

***Boundary Hydroelectric Project (FERC No. 2144)***

***Study No. 20***

***Bat Surveys and Habitat Inventory***

***Interim Report***

**Prepared for  
Seattle City Light**

**Prepared by  
Gregory A. Green, Jessica Piasecke, and Steve Negri  
Tetra Tech**

**March 2008**



**TABLE OF CONTENTS**

**1 Introduction.....1**

**2 Study Objectives.....1**

**3 Study Area .....1**

**4 Methods.....4**

4.1. Information Update.....4

4.2. Inventory and Characterization of Bat Habitats.....5

4.3. Roost Site and Maternity Colony Surveys.....5

4.4. Hibernacula Surveys .....6

4.5. Foraging Site Sampling.....6

4.6. Tree Roost Mapping .....7

4.7. Documentation and Effects Assessment.....7

**5 Preliminary Results .....7**

5.1. Information Update.....7

5.2. Inventory and Characterization of Bat Habitats.....13

5.3. Roost Site and Maternity Colony Surveys.....17

5.4. Hibernacula Surveys .....19

5.5. Foraging Site Sampling.....19

5.6. Tree Roost Mapping .....20

5.7. Documentation and Effects Assessment.....21

**6 Summary.....21**

**7 Variances from FERC-Approved Study Plan and Proposed Modifications.....22**

**8 References.....22**

**List of Tables**

Table 5.1-1. List of bat species potentially occurring in the Project area..... 8  
Table 5.1-2. Locations of mines with potentially suitable bat habitat, whether each is within the study area, and linear distances to the reservoir high-water mark (1,994 feet, NAVD 88).. 10  
Table 5.5-1. Bat species identified acoustically at seven foraging sites surveyed in the study area..... 20

**List of Figures**

Figure 3.0-1. Study area for the Bat Study. .... 3  
Figure 5.1-1. Locations of mines within and nearby the study area..... 11  
Figure 5.2-1. Locations of sites surveyed for bat use. .... 14  
Figure 5.3-1. Researcher at entrance to Washington Mine..... 18

# **Study No. 20: Bat Surveys and Habitat Inventory Interim Report Boundary Hydroelectric Project (FERC No. 2144)**

## **1 INTRODUCTION**

Study No. 20, the Bat Surveys and Habitat Inventory Study (Bat Study), is being conducted in support of the relicensing of the Boundary Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 2144, as identified in the Revised Study Plan (RSP; SCL 2007) submitted by Seattle City Light (SCL) on February 14, 2007, and approved by FERC in its Study Plan Determination letter dated March 15, 2007. This interim report describes study efforts through October, 2007.

## **2 STUDY OBJECTIVES**

The primary goal of the Bat Study is to provide information needed to determine the presence of bat species and/or their important habitats in the Project vicinity and assess ongoing Project effects on these species.

Specific objectives of the study are to:

- Document bat species occurrence in the Project vicinity.
- Inventory and characterize structures potentially used for day roosting, night roosting, maternity colonies, and hibernacula.
- Document use of selected structures during the breeding and winter hibernation time periods.
- Assess the level of use of selected foraging areas (e.g., the Boundary Wildlife Preserve [BWP]).
- Identify threats to bat species or habitats, including potential Project effects.

## **3 STUDY AREA**

The study area for the Bat Study extended approximately 18 miles along the Pend Oreille River from the Box Canyon tailrace downstream to the U.S.-Canada border (Figure 3.0-1) and encompassed the following:

- Downstream of Metaline Falls — The reservoir fluctuation zone under existing operations, and the land within the FERC Project boundary (Project area). The Project area includes most Project facilities, the area 200 horizontal feet (i.e., along the ground surface, perpendicular to the shoreline) beyond the high water level along

both reservoir shorelines, and the transmission line right-of-way from the powerhouse to the BPA interconnection.<sup>1</sup>

- Upstream of Metaline Falls — The reservoir fluctuation zone and the land within approximately 200 horizontal feet of the high water level (approximately 2,019 feet NAVD 88 [2,015 feet NGVD 29]<sup>2</sup>) along both reservoir shorelines extending to the FERC project boundary for the Box Canyon Project.<sup>3,4</sup>
- The BWP (155 acres) and adjoining SCL-owned property (85 acres).
- 100 feet around any Project works areas that extend outside the Project boundary.
- Land within 100 horizontal feet along both sides of the river from Boundary Dam to the U.S.-Canada border (approximately 0.9 mile).

Concerning the reservoir fluctuation zone, the range of water surface elevations recorded during the survey periods for this study is presented below; these ranges represent typical operating conditions for the period in which data were collected. Existing conditions at the time of surveys were considered adequate to acquire all data required for this study:

- From Box Canyon Dam to Metaline Falls – Elevation 1,988–2,003 feet NAVD 88 (1,984–1,999 feet NGVD 29), as measured at the U.S. Geological Survey (USGS) gage 12396500 (surveys to identify potential bat habitat were not targeted for the fluctuation zone in this area);
- From Metaline Falls to Boundary Dam – Elevation 1,987–1,993 feet NAVD 88 (1,983–1,989 feet NGVD 29), as measured at the SCL gage located in the Boundary forebay. The bat habitat survey for this section of the reservoir was conducted during a drawdown event on Sept 6, 2007. Water surface elevations were at or below elevation 1,974 NAVD 88 (1,970 feet NGVD 29), as measured at the SCL gage located in the Boundary forebay, while the survey was conducted.

---

<sup>1</sup>Per Task 5 of the RSP, SCL conducted bat foraging surveys in representative habitats throughout the study area. The reader will note that on Figure 5.2-1 in the vicinity of Monument Bar, the site surveyed falls just outside of the study area. The survey crew was not able to locate a site in that vicinity within the study area that could accommodate the placement of the mist nets. SCL considers the data collected at this location to be suitable to interpret the effectiveness of the area to support foraging bats.

<sup>2</sup>SCL is in the process of converting all Project information from an older elevation datum (National Geodetic Vertical Datum of 1929 [NGVD 29]) to a more recent elevation datum (North American Vertical Datum of 1988 [NAVD 88]). As such, elevations are provided relative to both data throughout this document. The conversion factor between the old and new data is approximately 4 feet (e.g., the crest of the dam is 2,000 feet NGVD 29 and 2,004 feet NAVD 88).

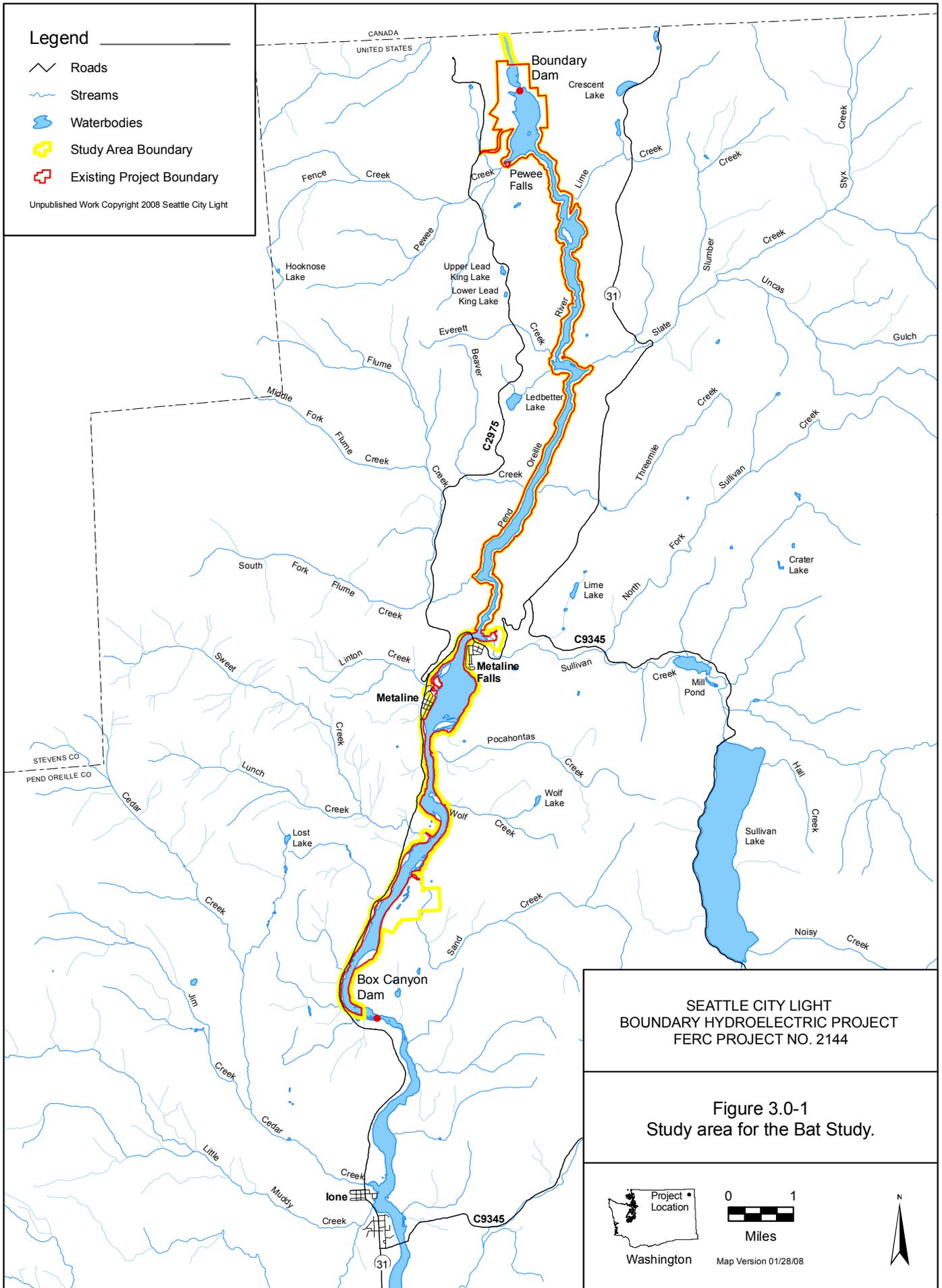
<sup>3</sup>As indicated in this and other study reports in the Initial Study Report, SCL agrees it is appropriate to study the existing fluctuation range of the reservoir; however, for development of the Preliminary Licensing Proposal (PLP) and License Application, SCL will base its assessment of potential protection, mitigation, and enhancement measures on that portion of the fluctuation zone that is determined to be under the influence of Boundary Project operations, versus the effects of inflows and Metaline Falls that are beyond the control of the Project.

