FINAL TECHNICAL REPORT

for

TERRESTRIAL RESOURCES

Yale Hydroelectric Project
FERC Project No. 2071

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ACRONYMS AND ABBREVIATIONS

C	confirmed breeding
CFR	Code of Federal Regulations
dbh	diameter at breast height
DNR	Department of Natural Resources
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FR	Federal Register
FSCD	First Stage Consultation Document
FTR	Final Technical Report
GIS	geographical information system
HCP	Habitat Conservation Plan
ILM	Integrated Landscape Management
ITR	Interim Technical Report
NWI	National Wetlands Inventory
OSU	Oregon State University
P	probable breeding
PHS	Priority Habitats and Species
ROW	right-of-way
SPU	Seattle Public Utilities
TES	Threatened, Endangered, or Sensitive
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WMZ	Wetland Management Zone
WNHP	Washington Natural Heritage Program

1.0 INTRODUCTION

The Yale Hydroelectric Project is owned and operated by PacifiCorp under the authority of the Federal Energy Regulatory Commission (FERC; Project No. 2071). The project is 1 of 4 hydroelectric projects located on the North Fork of the Lewis River in southwestern Washington. Three of the projects-Yale, Merwin, and Swift No. 1-are owned and operated by PacifiCorp (Figure 1.0-1). The fourth project, Swift No. 2, is owned by Public Utility District (PUD) No. 1 of Cowlitz County and is operated and maintained by PacifiCorp for the PUD. The Yale Project is located in Cowlitz and Clark counties, approximately 23 miles east of Woodland, Washington, and 45 miles northeast of Portland, Oregon.

1.1 SCOPE OF REPORT

The Yale Project currently operates under a license from the FERC that expires on April 30, 2001. PacifiCorp is seeking a new license to continue to operate the project and (as required by the FERC) issued a Notice of Intent (NOI) on February 7, 1996 to apply for a new license. FERC regulations establish a 3-stage process of consultation between the applicant, state and federal resource agencies, and tribes. The regulations also establish a process for obtaining public comment during relicensing. PacifiCorp began the first stage of the consultation process by issuing a First Stage Consultation Document (FSCD) (PacifiCorp 1996) that described the facilities, operation, and environmental setting of the existing Yale Project. This document also described studies that PacifiCorp planned to conduct in the areas of aquatic (water quality and fisheries), terrestrial, land use, aesthetics, recreation, and cultural resources in accordance with Title 18, Part 4, Section 51 of the Code of Federal Regulations (18 CFR 4.51): Application for Major Project-Existing Dam.

Study results for 1996 were described in the Interim Technical Report (ITR) (PacifiCorp 1997), which covered all resource disciplines. Results for studies conducted in 1997 are combined with those for 1996 and presented in final technical reports (FTRs) that are resource specific. This draft FTR for Terrestrial Resources describes the results of studies conducted in 1996 and 1997 on wildlife and vegetation in the vicinity of the Yale Project. Other resource-specific FTRs have been prepared for aquatic resources, recreation, and cultural resources; FTRs were not prepared for visual resources or land use because no specific studies were conducted in 1997 for these resources.

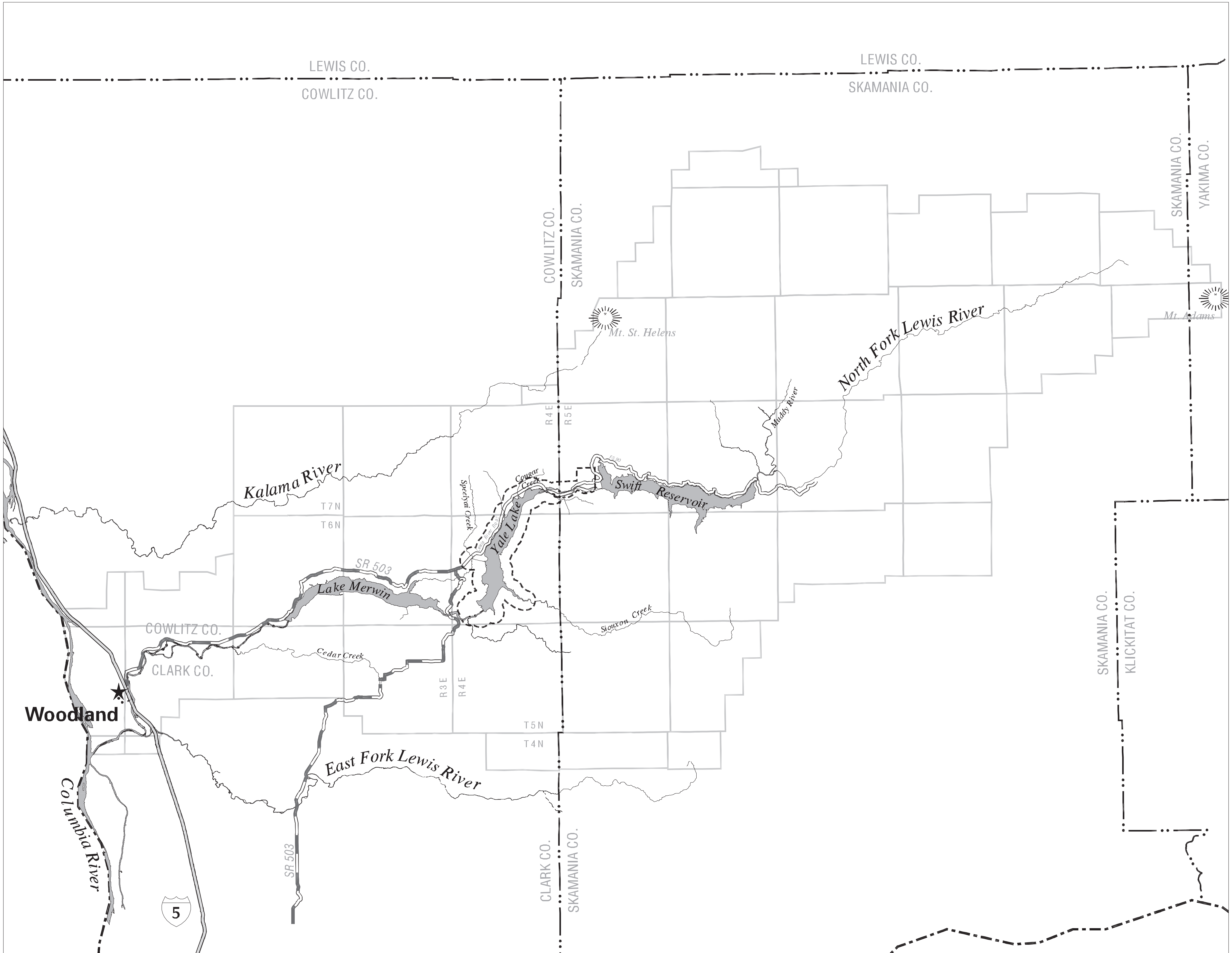
The draft FTR for Terrestrial Resources describes the area of each study, detailed methods and procedures used to conduct each study, and results. The report has been distributed for agency review. Based on agency comments received, the final FTR will be prepared and integrated into the draft License Application, which will be distributed to agencies and public in June 1998.

1.2 OVERVIEW OF TERRESTRIAL RESOURCE STUDIES

FERC regulations for relicensing require that PacifiCorp describe existing terrestrial resources associated with the Yale Project and develop measures to protect and/or enhance wildlife and vegetation (FERC 1990). To comply with these regulations, PacifiCorp initiated 5 specific studies to accomplish the following: (1) characterize the wildlife and botanical resources associated with the Yale Project; (2) assist in making sound decisions regarding the effects of continued operation and maintenance of the project, as well as any proposed changes on terrestrial resources; and (3) identify protection and enhancement measures to be included in the License Application. These studies were begun in 1996 and completed in 1997 and included the following:

- Vegetation cover type mapping and habitat characterization
- Threatened, endangered, and sensitive (TES) plant studies
- Species/habitat association studies
- TES and priority wildlife studies
- Reservoir drawdown studies

Results of these studies will be considered in the License Application. The following sections of the FTR describe the results of each terrestrial resource study conducted in 1996 and 1997, as well as activities planned for 1998.



Legend

- Study Area
- Public Land Survey

ADMINISTRATIVE BOUNDARIES

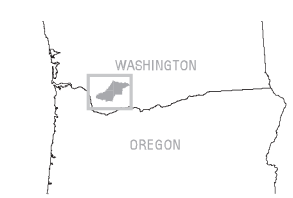
- County Line
- State Line

HYDROGRAPHY

- Water
- Stream

TRANSPORTATION

- Primary Road
- Secondary Road
- Light Duty Road



NORTH

0 5 10 Miles

Scale 1:325000

Yale Hydroelectric Project

Figure 1.0-1
Project Vicinity

Created by VESTRA Resources for PacifiCorp

/p1/proj_map/projects/yale/license/ftr/recreatn/project_vicinity.map

January 29, 1999

2.0 VEGETATION COVER TYPE MAPPING AND CHARACTERIZATION

Cover type mapping provides baseline information on wildlife habitats and botanical resources in the project vicinity. This information was used to design the TES and species/habitat association studies. For the License Application, information provided by the cover type mapping will be used identify locations for potential habitat improvements and assess the effects of proposed project changes. The mapping describes the distribution and abundance of all vegetation types, especially those defined by the Washington Department of Fish and Wildlife (WDFW) as priority habitats, such as wetlands, riparian areas, and rock talus. This information is especially important for assessing effects on TES wildlife and plant species, which are often associated with unique habitats. The information can also be used to estimate the amount of cover and forage habitat available for deer and elk in the study area.

Vegetation cover types were mapped in 1996. Studies in 1997 focused on collecting data to characterize the vegetation in each of the main cover types in the vicinity of the Yale Project, as requested by the WDFW in their comments on the FSCD (letter from C. Leigh, Biologist, WDFW, Olympia, Washington, August 9, 1996).

2.1 STUDY AREA

PacifiCorp's study area for cover type mapping and characterization includes all lands within 0.5 mile of Yale Lake and the area within 0.125 mile on either side of the 11.5-mile Merwin-Yale transmission line right-of-way (ROW), as described in the FSCD (Figure 2.1-1). The study area was expanded during agency consultation to also include some lands upstream of Yale Lake to address PacifiCorp ownership and lands identified by the WDFW for potential acquisition. This additional area includes the following: (1) a 200-foot buffer of land on the south side of the Lewis River channel upstream of Yale Lake to Swift Dam, (2) land on the north side of the Lewis River channel up to a line 0.125 mile north of the Swift transmission line, (3) the north half of Section 29, and (4) the south half of Section 20 (Figure 2.1-1). The study area covers a total of 16,074 acres.

2.2 METHODS

Vegetation mapping and characterization consists of 2 primary tasks: (1) develop a detailed map of vegetation cover types in the study area; and (2) collect the data needed to characterize the vegetation in each cover type. The methods used to map vegetation cover types are described in Section 2.2.1; methods used to characterize the vegetation in each type and are described in Section 2.2.2.

2.2.1 Vegetation Cover Type Mapping

The methodology used to map cover types in the study area was selected to produce the most accurate, up-to-date map and database as reasonably possible that is consistent with the needs of other resource studies. The methodology employed a combination of photo-interpretation and field verification. A geographic information system (GIS) was used to facilitate data compilation, analysis, and reporting. Vegetation cover type mapping of the study area followed the general sequence described below.

- Obtain existing map data, base maps, aerial photos, and orthophotos;
- Develop a classification system that properly describes the vegetation in the study area and is consistent with PacifiCorp's timber inventory and wetlands mapping, as well as systems used by the agencies (e.g., the Integrated Landscape Management [ILM] watershed mapping produced by WDFW);
- Develop a photo key of cover type signatures to aid in consistency of photo-interpretation;
- Compile existing mapping/GIS coverages onto a common base map;
- Interpret and field verify the cover type delineations on the 1:7,920 aerial photos;
- Compile the data onto orthophotos; and
- Digitize the data into a GIS using digital orthophotography as a registration and basemap and produce a cover type map and report.

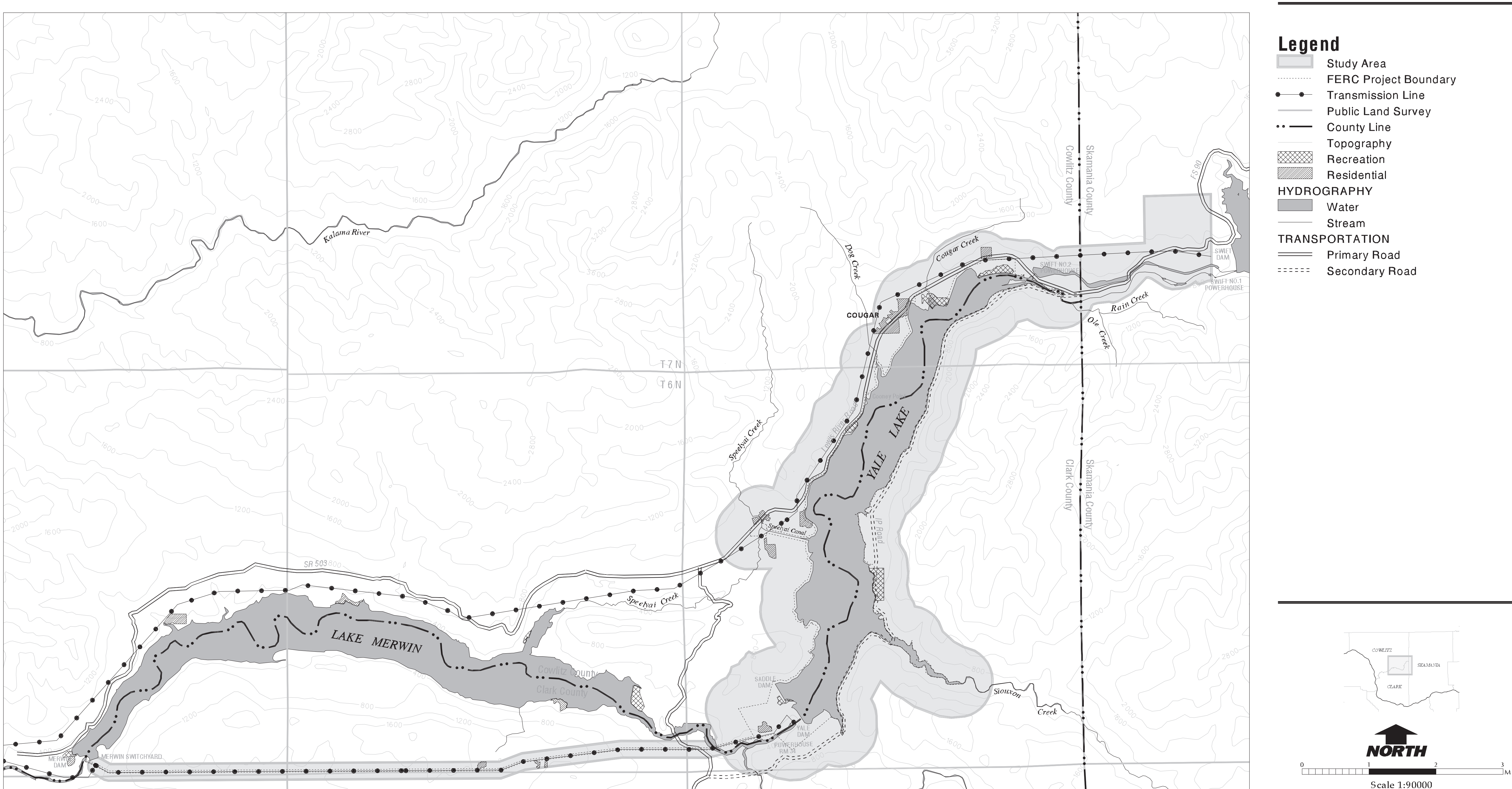
Each of these study components is described below.

2.2.1.1 Obtain Existing Map Data

Prior to initiating the relicensing studies, PacifiCorp conducted several inventories and acquired some of the data needed to map vegetation in the study area, including the following: (1) 1994 inventory of timber and wetland resources on land in PacifiCorp ownership (Hildreth 1995; Dueker and Paz 1995); (2) 1:7,920 color infra-red photographs of the study area taken in 1988; (3) 1:7,920 natural color photographs of the study area taken in 1995; and (4) digital orthophoto coverage for most of the lands adjacent to Yale Lake. Additional mapped data available from other sources include the following: (1) 1991 Landsat data (1:24,000 scale) used by the WDFW to map vegetation in the Lewis-Kalama watershed as part of the ILM process; (2) 1990 Washington Department of Natural Resources (DNR) 1:12,000 black-and-white orthophotos; (3) National Wetland Inventory (NWI) maps; and (4) soil survey maps for Clark, Cowlitz, and Skamania counties.

2.2.1.2 Develop Classification System

The cover type classification system forms the basis for the mapping and subsequent analyses required by the FERC for impact assessment and enhancement planning. The classification of cover types was based on the following criteria: (1) the types have unique characteristics, making them readily identifiable on the aerial photographs; (2) the system includes all cover types that are deemed unique, critical for TES species, or important for wildlife; and (3) the system is consistent with PacifiCorp's existing timber inventory mapping and classification systems being used by resource agencies/tribes in



Yale Hydroelectric Project

Figure 2.1-1

Study Area

the area. Consistency with other classification systems will allow agencies involved in resource management in the area to interpret the data easily. It will also allow for consistent interpretation of the data in terms of regional landscape ecology.

The classification system for the Yale Project was used to describe the dominant vegetation in the study area (Table 2.2-1). The system incorporates priority habitats and habitats critical for TES species. Classification of wetlands follows that used by the U.S. Fish and Wildlife Service (USFWS) for the NWI (Cowardin et al. 1979), and includes information on wetland values consistent with PacifiCorp's 1994 wetland inventory (Dueker and Paz 1995). Cover types within the transmission line ROW were described using the same classification as adjacent lands. The classification of upland conifer forest types incorporated dominant size class and successional stage.

Table 2.2-1. Preliminary classification system for the Yale Project.

Major Type	Cover Type
Upland Types	Lodgepole Pine Forest Old-Growth Conifer Forest Mature Conifer Forest Mid-Successional Conifer Forest Pole Conifer Forest Seedling/Sapling Conifer Forest Upland Mixed Conifer/Deciduous Forest Riparian Mixed Conifer/Deciduous Forest Upland Deciduous Forest Riparian Deciduous Forest Shrubland Meadow/Grassland Rock Talus Rock Outcropping
Wetland/Deepwater Types	Riverine Unconsolidated Bottom (open water) Riverine Unconsolidated Shore (gravel bars) Lacustrine Unconsolidated Bottom (lake-limnetic zone) Lacustrine Unconsolidated Shoreline (lake-littoral zone) Palustrine Unconsolidated Bottom (pond-open water) Palustrine Emergent Wetland Palustrine Scrub-Shrub Wetland Palustrine Forested Wetland
Disturbed/Modified Types	Transmission Line ROW Recreational Agriculture Developed Residential Disturbed

2.2.1.3 Develop Photo-Interpretation Key

To ensure that the study area cover types are delineated in a consistent manner, a photo-interpretation key was developed (Figure 2.2-1). This key assisted in identification of photographic signatures and vegetation characteristics for each cover type in the study area.

2.2.1.4 Compile Existing Mapping

Developing a cover type map for the study area required compiling the existing GIS coverage's onto 1 base map. The existing GIS information that covered portions of the study area included the: (1) Merwin forest inventory mapping; (2) Yale forest inventory mapping (Hildreth 1995); and (3) Yale wetlands mapping (Dueker and Paz 1995). Since the Yale and Merwin forest inventories did not overlap, they were combined to create a new map coverage within the study area. Data from the 1994 wetland inventory were then added to this map, taking priority over the forest inventory data where they overlapped.

2.2.1.5 Interpret and Field Verify Cover Types

Photo-interpretation of the study area cover types was conducted in 4 steps. The first step focused on PacifiCorp's property and involved assigning specific cover types to the timber type polygons already in the GIS from the forest inventory. The second step was photo-interpretation of lands within PacifiCorp's digital orthophoto coverage that had not previously been mapped. The third step was photo-interpretation of lands outside of PacifiCorp's digital orthophoto coverage. The fourth step, field verification of the cover typing, was conducted upon completion of the previous steps. Each of these steps is described below.

In all cases the minimum mapping unit for most of the upland types was 1 acre. The more unique types were delineated as small as possible (approximately 0.1 acre). Roads, project facilities, and other planimetric features were not delineated during the cover type mapping. Instead, the ARC/INFO files were combined during the GIS processing step to produce a complete coverage of vegetation cover types.

<u>Step 1 - PacifiCorp Property</u>

The first step involved overlaying a map of the timber type and wetland polygons from the 1994 inventories (Hildreth 1995; Dueker and Paz 1995) with the digital orthophoto that covered much of the study area. Cover type boundaries were determined by evaluating the existing polygons and the 1:7,920 color aerial photos (1995). The timber type boundaries were modified as necessary to accurately reflect the cover type classification system (Figure 2.2-1). The timber inventory coding was then translated to match the cover type classification for the study area. Due to the larger minimum mapping unit used for the timber inventory mapping, many of the timber type polygons were divided into smaller cover type polygons. The wetland boundaries were not modified but were reviewed for consistency with the classification scheme.

Classification Description		Cover Type Code
1a. Site characterized by upland vegetation types.	Upland	go to 2
2a. Greater than 10% forested canopy coverage.	Forested	go to 3
3a. Greater than 70% of canopy coverage is composed of conifer.	Conifer Forest	go to 4
4a. Site composed of Lodgepole Pine on lava flow.	Lodgepole Pine Lava Beds	**LP**
4b. Site is not on lava flow; canopy composed of conifer species.	Mixed Species Conifer Forest	go to 5
5a. Avg. stand diameter > 26" dbh. Stands forming a multi-layered canopy with occasional small openings. Greater than 4 snags/acre > 20" dbh. Greater horizontal and vertical canopy structure than is generally found in mature conifer stands.	Old-Growth Conifer Forest	**OG**
5b. Avg. stand diameter 21" - 26" dbh. Only 1 canopy layer present with trees > 30 feet tall. Canopy structure has a uniform vertical and horizontal texture.	Mature Conifer Forest	**M**
5c. Avg. stand diameter 16" - 20" dbh. Even-aged stands with relatively uniform stand structure.	Mid-Successional Conifer Forest	**MS**
5d. Avg. stand diameter 8" - 15" dbh. Even-aged stands with relatively uniform stand structure.	Pole Conifer Forest	**P**
5e. Avg. stand diameter < 8" dbh. Recent clearcuts.	Seedling/Sapling Conifer Forest	**SS**
3b. Greater than 30% and less than 70% conifer or deciduous forest.	Mixed Conifer/Deciduous Forest	go to 6
6a. Mixed forest located greater than 200 feet from a designated stream course or wetland.	Upland Mixed Conifer/Deciduous Forest	**UM**
6b. Mixed forest located less than 200 feet from a designated stream course or wetland.	Riparian Mixed Conifer/Deciduous Forest	**RM**
3c. Greater than 70% deciduous canopy coverage.	Deciduous Forest	go to 7
7a. Deciduous forest located greater than 200 feet from a designated stream course or wetland.	Upland Deciduous Forest	**UD**
7b. Deciduous forest located less than 200 feet from a designated stream course or wetland.	Riparian Deciduous Forest	**RD**
2b. Less than 10% forested canopy coverage.	Non-Forested	go to 8
8a. Ground area is comprised of > 30% vegetation cover.	Vegetated	go to 9
9a. Ground cover consists of greater than 50% shrub species.	Shrubland	**SH**
9b. Ground cover consists of greater than 50% grass species.	Dry Meadow/Grassland	**MD**
8b. Ground area is comprised of >70% exposed rock.	Non-Vegetated	go to 10
10a. Ground area consists of rock rubble.	Rock Talus	**RT**
10b. Ground area consists of solid rock cliffs and slopes.	Rock Outcropping	**RO**

Figure 2.2-1. Yale Hydroelectric Project cover type classification key.

Classification Description		Cover Type Code
10c. Area is exposed bare ground due to natural disturbance events.	Unvegetated	**UV**
1b. Site characterized by open water or wetland vegetation, soils, and hydrology.	Wetland/Deepwater	go to 11
11a. Habitat within a channel that contains moving water.	Riverine	go to 12
12a. Riverine habitat with unconsolidated substrate and < 30% vegetative cover.	Unconsolidated Bottom (open water)	**RUB**
12b. Riverine habitat intermittently flooded or exposed with unconsolidated substrate and < 30% vegetative cover, except pioneering plants.	Unconsolidated Shore (gravel bars)	**RUS**
11b. Habitat within a topographic depression exceeding 20 acres is size with less than 30% areal cover of trees, shrubs, and emergent vegetation.	Lacustrine	go to 13
13a. Lacustrine habitat with unconsolidated substrate and < 30% vegetative cover.	Unconsolidated Bottom (lake-limnetic zone)	**LUB**
13b. Lacustrine habitat intermittently flooded or exposed with unconsolidated substrate and < 30% vegetative cover, except pioneering plants.	Unconsolidated Shore (lake-littoral zone)	**LUS**
12c. Habitat within a topographic depression less than 20 acres in size, dominated by trees, shrubs, and emergent vegetation.	Palustrine	go to 14
14a. Palustrine habitat with unconsolidated substrate and < 30% vegetative cover.	Unconsolidated Bottom (pond-open water)	**PUB**
14b. Palustrine habitat with rooted herbaceous hydrophytes present throughout most of the growing season.	Emergent Wetland	**PEM**
14c. Palustrine habitat dominated by woody vegetation, shrubs and stunted trees, less than 20 feet tall.	Scrub-Shrub Wetland	**PSS**
14d. Palustrine habitat dominated by woody vegetation greater than 20 feet tall.	Forested Wetland	**PFO**
1c. Site characterized by human disturbance, development, or modification.	Disturbed/Modified	go to 15
15a. Area is within the cleared transmission line right-of-way corridor. Type code is used as a modifier to other cover type categories.	Transmission Line ROW	**ROW**
15b. Area is within a the boundary of a designated recreation facility.	Recreational	**REC**
15c. Area is annually seeded or planted and harvested for commercial agricultural use.	Agriculture	**AG**
15d. Area is developed with commercial buildings and/or facilities.	Developed	**DV**
15e. Area is developed with residential houses.	Residential	**RES**
15f. Area is exposed bare ground due to human caused activities or contains non-native invasive shrub species.	Disturbed	**DI**

Figure 2.2-1. Yale Hydroelectric Project cover type classification key (continued).

Step 2 - Other Lands Within the Digital Orthophoto Coverage

The PacifiCorp forest inventory mapping was used as a photo-interpretive aid to classify other lands within the study area. Because the forest inventory maps had been previously field verified, they could be used as reference types while conducting mapping on adjacent lands. Vegetation cover types were delineated directly on the 1:7,920 scale natural color aerial photos using a wax photo pencil. Photo-interpretation was conducted using a stereoscope on a light table to enhance the clarity of the aerial photos. Cover types were delineated within the effective area of the photos to provide for efficient transfer to the orthophotos. During mapping, cover types on adjacent land were edge matched on the orthophoto to ensure consistency.

Step 3 - Lands Outside the Digital Orthophoto Coverage

Once the cover types were delineated within PacifiCorp's digital orthophoto coverage, a revised map was produced at a 1:12,000 scale. This scale matched the DNR orthophotos that covered the remaining portion of the study area. The area remaining to be mapped at this point consisted primarily of the transmission line portion of the study area. Vegetation cover types were delineated directly on the 1:7,920 scale natural color aerial photos using a wax photo pencil. Photo-interpretation was conducted with the aid of a stereoscope and light table to enhance the clarity of the aerial photos. Information from PacifiCorp's resource mapping was used as an aid in classifying cover types on lands outside of PacifiCorp's ownership. Cover types were delineated within the effective area of the photos to provide for efficient transfer to the orthophotos. Mapping was edge matched as it was transferred to the DNR orthophotos.

Step 4 - Field Verification

All cover type mapping was field verified by biologists during the last week of October 1996 to ensure accuracy. Field verification concentrated on identifying the separation between cover types that were closely associated with each other, and on types of features that might not easily be interpreted on the aerial photos. Cover type polygons that were changed during field verification were marked on the aerial photos with a different color wax pencil than the one used during photo-interpretation. The cover type maps were then updated to reflect changes identified during field verification.

2.2.1.6 Compile Data on Orthophotos

To produce an accurate, geographically correct map, the cover type polygons on the aerial photos were transferred to overlays on PacifiCorp's digital orthophotos and the DNR orthophotos to complete the mapping of the study area. The polygons on the DNR orthophotos were edge matched with the polygons on the PacifiCorp digital orthophotos.

2.2.1.7 Produce Cover Type Map and Report

Producing a cover type map of the study area involved the following 3 steps: (1) digitizing the cover type polygons from the orthophoto overlays into the GIS; (2) plotting and comparing check maps against the typed aerial photos to check for errors; and (3) producing a geographical database, map, and acreage summary for the study area.

2.2.2 Vegetation Cover Type Characterization

Information on vegetation characteristics of each of the cover types in the study area was obtained from 3 sources-existing data in PacifiCorp's wetlands (Dueker and Paz 1995) and timber inventories (Hildreth 1995), and a field sampling program. PacifiCorp's timber and wetlands inventories were used as sources of information for forested and wetland/riparian cover types, respectively. The vegetation field sampling program was used to obtain data on snags and on the canopy cover and height of the shrub and herbaceous layers in all upland cover types. Methods used for the timber inventory and wetlands assessment are summarized from Dueker and Paz (1995) and Hildreth (1995) in the following 2 sections; Section 2.2.2.3 presents the methods used in the field sampling program.

2.2.2.1 Wetlands Inventory

PacifiCorp's wetland inventory involved detailed mapping of each of the 14 wetlands and wetland/riparian complexes that occur in the study area. For each of these wetlands, information was recorded on plant species composition, wetland type, value (based on the Washington State Department of Ecology [WDOE] rating system), water sources, water depth, and the amount of open water to vegetated wetland.

2.2.2.2 Timber Inventory

PacifiCorp's timber inventory was intended to provide the data necessary for development of a Forest Management Plan for the Yale Project lands. The sample design was expected to estimate board feet within a standard error of 10 to 15 percent (Hildreth 1995). Sample plots were 0.9 acre (200 x 200 feet) and were selected randomly using a standard grid. The number of plots sampled for each forest type was based on the acreage of that type in PacifiCorp ownership (Table 2.2-2). Tree canopy closure was measured in each plot using a mirror densimeter; readings were recorded for each cardinal direction. Standard timber cruising techniques were used to collect species-specific data on tree height, density, and diameter at breast height (dbh), as well as on a number of other parameters.

2.2.2.3 Vegetation Field Sampling Program

The field sampling program was designed to collect data on vegetation in upland cover types that were not provided by PacifiCorp's forest inventory. It was therefore focused on nonforested cover types and on the shrub and herbaceous layers in forested types. The vegetation field sampling program was conducted in the 31 upland survey plots established for the seasonal surveys (see Section 4.2.2); between 1 and 6 plots were sampled in each of the 10 upland cover types (Table 2.2-2). Each of the survey plots were circular, 2.5 acres in size, and randomly located within the cover type.

Table 2.2-2. Number and location of survey plots by cover type.

Cover Type	Percent of Study Area[1]	No. of Timber Inventory Plots/Trees[2]	No. of Field Program Sample Plots[3]
Old-growth conifer forest	<1	9/66	3
Mature conifer forest	5	24/133	2
Mid-successional conifer forest	12	101/487	4
Pole conifer	8	29/102	3
Mixed conifer/deciduous forest	9	40/273	3
Upland deciduous forest	24	136/465	6
Lodgepole pine[4]	1		3
Seedling/sapling conifer[4]	8		3
Shrubland[4]	1		3
Meadow[4]	1		1

[1] The reservoir, river, disturbed, wetland, and rock talus cover types account for the remaining 30 percent of the study area.

[2] Number of plots/trees sampled during timber resource inventory (Hildreth 1995).

[3] See Section 4.2.2 for additional information on site selection and location.

[4] Cover types that do not support commercial timber were not sampled as part of the timber inventory.

At each plot, a 330-foot transect was established by selecting a random direction through the plot center. The canopy cover of shrubs and tall forbs was measured along the transect using the line intercept method (Bonham 1989) and was recorded by species. Canopy cover of low forbs, grass, woody debris, and bare ground was estimated every 16.5 feet along the transect using a plot frame 1.1 sq. feet (1.6 x 0.6 feet) in size (Bonham 1989); a total of 20 measurements per plot were recorded. Heights of the shrub, tall forb, and low forb closest to the transect were recorded every 16.5 feet (20 total measurements each). Snags were measured using a diameter tape. In plots with few snags all were measured; in plots with apparent high numbers, snags within 16.5 feet of either side of the transect (330 x 32-foot belt transect) were measured.

Vegetation sampling occurred primarily between May 19 and June 27, 1997; 2 plots were sampled in July 1997. Data were entered into a database using the Excel software package. Excel was used to calculate standard summary statistics. For the analysis of canopy cover, each species measured was assigned to 1 of 4 layers that corresponded to the height classes observed in most of the survey plots-tall shrub, low shrub, tall forb, and low forb. The tall shrub layer consisted of woody species that are typically at least 6 feet in height at maturity and may grow to 20 feet or more; examples are vine maple (*Acer circinatum*), cascara (*Rhamnus purshiana*), and hazelnut (*Corylus cornuta*). Low shrubs are woody species that tend to be less than 6 feet tall at maturity, such as salal (*Gaultheria shallon*), Oregon grape (*Berberis nervosa*), and kinikinik (*Arctostaphylos uva-ursi*). The tall forb layer includes herbaceous species that are generally more than 1 foot in height; examples are sword-fern *(Polystichum munitum)*, bracken fern (*Pteridium aquilinum*), and stinging nettle (*Urtica dioica*). Low forbs are herbaceous species that are usually less than 1 foot tall at maturity; this layer includes inside-out-flower (*Vancouveria hexandra*), vanillaleaf (*Achlys triphylla*), montia (*Montia* spp.), and trailing blackberry (*Rubus ursinus*). Canopy cover was calculated for each of these 4 layers. Because heights of the low shrub and tall forb category typically overlap, heights were calculated for 3 layers-tall shrub, low shrub/tall forb, and low forb.

2.3 RESULTS AND DISCUSSION

A total of 28 cover types, including 14 upland, 8 deep water/wetland, and 6 disturbed/modified types, were identified in the 16,074-acre Yale Project study area (Table 2.3-1, Figure 2.3-1). These types are briefly described below using the information provided by PacifiCorp's wetland and forest inventories (Dueker and Paz 1995; Hildreth 1995) and the vegetation field sampling program. Summary statistics for the vegetation parameters measured in the field are provided in Appendix 2.3-1. Parcels owned by PacifiCorp are presented as Merwin and proposed Yale Wildlife Habitat Management Lands in Figure 8.1-3 of the Draft License Application (PacifiCorp 1998).

2.3.1 Uplands

Uplands, exclusive of the transmission line ROW, represent 11,187 acres or 70 percent of the study area and are primarily forested (Table 2.3-1, Figure 2.3-1). Forests include both conifer and deciduous cover types. Non-forested upland cover types include shrublands, meadow/grasslands, rock talus, and rock outcroppings. Vegetation on the transmission line ROWs is modified by periodic maintenance activities and is discussed with the disturbed types in Section 2.3.4. The structure and composition of each of the upland cover types is briefly described in the following subsections.

2.3.1.1 Conifer Forest Cover Types

Conifer forests occupy 5,422 acres or 34 percent of the study area (Table 2.3-1, Figure 2.3-1). The conifer forest types were defined primarily by successional stage ranging in age and stand structure from recent clearcuts to even-aged/sized pole stands to mixed canopy old-growth forest. An additional type was added to account for a lodgepole pine community that is unique to the lava flow area (Figure 2.3-1). The variety of successional stages that are present are predominantly a result of the forest management policies and practices of the various landowners in the basin, and to a lesser extent on the fire and geological history of the basin.

Douglas-fir *(Psuedotsuga menziesii)* is the dominant species in the various conifer forest cover types throughout the study area; most conifer stands also have a small percentage of western hemlock *(Tsuga heterophylla)* and western red cedar *(Thuja plicata)*, especially in the mid- to lower elevations of the basin. Mixed lodgepole pine *(Pinus contorta)* and Douglas-fir forest occur on the drier lava flows in the northern portion of the study area. A sword-fern plant community is the dominant understory within many of the conifer types (excluding the lodgepole stands). Understory vegetation also includes a variety of shrubs and forbs, such as vine maple, Oregon grape, salal, trailing blackberry, and

Table 2.3-1. Cover type acres for the Yale Project study area.

Cover Types	Acreage in Study Area	Percent of Study Area
UPLANDS		
Conifer Forest		
Lodgepole Pine	180.1	1.1
Old-Growth	103.0	0.6
Mature	726.4	4.5
Mid-Successional	1,966.6	12.2
Pole	1,204.6	7.5
Seedling/Sapling	1,240.9	7.7
Conifer Forest Subtotal	5,421.6	33.7
Mixed Conifer/Deciduous Forest		
Upland Mixed Conifer/Deciduous	1,291.5	8.0
Riparian Mixed Conifer/Deciduous	120.0	0.7
Mixed Conifer/Deciduous Forest Subtotal	1,411.5	8.8
Deciduous Forest		
Upland Deciduous	3,880.2	24.1
Riparian Deciduous	120.8	0.8
Deciduous Forest Subtotal	4,001.0	24.9
Non-forested Areas		
Shrubland	131.2	0.8
Meadow/Grassland	204.8	1.3
Rock Talus	5.2	0.0
Rock Outcropping	11.8	0.1
Non-forested Areas Subtotal	353.0	2.2
UPLANDS TOTAL	11,187.1	69.6
DEEP WATER AND WETLAND TYPES		
Deep Water Types		
Riverine Unconsolidated Bottom	27.1	0.2
Riverine Unconsolidated Shore	9.2	0.1
Lacustrine Unconsolidated Bottom	3,842.2	23.9
Lacustrine Unconsolidated Shore	1.0	0.0
Deep Water Subtotal	3,879.5	24.1
Wetlands		
Palustrine Emergent	20.2	0.1
Palustrine Scrub-Shrub	70.1	0.4
Palustrine Forested	32.7	0.2
Palustrine Unconsolidated Bottom	34.0	0.2
Wetlands Subtotal	157.0	1.0
DEEP WATER AND WETLANDS TOTAL	4,036.5	25.1
DEVELOPED/DISTURBED AREAS		
Transmission Line Right-of-Way	229.5	1.4
Recreation	68.9	0.4
Agriculture	66.5	0.4
Developed	218.2	1.4
Residential	210.4	1.3
Disturbed	56.8	0.4
DEVELOPED/DISTURBED AREAS TOTAL	850.3	5.3
STUDY AREA TOTAL	16,073.9	100.0

redwood sorrel *(Oxalis oregana)*. Understory composition is dependent upon the successional stage and canopy density of the overstory. The following sections briefly describe each of the 6 conifer cover types.

