-5221 to A-5223). This will be accomplished using fill material to raise the roadway several feet. Raising the roadway will 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. Fill material will be loaded into dump trucks (Peterbuilt 10 CY trucks) using a loader (Caterpillar 938). Fill material sources will be approved by SCL ecologist and NPS biologist. Only certified weed free materials will be used. A

dump truck will deposit crushed rock onto the road in approximately 12 inch layers (lifts), a Caterpillar D6 dozer will move the crushed rock into position, and a Bomag 10-ton vibratory compactor will compact the materials.

Once the road sub-grade is brought to the appropriate elevation and alignment, a MSE retaining wall will be constructed to raise the road bed. A raised road bed will allow for widening the road and construction of rock protection measures on the uphill side of the road. Rock protection measures for the new roadway may include a catchment swale, and/or an ecology block wall. Refer to the Permanent Roadway Cross-Section on Drawing A-5222.

The MSE wall will be constructed on the downhill side of the fill. The MSE wall will be constructed by laying down compacted lifts of fill material 6 to 12 inches thick on a mat of non-woven geotextile. After each lift, the geotextile will be folded back over the top of the preceding lift to form the base for the next layer of fill. Fill material used to raise the roadbed will be native gravel material obtained from the rockslide debris pile.

The general sequence for permanent road construction is given below.

1) Survey the rock pile to establish the road alignment.
2) Delineate the construction zone limits with particular attention to areas below OHW prior to any ground disturbing activities.
3) Install TESC measures, BMPs, and monitoring equipment, if any, prior to construction activities.
4) Begin rock splitting and crushing.
5) Construct the permanent roadbed to the designated line and grade by raising the temporary road bed with fill and an MSE wall as described above.
6) Restore bank where temporary barge landing and temporary barge landing road was constructed.
7) Prepare site for restoration.
8) Evaluate TESC measures and BMPs at each stage.
9) Demobilize.

If possible, the MSE wall for the permanent road will be vegetated and/or designed blend in with the surrounding landscape. The final restoration plan for the permanent road and other project elements will be developed in consultation with the NPS, ACOE, WDFW and Whatcom County.

C. **Phase III: Barge Landing Construction.** Replacement of the 100-ton landing destroyed by the rockslide is planned for 2012. SCL has two barges (80-ton and 100-ton) with different docking mechanisms that require separate landings. SCL is evaluating whether it is possible to site and construct a single new landing that would accommodate both docking mechanisms.

Construction of a single landing would minimize the shoreline industrial footprint and environmental impacts. See Drawings A-5220 to A-5223 for preliminary design.

Associated road excavation and embankment work upstream and downstream of the rock debris pile will be necessary to provide a workable grade from the landing to the permanent road for large vehicles transporting heavy powerhouse components from/to the barge landing to Ross Powerhouse. Because the proposed new barge landing will approach the shore at an angle (see Drawing A-5221), there will be a combination of excavation on the uphill side and fill on the downhill side of the landing approach. A hydraulic excavator will be used for excavation and fill tasks. The total amount of fill for construction the new barge landing is estimated to be 171 CY, with about 130 CY of this amount below OHW (Drawing A-5523); about 250 CY of material will also be cut from below OHW. The reservoir will be drawn down 5-8 ft for work on the barge landings, so material cut and filled below OHW will be done in the dry.

A concrete bulkhead will be constructed crosswise to the centerline of the landing as close as possible to shore, consistent with depth needs for barge usage. The bulkhead will be formed using hand tools, dimensioned lumber, plywood and reinforcing bar. Reinforcing bars will be drilled and grouted into solid rock in the foundation area. Once the bulkhead is constructed, fill will be needed to link the shore to the bulkhead. A barge landing superstructure is expected to be constructed from structural steel with an adjustable ramp that can be used to accommodate a variety of lake levels. This description is conceptual in nature because the barge landing has not yet been designed. Design details will be submitted once finalized and prior to construction.

The general sequence for barge construction is given below.

1. Survey the area to establish the barge landing alignment.
2. Delineate the construction zone limits with particular attention to areas below OHW prior to construction.
3. Install TESC measures, BMPs, and monitoring equipment, if any, prior to construction activities.
4. Drawdown Diablo Lake elevation so that construction activities can take place in the dry.
5. Perform rock cut and fill, and bulkhead construction.
6. Construct landing structure.
7. Evaluate TESC measures and BMPs at each stage.
8. Demobilize.

D. Phase IV: Ferry Landing and Recreation Structures. Following the rockslide, a new site was established to accommodate the East Diablo Ferry Landing and NPS dock in June 2010. The site location and the associated recreation facilities were originally planned as temporary measures. SCL may propose to convert temporary structures to permanent after consultation

with Whatcom County, NPS, the ACOE and WDFW. Some additional work may be needed to improve access between the landing and the Ross Service Road. This phase will be submitted separately as a recreation project.

E. **Phase V: Final Restoration Phase.** Final restoration plans will be developed in consultation with the NPS, ACOE, WDFW and Whatcom County. Restoration and mitigation will take into account all actions related to this project which began in March 2010. Actions include:

- Construction of temporary facilities (temporary barge landing and road [constructed in fall 2010] and the temporary road across the rock pile)
- Trees and vegetation removal (staging area, Upper Access Road, "downstream gully" [if used])
- Rock scaling and bolting
- Blasting
- Construction of new permanent or relocated structures (East Diablo Ferry Landing, NPS floating dock, permanent road across rockslide, permanent barge landing(s), upper access road)

Restoration will include removing any temporary fill materials from the shoreline to original bank location, reconstructing the bank the bank where possible, stabilizing the bank, planting native vegetation, and restoring an area(s) off-site.

IV. ***Equipment and Materials:*** Equipment used for each phase of the project is provided in Table 1 along with estimated decibel levels.

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.

V. ***Best Management Practices (BMPs):*** A number of BMPs will be implemented to reduce project impacts on the environment. BMPs for the blast/rock stabilization phase have been developed and are provided below, along with BMPs that will apply to al project phases. BMPs specific to road and barge landing construction will be developed as designs are finalized.

A. Phase I: Blasting/Rock Stabilization. BMPs for blasting and other rock stabilization tasks are designed to reduce the risk of spills and minimize impacts from clearing, noise, and turbidity.

1. Delineation of Staging Area and Blast/Construction Zone Limits. Flagging and/or construction fencing will be used to clearly delineate the staging areas, blast/construction zones, and Upper Access Road excavation area. The purpose of delineating these areas is to protect vegetation in adjacent locations from being damaged by project activities. Trees that have been identified for removal will be flagged by a SCL ecologist and/or a NPS botanist.

2. Blasting
   - ANFO and other explosive materials will be delivered to the site by barge in a DOT-certified truck by the explosive supplier. Bulk ANFO will only be used in dry holes drilled in competent rock. If significant fracturing, large voids, and/or wet conditions are encountered in the drill holes, the WR ANFO cartridges will be used. Blasting will not occur in severe water or if standing water conditions are encountered.
   - Decking (i.e. placement of stemming material or an air gap at specific locations within a drill hole to bypass potentially problematic zones) will be used to increase blast effectiveness and reduce noise levels.
   - Each blast is subdivided into many smaller blasts, separated by a few milliseconds to reduce noise impacts.

3. Spills and Containment
   - A spill prevention and containment plan has been developed and will be implemented by the contractor. Spill clean up kits will be kept at all staging areas.
   - ANFO will be poured carefully into each bore hole. Small spills around the bore hole will be consumed by the blast. Spills that will not be consumed by blast will be cleaned immediately and placed back into the appropriate container.

4. Turbidity
   - A Temporary Erosion and Sedimentation (TESC) Plan has been developed and will be implemented.

- Sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials will be prevented from entering or leaching into the lake.
- Depending on site conditions, upper and/or lower catchment berms (Drawing A-5205) may be constructed to aid in preventing some of the blast rock from reaching the barge landings and/or Diablo Lake. Berms would be constructed from the rock in the debris pile. Site conditions prevent installation of catchment berms across the base of the slide, but it may be possible to construct some catchment berms off to the sides of the slide area. Catchment berms would be located above OHW.
- If practicable, a sediment curtain will be installed to intercept and mitigate turbidity at the rock fall site.
- Turbidity will be monitored in accordance with Department of Ecology regulations.

B. BMPs for All Phases. BMPs that will apply to all phases include the following.

1. Trucks and Equipment Operating on the Shoreline
   - All equipment used for the project will be staged above full pool in the equipment staging area.
   - Equipment and vehicles will 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 will include compliance with regulations for handling fuels.
   - Equipment will be kept free of external petroleum-based products.
   - All diesel and gasoline-powered vehicles and equipment will be checked regularly to ensure that they are in proper working condition and do not leak. Any necessary repairs will be made off-site.
   - A Spill Response and Containment Plan will be implemented as needed. Spill containment materials and cleanup kits will be present on all equipment at all times.
   - Containment booms will be available for immediate response in case a spill occurs and the material enters the water.
   - Equipment and vehicles will be refueled in designated upland staging areas or off-site and will not occur on the shoreline.
   - Vehicles and equipment used for construction activities will be cleaned and washed off-site; no washwater or deleterious material will be allowed to enter the reservoir.
   - Vehicle engines will be turned off when not in use instead of allowing them to idle.

- If possible, antifreeze in radiators will be replaced with a non-toxic alternative.

2. Turbidity
   - If a clamshell-type dredge is used to transfer construction fill to shore, the clamshell will be completely closed prior to initiating the swing to avoid releasing fill material during transfer.
   - Clean imported fill material will be used and construction materials will be stockpiled away from the shoreline/stream areas.
   - TESC plans for phases II and III will be developed for when final designs for these phases are complete and implemented during construction.
   - Work below OHW will be done in the dry, when the reservoir is drawndown.
3. Weed Control
   - All construction equipment and all vehicles that enter the site will be washed and free of imported soil and plant materials prior to entering the site.
   - Fill material will be sourced from an inspected and approved weed-free supplier.