<sup>4</sup>Data for the riparian zone downstream of the Box Canyon Dam located within the FERC project boundary for the Box Canyon Project (FERC #2042) are included in this report; however, in the development of the Preliminary Licensing Proposal and License Application, SCL's assessment of potential protection, mitigation, and enhancement efforts will be limited to those effects that are determined to be under the influence of Boundary Project operations.

**Legend**

-  Roads
-  Streams
-  Waterbodies
-  Study Area Boundary
-  Existing Project Boundary

Unpublished Work Copyright 2008 Seattle City Light



## 4 METHODS

Seven tasks were identified for this study:

- Task 1: Information update
- Task 2: Inventory and characterization
- Task 3: Roost site and maternity colony surveys
- Task 4: Hibernacula surveys
- Task 5: Foraging site sampling
- Task 6: Tree roost mapping
- Task 7: Documentation and effects assessment

The methodologies for tasks completed or initiated in 2007 are described in detail below; methods for tasks to be completed in 2008 are described in the RSP.

### 4.1. Information Update

This task involved updating the information provided in the RSP on bat species potentially inhabiting the study area and on potential roost sites and hibernacula occurring there. Species information provided in the RSP was verified by consulting available literature on the distribution and habitat use of bats. Additional site-specific information relative to the study area potentially residing with the U.S. Forest Service (USFS) (Mike Borysewicz), Bureau of Land Management (BLM) (Joyce Whitney), or Washington Department of Fish and Wildlife (Howard Ferguson) has not yet been requested, but will be early in 2008.

The USFS provided a list of 32 potential bat sites (24 mines, 7 caves, and 1 bridge) in the vicinity of the Project, which was included in the RSP. However, for approximately half of these sites, the location information was missing or lacking the detail needed to accurately map the sites and determine if they were within the study area. Additional information on the location of these sites was requested from the USFS, but more accurate information did not exist and thus could not be provided. Subsequently, additional sources were consulted, including the U.S. Environmental Protection Agency (EPA) CERCLA reports (E&E 2002), the Washington Department of Ecology (Ecology) abandoned mines lands investigation reports (Hart Crowser 2007), and the USGS minerals resource database (Boleneus 1999). The goal was to accurately map all potential mine adits in the Project vicinity and determine which adits occur within the study area, thus warranting further field investigation. None of the caves provided on the USFS list came with location information detailed enough to ensure a match with the locations of caves discovered during the field investigations, although it is very likely that all the caves on the USFS list, occurring within the study area, were located and evaluated as to their potential to serve as bat habitat. Because these reports were not discovered until late in 2007 (in conjunction with research being conducted under Study 24, the Cultural Resources Study), additional work will be required during the 2008 field season to determine if some of the sites fall within the study area. If it is concluded that some of these sites are within the study area, additional field survey work will be conducted as warranted.

## 4.2. Inventory and Characterization of Bat Habitats

Potential bat roosting, hibernacula, and maternity colony sites were characterized to include caves and mines that are relatively isolated or undisturbed, not regularly flooded, and provide protection from predators and the elements. Some Project-related structures, such as dam tunnels and portals and maintenance buildings, were also considered potential roosting, hibernacula, and maternity colony sites.

All sites identified in Task 1 as potentially suitable bat habitat, as well as additional sites observed in the field, were investigated. Each of these sites was visited, mapped using a Global Positioning System (GPS) unit, characterized, and photographed. Based on site characteristics, the bat species likely to use each site were identified. Lastly, the need for additional surveys was determined. Data collected at each site included temperature, humidity, opening size, evidence of disturbance, and vegetation present. These data were then used to assess each site's potential for providing maternal or hibernating habitat.

In addition, during a study-related reservoir drawdown event on September 6, 2007, a survey was conducted for all mine adits and caves occurring in the fluctuation zone down to elevation 1,974 feet NAVD 88 (1,970 feet NGVD 29) that could provide potential habitat for bats.

## 4.3. Roost Site and Maternity Colony Surveys

Nocturnal emergence/dispersal surveys (Kunz et al. 1996), also known as visual exit surveys, were conducted to identify bat use of potential roosting or maternity sites at locations identified in Task 2. Surveys were conducted from 30 minutes before sunset until 2 hours after sunset (Tuttle and Taylor 1998). Field staff sat quietly close to the entrance to the cave or mine, to minimize disturbance to bats, and used tally counters to keep track of bat exits and entrances. The difference between the “exit” and “entrance” counts during each survey period was calculated to estimate the number of individual bats using the site. Bat calls were also recorded to identify bat species because most can be difficult or impossible to identify by sight alone in low light conditions. Pettersson 240x ultrasonic sound detectors (Pettersson Elektronik AB, Uppsala, Sweden) and iRiver digital recorders (iRiver, Seoul, Korea) were used to collect echolocation call data. The call data were later analyzed using SonoBat bat call analysis software (SonoBat, Arcata, California).

At sites where the potential for bat use was considered low, such as some of the tunnels and portals associated with the Boundary Dam and powerhouse, “pre-surveys” were conducted with acoustical bat detectors. If bats were acoustically detected, a visual exit survey would be conducted the following night. The portals and tunnels associated with Boundary Dam and powerhouse were surveyed during the day using flashlights to investigate cracks and cervices in the ceilings and upper walls of these structures. In addition, some potential roost sites occurring in the canyon reach, such as caves, were only acoustically surveyed, as field safety protocols prevented working in the canyon reach after sunset. Surveys of roost sites were conducted once in June and again in August.

#### 4.4. Hibernacula Surveys

From information gathered in Tasks 1 and 2, potential winter hibernacula (Metaline and Washington mines and the Thurman exploratory adit) were identified in the study area. These sites were then surveyed in September and October for the presence of swarming bats, which can be indicative of use as a winter hibernaculum (Vonhof and Gwilliam 2000). Data collected at these sites included temperature, relative humidity, and air flow. Visual exit surveys of the entrances were conducted beginning one half hour before dusk, and ultrasonic detectors were used to collect call data. Recordings were later analyzed using SonoBat bat call analysis software.