Lodgepole Pine

Lodgepole pine is more typical of drier climates east of the Cascade crest and therefore represents the most unusual forest type in the study area. This type covers 180 acres or 1 percent of the study area and is restricted to the lava flow north of the upper end of the reservoir (Table 2.3-1, Figure 2.3-1). Overstory vegetation within this type consists of lodgepole pine and Douglas-fir, with a canopy closure of approximately 59 percent (Table 2.3-2). A thick layer of moss and lichen covers over 90 percent of the lava surface; low herbaceous vegetation is sparse, covering only about 4 percent of the ground (Tables 2.3-3). Shrub cover in the lodgepole pine type is lower than most other conifer types, averaging 40 percent for tall and low species layers combined, and dominated by bristly manzanita (*Arctostaphylos columbian*) (Table 2.3-4). Manzanita, kinikinik, and prostrate ceanothus (*Ceanothus prostratus*) occur on the lava flow but nowhere else in the study area.

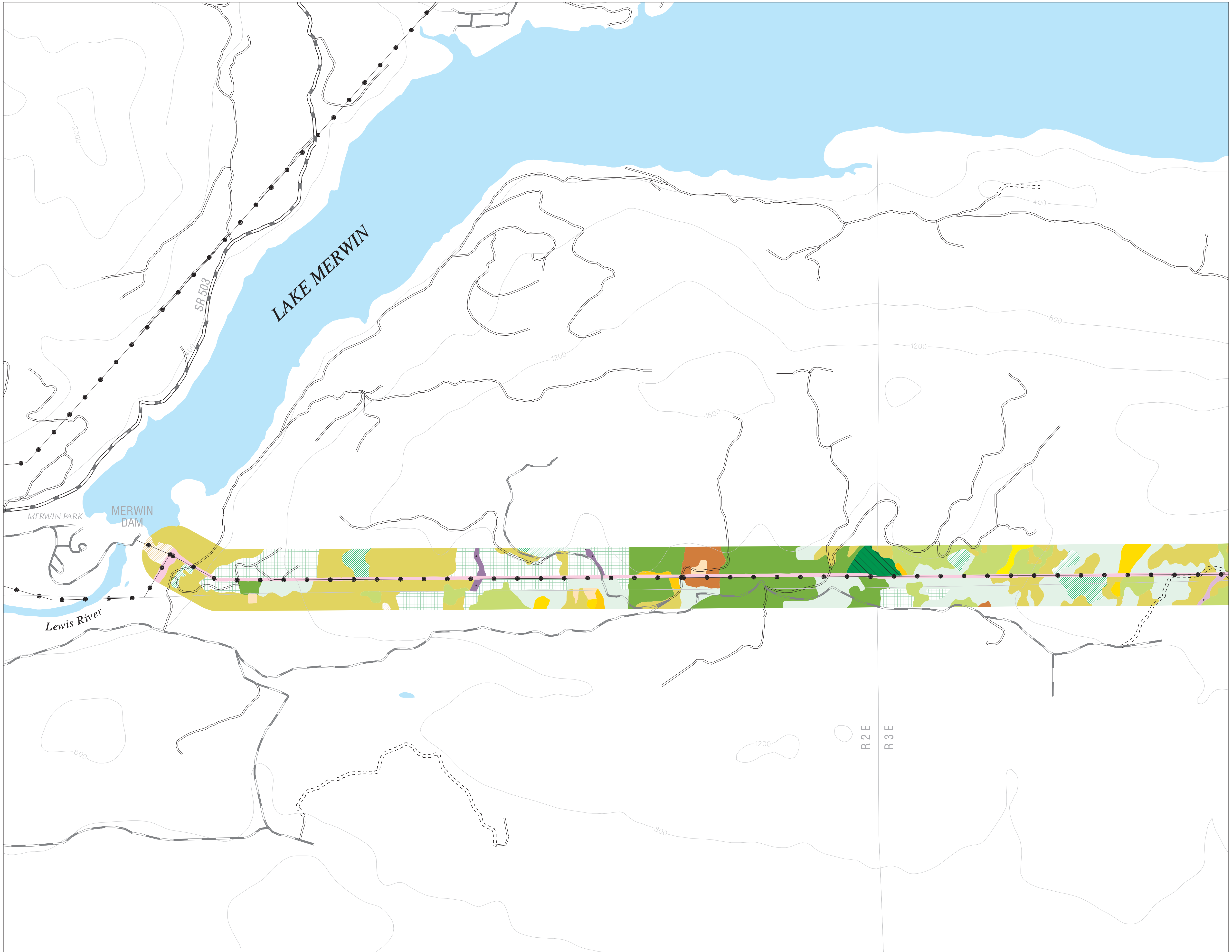
Old-Growth and Mature Conifer

The WDFW Priority Habitats and Species (PHS) Program defines old-growth west of the Cascade crest as stands with the following characteristics:

- at least 2 tree species, forming a multi-layered canopy with occasional small openings;
- at least 8 trees/acre >32 inches dbh or >200 years of age;
- >4 snags/acre over 20 inches diameter and 15 feet tall; and
- numerous downed logs, including 4 logs/acre >24 inches (http://www.wa.gov/wdfw/hab/phshabs.htm, 5 February 1999).

For the purpose of this study, we classified areas as old-growth if they had at least some of the characteristics listed above.

Old-growth conifer covers 103 acres or less than 1 percent of the study area (Table 2.3-1, Figure 2.3-1). All of the old-growth conifer in the study area occurs in 7 patches-1 just south of Siouxon Creek, 1 at the upstream end of Yale Lake, 1 east of the IP Road, 1 in the transmission line ROW east of Merwin Dam, and 3 north of the transmission line in the northeast portion of the study area (Figure 2.3-1). These old-growth conifer stands generally had 3 tree canopy layers-an overstory composed of large Douglas-fir (27.9-inch mean dbh), and 2 understory layers that consisted of smaller western hemlock, and big-leaf maple (*Acer macrophyllum*) (Table 2.3-2). Most stands were also characterized by high densities (mean 35/acre) of large snags (20.1-inch mean dbh). Cover of downed woody debris was relatively low (12 percent) and was similar to that found in younger conifer stands in the study area (Table 2.3-3). Mean tree canopy closure (85 percent), height (109 feet), and dbh (21.4 inches), however, were greater in old-growth stands than



Legend

- Agriculture
- Residential
- Developed
- Disturbed
- Recreation
- Transmission Line Right-Of-Way
- Rock Outcropping
- Rock Talus
- Old Growth Forest
- Mature Conifer Forest
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- Seedling/Sapling Conifer Forest
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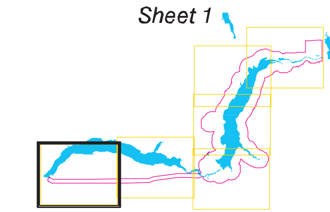
- Upland Deciduous Forest
- Upland Mixed Conifer/Deciduous Forest
- Riparian Deciduous Forest
- Riparian Mixed Conifer/Deciduous Forest
- Dry Meadow/Grassland
- Shrubland
- Palustrine Scrub-Shrub Wetland
- Palustrine Emergent Wetland
- Palustrine Forest Wetland
- Palustrine Unconsolidated Bottom
- Lacustrine Unconsolidated Shore
- Lacustrine Unconsolidated Bottom
- Riverine Unconsolidated Bottom
- Riverine Unconsolidated Shore
- Wildlife Observation Point

Cave locations were mapped from the WDFW PHS but are not shown

Sheet 1



NORTH

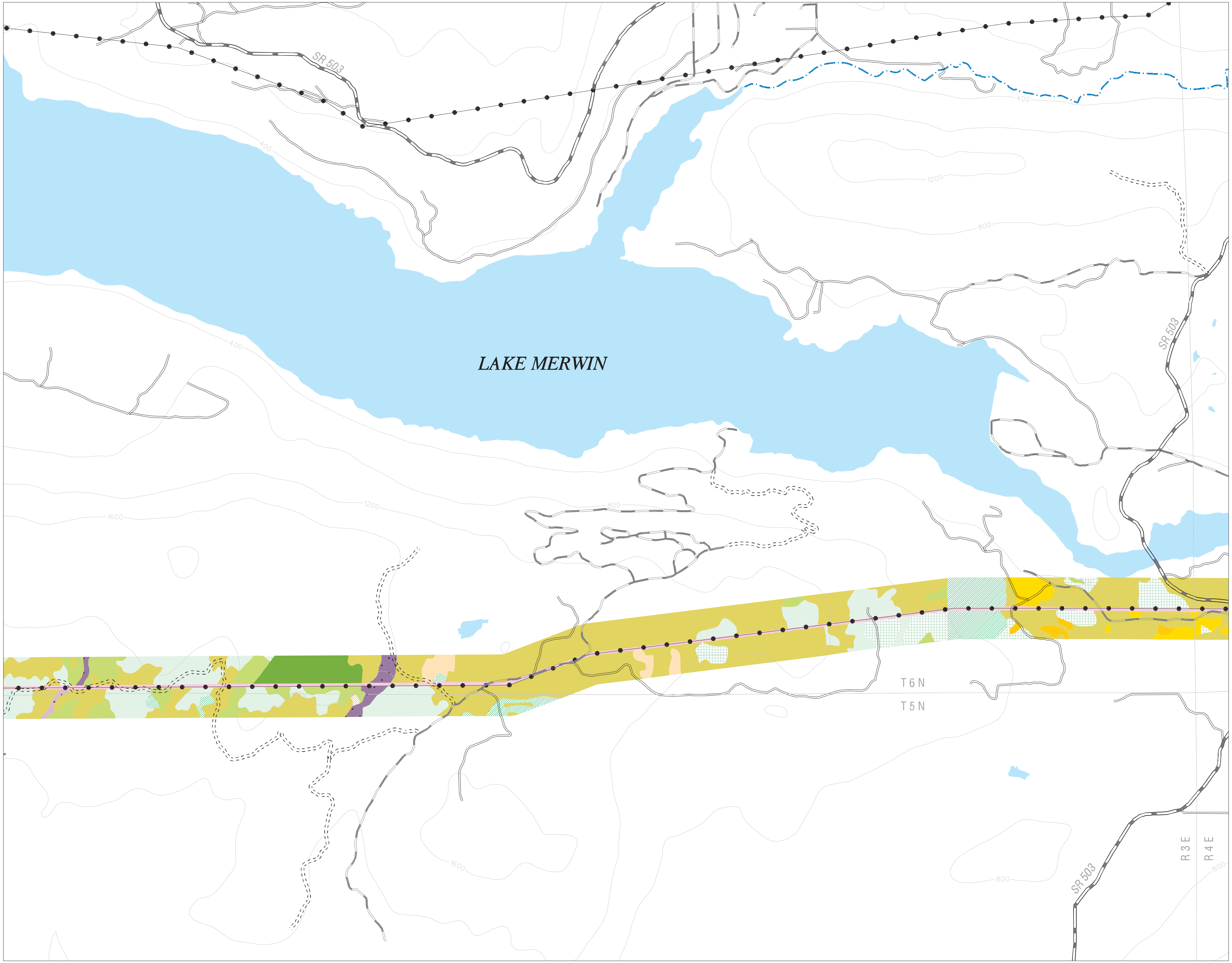
0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/veg.batchmap March 29, 1999



Legend

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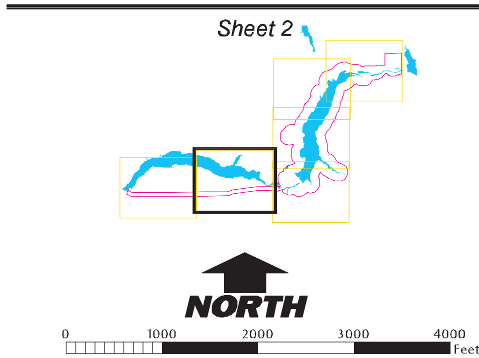

Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

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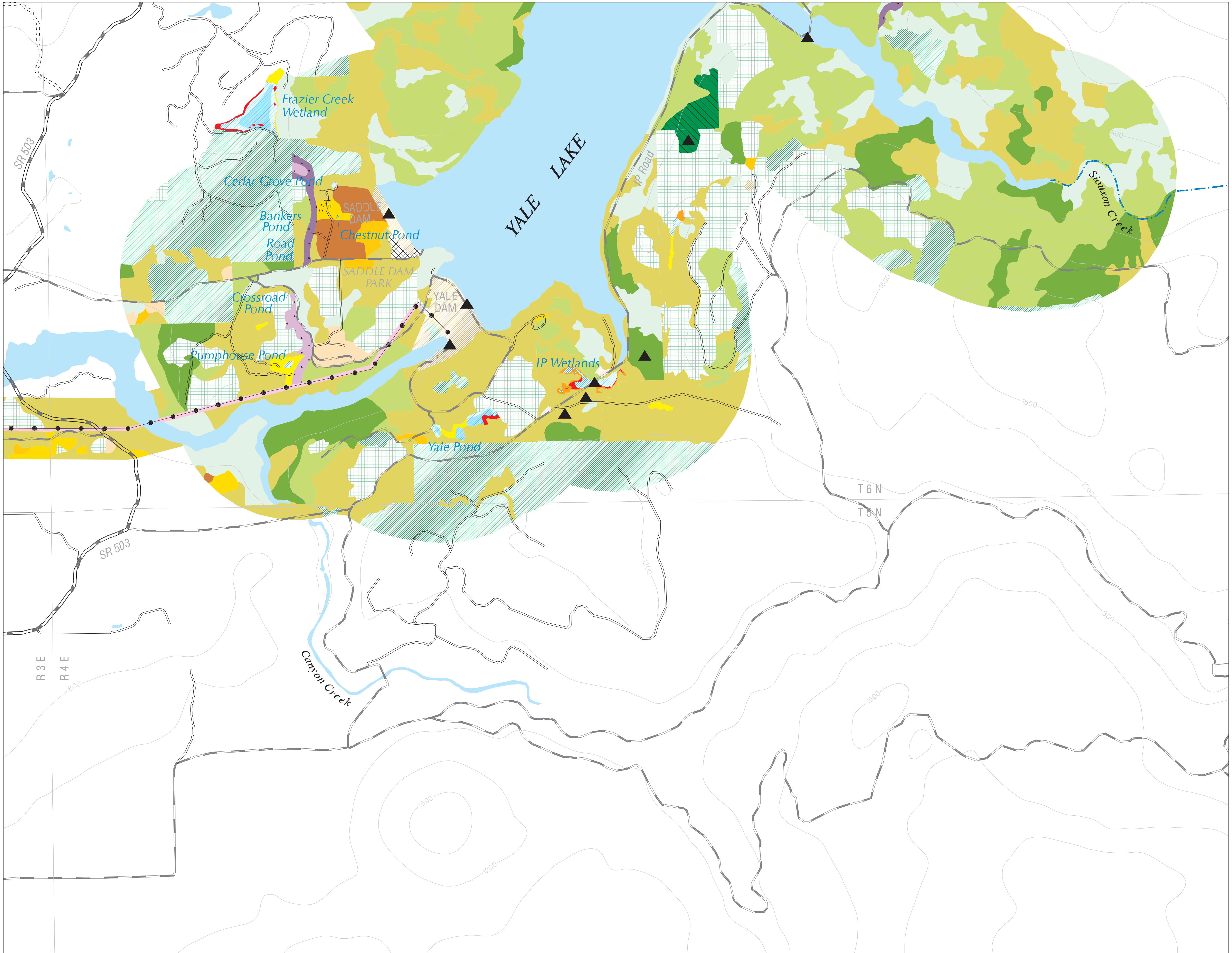
March 29, 1999



Legend

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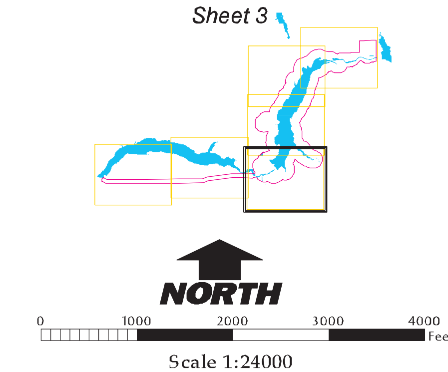

Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

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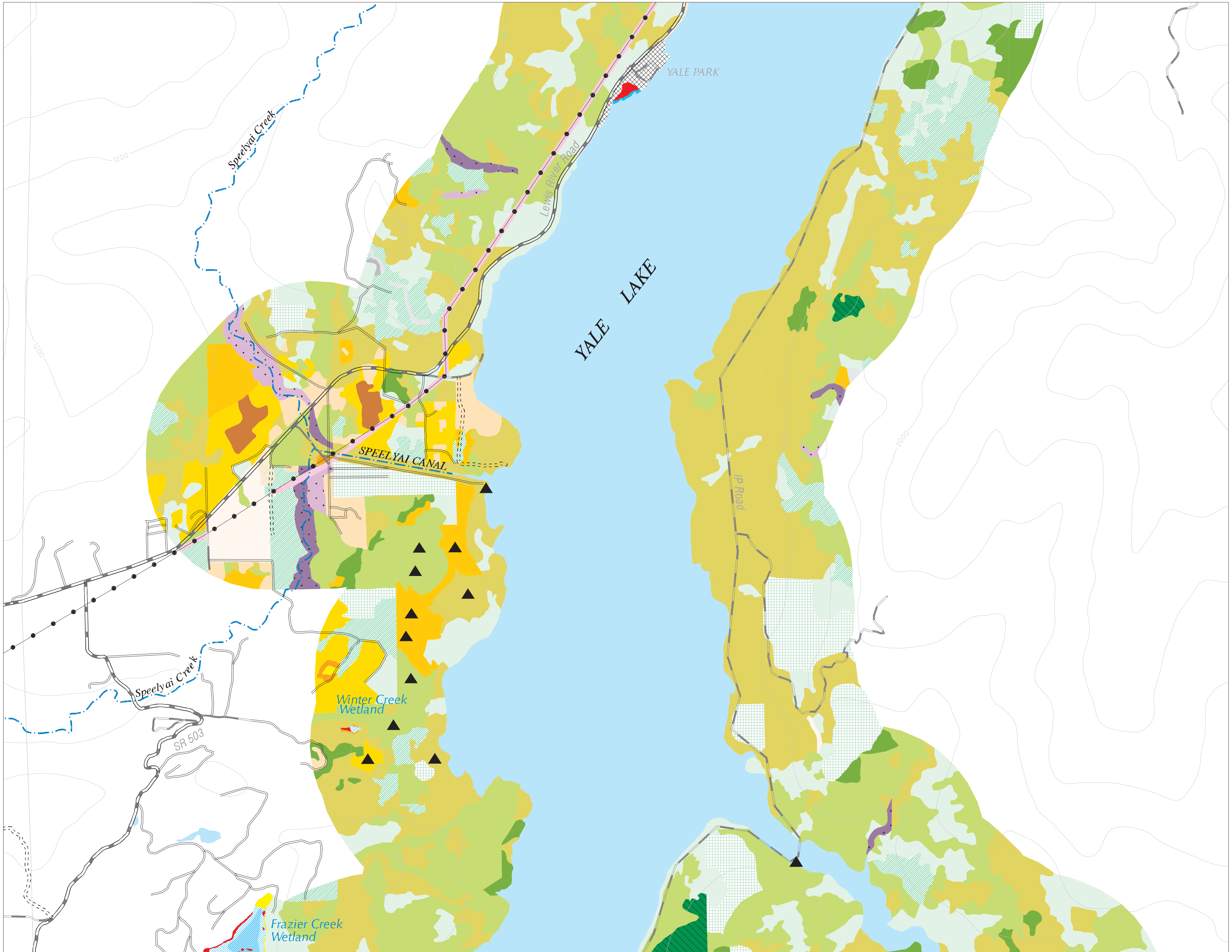

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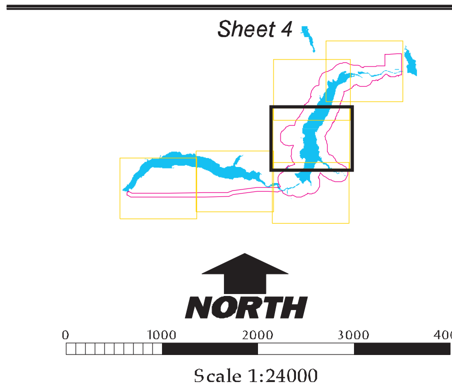

Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

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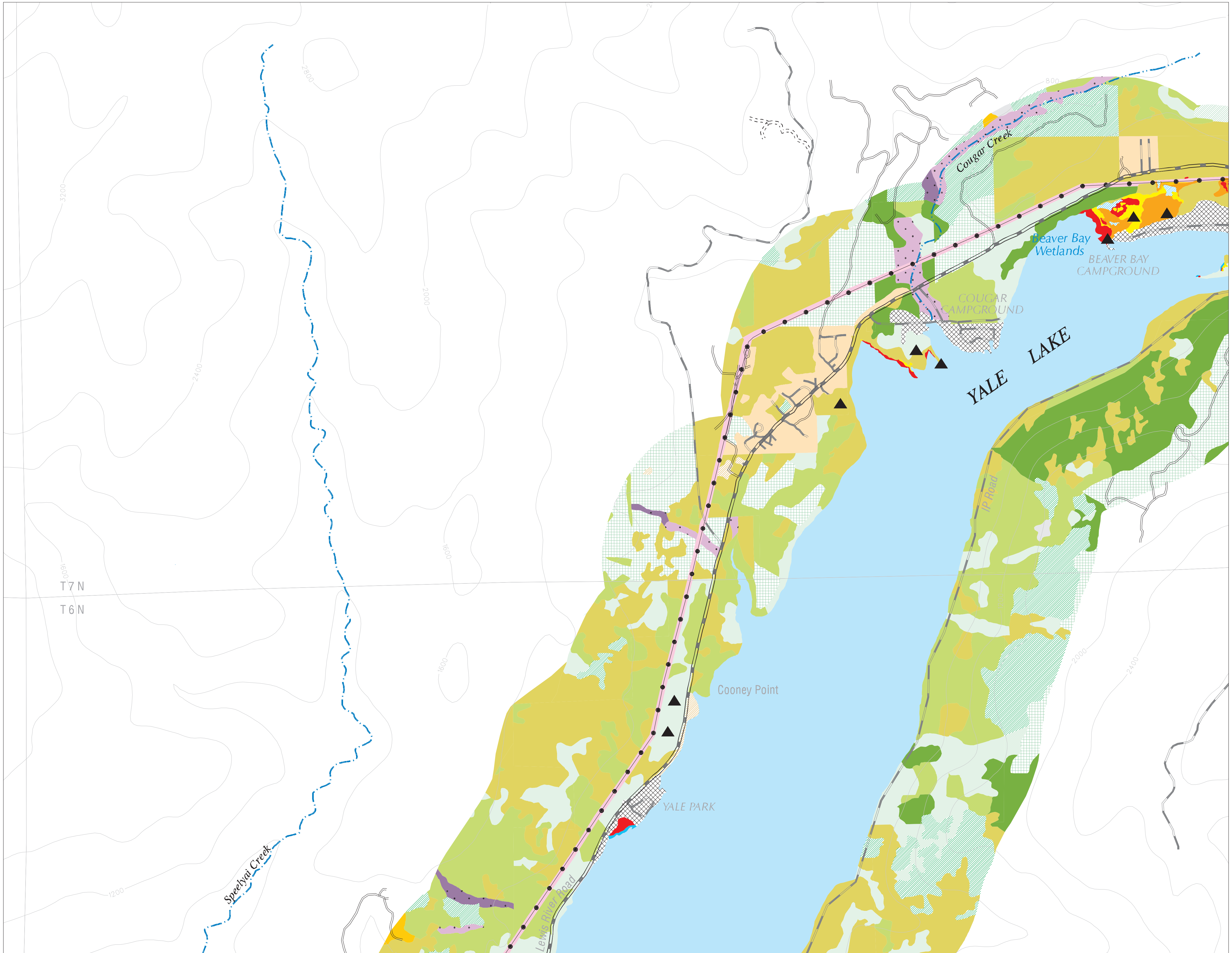

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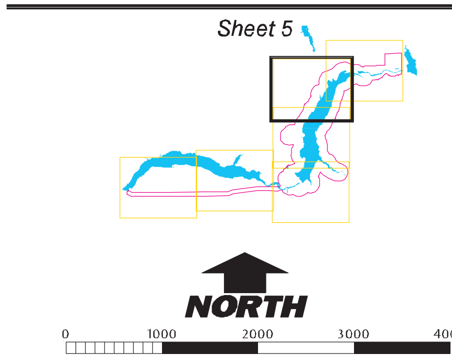

Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

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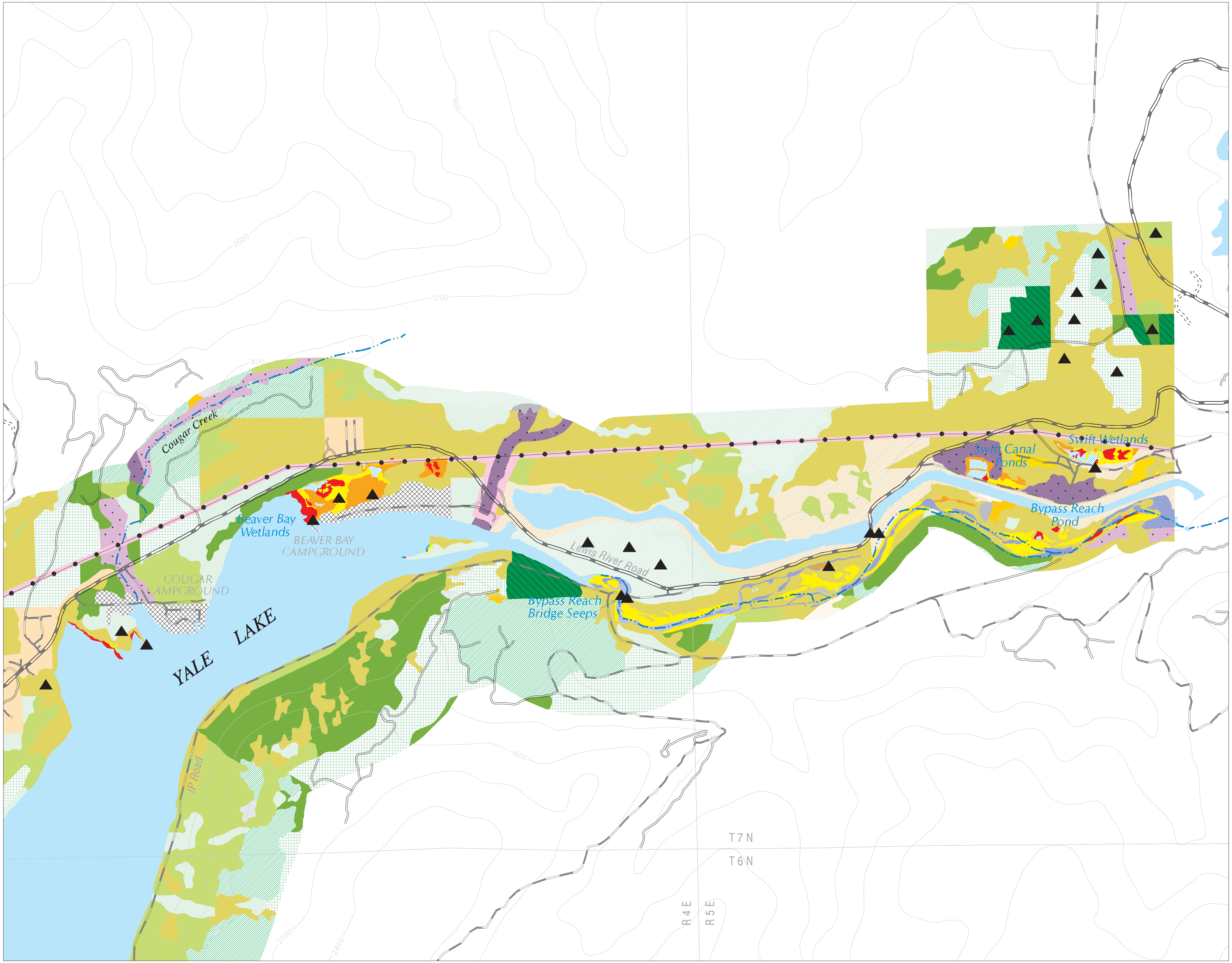

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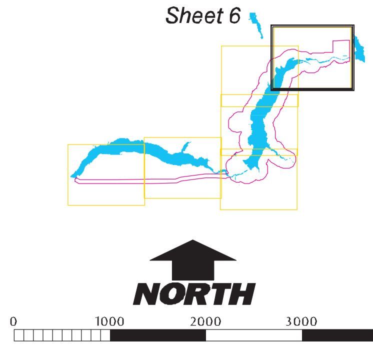


Yale Hydroelectric Project

Figure 2.3-1 Vegetation Cover Types and Wildlife Observation Points

 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/veg.batchmap March 29, 1999

Table 2.3-2. Tree layer attributes for forest cover types in the study area for the Yale Project[1].

Forest Cover Type	Tree Canopy Closure (%)	No. Trees/ Ac	Mean Tree Ht. (ft)	Overstory Tree Ht. (ft)	Mean Tree dbh (in)	No. Trees/ Ac>22 in dbh
Lodgepole Pine[2]	59	n/a	n/a	n/a	n/a	n/a
Old-Growth Conifer	85	101	109	158	21.4	33
Mature Conifer	69	107	71	127	17.4	21
Mid-Successional Conifer	76	121	90	102	16.9	20
Pole Conifer	79	195	69	77	12.3	7
Seedling/Sapling Conifer[3]	--	357	<20	<20	<6	0
Mixed Conifer/ Deciduous	57	138	76	98	15.4	18
Upland Deciduous[4]	>75	185	64	87	12.0	6

[1] Summarized from Hildreth 1995; range and standard deviation were not reported for these attributes.

[2] Tree and canopy measurements for lodgepole pine stands were not included in the forest inventory; tree canopy closure was measured during the field sampling program.

[3] Canopy closure and dbh in the seedling/sapling conifer type were not measured as part of the forest inventory because all trees are <20 feet; seedling/sapling density and dbh were estimated during the field sampling program.

[4] Deciduous canopy closure was not measured as part of the forest inventory; however, canopy closure of deciduous trees during the summer is high and was estimated >75 percent in all sampled stands.

in any other successional stage; mean stem density was lower at 101 trees per acre (Table 2.3.2). Mean shrub cover was 54 percent, with nearly two-thirds of the canopy composed of vine maple. Unlike some of the earlier successional forest types in the study area, old growth did not support dense stands of sword-fern; mean canopy cover of this species was about 15 percent (Table 2.3.4).

Mature forest stands cover 726 acres and represent 5 percent of the study area. These stands were similar to old-growth stands in species composition, but lacked the uneven canopy structure. In addition, mean canopy closure (69 percent), overstory height (127 feet), and dbh (17.4 inches) were all about 20 percent less than these parameters in old-growth stands (Table 2.3-2). Stem and snag density, however, were higher-107 and 37 per acre, respectively (Table 2.3-3). Shrub cover was about 57 percent, similar to that of old-growth stands (54 percent), and was also dominated by vine maple. At 24 percent, mean canopy cover of sword-fern was higher than in old-growth stands (15 percent) (Table 2.3-4); low forb/grass cover was substantially lower (Table 2.3-3).

Mid-successional and Pole Conifer Types

Mid-successional conifer forest covers 1,967 acres or 12 percent of the study area and is the dominant conifer type within the study area. Pole conifer stands represent 1,205 acres or about 8 percent of the study area (Table 2.3-1, Figure 2.3-1). Both mid-successional and pole conifer forest stands had high tree canopy closure, 76 and 79 percent, respectively. Mean tree height (90 feet), overstory height (102 feet), and dbh (16.9 inches) were all about 25 percent greater in mid-successional forests than in pole stands (Table 2.3-2). However, stem densities in pole stands were considerably higher-195/acre vs. 121/acre-than in mid-successional forests. The pole stands were apparently undergoing natural thinning, as evidenced by moderately high numbers of small snags (10.5-inch mean dbh) and a substantial cover of woody debris (19 percent) compared to other forest types (Table 2.3-3). Shrub and tall forb cover in mid-successional stands was high, about 86 and 58 percent, respectively, and greater than in any other forest stand. Vine maple represents about 45 percent of the shrub cover; the tall forb layer was dominated by sword-fern. Shrub and tall forb cover in pole stands was much lower, 60 and 10 percent, respectively. Over 85 percent of the shrub layer consisted of vine maple; sword-fern cover was only 6 percent (Table 2.3-4).

Table 2.3-3. Summary of data on snags, woody debris, and low forb/grass layer for cover types in the study area for the Yale Project[1].

Forest Cover Type	Mean No. Snags/ Ac		Mean Snag dbh (in)	Mean Downed Woody Debris Cover (%)	Mean Low Forb/ Grass Canopy Cover[1] (%)	Mean Low Forb/ Grass Ht. (in)	Common Low Forb/ Grass Species
	Snags > 20 in dbh	All Snags					
Lodgepole Pine Forest[2]	0.5 (0-1.2)	8 (4-12)	9.1 (2.3-34.3)	<1	4 (1-8)	5.1 (2.0-17.0)	Dogbane Tr. blackberry
Old-Growth Conifer Forest	13.3 (0-32)	35 (24-52)	20.1 (4.3-57.5)	12 (2-26)	47 (8-73)	8.7 (2.0-24.0)	Vanillaleaf Inside-out fl.
Mature Conifer Forest	1.6 (1.2-2)	37 (6-68)	16.9 (3.1-43.3)	15 (12-19)	22 (7-37)	6.1 (1.6-17.0)	Twin flower Tr. blackberry
Mid-Successional Conifer Forest	0.4 (0-1.2)	9 (0-50)	13.4 (3.5-57.9)	14 (7-23)	19 (7-32)	5.4 (1.2-39.4)	Bedstraw Twinflower
Pole Conifer Forest	1.7 (0-4.4)	25 7-34	10.5 (2.0-56.3)	19 (14-26)	23 (2-34)	5.1 (0.8-31.5)	Star flower Inside-out fl.
Seedling/ Sapling Conifer Forest	0.3 (0-0.4)	7 (4-8)	26.4 (16.1-44.1)	10 (6-12)	58 (33-77)	8.7 (1.2-22.0)	Lettuce Tr. blackberry
Mixed Conifer/ Deciduous Forest	0	19 (16-24)	8.8 (3.9-13.8)	5 (3-9)	31 (21-40)	7.0 (2.0-24.8)	Tr. blackberry Bedstraw
Upland Deciduous Forest	0.3 (0-0.8)	3 (1-15)	10.2 (2.0-53.5)	4 (<1-8)	53 (36-80)	8.2 (2.0-26.8)	Montia spp. Vanillaleaf
Shrubland	0.1 (0-0.4)	0	--	6 (5-8)	15 (6-34)	5.6 (0.8-24.8)	Tr. blackberry Bedstraw
Meadow[3]	0	0	--	0	98.2	--	Canada thistle Sedge sp.

[1] Range is shown in parentheses; see Appendix 2.3-1 for other summary statistics.
[2] About 90 percent of the ground surface in lodgepole pine stands is covered by mosses and lichens.
[3] Only 1 meadow plot was measured; height of low forb/grass layer was not measured.

Table 2.3-4. Shrub and tall forb layer attributes for cover types in the study area for the Yale Project[1].

Forest Cover Type	Mean Tall Shrub Canopy Cover (%)	Mean Low Shrub Canopy Cover (%)	Mean Tall Forb Canopy Cover (%)	Dominant Shrub & Tall Forb Species & Mean Canopy Cover (%)	Mean Shrub Ht. (ft)	Mean Low Shrub/ Tall Forb Ht. (ft)
Lodgepole Pine Forest	31 (25-37)	9 (6-12)	1 (<1-1)	Bristly manzanita - 12 Salal - 6	5.2 (2.3-11.5)	0.9 (0.2-2.0)
Old-Growth Conifer Forest	41 (4-61)	13 (6-20)	15 (2-29)	Vine maple - 36 Sword-fern - 15	12.1 (1.3-26.2)	1.5 (0.1-3.7)
Mature Conifer Forest	49 (24-74)	8 (4-12)	29 (2-56)	Vine maple - 42 Sword-fern - 24	10.5 (3.3-29.5)	2.1 (0.4-3.2)
Mid-Successional Conifer Forest	77 (59-103)	9 (<1-32)	58 (41-76)	Vine maple - 39 Sword-fern - 40	11.1 (0.4-26.2)	2.2 (0.4-4.4)
Pole Conifer Forest	59 (50-70)	1 (0-2)	10 (4-18)	Vine maple - 51 Sword-fern - 6	11.0 (0.7-24.9)	1.1 (0.2-2.6)
Seedling/Sapling Conifer Forest	3 (1-6)	6 (0-16)	64 (56-69)	Oregon grape - 5 Bracken fern - 59	7.2 (0.5-17.4)	3.2 (0.4-7.5)
Mixed Conifer/ Deciduous Forest	58 (40-78)	18 (10-26)	52 (47-60)	Vine maple - 38 Sword-fern - 48	11.0 (1.3-30.5)	2.6 (0.4-4.2)
Upland Deciduous Forest	50 (5-92)	17 (<1-45)	36 (10-66)	Salmonberry - 19 Sword-fern - 27	9.5 (1.3-24.9)	2.7 (0.7--7.1)
Shrubland	105 (94-114)	17 (7-24)	41 (35-47)	Hazelnut - 46 Bracken fern - 22	13.7 (0.3-29.5)	1.9 (0.1-4.5)
Meadow[2]	6	1	5	Apple - 6 Bracken fern - 5	1.2 (1.1-1.5)	1.3 (0.6-1.9)

[1] Range is shown in parentheses; see Appendix 2.3-1 for other summary statistics.
[2] Only 1 meadow plot was sampled.