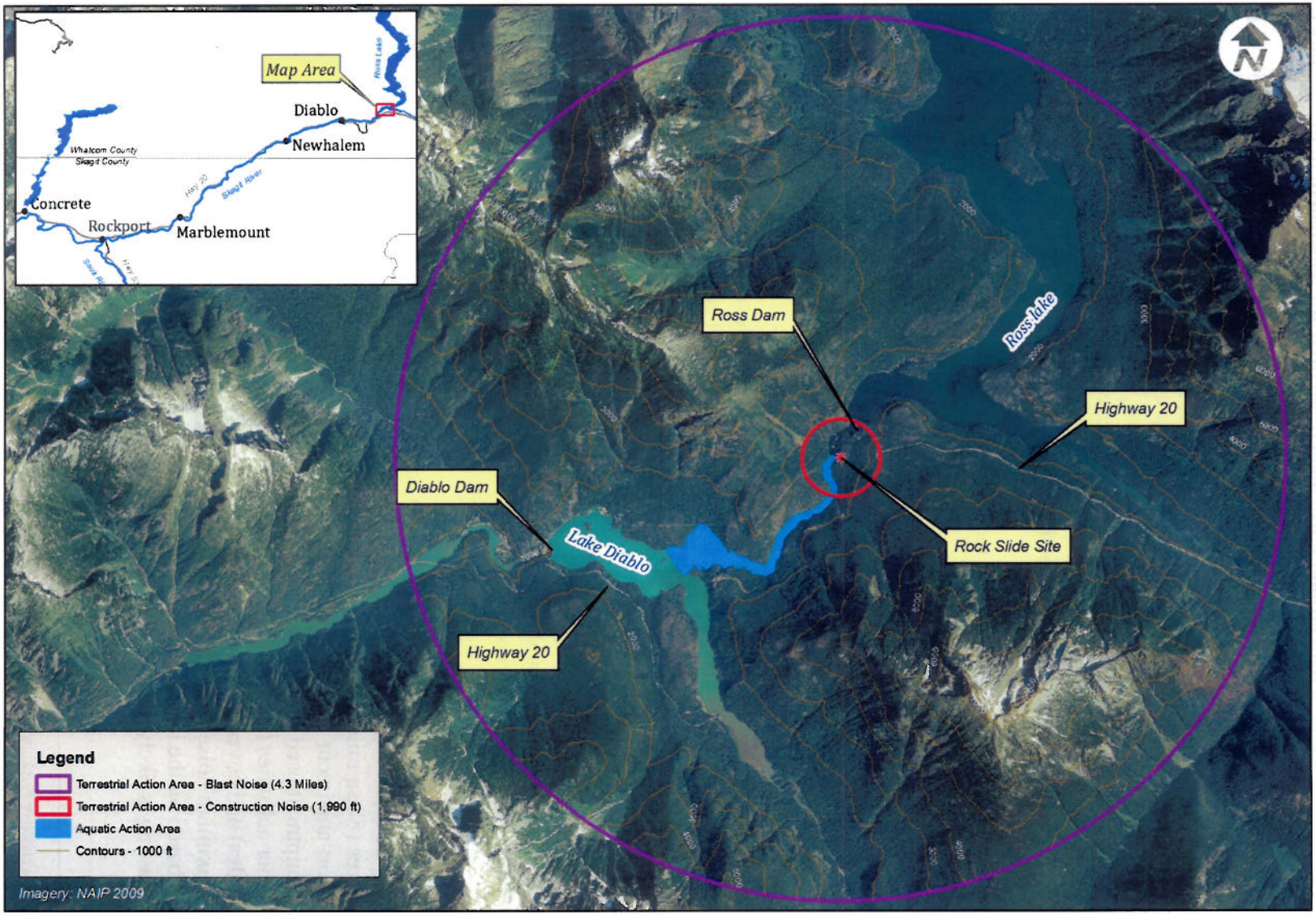
VI. ***Action Area:*** For biological resources associated with the site, the area potentially affected directly and indirectly by the project is estimated as follows:

A. Aquatic species: Diablo Lake in the vicinity of the project is in a very narrow canyon, approximately 200 ft wide, which 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 very 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 a great deal of suspended sediment, the result of 51 glaciers upstream. The action area for aquatic species encompasses the width of the reservoir from project site downstream to Thunder Arm to take into account potential effects to water quality from rock entering the reservoir during blasting and associated turbidity (Figure 3). This area is about 188 acres, or about 24% of the 770-acre Diablo Lake.

B. Terrestrial species: The rock slide in March 2010 removed much of the vegetation from the project site, but the surrounding area is characterized by forest stands dominated by Douglas-fir trees. The full range of size/age classes is represented, with younger trees on the top of the rock scarp, along the existing jeep road, and near Ross Powerhouse; and older trees in gullies, along the shoreline, and on the steep slopes above the reservoir on the side opposite the rockslide.

The action area for terrestrial species is based on the distance affected by project-generated noise above ambient levels. The distance of noise attenuation to ambient levels was calculated using the following assumptions:

Figure 3. Action Areas



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- NPS measured a background noise level of 46 dBA for Newhalem in the vicinity of Gorge Powerhouse (Soundscapes). Like the project site, noise sources in this area include the nearby powerhouse, traffic from SR 20, and flowing water. 46 dB will be used as the ambient noise level for analysis.

- Blasting at the magnitude planned for the project site will generate noise levels in the order of 115 to 150 dB at 10 ft (pers. comm., L. Magnoni, Biologist, WSDOT, 2011). If noise levels measured from any one blast event exceed 130 dBA at 10 ft, adjustments will be made to subsequent blast plans. 130 dBA at 10 ft is therefore assumed to be the maximum noise level from the blast.

- Work in the project area will include rock drilling, rock scaling, and excavating; it will require a variety of construction equipment and vehicles (see Table 1). The maximum sound levels for project equipment range from 78 to 84 dBA at 50 ft (Table 1; WDOT 2011). However, several pieces of equipment are likely to be in use at a single time, resulting in additive effects. 86 dBA will be the assumed noise level 50 ft from the work area for all Phase I activities (rock drilling, excavating) except blasting, and for Phases II and III (calculated using formulas in WSDOT 2011).

- 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 (calculated using $\mathbf{D = Do * 10^{(Construction\ Noise - Ambient\ Sound\ Level\ in\ dBA)/}}$ $\mathbf{D = Do * 10^{((Construction\ Noise - Ambient\ Sound\ Level\ in\ dBA)/\alpha)}}$ (where D = distance, Do = reference distance, and $\alpha = 25$ [WSDOT 2011]).

Based on these assumptions, the action area during blasting for terrestrial species is centered on the rock scarp and extends out 4.3 miles, encompassing an area of approximately 37,176 acres (58 sq miles) (Figure 3). Up to 8 blasts are planned but each blast event will be very short and occur over a period of weeks; more consistent disturbance will result from the equipment used for other activities in phases I-III. The action area for terrestrial species for other activities (rock drilling and scaling and road construction will extend 1,990 ft (0.34 miles) and cover an area of 285 acres (Figure 3). Since these assumptions are based on the maximum noise levels for the individual pieces of equipment, and the background noise level is based on the lowest measured level, the impact area for project activities other than blasting is likely smaller than indicated.

V. ***Endangered Species Act (ESA) Protected Species and Essential Fish Habitat:*** Diablo Reservoir, known as Diablo Lake, is part of the Skagit River Hydroelectric Project (Skagit Project Number 553), which is operated under a license issued by the Federal Energy Regulatory Commission (FERC) in 1995. The Project is located in the upper Skagit River basin. The Skagit River, which originates in Canada, is the third largest in Washington and drains an area of 3,100 square miles. The Skagit River and its tributaries drain mountain areas from east to west, entering the United States from British Columbia at river mile (RM) 127 and flowing a total of 162 river miles to Puget Sound near Mount Vernon, Washington. The basin is characterized by rugged mountain topography in the central and eastern parts, and by broad floodplains and rolling uplands in the western part. Diablo Lake has a drainage area of 1,125 square miles and is surrounded by very steep mountains over 6,000 ft elevation.

As part of obtaining its operating license from the FERC, SCL summarized information on ESA protected and state listed species known or potentially occurring in the Skagit Project area; this material was submitted to the FERC in 1989. SCL also agreed to a number of research studies, surveys, and monitoring activities over the term of the license (1995-2025). The information in this section is based on material submitted to FERC in 1989 (Brueggeman et al. 1988) and updated with more recent information from the literature and subsequent studies, surveys, and monitoring activities by both SCL and the NPS. Three SCL biologists: Ron Tressler, Ed Connor, PhD., and Colleen McShane, provided input to and/or reviewed this document.

There are no extant ESA-protected plant species known or suspected to occur at or near the project site. There are, however, eight ESA protected listed fish and wildlife species known to occur in the North Cascades Ecosystem and potentially found within the Skagit Hydroelectric Project (Skagit Project) area. These include two bird, three mammal, and three fish species: marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), gray wolf (*Canus lupus*), grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), and bull trout (*Salveninus confluentus*), Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), and steelhead (*O. mykiss*).

Puget Sound Chinook salmon and steelhead are found in the Skagit River downstream of the Gorge Powerhouse. Neither of these species occurs in Diablo Reservoir as upstream migration was blocked by natural barriers located above the Gorge Powerhouse prior to the construction of the Skagit dams, as well as by Gorge and Diablo dams under current conditions. Since Chinook and steelhead do not occur in the action area for aquatic species, they are not included in this biological evaluation.

Diablo Lake does not provide Essential Fish Habitat (EFH) for salmon or steelhead. Chinook salmon, coho salmon (*Oncorhynchus gorbuscha*) and pink salmon (*O. kisutch*) do not occur in the lake because natural barriers on the Skagit River, including the Gorge Reach above the town of Newhalem and Diablo Canyon downstream of Diablo Dam, prevented fish passage upstream into the Diablo Lake area. As a result, these three anadromous fish species were not historically present in Skagit River in the vicinity of Diablo Lake.

Habitat requirements for the six species addressed in this BE and project effect determinations are provided below.

A. Marbled Murrelet

Status: Federal Threatened, State Threatened

The marbled murrelet is a small seabird that nests in forest habitats and forages in coastal waters. The species was federally listed as threatened in 1992 due to loss of breeding habitat and mortality associated with gill net fishing and oil spills (57 FR 45328-45337). Critical habitat was designated in 1996 (61 FR 26255-26320) and the recovery plan was finalized in 1997 (USFWS 1997). The marbled murrelet ranges from Alaska to the central California coast and populations have declined throughout this area over the last 30 years (http://www.natureserve.org/ explorer/servlet/NatureServe). At-sea breeding population estimates for marbled murrelets in Puget Sound and the Strait of San Juan de Fuca have fluctuated in the years 2000 through 2008, with no discernable increasing or decreasing trend; however, additional years of data are needed before a population change can be detected with high confidence (Lance et al. 2009). Recent data on nest success and adult:juvenile ratios at sea continue to confirm that murrelet reproduction in Washington, Oregon, and California is too low to sustain populations (USFWS 2009).

The distance inland that marbled murrelets breed is variable and is influenced by a number of factors, including the availability of suitable habitat, climate, and topography; predation rates; and maximum forage range (McShane et al. 2004). In Washington the primary range is considered to extend 40 miles inland, but occupied habitat has been documented 52 miles from the coast (Hamer 1995; Madsen et al. 1999) and the species has been detected up to 70 miles inland. Marbled murrelets typically nest in old growth forests and select large, old trees with branches that support mats of epiphytes (McShane et al. 2004). The nesting in Washington occurs over an extended period from late April through late August (McShane et. al. 2004). Incubation lasts about 30 days and chick rearing takes another 28 days.

The blast action area for terrestrial species extends west to a point just downstream of Diablo Dam, about 60 miles straight-line distance from Puget Sound and approximately 103 river miles, and is considerably outside of the primary breeding range for the marbled murrelet in Washington. The nearest detections of marbled murrelets have been about 9 miles to the west of the blast action area, in the Thorton Creek drainage at the western edge of North Cascades National Park (Hamer Environmental, L.P. 2009); the closest designated critical habitat is about 20 miles west. The proposed project is not located in suitable nesting or foraging habitat for the marbled murrelet nor will the project occur during nesting season. The proposed project will have ***"no effect"*** on marbled murrelets.