#### 4.5. Foraging Site Sampling

Seven sites in the study area (see Figure 5.2-1) were identified in the RSP as being representative of potential bat foraging habitat. Mist nets were used to survey these sites for the presence of foraging bats. The seven sites are described below:

1. The Sullivan Creek site is located on a dike at the edge of the Sullivan Creek wetland. Snowberry (*Symphoricarpus albus*), reed canarygrass (*Phalaris arundinacea*), and willow (*Salix* spp.) are the main plant species present. This site was surveyed on July 24, 2007; two mist nets were stretched across the dike.
2. The Forebay site is located at the western edge of the SCL Forebay Recreation Area. One net was stretched under two cottonwood trees near the corner of the Ross Cabin, while a second net was placed across the northern front of the cabin; this site was surveyed on July 25, 2007.
3. The BWP site is located at the head of the BWP slough. Two nets were placed in a v-pattern at the head of a small pond at the southern end of the slough, and a third net was placed upslope of the pond at the edge of an aspen stand. The site was surveyed on July 26, 2007.
4. The Monument Bar site is located just north of Monument Bar within a second-growth conifer stand. On August 15, 2007, two nets were placed across a USFS road in the vicinity of Monument Bar; a third was placed on a spur road heading west toward the river, approximately 75 feet away from the other two nets (see note in Section 3, Study Area).
5. The Tailrace site is located in riparian habitat downstream of Boundary Dam on the east side of the river. Two nets were placed in a v-pattern near an old mining cabin site, and a third net was placed across the very end of USFS Road 200 on July 27, 2007.
6. The Box Canyon site is located in a stand of cottonwood trees on the east side of the river just below Box Canyon Dam. Three mist nets were placed in gaps between trees that are possible flyways; this site was surveyed on August 17, 2007 (see note in Section 3, Study Area).
7. The Lime Creek site is located at the mouth of Lime Creek where a series of cascading pools and shrubby riparian habitat border a forested wetland. Three mist nets were placed across the mouth of the braided stream just before it enters the reservoir embayment. The site was surveyed on August 16, 2007.

The mist nets were deployed for approximately 3 hours beginning at sunset. Each bat captured was immediately removed from the net, weighed and measured, identified to species, sexed and aged (juvenile or adult), and then released. A description of each site was recorded, including location, habitat features, and the position of the mist nets. Ultrasonic bat detectors were also deployed at each site in conjunction with the mist netting to identify bats not captured in the nets.

#### 4.6. Tree Roost Mapping

Incidental to other wildlife survey efforts, sites in the study area with an abundance of potential roost trees were mapped. These sites were identified by the presence of quaking aspen (*Populus tremuloides*) and/or large-diameter, intermediate decay-class conifer trees. These habitat types were the most often used day roost sites by bats in the Pend Oreille River basin of British Columbia, Canada (Vonhof and Gwilliam 2000). Locations of tree roost sites were marked and entered into a Geographic Information System (GIS) database.

#### 4.7. Documentation and Effects Assessment

All data gathered in the field during emergence/dispersal surveys, forage site mist-netting, and other surveys were recorded on data sheets. These were then scanned into portable document format for electronic storage and backup, and the original data sheets were archived. All locations of known roosting, hibernacula, and maternity colony sites were recorded and maintained in a GIS database.

This interim report presents the first year efforts of a two year study; data collection is not yet complete. Consequently, assessing Project effects on bats and their habitats is not addressed in this interim report; the effects assessment will be fully addressed in the Updated Study Report (USR).

## 5 PRELIMINARY RESULTS

### 5.1. Information Update

Results of the information update confirmed that there are 12 species of bats that use, or potentially use, the study area (Table 5.1-1), five of which have been previously documented near the study area by the USFS. These five species are Townsend's big-eared bat (*Corynorhinus townsendii*), long-legged myotis (*Myotis volans*), Yuma myotis (*M. yumanensis*), little brown myotis (*M. lucifugus*), and big brown bat (*Eptesicus fuscus*).

**Table 5.1-1.** List of bat species potentially occurring in the Project area.

<b>Common Name Scientific Name</b>	<b>USFS Status<sup>1</sup></b>	<b>BLM Status<sup>2</sup></b>	<b>WDFW Status<sup>3</sup></b>	<b>Suitable Habitat</b>
California myotis <i>Myotis californicus</i>	None	None	None	Desert-shrub-oak woodland to ponderosa pine. Roost in crevices and cracks of canyon walls, caves, and mine shafts.
Small-footed myotis <i>Myotis ciliolabrum</i>	None	BT	SM	Wide ecological range, from rock outcrops on open grasslands to canyons in the foothills to lower mountains with yellow pine woodlands. Day roosts are variable, but include cracks and crevices in cliffs, beneath tree bark, in mines and caves, and human dwellings. Night roosts are under a variety of natural and human-made structures. Hibernacula include caves, mines, and tunnels.
Long-eared myotis <i>Myotis evotis</i>	None	BT	SM	Hibernates in caves; summer day roosts under tree bark in coniferous forests.
Little brown myotis <i>Myotis lucifugus</i>	None	None	None	Day and night roosts are used by active bats and include, but are not limited to, buildings, trees, under rocks, and in wood piles; hibernacula usually include abandoned mines or caves.
Fringed myotis <i>Myotis thysanodes</i>	None	BT	SM	Woodlands at moderate elevation in mountains; night and day roosts include caves, mines, and buildings (typically abandoned); hibernacula include caves and buildings.
Long-legged myotis <i>Myotis volans</i>	None	BT	SM	Mid-elevation forests; hibernates in winter in mines or caves.
Yuma myotis <i>Myotis yumanensis</i>	None	None	None	Variety of habitats, ranging from juniper and riparian woodlands to desert regions near open water.
Hoary bat <i>Lasiurus cinereus</i>	None	None	None	Preference for coniferous versus broadleaf trees.
Silver-haired bat <i>Lasionycteris noctivagans</i>	None	None	None	Hardwoods with ponds or streams nearby. Roost under loose tree bark, particularly willow, maple, and ash, hollow snags, buildings; during winter they hibernate inside trees, buildings, rock crevices, and similarly protected structures.
Big brown bat <i>Eptesicus fuscus</i>	None	None	None	Roosts in tree hollows, natural caves, or openings in rock ledges; some hibernate in caves.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	S	BA	SC	Maternity colonies and roosts in caves, mines, and buildings in a variety of habitats.
Pallid bat <i>Antrozous pallidus</i>	None	None	SM	Rocky, mountainous areas near water; prefer to forage in the open; day roost is usually in a warm, horizontal opening such as attics or rock cracks; night roost is usually in the open, near foliage; the hibernation roost is often in buildings, caves, or cracks in rocks.

**Notes:**

- 1 U.S. Forest Service (USFS): S = Sensitive
- 2 Bureau of Land Management (BLM) Status: BA = Bureau Assessment, BT = Bureau Tracking
- 3 Washington Department of Fish and Wildlife (WDFW) Status: SC = State Candidate for listing as threatened or endangered, SM = State Monitor

Table 5.1-2 provides more precise locations (from Boleneus 1999) of the mines listed in the RSP and helps to resolve whether each mine site occurs within the study area. These locations are presented in Figure 5.1-1. The Emerald Mine could not be located (although there is an Emerald Mine located near Salmo, B.C.) The Sterling Mine, part of which may occur in the study area, was not included in the original table but has been added here. The Thurman site, which is a prospect rather than a past working mine, was located during field surveys and has been added to the list.

The results of this effort are that seven mining-related sites occur within the study area and portions of three sites — Sterling, Riverside, and Tom Cat mines — may occur in the study area (additional work is required in 2008 to make this determination). The Robert E. Lee Mine is flooded and evidence of the Hanley Mine is no longer present (it may be underwater). The EPA's Superfund Technical Assessment and Response Team (E&E 2002) searched for the Z Canyon Mine but could not locate it and concluded it too was underwater. The Tom Cat Mine is located at the top of a ridge west of the dam and it has not yet been determined whether adits associated with this site fall within the study area. The Flusey Group Mine is located on a steep slope on the western side of the canyon reach and it is believed that some small adits associated with the mine may occur within the study area and may provide suitable bat habitat. While the presence of the Sterling Mine has not been established as occurring within the study area, it also may have some adits that could serve as bat habitat. Finally, while the Riverside Mine occurs outside of the study area boundary, it was recently learned that there may be an associated adit that occurs inside the study area. The Riverside, Sterling, Tom Cat, and Flusey Group mines will be visited during the summer of 2008 to confirm their relationship to the study area, their relevance to bats, and to identify any subsequent survey needs.

**Table 5.1-2.** Locations of mines with potentially suitable bat habitat, whether each is within the study area, and linear distances to the reservoir high-water mark (1,994 feet, NAVD 88).