Seedling/Sapling Conifer Type

Seedling/sapling stands consist primarily of recent timber harvest areas and cover 1,241 acres or 8 percent of the study area. These areas were characterized by very high stem densities (357/acre) and were dominated by Douglas-fir that were generally less than 20 feet tall and 6 inches in diameter (Table 2.3-2). Snag density was low (6/acre) but the few remaining snags were large, with a mean diameter of 26.4 inches dbh (Table 2.3-3). Shrub canopy cover was lower than any other forest type-only 9 percent-but tall forb and low forb/grass cover was high, 64 and 58 percent, respectively. Mean height of the low shrub/tall forb layer (3.2 feet) was higher in seedling/sapling stands than in any other forest type, most likely the result of the dominance of bracken fern, which represented over 90 percent of the tall forb layer (Table 2.3-4).

2.3.1.2 Mixed Conifer/Deciduous Forest

There are 2 types of mixed conifer/deciduous forest stands present within the study area–an upland type (>200 feet from a stream or wetland) and a riparian type (<200 feet from a stream or wetland). Upland mixed forest stands cover 1,292 acres or 8 percent of the study area (Table 2.3-1, Figure 2.3-1). Riparian mixed forest stands cover 120 acres or 1 percent of the study area.

Mixed forest stands are characterized by an overstory of Douglas-fir and a second canopy layer of western hemlock, red alder *(Alnus rubra)*, and/or big-leaf maple. Overstory tree height, stem density, and number of trees >22 inches dbh were similar to mid-successional stands but mean tree height was lower (Table 2.3-2), likely reflecting the higher proportion of deciduous species. Snag density was moderate (19/acre) but consisted mostly of small (<14 inches dbh) alder and big-leaf maple (Table 2.3-3). Mean canopy closure of mixed forest stands was about 57 percent, lower than any other forest type (Table 2.3-2). The relatively open canopy was apparently conducive to dense shrub and forb layers. Mean shrub and tall forb cover in mixed stands was high-76 and 52 percent, respectively. Sword-fern represented over 90 percent of the tall forb layer and vine maple contributed over 60 percent of the shrub cover (Table 2.3-4).

The riparian mixed conifer/deciduous stands were not sampled because they represent a very small portion of the study area and because they typically occur in narrow strips that are difficult to sample effectively. These stands appeared to be similar to upland mixed conifer/deciduous forest but typically had a higher percentage of salmonberry (*Rubus spectabilis*) in the understory than upland stands.

2.3.1.3 Deciduous Forest

There are 2 types of deciduous forest within the study area, an upland type (>200 feet from a stream or wetland) and a riparian type (<200 feet from a stream or wetland). Upland deciduous forest stands represent 3,880 acres or 24 percent of the study area; riparian deciduous forest stands represent 121 acres or 1 percent of the study area (Table 2.3-1, Figure 2.3-1).

The overstory of upland deciduous forest stands are generally dominated by red alder but big-leaf maple also occurs. Black cottonwood *(Populus trichocarpa)* is present, but in small amounts and generally in stands along the reservoir or in riparian areas. Tree canopy closure and density were high (Table 2.3-2). In general, the understory in deciduous forest stands was very dense; mean cover of the tall shrub, low shrub, and tall forb layers combined was over 100 percent (Table 2.3-4). Species composition of these layers, however, was extremely variable depending on the slope and aspect of the sample plot. Stands sampled south of the reservoir were on north-facing slopes and were characterized by a dense tall shrub layer (>80 percent cover) dominated by salmonberry; tall forb cover was moderate (32 to 34 percent) and consisted primarily of sword-fern. The stands sampled along the north side of the reservoir were in areas that were relatively flat and dry. Shrub cover was moderate (42-46 percent), with Oregon grape dominant at 1 plot and hazelnut at the other; sword-fern cover at both plots was 41 percent. In contrast, the plot sampled in the northeast portion of the study area was characterized by a very high cover of vine maple (91 percent) but also supported a moderate low shrub layer dominated by Oregon grape (see Appendix 2.3-1 for data summaries for each plot). Low forb/grass cover in all stands sampled ranged from moderate to high (range 36-80 percent; Table 2.3-3), likely the result of the availability of more light, particularly in early spring.

Riparian deciduous stands were not sampled because they represent a very small portion of the study area and generally occur in very small parcels or strips that are difficult to sample effectively. These stands appeared to be most similar to the deciduous forest plots located on the north side of the reservoir and typically had a high percentage of salmonberry and stinging nettle in the understory.

2.3.2 Non-forested Cover Types

Non-forested cover types include shrubland, meadow/grassland, rock talus, and rock outcrops. Collectively these cover types occupy 353 acres or 2 percent of the study area. Nearly 60 percent of the non-forested land in the study area consists of meadows and open grasslands (Table 2.3-1, Figure 2.3-1). Most of these areas are associated with rural homes and agricultural sites. Shrublands represent an additional 38 percent of non-forested lands (Table 2.3-1, Figure 2.3-1). These areas are generally restricted to small openings within or adjacent to forested areas. Exposed rock outcrops and talus cover 12 acres and 5 acres, respectively, and are primarily located on slopes east of Yale Lake (Table 2.3-1, Figure 2.3-1).

2.3.2.1 Meadow

One meadow was included in the vegetation field sampling program. This area was dominated by low forbs and sedges with a cover of 98 percent; bracken fern contributed an additional 5 percent cover (Table 2.3-4). The only tree in the meadow was an old apple tree (*Pyrus* sp.); shrub cover was represented by a few snowberry (*Symphoricarpos albus*).

2.3.2.2 Shrubland

Shrublands in the study area were dominated by 3 species of tall shrub-hazelnut, cascara, and vine maple; mean canopy cover for each of these species is 46, 35, and 22 percent, respectively. Other species, such as rose (*Rosa* sp.), Indian plum (*Oemleria cerasiformis*), salal, and Oregon grape, provided an additional 20 percent shrub cover. Canopies of the various species often overlapped, resulting in a mean shrub cover that exceeded 100 percent (Table 2.3-4). Mean height of the tall shrub layer was nearly 14 feet but several individual shrubs were over 29 feet tall. The tall forb layer was moderate (>40 percent cover), and dominated by bracken fern and sword-fern. Cover by grasses and low forbs was sparse (15 percent; Table 2.3-3).

2.3.3 Deep Water and Wetlands

Deep water and wetland cover types include wetlands, lakes, rivers, and ponds in the study area. These cover types occupy a total of 4,037 acres or 25 percent of the study area and are described the following sections.

2.3.3.1 Deep Water Types

There are 4 deep water cover types in the study area, including riverine unconsolidated bottom and shore, and lacustrine unconsolidated bottom and shore. Collectively, these types cover 3,880 acres or 24 percent of the study area. Over 98 percent of the deep water acreage consists of the lacustrine unconsolidated bottom type which includes Yale Lake, a portion of Lake Merwin near the transmission line ROW, and the Swift No. 2 canal. The 36 acres of riverine habitat occurs in the Lewis River upstream of Yale Lake (the Swift bypass reach).

2.3.3.2 Wetlands

Wetlands represent 157 acres, or 1 percent of the study area. These wetlands were identified, mapped, and described in greater detail as part of the 1994 resource inventory on PacifiCorp lands (Dueker and Paz 1995) and have been incorporated into the cover type mapping. Wetland types in the study area include the following:

- Palustrine scrub-shrub - 70 acres
- Palustrine forested - 33 acres
- Palustrine emergent - 20 acres
- Palustrine unconsolidated bottom - 34 acres

Nearly all of the wetland acreage in the study area occurs either along the Swift bypass reach or as part of 5 large wetland complexes. These areas are briefly described below.

<u>Beaver Bay Wetland</u>

The Beaver Bay wetland is adjacent to Beaver Bay Campground and covers about 36 acres. It includes all 4 wetland types, with palustrine forest representing about half the acreage. Red alder is the dominant over-story species in the palustrine forest, but western red cedar, western hemlock, and big-leaf maple also occur. Skunk cabbage (*Lysichitum americanum*), slough sedge (*Carex obrupta*), and buttercup (*Ranuncolus* sp.) occur in the understory; snag density and the amount of downed woody debris are relatively high (Dueker and Paz 1995). The scrub-shrub wetland is characterized by willow (S*alix* spp.) and reed canarygrass (*Phalaris arundinacea*) and sedges dominate the emergent wetland portions. Although connected to the reservoir, this wetland also receives water from several small streams (Dueker and Paz 1995).

Swift Wetland

The Swift wetland is at the northeastern end of the study area and is bordered on the south side by an access road and a maintenance area. Nearly half of this 10.5-acre wetland consists of palustrine unconsolidated bottom that is bordered by a thin band of cattail (*Typha latifolia*) and bulrush (*Scirpus* sp.); most of the remainder is scrub-shrub wetland with small amounts of emergent and forested wetland. The scrub-shrub wetland consists primarily of willow and seedling/sapling alder. Alder is also the dominant overstory species in the forested wetland; blackberry, sword-fern, and buttercup occur in the understory (Dueker and Paz 1995). The emergent wetland is characterized by bulrush, skunk cabbage, and reed canarygrass. The wetland receives water from 2 streams, with outflow through a standpipe and culvert.

IP Wetland

This 7.3-acre wetland complex is located east of the reservoir and is bisected by the IP Road. Over half of this wetland consists of palustrine unconsolidated bottom and over 25 percent is palustrine forest; small amounts of scrub-shrub and emergent vegetation also occur. Red alder is the dominant tree species; cattails, sedges, and salmonberry are present as well.

Swift Bypass Reach Wetlands

Approximately 84 acres of wetland occur along the Swift bypass reach and are bordered by upland deciduous forest and the river channel. Over 85 percent of the wetlands along the bypass reach are scrub-shrub dominated by willow, sapling red alder, and cottonwood.

Frazier Creek Wetland

Over 70 percent of the 19-acre Frazier Creek wetland consists of palustrine unconsolidated bottom and is characterized by numerous snags and floating logs. In the summer, this area also supports a dense cover of pondweed (*Potamogeton* sp.). A thin band of emergent vegetation and scrub-shrub borders the open water portion. Originally created by a beaver dam, this wetland is currently maintained by a rock gabion dam, although beaver activity was evident. The Frazier Creek wetland is owned by Longview Fiber but PacifiCorp constructed the gabion dam through a cooperative agreement.

2.3.4 Developed/Disturbed Areas

Developed and disturbed areas cover 850 acres and represent 5 percent of the study area. The dominant disturbed type within the study area is the transmission line ROW, followed by developed areas and residential housing. Approximately 147 acres of the ROW acreage occurs along the 100- to 125-foot-wide transmission line that begins at the Swift No. 1 powerhouse and parallels the northern shore of Yale Lake; an additional 83 acres occur along the Yale to Merwin line. The majority of the transmission line ROW consists of dense shrub and bracken fern. Approximately 1,434 acres of land occur within 0.25 mile of the Yale to Merwin transmission line ROW, including 613 acres of upland deciduous forest, 238 acres of mixed deciduous/conifer forest, and150 acres of seedling sapling. Outside of the Merwin Wildlife Habitat Management Area, PacifiCorp owns less than 2 acres of land on or along this ROW.

3.0 THREATENED, ENDANGERED, AND SENSITIVE (TES) PLANT STUDIES

As part of the relicensing process, the FERC requires identification and assessment of Threatened, Endangered, and/or Sensitive (TES) plant species potentially affected by hydroelectric facilities and/or operations. TES plant species are defined generally as those species that are declining in population and/or in danger of extinction. Such species are protected at the federal level by the Endangered Species Act (ESA) of 1973, as amended. Under the ESA, the USFWS is responsible for identifying species that are threatened or endangered throughout all or a portion of their range. The USFWS maintains of list of federally protected species and candidate species and develops policies to promote their recovery. The Washington DNR's Natural Heritage Program (WNHP) has a similar responsibility at the state level. Although the state of Washington does not have a formal endangered species statute for plants, the WNHP maintains a database on species that are vulnerable to decline or extinction in Washington. Many of the species in the state database are federally listed as threatened or endangered; some are not.

The purpose of the TES plant studies conducted for the Yale Project was to provide the following information: (1) the locations of potential habitat for TES species in the study area; (2) the abundance and distribution of existing populations; (3) potential operation modifications needed to sustain existing populations; and (4) any potential protection or enhancement measures. This section describes the potential habitat for TES species in the vicinity of the Yale Project and the distribution and abundance of existing populations. Potential effects of project operations and proposed enhancement measures will be described in the License Application.

3.1 STUDY AREA

The study area for TES plant surveys generally included all land within 0.5 mile of Yale Lake. Within this area, emphasis was placed on habitats deemed most likely to support TES plant species based on topography, soils, cover type, and other features. The project transmission line ROW between Yale and Merwin Dams was also included in the study area but received limited attention because of the degree of disturbance to plant communities and the absence of habitat with a high probability of supporting TES plants.

3.2 METHODS

TES plant studies for the Yale Project consisted of the following 4 tasks: (1) review existing databases and literature to identify the TES species that potentially occur in the study area, (2) plan field surveys, (3) conduct field surveys, and (4) document results. The methodology for each of these tasks is discussed below.

3.2.1 Review of Existing Databases/Literature

The first step in the TES plant studies was to search the WNHP and the USFWS databases for information on species that are known to occur in the vicinity of the Yale

Project. According to these agencies, there are no populations of TES plant species or high quality native plant communities known to occur in the study area. However, the USFWS reported that 2 federally listed plants-water howellia (*Howellia aquatilis*) and Nelson's checker-mallow (*Sidalcea nelsoniana*)-potentially occur in the vicinity of the project. One species proposed for federal listing-golden paintbrush (*Castilleja levisecta*)-may also occur (letter from S. Moody, Environmental Coordinator, WNHP, October 31, 1996 and letter from D. Frederick, Supervisor, USFWS, Portland, Oregon, December 5, 1996). Subsequent consultation with botanists at the U.S. Forest Service (USFS), the WNHP, and Oregon State University (OSU) revealed that none of these 3 species were likely to occur in the study area because of a lack of suitable habitat.

A review of literature (USFS 1990, USFS 1995, WNHP 1994) and consultation with botanists familiar with Clark, Cowlitz, and Skamania counties identified several other TES species as potentially occurring in the study area (pers. comm., O. Terry, USFS, Botanist, Gifford Pinchot National Forest, Vancouver, Washington, November 26, 1996; J. Gamon, Botanist, WNHP, Olympia, Washington, November 26, 1996; and Dr. Scott Sundberg, Botanist, OSU, Corvallis, Oregon, May 1996; letter from Sandy Swope Moody, Environmental Coordinator, WNHP, January 25, 1999; http://www.wa.gov/dnr/htdocs/fr/nhp/wanhp.html). This information was used to compile the target species list for the field survey effort (Table 3.2-1). TES species that typically occur at high elevation or in habitats not generally found near the Yale Project (e.g., oak/madrone [*Quercus/Arbutus*] forests) were not included on the target list. The final target list for the Yale Project consisted of 21 TES species. Of the 21 species, 6 are state threatened or endangered, 12 are state sensitive, and 3 are on the state monitor or review lists.

3.2.2 Field Survey Planning

In preparing for the field surveys, project botanists reviewed cover type and topographic maps to identify the habitats most likely to support TES species. For the Yale project, these habitats included wetlands, ponds, and seeps; streambanks and riparian areas; and mesic forests and forest openings. Target species were grouped according to the habitat type most likely to support them, as shown in Table 3.2-2.

Next, project botanists examined herbarium specimens and compiled information on vegetative, floral, and fruit characteristics for each target species. This information was summarized on species treatment forms, which included a photocopy of the herbarium specimen or line drawing of the plant and a short key for identifying the species. Information from the herbarium specimens was also used to determine the timing of the field surveys. Field surveys were scheduled to occur when the species were most identifiable—that is, when they were in flower or in fruit.

Table 3.2-1. TES plant species potentially occurring in the vicinity of the Yale Project[1].

Species[2]	Species Status[3]		Habitat[4]	Notes
	Federal	State		
Adder's-tongue* (*Ophioglossum pusillum*)	-	T	Meadows and woods, usually in broad valleys	Low probability of occurrence
Branching montia*# (*Montia diffusa*)	-	S	Moist open areas in second-growth Douglas-fir forests	
Brewer's cinquefoil* (*Potentilla breweri*)	-	S	Currently known only from areas east of White Pass	Low probability of occurrence in study area
Clackamas corydalis*# (*Corydalis aquae-gelidae*)	-	T	Wet places above 2,500 feet elevation	Individuals occasionally occur at lower elevation
False pimpernel# (*Lindernia dubia var. anagallidea*)	-	R2	Moist river banks, widespread	
Flat-leaved bladderwort*# (*Utricularia intermedia*)	-	S	Open, slow moving water, bogs	
Fringed grass-of-Parnassus*# (*Parnassia fimbriata* var. *hoodiana*)	-	S	Wet meadows and streambanks	
Giant helleborine*# (*Epipactis gigantea*)	-	S	Springs, seeps, and channel margins on both sides of the Cascades	
Great polemonium*# (*Polemonium carneum*)	-	T	Thickets, woodlands, and forest openings west of the Cascades	
Green-fruited sedge* (*Carex interrupta*)	-	M3	Rocky streams and low wet places	
Hairy-stemmed checker-mallow# (*Sidalcea hirtipes*)	-	E	Prairie openings with little shrub and tree cover	
Large-awn sedge# (*Carex macrochaeta*)	-	S	Moist, open places, and seeps throughout region	
Lesser bladderwort# (*Utricularia minor*)	-	R1	Standing or slow moving water	
Nuttall's quillwort# (*Isoetes nuttallii*)	-	S	Seepy areas with low (or no) canopy cover	
Pale blue-eyed grass*# (*Sisyrinchium sarmentosum*)	-	T	Marshes, vernally moist places	Known only from Mt. Adams Ranger District and adjacent private lands; suitable habitat is probably not present in study area
Shining flatsedge* (*Cyperus bipartitus*)	-	S	Low, wet places	Generally restricted to banks of Columbia River
Small-flowered trillium# (*Trillium parviflorum*)	-	S	Moist woods, generally with Oregon ash or alder, sometimes in oak woodlands	Low probability of occurrence in study area

Table 3.2-1. TES plant species potentially occurring in the vicinity of the Yale Project[1] (continued).

Species[2]	Species Status[3] Federal	State	Habitat[4]	Notes
Tall agoseris[#] (*Agoseris elata*)	-	S	Meadows and open woods from low to mid elevation	
Tall bugbane*# (*Cimicifuga elata*)	-	T	Moist woods at low elevation	
Tree clubmoss (*Lycopodium dendroideum*)		S	Moist to dry forests, thickets, and bog edges	
Wheeler's bluegrass[#] (*Poa nervosa*)	-	S	Moist deciduous woodland slopes and mossy ledges on cliff faces	

[1] TES plant species listed are those with distributions that overlap at least part of the Lewis River drainage and grow in habitats found in the project vicinity.
[2] Species followed by (*) are on the USFS Region 6 Forester's list; species followed by (#) have been recorded in Clark, Cowlitz, and or Skamania counties (WNHP 1994; letter from Sandy Swope Moody, Environmental Coordinator, WNHP, January 25, 1999)
[3] Federal Status (USFWS): T—listed as threatened under the federal Endangered Species Act (ESA). State Status (DNR): E—listed as endangered, T—listed as threatened; S—listed as sensitive; M1—listed as a Group 1 Monitor species; M3—listed as Group 3 Monitor species; R1—Review 1: more fieldwork needed; R2—Review 2: unresolved taxonomic problems.
[4] Habitat information from Hitchock and Cronquist (1973) and from WNHP (letter from John Gamon, Botanist, WNHP, November 26, 1996).

Table 3.2-2. Target TES plant species by habitat type

Wetlands, Ponds, and Seeps	Streambanks and Riparian Areas	Mesic Forests and Forest Openings
Water howellia	False pimpernel	Tall bugbane
Clackamas corydalis	Green-fruited sedge	Great polemonium
Blue-eyed grass	Brewer's cinquefoil	Tree clubmoss
Large-awn sedge		Fringed pinesap
Shining flatsedge		Pine broonrape
Giant helleborine		Small-flowered trillium
Nutall's quillwort		Adder's tongue
Flat-leaved bladderwort		
Fringed grass-of-parnassus		
Howell's montia		
Lesser bladderwort		

3.2.3 Field Surveys

Field surveys were conducted by a 2-person team using the random meander approach (Nelson 1985). The lead botanist for the field work was Dr. Scott Sundberg from OSU. Both the lead and assistant botanist have conducted numerous surveys for TES plants and were familiar with the target species and the areas to be surveyed. Areas with a high probability of supporting TES species received 100 percent visual inspection; low probability areas received cursory inspection. Portions of the study area including steep slopes, reservoir shorelines, and other inaccessible locations were surveyed using binoculars. Specific areas surveyed are shown on Figure 3.2-1. Surveys were conducted in 2 separate sessions—1 in the spring and 1 in the summer—to capture the appropriate flowering and fruiting stages for target species. Specific survey dates were: May 12 to 16 and July 21 to 25, 1997. The survey effort involved more than 160 person-hours in the field.

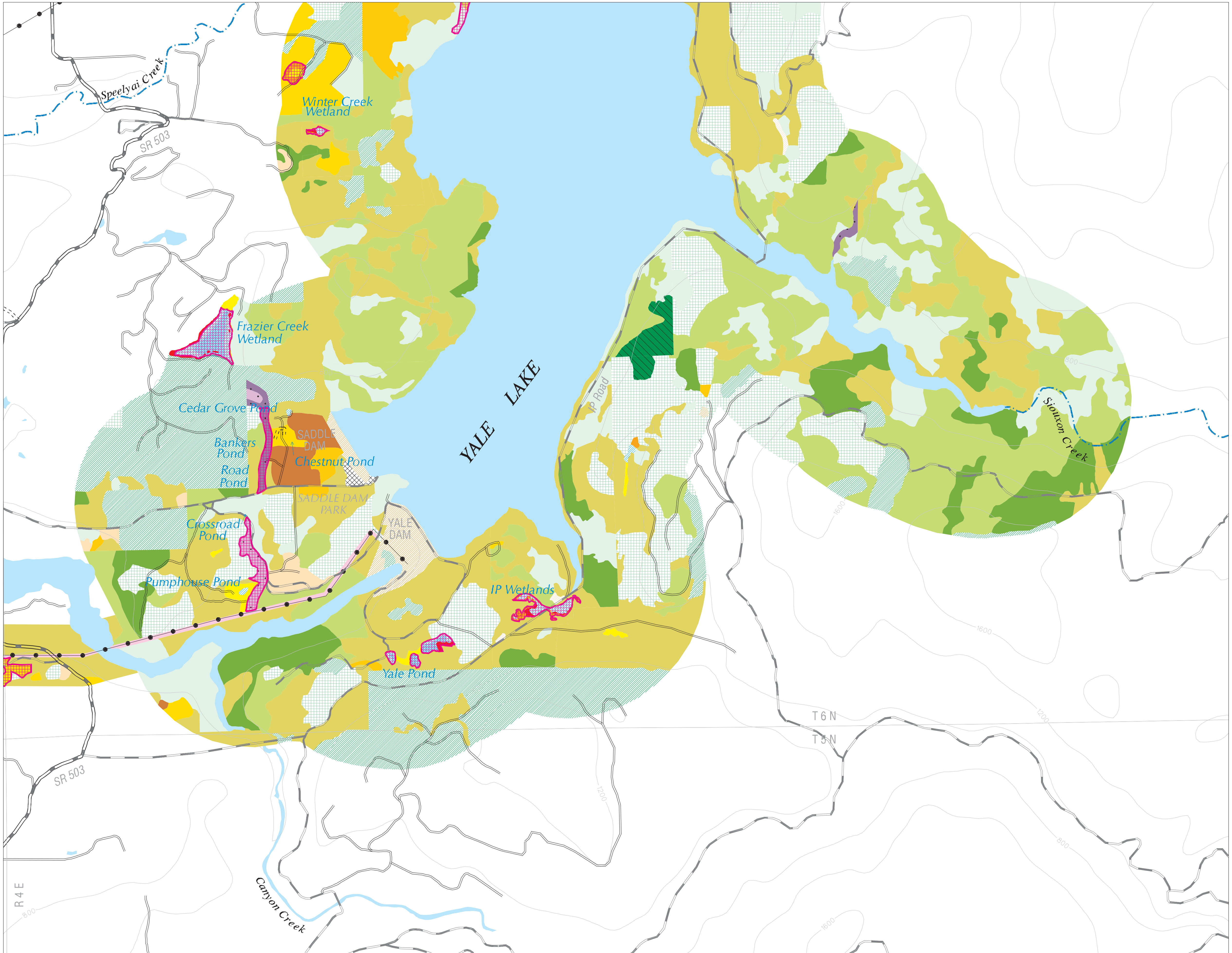
Plants potentially identified as TES were verified in the field using taxonomic keys for the Pacific Northwest (Hitchcock and Cronquist 1973). Some species were collected for more thorough examination with a dissecting microscope. The locations of all species found were mapped on cover type maps and/or topographic quadrangles of the study area. For each species observation, data were recorded on habitat, slope, aspect, associated species, soil type, population size, and possible threats. Voucher specimens were taken to document findings.

3.2.4 Documentation

All data collected during the field surveys will be provided to the WNHP for incorporation in their database. Materials to be submitted include a data form (WNHP Rare Plant Survey Form) and map for each species sighting; voucher specimens were deposited at the OSU herbarium. Location information will be keep confidential—that is, not distributed to the public—to protect the species from potential threats.

3.3 RESULTS AND DISCUSSION

A list of plant species identified in the study area during the TES field surveys is provided in Appendix 3.3-1. Only 1 TES species—the green-fruited sedge—was identified during the field survey. The green-fruited sedge is on the State Monitor List in Group 3. The monitor list consists of taxa of potential concern to the state, but for which no status is currently assigned. Species in Group 3 are more abundant and/or less threatened in Washington than previously assumed. Green-fruited sedge typically occurs along stream banks and in low wet places. It was believed to be somewhat restricted to the lower reaches of the Columbia River (Hitchcock and Cronquist 1973), but has been found to be widespread in western Washington and along the eastern slope of the Cascades. In the Yale study area, green-fruited sedge occurs in several locations between Swift Dam and the upstream end of Yale Lake. It was found in emergent wetlands, on the edge of a small pond, and in the riparian zone along 2 segments of the Lewis River. Green-fruited sedge was most often found growing in open or semi-open areas with other sedge species. Other similar habitats in the study area were searched extensively for the species but no additional populations were found.



Legend

TES Plant Survey Areas

Cover Types
- Agriculture
- Residential
- Developed
- Disturbed
- Recreation
- Transmission Line Right-Of-Way
- Rock Outcropping
- Rock Talus
- Old Growth Forest
- Mature Conifer Forest
- Mid-Successional Conifer Forest
- Pole Conifer Forest
- Seedling/Sapling Conifer Forest
- Lodgepole Pine Forest
- Upland Deciduous Forest
- Upland Mixed Conifer/Deciduous Forest
- Riparian Deciduous Forest
- Riparian Mixed Conifer/Deciduous Forest
- Dry Meadow/Grassland
- Shrubland
- Palustrine Scrub-Shrub Wetland
- Palustrine Emergent Wetland
- Palustrine Forest Wetland
- Palustrine Unconsolidated Bottom
- Lacustrine Unconsolidated Shore
- Lacustrine Unconsolidated Bottom
- Riverine Unconsolidated Bottom
- Riverine Unconsolidated Shore

Sheet 1

NORTH

0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 3.2-1
TES Plant Survey Areas

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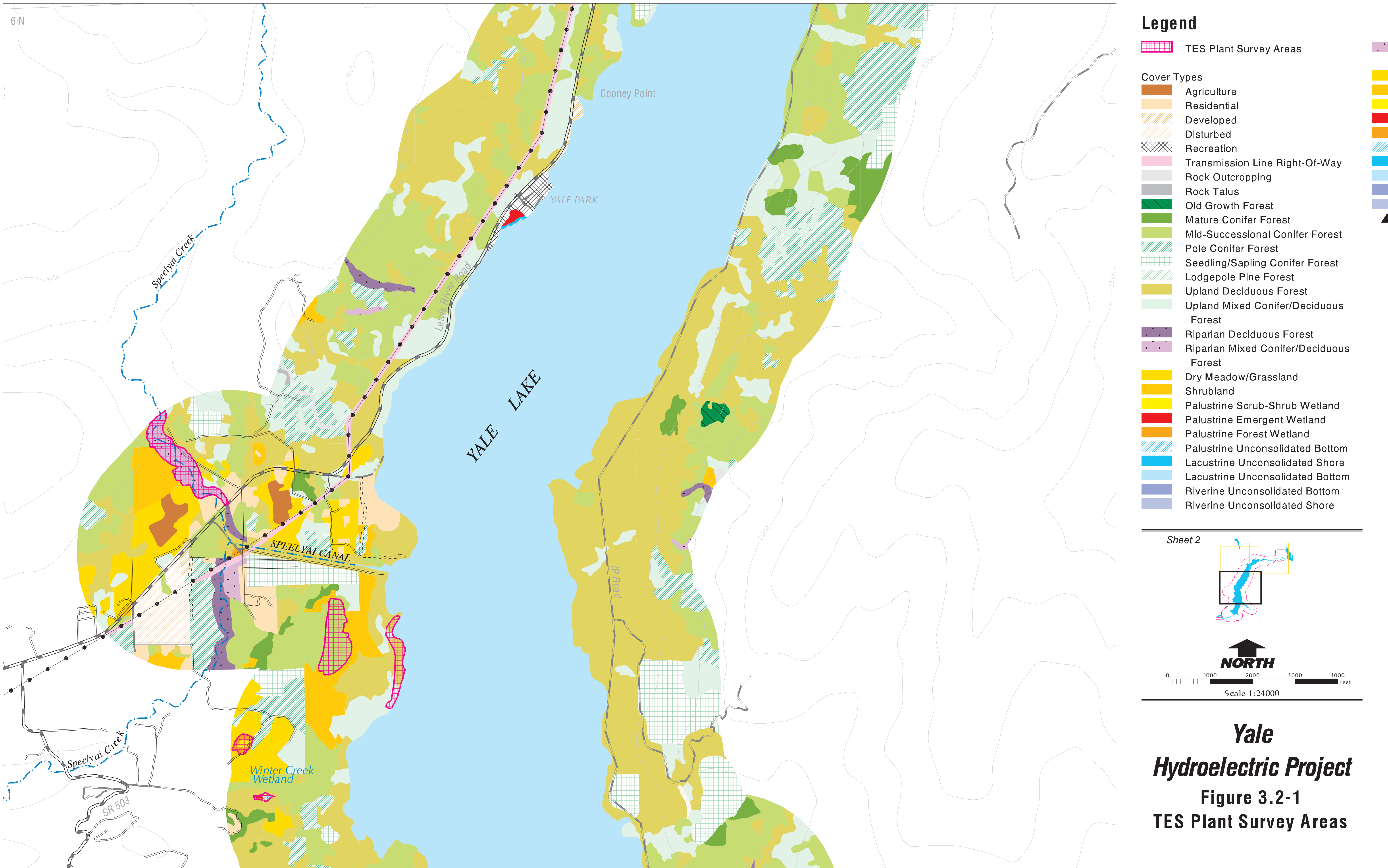

Yale Hydroelectric Project

Figure 3.2-1
TES Plant Survey Areas

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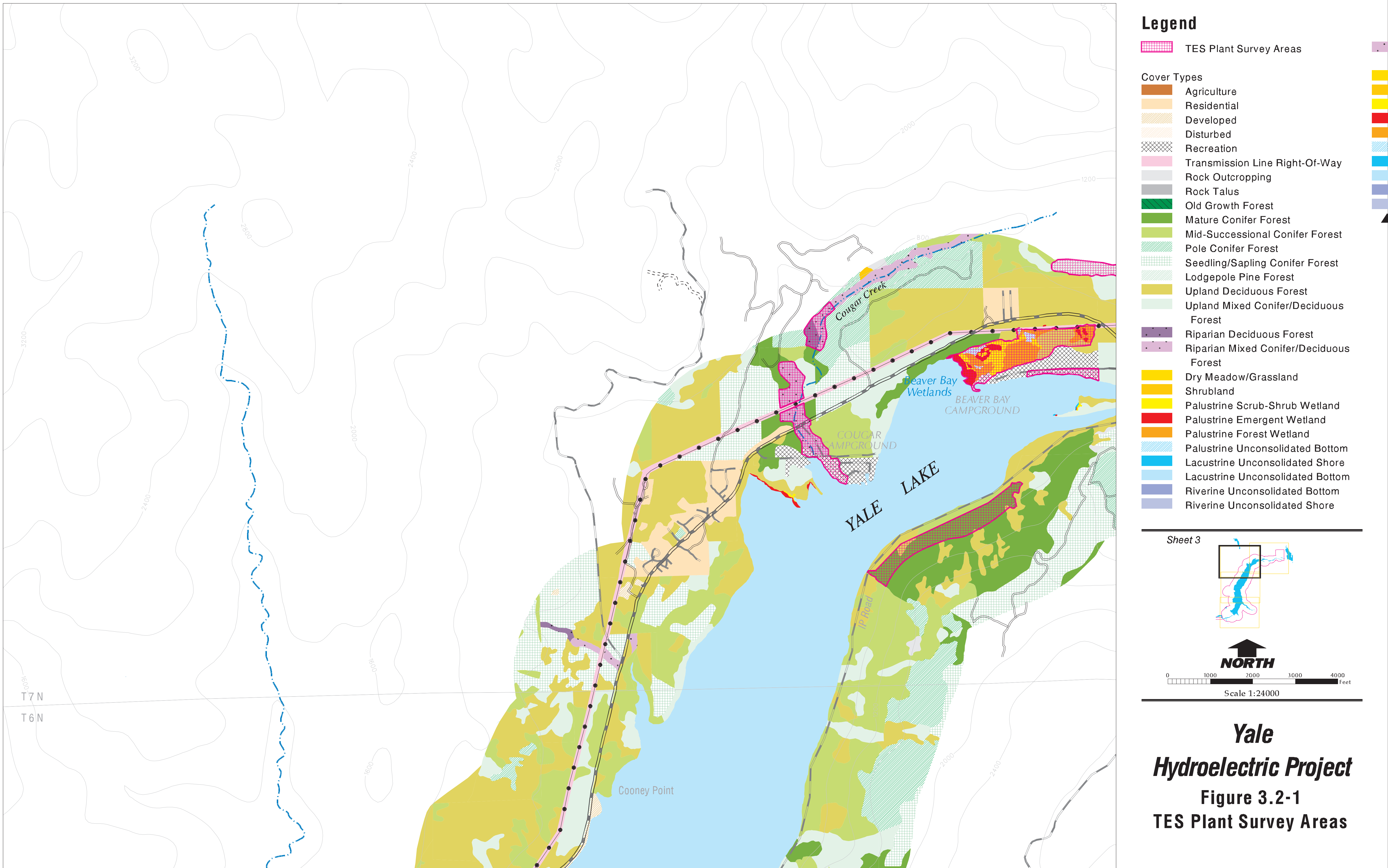

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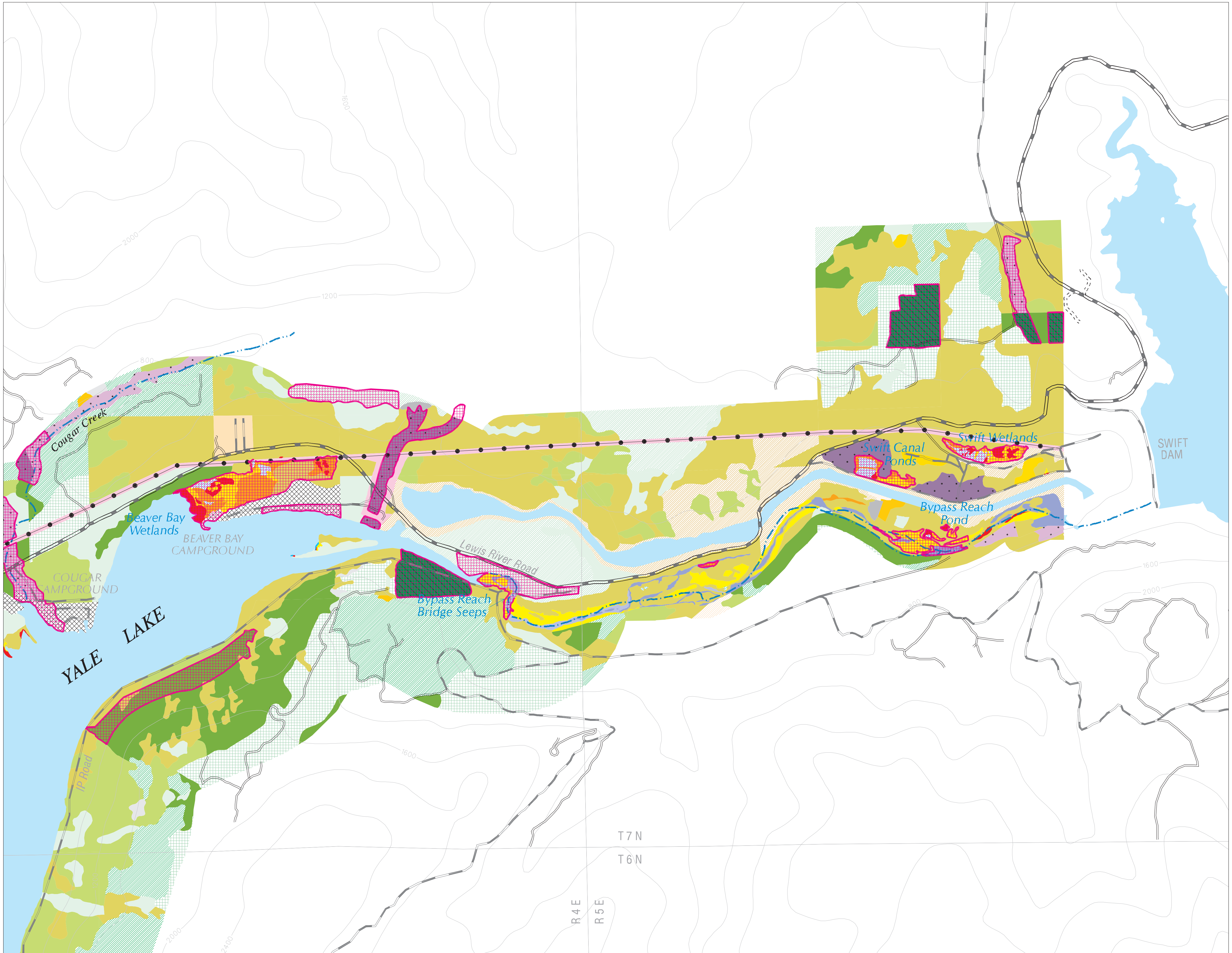
Yale Hydroelectric Project

Figure 3.2-1
TES Plant Survey Areas



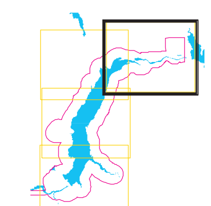
Legend

TES Plant Survey Areas

Cover Types

- Agriculture
- Residential
- Developed
- Disturbed
- Recreation
- Transmission Line Right-Of-Way
- Rock Outcropping
- Rock Talus
- Old Growth Forest
- Mature Conifer Forest
- Mid-Successional Conifer Forest
- Pole Conifer Forest
- Seedling/Sapling Conifer Forest
- Lodgepole Pine Forest
- Upland Deciduous Forest
- Upland Mixed Conifer/Deciduous Forest
- Riparian Deciduous Forest
- Riparian Mixed Conifer/Deciduous Forest
- Dry Meadow/Grassland
- Shrubland
- Palustrine Scrub-Shrub Wetland
- Palustrine Emergent Wetland
- Palustrine Forest Wetland
- Palustrine Unconsolidated Bottom
- Lacustrine Unconsolidated Shore
- Lacustrine Unconsolidated Bottom
- Riverine Unconsolidated Bottom
- Riverine Unconsolidated Shore

Sheet 4



NORTH

0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 3.2-1
TES Plant Survey Areas

 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/plant_survey.batchmap March 29, 1999

4.0 SPECIES/HABITAT ASSOCIATION STUDIES

FERC recommends that license applications include an inventory of significant biological resources and lists of plant and animal species that occur in the project vicinity (FERC 1990). The purpose of the species/habitat association studies is to provide information on wildlife species and their associated habitats in the Yale Project study area. Information about wildlife use of various habitats in the study area will be important in developing appropriate habitat protection and enhancement measures. In particular, species/habitat association studies focus on the following: (1) identifying habitat associations for priority species not included in specific TES surveys, or species deemed sensitive due to their reliance on relatively unique or diminishing habitats (e.g., amphibians, bats, and neotropical migratory birds); (2) identifying locations within the study area that are high value wildlife habitats (e.g., areas with high density of snags or high elk/deer use); (3) documenting seasonal wildlife use patterns of the study area; (4) characterizing habitats and identifying species potentially affected by any proposed project changes; and (5) providing the data needed to evaluate and document the contribution of PacifiCorp lands to big game winter range in the Lewis River watershed.