B. Northern Spotted Owl

Status: Federal Threatened, State Endangered

The northern spotted owl was federally listed as threatened in June 1990 (65 FR 5298-5300), with a final recovery plan for the species published in May 2008 (USFWS 2008a) and a revised recovery plan released in June 2011 (USFWS 2011). The four recovery criteria in the plan are: stable population trends throughout its range; adequate population distribution among defined recovery units; and continued maintenance and recruitment of spotted owl habitat; and post-delisting monitoring (USFWS 2011). In Washington, populations of spotted owls are thought to have declined precipitously since 1990; however, the current number of occupied territories is unknown because not all areas have been or can be surveyed annually (USFWS 2011).

In the state of Washington, spotted owls typically nest in older, multilayered forests at elevations from near sea level to 4,000 ft in the North Cascades. Spotted owl nesting and roosting habitat is characterized by a moderate to high canopy closure (60 to 90 percent); a multilayered, multi-species canopy with large overstory trees (>30 inches dbh); a high incidence of large trees with large cavities, broken tops, mistletoe infections, and other evidence of decadence) large snags; large accumulations of downed trees and other woody debris; and sufficient open space below the canopy for flight (USFWS 2008a). Northern spotted owls typically lay eggs in late March or April. After the incubation and brooding period, the young typically start flying nearby between May and June, and parental care continues into September (USFWS 2008a).

The northern spotted owl is considered an uncommon resident in the North Cascades National Park Complex (NOCA), which includes the action area. Most previously known territories west of the Cascade crest are now occupied by barred owls (*Strix varia*). Based on surveys conducted by the NPS, the nearest known spotted owl nest site is located in the Newhalem Creek drainage, more than 5 miles to the southwest of the blast action area. This site was active in 2009 but no spotted owls detected in 2010, the most recent survey year (pers. comm., R. Kuntz, Wildlife Biologist, North Cascades National Park, 2011). There are no records in the last 15 years of spotted owl activity within a 5-6 sq mile area in the vicinity of the rockslide site year (pers. comm., R. Kuntz, Wildlife Biologist, North Cascades National Park, 2011). The closest designated critical habitat is about 20 miles west.

The forest in the construction action area (285-acre area surrounding the project site) generally consists of smaller trees and a relatively open understory. This area does not represent suitable nesting, roosting, or foraging habitat for spotted owls but could be used for dispersal (pers. comm., R. Kuntz, Wildlife Biologist, North Cascades National Park, 2011). The proposed project has already required the removal of 99 trees, all less than 22 inches dbh, from the construction action area and several more trees may need to be cut prior to blasting. While these trees will re-grow or be replanted as part of restoration efforts, the project has resulted in the temporary loss of dispersal habitat.

Thresholds of 57 dBA and 70 dBA are used by the Olympic National Forest and adopted by WSDOT (2011) as noise levels that potentially result in "alert" and "disturbance" behaviors, respectively, by spotted owls. Alert behavior is defined as when the spotted owl shows apparent interest by turning the head or extending the neck; disturbance is when the owl shows avoidance by hiding, defending itself, moving the wings or body, or postponing a feeding (WSDOT 2011). Noise associated with rock drilling and construction activities will be up to 86 dBA within 50 ft of operating equipment and will attenuate to 70 dBA at 218 ft and 57 dBA at 723 ft (Figure 4). Equipment noise from the project could therefore result disturbance responses by spotted owls within a 3.4-acre area centered on the project site and alert behaviors within 37.7 acres.

Areas of large trees do occur in the blast action area (37,828 acres) and may provide some potentially suitable spotted owl nesting, foraging, and roosting habitat. Blasting noise will attenuate to 92 dBA at 331 ft, 70 dBA at 2,512 ft, and 57 dBA at 8,318 ft. 92 dBA is used by the Olympic National Forest and adopted by WSDOT (2011) as the harassment/injury threshold, where a spotted owl could be actually injured, which is defined as an adult flushed from the nest or the young missing a feeding. The area where blast noise could injury spotted owls is very small—about 7.9 acres centered on the project site—and does not currently provide suitable nesting, roosting, or foraging habitat for this species. The blast could, however, result in alert or disturbance behaviors by spotted owls in 4,987 acres and 455 acres, respectively (Figure 5).

No spotted owls have been observed nesting, foraging, or roosting in either the blast or the construction action areas. Nonetheless, noise levels from the blast will be high enough to possibly cause injury in a small area and disturbance or alert behaviors over larger areas. Construction equipment could also result is alert and disturbance reactions. The project "***may affect, not likely to adversely affect***" the northern spotted owl.

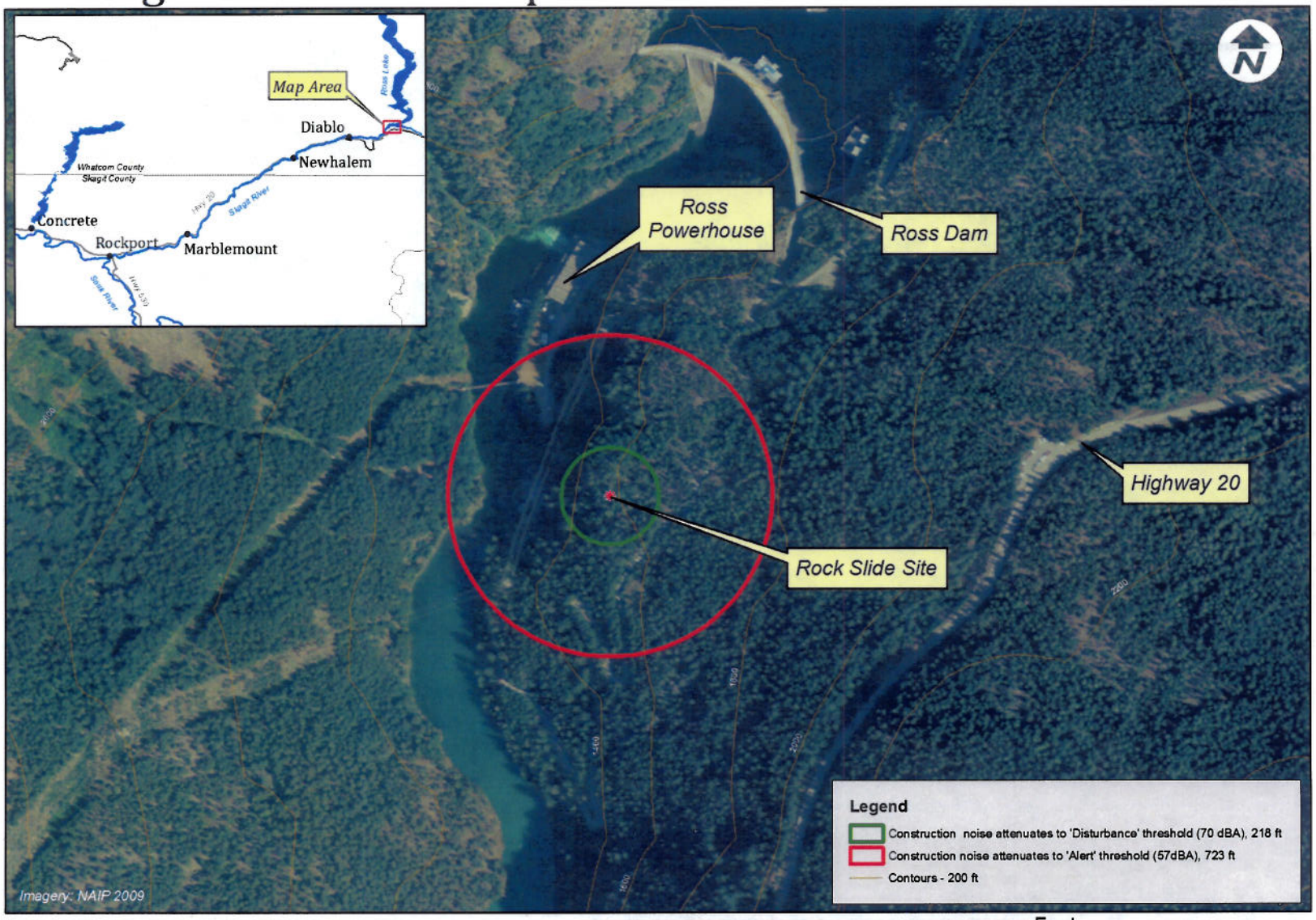
B. Gray Wolf

Status: Federal Endangered, State Endangered

The gray wolf was listed as an endangered species in all states except Minnesota and Alaska in 1978 (43 FR 9607-9615). No population recovery goals were developed for wolves in the North Cascades or Washington State in the recovery plan and no critical gray wolf habitat was designated in Washington (USFWS 1987). The species was delisted in the eastern one-third of Washington in March 2011 but remains federally protected in the western two-thirds of the state.

Wolves are carnivorous and typically prey on large ungulates; however, they will also feed on fish, carrion, small mammals, rabbits, and birds. Wolves may travel as far as 43 miles within a 24 hour period to hunt and range over greater distances during dispersal. Key components of wolf habitat are: 1) sufficient, year-round prey base of ungulates and alternative prey; 2)

Figure 4. Northern Spotted Owl - Construction Noise



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0 250 500 1,000 1,500 2,000 Feet