Site Name	Location (UTM) <sup>1</sup>		Within Study Area?	Distance to Reservoir (ft)	Comments
	Easting	Northing			
Tom Cat	474006	5426338	TBD	>800	Additional investigations required in 2008.
Lakeview	477197	5426324	No	7,552	Outside of study area.
Z Canyon	474944	5426032	Yes	445	Not able to locate in field.
Hanley	474393	5425877	Yes	14	Flooded; access not possible
Giant #1 and #2	474135	5422514	No	3,794	Outside of study area.
Hoage	474008	5421880	No	4,525	Outside of study area.
Lead King	474097	5420613	No	4,148	Outside of study area.
Flusey Group	475546	5420351	Yes	26	Additional investigations required in 2008.
Lucky Strike #1 and #2	475764	5419783	No	1,041	Outside of study area.
Robert E. Lee	475036	5419263	Yes	9	Flooded; access not possible
Riverside	475559	5418460	TBD	350	Additional investigations required in 2008.
Yellowhead	472830	5414549	No	737	Outside of study area.
Pend Oreille	473606	5414367	No	1,159	Outside of study area.
Sullivan	472526	5414028	No	925	Outside of study area.
Grandview	473802	5413376	No	1,574	Outside of study area.
Washington	472691	5412606	Yes	27	Surveyed during 2007 study season
Oriole	469715	5411997	No	6,362	Outside of study area.
Bluebucket	470783	5410168	No	1,783	Outside of study area.
Metaline	471385	5410009	Yes	61	Surveyed during 2007 study season
Wolf Creek	472007	5408439	No	981	Outside of study area.
Thurman	47223	5410504	Yes	50	A prospect, not a mine. Not included on the list in the RSP
Emerald	N/A	N/A	N/A	N/A	Could not be located.
Sterling Mine	471278	5409321	TBD	258	Additional investigations required in 2008.

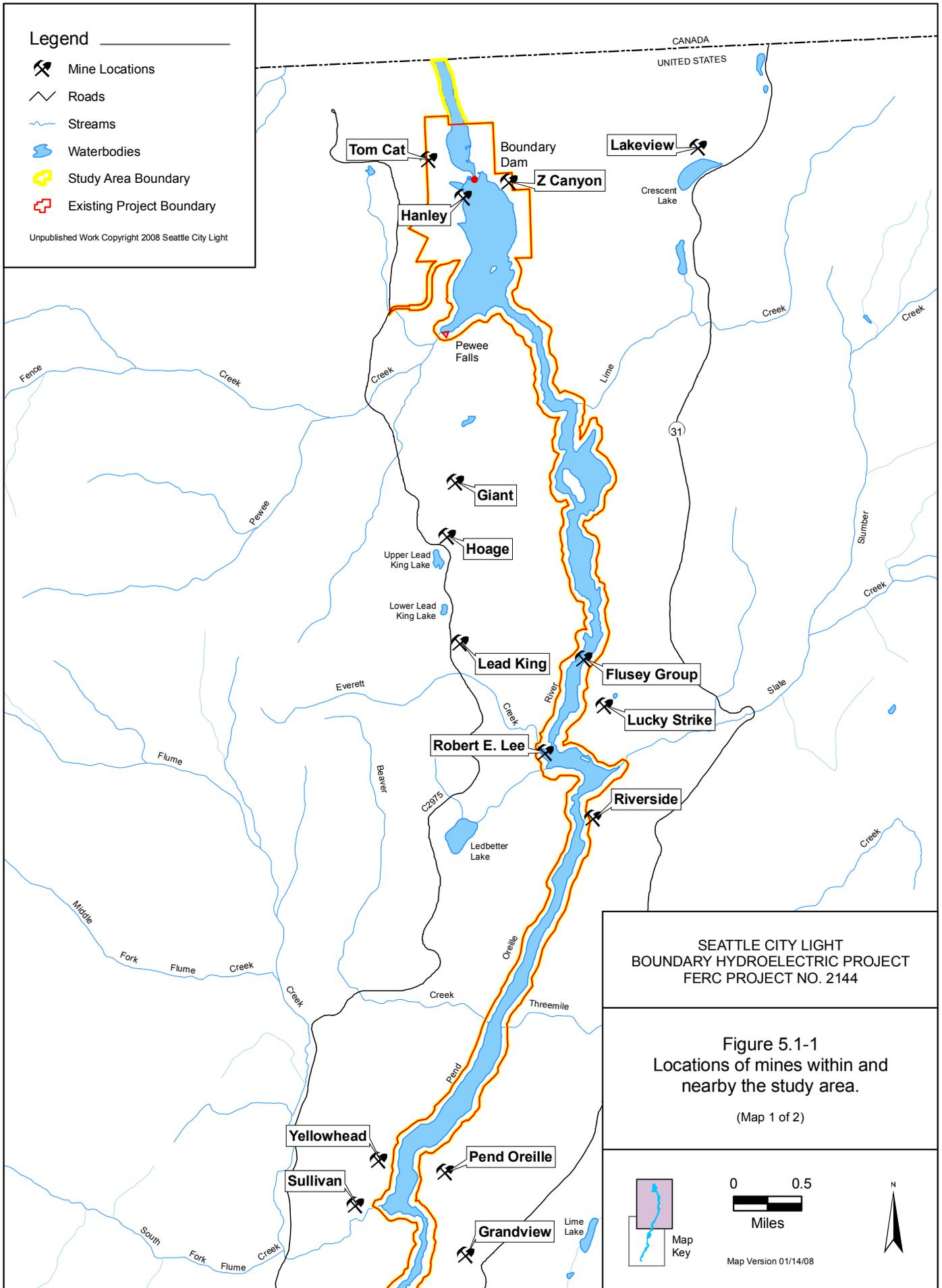
Note:

1 Boleneus (1999)

**Legend**

-  Mine Locations
-  Roads
-  Streams
-  Waterbodies
-  Study Area Boundary
-  Existing Project Boundary

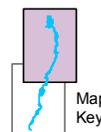
Unpublished Work Copyright 2008 Seattle City Light



SEATTLE CITY LIGHT  
BOUNDARY HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2144

Figure 5.1-1  
Locations of mines within and  
nearby the study area.

(Map 1 of 2)