4.1 STUDY AREA

Species/habitat surveys were conducted throughout the study area described for the vegetation cover type mapping (Section 2.1); the majority of effort is focused on project facilities and PacifiCorp-owned property in the vicinity of Yale Lake.

4.2 METHODS

Information on species/habitat associations for the Yale Project was collected from a number of sources and survey efforts, including the following: (1) existing PacifiCorp and WDFW data; (2) seasonal surveys of habitats in the study area; (3) amphibian and reptile studies in study area wetlands, tributary streams, and selected upland habitats; and (4) other field activities conducted in the study area (e.g., vegetation cover type mapping and TES species surveys). Surveys focused on identifying the wildlife species that typically use the study area, and their habitats, distribution, and relative abundance. All wildlife observations and habitat data were entered into a computer database and summarized to create a species/habitat association matrix that links each species with the vegetation cover type (habitat), as well as the various project components (e.g., tailrace area, transmission line). The wildlife observation database was created using Paradox (Version 5.0 for Windows), a software program for relational data. Methodologies for each of the species/habitat studies are described below.

4.2.1 Existing Wildlife Data Review

Prior to conducting fieldwork for the species/habitat association studies, information on wildlife and wildlife habitats in the area was gathered from WDFW, DNR, and USFS databases and reports. Unpublished data and reports were also obtained from regional experts, PacifiCorp personnel, and individuals familiar with the study area. It is worth noting that very little data has been collected on breeding birds in the Lewis River drainage. Records from the Breeding Bird Atlas project, which was has been conducted statewide since 1987, show that Clark County received the least amount of survey effort of any county and Cowlitz County ranked 33 out of the 39 Washington counties (Smith et al. 1997). Consequently, Washington's gap analysis shows very little breeding evidence for any bird species in the study area (Smith et al. 1997).

4.2.2 Seasonal Surveys

Seasonal surveys were designed specifically to determine seasonal habitat use, species richness, distribution, and relative abundance of birds in the study area, although observations of all wildlife or their sign (tracks, scat, evidence of browse) were recorded. Surveys were conducted in spring, summer, and fall of 1996 and 1997 and winter 1997. Additional seasonal surveys are planned in winter 1998. Spring and summer surveys were timed to coincide with the peak breeding season for neotropical migratory birds, which extends from mid-May through the end of June in western Washington (Altman 1995). Survey dates were as follows:

- Spring - May 30 to June 1, 1996 and May 19 to 23, 1997
- Summer - June 25 to 28, 1996 and June 23 to 27, 1997
- Fall - October 29 to 31, 1996 and October 14 and 15, 1997
- Winter - February 4 to 6, 1997, and February 27 and March 5 and 6, 1998

All surveys were completed within 5 hours of sunrise by a team of 3 to 5 biologists; surveys at any given site were conducted by a single biologist. Prior to conducting surveys, biologists reviewed seasonal range maps for species likely to occur in the study area as well as recordings of bird songs and calls. Most team members also completed the Partners in Flight course in bird identification. To facilitate detection, surveys were not conducted if it was rainy or windy. Data recorded during the seasonal surveys included species, number of individuals, type of detection (visual, auditory), sex (if possible), habitat, and behavior. All data were recorded on standard field forms (Appendix 4.2-1) and entered into the wildlife database for the project. Data were analyzed to estimate species richness and relative abundance, by habitat type, and to develop species/habitat associations for the project. Relative abundance was calculated by dividing the number of individuals of each species observed by the total number of individuals of all species recorded over all surveys by season.

Because the ability to detect birds is somewhat dependent on habitat type, different protocols were used for seasonal surveys in uplands, wetlands/riparian areas, and lacustrine (reservoir)/riverine habitats. The methods used in each of these habitats are described below.

4.2.2.1 Upland Habitats

Seasonal surveys in upland habitats were conducted using the area search bird census method (Geupel et al. 1996). This method is a variation of point counts and transects and is time- and area-constrained. It was selected because it is an effective technique for determining species presence/absence, richness, relative abundance, seasonality, and habitat associations (Altman 1995). This technique mimics standard bird census methods and allows the observer to move freely throughout a defined area. It therefore requires less training in auditory detection and is suitable for use during the nonbreeding season when vocalizations are reduced (Altman 1995).

The protocol for the area search method recommends establishing at least 3 separate "search areas" or survey plots within a single block of a given habitat. The protocol does not recommend a specific survey plot size, but suggests that it be based on the ability to completely cover the search area in 20 minutes (Geupel et al. 1996). Based on vegetation density, a plot size of 2.5 acres was selected for upland habitats in the Yale Project. To minimize problems with access, it was decided to establish plots only on lands owned or managed by PacifiCorp, the USFS, or DNR.

To the extent possible, at least 3 replicate survey plots were established in each of 10 upland habitat types in the study area. Additional plots were established in mid-successional conifer and upland deciduous forests since these 2 types cover over 40 percent of the non-water portion of the study area (Table 4.2-1). An attempt was made to randomly locate the 3 replicates for each type within a single habitat block and to distribute the sampling effort of various habitats along both sides of the reservoir. However, much of the habitat within the study area occurs in relatively small patches that are large enough for only 1 or 2 survey plots. Where possible, plots were located in single habitat blocks or in smaller blocks that were in proximity to each other. Several large blocks of a single type are either on privately owned land or were inaccessible; mudslides along the IP Road prevented access to much of the area along the east side of the reservoir. A total of 31 survey plots were established in upland habitats (see Figure 2.3-1).

Within a given habitat block, survey plots were located by selecting a random distance and compass direction from the access point. Plots were circular, with centers marked with a stake and flagging. From the center, a distance of 183 feet was measured in each cardinal direction to determine plot boundaries, which were also marked with flagging. Additional flags were placed at the mid-point of each of the 4 radii; extra flags were added to plots with particularly dense vegetation.

Table 4.2-1. Number and location of survey plots by habitat type.

Cover Type	Percent of Study Area*	No. of Plots	Location
Old-growth conifer forest	<1	3	2 in the NE portion of the study area; 1 along east side of the reservoir.
Mature conifer forest	5	2	1 in the NE portion of the study area, 1 along the east side of the reservoir.
Mid-successional conifer forest	12	4	All 4 are in proximity on the west side of the reservoir, south of Speelyai Canal.
Pole conifer	8	3	All 3 in the NE portion of the study area.
Mixed conifer/deciduous forest	9	3	All are on the west side of the reservoir, 1 near Cougar Park and 2 between Lewis River Road and the transmission line.
Upland deciduous forest	24	6	1 in the NE portion of the study area; 3 on the west side of the reservoir, 2 south of Speelyai Canal and 1 near Cougar; and 2 on the SE corner of the study area off the IP Road.
Lodgepole pine	1	3	All 3 are located in a single habitat block between Swift No. 2 Canal and the Lewis River Road.
Seedling/sapling conifer	8	3	All 3 are in proximity in the NE portion of the study area.
Shrubland	1	3	All 3 are in proximity on the west side of the reservoir, south of Speelyai canal.
Meadow	1	1	West side of the reservoir, south of Speelyai canal.

* The reservoir, river, disturbed areas, wetlands, and rock habitats account for the remaining 31 percent of the study area.

Surveys of each plot were conducted for 20 minutes. The observer began each survey at the plot center, noting any auditory detections, including distance and direction. The observer then slowly walked around the plot, typically stopping at the midpoints along each radius and searching for birds with unfamiliar calls. Wildlife seen or heard outside the plot within the observation period were recorded separately from those inside the plot; birds flying over the plot and wildlife sign were also noted.

4.2.2.2 Wetland/Riparian Habitat

Wetland and riparian habitats are both difficult to survey using the area search method. The typically small size of wetlands and the linear nature of riparian areas tend to preclude plot establishment. For the Yale Project, seasonal surveys of these 2 habitat types were conducted along transects; a total of 10 transects were established—6 in wetlands and 4 in riparian areas.

The Beaver Bay, IP, Swift, and Frazier Creek wetland complexes were selected for seasonal surveys (Figure 2.3-1). These wetlands represent the major portion of the wetland habitat in the study area. The IP, Swift, and Frazier Creek wetlands are paralleled or bisected by dirt roads which provide good visibility, especially with the aid of a spotting scope. At the Beaver Bay wetland, 3 transects were established to access different portions and provide coverage of most of this area. Wetlands were surveyed by walking along roads or transects and recording all species seen or heard; the type of wetland habitat used (i.e., open water, scrub-shrub, emergent, or forested) by each species observed was also noted on the data forms. Surveys were conducted for 30 minutes to ensure thorough coverage

The most significant riparian habitat in the study area occurs along the Lewis River between the north end of Yale Lake and Swift Dam. This area is the bypass reach for the Swift No. 2 Project. Transects were established at the following 3 locations along this reach: (1) adjacent to the bridge over Swift No. 2 Canal, (2) about 0.5 mile south of the bridge over Swift No. 2 Canal, and (3) at the swimming hole bridge just north of the reservoir (Figure 2.3-1). Another transect was also established in the riparian area along Cougar Creek extending about 0.25 mile north from Lewis River Road. All riparian habitat transects were surveyed for 20 minutes.

4.2.2.3 Reservoir/Riverine Habitat

The focus of surveys along the reservoir is to determine use of open water and shorelines. A total of 5 shoreline locations that provide good visibility of the reservoir were selected as observation points (Figure 2.3-1). These points are located at Cougar Point, the mouth of Speelyai canal, Saddle Dam, Yale Dam, and the bridge over Siouxon Creek. An additional observation point was located near the Yale powerhouse to identify species that use the riverine and shoreline habitats immediately downstream of the project. Surveys at the 6 shoreline observation points were conducted for 10 minutes; species observed using reservoir, riverine, or adjacent shoreland habits were recorded.

4.2.3 Amphibian and Reptile Studies

Based on habitat and range information, 16 amphibian and 7 reptile species potentially occur in the study area (Table 4.2-2). Surveys conducted during 1996 and 1997 were specifically designed to detect amphibians. Amphibian studies in 1996 focused on aquatic habitats and involved trapping for species in ponds and wetlands, and electroshocking for stream-dwelling species. In 1997, amphibian studies were expanded to cover several TES species (see Section 5.0) and included searches for egg masses in wetlands and surveys of selected tributary streams, rock talus areas, and old-growth stands on steep slopes in the study area. Methods for each of these studies are described below.

Table 4.2-2. Amphibian and reptile species potentially occurring in the Yale study area.

Species	State/Federal Status	Aquatic/Terrestrial Life Stages	Habitat Characteristics
Salamanders			
Northwestern salamander (*Ambystoma gracile*)	None/None	Adult-terrestrial Larvae-aquatic; pond-adapted. Neotenes are frequent.	Sea level to 5,725 feet--humid, conifer forests. Adults make extensive use of underground burrows.
Long-toed salamander (*Ambystoma mactodactylum*)	None/None	Adult-terrestrial Larvae- aquatic; pond-adapted. No known neotenes.	Widespread to 6,190 feet--lowland forests, disturbed pastures, high elevation lakes and ponds, shrub-steppe areas. Subterranean during dry, hot, or freezing periods.
Cope's giant salamander (*Dicamptodon copei*)	Monitor/None	Adult-terrestrial (almost unknown) Larvae-aquatic; stream-adapted. Neotenes are most common.	Sea level to 3,200 feet. Larvae/neonates - small, rocky creeks, streams, and seeps, 8-14°C (18°C max); hide under rocks, bark, other debris during the day. Adults occur in surface debris at water's margin.
Pacific giant salamander (*Dicamptodon tenbrosus*)	None/None	Adult-terrestrial (infrequent) Larvae-aquatic; stream adapted (common). Neotenes common.	Sea level to 5,900 feet. Larvae--clear, cold streams in cool, moist coniferous forests; hide under rocks, bark, other debris during the day. Adults occur near streams but are usually concealed by surface debris or in burrows.
Cascade torrent salamander* (*Rhyacotriton cascadae*)	Candidate/ None	Adult-terrestrial Larvae-aquatic; stream adapted. Neotenes unknown.	Splash zones of small cold, clear streams, seeps, and waterfalls, 8-12°C. Ideal habitat is provided by seeps through talus and water percolating through gravel, often moss-covered.
Rough-skinned newt (*Taricha granulosa*)	None/None	Adult-terrestrial, extended aquatic phase during breeding. Larvae-aquatic; pond-adapted. Neotenes unknown.	Widespread to 5,040 feet on land in conifer and hardwood forests, farmlands, and open areas; also in lakes, ponds, sluggish streams.
Larch Mountain salamander* (*Plethodon larselli*)	Sensitive/ None	Adult-terrestrial. No free-living larval stage.	To 3,040 feet on steep talus slopes covered with moss and with dense tree cover; boulder fields, cave entrances, and mature/old-growth forests.
Van Dyke's salamander* (*Plethodon vandykei*)	Candidate/ None	Adult terrestrial. No free-living larval stage.	Sea level to 3,600 feet in splash zones of creeks or waterfalls under rocks or woody debris, or under logs, bark, and bark on logs near water; seeps over talus or rock faces. Also far from water in deep talus mixed with moist soil on well-shaded, north-facing slopes.

Table 4.2-2. Amphibian and reptile species potentially occurring in the Yale study area (continued).

Species	State/ Federal Status	Aquatic/ Terrestrial Life Stages	Habitat Characteristics
Western red-backed salamander (*Plethodon vehiculum*)	None/None	No free-living larval stage.	Widespread, sea level to 3,400 feet in dense coniferous forests, often in seeps or near streams. Affinity for rocky substrates, including talus, boulders, rock outcrops; also woody debris logs, and litter on forest floor.
Ensatina (*Ensatina eschscholtzii*)	None/None	Adult-terrestrial No free-living larval stage.	Sea level to 3,800 feet in forests, generally under woody debris, leaf litter, bark, rocks, and logs.
Frogs/Toads			
Tailed frog (*Ascaphus truei*)	Monitor/None	Adult and larvae both aquatic.	Sea level to 5,250 feet in cold, rocky streams (avoid moss covered rocks and silt deposits).
Western toad (*Bufo boreas*)	None/None	Adult-terrestrial, aquatic tadpole.	Widespread, sea level to 6,500 feet. Most common near marshes and small lakes but also seen in dry forests and shrub areas.
Pacific chorus frog (*Pseudacris regilla*)	None/None	Adult-terrestrial, aquatic tadpole.	Widespread, sea level to 5,200 feet in nearly all habitats.
Red-legged frog (*Rana aurora*)	None/Species of Concern	Adult-terrestrial, aquatic tadpole.	Sea level to 2,800 feet in moist forests.
Cascades frog (*Rana cascadae*)	None/Species of Concern	Adult-terrestrial, aquatic tadpole.	Cascades Mts., 2,000-6,190 feet (rare below 2,000 feet), in small ponds, lakes, and wetlands; in marshy areas adjacent to streams.
Bullfrog (*Rana catesbeiana*)	None/None	Adult and tadpole both aquatic.	Sea level to 1,075 feet, along shorelines of lakes, ponds, sloughs, and reservoirs.
Reptiles			
Northern alligator lizard (*Elgaria coerulea*)	None/None	Adults and juveniles are terrestrial	Forests and forest clearings.
Northwestern pond turtle* (*Clemmys marmorata marmorata*)	Endangered/ Species of Concern	Aquatic but breeds on land	Ponds and slow moving streams with logs and rocks along shorelines.
Painted turtle (*Chrysemys picta*)	None/None	Aquatic	Marshes, slow rivers, ponds, and lakes with abundant vegetation.
Rubber boa (*Charina bottae*)	None/None	Terrestrial but swim well	Wide variety of habitats ranging from grasslands to forests.
Western terrestrial garter snake (*Thamnophis elegans*)	None/None	Terrestrial	Grasslands, shrublands, forests, usually near water.
Northwestern garter snake (*T. ordinoides*)	None/None	Terrestrial	Meadows, talus, brush thickets, forest clearings.
Common garter snake (*T. sirtalis*)	None/None	Terrestrial	Grasslands, shrublands, forests, usually near water.

Sources: Nussbaum, et al. 1983; Leonard, et al. 1993; Subgroup 1996; Olson and Leonard 1997; Brown et al. 1995.
* WDFW priority species

4.2.3.1 Amphibian Trapping

Trapping is an effective method of detecting amphibians in wetlands with dense vegetation, especially species that are relatively uncommon or most active during the night (Adams et al. 1997). Amphibian traps were set in the 4 large wetland complexes in the study—Beaver Bay, Swift, IP, and Frazier Creek (Table 4.2-3; Figure 5.2-1 in Section 5.0).

Table 4.2-3. Amphibian trap numbers and sample dates by wetland complex

Wetland Complex	Number of Traps	Dates Set	Dates Sampled
Swift	29	May 21 and 22, 1996	May 22 and 23, 1996
Beaver Bay	28	May 22 and 23, 1996	May 23 and 24, 1996
IP	24	May 21 and 22, 1997	May 22 and 23, 1997
Frazier Creek	24	June 25 and 26, 1997	June 26 and 27, 1997

All of the sites selected for trapping are composed of complexes of open water and emergent wetland vegetation with water depths less than 3.3 feet. The trapping protocol generally followed Adams et al. (1997), Richter (1995), and Heyer et al. (1994). Unbaited mesh minnow traps were placed in or near areas that provide cover for amphibians, including shoreline edges and emergent vegetation. Within each type of cover, an equal number of traps were placed at the top, midpoint, and bottom of the water column by attaching the traps horizontally to wooden stakes. Traps were checked twice—once after 24 hours and again after 48 hours. Data recorded for each trap included water depth, funnel (trap opening) depth, and habitat. At each check, amphibian and/or fish species were identified as well as life stage. Identification followed Leonard et al. (1993), Nussbaum et al. (1983), and Stebbins (1985).

4.2.3.2 Electroshocking

In conjunction with fisheries investigations, biologists documented amphibians during electroshocking of selected aquatic habitats. Electroshocking was conducted once on each of the following tributaries, wetlands, and ponds between September 9-12 and 19-21 and October 1-30, 1996:

- Beaver Bay wetlands
- Bypass reach
- Bypass reach ponds
- Cougar Creek headwaters
- IP wetlands
- Ole Creek
- Panamaker Creek
- Rain Creek
- Dog Creek
- 1 unnamed creek along IP Road

Electroshocking was generally conducted along the lowest 500 feet of the smaller tributaries but was extended to 5,500 feet along Ole Creek and 2,365 feet along Panamaker Creek. On Cougar Creek, electroshocking was only conducted near the headwaters; the USFS had previously collected data on fish in the lower reaches of the stream. Representative sections of shoreline along each pond and wetland were shocked, focusing on areas with suitable vegetative cover. The bypass reach was stratified into habitat units and sampled according to the abundance of each habitat type (see the FTR for Aquatic Resources).

A team of 2 or 3 biologists walked upstream and along the pond shorelines and sampled representative aquatic habitats using a gasoline powered backpack shocker. All fish and amphibians stunned were collected into a bucket of water, identified, and released. For amphibians, data recorded included species, life stage, general habitat, and water temperature. Data on fish were also collected (see the FTR for Aquatic Resources).

4.2.3.3 Egg Mass Searches

Searches for amphibian egg masses were conducted primarily to determine use of study area wetlands by the red-legged frog, which is designated as a Species of Concern by the USFWS. However, it is also an effective method for locating other species, such as northwestern and long-toed salamanders, that breed in stillwater habitats in late winter/earl spring. Egg mass searches were conducted in a total of 14 ponds and wetlands on March 3 and 4, 1997; detailed methods and specific locations are described in Section 5.2.3.2. Egg masses were identified using Corkran and Thoms (1996).

4.2.3.4 Upland Habitat Surveys

Amphibian surveys in upland habitats were designed to locate the Larch Mountain and Van Dyke’s salamanders, both TES species. Area constrained searches using belt transects (Survey and Manage Amphibian Subgroup [Subgroup] 1996) were conducted in 9 upland locations-4 old-growth stands and 5 rock talus sites (see Figure 5.2-1 in Section 5.0). The entrances to several small caves and basalt fissures were also searched for amphibians. Surveys were conducted in spring and fall 1997; detailed methods are provided in Section 5.2.3.1.

4.2.3.5 Riparian/Streamside and Lotic Habitat Surveys

Surveys of riparian/streamside and lotic habitats were specifically designed to locate the Van Dyke's salamander as well as several other TES amphibian species, including the Cope’s giant salamander, Cascade torrent salamander, red-legged frog, and tailed frog. A time constrained approach (Bury and Corn 1991) was used to conduct surveys in riparian/streamside and lotic habitats along the following:

- 12 unnamed streams that drain Souxion Ridge, cross the IP Road, and flow into the east side of Yale Lake, which are referenced as IP-1 through IP-13 and collectively referred to as the IP streams (IP-12 was not sampled due to lack of suitable habitat);
- the headwaters and lower portions of Cougar Creek;
- lower Panamaker Creek;
- portions of the Lewis River upstream of the reservoir; and
- lower Rain, Ole, Dog, and Speelyai creeks.

Surveys were conducted in spring and fall 1997. Detailed methods are provided in Section 5.2.3.1 (see Table 5.2-3) and survey locations are shown in Figure 5.2-1.

4.2.3.6 Instream Surveys

Surveys of instream habitats focused on locating Pacific giant salamanders as well as a number of TES amphibians—the Cope's giant salamander, tailed frog, and Cascade torrent salamander. Instream habitats were surveyed along the same streams included in the riparian/streamside and lotic habitat searches (see Section 4.2.3.5, Table 5.2-3 and Figure 5.2-1). Surveys were conducted during the summer low flow period using a time and area constrained method (Bury and Corn 1991). Detailed methods are provided in Section 5.2.3.1.

4.2.4 Incidental Wildlife Observations

Wildlife observations made enroute to seasonal survey plots and during cover type mapping or other activities in the study area were recorded in field notebooks or on the field forms used for seasonal surveys (Appendix 4.2-1). All incidental observations were entered into the wildlife database.

4.3 RESULTS AND DISCUSSION

Results of the various species/habitat association studies are presented in the following sections. The first section presents the species/habitat associations developed for the project. The remaining sections discuss the seasonal distribution and relative abundance of the taxa recorded during the wildlife surveys conducted in the study area, including the seasonal surveys, amphibian studies, and helicopter surveys (see Section 5.2.3.8). A list of common and scientific names for all wildlife species mentioned in the text is provided in Appendix 4.3-1.

4.3.1 Species/Habitat Associations

Wildlife data collected during all terrestrial resource studies conducted in 1996-1998 were compiled and reviewed to develop species/habitat associations for the Yale Project (Table 4.3-1). A total of 145 species, including 15 amphibians, 4 reptiles, 113 birds, and 13 mammals were documented in the 15 major cover types in the study area. These totals do not include wildlife not identified to species (e.g., frog sp.). Wetlands by far supported the greatest number of species; 95 species, or 66 percent of all taxa observed in the study area were recorded in wetlands. Although wetlands typically support more wildlife species than upland habitats, the amount of survey time spent in wetlands was also greater. The combination of open water and adjacent vegetation that characterizes riverine and reservoir habitats also resulted in high species richness; 68 and 61 species were observed in these 2 habitats, respectively. Upland habitats in the study area generally supported between 34 and 57 species; fewer species were recorded in disturbed areas and rock/talus (Table 4.3-1).

Table 4.3-1. Species/habitat associations at the Yale Hydroelectric Project.

	Habitat Types[1]														
Species	**LPP**	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RI**	**RE**	**SH**	**SS**	**UD**	**WL**	**DST**	**ROCK**
Amphibians															
western red-backed salamander	X					X		X						X	X
rough-skinned newt		X	X			X		X			X	X	X		
ensatina	X				X	X		X					X	X	X
Pacific giant salamander								X							
Cope's giant salamander								X							
Cascade torrent salamander*								X				X			X
Larch Mountain salamander*								X						X	X
Van Dyke's salamander*								X							X
long-toed salamander[2]													X		
northwestern salamander								X					X		
frog (sp.)								X							
tailed frog								X							
Pacific chorus frog			X	X		X		X				X	X		
northern red-legged frog						X		X					X		
bullfrog								X				X	X		
western toad								X							
Reptiles															
garter snake (sp.)													X		X
northwestern garter snake													X		X
rubber boa															X
northern alligator lizard					X					X				X	X
painted turtle													X		
Waterfowl and Waterbirds															
waterfowl (sp.)				X					X				X		
common loon*									X						
western grebe									X				X		
pied-billed grebe									X						
double-crested cormorant									X						
Canada goose				X	X		X				X	X	X		
mallard								X	X				X		
American wigeon									X				X		
blue-winged teal													X		
wood duck*								X					X		
ring-necked duck													X		
lesser scaup													X		
bufflehead*									X				X		
common merganser								X	X				X		
hooded merganser*									X				X		

Table 4.3-1. Species/habitat association at the Yale Hydroelectric Project (continued).

	Habitat Types[1]														
Species	**LPP**	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RI**	**RE**	**SH**	**SS**	**UD**	**WL**	**DST**	**ROCK**
Gulls and Shorebirds															
Caspian tern						X									
gull (sp.)	X							X	X				X		
glaucous-winged gull									X						
ring-bill gull									X						
California gull								X	X						
great blue heron*								X	X				X		
green-backed heron													X		
killdeer					X			X	X				X		
spotted sandpiper								X	X				X		
Raptors, Vultures, and Owls															
bald eagle*	X					X	X	X	X				X		
sharp-shinned hawk	X										X	X			
red-tailed hawk	X	X		X				X				X	X		
osprey[#]	X	X		X		X	X	X	X			X	X		
owl (sp.)												X			
great horned owl	X														
barred owl				X											
northern spotted owl*		X													
pygmy owl						X							X		
turkey vulture	X		X					X	X				X		
Gamebirds															
band-tailed pigeon*		X			X		X				X	X			
mourning dove								X	X		X		X		
blue grouse*						X					X				
ruffed grouse				X					X		X		X		
common snipe													X		
wild turkey*							X								
Nightjars, Swifts, and Hummingbirds															
belted kingfisher					X			X	X				X		
Vaux's swift*													X	X	
common nighthawk	X														
hummingbird (sp.)	X							X					X		
rufous hummingbird	X		X	X		X		X	X	X	X	X	X		
black-chinned hummingbird	X											X			
Woodpeckers															
woodpecker (sp.)	X		X	X	X	X		X				X	X		
red-breasted sapsucker		X	X	X				X			X	X	X		
pileated woodpecker*	X	X	X			X	X	X	X		X	X	X		
common flicker	X	X		X	X	X	X	X		X	X	X	X		

Table 4.3-1. Species/habitat association at the Yale Hydroelectric Project (continued).

	Habitat Types[1]														
Species	**LPP**	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RI**	**RE**	**SH**	**SS**	**UD**	**WL**	**DST**	**ROCK**
downy woodpecker	X				X	X		X	X		X	X	X	X	
hairy woodpecker		X		X		X				X	X	X	X		
Flycatchers and Swallows															
flycatcher (sp.)					X										
Hammond's flycatcher	X	X		X	X	X		X	X	X		X	X		
alder flycatcher											X				
western flycatcher												X			
Pacific slope flycatcher		X	X	X	X	X	X	X	X	X	X	X	X		
willow flycatcher			X		X	X	X	X	X		X	X	X		
olive-sided flycatcher			X												
western wood-pewee		X		X	X							X	X		
swallow (sp.)	X	X			X				X		X	X	X		
tree swallow								X	X				X		
violet green swallow								X	X				X		
cliff swallow								X	X						
barn swallow			X					X	X			X	X		
northern rough-winged swallow								X	X				X		
Jays and Crows															
scrub jay	X											X			
Steller's jay	X	X	X	X	X	X	X	X	X	X	X	X	X		
American crow	X	X		X	X	X	X	X	X	X	X	X	X		
common raven	X	X	X	X		X	X	X	X	X	X	X	X	X	
brown-headed cowbird	X				X			X				X	X	X	
brown creeper		X				X									
Chickadees, Wrens, and Thrushes															
chickadee (sp.)	X	X	X		X	X	X				X	X	X		
black-capped chickadee	X	X	X	X	X	X		X	X	X	X	X	X		
mountain chickadee	X				X										
chestnut-backed chickadee	X	X		X	X	X	X	X	X	X	X	X	X	X	
bushtit												X	X		
red-breasted nuthatch	X	X		X	X	X	X		X	X	X	X	X		
white-breasted nuthatch												X			
winter wren	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
marsh wren													X		
kinglet (sp.)					X								X	X	
ruby-crowned kinglet	X				X				X		X		X	X	
golden-crowned kinglet	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
hermit thrush					X		X								
Swainson's thrush	X	X	X	X	X	X	X	X	X	X	X	X	X		

Table 4.3-1. Species/habitat association at the Yale Hydroelectric Project (continued).

	Habitat Types[1]														
Species	**LPP**	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RI**	**RE**	**SH**	**SS**	**UD**	**WL**	**DST**	**ROCK**
varied thrush	X	X		X	X	X	X		X	X	X	X	X	X	
American robin	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
American dipper								X	X				X		
cedar waxwing			X	X	X			X	X		X	X	X		
European starling								X	X			X	X	X	
Vireos and Warblers															
Hutton's vireo					X	X				X	X		X	X	
solitary vireo				X					X	X		X	X		
warbling vireo	X				X		X	X	X	X	X	X	X		
warbler (sp.)												X			
orange-crowned warbler								X				X			
black-throated gray warbler	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
yellow warbler								X		X	X		X		
yellow-rumped warbler					X							X	X		
Nashville warbler										X	X				
MacGillivary's warbler		X	X		X	X	X			X	X		X		
Heto warbler		X				X									
Hermit warbler		X													
Wilson's warbler			X	X	X	X	X	X	X	X		X	X		
common yellowthroat		X	X					X	X	X		X	X		
Grosbeaks, Buntings, and Sparrows															
black-headed grosbeak		X	X	X			X			X		X	X		
Lazuli bunting			X												
evening grosbeak						X		X		X	X	X	X		
spotted towhee	X		X	X	X	X	X			X	X	X	X	X	
song sparrow			X	X	X	X	X	X	X		X	X	X		
chipping sparrow											X				
dark-eyed junco	X	X	X	X	X	X	X	X	X	X	X	X	X		
white-crowned sparrow	X		X	X	X	X	X	X	X		X		X		
golden-crowned sparrow			X				X								
pine siskin													X		
Blackbirds, Orioles, and Finches															
red-winged blackbird									X				X		
Brewer's blackbird								X					X		
northern oriole													X		
Bullock's oriole													X		
western tanager	X	X	X	X	X	X	X	X	X	X	X	X	X		
finch (sp.)											X				
American goldfinch						X		X	X		X	X	X		
red crossbill							X								

Table 4.3-1. Species/habitat association at the Yale Hydroelectric Project (continued).

	Habitat Types[1]														
Species	**LPP**	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RI**	**RE**	**SH**	**SS**	**UD**	**WL**	**DST**	**ROCK**
purple finch	X			X			X				X		X		
Mammals															
Pacific western big-eared bat*															X
Townsend chipmunk						X						X			
Douglas squirrel	X	X		X	X	X	X		X	X	X	X		X	
beaver			X										X		
mink*									X				X		
coyote											X		X	X	
bobcat												X			
black bear					X										
elk*	X	X		X	X	X	X	X		X	X	X	X	X	
black-tailed deer*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
pocket gopher											X				
striped skunk				X		X				X					
raccoon													X		
Total No. of Species[3]	40	35	32	39	42	47	36	68	61	35	49	58	95	22	9

* WDFW priority species.

[#] Osprey is currently being reviewed for removal from the WDFW priority species list (pers. comm. N. Nordstrom, PHS Program, WDFW, Olympia, Washington, February 4, 1999)

[1] Habitat types: LPP-lodgepole pine, M-mature conifer, MD-meadow, MS-mid-successional conifer, MX-mixed conifer/deciduous, OG-old-growth conifer, P-pole conifer, RI=riparian deciduous/riverine, RE-reservoir/shoreline, SH-shrubland, SS-seedling/sapling, UD-upland deciduous, WL-wetland, DST-disturbed, ROCK-rock/talus/cave.

[2] Identification unconfirmed

[3] Wildlife not recorded to species (e.g., frog sp.) are not included in totals.

Observations of most waterfowl, waterbirds, gulls, and shorebirds were restricted to wetlands, riparian/riverine, and reservoir/shoreline habitats (Table 4.3-1). Amphibians were also associated primarily with wetland and riparian/riverine habitats, although several species occurred in upland habitats as well.

Raptors and vultures were observed in or flying over nearly all habitats in the study area. The greatest number of raptor species (5) were recorded in or flying over lodgepole pine, perhaps because the open canopy resulted in greater visibility. The entire eastern shoreline of Yale Lake and portions of the adjoining slope are classified as a raptor management area (DNR 1996). This area supports breeding pairs of ospreys and bald eagles (see Section 5.3.1). Conversely, gamebirds were observed in relatively few habitats; seedling/sapling conifer stands appeared to support the greatest number of species (4) (Table 4.3-1).

Five woodpecker species were recorded in the study area in a wide variety of habitats. Pileated woodpeckers were observed on snags in wetlands and seedling/sapling conifer stands as well as in upland deciduous forests and older conifer stands. The 7 flycatcher species recorded were associated primarily with forested habitats; swallows were observed mostly in or near riparian/riverine, reservoir/shoreline, and wetland habitats. Jays, crows, and most of the passerines were ubiquitous throughout the study area, occurring in most forested habitats. The American robin and winter wren were the only 2 species that were observed in virtually every habitat (Table 4.3-1).