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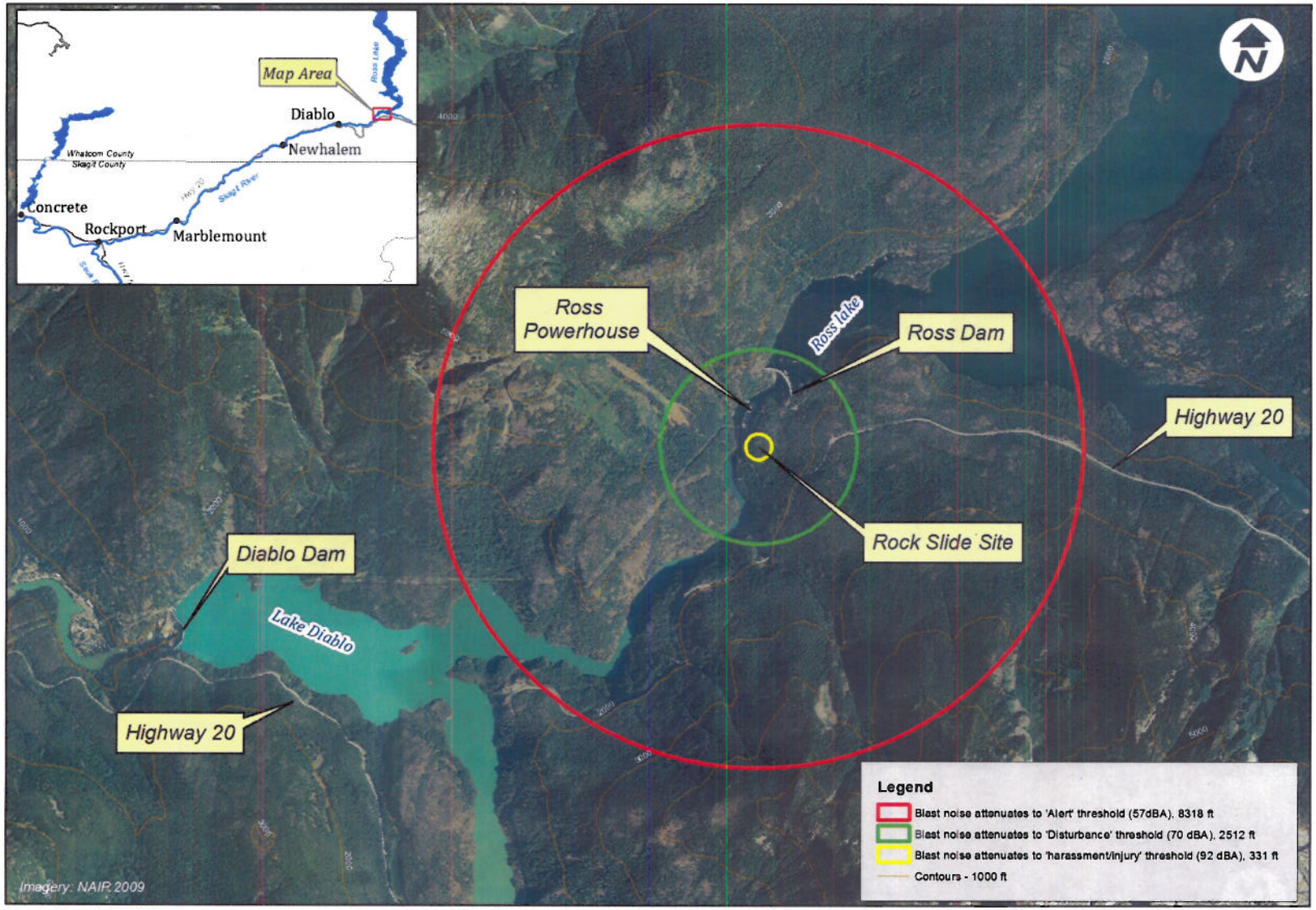
Figure 5. Northern Spotted Owl - Blast Noise



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suitable denning and rendezvous sites; and 3) adequate space with minimal exposure to humans (USFWS 1987).

With the exception of the reservoirs and developed portions of the Skagit Hydroelectric Project, there is abundant habitat suitable for denning and rendezvous sites for the gray wolf in the North Cascades, as well as large areas that are isolated from humans. It is possible, however, that prey may be limited in this region since the area west of the Cascade crest does not currently support large ungulate populations (Wiles et al. 2011).

Wolves have been documented in the vicinity of the Skagit Project, both recently and in the past. Wolves were documented in the Hozomeen area of Ross Lake every year from 1990 to 1993 (Almack and Fitkin 1998). After many years with no reported observations, one potential wolf track was found in the Ross Lake drawdown zone near Hozomeen by a NPS biologist on May 27, 2009 (pers. comm., R. Christopherson, Wildlife Biologist, North Cascades National Park, 2009). In late May, 2010 numerous probable wolf tracks and scat were found in the Hozomeen area during surveys by NPS and WDFW biologists (pers. comm. J. Bohannon, Wildlife Biologist, Washington Department of Fish and Wildlife, 2010,). Photos of one or more wolves were captured by remote cameras in this area in 2011 and tracks were observed at several locations in May 2011 (pers. comm., R. Christopherson, Wildlife Biologist, North Cascades National Park, 2011). It is currently hypothesized that the wolves observed near Hozomeen likely have the majority of their home range in Canada. Hozomeen is about 19 miles from the project site.

Despite these observations, the nearest known wolf pack to the action area is in western Okanogan County (WDFW 2011; http://wdfw.wa.gov/conservation/gray_wolf; accessed on July 29, 2011). The territory for this pack, known as the Lookout Pack, is thought to be east of the Cascade crest and mostly within the Lake Chelan-Sawtooth Wilderness Area. Straightline distance between the project site and the Cascade crest is approximately 17 miles; it is another 30 miles to the Lookout Mountain area near Twisp, Washington, which is where the pack was first documented. This pack has recently been decimated by poaching and there is no evidence to suggest that the few remaining wolves use the habitats in or near the action area.

Human activity associated with the operation of Ross Powerhouse, as well as the steep terrain along Diablo Lake and recreational activities are all deterrents to use of the immediate project vicinity by gray wolves. There are no reports of this species at or near the project site, suggesting that the area is not typically used as a travel corridor. Although wolves could use habitats within the blast action area, this species has not been sighted west of the Cascade crest for many decades. The proposed project will have ***"no effect"*** on the gray wolf.

D. Grizzly Bear
Status: Federal Threatened, State Endangered

Grizzly bears were listed by the USFWS as threatened in 1970 (35 FR 16047-16048). Remnant populations are currently managed in Washington and three other states. The Grizzly Bear Recovery Plan (USFWS 1982) includes the North Cascades as one of the six ecosystems in which grizzly bears are known to have occurred within the decade prior to listing. Recovery goals for the North Cascades region are to 1) maintain current population, 2) provide protection under state and federal laws, and 3) collect baseline data on population status and habitat (USFWS 1982).

The NOCA and adjacent wilderness areas are believed to have suitable habitat to support grizzly bears (USFWS 1993). Suitable spring forage areas in the North Cascades include marshes, riparian areas, and low elevation shrubfields. Upper elevation shrubfields and grass sidehill parks and alpine ridges represent suitable summer foraging habitat. Densely forested areas with downfall are considered to be important for cover. No den sites have been identified in the North Cascades. However, suitable denning habitat – in excavated chambers or natural caves – is not considered a limiting factor in the North Cascades (Almack 1986).

The grizzly bear population in the North Cascades Ecosystem, which includes British Columbia and Washington, has been estimated at <50 bears on based on sighting data (Grizzly Bear Outreach Project web site http://www.washingtongrizzlies.org/; accessed July 2, 2010). Population estimates based on DNA hair sampling methods are lower, about 6 bears for the entire ecosystem or 0.39 bears/100 sq miles (0.15 bears/100 km) (Romain-Bondi et al. 2004). Natural recovery of grizzly bears in this region is considered unlikely due to the demographic and environmental stochastic events associated with small populations (Romain-Bondi et al. 2004).

It is very unlikely that grizzly bears use the action area and there have been no documented observations of this species in or near the action area. Between 1959 and 1991, there were 21 confirmed grizzly bear observations in the Washington North Cascades; additional sightings are considered highly probable (Almack et al. 1993). Until recently, the only evidence of grizzly bears near the action area was a photograph of a grizzly bear track taken in 1991 in the Thunder Creek drainage, which is a tributary to Diablo Lake (North Cascades Grizzly Bear Outreach Project, accessed June 17, 2008; www.bearinfo.org). In October 2010, however, a grizzly bear was photographed in an alpine meadow in the upper Cascade River drainage, about 7 miles southwest of the project site (North Cascades Grizzly Bear Outreach Project, accessed July 29, 2011; www.bearinfo.org).

The project site and general vicinity do not represent suitable foraging or denning habitat for grizzly bears. In addition, the level of human activity in the area associated with the Ross Powerhouse and various boating docks, as well as trails and camps in the area, preclude the seclusion preferred by grizzly bears. There are no reports of this species at or near the project site, suggesting that the area is not typically used as a travel corridor. Grizzly bears could use more remote parts of the blast action area but the noise levels are unlikely to result in anything

more than alert behavior. No grizzly bear critical habitat has been designated. For these reasons, the project will have ***"no effect"*** on grizzly bears.

E. Canada Lynx

Status: Federal Threatened, State Threatened

The Canada lynx was state listed as threatened in Washington in 1993 and federally listed as threatened in 2000. Primary threats to the species include habitat loss and over utilization (trapping) (FR 65 FR 16051-16086). Critical habitat was designated in 2006 (71 FR 53355-53361). A state recovery plan was published in 2001 (Stinson 2001) but there is no federal recovery plan to date for the lynx.

Lynx are closely associated with boreal forests because of their near-dependence on a single prey species—the snowshoes hare—which is mostly limited to this habitat type. In Washington, most records of lynx are from the northeastern and north central portions of the state, in the Selkirks, Kettle Range, and North Cascades east of the crest (Stinson 2001). Lynx typically occupy high elevation forests but can travel over 300 miles when dispersing during prey declines. Lynx populations in the northern boreal forest fluctuate on an approximate 10-year cycle in response to changes in snowshoe hare numbers. Cyclic variations in snowshoe hare-lynx populations are dramatic in Alaska and Canada but tend to be more moderate in Washington (Stinson 2001).

Critical habitat for lynx in Washington includes the North Cascades above 4,000 ft elevation and east of the crest (71 FR 53355-53361). The closest designated critical habitat is about 17 miles south of the project site. Most evidence suggests that lynx historically were rare west of the crest. The project site is at about 1,200 ft elevation and considerably west of the Cascade crest. The blast action area encompasses a greater range of habitats and elevations but still lacks the boreal habitat and lodgepole pine (*Pinus contorta*) stands that provide a suitable prey base for the lynx. It is possible that the species may occasionally move through the action area during dispersal but would not be expected to occupy the area because of the lack of suitable habitat for snowshoe hares. The project will have ***"no effect"*** on the Canada lynx.

F. Bull trout

Status: Federal Threatened; State Candidate

The Skagit River system is part of the Puget Sound Management Unit of the Coastal-Puget Sound Distinct Population Segment (DPS) of bull trout (USFWS 2004). The Skagit River is considered to have some of the healthiest bull trout populations in the U.S., and is one of the few river systems in the western United States where harvest is allowed (harvest is restricted to Skagit River downstream of the Sauk River, and is limited to fish over 20 inches in length). Bull trout in the coterminous U.S. were federally listed as threatened under the ESA in 1999. Diablo Reservoir is located in the Upper Skagit core area, as designated under the Puget Sound bull trout recovery plan (USFWS 2004). The USFWS designated the Upper Skagit

core area in the "Low Risk" category (USFWS 2008b), meaning that the population is considered to be healthy and diverse, and threats to the population are considered to be low. Only 4 out of 121 core areas in the United States received the "Low Threat" classification by the USFWS.

The abundance of bull trout in Diablo Lake is not known, but is assumed to be low relative to other areas of the Skagit based upon WDFW creel surveys conducted in this reservoir in recent years. Bull trout have not been observed spawning in any of the tributaries of Diablo Lake during surveys conducted by the NPS, including the large Thunder Creek drainage, approximately 5 shoreline miles from the project site. All juvenile native char captured at the mouth Thunder Creek were found to be Dolly Varden by WDFW geneticists. Bull trout in Diablo Lake may originate from Ross Lake, with individuals being transported into Diablo Lake over the Ross Dam spillways or through the Ross Powerhouse turbines.