0 0.5  
Miles

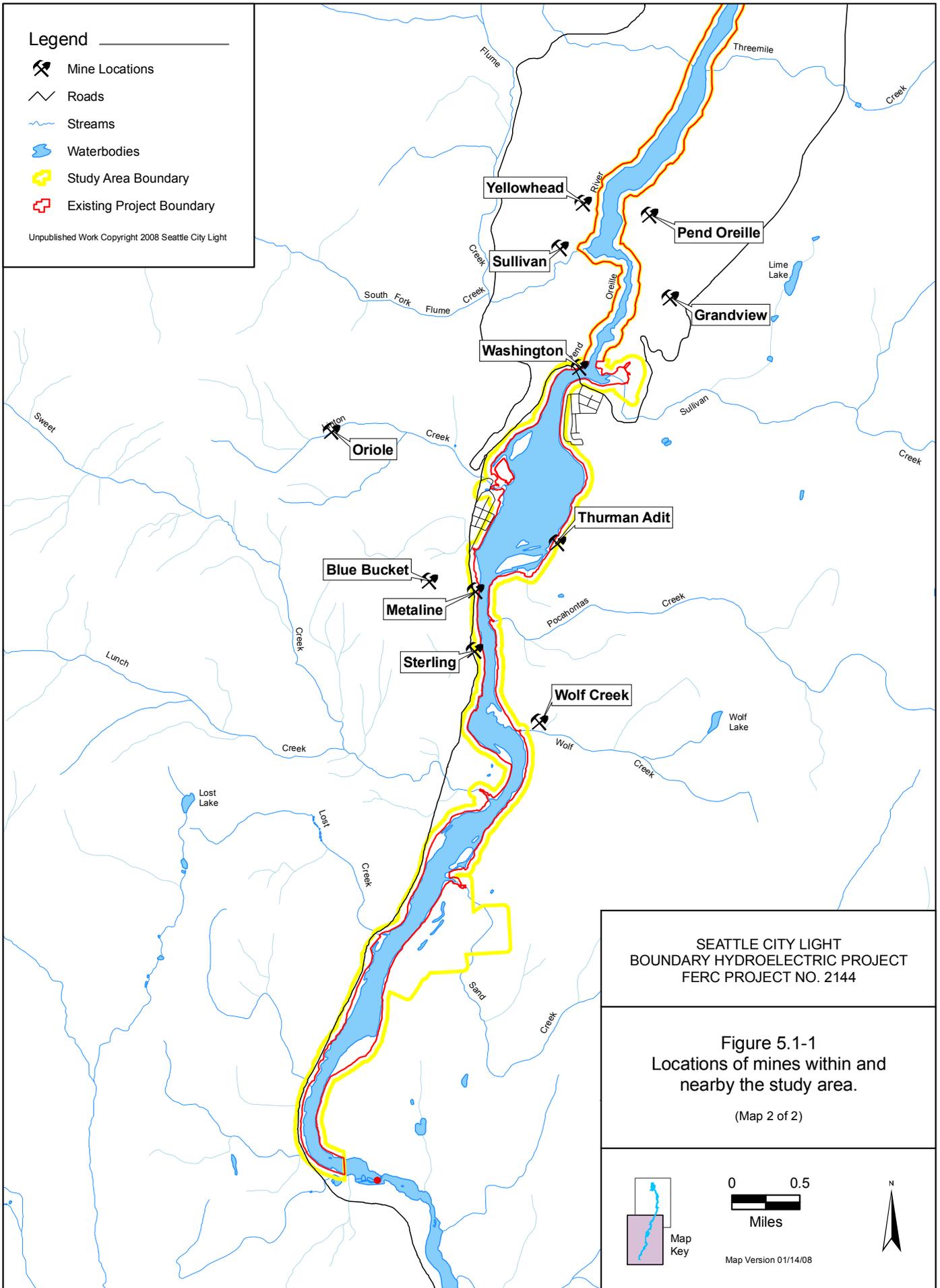


Map Version 01/14/08

**Legend**

-  Mine Locations
-  Roads
-  Streams
-  Waterbodies
-  Study Area Boundary
-  Existing Project Boundary

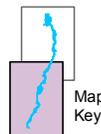
Unpublished Work Copyright 2008 Seattle City Light



SEATTLE CITY LIGHT  
BOUNDARY HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2144

Figure 5.1-1  
Locations of mines within and  
nearby the study area.

(Map 2 of 2)



Map  
Key

0 0.5  
Miles



Map Version 01/14/08

## 5.2. Inventory and Characterization of Bat Habitats

Sites identified in the field as potential day roosts, maternal roosts, or hibernacula are identified in Figure 5.2-1 and include mine adits, mine prospects (shallow exploratory adits), caves, tree roost sites (discussed in Section 5.6), tunnels and portals associated with Boundary Dam, and the SCL maintenance buildings. Bats use a variety of sites as day roosts, including all of the structures mentioned above. However, maternal roosts must have specific characteristics to facilitate the protection and growth of natal bats. In general, bat species potentially breeding in the study area use maternity sites that are humid and warm. *Myotis*, for example, can tolerate maximum daily temperatures from 30 to 40°C (86 to 104°F) (Nagorsen and Brigham 1993, Williams and Brittingham 1997), while 18 to 30°C (64 to 86°F) is more typical for Townsend's big-eared bat maternal roosts (Pierson and Rainey 1998). Bats will develop maternal colonies in structures with lower temperatures but there must be enough individuals to raise the temperature by clustering (in numbers from 30 to the hundreds) thereby using their combined body heat to increase and maintain a higher temperature microclimate (Betts et al. 1997). In contrast, suitable hibernacula are humid structures that will maintain cold temperatures near 0°C (Fenton and Barclay 1980). Temperatures below freezing will kill hibernating bats, and temperatures much higher than freezing will wake bats from torpor resulting in depletion of energy reserves leading to starvation (Humphries et al. 2006). Relative humidity of greater than 85 percent is apparently necessary to help hibernating *myotis* prevent water loss (Fenton and Barclay 1980, Fenton 1983, Bilecki 2003). Townsend's big-eared bats are apparently more tolerant of the coldest temperatures near freezing and a lower humidity (Raesly and Gates 1987, Clark et al. 1996, Jagnow 1998).

- **Mine Adits** — Investigations to date have revealed that three mine adits within the study area (Metaline, Washington, and Thurman) provide roosting habitat for bats (Figure 5.2-1). Metaline and Washington mines are extensive enough to provide day roosting and possibly hibernating habitat for bats, but are probably too cold for use by maternal bats. Recorded June temperatures at the adit entrances were less than 20°C (68°F), with the likelihood of much colder summer temperatures deeper in the mine. October humidity recordings at the entrances of both mines were less than 75 percent, but that value may not represent the relative humidity at microsites within the mine that might support hibernating bats. Running water is also found in both the Metaline and Washington mines, providing a humidity source. Thurman adit is an exploratory prospect extending only about 30 feet into the ground, with a small, partially collapsed entrance. While it provides suitable day roosting habitat, it is probably too small to maintain winter temperatures above freezing, and too enclosed (the entrance has collapsed to a small crawl space) to allow enough warm summer air inside to heat the interior to suitable temperatures for maternal colonies. The summer temperature recorded at the adit entrance was only 16°C (60°F).

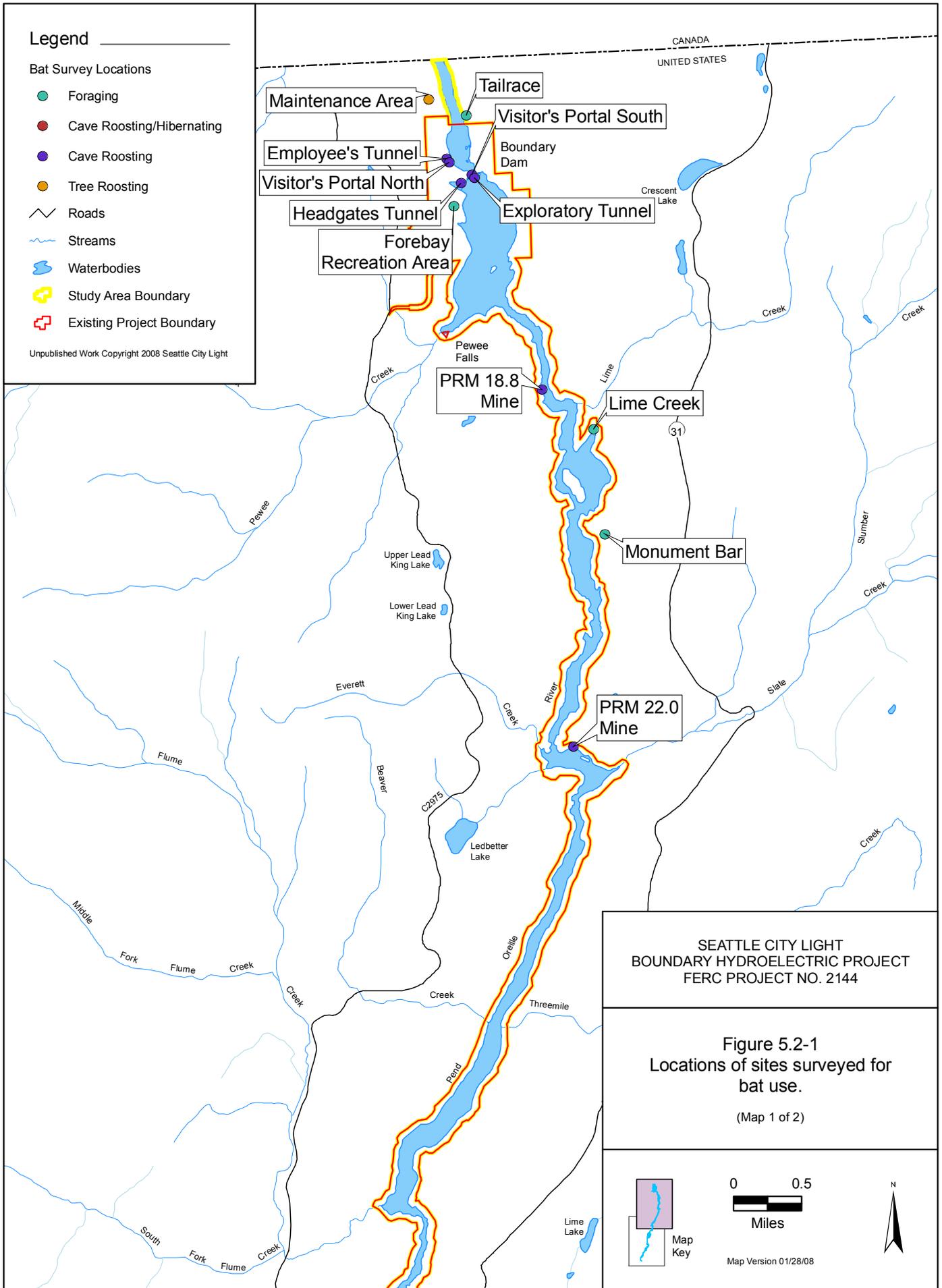
The Sterling, Tom Cat, Riverside, and Flusey Group mines allegedly have open adits and could provide suitable bat habitat, but these sites remain to be investigated.