All of the study area, exclusive of open water, represents winter range for big game; deer and elk or their sign were recorded in the majority of habitat types. Mink and beaver were observed in several wetlands and the Douglas squirrel occurred in most forested habitats. Observations of most other mammal species were few (Table 4.3-1).

Twenty WDFW priority species were identified in study area habitats, including the following:

- Cascades torrent salamander*
- Van Dyke's salamander*
- bufflehead
- wild turkey
- wood duck*
- great blue heron
- Vaux's swift
- Pacific western big-eared bat*
- elk*
- black-tailed deer*
- Larch Mountain salamander*
- common loon
- band-tailed pigeon
- blue grouse
- hooded merganser*
- bald eagle*
- northern spotted owl
- pileated woodpecker
- mink
- osprey* (proposed to be removed from PHS list)

Observations of juveniles during the 1996-1998 studies suggested that at least 9 WDFW priority species—3 amphibian, 3 bird, and 3 mammal species—reproduce in or near the study area (indicated by asterisk above). Although not observed, it is likely that 5 additional priority species—the band-tailed pigeon, great blue heron, northern spotted owl, pileated woodpecker, and mink—breed in the project vicinity.

4.3.2 Amphibians and Reptiles

Amphibian and reptile surveys in 1996 and 1997 confirmed the presence of 14 of the 16 amphibian species that potentially occur in the study area and 4 of the 8 reptile species. The only 2 amphibian species that were not confirmed were the long-toed salamander and Cascades frog. The absence of the Cascades frog was not surprising since this species typically occurs at elevations above 2,000 feet (Leonard et al. 1993). The long-toed salamander, however, is generally widespread throughout the Northwest (Leonard et al. 1993) and likely occurs in the study area. Several eggs thought to be those of the long-toed salamander were observed in 1 wetland during 1996-1997 surveys, but species identification could not be confirmed. Of the 8 reptile species that potentially occur in the study area, 4—the northwestern garter snake, rubber boa, northern alligator lizard, and painted turtle—were observed during field surveys. Several garter snakes not identified to species were also noted. The following sections summarize the observations of amphibians and reptiles in the study area. Survey data specific to amphibians and reptiles are presented in Appendix 4.3-2.

4.3.2.1 Amphibians

Although the annual fluctuations of Yale Lake limit amphibian use of the reservoir, abundant and diverse amphibian populations were noted in virtually all of the surveyed wetlands, tributary streams/riparian habitat, rock talus areas, and mature and old-growth forests within the study area (Tables 4.3-1 and 4.3-2). Several terrestrial salamander species were also noted in younger successional forests and disturbed sites, including the face of Yale Dam. Three designated WDFW priority species were observed, including the Larch Mountain salamander, Van Dyke's salamander, and Cascade torrent salamander (see Figure 5.3-1 in Section 5.0). The following sections summarize observations for each of the habitat groups in the study area—lake drawdown zones, wetlands/ponds, streams/riparian area, and upland sites.

Lake Drawdown Zone

The annual water level fluctuation of Yale Lake and generally steep shorelines virtually eliminate suitable aquatic amphibian breeding habitat in the lake itself. Other than the Beaver Bay wetland, only two small areas in the drawdown zone have wetland vegetation: a site near Yale Park and an area near Cougar Creek Campground. During transect surveys of the drawdown zone, breeding rough-skinned newts were observed in a small puddle on the south shore. No other amphibians were noted in the drawdown zone, although it is possible that red-legged frogs and northwestern salamanders also use small puddles for egg deposition, as both species were noted in numerous locations near the lake. It is unlikely that any successful amphibian reproduction occurs. The small number of eggs that are deposited in the drawdown zone by these three species are likely killed when Yale Lake fills in early to mid May. Western red-backed salamanders and ensatinas are the other terrestrial species most likely to occur near the lake shoreline. These species are not likely to be affected by the lake fluctuations.

Wetland/Pond Habitats

Results of the 1996-1997 surveys indicate that wetlands and ponds in the Yale study area provide breeding habitat for at least 5 amphibian species-the northern red-legged frog, northwestern salamander, rough-skinned newt, Pacific chorus frog, and bullfrog; and possibly 6, if the unconfirmed observation of the long-toed salamander is included (Table 4.3-2). Amphibians were found in a total of 14 wetlands and ponds. Two of these wetlands—Beaver Bay and IP—are directly connected to Yale Lake but have beaver dams that maintain relatively constant water levels; the other wetlands/ponds are isolated from the reservoir and have hydrology regimes that are independent of project operations. All wetlands/ponds with evidence of breeding amphibians had shallow water habitat with abundant submerged and/or emergent vegetation and fine woody debris (branches and twigs) that provided cover and egg attachment sites.

Table 4.3-2. Results of amphibian and reptile surveys in wetlands and pond habitats in the Yale Hydroelectric Project study area.

Site	Survey Methods/Effort	Year	Species Observed	Life Stage	Number
Frazier Creek Wetland	Seasonal Survey (auditory)	1996	Bullfrog Garter snake (sp.)	Adult Adult	4 1
	Egg Mass Survey	1997	Northwestern salamander Rough-skinned newt	Eggs Adult	113 2
	48 Trap-nights (24 traps x 2 nights)	1997	Rough-skinned newt Northwestern salamander Bullfrog	Adult Neotenic Larvae Tadpole/Adult	58 48 10/3
Beaver Bay Wetlands	56 Trap-nights, Seasonal Survey (auditory)	1996	Rough-skinned newt Pacific chorus frog Red-legged frog	Adult (aquatic phase) Adult Adult/Tadpole/Eggs	2 3 1/3/Many
	Egg Mass Survey	1997	Red-legged frog	Eggs	5 masses
IP Wetlands	1 day Electroshocking, Incidental	1996	Northwestern salamander Rough-skinned newt Bullfrog Pacific chorus frog	Larvae Adult (aquatic phase) Juvenile Adult	3 3 approx. 20 1
	Egg Mass Survey	1997	Red-legged frog Northwestern salamander Rough-skinned newt	Eggs Eggs Adults	68 masses 8 masses 9
	48 Trap-nights (24 traps x 2 nights)	1997	Rough-skinned newt Northwestern salamander Red-legged frog	Adult Neotenic Larvae Tadpole	12 12 228
Swift Wetlands	58 Trap-nights	1996	Northwestern salamander Rough-skinned newt Pacific chorus frog Red-legged frog	Neotenic Larvae Adult (aquatic phase) Adult/tadpoles Tadpoles	5 34 2/16 2
	Egg Mass Survey	1997	Red-legged frog Long-toed salamander[1] Northwestern salamander Rough-skinned newt	Eggs Eggs Eggs Adults	56 masses 1 mass 6 masses 18
Bypass Reach Pond	1 day Electroshocking	1996	Northwestern salamander	Larvae	4
	Egg Mass Survey	1997	Red-legged frog Northwestern salamander	Eggs Eggs	31 14
Swift Canal Ponds	Egg Mass Survey	1997	Red-legged frog	Eggs	4 masses
Yale Pond	Egg Mass Survey	1997	Red-legged frog Northwestern salamander	Eggs Eggs	8 masses 4
Crossroad Pond	Egg Mass Survey	1997	Northwestern salamander	Eggs	2
Chestnut Pond	Egg Mass Survey	1997	Red-legged frog Northwestern salamander Rough-skinned newt	Eggs Eggs Adults	5 masses 1 mass

Table 4.3-2. Results of amphibian and reptile surveys in wetlands and pond habitats in the Yale Hydroelectric Project study area (continued)

Site	Survey Methods/Effort	Year	Species Observed	Life Stage	Number
Wallow Pond	Egg Mass Survey	1997	Northwestern salamander Rough-skinned newt Red-legged frog	Eggs Adults Eggs	2 23 1
Road Pond	Egg Mass Survey	1997	Red-legged frog Northwestern salamander	Eggs Eggs	1 mass 2 masses
Bankers Pond	Egg Mass Survey	1997	Red-legged frog	Eggs	25 masses
Winter Creek Wetland	Egg Mass Survey	1997	Red-legged frog	Adult	1
IP Road jeep trail ephemeral pond	Egg Mass Survey	1997	Red-legged frog Northwestern salamander Rough-skinned newt	Eggs Eggs Adult	10 masses 5 masses 3

[1] Identification not confirmed.

Three of the 4 major wetland complexes in the study area—Frazier Creek, IP, and Swift—had large numbers of individual amphibians and egg masses observed (Table 4.3-2). Notably, bullfrogs were observed only at the Frazier Creek and IP wetland complexes. Bullfrogs were numerous in Frazier Creek wetland and the only other amphibian species observed-the northwestern salamander and rough skinned newt-are toxic and often coexist with bullfrogs. Noticeably fewer bullfrogs were observed in the IP wetland complex, and this species currently appears to be restricted to the 2 portions bordering the IP Road. In addition to bullfrogs, rough-skinned newts, and northwestern salamanders, the IP wetland complex also supports red-legged frogs. Most red-legged frog egg masses were observed in the upstream portion of the wetland that was somewhat separated from the areas with bullfrogs. This portion of the wetland had greater tree and shrub cover and less open water.

The Swift and Beaver Bay wetland complexes and the smaller isolated wetlands and ponds in the study area seem free of bullfrogs. Numerous fish, including stickleback, sculpin, dace, sucker, lamprey (*Lampetra* sp.), and brook trout, were found in Beaver Bay wetland, which nonetheless also supported red-legged and Pacific chorus frogs, as well as rough-skinned newts. The dense vegetation and complex of ponds and flowing water apparently provide cover sufficient to protect amphibians from predation (Richter and Azous 1995). The Swift wetland complex appears free of fish and provided habitat for red-legged frogs, northwestern salamanders, newts, and possibly, long-toed salamanders. Several eggs found in this wetland were tentatively identified as those of the long-toed salamander but not confirmed. A number of the other smaller permanently flooded wetlands, including the complex of ponds southwest of Yale Dam, and ephemeral ponds (i.e., 1 along a jeep trail between the IP Road and Yale Lake) in the study area also appear to be used for breeding by red-legged frogs and northwestern salamanders. The number of egg masses found in the small ponds was usually less than 10; however, a small pond in the floodplain of the Swift bypass reach had 31 red-legged frog and 14 northwestern salamander egg masses.

Instream, Streamside/Riparian, and Lotic Habitats

Streams surveyed during 1996-1997 amphibian studies ranged from large, low gradient streams, such as lower Cougar, Speelyai, Dog, Ole, and Rain creeks, to small, high gradient streams, including the 13 IP streams. In all, 14 amphibian species were observed in or near streams and riparian habitat in the study area (Table 4.3-1). The most common species in and along the smaller creeks included Cascade torrent salamanders, western red-back salamanders, tailed frogs, and Cope's and/or Pacific giant salamanders (Table 4.3-3). Red-legged frogs, rough-skinned newts, ensatina, and Pacific chorus frogs were occasionally observed in or near the streams as well. Adult Cascade torrent salamanders were found in 15 of the 20 stream segments surveyed; larvae were seen in only 6, likely due to their habit of burrowing deep into stream substrate. Cope's giant salamander larvae/neotenes were documented in 7 high-gradient IP streams (Table 4.3-3); adult forms of this species are rarely seen (Leonard et. al. 1993). Tailed frogs and larval/neotenic Pacific giant salamanders were found in only 3 and 2 study area creeks, respectively (see Figure 5.3-1 in Section 5.0). Both species were documented in IP-7 and Ole Creek; the tailed frog was also observed in the Swift bypass reach. One adult Pacific giant salamander was noted along IP-7. It should be noted that larval tailed frogs and giant salamanders may have been under-represented during surveys of the larger streams due to the difficulty of sampling in higher flows and/or lower densities of individuals.

The 13 small tributaries to Yale Lake along the IP road support large amphibian populations, in particular Cascade torrent, Cope's giant, and western red-backed salamanders (Table 4.3-3). The numerous small pools, segments with bedrock substrate, seeps, and waterfalls associated with most of the IP tributaries appeared to provide optimal habitat for salamanders. Several of the smaller IP streams actually supported larger numbers of individuals than the larger streams (e.g., Rain and Speelyai creeks) in the study area. Along these smaller streams, Cascade torrent and western red-backed salamanders were most common. IP-5 and IP-7, which drain the largest areas and have the highest instream flows, had the greatest observed species richness.

The greatest amphibian density in the study area was associated with a large seep/ talus/riparian site near the bridge over the Swift bypass reach (Table 4.3-3). This site has a perennial stream of water (at least 10 cfs) that emerges from the base of a basalt cliff and flows through loose talus and boulders in the riparian zone before entering the bypass reach. The entire site is shaded by a dense alder overstory. Ninety-three western red-backed and 55 Cascade torrent salamanders were observed during 3 surveys of the 50 ft x 200 ft site.

The instream habitats in the lower portions of Cougar Creek, a major tributary to Yale Lake, did not appear to support large numbers of aquatic amphibians. However, the riparian habitat and associated beaver ponds do provide habitat for 5 amphibian species—red-legged frogs, rough-skinned newts, ensatinas, Cascade torrent salamanders,

Table 4.3-3. Results of amphibian and reptile surveys in instream, streamside/riparian, and lotic habitats in the Yale Hydroelectric Project study area.

Site	Survey Methods/Effort (date)	Year	Species Observed	Life Stage	Number
Lower Cougar Creek	Streamside (4/7, 4/29, and 10/23) Instream (8/18)	1997	Red-legged frog Cascade torrent salamander Western red-backed salamander Ensatina Rough-skinned newt	Adult/Tadpole Adult Adult/Juvenile Adult/Juvenile Adult	1/5 3 22/2 10/1 3
Cougar Creek Headwaters (includes springs)	Streamside (4/10, 4/29, and 10/21) Instream (8/21)	1997	Red-legged frog Cascade torrent salamander Western red-backed salamander Ensatina Rough-skinned newt Giant salamander (sp.)	Adult Adult Adult/Juvenile Adult Adult Larvae	1 85 47/1 2 3 1
Cougar Creek Headwaters	Electroshocking of 150 ft (9/11)	1996	Cascade torrent salamander	Adult	2
Panamaker Creek	Streamside (4/7, 4/11, 4/29, and 10/23) Instream (8/18)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Ensatina Northern alligator lizard	Adult Adult Adult Adult Adult	1 26 3 1 1
Panamaker Creek	Electroshocking of 2,600 ft (9/10)	1996	No species observed		
Dog Creek	Instream survey of 1,400 ft (8/21)	1997	No species observed		
	Electroshocking of 2,523 ft (9/10)	1996	No species observed		
Speelyai Creek	Streamside (4/4) Instream (8/21)	1997	Ensatina Pacific chorus frog Garter snake (sp.)	Adult Adult Adult	4 1 1
Ole Creek	Streamside (4/7) Instream (8/21)	1997	Red-legged frog Tailed Frog	Adult Larvae	3 3
	Electroshocking of 5,535 ft (9/9)	1996	Pacific giant salamander Cascade torrent salamander Red-legged frog Northwestern garter snake	Larvae Adult Adult Adult	2 1 2 1
Rain Creek	Streamside (4/7)	1997	Western red-backed salamander	Adult	2
	Electroshocking of 2,500 ft (9/9)	1996	No species observed		
Bypass Reach Bridge Seeps	Total Search of Seep (4/8, 4/28, and 10/22)	1997	Western red-backed salamander Cascade torrent salamander	Adults/Juvenile Adults/Larvae	92/1 53/2
Swift Bypass Reach	Electroshocking (10/17)	1996	Red-legged frog Tailed frog	Adult Tadpole	1 4

Table 4.3-3. Results of amphibian and reptile surveys in instream, streamside/riparian, and lotic habitats in the Yale Hydroelectric Project Study Area (continued).

Site	Survey Methods/Effort (date)	Year	Species Observed	Life Stage	Number
IP-1	Streamside (4/8, 4/30, and 10/20) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Cope's giant salamander Giant salamander (sp.)	Adults/Larvae Adults/Juvenile Adult Larvae Larvae	42/6 24/5 2 9 1
IP-2	Streamside (4/7, 4/30, and 10/20) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander	Adult Adult	22 11
IP-3	Streamside (4/9, 5/1, and 10/20) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Cope's Giant salamander	Adult Adult/Juvenile Adult Larvae	63 19/1 4 2
IP-4	Streamside (4/9, 5/1, and 10/20) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Ensatina	Adult Adult/Juvenile Adult Adult	5 35/5 1 1
IP-5	Streamside (4/10, 5/1, and 10/21) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Cope's giant salamander giant salamander (sp.)	Adult/Larvae Adult/Juvenile Adult Larvae Larvae	52/3 16/6 1 10 1
IP-6	Streamside (4/8, 4/30, and 10/21) Instream (8/19)	1997	Cascade torrent salamander Western red-backed salamander Cope's giant salamander	Adult/Juvenile Adult Larvae	6/1 13 1
IP-7	Streamside (4/10, 5/2, and 10/22) Instream (8/20)	1997	Red-legged frog Cascade torrent salamander Western red-backed salamander Cope's giant salamander Pacific giant salamander Giant salamander (sp.) Tailed Frog Ensatina	juvenile Adult/Larvae Adult Larvae Larvae/adult Larvae Adult/Juvenile/ Tadpole Adult	1 41/2 101 5 2/1 6 1/3/3 1
IP-8	Streamside (5/2 and 10/22) Instream (8/20)	1997	Cascade torrent salamander Western red-backed salamander Cope's Giant salamander Pacific chorus frog	Adult/Larvae Adult/Juvenile Larvae Juvenile	46/1 21/1 6 1

Table 4.3-3. Results of amphibian and reptile surveys in instream, streamside/riparian, and lotic habitats in the Yale Hydroelectric Project Study Area (continued).

Site	Survey Methods/Effort (date)	Year	Species Observed	Life Stage	Number
IP-9	Streamside (4/8, 5/1, and 10/21) Instream (8/20)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Red-legged frog Ensatina	Adult Adult/Juvenile Adult Adult Adult	4 15/2 4 1 3
IP-10	Streamside (4/8, 4/30, and 10/23) Instream (8/20)	1997	Cascade torrent salamander Western red-backed salamander Rough-skinned newt Cope's giant salamander Ensatina	Adult Adult/Juvenile Adult Larvae Adult	10 21/1 1 2 1
IP-11	Streamside (4/3, 4/30, and 10/23) Instream (8/20)	1997	Cascade torrent salamander Western red-backed salamander	Adult/Larvae Adult	10/5 7
IP-13	Instream survey of 300 ft (8/22)	1997	Bullfrog Pacific chorus frog Rough-skinned newt	Adult Adult Adult	6 6 26

and western red-backed salamanders (Table 4.3-3). The Cougar Creek headwaters springs and surrounding riparian and old-growth forest appear to supports a large population of Cascade torrent salamanders and western red-backed salamanders. During 3 surveys of this area, 85 Cascade torrent salamanders and 48 western red-backed salamanders were observed (Table 4.3-3). The other creeks that drain into Yale Lake—Dog, Speelyai, Ole, and Rain—have been heavily impacted by land use activities and do not support particularly diverse or abundant amphibian populations (with the exception of the upper reaches of Ole Creek).

Upland Sites

Talus sites in the study area generally supported western red-backed salamanders, ensatina, and rough-skinned newts (Table 4.3-4). Cascade torrent salamanders were sometimes found at talus sites that had seeps or water sources nearby. Two other fully terrestrial salamander species-the Van Dyke's salamander and Larch Mountain salamander—were found at 2 of the sampled talus sites (see Figure 5.3-1 in Section 5.0). Adult and juvenile Van Dyke's salamanders were found at a talus site just north of the Swift No. 2 Canal. This site is a south-facing slope near the edge of the old lava flow and consists mostly of large boulders. Smaller-sized talus occurs immediately below a large cliff to the north and a mostly subterranean stream runs beneath the site. Adult and juvenile Larch Mountain salamanders were found in the talus that composes the face of Yale Dam and in the adjacent cliff/talus on the south side of the dam. It is likely that Yale Dam site was colonized by salamanders that emigrated from the nearby cliff and talus habitat. The only other site in the study area known to support Larch Mountain salamanders is Moss Cave, which was documented by the WDFW and USFS (letter from

L. Adkins, Cartographer, WDFW, Olympia, Washington, October 18, 1996; letter from L. Guggenmos, Cartographer, WDFW, Olympia, Washington, January 25, 1999). Van Dyke's and Larch Mountain salamanders are both TES species and additional information is provided in Section 5.0.

Table 4.3-4. Results of terrestrial amphibian and reptile surveys in the upland habitats in the Yale Hydroelectric Project study area.

Site	Survey Method/Effort	Year	Species Observed	Life Stage	Number
Face of Yale Dam & adjacent cliff	5 m-wide transects (4/4 and 4/28)	1997	Western red-backed salamander Larch Mountain salamander Ensatina Northern alligator lizard Rubber boa	Adult Adult/Juvenile Adult Adult Adult	8 4/1 1 1 1
Swift Canal Rock/Talus	Total Area Search of seeps/5-m-wide transects in talus (10/21 and 11/3)	1997	Western red-backed salamander Cascade torrent salamander Ensatina Rough-skinned newt Van Dyke's salamander	Adult/Juvenile Adult Adult/Juvenile Adult Adult/Juvenile	13/2 3 3/2 1 1/1
Lava Flow	10-m-wide transects (4/8 and 4/28)	1997	Western red-backed salamander Ensatina	Adult/Juvenile Adult	31/1 4
Northern IP Old-Growth	10-m-wide transects (4/9, 4/28, and 11/3)	1997	Pacific chorus frog Red-legged frog Ensatina Western red-backed salamander	Adult Adult Adult Adult/Juvenile	1 1[1] 8 9/1
Southern IP Old-Growth	10-m-wide transects (4/10, 4/28, and 11/3)	1997	Pacific chorus frog Ensatina Western red-backed salamander Rough-skinned newt	Adult Adult/Juvenile Adult/Juvenile Adult	2 27/7 2
Cougar Creek Talus	Total Area Search of talus (4/7 and 4/29)	1997	Western red-backed salamander Garter snake (sp.)	Adult Adult	7 1
IP-10 Talus	Total Area Search of talus (4/30)	1997	Western red-backed salamander	Adult/Juvenile	1/1
Cougar Creek Mature/Old-Growth	10-m-wide transects (4/10 and 4/29)	1997	Western red-backed salamander Ensatina Rough-skinned newt	Adult Adult Adult	18 1 1
IP-4 Mature/Old-Growth	10-m-wide transects (4/8-4/9)	1997	Western red-backed salamander Ensatina	Adult Adult	6 1

[1] Observed incidentally

Old-growth and mature conifer forest habitats in the study area supported western red-backed salamanders, ensatina, rough-skinned newts, Pacific chorus frogs, and a few red-legged frogs. It is likely that red-legged frogs were more common but went undetected;

this species tends to be cryptic when away from breeding sites. Adult northwestern salamanders probably also inhabit the forests in the study area but were undetected due to their subterranean habits. Several amphibian species were also observed in other forested habitats. Western red-backed salamanders and Pacific chorus frogs were noted in mid-successional forests and mixed deciduous/conifer forests and Pacific chorus frogs and bullfrogs were documented in upland deciduous forests (Table 4.3-1).

4.3.2.2 Reptiles

Reptiles in the study area appear to be restricted to relatively dry, open habitats. A single rubber boa was found on Yale Dam but likely occurs in other talus habitats. Of the 5 northern alligator lizards observed, 3 were in talus sites; 1 was along the transmission line ROW; and 1 was found along Panamaker Creek, on a wide boulder-dominated shoreline. Although not commonly observed, garter snakes were occasionally seen near wetlands and in rock/talus sites (Table 4.3-1). Painted turtles were noted at the Frazier Creek wetland during seasonal surveys.

4.3.3 Birds

A total of 113 bird species were recorded in the study area during 1996, 1997, and 1998; of these, 38 were recorded only during seasonal surveys. Thirteen bird species were documented that are WDFW priority species including the following (see Figure 5.3-1 in Section 5.0):

- common loon
- band-tailed pigeon
- wild turkey
- blue grouse
- bufflehead
- wood duck
- hooded merganser
- great blue heron
- bald eagle
- osprey
- northern spotted owl
- Vaux's swift
- pileated woodpecker

Pooling data across all habitat types and all seasons, the most commonly observed species in the study area was the winter wren, with 238 observations, followed by the Swainson's thrush (187), black-throated gray warbler (163), American robin (122), and Pacific slope flycatcher (119). Multiple observations of singing males, pairs, or aggressive behavior during spring and summer surveys indicated probable breeding for all 5 of these species in the study area. Records from the Washington gap analysis indicate probable breeding only for the robin; possible breeding was indicated for the other 4 species (Smith et al. 1997). The definitions for possible, probable, and confirmed breeding were modified slightly from the Washington gap analysis (Smith et al. 1997) for use in this FTR and are as follows:

- Possible breeding: Species in suitable habitat during breeding season Singing male present

- Probable breeding: >7 singing males during 1 visit in a given habitat type
  Pair observed in suitable habitat
  Territory established
  Adults visiting probable nest site
  Agitated behavior from adults
  Nest building or excavation

- Confirmed breeding: Distraction display
  Used nest or eggshells of positive identity
  Recently fledged young incapable of sustained flight
  Occupied nest (adults entering, leaving, incubating)
  Adults delivering food to nest
  Nest with eggs or young seen or heard

A total of 97 bird species were documented in the study area during the breeding season. Of these, breeding was confirmed for the following 9 species:

- common merganser
- wood duck
- bald eagle
- downy woodpecker
- common yellowthroat
- hooded merganser
- Canada goose
- osprey
- northern flicker

The presence of adult pairs or 7 or more singing males within a habitat type during at least 1 breeding season survey suggested that a minimum of 15 additional bird species probably breed in the study area.

Species richness in all habitat types was highest during the breeding season surveys (spring and summer) and lowest during the winter. In all seasons, far more species and individuals were recorded in wetlands than in any other habitat type in the study area. This result is not unexpected given the mix of open water, emergent, shrub, and forest that characterize the 4 large wetlands selected for the seasonal surveys. Results of the seasonal surveys for birds in each habitat are summarized below. Specific data for each plot and survey are provided in Appendix 4.3-3.

4.3.3.1 Conifer Forests

In general, the 6 conifer forest types in the study area—old-growth, mature, lodgepole pine, mid-successional, pole, seedling/sapling—supported a similar number and mix of bird species during the breeding season, despite differences in successional stage (Tables 4.3-5 and 4.3-6). Manual (1991) found a similar lack of difference in species richness between different aged unmanaged conifer forest stands in the southern Washington Cascades. The highest breeding season species richness (N=22) and number of individuals (N=115) were observed in the seedling/sapling conifer type; the fewest number of species (N=14) and individuals (N=41) were recorded in mature stands. The 4

Table 4.3-5. Relative abundance (%) of species observed in old-growth, mature, and lodgepole pine forest in the study area for the Yale Hydroelectric Project[1].

Species	Relative Abundance (%)								
	Old Growth			Mature Conifer			Lodgepole Pine		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Raptors, Vultures, and Owls									
Bald Eagle*	2.0								
Nightjars, Swifts, and Hummingbirds									
hummingbird (sp.)							2.8		
rufous hummingbird	4.0						7.4		
black-chinned hummingbird							1.5		
Woodpeckers									
pileated woodpecker*	2.0								
downy woodpecker			3.2						
hairy woodpecker	2.0				3.1				
common flicker							2.8	2.6	
Flycatchers and Swallows									
Hammond's flycatcher	2.0			2.4			4.2		
Pacific slope flycatcher	4.0			14.6					
Jays and Crows									
scrub jay							1.5		
Steller's jay	10.0	3.9		2.4	3.1		11.3	10.5	6.7
American crow		2.0					1.5		6.7
brown creeper	8.0			4.9	3.1				
Chickadees, Wrens, Shrikes, and Thrushes									
chickadee (sp.)		7.8	12.9		18.8			18.4	
black-capped chickadee	8.0		6.5	12.2	3.1		1.5		
mountain chickadee								5.3	
chestnut-backed chickadee	14.0	3.9		22.0		13.3	4.2	13.2	
red-breasted nuthatch	6.0	3.9		4.9			1.5		
winter wren	10.0	31.4	32.3	22.0	18.8	26.7	1.5		6.7
golden-crowned kinglet	8.0	33.3	25.8	2.4	46.9	46.7	4.2	21.5	13.3
ruby-crowned kinglet								5.3	
Swainson's thrush				2.4			1.5		
varied Thrush		3.9	9.7						
American robin	4.0	3.9	9.7				9.9	15.8	
Vireos and Warblers									
warbling vireo							2.8		
black-throated gray warbler	2.0	2.0		2.4			4.2		
Hermit warbler				2.4					
Heto warbler	2.0			2.4					

Table 4.3-5. Relative abundance (%) of species observed in old-growth, mature, and lodgepole pine forest in the study area for the Yale Hydroelectric Project[1] (continued).

Species	Relative Abundance (%)								
	Old Growth			Mature Conifer			Lodgepole Pine		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
MacGillivary's warbler	2.0								
Grosbeaks, Buntings, and Sparrows									
evening grosbeak		2.0							
dark-eyed junco	2.0				3.1	13.3	35.2	7.9	66.7
white-crowned sparrow							1.5		
song sparrow		2.0							
Blackbirds, Orioles, and Finches									
western tanager	8.0			2.4					
Total No. of Species	19	12	7	14	8	4	19	9	5
Total No. of Individuals	0	51	31	41	32	15	71	38	15
Mean Species Richness	3.3	4.2	2.0	3.3	3.8	1.5	3.6	6.3	1.3

*WDFW Priority Species

[1] Relative Abundance was calculated by dividing the number of individuals of each species observed by the total number of individuals of all species recorded over all surveys by season. There were four breeding season, two fall, and two winter surveys conducted.

other conifer forest types supported between 17 and 21 species during the breeding season. Mean species richness during the breeding season ranged from 3.3 to 5.8 species/2.5-acre survey plot (Tables 4.3-5 and 4.3-6). Unmanaged conifer stands in the southern Washington Cascades supported similar numbers of species but typically had higher mean species richness (Manual 1991). Manual's study (1991), however, included many more survey sites over a much wider elevational gradient.

Most of the species observed in conifer stands during the breeding season are widely distributed in the forests of western Washington (Brown 1985; Manual 1991). Eight species—the Pacific slope flycatcher, Steller's jay, chestnut-backed chickadee, black-capped chickadee, winter wren, golden crowned kinglet, American robin, and western tanager—were observed in at least 5 of the 6 conifer types (Tables 4.3-5 and 4.3-6). The winter wren was 1 of the most commonly observed species in all types except seedling/sapling and lodgepole pine stands. The winter wren was also reported by Manual (1991) as the most abundant species in unmanaged conifer stands in the southwestern Cascades. The ubiquitous American robin was the most common species in seedling/sapling stands during the breeding season; white-crowned sparrows and willow flycatchers, both species which are typically associated with open, brushy areas (Brown 1985) were nearly equally as abundant (Table 4.3-6). The dark-eyed junco was the most frequently observed species in lodgepole pine stands. Several of the more uncommon species observed included the sharp-shinned hawk, pileated woodpecker, and ruffed grouse (Table 4.3-6).

Table 4.3-6. Relative abundance (%) of species observed in mid-successional, pole, and seedling/sapling forest in the study area for the Yale Hydroelectric Project[1].

Species	Relative Abundance (%)								
	Mid-Successional			Pole Conifer			Seedling/Sapling		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Raptors, Vultures, and Owls									
sharp-shinned hawk							0.9		
common raven		1.4							
Gamebirds									
ruffed grouse							0.9		
band-tailed pigeon*							0.9		
Nightjars, Swifts, and Hummingbirds									
rufous hummingbird	0.9						0.9		
Woodpeckers									
woodpecker (sp.)		1.4							
red-breasted sapsucker							0.9		
pileated woodpecker						3.8			
hairy woodpecker	0.9	1.4					2.8	2.8	
common flicker					2.4		3.5		
Flycatchers and Swallows									
Hammond's flycatcher	0.9								
Pacific slope flycatcher	11.1			21.5			0.9		
willow flycatcher				1.3			13.9		
Jays and Crows									
Steller's jay	3.7	5.8	7.0	3.8	9.5	3.8	3.5	2.8	
Chickadees, Wrens, Shrikes, and Thrushes									
chickadee (sp.)						15.4			
black-capped chickadee	2.8			3.8			3.5		
chestnut-backed chickadee	7.4	5.8	9.3	12.7	9.5	26.9	6.1	8.3	30.8
red-breasted nuthatch				1.3					
winter wren	28.7	39.1	30.2	17.7	16.7	11.5		41.7	23.1
golden-crowned kinglet	1.9	43.5	44.2	7.6	50.0	30.8		22.2	30.8
ruby-crowned kinglet								2.8	
Swainson's thrush	6.5			5.1			3.5		
varied thrush		1.4			7.1			2.8	
American robin	0.9			2.5	4.8		14.8	2.8	
Vireos and Warblers									
warbling vireo				1.3					
Hutton's vireo								2.8	
black-throated gray warbler	16.7			6.3					

Table 4.3-6. Relative abundance (%) of species observed in mid-successional, pole, and seedling/sapling forest in the study area for the Yale Hydroelectric Project[1] (continued).

Species	Relative Abundance (%)								
	Mid-Successional			Pole Conifer			Seedling/Sapling		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
MacGillivary's warbler							8.7		
Wilson's warbler	3.7			1.3					
cedar waxwing	0.9						4.3		
Grosbeaks, Buntings, and Sparrows									
black-headed grosbeak	0.9			2.5					
spotted towhee	3.7			3.8			2.6		
song sparrow	1.9						1.7	5.6	
dark-eyed junco	0.9		9.3	1.3		7.7	11.3		15.4
white-crowned sparrow	0.9						12.2		
Blackbirds, Orioles, and Finches									
western tanager	3.7			6.3			3.5		
purple finch	0.9						0.9		
Total No. of Species	21	8	5	17	7	7	22	10	4
Total No. of Individuals	108	69	43	79	42	26	115	34	13
Mean Species Richness	4.3	2.9	1.9	4.6	3.3	2.5	5.8	2.8	1.3

*WDFW Priority Species

[1] Relative Abundance was calculated by dividing the number of individuals of each species observed by the total number of individuals of all species recorded over all surveys by season. There were four breeding season, two fall, and two winter surveys conducted.

Three WDFW priority species—the pileated woodpecker, bald eagle, and band-tailed pigeon-were observed during breeding season surveys in conifer forest types.

These three priority species, as well as the northern spotted owl, were also frequently observed incidentally in conifer types (Table 4.3-1). The spotted owl was seen in a mature conifer stand; the pileated woodpecker and band-tailed pigeon were noted in a wide variety of conifer types (see Figure 5.3-1 in Section 5.0).

Breeding in conifer forest types was confirmed for 2 species—the bald eagle and northern flicker. Bald eagles nested in old-growth forest near 1 of the survey plots. The northern flicker was observed nesting in a snag in seedling/sapling habitat. The presence of at least 7 singing males or adult pairs during 1 or more breeding season survey suggested probable breeding in conifer forest types by the following 6 species:

- winter wren - mid-successional conifer
- black-throated gray warbler - mid-successional conifer
- Pacific slope flycatcher - pole conifer
- dark-eyed junco - lodgepole pine
- willow flycatcher - seedling/sapling
- American robin - seedling/sapling

Species richness in all conifer forest types decreased precipitously between the breeding season, fall, and winter surveys (Tables 4.3-5 and 4.3-6). Fall species richness ranged from 7 to 12, and was highest in old growth and seedling/sapling forests. During the fall, the winter wren and/or the golden crowned kinglet were most commonly observed in all conifer types except lodgepole pine, where chickadees were most abundant (Tables 4.3-5 and 4.3-6). Winter species richness was uniformly low, ranging from 4 to 7; the winter wren, golden-crowned kinglet, and chestnut-backed chickadee were most abundant in all but lodgepole forest, where the dark-eyed junco was most common (Tables 4.3-5 and 4.3-6).

4.3.3.2 Mixed Conifer/Deciduous Forest

A total of 25 species and 105 individuals were recorded in mixed conifer/deciduous forest stands during the breeding season surveys; 10 and 5 species were observed in the fall and winter, respectively (Table 4.3-7). Species richness in mixed conifer/deciduous stands was higher than any of the conifer forest types and slightly lower than the upland deciduous forest (Tables 4.3-5 through 4.3-7). The Pacific slope flycatcher was the most common species during the breeding season, representing 20 percent of all observations. The presence of at least 7 singing males during 1 or more spring/summer surveys indicates that this species probably breeds in the mixed conifer/deciduous forests in the study area. The next most common species were the winter wren and black-throated gray warbler, with relative abundance of about 13 and 11 percent, respectively. During the fall and winter, the winter wren was the most frequently recorded species, as it was in many forested habitats.

One WDFW priority species—the band-tailed pigeon—was noted incidentally in mixed conifer/deciduous forest (Table 4.3-1; see Figure 5.3-1 in Section 5.0).

4.3.3.3 Upland Deciduous Forest

A total of 28 bird species and 199 individuals were documented using the upland deciduous forest habitat type during the breeding season (Table 4.3-7). There was considerable variation in vegetation, slope, and aspect among the 6 upland deciduous survey plots (see Section 2.3.1.3). Similarly, the number of species detected during the 4 breeding season surveys ranged from 2 to 10 per plot, with a mean of 5.5 species/plot/survey. The Pacific slope flycatcher was the only species documented at least once in all 6 plots; this species composed approximately 16 percent of all observations during the breeding season. Other common species during the breeding season were the song sparrow and winter wren, representing nearly 13 and 11 percent of all individuals, respectively. There were 4 species that were observed at only 1 of the 6 plots during the breeding season surveys (see Appendix 4.3-3). The Pacific slope flycatcher, winter wren, and song sparrow probably breed in the upland deciduous forests in the study area. The pileated woodpecker was the only WDFW priority species observed in upland deciduous forests during breeding surveys. The band-tailed pigeon was noted incidentally (see Table 4.3-1; Figure 5.3-1 in Section 5.0).