The aquatic action area does provide habitat for bull trout and their prey, which is primarily rainbow trout (*O. mykiss*). Although no fish were observed near the project site during bathymetric surveys conducted by NPS in May-June 2011, bull trout are presumed to be present in the action area on a year-round basis. Bull trout typically forage in the shallow waters of lakes at night, and reside in deeper waters during the daytime. Bathymetric data indicated that Diablo Lake is approximately 40-55 ft deep adjacent to the project site, so daytime construction activities along the shoreline during road and barge construction activities will have little impact on bull trout, which are likely to be near the bottom (or sitting on the bottom) of the reservoir during these periods. The reservoir will be drawn down for work on the temporary and permanent roads and the barge landing, so fill material below OHW will be placed in the dry and would not impact any bull trout in the area. In addition, TESC measures, including the installation of geotextiles and silt fences will be implemented to avoid erosion and sediment input into the reservoir.

The blasts, however, will discharge rock and sediment to Diablo Lake that will reach the bottom of the reservoir. Assuming an estimated total discharge of 3,600 CY (pers. comm., L. Pierson and B. George, Geologists, Landslide Technology, 2011), and roughly equal amounts per blast, 450 CY of material would be expected to enter the reservoir with each blast. 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 will likely cause most fish to move out of the aquatic habitat immediately adjacent to the project. There should be time for fish to move away from the area because there will 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 will need to travel the length of the existing 200-ft long debris pile before entering the water. There will not be a solid mass of rock, as would be expected from a landslide, rapidly entering the water. Therefore, the likelihood that bull trout and/or their prey would be entrapped by the rock entering the reservoir from the blast is expected to be very small.

Rock from the blast, rock scaling, and constructing the road and barge landings will alter the aquatic habitat adjacent to the project site by discharging up to 5,170 CY of rock to the sides and bottom of the reservoir (see JARPA Section 8e). 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., July 7, 2011). This fill material will 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 foraging habitat for bull trout; the deeper areas of the reservoir would still provide suitable cover habitat.

Some amount of sediment will also enter the reservoir with each blast. The portion of Diablo Lake in the action area is in a canyon, only 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 will be moved through the action 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 bull trout.

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 dB_{peak} and 170 to 202 dB_{RMS} (WSDOT 2011). Impulsive noises are of short duration, are repeated over and over, and consist of a broad range of frequencies. dB_{peak} is the instantaneous maximum overpressure while dB_{RMS} is a measure of both sound energy and duration. WSDOT (2011) uses 180 dB_{peak} for injury and 150 dB_{RMS} for behavioral effects as the thresholds for protecting salmon. Noise from the blast will not be impulsive and the peak level will be far less than 180 dB and very brief. In addition, the reservoir is about 385 vertical feet below the rock scarp to be blasted; at this distance, noise will have attenuated to about 90 dB. Further, noise propagation in water is limited by the sinuosity of the system; noise from the blast will not propagate past the curve in the reservoir downstream of the project site (WSDOT 2011). Noise from the blast is not expected to injure bull trout 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 (see Section II). Nonetheless, it is likely that all or part of phases I-III will 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-July 31 (ACOE, accessed August 9, 2011, http://www.nws.usace.army.mil/PublicMenu/documents/REG/All_freshwaters_except_NPs,_CR,_SR_&_Lakes__2010-03-09_.pdf). However, bull trout and rainbow trout are present in Diablo Lake year round and the temperature in the reservoir is suitable for these species at all times pers. comm.., E. Connor, PhD., Fisheries Biologist, SCL, 2011).

The number of bull trout in Diablo Lake (most char being tested as Dolly Varden) is low. Nonetheless, the project could impact habitat for this species through the discharge of rock and sediment and may influence the behavior of individual fish through the vibration and noise generated by blasting. The project ***"may affect, not likely to adversely affect"*** bull trout.

VI. *Critical Habitat*

Critical habitat is designated for areas containing the physical and biological habitat features, or primary constituent elements (PCEs) essential for the conservation of the species or that require special management consideration. PCEs include sites that are essential to supporting one or more life stages of the evolutionarily significant unit (ESU) and that contain physical or biological features essential to the conservation of the ESU. No critical habitat has been designated in or near the action area for the northern spotted owl, marbled murrelet, gray wolf, grizzly bear, or Canada lynx.

Critical habitat for bull trout in the Puget Sound DPS was designated by the USFWS (70 FR 56212) September 26, 2005. Under the 2005 designation, Diablo Lake was exempted as critical habitat. More recently in January, 2010, the USFWS requested, and was granted, a voluntary remand of the 2005 final rule and reconsidered critical habitat designations for bull trout (75 FR 2270). Diablo Lake was designated as critical habitat for bull trout under revised rule finalized by the USFWS on October 18, 2010, with the rule becoming effective on November 17, 2010 (USFWS 2010b).

Seven of the nine PCEs for Coastal-Puget Sound bull trout critical habitat are present in the action area:

- **PCE #1: Permanent water of sufficient quantity and quality such that normal reproduction, growth and survival are not inhibited.**

  Bull trout have not been documented to spawn in Diablo Lake or its tributaries. The most likely spawning and juvenile rearing area for bull trout in the Diablo Lake subbasin is Thunder Creek, which is located a substantial distance (4.5 river miles) away from the construction area. Deer Creek, a small tributary located near Diablo Dam, was also identified by the USFS as a potential spawning area for bull trout. This tributary is located 3.2 river miles from the construction area. This project will not impact water quantity and quality in Thunder Creek and Deer Creek. In addition, the growth and survival of bull trout residing throughout Diablo Lake will not be affected by the proposed construction activities because the action area is small compared to the size of the reservoir, and because construction activities are not expected to interfere with bull trout foraging and habitat use.

- **PCE #2 - Water temperatures that support bull trout use.** *Bull trout have been documented in streams with temperatures from 32° to 72° F (0 to 22° C), but are found*

more frequently in temperatures ranging from 36° to 59° F (2 to 16° C). The temperature ranges used by bull trout may vary depending on their life-history stage and form, geography, elevation, diurnal and seasonal variation, shade (such as that provided by riparian habitat), and local groundwater influences.

Approximately 130 feet of riparian vegetation was removed from the Diablo Lake shoreline to construct the temporary barge landing and access road. No additional vegetation is expected to be removed from the shoreline for any of the project phases. Temperatures in the project area are maintained by cold water releases (< 13 C) from the Ross Dam powerhouse, which is located immediately upstream of the project area. Moreover, bull trout prefer the cold waters found in the lower depths of Diablo Lake, which are thermally isolated from the vegetation removal area. Due to the small size of the riparian zone in the construction area compared to the area and volume Diablo Lake, the removal of vegetation in the construction area will not affect water temperatures in the action area.

- **PCE #3 - Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.**

  The aquatic action area represents only about 6% of Diablo Lake. This area contributes to the variety of water depths, velocities, and instream structures available in the lake but has never had side channels or pools. The rock walls of the canyon do not provide a substrate that can catch and hold wood debris. The proposed construction will reduce local water depths in the reservoir adjacent to the project site by about 3 ft, and will decrease the amount of aquatic habitat by about 0.06 acres. Bathymetric surveys conducted by NPS biologist found that the area of the reservoir adjacent to the construction area has a relatively flat bottom. The addition of large cobbles and boulders to this area as a result of blasting will improve the habitat complexity and cover in this area of the reservoir, which may result in increased use by bull trout following the completion of the project.

- **PCE#4: Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.**

  This PCE is not applicable to this project because bull trout have not been documented to spawn in Diablo Lake or its tributaries. The project will not affect substrates, spawning, and egg and fry survival in the two tributaries (Thunder and Deer creeks) that provide potential spawning habitat for bull trout in the Diablo Lake subbasin. Because bull trout rear in their natal streams for two to three years, the project will not impact young-of-year and juvenile survival. Due to low water velocities in the reservoir (less than 0.5 fps), accumulations of sediments from the project area will be restricted to the area adjacent to and immediately downstream of the blasting and construction zone. These areas are of the

reservoir are only used by bull trout as foraging, migration, and overwintering (FMO) habitat. FMO habitat uses will not be impacted by localized sediment accumulations resulting from the project.

- **PCE #5: A natural hydrograph, including peak, high, low, and base flows within historic ranges, or if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.**

  This PCE is not applicable to this project, since the construction actions are limited to the shoreline area of Diablo Lake. The reservoir water elevation normally fluctuates between 1202 ft, NAVD 88 and 1205 ft, NAVD88. In order to work in the dry for road and barge landing construction, the water elevation will be drawn down to approximately 1199 ft NAVD88 for a period of one to two weeks. Reservoir hydrology is regulated by the Skagit River Hydroelectric FERC License 553 and 1199 ft is within license requirements. The additional 3-ft of drawdown is not expected to affect the habitat used of bull trout, since the preferred habitats area located near the bottom of the reservoir (approximately 140-ft deeper than the drawdown elevation).

- **PCE #6: Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.**

  The project will not result in any changes to springs, seeps, groundwater sources, or subsurface water connectivity in the area. This project site is located along the shoreline of a reservoir, and the 3-ft of additional drawdown during construction is not expected to affect the flow of springs, seeps, and groundwater into the reservoir.

- **PCE #7: Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.**

  Natural barriers in the Gorge Reach and at Diablo Canyon (located immediately below Diablo Dam) historically prevented upstream fish passage into the Skagit River at the current location of Diablo Reservoir. Ross Dam and Diablo Dam currently block the upstream migration and inhibit the downstream migration to the Skagit River. The project is not expected to effect the migration of bull trout to spawning, rearing, overwintering, and foraging areas within the Diablo Lake subbasin, including foraging areas located at the tailrace of Ross Powerhouse and at the mouth of Thunder Creek, potential spawning and juvenile rearing areas within Thunder Creek, and overwintering habitats located throughout Diablo Lake.

The blasting will result in short-term startle/escape behavior by bull trout foraging in the vicinity of the construction area. However, construction and blasting will not effect the long-term use of construction area by bull trout. Moreover, the increase in boulder substrates and resulting increase in bottom cover will likely increase the long-term use of the project area by adult bull trout.

- **PCE #8: An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.**

  Rainbow trout and bull trout are the predominant fish species in Diablo Lake. Bull trout are primarily piscivorous, and feed on 1-3 year old rainbow trout throughout the reservoir. Rainbow trout are primarily insectivores and forage in the pelagic and littoral zones of the reservoir. The project will reduce the amount of littoral habitat available for rainbow trout by 0.06 acre. Turbidity resulting from blasting in Phase I may temporarily impact rainbow trout foraging behavior in the action area (46 acres). During construction of the road and barge landing the lake elevation will be drawn down about 3 ft below normal low pool elevation. This additional drawdown is not expected to have any significant impacts on the rainbow trout forage base to bull trout in Diablo Lake. BMPs (Section V) will be implemented to control and prevent erosion that could potentially affect rainbow trout in the project area, and also avoid turbidity impacts in phase II and III that could affect the foraging behavior and efficiency of bull trout.