# Legend

## Bat Survey Locations

- Foraging
- Cave Roosting/Hibernating
- Cave Roosting
- Tree Roosting
- Roads
- Streams
- Waterbodies
- Study Area Boundary
- Existing Project Boundary

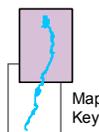
Unpublished Work Copyright 2008 Seattle City Light



SEATTLE CITY LIGHT  
BOUNDARY HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2144

Figure 5.2-1  
Locations of sites surveyed for  
bat use.

(Map 1 of 2)



0 0.5  
Miles



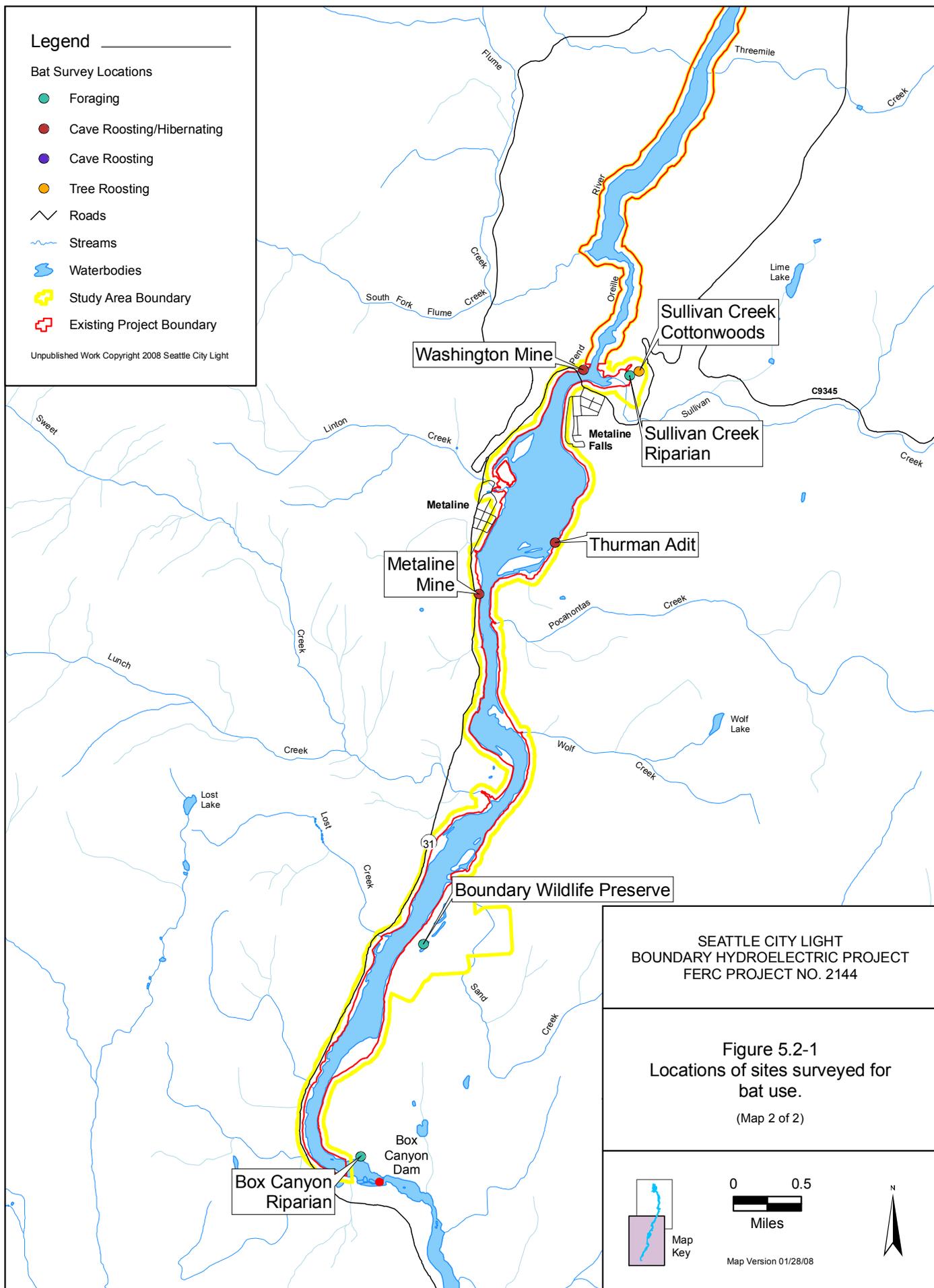
Map Version 01/28/08

**Legend**

**Bat Survey Locations**

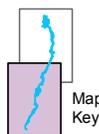
- Foraging
- Cave Roosting/Hibernating
- Cave Roosting
- Tree Roosting
- Roads
- Streams
- Waterbodies
- Study Area Boundary
- Existing Project Boundary

Unpublished Work Copyright 2008 Seattle City Light



SEATTLE CITY LIGHT  
BOUNDARY HYDROELECTRIC PROJECT  
FERC PROJECT NO. 2144

**Figure 5.2-1**  
Locations of sites surveyed for  
bat use.  
(Map 2 of 2)



0 0.5  
Miles



Map Version 01/28/08

- **Shoreline Caves** — A number of variously-sized natural caves occur along the reservoir downstream of Metaline Falls. However, only two of these features located within the study area were deemed large enough to provide day roost habitat for bats. The cave at Project river mile (PRM) 18.8 is located on the river canyon left bank, approximately one half mile upstream of the Boundary forebay. This is a large natural cave with an opening approximately 20 feet high and 15 feet wide, and a depth of about 30 feet. No bats were observed inside the cave during spring and summer investigations, although some roosting use is likely based on acoustical surveys. Another much smaller cave is located less than a half mile downstream of the mouth of Slate Creek at PRM 22.0. The entrance is about 5 feet by 5 feet, but the cave forms a pocket with a depth of about 10 feet. Its value to bats appears limited, although the carcass of an unknown myotis was found inside. Neither cave is large enough to serve as a hibernaculum, and no evidence of maternal bat use was recorded during spring and summer surveys. A third cave was included on the USFS list provided in the RSP as “Unknown Cave above Lime Creek”. This cave has not yet been located, and probably occurs outside of the study area.
- **Dam Portals and Tunnels** — Five portals associated with Boundary Dam (Figure 5.2-1) may provide limited habitat for bats. These include the north and south portals of the visitor’s tunnel, the employee’s portal (with an offshoot adit to the mucking room), the headgate portal, and the exploratory portal. [For purposes of this discussion, a “portal” is defined as an opening into the rock; several large openings of this nature were created in association with construction of the Project. A “tunnel” is a continuous opening that is entered/exited at each end through a portal.] Based on the high level of human and equipment activity and the relatively smooth rock substrate, the employee’s portal appears least likely to support bats. However, the mucking room fork of the employee’s portal is relatively dark and there is little human activity and, therefore, may offer better conditions for roosting bats. The visitor’s tunnel provides some crevices for roosting bats near the north portal entrance, but most of its length to its southern opening has been smoothed with concrete, or covered with tile and other materials, therefore, is not adequate for roosting. The headgate portal is similar to the visitor’s tunnel, but there are fewer crevices. The exploratory portal is a narrow shaft extending only about 20 feet into the solid rock and does not appear to provide more than marginal roost habitat. While the few crevices and recesses found in these features may provide some opportunity for roosting bats, none are large enough for establishing maternal colonies, and the interiors are relatively cool (20°C) and lower in humidity (<70 percent) than preferred by maternal bats.
- **Buildings** — Six maintenance facility buildings, located below Boundary Dam (Figure 5.2-1), were examined for potential bat use. Only the large shop building appeared to be accessible to bats, but no evidence of bat use was found there or at any of the other facilities. Ross Cabin, an old miner’s log cabin in the Forebay Recreation Area, could potentially support roosting bats and is discussed further in Section 5.5.

- **Mine Adits and Caves Below the Normal High Water Level** — During a study-related drawdown event on September 6, 2007, a survey of the river below Metaline Falls to Boundary Dam was conducted to record the presence of features in the normal reservoir fluctuation zone (elevation 1,974 to 1,994 feet NGVD 88 [1,970 to 1,990 feet, NAVD 29]) that could provide habitat for bats. Seven adits and four caves were recorded, none of which extended to a depth greater than 30 feet, with the exception of a collapsed and flooded adit associated with the Josephine Mine. Based on extensive flooding in the case of the Josephine Mine, and the shallow depths of the remaining exploratory adits and caves, it was concluded that none of these structures represent significant potential bat habitat, especially for maternal or hibernating bats.