Table 4.3-7. Relative abundance (%) of species observed in mixed conifer, riparian, and upland deciduous types at the Yale Project[1].

Species	Relative Abundance (%)								
	Mixed Conifer/Deciduous			Riparian Deciduous			Upland Deciduous		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Waterfowl and Waterbirds									
mallard				1.7		12.5			
wood duck*				0.3					
Gulls and Shorebirds									
great blue heron*					1.3				
California gull					1.3				
killdeer				1.4					
spotted sandpiper				1.4					
Raptors, Vultures, and Owls									
bald eagle*				1.0	1.3				
red-tailed hawk					2.6				
osprey[#]				0.3	1.3				
turkey vulture				0.3					
Pigeons and Doves									
mourning dove					1.3				
Nightjars, Swifts, and Hummingbirds									
belted kingfisher				1.4	1.3				
rufous hummingbird				0.3					
black-chinned hummingbird							1.0		
hummingbird (sp.)				0.7					
Woodpeckers									
red-breasted sapsucker				0.3					
common flicker	1.0	3.0		1.0	1.3			1.6	
woodpecker (sp.)				0.3					
pileated woodpecker*				0.3			1.5		
hairy woodpecker							0.5	1.6	1.6
downy woodpecker		3.0		0.7			0.5		
Flycatchers and Swallows									
flycatcher (sp.)	1.9								
Hammond's flycatcher	2.9			0.3			2.5		
Pacific slope flycatcher	20.0			3.4			15.8		
willow flycatcher	3.8			1.7			1.0		
tree swallow				2.4					
violet green swallow				15.9					
cliff swallow				13.4					

Table 4.3-7. Relative abundance (%) of species observed in mixed conifer, riparian, and upland deciduous types at the Yale Project (continued).

Species	Relative Abundance (%)								
	Mixed Conifer/Deciduous			Riparian Deciduous			Upland Deciduous		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
barn swallow				5.9					
northern rough-winged swallow				7.9					
Jays and Crows									
Steller's jay	1.9			2.4	3.9		1.0	3.3	1.6
American crow	1.9			2.1	22.1		1.5		
brown-headed cowbird				1.0			1.0		
common raven				0.7		25.0			
Chickadees, Wrens, Shrikes, and Thrushes									
chickadee (sp.)	1.0	30.3	7.1					8.2	4.8
black-capped chickadee	2.9		3.6		14.3		2.0	4.9	
chestnut-backed chickadee		6.1	7.1	1.0	13.0		4.5	13.1	9.5
mountain chickadee		3.0							
white-breasted nuthatch							0.5		
winter wren	13.3	24.2	42.9	3.4	14.3	25.0	11.4	29.5	38.1
golden-crowned kinglet	3.8	15.2	10.7	1.0	9.1	37.5	2.0	26.2	15.9
ruby-crowned kinglet		6.1							
Swainson's thrush	6.7			0.3			7.4		
varied thrush			17.9					4.9	6.3
hermit thrush	1.0								
American robin	4.8	6.1		3.8	2.6		5.4		4.8
American dipper				1.0	3.9				
European starling				0.3					
Vireos and Warblers									
Hutton's vireo	1.0								
warbling vireo	6.7			1.7			4.5		
warbler (sp.)							0.5		
orange crowned warbler				0.3					
black-throated gray warbler	11.4			1.7			7.9		
yellow warbler	1.0			1.4					
MacGillivary's warbler	1.9								
Wilson's warbler	1.0			0.3			2.5		
common yellowthroat				1.7			1.0		
cedar waxwing	1.9			0.7					
Grosbeaks, Buntings, and Sparrows									
black-headed grosbeak							1.0		

Table 4.3-7. Relative abundance (%) of species observed in mixed conifer, riparian, and upland deciduous types at the Yale Project (continued).

Species	Relative Abundance (%)								
	Mixed Conifer/Deciduous			Riparian Deciduous			Upland Deciduous		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
spotted towhee							4.5		
song sparrow	1.0		3.6	2.1	3.9		12.9	1.6	9.5
dark-eyed junco	3.8	3.0	7.1	1.0			1.0	4.9	7.9
white-crowned sparrow	1.0			3.8					
western wood pee-wee							0.5		
Blackbirds, Orioles, and Finches									
western tanager	2.9			1.7			3.0		
American goldfinch				2.4					
Total No. of Species	25	10	8	46	17	4	28	11	10
Total No. of Individuals	105	33	28	287	76	8	199	61	63
Mean Species Richness	6.3	2.7	2.3	8.7	5.5	1.0	5.5	2.8	2.3

* WDFW Priority Species

[#] Osprey is currently being reviewed for removal from the WDFW priority species list (pers. comm., N. Nordstrom, PHS Program, WDFW, Olympia, Washington, February 4, 1999).

[1] Relative Abundance was calculated by dividing the number of individuals of each species observed by the total number of individuals of all species recorded over all surveys by season. There were four breeding season, two fall, and two winter surveys conducted.

As in other forest types, species richness in upland deciduous forests in the fall and winter was low; 11 and 10 species were documented, respectively (Table 4.3-7). The winter wren and golden-crowned kinglet were the most frequently observed species in both seasons. During the fall, each upland deciduous forest plot supported between 1 and 7 species, with a mean of 2.8 species/plot/survey (Table 4.3-7).

4.3.3.4 Riparian Deciduous Forest

Forty-six bird species and 207 individuals were recorded using riparian deciduous forests during the breeding season (Table 4.3-7); as many as 16 species were documented along a single transect (see Appendix 4.3-3). Mean breeding season species richness was 8.7 species/transect, the highest of any forest type in the study area. The high overall and mean species richness recorded for riparian deciduous forests is most likely the result of the proximity of this type to water. However, 10 species were seen only once during the 4 breeding surveys, suggesting transitory use of this habitat by about 22 percent of the species observed. No single species was observed along all 4 transects in riparian forests. The violet green swallow, cliff swallow, American robin, and western tanager were seen along each of the 3 transects in the Swift bypass reach during at least 1 of the breeding season surveys (see Appendix 4.3-3). Overall, swallows dominated the species composition in this habitat; 5 swallow species represented more than 45 percent of all individuals observed and likely breed in or near riparian habitat. Four WDFW priority species were observed in riparian deciduous forests during the breeding season-the wood duck, bald eagle, osprey, and pileated woodpecker (see Figure 5.3-1 in Section 5.0).

A total of 17 species were recorded in riparian deciduous habitats during the fall, more than in any other upland habitat type in the study area except wetlands (Table 4.3-7). The American crow was most common, representing over 22 percent of the observations. An additional 42 percent of the observations consisted of just 3 species-the chestnut-backed chickadee, black-capped chickadee, and winter wren. The bald eagle, osprey, and great blue heron, all WDFW priority species, were also observed at least once during fall surveys (see Figure 5.3-1 in Section 5.0). Winter species richness in riparian deciduous forests was as low as in other forest types in the study area. Only 8 individuals of 4 species were observed-winter wrens, mallards, golden-crowned kinglets, and common ravens.

4.3.3.5 Shrubland

Twenty bird species and 77 individuals were documented in shrubland habitats during the breeding season (Table 4.3-8). Between 1 and 7 species were detected at a given shrubland plot during breeding season surveys; mean species richness was 4.0 species/plot/survey. Nine species, nearly half of those documented during the breeding season, were detected only once and probably represent transitory use of this type (see Appendix 4.3-3). The black-throated gray warbler and winter wren probably breed in shrubland habitat. The black-throated gray warbler accounted for over 27 percent of all individuals detected in shrublands; the winter wren was also relatively abundant, representing about 18 percent of the observations (Table 4.3-8).

During the fall, 7 species and 76 individuals were observed in shrubland habitats. Three of these species—the golden crowned kinglet, winter wren, and chestnut backed chickadee—accounted for nearly 90 percent of the observations. Six species were observed during winter surveys; the golden-crowned kinglet and winter wren were most common (Table 4.3-8).

4.3.3.6 Meadow

A total of 16 species and 50 individuals were documented during the breeding season in the 1 meadow habitat plot that was sampled (Table 4.3-8). Nine species were observed only once, generally in the shrubs or trees on the edge of the meadow (see Appendix 4.3-3). Most of these species are more typically associated with forest or shrub habitats but may forage along the edges of open areas. The most abundant species were the willow flycatcher and common yellowthroat, which represented over 50 percent of the individuals observed in this wet meadow during the breeding season. Two other species typically associated with more open habitats—MacGillivary's warbler and Wilson's warbler—were also observed several times during breeding season surveys. Breeding was confirmed for the common yellowthroat in meadow habitat; the presence of pairs and/or 7 or more singing males during spring/summer surveys indicated probable breeding for the willow flycatcher and Wilson's warbler.

Table 4.3-8. Relative abundance (%) of species observed in shrublands, meadows, and reservoir/shoreline habitats in the study area for the Yale Hydroelectric Project[1].

	Relative Abundance (%)								
	Shrubland			Meadow			Reservoir		
Species	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Waterfowl and Waterbirds									
western grebe							0.6	13.5	6.1
pied-billed grebe								1.0	
double-crested cormorant							0.6	5.2	3.0
American wigeon								16.7	
bufflehead*								8.3	
common merganser							2.6	10.4	9.1
common loon*							0.3	1.0	
mallard							0.3		6.1
waterfowl (sp.)									39.4
Gulls and Shorebirds									
glaucous-winged gull								3.1	
ring-billed gull								2.1	
California gull								1.0	
great blue heron*							1.0	15.6	
spotted sandpiper							0.3	1.0	
killdeer							0.3		3.0
gull (sp.)								2.1	
Raptors, Vultures, and Owls									
bald eagle*								4.2	21.2
osprey[#]							3.9	2.1	
common raven									
Nightjars, Swifts, and Hummingbirds									
belted kingfisher							0.6	1.0	
rufous hummingbird	1.3			2.0			0.3		
Woodpeckers									
pileated woodpecker*							0.3		3.0
common flicker		2.6							
downy woodpecker							0.3		
Flycatchers and Swallows									
Hammond's flycatcher	1.3						0.3		
Pacific slope flycatcher	3.9			2.0			1.6		
willow flycatcher				30.0			1.0		
olive-sided flycatcher				2.0					
swallow (sp.)							17.9		
tree swallow							0.6		

Table 4.3-8. Relative abundance (%) of species observed in shrublands, meadows, and reservoir/shoreline habitats in the study area for the Yale Hydroelectric Project[1] (continued).

	Relative Abundance (%)								
	Shrubland			Meadow			Reservoir		
Species	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
violet green swallow							3.2		
cliff swallow							17.9		
barn swallow				4.0			7.1		
northern rough-winged swallow							15.6		
Jays and Crows									
Steller's jay	2.6	2.6	4.2	4.0		33.3	1.6	1.0	
American crow							0.3	3.1	
common raven							1.6		
Chickadees, Wrens, Shrikes, and Thrushes									
black-capped chickadee				2.0			0.6		
chestnut-backed chickadee	9.1	12.8						3.1	
red-breasted nuthatch	1.3								
winter wren	18.2	28.2	25.0		15.4	33.3	1.0	3.1	
golden-crowned kinglet	1.3	48.7	54.2	2.0					
Swainson's thrush	6.5						1.9		
varied thrush		2.6					0.3		
American robin			4.2			33.3	2.6		
cedar waxwing				4.0			1.6		
American dipper							0.3	1.0	
Vireos and Warblers									
solitary vireo							0.3		
Hutton's vireo			4.2						
warbling vireo	1.3						1.9		
black-throated gray warbler	27.3			2.0			0.3		
MacGillivary's warbler	2.6			8.0					
Wilson's warbler	7.8			10.0			0.6		
Nashville warbler	1.3								
yellow warbler	1.3								
common yellowthroat				22.0			0.6		
Grosbeaks, Buntings, and Sparrows									
black-headed grosbeak	3.9								
evening grosbeak	1.3								
spotted towhee	3.9	2.6			30.8				
song sparrow					38.5		2.3		9.1
dark-eyed junco	1.3		12.5	2.0			0.6		

Table 4.3-8. Relative abundance (%) of species observed in shrublands, meadows, and reservoir/shoreline habitats in the study area for the Yale Hydroelectric Project[1] (continued).

	Relative Abundance (%)								
	Shrubland			**Meadow**			**Reservoir**		
Species	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**
white-crowned sparrow				2.0			3.2		
golden-crowned sparrow					15.4				
Blackbirds, Orioles, and Finches									
western tanager	2.6			2.0			0.3		
American goldfinch							0.6		
Total No. of Species	20	7	6	16	4	3	42	21	9
Total No. of Individuals	77	39	24	50	13	6	308	96	12
Mean Species Richness	4.0	2.8	1.7	6.3	2.5	1.5	5.3	2.5	13.2

*WDFW Priority Species

[#] Osprey is currently being reviewed for removal from the WDFW priority species list (pers. comm., N. Nordstrom, PHS Program, WDFW, Olympia, Washington, February 4, 1999).

[1] Relative Abundance was calculated by dividing the number of individuals of each species observed by of all species recorded over all surveys by season. There were four the total number of individuals breeding season, two fall, and two winter surveys conducted.

Four species—the golden crowned sparrow, winter wren, spotted towhee, and song sparrow—were observed during fall surveys in meadow habitat. All of these species were observed in the shrubs and small trees on the edge of the meadow. Interestingly, none of these species used meadow habitat during the breeding season. Three species were observed in meadow habitat during the 1997 and 1998 winter surveys.

4.3.3.7 Reservoir/Shoreline

Forty-two bird species were observed using the reservoir and adjacent shoreline habitat during the breeding season. Various species of swallows accounted for a majority of the observations (63 percent) and probably breed in or near reservoir/shoreline habitat. No other species comprised more than 4 percent and 14 species were observed only once, suggesting relatively high transitory use (Table 4.3-8). Between 0 and 17 species were seen at a given reservoir/shoreline point; the mean breeding season species richness was 5.3 species/point/survey. Breeding in reservoir/shoreline habitat was confirmed for 1 species-the common merganser. Three WDFW priority species were documented in reservoir/shoreline habitats during the breeding season-the common loon, pileated woodpecker, and great blue heron (see Figure 5.3-1 in Section 5.0).

During the fall, 21 species were observed at the reservoir/shoreline points; mean species richness was low—only 2.5 species/point/survey. Fall observations were predominately waterfowl, waterbirds, gulls, and shorebirds; collectively this group of 14 species represented 80 percent of the individuals seen. Of these, the great blue heron and American widgeon were the most common, accounting for over 30 percent of the observations. Only 9 species were seen using reservoir/shoreline habitats during the winter; waterfowl represented over 70 percent of the observations (Table 4.3-8).

4.3.3.8 Wetlands

Breeding Season

Seasonal wildlife surveys were conducted in the 4 major study area wetlands-Swift, IP, Beaver Bay, and Frazier Creek. A total of 62 bird species and 571 individuals were recorded during the breeding season in wetland habitats, more than in any other cover type in the study area (Table 4.3-9). However, species richness and number of individuals observed is not directly comparable between wetland and upland habitats. Ranging from 7 to 39 acres, the 4 wetlands surveyed are substantially larger than the 2.5-acre plots established in upland habitats. They also include several different habitat types (e.g., open water, emergent wetland, shrub-scrub wetland); upland plots encompassed single types. Although wetlands are generally known to be heavily used by wildlife (Brown et al. 1985), the larger size and combination of habitats that characterize study area wetlands probably contribute to their high species richness relative to uplands.

Between 4 and 16 species were recorded along wetland transects during the 4 breeding season surveys (see Appendix 4.3-3); mean species richness was 11 species/transect/survey. Six species—the song sparrow, rufous hummingbird, belted kingfisher, American robin, northern rough-winged swallow, and common yellowthroat—were observed at all 4 wetlands during the breeding season (Table 4.3-9). As with riparian deciduous habitats, there was no 1 taxon that dominated the breeding season species composition in wetlands. The song sparrow was the most abundant species, representing slightly more than 10 percent of the individuals seen. The red-winged blackbird, American robin, and Canada goose each represented nearly between 5 and 8 percent of the individuals during the breeding season. Observation of nests, flightless young, pairs, and/or multiple singing males suggested probable (P) or confirmed (C) breeding by at least 13 species in study area wetlands (Appendix 4.3-3). These species are as follows

- downy woodpecker (C)
- tree swallow (P)
- violet green swallow (P)
- American robin (P)
- cedar waxwing (P)
- European starling (P)
- red-winged blackbird (P)
- willow flycatcher (P)
- song sparrow (P)
- mallard (P)
- hooded merganser (C)
- wood duck (C)
- Canada goose (C)

Of the 4 wetlands surveyed, Beaver Bay had the greatest breeding season species richness-46-about twice the number observed in the other 3 wetlands, which each supported between 22 and 28 species (Table 4.3-9). Beaver Bay also had the greatest number of individuals observed–224. At 36 acres, Beaver Bay is considerably larger than any of the other 3 wetlands and consists of all 4 palustrine wetland types, including

Table 4.3-9. Relative abundance (%) of species observed in wetlands in the study area for the Yale Hydroelectric Project[1]

	Relative Abundance (%)														
	Swift Wetland			IP Wanted			Beaver Bay Wetland			Frazier Creek Wetland			Total Wetland		
Species	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Waterfowl and Waterbirds															
Canada goose	4.3		7.0				10.7						5.1		
mallard	8.7	10.7	11.6			9.5	1.3	4.4	9.5	1.9	20.6	9.9	2.8	10.7	14.4
American wigeon		8.3									23.5			8.3	
blue-winged teal		5.0												5.0	
wood duck*							0.4			16.9		1.2	4.9		0.5
ring-necked duck		4.1									8.8	8.6		4.1	3.2
lesser scaup		1.7									5.9			1.7	
bufflehead*		0.8	14.0									55.6		0.8	25.0
common merganser	2.6												0.5		
hooded merganser*	0.9	6.6		4.2						11.9	23.5	4.9	4.0	6.6	1.9
Gulls and Shorebirds															
gull (sp.)							0.4						0.2		
great blue heron*		0.8	2.3				2.2		3.2	0.6			1.1	0.8	1.9
green-backed heron			2.3				0.4						0.2		
killdeer	7.0												1.4		0.5
spotted sandpiper	0.9												0.2		
common snipe			2.3							0.6			0.2		
Raptors, Vultures, and Owls															
osprey#							1.3						0.5		
common raven							1.3						0.5		
red-tailed hawk						4.8			1.6						0.9
American kestrel		0.8						2.2						0.8	
bald eagle*		0.8	2.3					2.2	1.6					0.8	0.9
Nightjars, Swifts, and Hummingbirds															
belted kingfisher	3.5	4.1	11.6	1.4			0.4	6.7	1.6	5.0	2.9		2.5	4.1	1.9
hummingbird (sp.)							0.9						0.4		
rufous hummingbird	0.9		16.3	5.6			0.4			0.6			1.2		
Woodpeckers															
red-breasted sapsucker							0.9						0.4		
pileated woodpecker*				1.4		4.8							0.2		0.5
common flicker		3.3					0.9	6.7	3.2	1.9	2.9		0.9	3.3	1.4

Table 4.3-9. Relative abundance (%) of species observed in wetlands in the study area for the Yale Hydroelectric Project[1] (continued).

	Relative Abundance (%)														
	Swift Wetland			IP Wanted			Beaver Bay Wetland			Frazier Creek Wetland			Total Wetland		
Species	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
downy woodpecker				1.4			3.6						1.6		
hairy woodpecker			2.3	1.4			0.4						0.4		
woodpecker (sp.)									1.6	0.6			0.2		0.5
Flycatchers and Swallows															
Pacific slope flycatcher				2.8			0.9						0.7		
willow flycatcher	3.5						6.3			3.8			4.2		
flycatcher (sp.)			7.0												0.5
western wood-pewee															
swallow (sp.)							0.4						0.2		
tree swallow	0.9			2.8						12.5			4.0		
violet green swallow	6.1						3.1			1.3			2.8		
northern rough-winged swallow	7.0		4.7	2.8			2.7						2.8		
Jays and Crows															
Steller's jay		7.4			5.0		1.3	13.3	12.7	1.9	5.9	3.7	1.1	7.4	5.1
American crow		8.3	2.3	1.4			1.3				2.9		0.7	0.8	0.5
brown-headed cowbird	1.7						0.9			0.6			0.9		
Chickadees, Wrens, Shrikes, and Thrushes															
chickadee (sp.)		0.8												0.8	
black-capped chickadee		6.6		2.8			1.8	17.8	1.6				1.1	6.6	0.5
chestnut-backed chickadee		3.3		1.4	10.0			4.4					0.2	3.3	
red-breasted nuthatch							0.4						0.2		
winter wren		4.1			10.0	14.3	1.3	4.4			2.9	9.9	0.5	4.1	5.1
marsh wren		1.7						4.4		1.3			0.4	1.7	
golden-crowned kinglet				1.4					14.3			3.7	0.2		5.6
ruby-crowned kinglet		0.8						2.2						0.8	
Swainson's thrush			4.7	9.7			1.3			0.6			1.9		
varied thrush		2.5				14.3		6.7	3.2					2.5	2.3
American robin	3.5	1.7		6.9	5.0	4.8	6.7	2.2	12.7	3.8			5.3	1.7	5.6
cedar waxwing				11.1			4.0			8.8			5.4		

Table 4.3-9. Relative abundance (%) of species observed in wetlands in the study area for the Yale Hydroelectric Project[1] (continued).

	Relative Abundance (%)														
	Swift Wetland			IP Wanted			Beaver Bay Wetland			Frazier Creek Wetland			Total Wetland		
Species	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**	**Breeding Season**	**Fall**	**Winter**
European starling	0.9						1.3			5.6			2.3		
American dipper		1.7												1.7	
bushtit							1.8						0.7		
Vireos and Warblers															
warbling vireo				1.4			0.9						0.5		
Hutton's vireo		0.8					0.4	2.2					0.2	0.8	
solitary vireo							0.9						0.4		
black-throated gray warbler			2.3	1.4			1.8						0.9		
yellow warbler	4.3												2.1		
yellow-rumped warbler		2.5												2.5	
Wilson's warbler				1.4			0.4						0.4		
MacGillivary's warbler				4.2						0.6			0.7		
common yellowthroat	4.3			4.2			4.0			5.0			4.4		
Grosbeaks, Buntings, and Sparrows															
black-headed grosbeak				2.8			0.9			0.6			0.9		
song sparrow	7.0	13.2	4.7	16.7	70.0	33.3	14.3	20.0	15.9	5.0		2.5	10.5	13.2	10.6
dark-eyed junco		3.3		1.4		14.3	0.4		7.9				0.4	3.3	5.1
white-crowned sparrow	0.9						1.3						0.7		
western wood pee-wee	3.5			1.4									0.9		
Blackbirds, Orioles, and Finches															
red-winged blackbird	20.9	1.7					5.8		9.5	8.1			8.8	1.7	6.0
Brewer's blackbird							0.4						0.2		
northern oriole				1.4			0.4						0.4		
Bullock's oriole				2.8									0.4		
western tanager				2.8			1.8			0.6			1.2		
American goldfinch	7.0		2.3				0.9						1.8		
purple finch													0.2		

Table 4.3-9. Relative abundance (%) of species observed in wetlands in the study area for the Yale Hydroelectric Project[1] (continued).

Species	Relative Abundance (%)														
	Swift Wetland			IP Wanted			Beaver Bay Wetland			Frazier Creek Wetland			Total Wetland		
	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter	Breeding Season	Fall	Winter
Total No. of Species	22	28	17	28	5	8	46	15	15	25	10	9	62	28	24
Total No. of Individuals	115	121	43	72	20	21	224	45	63	160	34	81	571	220	216
Mean Species Richness	12.0	7.0	9.0	11.5	3.0	5.0	9.8	4.8	4.8	12.5	6.0	6.0	11.0	5.1	12.4

*WDFW Priority Species

[#] Osprey is currently being reviewed for removal from the WDFW priority species list (pers. comm., N. Nordstrom, PHS Program, WDFW, Olympia, Washington, February 4, 1999).

[1] Relative Abundance was calculated by dividing the number of individuals of each species observed by the total number of individuals of all species recorded over all surveys by season. There were four breeding season, two fall, and two winter surveys conducted.

several large stands of palustrine forest. The diversity of wetland types, canopy layers, and plant species found in Beaver Bay is probably at least partially responsible for the high bird species richness observed at this site. The song sparrow was the most common species observed during the breeding season at Beaver Bay, IP, and Swift wetlands. Overall, breeding waterfowl use of these 3 wetlands was relatively low, ranging from 4 percent of the individuals observed at the IP wetland to about 16.5 percent at Swift. Conversely, waterfowl use of Frazier Creek wetland was relatively high, accounting for over 30 percent of the observations. The wood duck, a WDFW priority species, was the most commonly observed waterfowl species at Frazier Creek and appeared to be nesting in several of the large snags in the northwest portion of this wetland. Another WDFW priority species, the hooded merganser, was also apparently nesting at the Frazier Creek and IP wetlands and was observed once at Swift. Other WDFW priority species observed in at least 1 of the 4 wetlands during the breeding season included the great blue heron, pileated woodpecker, and osprey (see Figure 5.3-1 in Section 5.0).

Fall Season

The fall surveys indicated much lower species richness and overall abundance of birds in wetlands (Table 4.3-9). Nonetheless, 28 species and 220 individuals were observed in wetlands during the fall, considerably more than any other habitat type in the study area. In contrast to the breeding season, species richness was highest at the Swift wetland (28 species) and ranged from 5 to 15 at the other 3 wetlands. Swift wetland was the only site in the study area where more species were observed in the fall than in the summer. About 37 percent of the 121 individuals observed at Swift were represented by 7 waterfowl species, but a large number of passerine species was recorded as well. Waterfowl were also abundant at Frazier Creek; 5 species accounted for over 82 percent of the 160 individuals observed. American wigeon, blue-winged teal, and hooded merganser were the most common waterfowl at both the Frazier Creek and Swift wetlands. Conversely, relatively few waterfowl were observed at either Beaver Bay or IP during the fall. Passerines were more common at these sites, with the song sparrow most abundant (Table 4.3-9).

Winter Season

In total, 24 species were observed in wetlands during the 1997 winter survey—slightly less than the number observed in the fall, and substantially greater than winter species richness in any other habitat type. Species richness at individual wetlands, however, was relatively low, ranging from 8 and 9 at IP and Frazier Creek, respectively, to 17 at Swift (Table 4.3-9). At Frazier Creek, over 80 percent of the 81 individuals observed during the winter were waterfowl, with bufflehead, a WDFW priority species, the majority (>55 percent). Waterfowl were common at Swift as well; 2 species—the mallard and bufflehead—accounted for over 25 percent of the 43 individuals observed (see Figure 5.3-1 in Section 5.0). Conversely, only a few mallards were observed at the IP and Beaver Bay wetlands. Song sparrows represented 33 percent of the 21 individuals observed at IP. At Beaver Bay, song sparrows and golden-crowned kinglets together represented more than 30 percent of the 63 observations (Table 4.3-9).

4.3.4 Mammals

There were 13 mammal species documented in the study area during 1996-1998 field studies, including 1 bat taxon, 2 big game species, 2 aquatic furbearers, 2 medium-sized mammal species, 3 small mammal species, bobcat, coyote, and black bear (Table 4.3-1). Four of these taxa—the Pacific western big-eared bat, elk, black-tailed deer, and mink—are WDFW priority species (see Figure 5.3-1 in Section 5.0). Six of the 13 mammal species were documented in old-growth conifer and upland deciduous forest types; wetlands, shrublands, and mixed conifer forests had 4 species each. Elk and/or black-tailed deer were documented in virtually all habitats; the entire study area represents big game winter range (WDFW 1995; DNR 1996). Elk calves and deer fawns were observed on several occasions. Squirrels or chipmunks were noted in most forested habitats as well. Mink and beaver were documented primarily in wetlands.

Mammal species affected most by the continued annual water level fluctuations of Yale Lake include beaver, muskrat, river otter, weasels, and mink; some small mammals associated with riparian habitat are also likely affected to a lesser degree. Several studies have indicated that water needs to be present at least 3 months of the year to be suitable mink habitat and that under optimal conditions water is present at least 9 months. A similar trend is likely for other amphibious species. The water level fluctuations make virtually the entire shoreline unsuitable for beaver or muskrat denning. Under more stable water levels, both species may occur along protected sections of the lake. Although not confirmed, it is possible that these species den along tributaries or in nearby wetlands and use riparian forests along the lake for foraging habitat, as most of these species have been documented ranging up to 656 feet from water.

5.0 THREATENED, ENDANGERED, AND SENSITIVE WILDLIFE SPECIES

Endangered and threatened species and their habitats are protected by the ESA. FERC requires that "wildlife and botanical resources of the project and its vicinity, and of downstream areas affected by the project, including identification of any species listed as threatened or endangered by the USFWS" be described (18 CFR 4.51). In addition to species listed or proposed as threatened or endangered under the ESA, federal candidates and species of concern, as well as state listed, candidate, and monitor species, are considered significant biological resources. These species, collectively called threatened, endangered, and sensitive (TES) species in this report, receive special management by the USFS and state wildlife agencies to prevent adverse impacts that could ultimately lead to listing under the ESA.

The purpose of the TES wildlife studies was to provide the following information: (1) existing habitat, species abundance, and species distribution; (2) effects of the existing project; (3) potential effects of any proposed changes to the project; (4) potential operational modifications needed to sustain existing TES species populations; and (5) opportunities for potential protection or enhancement measures. This section describes the potential habitat for TES species in the vicinity of the Yale Project and the distribution and abundance of existing populations. Potential effects of project operations and proposed enhancement measures will be described in the Yale License Application.

5.1 STUDY AREA

The primary focus of the TES surveys was on habitats likely to support these species and any areas affected by operation of the project or proposed changes to the project. In general, surveys were conducted in the WDFW priority habitats identified in the study area, including old growth, wetlands, riparian areas, and rock/talus.

5.2 METHODS

Surveys for TES wildlife species focused on identifying potential habitat and documenting occurrence of these species in the study area. TES wildlife surveys involved the following 4 tasks: (1) identifying TES species potentially occurring in the study area, (2) planning the field surveys, (3) conducting the field surveys, and (4) documenting the results. Methods used for each of the 4 tasks are described below.

5.2.1 TES Wildlife Species Identification

The first step in the TES wildlife studies was a search of the WDFW priority habitat and species (PHS) database for records of TES wildlife in the vicinity of the Yale Project. In addition, the USFWS was requested to provide a list of any federally listed, proposed, or candidate species within the study area. Information provided by the WDFW and USFWS, as well as a review of the literature and consultation with biologists familiar with the project vicinity, identified 26 TES wildlife species that are either known to occur or potentially occur in the study area. Of these 26 TES species, the WDFW PHS has documented the occurrence of 11 in or near the study area (letter from L. Adkins, Cartographer, WDFW, Olympia, Washington, October 18, 1996; letter from L. Guggenmos, Cartographer, WDFW, Olympia, Washington, January 25, 1999). The USFWS identified 12 species as potentially occurring in the study area based on habitat and range information (letter from N. Gloman, Acting Supervisor, USFWS, Lacey, Washington, February 4, 1999).

Of the 26 TES species documented in the study area or potentially occurring, 4 are federally listed as threatened or endangered, 1 is a candidate for federal listing, 14 are designated USFWS species of concern, 6 are state listed as threatened or endangered, 8 are state listed as sensitive or monitor, and 9 are candidates for state listing (Table 5.2-1). Four species appear on both state and federal TES species lists (excluding species of concern) and 20 have also been designed as priority species by the WDFW.

5.2.2 Field Survey Planning

A literature review and interviews with local agency biologists were used to identify habitat types with a high probability of supporting TES wildfire species. This information, in combination with the vegetation cover type maps (see Section 2.0), was used to prepare working maps that depicted high probability habitat in the study area for the various TES species. The maps were used to guide field survey effort and intensity and to consult with agency biologists on specific field survey methodologies and protocols.

Field teams were trained to identify TES wildlife species and their associated habitat. Training involved reviewing morphological characteristics, behavior, and habitat characteristics for all TES species potentially occurring in the study area. In addition, field teams made reconnaissance trips to known locations of potentially suitable habitat near the study area for 3 TES amphibian species—the Cascade torrent, Van Dyke’s, and Larch Mountain salamanders—to develop search images of habitat for these species. C. Crisafulli, USFS ecologist and amphibian species expert, accompanied field teams on reconnaissance trips for Van Dyke’s and Larch Mountain salamanders and reviewed proposed survey techniques for these species.

5.2.3 Field Surveys

Survey methods used for each of the various TES wildfire species are described below and summarized in Table 5.2-2. Overall, 2 types of surveys were used to determine presence/absence of TES species in the study area—specific surveys and seasonal surveys (see Section 4.0). Specific surveys were conducted for species that either have standard survey protocols (e.g., Larch Mountain and Van Dyke’s salamanders) or are closely associated with specific habitats with well-defined boundaries (e.g., streams, wetlands, caves). Seasonal surveys were used to locate species, mostly birds, that are very mobile and more wide-ranging. No specific surveys were conducted for the Cascades frog,

Table 5.2-1. TES wildlife species known or potentially occurring in the vicinity of the Yale Project[1].

Species	TES Status[2]		Habitat[3]	Location(s)[4]
	Federal	WDFW		
Amphibians and Reptiles				
Red-legged frog (*Rana aurora*)	SC	—	Adults found in woodlands adjacent to streams; breed in marshes, ponds, lakes, slow-moving streams, swamps, bogs; sea level to 2,830 feet elevation.	WDFW has no records for this species since it has no state status and is not a priority species. Study area is within distribution and elevational range.
Cascades frog (*Rana cascadae*)	SC	—	Small pools, adjacent to streams, bogs and ponds, 2,000-6,200 feet elevation.	WDFW has no records for this species since it has no state status and is not a priority species. Study area is outside elevational range.
Oregon spotted frog* (*Rana pretiosa*)	C	C	Springs, ponds, lakes, or sluggish streams with nonwoody wetland plant communities.	Yale Lake is in historical range, but no confirmed records in study area.
Tailed frog (*Ascaphus truei*)	SC	M	Clean, cold mountain streams.	WDFW has records for several tributary streams east of Yale Lake.
Cascade torrent salamander* (*Rhyacotriton cascadae*)	—	C	Clear, cold streams, seeps, or waterfalls, particularly the splash zone; seeps through talus are ideal habitat.	WDFW has records for a tributary of Siouxon Creek, and tributary of Yale Lake.
Cope's giant salamander (*Dicamptodon copei*)	—	M	Small, rocky creeks, seeps. Adults at water margins.	WDFW has records for several tributary streams east of Yale Lake.
Larch Mountain salamander* (*Plethodon larselli*)	SC	S	Steep talus slopes where talus and decaying materials (0.5 to 2.5 inch size class) are kept moist by a covering of mosses and a dense overstory of coniferous trees.	WDFW has records for: (1) Cooney Pt. 3 miles east of Yale Lake, (2) Ole's Cave, (3) Ape Cave, and (4) Powerline Cave.
Van Dyke's salamander* (*Plethodon vandykei*)	SC	C	Splash zones of creeks or waterfalls; under rocks, woody debris, logs, or bark near water; seeps over talus or rock faces.	WDFW has records for Ole's Cave.
Northwestern pond turtle* (*Clemmys marmorata marmorata*)	SC	E	Ponds and slow moving streams with logs and rocks along shorelines.	WDFW has no records for the project vicinity.

Table 5.2-1. TES wildlife species known or potentially occurring in the vicinity of the Yale Project[1] (continued).

Species	TES Status[2]		Habitat[3]	Location(s)[4]
	Federal	WDFW		
Birds				
Common loon* (*Gavia immer*)	—	C	Remote isolated lakes.	WDFW has no records in the project vicinity.
Great blue heron* *(Ardea herodias)*	—	M	Nests in large trees near water. Forages in wetlands, along margins of lakes, rivers, reservoirs.	WDFW has no records in the project vicinity.
Harlequin duck* (*Histrionicus histrionicus*)	SC	—	Winters in ocean along rocky coasts, moves inland to nest on the ground along swift streams and rivers.	WDFW has no records in the project vicinity.
Bald eagle* (*Haliaeetus leucocephalus*)	T	T	Any area with salmon carcasses and waterfowl concentrations during winter; perch on large trees/snags near food sources; roosts are usually conifer forest with old-growth characteristics; nest in large trees near water.	WDFW and PacifiCorp have records for: (1) an active nest in 1996 and 1997 on the east side of Yale Lake; (2) communal roosts on east side of Yale Lake, and (3) winter forage area along Yale tailrace.
Northern goshawk* (*Accipter gentilis*)	SC	C	Mature and old-growth forests.	WDFW has records for an area northwest of Yale Lake.
Osprey[#] (*Pandion haliaetus*)	—	M	Nests in large trees adjacent to waterbodies that are clear and contain abundant fish.	PacifiCorp has 1996 and 1997 records for at least 6 active nest sites in the vicinity of the Yale Project.
Peregrine falcon* (*Falco peregrinus*)	E	E	Nests on cliffs near water, forages in wetlands, lakes, reservoirs.	WDFW has no records in the project vicinity.
Northern spotted owl* (*Strix occidentalis*)	T	E	Old-growth (Type A) and mature (Type B) conifer forest; require trees with cavities, broken tops, or platforms for nesting.	WDFW has not records for activity centers in the study area but there are several on nearby DNR, USFS, and Weyerhaeuser lands.
Pileated woodpecker* (*Dryocopus pileatus*)	—	C	Old-growth and mature conifer, mixed, or broadleaf forests.	WDFW has records for observations west of Yale Lake.
Vaux's swift* (*Chaetura vauxi*)	—	C	Old-growth and mature forests, often near water.	WDFW has no records in the project vicinity.
Olive-sided flycatcher (*Contopus borealis)*	SC	—	Coniferous forests and forested wetlands.	WDFW has no records for this species since it has no state status and is not a priority species. Study area is within distribution and elevational range.