- **PCE #9: Few or no predatory, interbreeding, or competitive nonnative species present.**

  Bull trout and rainbow trout are the primary fish species present in Diablo Lake, though non-native eastern brook trout are present in low numbers in this reservoir. Bull trout are known to hybridize with Dolly Varden, a native char species, and brook trout, a non-native char species, in the Thunder Creek drainage. However, the proposed project will not affect the abundance of Dolly Varden or brook trout in the reservoir, or increase the likelihood that bull trout will interbreed with these species in Thunder Creek. It is unlikely that the project that will increase rates of predation, interbreeding or competition with nonnative species. This project will not impact the biological persistence or genetic integrity of bull trout.

To avoid potential impacts on critical habitat for bull trout, the Phases II and III of the project will be constructed in the dry, the shoreline will be protected from sediment deposition and temporary erosion and sediment controls will be implemented. However, blasting will cause unavoidable discharge to the reservoir that will slightly decrease the amount of aquatic habitat (0.06 acre), change the depth of the reservoir in a small area (0.75 acre), and temporarily increase turbidity in the action area. Therefore, the proposed project ***"may affect, not likely to adversely affect"*** critical habitat for bull trout.

VII. *References*

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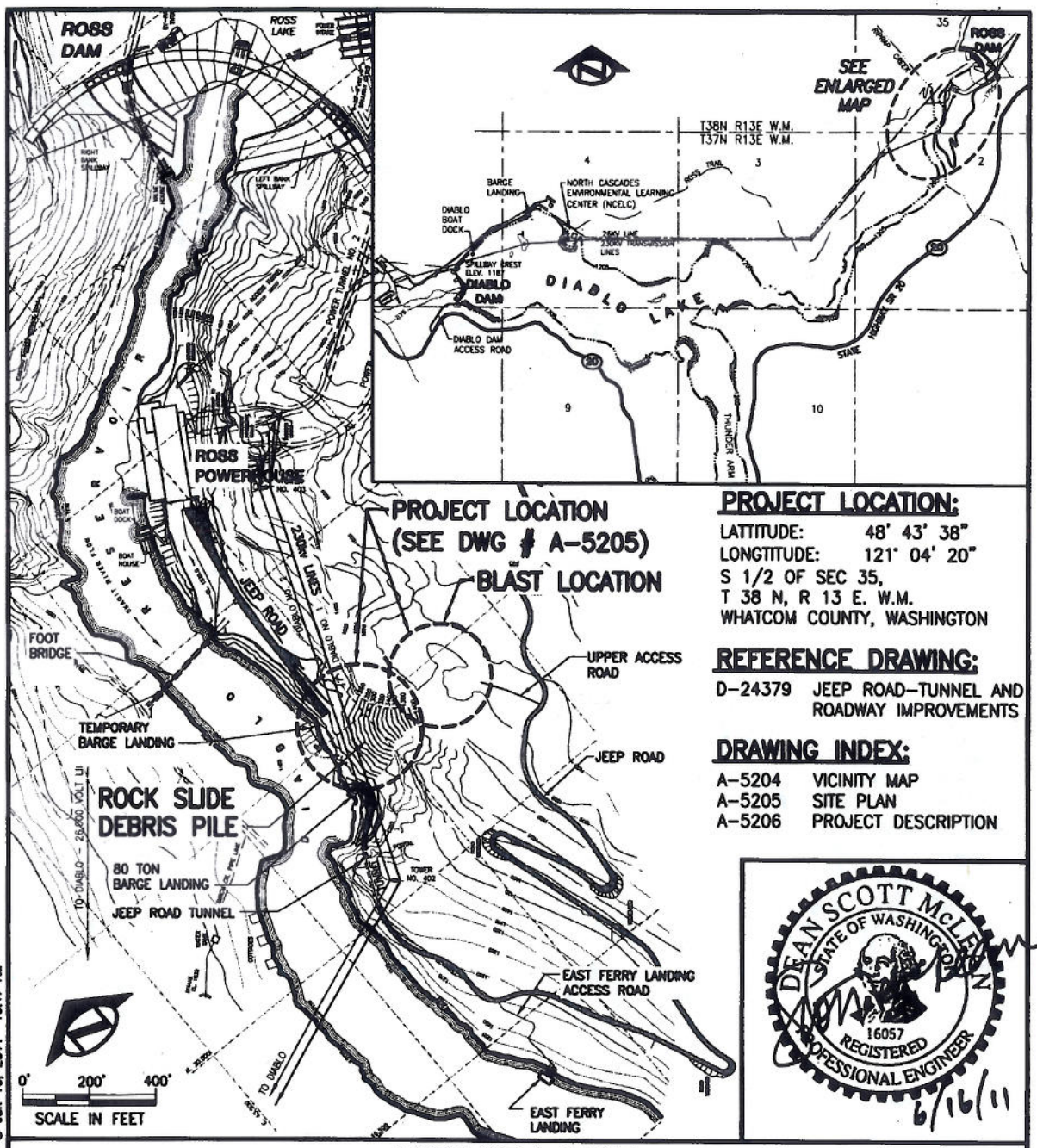
ATTACHMENT A
PROJECT DRAWINGS



PROJECT LOCATION:

LATTITUDE: 48° 43' 38"
LONGTITUDE: 121° 04' 20"
S 1/2 OF SEC 35,
T 38 N, R 13 E. W.M.
WHATCOM COUNTY, WASHINGTON

REFERENCE DRAWING:

D-24379 JEEP ROAD–TUNNEL AND ROADWAY IMPROVEMENTS

DRAWING INDEX:

A-5204	VICINITY MAP
A-5205	SITE PLAN
A-5206	PROJECT DESCRIPTION

DEAN SCOTT McLEAN
STATE OF WASHINGTON
16057
REGISTERED
PROFESSIONAL ENGINEER
6/16/11

VICINITY MAP

PROJECT:	ROSS POWERHOUSE ROCK SLIDE BLASTING
REF.#:	TO BE DETERMINED
PURPOSE:	REMOVE UNSTABLE ROCK WITHIN ROCK SLIDE ZONE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	06/16/2011

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	1 OF 3
DRAWING NO.	REV. NO.
A-5204	0

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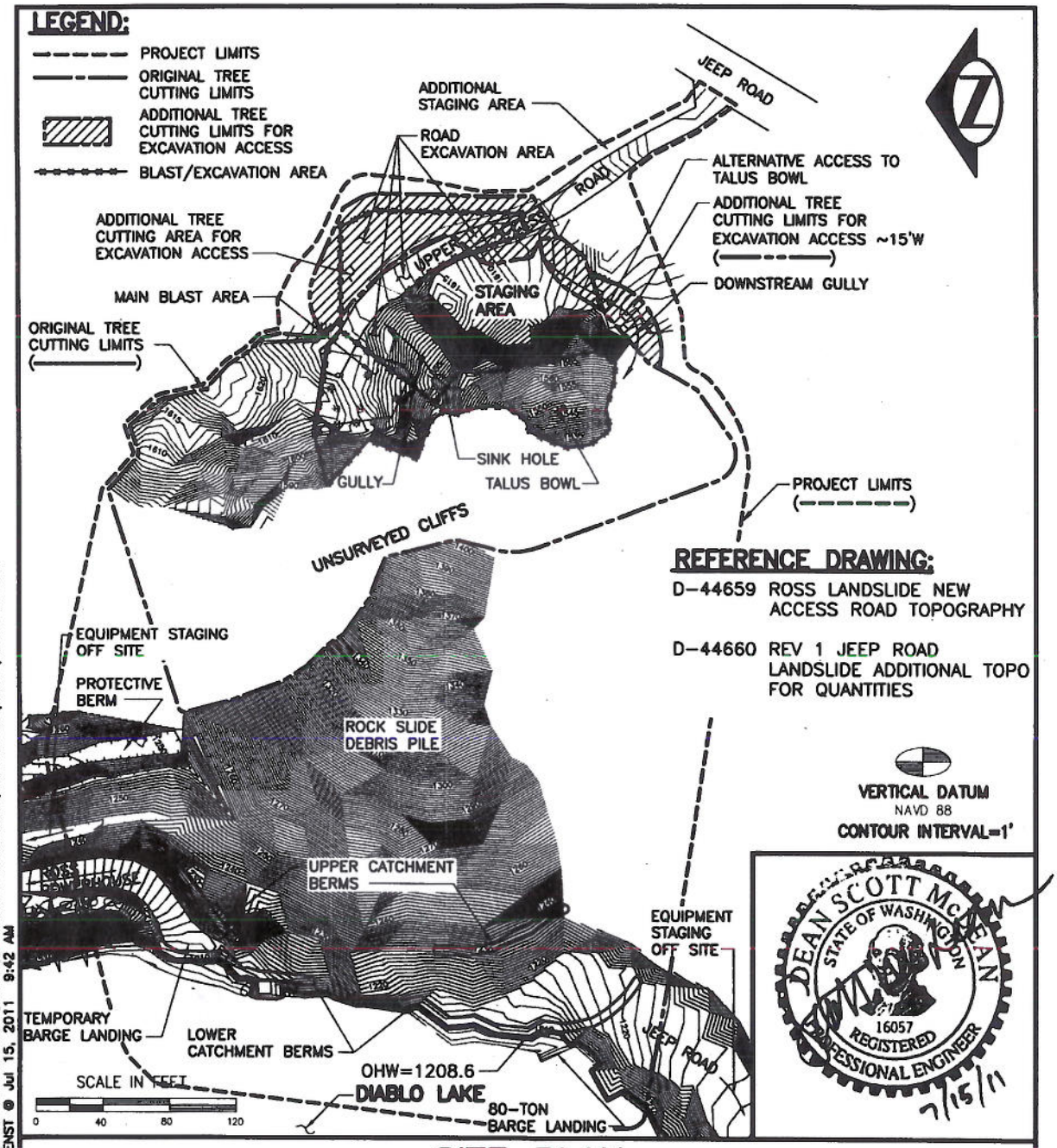

SITE PLAN

PROJECT:	ROSS POWERHOUSE ROCK SLIDE BLASTING
REF.#:	TO BE DETERMINED
PURPOSE:	REMOVE UNSTABLE ROCK WITHIN ROCK SLIDE ZONE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	07/14/2011

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	2 OF 3

DRAWING NO.	REV. NO.
A-5205	1

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LAYOUT: A5205, PLOTTED BY: NGUYENST @ Jul 15, 2011 9:42 AM

PROJECT DESCRIPTION

1. THIS PROJECT CONSISTS OF BLASTING AND EXCAVATION OPERATIONS TO REMOVE AN APPROXIMATELY 90–FOOT DEEP ZONE OF UNSTABLE ROCK LOCATED IN THE CLIFFS ABOVE THE ROSS POWERHOUSE ROCK SLIDE. THE PROJECT LIMITS FOR THE ENTIRE PROJECT ENCOMPASS 4.26 ACRES. THE BLAST AREA IS 0.21 ACRES, AND THE TREE CUTTING AREA (ORIGINAL + ADDITIONAL) IS 1.56 ACRES.