### 5.3. Roost Site and Maternity Colony Surveys

Summer surveys were conducted at 10 locations to record bat roosting use. Although most of the sites appeared capable of providing day roosting habitat based on the assessments of Task 2 (Section 5.2), none appeared particularly suitable for use by maternal bats based on either cool or unmoderated temperatures. Still, bats are capable of increasing and maintaining microclimate temperatures by combining body heat in the form of clustering, and thus use of cool temperature structures cannot be ruled out. Although the best means of identifying maternal roosts would be to enter the sites, the mine adits were not entered due to safety concerns. However, maternal bat use of a structure would be evident by the exiting of large numbers (greater than 30) of bats during the early evening. If large numbers were observed, follow-up mist net surveys for lactating females could confirm maternal use. The summer survey results from each of the 10 locations follow.

- **Metaline Mine** was surveyed on June 25, June 28, and August 13, 2007, to determine its use by roosting or maternal bats. Only a small number (high emergence count of only three bats) of California myotis (*Myotis californicus*) were recorded exiting the mine each night. Larger numbers of bats (California myotis, Yuma myotis, little brown bat, and big brown bat) were observed passing overhead at dusk near the mine entrance, originating from northwest of the Metaline Mine. The mines' cool temperature, and the presence of only low numbers of bats exiting the structure strongly suggest that it is not being used for maternal purposes. No follow up mist net surveys were conducted at this site.
- The **Washington Mine** was surveyed on June 26 and August 14, 2007 (Figure 5.3-1). Similar to the Metaline Mine, a small number (high count of eight) of California myotis were recorded exiting this mine at each survey. At least three other species of bats were acoustically detected outside the mine, especially near the river, but only California myotis were identified actually exiting the mine. The cool interior temperature and lack of use by a large number of bats suggest that the Washington Mine is not being used as a maternal colony. No follow-up mist netting efforts were conducted due to these conditions.



**Figure 5.3-1.** Researcher at entrance to Washington Mine.

- The **Thurman** adit was surveyed on June 25 and August 13, 2007. This site is a prospect extending back only about 30 feet and the ceiling can be visually surveyed from the entrance. No bats, roosting or maternal, were observed inside the small enclosure during the June and August surveys. Although bats (myotis) were visually and acoustically detected in the vicinity of the adit entrance, no bats were confirmed exiting the adit.
- **Caves at PRM 18.8 and 22.0** — Due to safety concerns regarding boating at night in the canyon reach below Metaline Falls, visual emergence/dispersal surveys were not conducted at the caves at PRM 18.8 and 22.0, although detectors and recorders were left to operate overnight at both locations on June 26 and the grotto at PRM 18.8 only on August 16. Although bat use was recorded, analysis of the acoustical data is not yet complete. While both are most likely used as day roosting sites (and a dried bat carcass was found in the cave at PRM 22.0), neither cave is very large and both are unlikely to support maternal bat use. No bats were observed in the caves during daylight surveys prior to detector placement, suggesting that any roosting occurring in these structures is concealed within crevices.
- **Dam Portals and Tunnels** — A bat survey of the underground structures associated with the Boundary Dam and powerhouse was conducted on June 17, 2007. No bats or guano were observed, and only a few bat habitat features, such as crevices, were noted. Still, given that these features represent potential (albeit marginal) bat habitat, additional survey work was conducted. The north portal of the visitor's tunnel and employee's portal were visually (and acoustically) surveyed for exiting bats. The south portal of the visitor's tunnel, the headgate portal, and the exploratory portal were surveyed acoustically. The exit surveys at the north portal of the visitor's tunnel and the employee's portal were conducted on June 27, 2007. No bats were observed emerging from the employee's portal, whereas four bats emerged from the visitor's tunnel north portal. The bats were visually identified as myotis and acoustically identified as little brown bats (a myotis). Silver-haired bats were acoustically

detected several times at the entrance to the visitor's tunnel north portal, but it is believed that these bats were not entering the portal, but rather feeding around the nearby security lighting. No bat calls were acoustically detected at the visitor's tunnel south portal, the headgate portal, or the exploratory portal during the June 27th survey. It was concluded that only a very few little brown bats are day roosting in the portals and tunnel associated with Boundary Dam, and none of this use is maternal. Too few bats were observed to warrant a follow-up mist net survey to confirm a lack of maternal use of these structures.

Although the observed level of bat use of potentially suitable roost sites in the study area was low, and no evidence of maternity use was found, large numbers of bats were regularly observed foraging over the reservoir between Metaline Falls and the Metaline Mine. This area also receives a lot of use by other wildlife species, suggesting a rich ecology driven by the presence of high populations of aquatic insects.

#### **5.4. Hibernacula Surveys**

The Metaline and Washington mines are likely the only features in the study area that represent potential hibernacula. The exploratory portal at Boundary Dam, the caves along the reservoir, and the Thurman adit are too shallow and/or too exposed to maintain temperatures above freezing during the winter (bats generally hibernate in mines or caves at depths of several hundred feet where freezing temperatures cannot penetrate). While the Boundary Dam portals and tunnel would remain above freezing during the winter, constant human activities associated with these structures, coupled with marginal habitat features, may inhibit use by hibernating bats.

The Metaline and Washington mines were surveyed in September and October for the presence of swarming bats, which is indicative of winter hibernacula. Similar to the results of the roost site and maternity colony surveys, only small numbers of California and Yuma myotis were observed using the two mines (a high count of five bats for the Metaline Mine and 14 for the Washington Mine). During the October 11 exit survey, a larger bat was visually observed at ground-level very near the Washington Mine entrance; this bat was visually observed triggering the acoustical detector and later acoustically identified as a Townsend's big-eared bat. The Thurman adit was surveyed in September and October. During the October 12 survey, a single Townsend's big-eared bat was noted day roosting near the entrance. While recording the bat, a better view of the adit interior was afforded, which revealed the adit was not a mine, but rather a shallow (30 feet deep) prospect. It was subsequently removed from consideration as a potential hibernaculum. In conclusion, small numbers of myotis appear to be using Metaline and Washington mines as day roosts, and possibly as hibernacula, but the latter cannot be confirmed without a winter interior inspection of each mine. However, given that only a small number of bats were recorded using these mines in the fall, no large bat swarms were noted, and no Townsend's big-eared bats were observed exiting Metaline or Washington mines, there is not sufficient cause to warrant conducting winter surveys in 2008.

#### **5.5. Foraging Site Sampling**

Foraging surveys were conducted at seven sites in July and August, as shown on Figure 5.2-1. Bats were observed at all sites except in the conifer habitats at Monument Bar. Nine species of

bats were acoustically recorded at Box Canyon and four at Lime Creek, but the acoustical data collected at the remaining four sites have not been fully analyzed (Table 5.5-1). Four adult male Yuma myotis were captured at the Box Canyon riparian site on October 17 and represent the only successful mist net captures during the course of the foraging site sampling, although on several occasions bats were observed actively avoiding the nets. Consequently, the acoustical data are likely to provide much more information on bat use than the mist net data.

The following general observations can be made at this time:

- Numerous bats, representing nine species, including long-eared and long-legged myotis, both BLM Assessment Species, were acoustically recorded at the Box Canyon riparian site.
- Very few bats were recorded at the Sullivan Creek riparian site and no bats were recorded at the Monument Bar conifer site.
- No bats were detected using the Ross Cabin near the SCL Forebay Recreation Area.
- No Townsend’s big-eared bats were detected during foraging surveys.

Final analysis of the acoustical data will be completed in winter 2008, and all acoustical records of RTE bats will be confirmed by Dr. Joe Szewczak, developer of the SonoBat program and leading expert on the acoustical detection of bats. The final results will be reported in the USR.

**Table 5.5-1.** Bat species identified acoustically at seven foraging sites surveyed in the study area.

Bat Species	Monument Bar <sup>1</sup>	Lime Creek	Box Canyon	Sullivan Creek <sup>2</sup>	Forebay Recreation Area <sup>2</sup>	Boundary Wildlife Preserve <sup>2</sup>	Tailrace <sup>2</sup>
California myotis		x	x				
Yuma myotis			X <sup>3</sup>				
little brown bat		x	x				
long-legged myotis		x	x				
western small-footed myotis			x				
long-eared myotis			x				
big brown bat			x				
hoary bat			x				
silver-haired bat		x	x				

Notes:

- 1 No bats were recorded at the Monument Bar conifer site.
- 2 Analysis of bat calls from this location is pending.
- 3 Four adult male Yuma myotis were captured in the mist nets during this survey.