Table 5.2-1. TES wildlife species known or potentially occurring in the vicinity of the Yale Project[1] (continued).

Species	TES Status[2]		Habitat[3]	Location(s)[4]
	Federal	WDFW		
Mammals				
Pacific western big-eared bat* (*Corynorhinus townsendii*, previously known as *Plecotus townsendii*)	SC	C	Underneath bridges, in cracks on rock cliffs, caves.	WDFW has records for this species for Moss Cave in the study area and several nearby.
Long-eared myotis* (*Myotis evotis)*	SC	M	Forested areas; uses caves, mines, stumps, woodpecker cavities, natural hollows, talus, bridges, and buildings for roosting.	WDFW has no records in the project vicinity but species could occur.
Long-legged myotis* (*M. volans)*	SC	M	Forested areas; uses caves, mines, woodpecker cavities, crevices, houses for roasting.	WDFW has no records in the project vicinity but species could occur.
Wolverine (*Gulo gulo lascus)*	SC	C	High elevation conifer forests and tundra, typically in areas with little human activity.	Few recent records for entire state; one historical record south of Yale Lake; unlikely to occur in project vicinity.
Fisher* (*Martes pennanti*)	SC	E	Late-successional conifer and mixed conifer-deciduous forest.	Extremely rare in Washington; unlikely to occur in project vicinity.
Gray wolf* (*Canis lupus)*	E	E	Forested habitats in areas with little human disturbance.	Most records for the state are from the North Cascades; unlikely to occur in the project vicinity.

[1] TES species listed in table are those with distributions that encompass at least a portion of the Lewis River drainage and use habitats occurring in the project vicinity.

[2] Federal Status (USFWS): **E**—listed as endangered, those species likely to become extinct within the foreseeable future; **T**— listed threatened, those species likely to become endangered within the foreseeable future; **SC**—species of concern, formerly Category 2 candidate for listing, species needs additional information to support a proposal to list as threatened or endangered; not protected under the ESA; C—candidate for listing.

WDFW Status: E-listed endangered; T-listed threatened; S-listed sensitive; C-candidate for listing as endangered, threatened, or sensitive; M-monitor species.

[3] Habitat information from Stebbins 1985; Leonard et al. 1993; Rodrick and Milner 1991; National Geographic Society 1987.

[4] Location(s) documented by WDFW Priority Habitats and Species Program or PacifiCorp.

* Indicates that species is also a state priority species.

[#] Osprey is currently being reviewed for removal from the WDFW priority species list (pers. comm., N. Nordstrom, PHS Program, WDFW, Olympia, Washington, February 4,1999).

Sources: Letter from L. Guggenmos, Cartographer, WDFW, Olympia, Washington, January 25, 1999; letter from N. Gloman, Supervisor, USFWS, Lacey, Washington, February 4, 1999; and Rodrick and Milner 1991.

Table 5.2-2. General methods used to determine use of the study area by TES wildlife species[1]

Species	Instream Surveys	Riparian/ Streamside Surveys	Lotic Habitat Surveys	Egg Mass Searches and Trapping	Upland Forest/Rock Talus/Cave Surveys	Cave Exit Surveys	Seasonal Wildlife Surveys	Helicopter Surveys
Northern red-legged frog	X	X		X				
Tailed frog	X	X						
Cascade torrent salamander	X	X	X					
Cope's giant salamander	X	X						
Larch Mountain salamander					X	X		
Van Dyke's salamander		X	X		X	X		
Northwestern pond turtle							X	
Common loon							X	
Great blue heron							X	
Harlequin duck	X	X						
Bald eagle							X	X
Northern goshawk							X	
Osprey							X	X
Peregrine falcon							X	
Northern spotted owl							X	
Pileated woodpecker							X	
Olive-sided flycatcher							X	
Vaux's swift							X	
Pacific western big-eared bat						X		
Long-eared myotis						X		
Long-legged myotis						X		

[1] No specific surveys were conducted for the Cascades frog, California wolverine, or gray wolf because it is unlikely that they occur in the study area; it is also doubtful that these species would be observed during seasonal wildlife surveys or searches for other TES species.

wolverine, or gray wolf, and it is unlikely that these species would be observed during seasonal surveys. However, the probability that any of these 3 species occurs in the study area is very low due to a lack of suitable habitat. Most of the study area is lower than the elevational range for the Cascades frog, which is rare below 1,600 feet elevation (Corkran and Thoms 1996); the wolf and wolverine are typically restricted to areas with very little human presence.

5.2.3.1 Larch Mountain Salamander and Van Dyke's Salamander

Survey protocols for the Larch Mountain and Van Dyke's salamanders have been recently developed by the USFS, BLM, and National Biological Survey and released in draft form (Survey and Manage Amphibian Subgroup [Subgroup] 1996). Specific surveys conducted in the Yale study area followed the protocols developed by the Subgroup (1996), with a few modifications, as recommended by C. Crisafulli, a USFS ecologist with expertise in surveying for these 2 species locally.

Surveys were conducted in habitats with a high probability of supporting Larch Mountain and Van Dyke's salamanders, with an emphasis on these habitats in areas potentially affected by project operations and associated developments. Both species occur in the following habitats: (1) steep rock talus slopes covered with moss and with dense tree cover; (2) mature/old-growth forests; and (3) cave entrances (Subgroup 1996). Additional habitats for Van Dyke's salamander include the following: (1) under rocks and woody debris in the splash zone of creeks and waterfalls; (2) under logs and bark near water, including lake shores; (3) seeps over talus or rock faces (lotic habitats); and (4) nearly all forest types, riparian as well as upland (Nussbaum et al. 1983; Leonard et al. 1993; Subgroup 1996). All priority habitats in the study area used by these species-rock talus slopes, cave entrances, and old growth stands-were surveyed. Surveys were also conducted in selected forest, lotic, and riparian/streamside habitats. As recommended by the protocols, surveys were conducted at least 3 times at the sites with suitable habitat to determine absence; sites with habitat determined to be unsuitable for both the Larch Mountain and Van Dyke's salamanders were surveyed at a lower intensity. Survey methods were based on the protocols developed for these 2 species and differed by habitat type, as described below.

<u>Upland Habitats</u>

Area constrained searches using belt transects arrayed in parallel were used in upland forest and rock talus/lava flow habitats to survey for both Larch Mountain and Van Dyke's salamanders (Subgroup 1996). Surveys of upland habitats were conducted in spring and fall 1997, during periods of optimal temperature and soil conditions for both species, as defined by the protocols. Specifically, surveys were conducted only under the following conditions:

- Soil under the litter was moist or wet to the touch,
- Reported local relative humidity was at least 45 percent,
- Soil temperature was between 39.2 and 59° F (4 and 15° C), and
- The previous night's air temperature was not below 32° F (0° C) (Subgroup 1996).

Nine upland sites-4 old-growth stands and 5 rock talus sites–were surveyed for Van Dyke’s and Larch Mountain salamanders (Table 5.2-3; Figure 5.2-1). Surveys at a given upland site were generally conducted 3 times unless presence of either species was confirmed. Surveys were not conducted at the entrance to the 1 known large cave in the study area to avoid disturbing the bats that use this site for day roosting. However, a number of small caves and large basalt fissures were encountered during surveys of forests and rock/talus habitats. The entrances to these sites were surveyed completely. Crew members did not enter caves, but restricted searches to the vicinity of the entrance.

In addition, the entrance to 1 large lava tube found in the lava flow was surveyed twice during the nighttime to look for eye shine from amphibians (Heyer et al. 1994).

<u>Riparian/Streamside and Lotic Habitats</u>

Surveys of riparian/streamside and lotic habitats focused on locating Van Dyke's salamanders as well as several other TES amphibian species, including the Cope’s giant salamander, Cascade torrent salamander, red-legged frog, and tailed frog. To survey lotic and riparian/streamside habitats 2 biologists walked stream shorelines and visually examined shallow pools, seeps, and under cover objects in the floodplain (Corn and Bury 1990). Any small patches of unique habitats, such as waterfalls, talus, and seeps, that were encountered were searched completely. Habitat features that were too large to survey completely were searched for at least 0.5 person-hours. A limit of 8 person-hours was established for each site/stream (Subgroup 1996); surveys ended earlier if an unsafe barrier was encountered. Three surveys were conducted in riparian/streamside and lotic habitats along 12 unnamed tributaries to the east side of Yale Lake (IP streams), the headwaters and lower portions of Cougar Creek, lower Panamaker Creek, and portions of Swift Canal and the Lewis River upstream of the reservoir (Table 5.2-3; Figure 5.2-1). Streamside/riparian areas along several other larger streams were surveyed once but were not revisited because the habitat did not appear suitable for most amphibian species (Table 5.2-3).

5.2.3.2 Red-legged, Cascades, and Oregon Spotted Frogs

An efficient method for determining presence of red-legged and other frogs is a visual search for egg masses (Thoms et al. 1997). Red-legged, Cascades, and Oregon spotted frogs typically deposit grapefruit-sized egg masses attached to vegetation in ponds or still water (Corkran and Thoms 1996; Leonard et al. 1993; Nussbaum et al. 1983; Olson and Leonard 1997). Searches for frog egg masses were conducted in 19 wetlands and ponds in the study area on March 3 and 4, 1997. Weather and water conditions at this time appeared to be conducive to breeding, which generally occurs between late January and mid-March at lower elevations (Corkran and Thoms 1996). Specific wetlands and ponds surveyed are listed below and shown in Figure 5.2-1.

Table 5.2-3. Summary of areas surveyed in 1997 for Van Dyke's, Larch Mountain, Cope's giant, and Cascade torrent salamanders and tailed frogs.

Site	Habitat Surveyed	Survey Dates	Length or Area (miles/acres)
Lower Cougar Creek	Riparian/seeps, Instream	April 7	0.6 mile
	Riparian/seeps, Instream	April 29	1.0 mile
	Instream/riparian	August 18	0.2 mile[1]
	Riparian/seeps, Instream	October 23	0.7 mile
Panamaker Creek	Riparian/seeps	April 7, 11	0.4 mile
	Riparian/seeps	April 29	0.3 mile
	Instream	August 18	0.2 mile[1]
	Riparian/seeps	October 23	0.3 mile
Dog Creek	Riparian/seeps	August 21	0.3 mile
Speelyai Creek	Riparian/seeps	April 4	0.5 mile
	Instream	August 21	0.5 mile
Cougar Creek Headwaters	Riparian/seeps/old-growth	April 10	0.3 mile
	Riparian/seeps/old-growth	April 29	0.3 mile
	Instream/seeps	August 21	0.2 mile[1]
	Riparian/seeps/old-growth	October 21	0.2 mile
12 unnamed tributaries (IP streams)	Shallow water/splash zone/ seeps/riparian	April 3-10	3.1 mile
	Shallow water/splash zone/ seeps/riparian	April 30- May 2	2.7 mile
	Instream	August 19-20	2.3 mile[1]
	Shallow water/splash zone/ seeps/riparian	October 20-23	2.5 mile
Lava flow	Basalt flow/tube entrances	April 8[2]	0.5 mile
	Basalt flow/tube entrances	April 28[2]	0.5 mile
Swift Canal Rock/Talus	Talus/seep	October 21	0.25 acre
	Talus/seep	November 3	0.25 acre
Bypass Reach Bridge Seeps	Seep/riparian	April 8	0.4 acre
	Seep/riparian	April 28	0.4 acre
	Seep/riparian	October 22	0.4 acre
IP-4 Mature/Old Growth	Forest	April 8-9	0.25 mile
Cougar Creek Talus	Talus	April 7	0.1 acre
	Talus	April 29	0.1 acre
Cougar Creek Mature/ Old Growth	Forest	April 10	0.5 mile
	Forest	April 29	0.5 mile
Northern IP Old-Growth Stand	Old-growth	April 9	1.0 miles
	Old growth	April 28	1.0 miles
	Old growth	November 3	1.0 miles
Southern IP Old-Growth Stand	Old-growth	April 10	0.5 mile
	Old-growth	April 28	0.6 mile
	Old-growth	November 3	0.5 mile

Table 5.2-3. Summary of areas surveyed in 1997 for Van Dyke's, Larch Mountain, Cope's giant, and Cascade torrent salamanders and tailed frogs (continued).

Site	Habitat Surveyed	Survey Dates	Length or Area (miles/acres)
Ole Creek	Instream/riparian	April 7	0.5 mile
	Instream/riparian	August 21	0.9 mile[1]
Rain Creek	Riparian	April 7	0.5 mile
Face of Yale Dam & adjacent cliff	Rock/talus, base of cliff	April 4	0.1 mile
	Rock/talus, base of cliff	April 28	0.1 mile

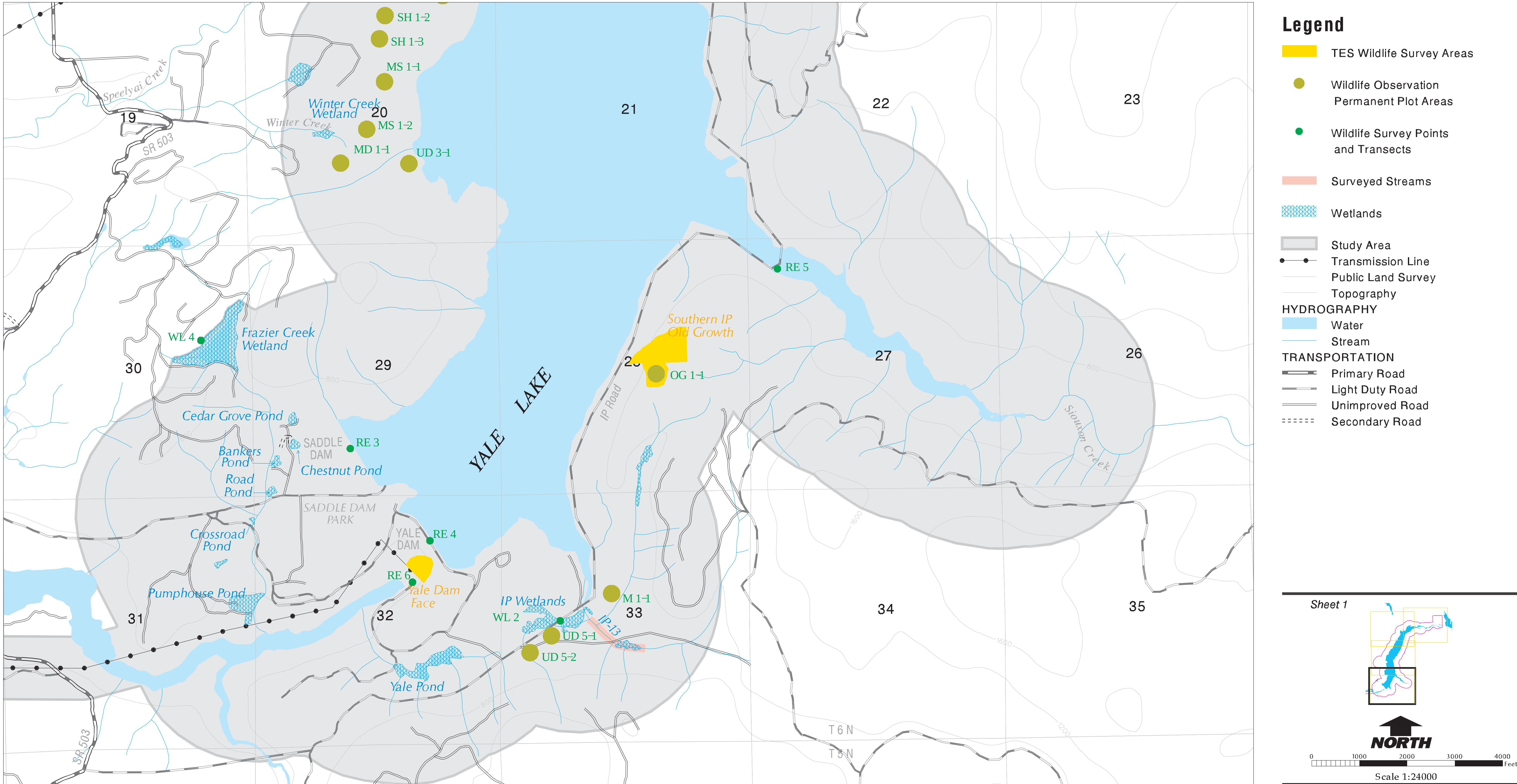
[1] 33-ft segments distributed along this distance.
[2] Included daytime transects and nighttime flashlight surveys of 1 large tube entrance.

- Beaver Bay wetland
- Winter Creek
- Swift wetlands
- IP road jeep trail (incidental)
- Swift bypass reach pond
- Swift Canal ponds
- Yale Pond #2
- Yale Pond #1
- Bankers pond
- IP wetland #1 (S of road)
- IP wetland #2 (N of road)
- IP wetland #3 (upper arm, N of road)
- IP wetland #4 (lower arm, N of road)
- Frazier Creek wetland
- Crossroad pond
- Chestnut pond
- Wallow pond
- road pond

Biologists searched for egg masses by walking along shorelines and in the shallow water zones in wetland and ponds. Egg mass searches in wetlands and ponds with poor shoreline access were conducted using a small inflatable kayak. Each egg mass found was identified to species and recorded; water depth was also measured for a sample of egg masses. Water temperature in each wetland surveyed was also recorded. Amphibian trapping conducted as part of the species/habitat studies (see Section 4.2.3.1) confirmed the presence of red-legged frogs in several wetlands and ponds and demonstrated successful reproduction.

5.2.3.3 Tailed Frog, Cope's Giant Salamander, and Cascade Torrent Salamander

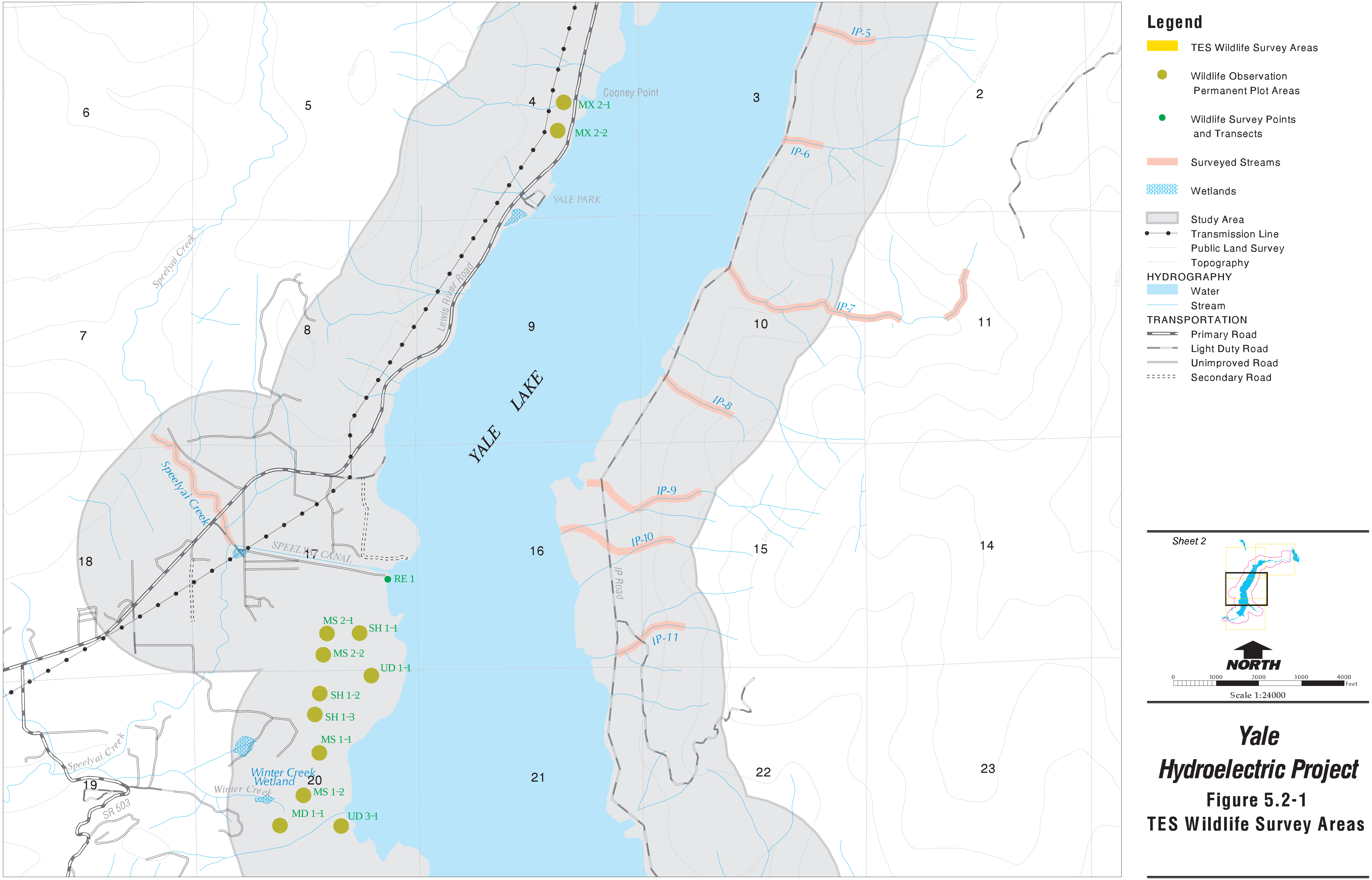
The tailed frog, Cope's giant salamander, and Cascade torrent salamander are associated with streams with clear, cold, water. Because they inhabit a range of flowing water habitat types and can be difficult to detect, presence/absence of these species was determined using the following 3 methods: (1) searches of riparian/streamside and lotic habitats; (2) instream surveys; and (3) electroshocking. Each of these methods is described below.



Yale Hydroelectric Project

Figure 5.2-1
TES Wildlife Survey Areas

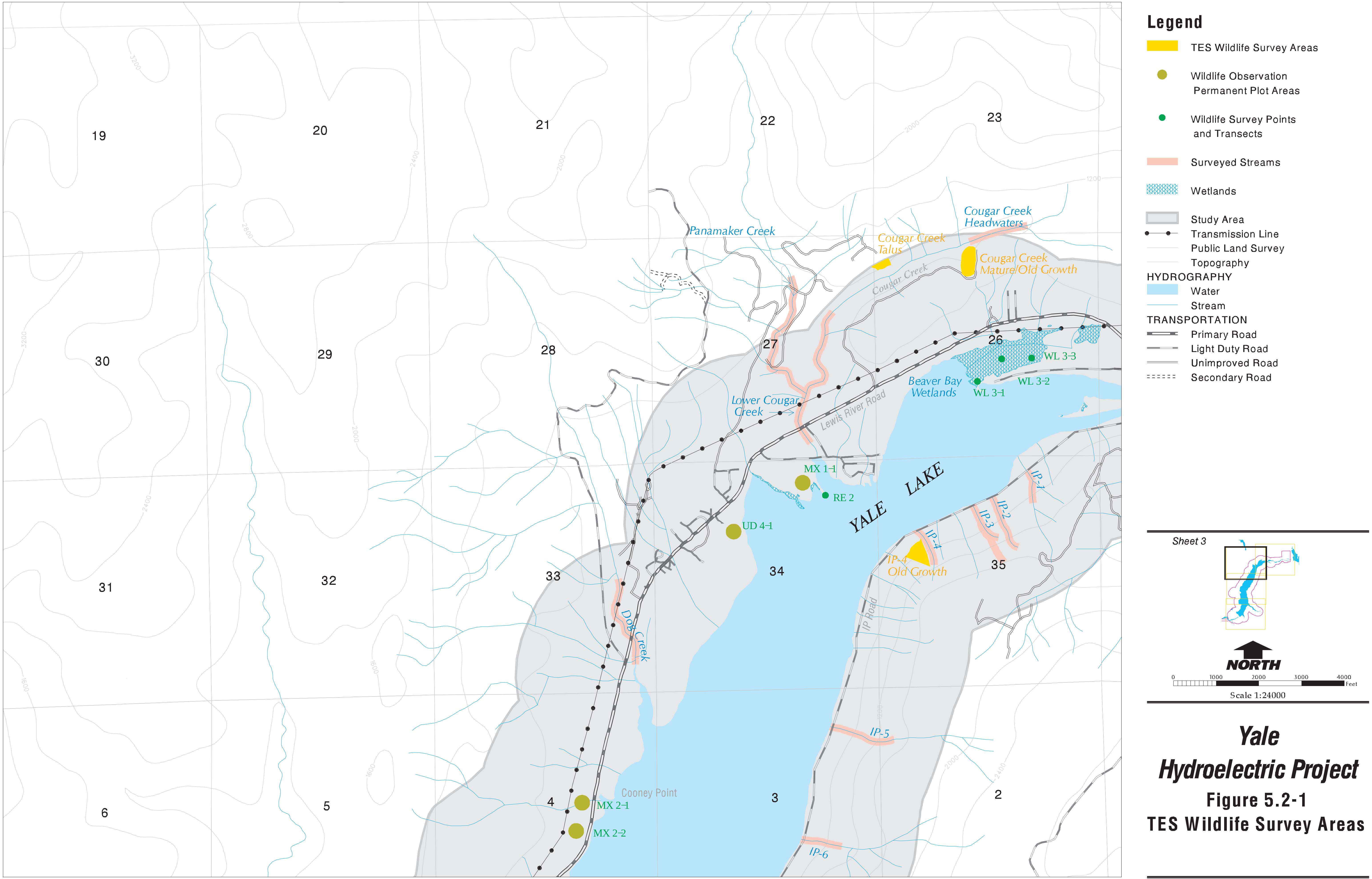
 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/wildlife_survey.batchmap April 05, 1999



Yale Hydroelectric Project

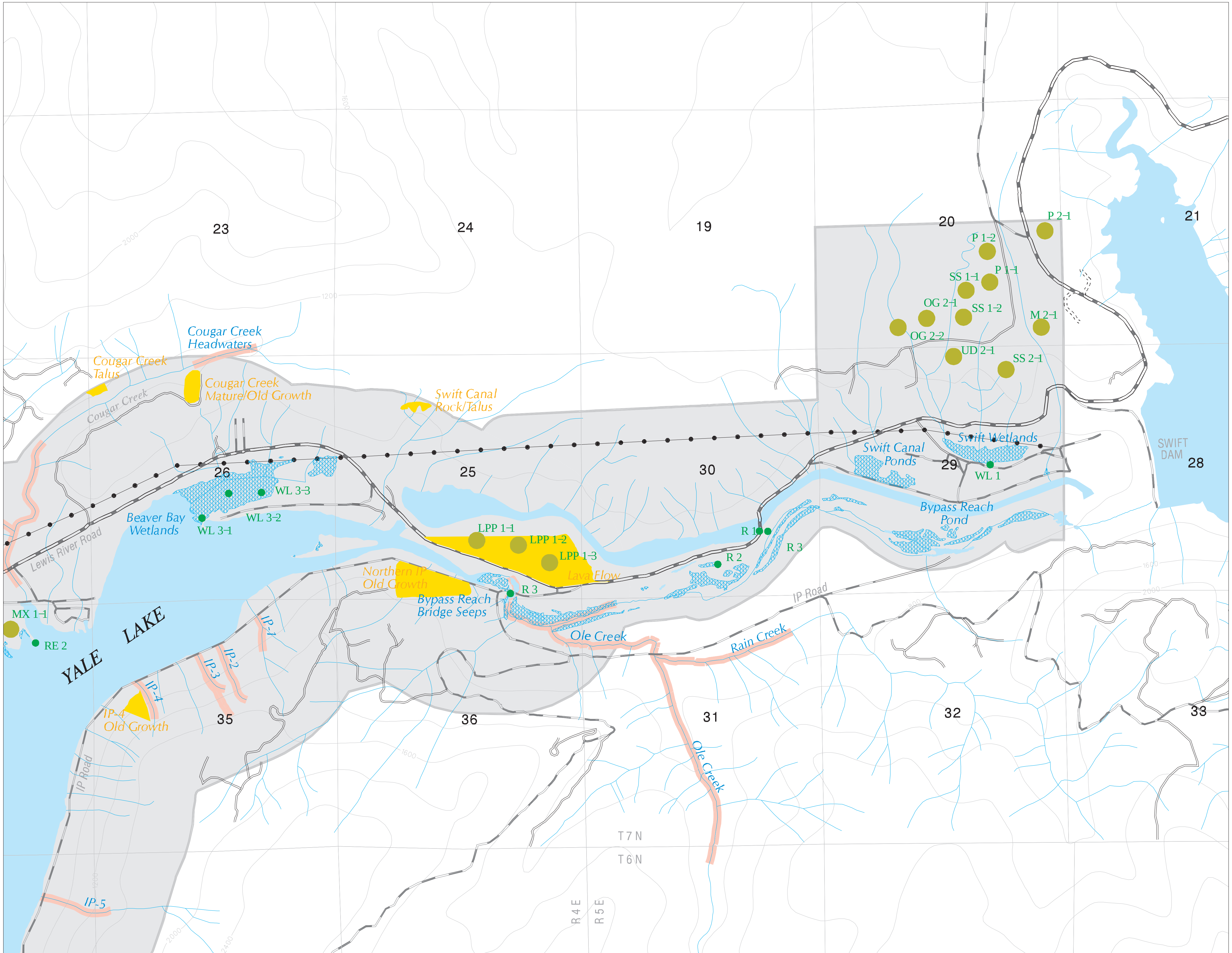
Figure 5.2-1
TES Wildlife Survey Areas

 PACIFICORP *Created by VESTRA Resources for PacifiCorp* */p1/proj_map/projects/yale/license/ftr/terrestl/wildlife_survey.batchmap* *April 05, 1999*



Yale Hydroelectric Project

Figure 5.2-1
TES Wildlife Survey Areas



Legend

- TES Wildlife Survey Areas
- Wildlife Observation Permanent Plot Areas
- Wildlife Survey Points and Transects
- Surveyed Streams
- Wetlands
- Study Area
- Transmission Line
- Public Land Survey
- Topography

HYDROGRAPHY
- Water
- Stream

TRANSPORTATION
- Primary Road
- Light Duty Road
- Unimproved Road
- Secondary Road

Sheet 4

NORTH

0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 5.2-1
TES Wildlife Survey Areas

 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/wildlife_survey.batchmap April 05, 1999

Riparian/Streamside and Lotic Habitat Searches

In riparian/streamside and lotic habitats, searches for Cope's giant salamanders, tailed frogs, and torrent salamanders were conducted in conjunction with surveys for Van Dyke's salamanders (see Section 5.2.3.1). These surveys were conducted along 12 small tributary streams (IP-1 through IP-11, and IP-13), seeps, and a portions of a several larger streams (Table 5.2-3).

Instream Surveys

Instream habitats were surveyed for Cope's giant salamanders, tailed frogs, and torrent salamanders. Surveys were conducted in most of the same streams included in the riparian/streamside and lotic habitat searches, as well as several others. Surveys were conducted during the summer when flows were low (Bury and Corn 1991; Welsh and Lind 1996). These surveys involved using drift and dip nets to intensively sample 33-foot segments of instream habitat, each spaced 500 feet apart. Biologists spent a maximum of 1 hour at each segment turning rocks looking for amphibians (Bury and Corn 1991). As 1 biologist turned rocks in the stream, the second biologist held a heavy-duty drift net immediately downstream to catch dislodged amphibians. All pebbles, cobbles, and boulders were turned and finer substrates carefully sifted by hand down to the armored streambed or to a depth of 6 inches (15 cm) (Welsh and Lind 1996). Each survey was considered complete when all habitat in this depth range has been examined.

Electroshocking

Cope's giant salamanders, tailed frogs, and torrent salamanders are cryptic and can often be overlooked in larger streams. Consequently, electroshocking is an effective tool for determining presence/absence of these species, particularly when combined with other survey methods (Bury and Corn 1991; Heyer et al. 1994). A wildlife biologist accompanied fisheries biologists conducting electroshocking studies in 6 of the major tributaries to the Yale Project-Cougar, Rain, Ole, Dog, Siouxon, and Panamaker-as well as the Swift bypass reach.

5.2.3.4 Northwestern Pond Turtle

The Yale Project is located east of the current known distribution for the northwestern pond turtle in Clark County (Brown et al. 1995), and at the higher end of the elevational range for this species (letter from L. Vigue, Biologist, WDWF, Olympia, Washington, March 12, 1998). None the less, potentially suitable habitat appears to exist in the study area. No specific surveys were conducted for the northwestern pond turtle; presence/absence of this species in the study area was determined by the seasonal wildlife surveys of wetland habitats (see Section 4.2.2; Figure 5.2-1) and observations during other field work (e.g., amphibian trapping).

5.2.3.5 Harlequin Duck

The harlequin duck winters in salt water along the coast but nests inland along swift streams. The WDFW PHS has records of observations of this species upstream of the

Yale Project and there are a few large streams in the study area that represent potential habitat. Searches for the harlequin duck were conducted in conjunction with the instream and riparian/streamside surveys conducted for TES amphibians (see Sections 5.2.3.2 and 5.2.3.3).

5.2.3.6 Common Loon and Great Blue Heron

The common loon typically breeds on remote inland lakes but may occasionally occur on Yale Lake. In contrast, the great blue heron is relatively common in western Washington and is usually seen in wetlands and along the margins of lakes, reservoirs, and rivers. No specific surveys were conducted for these species; presence/absence of the common loon and great blue heron in the study area were determined by the seasonal wildlife surveys of wetland, shoreline, and reservoir habitats (see Section 4.2.2; Figure 5.2-1) and observations during other field work.

5.2.3.7 Bald Eagle and Osprey

Use of the project vicinity by the bald eagle and osprey has been documented by PacifiCorp since 1987. Surveys are conducted by helicopter twice per year—once between January and March to document winter use by bald eagles, and once in May or June to record nesting locations for both bald eagles and ospreys. PacifiCorp and the WDFW PHS have also documented several roost sites and perch trees used by bald eagles in the study area. Helicopter surveys were conducted on February 22 and June 17, 1996 and March 11 and June 6, 1997.

5.2.3.8 Peregrine Falcon

Although there does not appear to be suitable cliff habitat in the study area for nesting, peregrine falcons are fairly wide-ranging, particularly during the winter, and observations would not be unlikely. No specific surveys were conducted for the peregrine falcon; occurrence of this species in the study area was determined by the seasonal wildlife surveys of shoreline, reservoir, and wetland habitats (see Section 4.2.2; Figure 5.2-1) and observations during other field work.

5.2.3.9 Northern Spotted Owl, Northern Goshawk, Pileated Woodpecker, Vaux's Swift, and Olive-sided Flycatcher

The northern spotted owl, northern goshawk, pileated woodpecker, Vaux's swift, and olive-sided flycatcher are all highly mobile species. The spotted owl and goshawk are generally associated with old-growth and mature forests, which are absent throughout most of the study area. The pileated woodpecker, Vaux's swift, and olive-sided flycatcher use old-growth and mature forests but are found in earlier successional stands as well. Survey protocols to document breeding activity centers have been developed for both the spotted owl and goshawk; no specific survey protocols exist for the pileated woodpecker, Vaux's swift, or olive-sided flycatcher. All 5 of these TES forest species are relatively conspicuous during the breeding season. Due to the minimal acreage of old-growth forest in the study area, no specific surveys were conducted for these species; the seasonal wildlife surveys were used to determine their occurrence in the study area (see Section 4.2.2; Figure 5.2-1). In addition, the WDFW PHS has records for several of these species in the project vicinity.

5.2.3.10 Pacific Western Big-eared Bat, Long-eared Myotis, and Long-legged Myotis

An exit survey was conducted at the 1 known cave in the study-Moss Cave (formerly known as Powerline Cave)—to determine its use by TES bats. This survey was conducted on August 12, 1997 with biologists from the Nature Conservancy and USFS. Observations were made with the assistance of night vision binoculars, from a location about 30 feet outside the cave entrance. The survey began at about 20:40 and continued until more bats were observed entering the cave than exiting. In addition, the undersides of several bridges in the study area were examined for roosting bats. The power tunnel located near Yale powerhouse was also evaluated for potential habitat and was determined to be unsuitable; it lacks an outlet and is too damp to be used as a nursery colony or communal roost.

5.2.3.11 Wolverine, Gray Wolf, and Fisher

The gray wolf, wolverine, and fisher all typically occur in areas relatively isolated from human activity. Although it is possible these species may occasionally move through the study area, it is highly unlikely that they are resident in the vicinity. No specific surveys were conducted for these species.

5.3 RESULTS AND DISCUSSION

The locations of all observations of TES species were mapped and entered into the wildlife database for the project. Of the 25 TES species documented or potentially occurring in or near the study area, 15 were observed during 1996 and 1997 field studies, including 6 amphibians, 8 birds, and 1 mammal (Table 5.3-1). Information on each of the TES species known to occur in the study area or potentially occurring is summarized below. The locations of TES species and WDFW priority species observed in the study area are shown on Figure 5.3-1. This figure also includes records from the WDFW PHS database for the study area (letter from L. Guggenmos, Cartographer, WDFW, Olympia, Washington, January 25, 1999).