1. A 90–FOOT DEPTH OF UNSTABLE ROCK WILL BE REMOVED WITH APPROXIMATELY 4–8 BLASTS. EACH BLAST OR "LIFT" WILL HAVE A LINE OF "PRE–SPLIT" BLAST HOLES TO DEFINE THE MARGIN OF THE BLAST SO AS TO LEAVE A UNIFORM SIDE–SLOPE SURFACE WHEN DONE. WITHIN THE ARC OF THE PRE–SPLIT LINE IS WHERE THE "PRODUCTION BLASTING" WILL BE DONE, WHICH IS WHERE THE MAIN VOLUME OF ROCK TO BE REMOVED WILL BE BROKEN UP BY THE BLASTING. THE GENERAL IDEA IS TO SET THE DETONATION DELAYS SUCH THAT THE SHOT ROCK FROM THE BLAST WILL BE THROWN AWAY FROM THE TRANSMISSION LINES.

2. THE AMOUNT OF BLASTED AND SCALED ROCK WHICH WILL FALL TO THE ROCK SLIDE DEBRIS PILE BELOW THE CLIFFS IS ESTIMATED TO BE APPROXIMATELY 28,700 CUBIC YARDS, SWELLED VOLUME. OF THIS, IT IS ESTIMATED THAT APPROXIMATELY 3,800 CUBIC YARDS (3,600 CY FROM BLAST, 200 CY FROM SCALING) WILL MAKE ITS WAY INTO DIABLO LAKE.

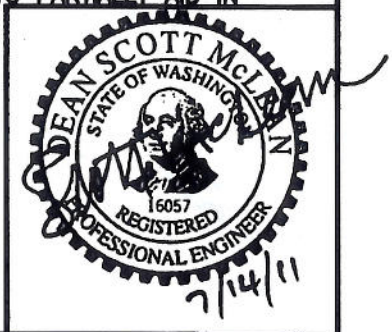
3. AFTER EACH BLAST, BROKEN ROCK WILL BE EXCAVATED AND PUSHED OVER THE SLIDE SCARP TO THE ROCK SLIDE DEBRIS PILE BELOW THE CLIFFS. ACCESS TO THE BLAST AREA WILL BE MAINTAINED BY EXCAVATING DOWN THE UPPER ACCESS ROAD IN THE "ROAD EXCAVATION AREA" IDENTIFIED ON DRAWING NO A–5205.

4. BLAST ROCK THAT FALLS INTO DIABLO LAKE SO AS TO BLOCK ACCESS TO THE BARGE LANDINGS WILL BE MOVED ASIDE IN THE WATER USING A HYDRAULIC EXCAVATOR MOUNTED EITHER ON SHORE OR ON A BARGE.

5. IN THE EVENT THAT BLAST ROCK HANGS UP IN THE TALUS BOWL, THE DOWNSTREAM GULLY MAY BE USED TO ACCESS THE TALUS BOWL FOR THE PURPOSE OF PUSHING BLAST ROCK OVER THE SLIDE SCARP.

6. UPPER AND/OR LOWER CATCHMENT BERMS MAY BE CONSTRUCTED FROM ROCKFALL ROCK AVAILABLE ON SITE, PLACED AS SITE CONDITIONS ALLOW TO PARTIALLY AID IN PREVENTING THE BLAST ROCKFALL FROM REACHING THE BARGE LANDINGS AND/OR DIABLO LAKE. SITE TERRAIN PREVENTS INSTALLATION OF CATCHMENT BERMS ALL THE WAY ACROSS THE BASE OF THE SLIDE. CATCHMENT BERMS IF CONSTRUCTED WILL BE A MAX. OF 6'–8' HIGH, ALL LOCATED ABOVE ORDINARY HIGH WATER.

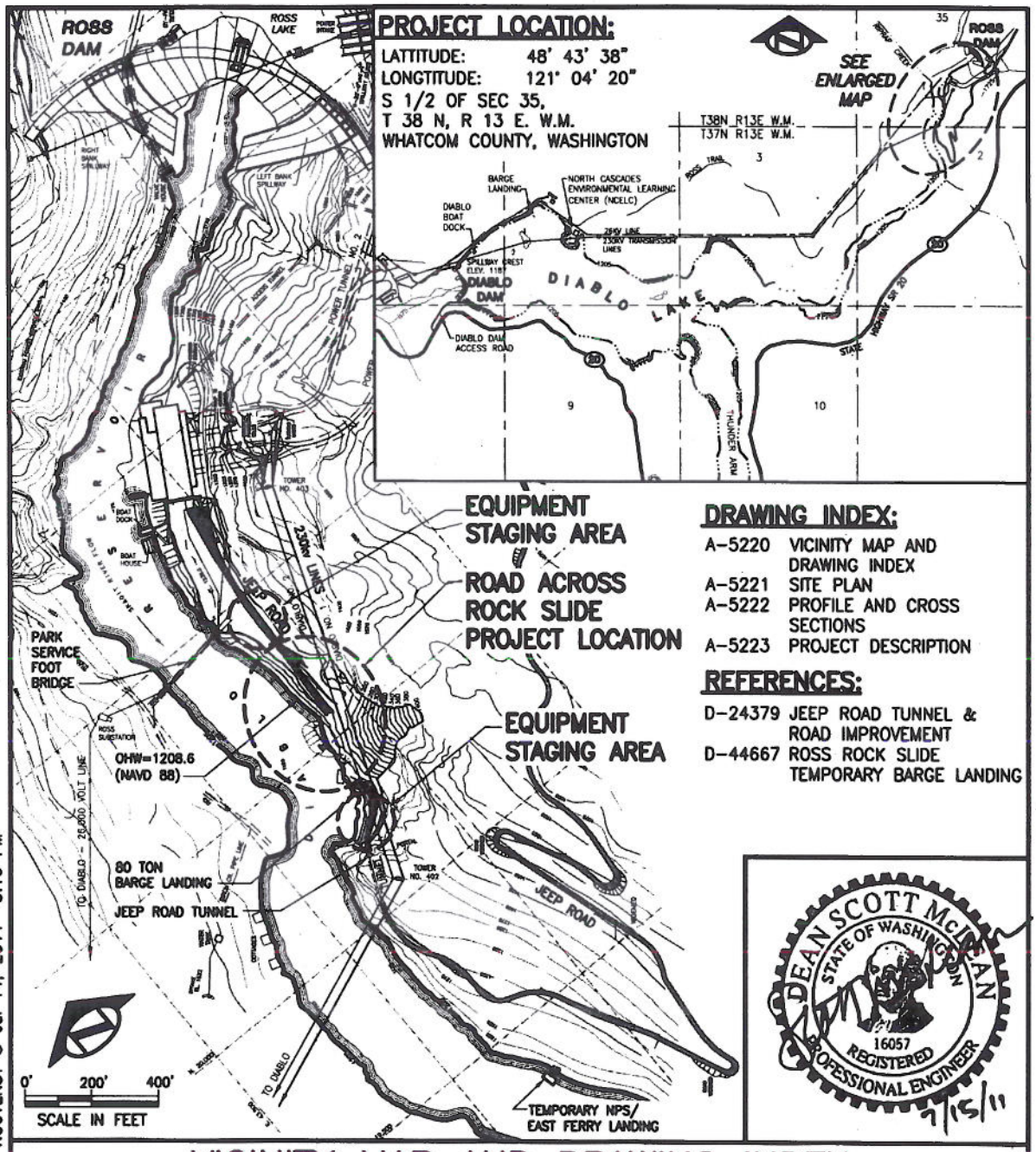
7. NONE OF THE WORK DESCRIBED ABOVE WILL PROCEED UNTIL THE CONTRACTOR'S SAFETY AND BLAST PLANS HAVE BEEN APPROVED BY THE ENGINEER, AND APPROVED PERMITS HAVE BEEN RECEIVED.



PROJECT DESCRIPTION

PROJECT:	ROSS POWERHOUSE ROCK SLIDE BLASTING
REF.#:	TO BE DETERMINED
PURPOSE:	REMOVE UNSTABLE ROCK WITHIN ROCK SLIDE ZONE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	07/14/2011

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	3 OF 3
DRAWING NO.	REV. NO.
A-5206	1



DRAWING INDEX:

A-5220	VICINITY MAP AND DRAWING INDEX
A-5221	SITE PLAN
A-5222	PROFILE AND CROSS SECTIONS
A-5223	PROJECT DESCRIPTION

REFERENCES:

D-24379	JEEP ROAD TUNNEL & ROAD IMPROVEMENT
D-44667	ROSS ROCK SLIDE TEMPORARY BARGE LANDING

DEAN SCOTT McLEAN
STATE OF WASHINGTON
16057
REGISTERED
PROFESSIONAL ENGINEER
7/15/11

VICINITY MAP AND DRAWING INDEX

PROJECT:	ROSS ROAD ACROSS ROCK SLIDE
REF.#:	TO BE DETERMINED
PURPOSE:	RESTORE HEAVY-LIFT ACCESS TO ROSS POWERHOUSE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	07/14/2011

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	1 OF 4
DRAWING NO.	REV. NO.
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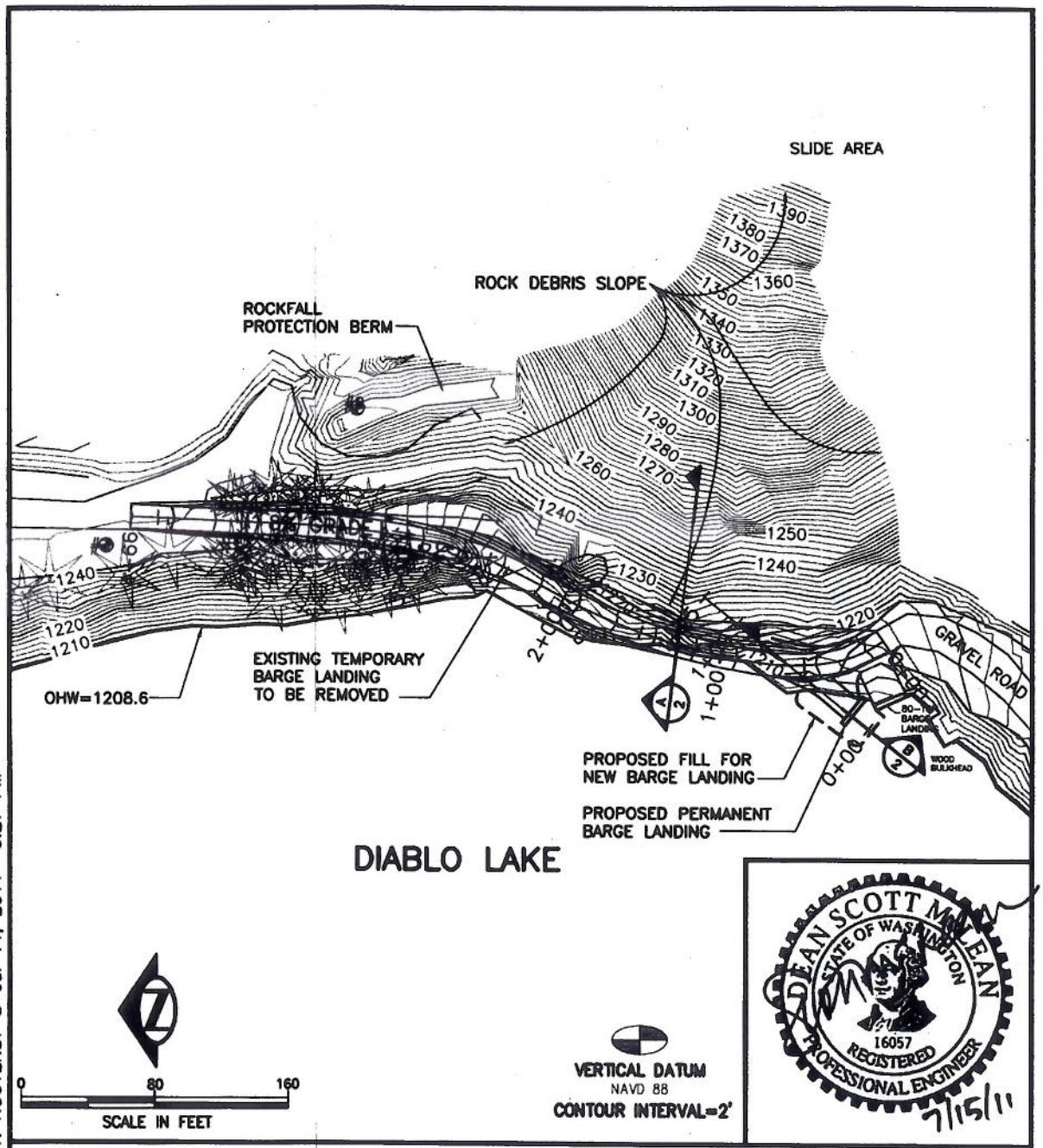