**5.6. Tree Roost Mapping**

The majority of the study area is comprised of second-growth conifer forest habitats. Consequently, decadent older age-class trees and large snags are not abundant. Apart from the occasional pine snag excavated by pileated woodpeckers (*Dryocopus pileatus*) or northern

flickers (*Colaptes auratus*), limited tree-roosting habitat for bats was recorded in the conifer forests in the study area. Potential deciduous tree-roosting habitat does occur at the BWP and along Sullivan Creek. The BWP supports extensive stands of cottonwood, aspen, and other deciduous trees that provide potential roosting habitat, and probably most closely represent the habitat types found to be used by roosting bats in the Pend Oreille River valley of British Columbia (Vonhof and Gwilliam 2000). The cottonwood stands of Sullivan Creek also offer potential tree-roosting habitat for bats. Detailed mapping of bat tree-roosting habitat will be refined in 2008 in conjunction with review of the results of the Riparian Tree and Shrub Study (Study 16) and the habitat mapping being conducted as part of the Big Game Study (Study 19).

## 5.7. Documentation and Effects Assessment

The effects of Project operations on bats and their habitats will not be assessed until all field efforts are completed and data analyzed. This documentation and effects assessment will be presented in the USR.

## 6 SUMMARY

Surveys were conducted for the presence of bats and bat habitat within the study area. Preliminary results reveal the following:

- Small numbers of bats (mostly California myotis) roost within the Metaline and Washington mines, but there is no evidence that these mines are used as maternity colonies or hibernacula.
- Large numbers of bats were incidentally observed foraging over the reservoir above Metaline Falls, especially over Metaline Pool.
- Relatively small numbers of bats were acoustically recorded, and none were captured, at the Boundary tailrace, SCL Boundary Forebay Recreation Area, Lime Creek, Sullivan Creek, and BWP riparian sites, and none were recorded at the Monument Bar conifer site.
- Relative to the other foraging sites, high numbers and a high diversity of bats (including tentative recordings of both long-eared and long-legged myotis) were recorded acoustically at the Box Canyon riparian site (outside of the study area) and four adult Yuma myotis were captured in the mist nets.
- The only bat use recorded inside any of the tunnels or buildings associated with Boundary Dam was by four little brown myotis observed exiting the visitor's tunnel north portal on June 27.
- Potential tree-roosting habitat for bats was noted at Sullivan Creek (cottonwood), at the BWP (aspen and cottonwood), and near Box Canyon Dam (cottonwood), although these habitat feature will be further researched in 2008.
- Use of the study area by three RTE bat species — Townsend's big-eared bat, long-eared myotis, and long-legged myotis — was (tentatively) recorded.

## 7 VARIANCES FROM FERC-APPROVED STUDY PLAN AND PROPOSED MODIFICATIONS

The 2007 field studies did not vary from the methods outlined in the RSP.

Near the end of the 2007 field season, SCL received documents from the Washington Department of Ecology relating to past mining activities at various locations in the Project vicinity. These documents indicated the presence of four additional mines (Sterling, Flusey Group, Tom Cat, and Riverside) that may have features in the study area that could serve as potentially suitable bat habitat. Sterling Mine, which did not appear on the USFS list in the RSP, is “officially” located outside the study area (based on Boleneus 1999) but does appear to have at least one open (but deteriorating) adit within 200 feet of the reservoir and will be further investigated in 2008 for bat use. The Flusey Group Mine appeared on the USFS list, but the location data provided by the USFS was not adequate to locate the site before surveys were conducted. An open adit associated with the Flusey Group Mine may or may not occur within the study area (and access may be dangerous), but it will be investigated in 2008. Based on the site location provided by Boleneus (1999), Tom Cat Mine is located on the very edge of the study area boundary and over 800 feet west of the Boundary Dam tailrace. Whether any associated adits occur inside the study area requires further investigation. Finally, results from the Cultural Resources Study (Study 24 Interim Report [SCL 2008]) suggest that the main features of the Riverside Mine are outside of the study area, but the Ecology report implies that an adit might occur (at a precarious location) nearer the river’s edge. Thus, the Riverside Mine site will be further investigated in 2008 to determine if potential bat habitat associated with the mine is present in the study area.

The RSP provides for follow up bat survey work to be conducted, if warranted. Because of the limited success of the mist netting activities in 2007 and the much greater success of the acoustical surveys, it is proposed that only acoustical surveys continue in 2008 at select locations. These surveys should emphasize unique habitats (e.g., the rocky reaches below Metaline Falls) or locations where very high numbers of foraging bats were observed (e.g., Metaline Pool). SCL will consult with the relicensing participants in early 2008 to discuss site selection for these additional acoustical surveys.

## 8 REFERENCES

- Betts, B.J. 1997. Microclimate in Hell’s Canyon mines used by maternity colonies of *Myotis yumanensis*. *Journal of Mammalogy* 78:1240-1250.
- Bilecki, L.C. 2003. Bat hibernacula in the Karst landscape of Central Manitoba: Protecting Critical Wildlife Habitat while Managing for Resource Development. M.S. Thesis, University of Manitoba, Winnipeg.
- Boleneus, D.E. 1999. Geologic datasets for weights-of-evidence analysis in northeast Washington – 2. Mineral databases. Open-File Report 99-384, USGS, Spokane, Washington. 34 pp.

- Clark, B.K., B.S. Clark, D.M. Leslie, Jr., and M.S. Gregory. 1996. Characteristics of caves used by the endangered Ozark big-eared bat. *Wildlife Society Bulletin* 24:8-14.
- E&E (Ecology and Environment, Inc.). 2002. Preliminary Assessments and Site Investigations Report, Lower Pend Oreille River Mines and Mills, Pend Oreille County, Washington, TDD: 01-08-0009. Unpublished report submitted to the U.S. Environmental Protection Agency, Seattle, Washington.
- Fenton, M.B. 1983. *Just bats*. The University of Toronto Press, Toronto, Ontario, Canada.
- Fenton, M.B., and R.M.R. Barclay. 1980. *Myotis lucifugus*. Mammal. Species No. 142. 8pp.
- Hart Crowser, Inc. 2007. Abandoned Mines Lands Initial Investigation Report: Bella May Mine, Blue Bucket Mine, and Bella May/Blue Bucket Mill Site, Metaline, Washington. Unpublished report submitted to the Washington State Department of Ecology, Seattle, Washington.
- Jagnow, D.H. 1998. Bat usage and cave management of Torgac Cave, New Mexico. *Journal of Cave and Karst Studies* 60:33-38.
- Kunz, T.H., D.W. Thomas, G.C. Richards, C.R. Tidemann, E.D. Pierson, and P.A. Racey. 1996. Observational techniques for bats. Pages 105–114 in D. E. Wilson, F. R. Cole, J. D. Nichols, R. Rudran, and M. S. Foster, editors. *Measuring and monitoring biological diversity: standard methods for mammals*. Smithsonian Institution Press, Washington, D.C.
- Nagorsen, D.W. and R.M. Brigham. 1993. Bats of British Columbia. Vol. 1, The mammals of British Columbia. University of British Columbia Press, Vancouver, B.C., Royal B.C. Museum Handbook. 165 pp.
- Pierson, E.D. and W.E. Rainey. 1998. Distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii*) in California. BMCP Technical Report No. 96-7, California Department of Fish and Game. 34 pp.
- Raesly, R.L. and J.E. Gates. 1987. Winter habitat selection by north temperate cave bats. *The American Midland Naturalist*. 118:15-31.
- SCL (Seattle City Light). 2007. Revised Study Plan for the Boundary Hydroelectric Project (FERC No. 2144). Seattle, Washington. February 2007. Available online at: [http://www.seattle.gov/light/news/issues/bndryRelic/br\\_document.asp](http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp)
- SCL. 2008. Study 24 – Cultural Resources Study Interim Report for the Boundary Hydroelectric Project (FERC No. 2144). Prepared by Historical Research Associates under contract to Tetra Tech. March.

Tuttle, M.D., and D.A.R. Taylor. 1998. Bats and mines. Bat Conservation International, Inc. Resource Publication No. 3.

Vonhof, M.J., and J.C. Gwilliam. 2000. A summary of bat research in the Pend d'Oreille Valley in southern British Columbia. Columbia Basin Fish and Wildlife Compensation Program, December 2000. 105 pp.

Williams, L.M., and M.C. Brittingham. 1997. Selection of maternity roosts by big brown bats. *Journal of Wildlife Management* 61:359-368.