DEAN SCOTT McLEAN
STATE OF WASHINGTON
16057
REGISTERED
PROFESSIONAL ENGINEER
7/15/11

SITE PLAN

PROJECT:	ROSS ROAD ACROSS ROCK SLIDE
REF.#:	TO BE DETERMINED
PURPOSE:	RESTORE HEAVY-LIFT ACCESS TO ROSS POWERHOUSE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	07/14/2011

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	2 OF 4
DRAWING NO.	REV. NO.
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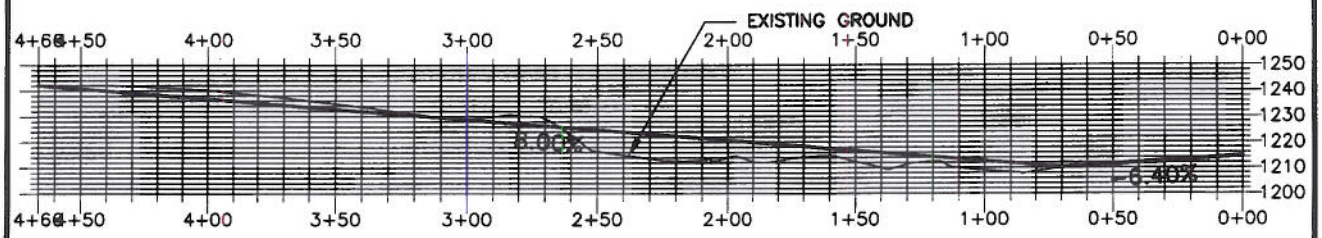
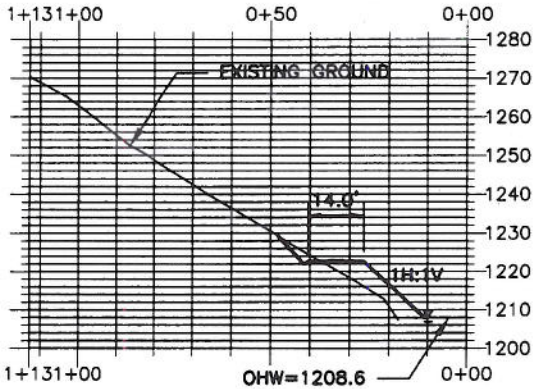
PROFILE AND CROSS SECTIONS

PROJECT: ROSS ROAD ACROSS ROCK SLIDE
REF.#: TO BE DETERMINED
PURPOSE: RESTORE HEAVY-LIFT ACCESS TO ROSS POWERHOUSE
APPLICANT: SEATTLE CITY LIGHT
IN: DIABLO LAKE, WASHINGTON
NEAR: DIABLO, WHATCOM COUNTY, WASHINGTON
DATE: 07/14/2011

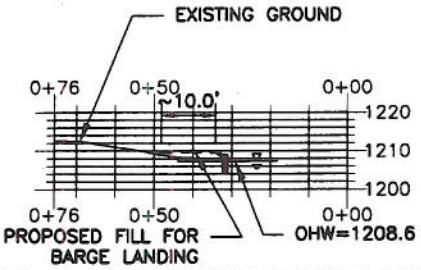
DR: SON NGUYEN
DSGN: SCOTT McLEAN
APPRV: SCOTT McLEAN
SHEET: 3 OF 4
DRAWING NO. A-5222
REV. NO. 1



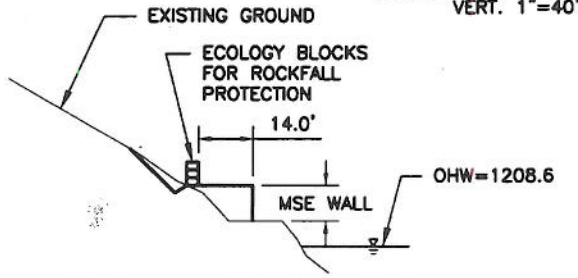
PROPOSED ROAD PROFILE
SCALE: HORZ. 1"=60'
VERT. 1"=60'



TEMPORARY ROADWAY TYPICAL CROSS SECTION @ A
SCALE: HORZ. 1"=40'
VERT. 1"=40'



PROFILE @ PERMANENT BARGE LANDING
SCALE: HORZ. 1"=40'
VERT. 1"=40'



PERMANENT ROADWAY CROSS SECTION @ A
SCALE: HORZ. 1"=40'
VERT. 1"=40'

PROJECT DESCRIPTION:

1. THE PORTION OF THE ROSS DAM "JEEP ROAD" DESTROYED BY THE 3/15/2010 ROSS ROCK SLIDE WILL BE RE-CONSTRUCTED ACROSS THE ROCK DEBRIS PILE. GENERALLY, THE REPLACEMENT ROADWAY WILL CONTOUR ACROSS THE ROCK DEBRIS PILE ON APPROXIMATELY AN 8% DOWNSLOPE, CONNECTING TO THE PORTIONS OF THE JEEP ROAD UNDISTURBED BY THE ROCK SLIDE AS SHOWN ON THE ATTACHED DRAWINGS.

2. BECAUSE THE CONTOURS OF THE ROCK PILE AFTER BLASTING WORK ARE UNKNOWN, THE ATTACHED DRAWINGS ARE CONCEPTUAL IN NATURE. REVISED DRAWINGS WILL BE PROVIDED AFTER COMPLETION OF ROCK STABILIZATION AND BLASTING WORK TO REFLECT ACTUAL FIELD CONDITIONS.

3. THE ROAD ACROSS THE ROCK SLIDE WILL BE CONSTRUCTED IN TWO STAGES: A TEMPORARY ROAD FOLLOWED BY A PERMANENT ROAD. THE TEMPORARY ROAD WILL BE APPROXIMATELY 14 FEET WIDE AND WILL ESTABLISH A ROUGH ROAD BED FOR THE PERMANENT ROADWAY TO BE BUILT UPON. THE TEMPORARY ROAD WILL BE CONSTRUCTED BY FIRST BREAKING DOWN LARGE BOULDERS (UP TO 25 FEET IN DIAMETER) TO SMALLER SIZES OF ABOUT 6 INCHES OR LESS, SO A HYDRAULIC EXCAVATOR CAN MOVE THE MATERIAL INTO POSITION AS NEEDED. THE HYDRAULIC EXCAVATOR WILL WORK ITS WAY ACROSS THE ROCK DEBRIS PILE CONSTRUCTING THE ROADBED BY EXCAVATING ROCK ON THE HIGH SIDE OF THE ROAD, AND PULLING MATERIAL DOWN AS NEEDED FOR FILL ON THE LOW SIDE.

4. FOR THE TEMPORARY ROAD, IT IS ESTIMATED THAT EXCAVATION OF APPROXIMATELY 1,200 CY WILL BE REQUIRED TO RE-CONSTRUCT THE ROAD (0 CY BELOW OHW). IT IS ESTIMATED THAT THERE WILL BE A TOTAL OF APPROXIMATELY 1,500 CY OF FILL (1,200 CY OF THIS BELOW OHW).

5. AFTER COMPLETION OF THE TEMPORARY ROAD, A PERMANENT ROADWAY WILL BE CONSTRUCTED ON TOP OF THE PRELIMINARY ROAD. IT IS ANTICIPATED THAT THE NEW ROADWAY WILL BE RAISED SEVERAL FEET, SUPPORTED ON THE DOWNHILL SIDE WITH A RETAINING WALL SUCH AS A MSE (MECHANICALLY STABILIZED EARTH) WALL, WHICH WILL ALLOW A WIDER CROSS-SECTION FOR ADDITION OF A ROCK PROTECTION FEATURE SUCH AS AN ECOLOGY BLOCK BARRIER AND/OR A CATCHMENT DITCH ON THE UPHILL SIDE OF THE ROAD. DETAILS OF THE PERMANENT ROAD DESIGN WILL BE PROVIDED WHEN AVAILABLE. A TOTAL OF 840 CY OF FILL IS ESTIMATED FOR THE PERMANENT ROAD (WITH 40 CY OR 5% OF THIS INCIDENTAL DISCHARGE BELOW OHW).

6. IN ADDITION, A NEW PERMANENT BARGE LANDING WILL BE CONSTRUCTED AT THE DOWNSTREAM MARGIN OF THE ROCK PILE TO REPLACE THE 100-TON LANDING DESTROYED BY THE MARCH 2010 SLIDE AND THE 80-TON LANDING. NO DESIGN DETAILS OF THE REPLACEMENT BARGE LANDING HAVE BEEN WORKED OUT, BUT WILL BE FORWARDED WHEN AVAILABLE. A TOTAL OF 380 CY OF CUT IS ESTIMATED FOR THE NEW BARGE LANDING (250 CY OF THIS BELOW OHW). 171 CY OF FILL IS ESTIMATED (130 CY OF THIS BELOW OHW).

PROJECT DESCRIPTION

PROJECT:	ROSS ROAD ACROSS ROCK SLIDE
REF.#:	TO BE DETERMINED
PURPOSE:	RESTORE HEAVY-LIFT ACCESS TO ROSS POWERHOUSE
APPLICANT:	SEATTLE CITY LIGHT
IN:	DIABLO LAKE, WASHINGTON
NEAR:	DIABLO, WHATCOM COUNTY, WASHINGTON
DATE:	07/14/2010

DR:	SON NGUYEN
DSGN:	SCOTT McLEAN
APPRV:	SCOTT McLEAN
SHEET:	4 OF 4
DRAWING NO.	REV. NO.
A-5223	1

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LAYOUT: A5194, PLOTTED BY: NGUYENST @ Jul 15, 2011 1:59 PM