5.3.1 Federally Listed Species

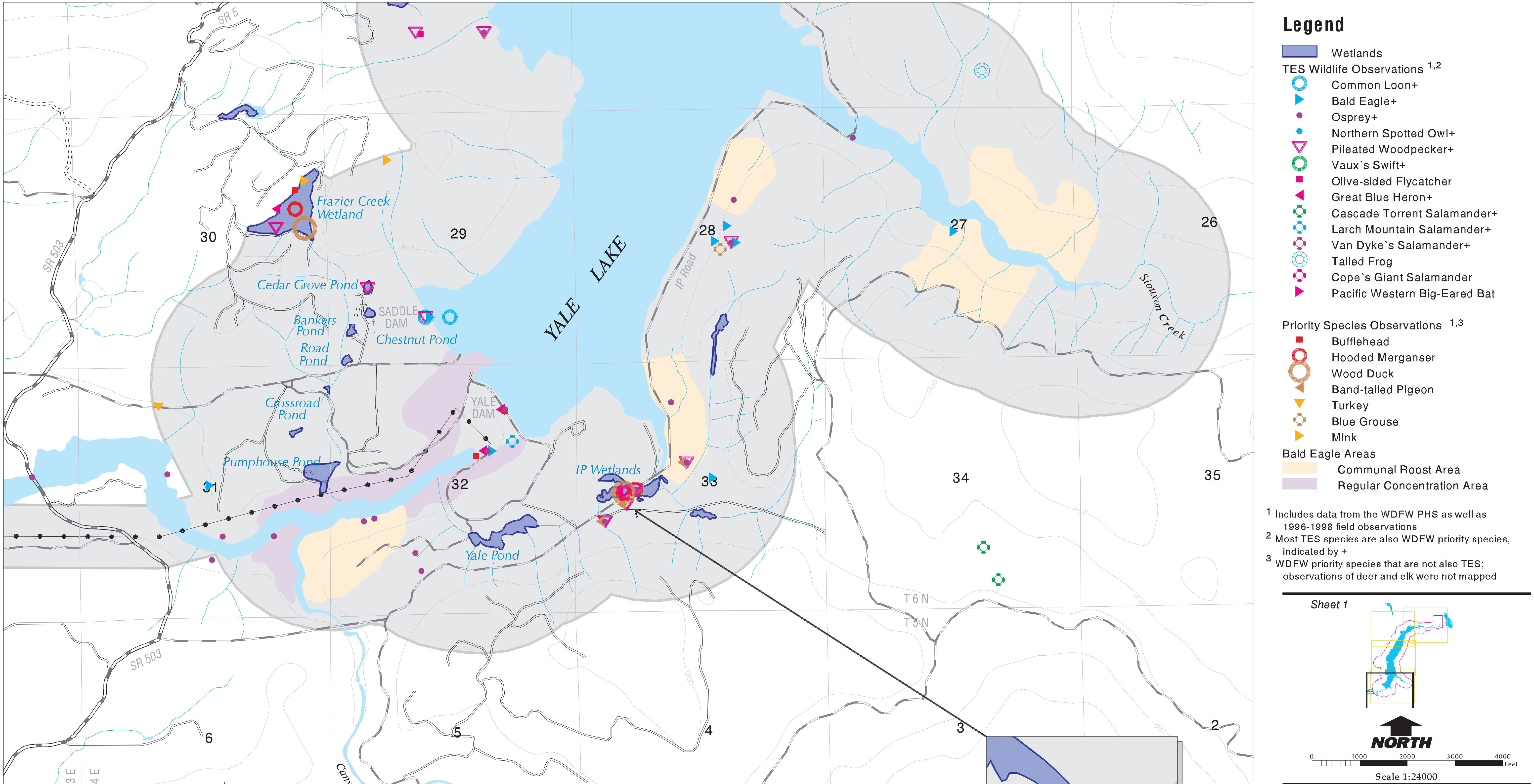
Two federally listed species—the bald eagle and the spotted owl—were documented in the study area during the 1996-1997 field studies; the peregrine falcon was last observed in 1994. There were no observations of wolves during the 1996-1997 field studies and the WDFW PHS has no records for this species in or near the study area. In general, it is unlikely that the Lewis River Valley in the vicinity of the Yale Project provides the isolation from human activity that the wolf needs for long-term survival; this species may, however, occasionally move through the study area.

Table 5.3-1. TES species observations by habitat in the vicinity of the Yale Hydroelectric Project.

Species	Habitat Types[1]														
	LPP	**M**	**MD**	**MS**	**MX**	**OG**	**P**	**RP/ RI**	**RE/ SL**	**SH**	**SS**	**UD**	**WL**	**DST**	**RO/ CA**
Red-legged frog						X		X					X		
Tailed frog								X							
Cascade torrent salamander								X				X			
Cope's giant salamander								X							
Larch Mountain salamander															X
Van Dyke's salamander															X
Common loon									X						
Great blue heron								X	X				X		
Bald eagle[2]	X					1/X	X	X	X				X		
Osprey[2]	X	X		X		X	X	X	1/X			1/X	X		
Northern spotted owl		X													
Pileated woodpecker	X		X			X	X	X	X		X	X	X		
Vaux's swift													X	X	
Olive-sided flycatcher			X												
Pacific western big-eared bat															X

[1] Habitat types: LPP—lodgepole pine, M—mature conifer, MD—meadow, MS—mid-successional conifer forest, MX—mixed conifer/deciduous forest, OG—old-growth forest, P—pole conifer forest, RP/RI—riparian deciduous forest/riverine/stream, RE/SL—reservoir/shoreline, SH—shrub, SS—seedline/sapling, UP—upland deciduous, WL—wetland, DST—disturbed, RO/CA—rock/cave.

[2] Numbers indicate habitats with occupied nests in 1996 and 1997; X indicate species was observed flying over or perched in habitat.



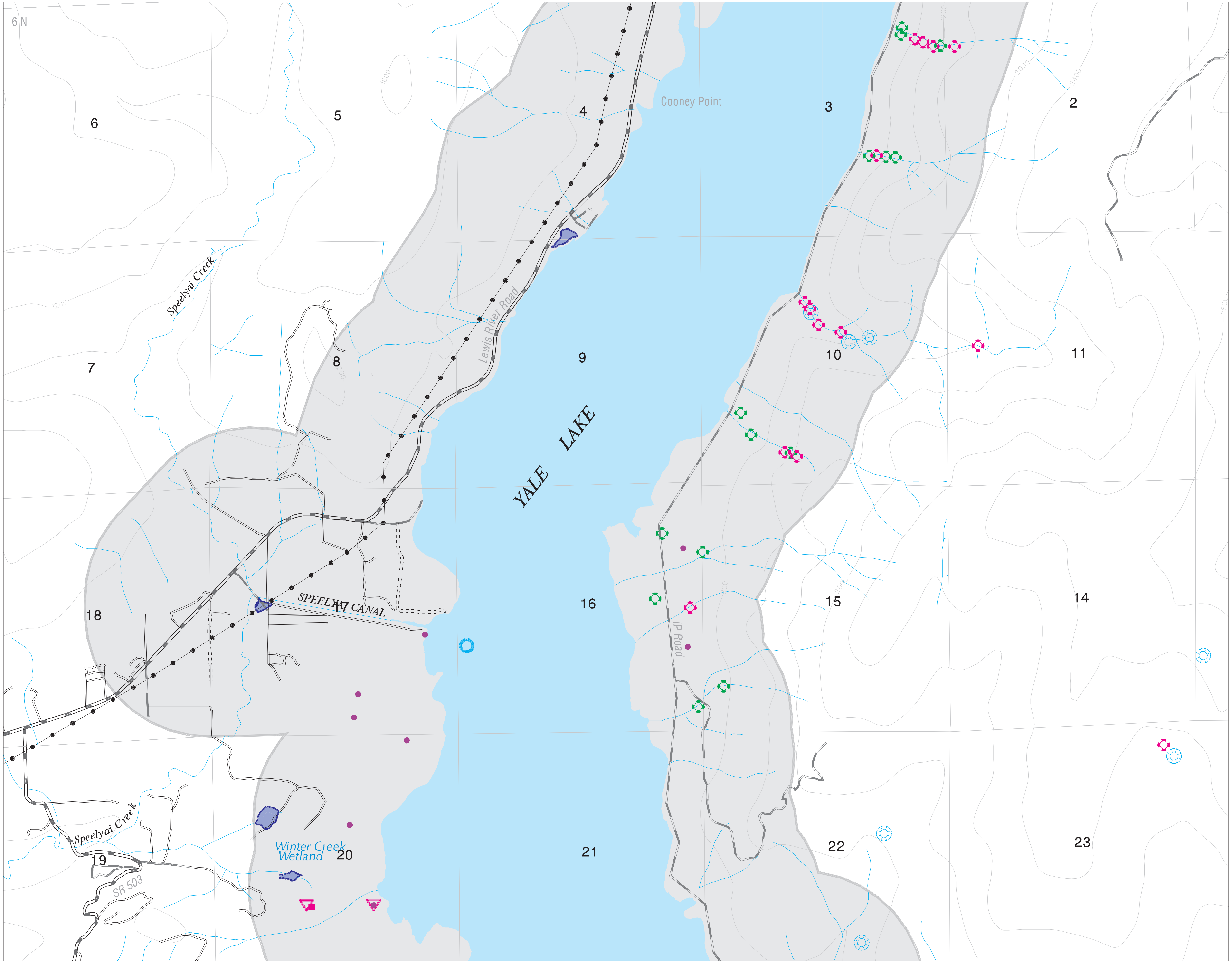
Yale Hydroelectric Project

Figure 5.3-1 TES and Priority Species Observations

Created by VESTRA Resources for PacifiCorp

/p1/proj_map/projects/yale/license/ftr/terrestl/spp_obs.map

March 29, 1999



Legend

- Wetlands

TES Wildlife Observations [1,2]

- Common Loon+
- Bald Eagle+
- Osprey+
- Northern Spotted Owl+
- Pileated Woodpecker+
- Vaux`s Swift+
- Olive-sided Flycatcher
- Great Blue Heron+
- Cascade Torrent Salamander+
- Larch Mountain Salamander+
- Van Dyke`s Salamander+
- Tailed Frog
- Cope`s Giant Salamander
- Pacific Western Big-Eared Bat

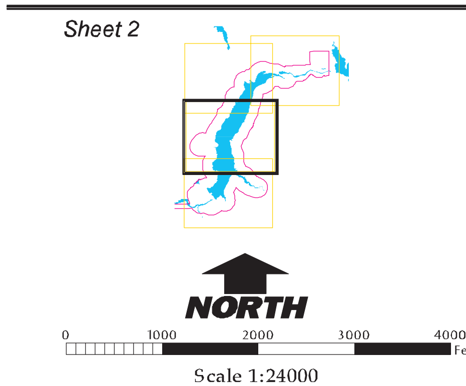
Priority Species Observations [1,3]

- Bufflehead
- Hooded Merganser
- Wood Duck
- Band-tailed Pigeon
- Turkey
- Blue Grouse
- Mink

Bald Eagle Areas

- Communal Roost Area
- Regular Concentration Area

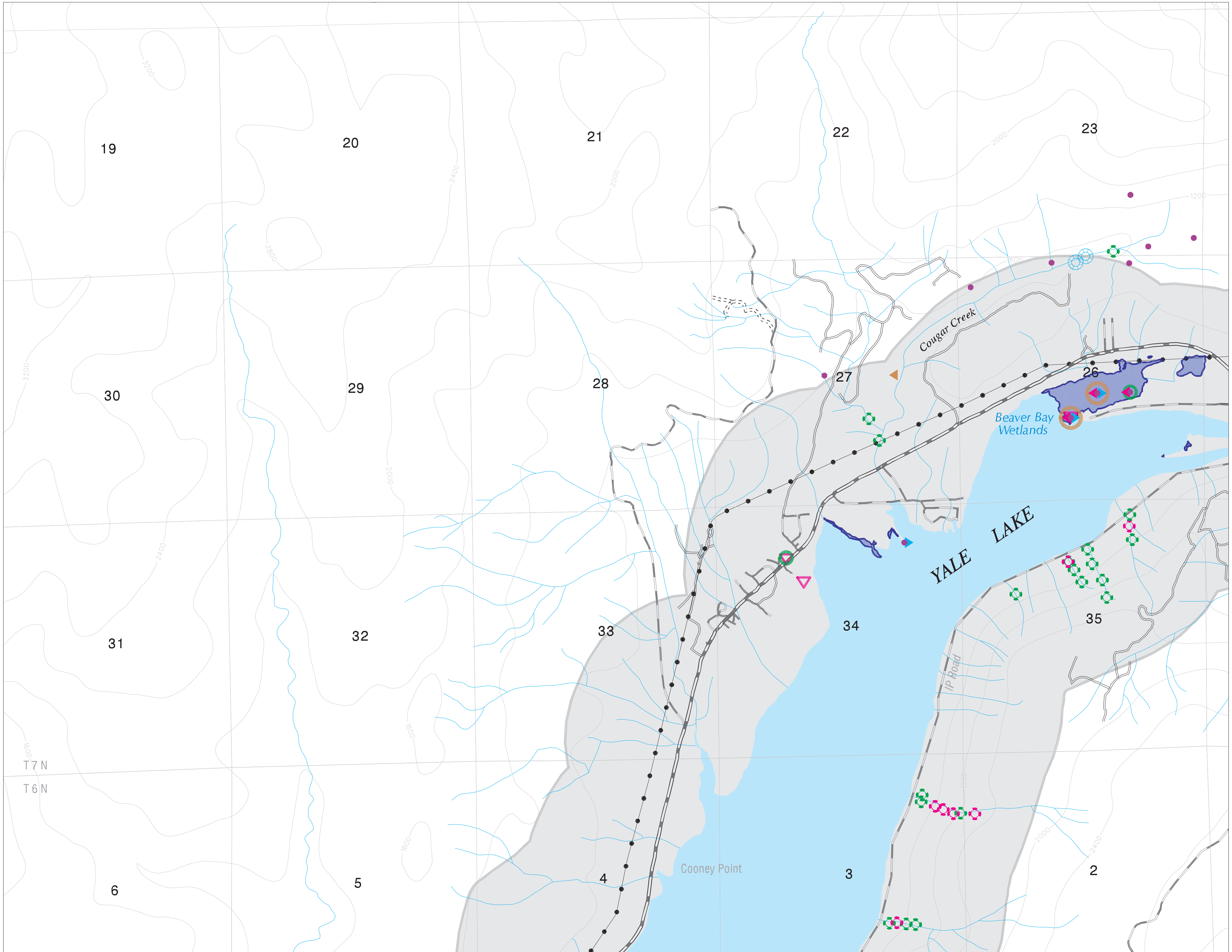
1 Includes data from the WDFW PHS as well as 1996-1998 field observations
2 Most TES species are also WDFW priority species, indicated by +
3 WDFW priority species that are not also TES; observations of deer and elk were not mapped



Yale Hydroelectric Project

Figure 5.3-1 TES and Priority Species Observations

 PacifiCorp Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/spp_obs.batchmap March 29, 1999



Legend

Wetlands

TES Wildlife Observations [1,2]

- Common Loon+
- Bald Eagle+
- Osprey+
- Northern Spotted Owl+
- Pileated Woodpecker+
- Vaux`s Swift+
- Olive-sided Flycatcher
- Great Blue Heron+
- Cascade Torrent Salamander+
- Larch Mountain Salamander+
- Van Dyke`s Salamander+
- Tailed Frog
- Cope`s Giant Salamander
- Pacific Western Big-Eared Bat

Priority Species Observations [1,3]

- Bufflehead
- Hooded Merganser
- Wood Duck
- Band-tailed Pigeon
- Turkey
- Blue Grouse
- Mink

Bald Eagle Areas

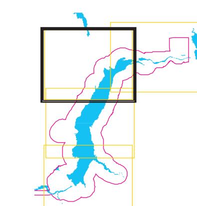
- Communal Roost Area
- Regular Concentration Area

1 Includes data from the WDFW PHS as well as 1996-1998 field observations

2 Most TES species are also WDFW priority species, indicated by +

3 WDFW priority species that are not also TES; observations of deer and elk were not mapped

Sheet 3



NORTH

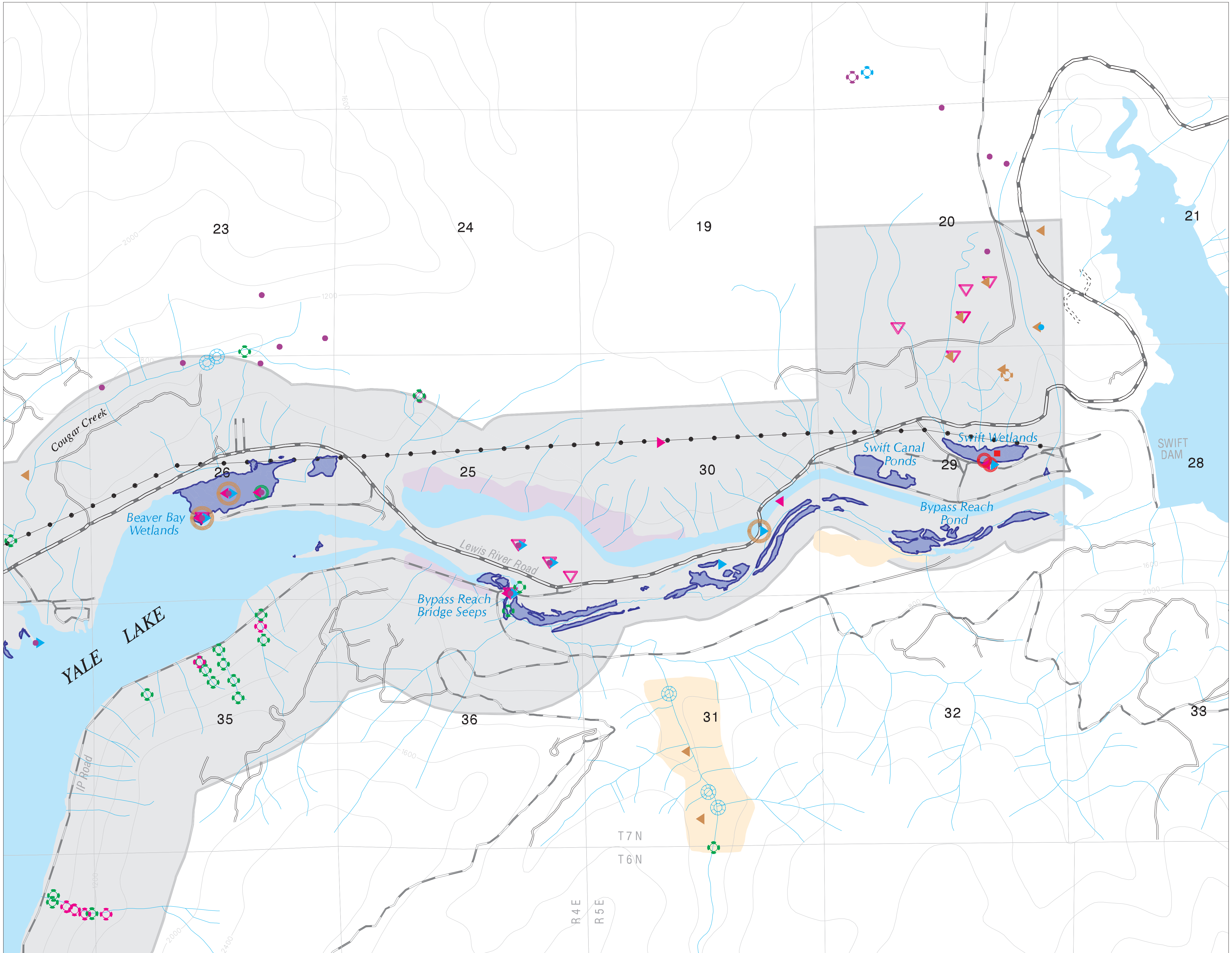
0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 5.3-1 TES and Priority Species Observations

 Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/spp_obs.batchmap March 29, 1999



Legend

Wetlands

TES Wildlife Observations [1,2]
- Common Loon+
- Bald Eagle+
- Osprey+
- Northern Spotted Owl+
- Pileated Woodpecker+
- Vaux`s Swift+
- Olive-sided Flycatcher
- Great Blue Heron+
- Cascade Torrent Salamander+
- Larch Mountain Salamander+
- Van Dyke`s Salamander+
- Tailed Frog
- Cope`s Giant Salamander
- Pacific Western Big-Eared Bat

Priority Species Observations [1,3]
- Bufflehead
- Hooded Merganser
- Wood Duck
- Band-tailed Pigeon
- Turkey
- Blue Grouse
- Mink

Bald Eagle Areas
- Communal Roost Area
- Regular Concentration Area

1 Includes data from the WDFW PHS as well as 1996-1998 field observations
2 Most TES species are also WDFW priority species, indicated by +
3 WDFW priority species that are not also TES; observations of deer and elk were not mapped

Sheet 4

NORTH

0 1000 2000 3000 4000 Feet

Scale 1:24000

Yale Hydroelectric Project

Figure 5.3-1 TES and Priority Species Observations

 PACIFICORP Created by VESTRA Resources for PacifiCorp /p1/proj_map/projects/yale/license/ftr/terrestl/spp_obs.batchmap March 29, 1999

5.3.1.1 Bald Eagle

Results of the 1996-1997 studies and ongoing survey efforts by PacifiCorp suggest that bald eagles use portions of the study area year-round for breeding, foraging, perching, and roosting. Bald eagles were regularly observed flying over the reservoir or perched in trees along the shorelines below Yale Dam and at the upstream end of Yale Lake. In June 1996, an active bald eagle nest along the east side of Yale Lake was identified during the summer seasonal survey of nearby old-growth habitat. This new nest was located just upslope from a site that had been used from 1993 through 1995. The Yale nest successfully fledged young in both 1996 and 1997-1 each year. Winter use of the study area by bald eagles was documented by helicopter surveys; 45 were observed in February 1996 and 14 in March 1997 (Table 5.3-2). Eagles were also observed foraging for fish in Yale Lake during the winter when the reservoir level was low. Roost sites and known regular concentration areas are shown on Figure 5.3-1.

Table 5.3-2. Summary of bald eagle observations during 1996-1997 winter helicopter surveys.

Segment of Study Area	1996 Survey	1997 Survey
SR 503 Bridge to immediately downstream of Yale Dam	10 total: 3 adults perched, 2 adults and 5 subadults flying	1 total: 1 subadult flying
Yale Dam	23 total: 15 adults and 8 subadults flying	6 total: 4 adults and 2 subadults perched
Yale Lake	4 total: 4 adults perched	1 total: 1 adult perched
Swift Dam to Yale Lake	8 total: 5 adults and 3 subadults perched	6 total: 1 adult and 2 subadults perched, 1 adult and 2 subadults flying
Total	45 total: 29 adults, 16 subadults	14 total: 7 adults and 7 subadults

5.3.1.2 Spotted Owl

According to records from the WDFW PHS, nearly all lands within the study area for the Yale Project are within 1.8 miles of known spotted owl activity centers (letter from L. Adkins, Cartographer, WDFW, Olympia, Washington, October 18, 1996). However, no activity centers have been identified within the study area, most likely due to the lack of old-growth and mature forest. During a seasonal wildlife survey conducted in June 1996, 1 spotted owl was observed in a stand of old-growth conifer on USFS land in the northeastern portion of the study area, just off USFS Road 90 (Figure 5.3-1). The owl was not resighted on a follow-up visit to the stand with mice or on subsequent seasonal surveys.

5.3.1.3 Peregrine Falcon

No peregrine falcons were observed during the 1996-1997 field surveys, nor are there any WDFW PHS records for this species in the study area or in the Lewis River drainage. However, biologists inventorying the study area wetlands in 1994 reported seeing a peregrine falcon flying over the bypass reach. Although the project vicinity lacks cliffs suitable for nesting use by peregrine falcons, study area wetlands represent potential foraging sites. This species can be fairly wide ranging, particularly in the winter, and occasional observations in the study area would not be unusual. The breeding population of peregrine falcons also seems to be expanding in Pacific Northwest and it is possible that a new territory could be established in the Lewis River Valley if suitable habitat exists.

5.3.2 Federal Candidate Species

The Oregon spotted frog is the only candidate for federal listing as threatened or endangered. This species is thought to be nearly extirpated from western Washington (Leonard et al. 1993). It is unlikely that this species occurs in the study area due to the presence of bullfrogs in virtually all wetlands and the lack of non-woody wetland communities.

5.3.3 Federal Species of Concern

Two species—the red-legged frog and olive-sided flycatcher, designated by the USFWS as species of concern but are not state listed TES, candidate, or monitor species—were documented in the study area during 1996-1997 field surveys. There were no observations of the 2 other federal species of concern with no state status—the Cascades frog and harlequin duck—that potentially occur in the study area. The WDFW PHS has no records of either species near the lake; they do have historic records of harlequin ducks on USFS lands upstream of the Yale Project (letter from L. Vigue, Biologist, WDFW, Olympia, Washington, March 12, 1998).

5.3.3.1 Red-legged Frog

The red-legged frog was observed to be a common breeding species in the study area. During the March 1997 egg mass surveys, large numbers of red-legged frog egg masses or tadpoles were observed in 11 separate locations: (1) Swift wetlands, (2) Beaver Bay wetland, (3) IP wetlands, (4) Swift Canal Ponds, (5) Swift Bypass Reach Pond, (6) Yale Ponds, (7) Chestnut Pond, (8) Road Pond, (9) Bankers Pond, (10) an ephemeral pond on a jeep trail off the IP road, and (11) lower Cougar Creek beaver pond (incidental observation) (Table 4.3-1; Figure 5.3-1). Adult and juvenile red-legged frogs were seen in the Swift bypass reach floodplain, along Ole Creek, near Winter Creek (south of Speelyai Canal), along lower Cougar Creek, along IP-7, near IP-9, and in an old-growth stand near the gate at the north end of the IP Road. It is likely that forested habitats in the vicinity of the 11 breeding sites in the study area are used by adult and juvenile frogs for foraging and cover outside of the breeding season.

5.3.3.2 Olive-sided Flycatcher

The olive-side flycatcher was observed once during the 1996-1997 field surveys. The 1 individual observed was perched in an alder tree at the edge of a wet meadow on the west side of Yale Lake. The WDFW PHS has no records of this species because it is not state listed or a priority species. The Washington gap analysis has records of possible breeding evidence for olive-sided flycatcher both the north and south of the study area, but not within the Lewis River drainage; core habitat for this species exists throughout western Washington, (Smith et al. 1997).

5.3.4 State Listed Species

The Larch Mountain salamander, northwestern pond turtle, and fisher are the only state-listed species potentially occurring in the study area that are not also federally listed.

5.3.4.1 Larch Mountain Salamander

Of 25 sites specifically surveyed for TES salamanders, Larch Mountain salamanders were found only on the downstream face of Yale Dam and the base of the adjacent north-facing cliff (Figure 5.3-1; Table 5.3-1). A total of 4 adults and 1 juvenile were found at this site on 28 April 1997. The identification was confirmed by C. Crisafulli, USFS ecologist and salamander expert. Three of the individuals were under the large moss-covered rocks that make up the dam and were located within approximately 50 feet of each other. The other 2 were found among smaller talus at the base of the cliff, where sapling alders provided shade. This observation represented the first reported population of Larch Mountain salamanders on a man-made structure and the most western record of this species in the Lewis River drainage (pers. comm., C. Crisafulli, Wildlife Biologist, USFS, PNW Research Station, Amboy, Washington, April 28, 1997). Factors responsible for the occurrence of the Larch Mountain salamander on Yale Dam include the following: (1) the age (44 years) and rock structure of the dam; (2) the presence of adjacent refugia habitat (the cliff/talus); and (3) nearly continual shade, which is provided by the adjacent canyon walls, and keeps the site cool and moist. Other species found in the immediate vicinity of the Larch Mountain salamanders included: western red-backed salamanders, ensatina, northern alligator lizards, and a rubber boa.

The WDFW PHS database has records of Larch Mountain salamanders at 1 additional site in the study area-Moss Cave-which is along the ROW for the Swift No. 1- Swift No. 2 transmission line. No surveys were conducted at this site since it is also used by a colony of Pacific western big-eared bats. The USFS and PacifiCorp take joint responsibility for ensuring that gates on access roads to the cave are closed (letter from A. Prucell, Wildlife Biologist, USFS, Mount St. Helens National Monument, Amboy, Washington, July 29, 1985). PacifiCorp is currently working with the USFS, The Nature Conservancy, and the property owner to install a gate at the cave entrance.

5.3.4.2 Northwestern Pond Turtle

There were no observations of the northwestern pond turtle during 1996-1997 field surveys in apparently suitable habitat, and the WDFW PHS has no records for this species in or near the study area. In Washington, this species occurs from sea level to 500 feet elevation (letter from C. Leigh, Fish and Wildlife Scientist, WDFW, Olympia, November 17, 1998). Although the study area wetlands are below 500 feet and the larger ponds, particularly those associated with the Swift, IP, and Frazier Creek wetlands, appear to have suitable habitat for this species, the study area may be too cool for northwestern pond turtles; the presence of bullfrogs or other predators may also be a factor.

5.3.4.3 Fisher

There were no observations of fisher or their sign during 1996-1998 field surveys, and the WDFW PHS has no records for this species in or near the Yale Lake study area. The fisher is thought to be nearly extirpated from western Washington (Lewis and Stinson 1998). Due to a lack of large patches of old-growth conifer forests, this species is not likely to occur in the study area.

5.3.5 <u>State Candidate Species</u>

Six candidate species for state listing-the Cascade torrent salamander, Van Dyke's salamander, common loon, pileated woodpecker, Vaux's swift, and Pacific western big-eared bat-were documented in the study area during the 1996-1998 field surveys. There is 1 historic record of a wolverine in Canyon Creek from 1973 (pers. comm., L. Vigue, Biologist, WDFW, Olympia, Washington, February 4, 1999). The wolverine is considered to be rare in the State of Washington and is unlikely to occur in the project vicinity due to a lack of suitable habitat. Each of the documented species is described below.

5.3.5.1 Cascade Torrent Salamander

Next to western red-backed salamanders, Cascade torrent salamanders were the most commonly observed amphibian in the study area. During 1996 and 1997, a total of 469 observations of this species were made in or along 14 streams and 2 seep/talus slope sites in the study area (Table 4.3-1, Figure 5.3-1). Cascade torrent salamanders were particularly common along the IP streams that had steep gradients, bedrock substrate, waterfalls, and seeps. Salamanders were generally found throughout the lower sections of these streams, often beginning just upstream of the IP Road. Adults were seen in or along 11 out of 12 IP streams; larvae were noted in 6. The only IP stream where Cascade torrent salamanders were not found was IP-13, which has a lower gradient and cobble substrate. Severely eroded segments of streams (e.g., lower IP-11 and upper Panamaker) did not have any torrent salamanders. In addition to being common along the IP streams, cascade torrent salamanders were found along lower and upper Cougar Creek, Panamaker Creek, and Ole Creek. The greatest density was associated with the seep/talus near the bypass reach bridge, where in excess of 50 individuals were noted within a 0.2-acre site.

5.3.5.2 Van Dyke's Salamander

Van Dyke's salamander was found at only 1 of the 25 sites surveyed for TES salamanders-a south-facing talus slope at the edge of the old lava flow just north of Swift No. 2 Canal (Figure 5.3-1). On 3 November 1997, 1 adult and 1 juvenile were found less than 5 feet apart at the base of a cliff. The adult was under a 12-inch, moss-covered rock; the juvenile was on the surface of a moss-covered rock. Both were approximately 50 feet from a subterranean creek that flowed under the talus. Identification was confirmed by a USFS biologist (pers. comm., V. Marable, Wildlife Biologist, USFS, Mount St. Helens Ranger District, Amboy, Washington, November 4, 1997). Other species found in the immediate vicinity of the Van Dyke's salamanders included western red-backed salamanders and Cascade torrent salamanders (near a seep).

5.3.5.3 Common Loon

The common loon was observed on Yale Lake several times during the 1996-1997 studies. Individual birds were noted near the confluence of Speelyai Canal with Yale Lake in May 1996 and near Yale Dam in May-June 1997. It is likely that these individuals were non-breeding adults since Yale Lake lacks the aquatic vegetation and shallow water habitat used by this species for nesting. Smith et al. (1997) reports no confirmed or possible breeding evidence anywhere in southwestern Washington.

5.3.5.4 Pileated Woodpecker

The pileated woodpecker was recorded over 30 times in the study area during the 1996-1997 field surveys. This species was observed either in or flying over nearly all habitat types but was most frequently noted in upland deciduous forests and in 2 wetlands-Frazier Creek and Beaver Bay-which both have substantial numbers of snags. All observations were during the breeding season. Overall, the study area appears to provide suitable foraging and nesting habitat for the pileated woodpecker; even the early successional stands typically have at least a few large snags and trees (see Section 2.3). Nesting habitat is probably more limited than foraging habitat.

5.3.5.5 Vaux's Swift

The Vaux's swift was documented twice in the study area during the 1996-1997 field surveys. Both were incidental observations were made during the breeding season and consisted of a few birds in flight; 1 occurred in wetland habitat and the other in the town of Cougar. Snags in wetlands and in mixed, mid-successional, mature, and old-growth forest stands in the study area may be used for nesting by this species; the reservoir and wetlands would provide nearby forage habitat.

5.3.5.6 Northern Goshawk

The WDFW PHS records from 1996 include an unconfirmed observation of a northern goshawk outside the study area, west of Cougar Creek (letter from L. Adkins, Cartographer, WDFW, Olympia, Washington, October 18, 1996). The study area contains very little of the old-growth and mature forests that provide habitat for this species, and the goshawk was not observed during the 1996-1998 field surveys. It may occur, however, in the suitable habitat that is present in the study area.

5.3.5.7 Pacific Western Big-eared Bat

Records from the USFS indicate use of Moss Cave by Pacific western big-eared bats since the mid-1960s (letter from C. Senger, Biologist, Western Washington University, Bellingham, Washington, July 1990). The cave appears to be used as a nursery colony, hiberaculum, and communal night roost (letter from L. Adkins, Cartographer, WDFW, Olympia, Washington, October 18, 1996). During the 1997 survey, 57 bats were counted exiting the cave; a similar number were counted in 1995 according to the USFS (memo from M. Garrett, Wildlife Biologist, PacifiCorp, September 10, 1997, Portland, Oregon).

Moss Cave is located near the Swift No. 1- Swift No. 2 transmission line; in 1985, PacifiCorp agreed to schedule ROW maintenance activities near the cave before May 15 or after September 15 to avoid disturbing the nursery colony (memo from S. Wilder, Biologist, PacifiCorp, Portland, Oregon, July 29, 1985). The USFS and PacifiCorp take joint responsibility for ensuring that gates on access roads to the cave are closed (letter from A. Prucell, Wildlife Biologist, USFS, Mount St. Helens National Monument, Amboy, Washington, July 29, 1985). PacifiCorp is currently working with the USFS, the Nature Conservancy, and the property owner to install a gate at the cave entrance.

5.3.6 State Monitor Species

Four state monitor species—the Cope's giant salamander, tailed frog, great blue heron, and osprey—were observed in the study area during the 1996-1998 studies. There are no records in the project vicinity for either the long-legged or long-eared myotis; however, suitable habitat exists and both species may occur.

5.3.6.1 Cope's Giant Salamander

A total of 33 observations of larval/neotenic Cope's giant salamanders were recorded during 1997 amphibian surveys. All observations were along 6 of the IP streams—IP-1, IP-3, IP-5, IP-6, IP-7, and IP-8 (Table 4.3-1, Figure 5.3-1); the WDFW PHS database had records of Cope's giant salamanders from several of these streams. Since there are only a few records of metamorphosed Cope's giant salamanders, it was not surprising that no adults were found during the surveys in the study area. IP-7 was the only creek in which both Pacific giant and Cope's giant salamanders were both observed.

5.3.6.2 Tailed Frog

Tailed frogs were observed at 3 locations in the study area during 1996-1997 surveys—Swift bypass reach, Ole Creek, and IP-7 (Figure 5.3-1). IP-7, the largest of the IP streams, had larvae, juveniles, and adults; only larvae were noted in the other 2 streams. The WDFW PHS database also had several observations of tailed frogs in the upper reaches of several of the IP streams. Several larvae were found attached to rocks in the bypass reach during 1996 electroshocking surveys. It was surprising that other creeks, such as upper Cougar Creek, did not support tailed frogs.

5.3.6.3 Great Blue Heron

Great blue herons were commonly observed during the 1996-1997 field surveys, but no nesting colonies were located in the study area. During the spring and summer seasonal surveys 1 or 2 individual herons were typically recorded in Beaver Bay, Frazier Creek, and Swift wetlands and along Yale Lake (see Tables 4.3-8 and 4.3-9 in Section 4.0). Fifteen great blue herons were observed along Yale Lake during a survey in fall 1997. It is likely that this species nests in the Lewis River Valley near the Yale study area.

5.3.6.4 Osprey

Osprey were commonly observed during the 1996-1997 surveys, generally flying over Yale Lake. The June 1996 helicopter survey located 5 osprey nests, 3 active and 2 inactive, along the Lewis River between Yale Dam and the SR 503 bridge. Two occupied osprey territories were observed along Yale Lake—1 near the dam and 1 on Siouxon Flats (Table 5.3-3). Only the Siouxon Flats site was active; this nest produced 3 young and the adults were frequently observed flying over the lake during the spring and summer. Of the 6 osprey nests along Cougar Creek, only 2 were active (Table 5.3-3). The June 1997 helicopter survey located 2 active osprey nest sites along Yale Lake and 3 along Cougar Creek (Table 5.3-3).

Table 5.3-3. Summary of osprey nesting activity in and near the study area for the Yale Hydroelectric Project.

1996 Survey		**1997 Survey**	
Occupied/Active Sites	**Inactive Sites**	**Occupied/Active Sites**	**Inactive Sites**
Yale Dam - site occupied but nest empty	Siouxon Creek	Yale Dam, 1 - adult brooding	Siouxon Creek - not located
Siouxon Flats No. 1 - 3 young	Cougar Creek No. 1	Siouxon Flats No. 2 - 2 young	Cougar Creek No. 2
Cougar Creek No. 3	Cougar Creek No. 2	Cougar Creek No. 1 - 1 young	Cougar Creek No. 3
Cougar Creek No. 5- 1 young	Cougar Creek No. 4	Cougar Creek No. 4 - no young	Cougar Creek No. 5
	Cougar Creek No. 6	Cougar Creek No. 6 - 2 young	

WDFW is currently considering removing the osprey from the priority species list (pers. comm., N. Nordstrom, PHS Program, Olympia, Washington, February 4, 1999).

5.3.6.5 Long-eared Myotis and Long-legged Myotis

The long-eared and long-legged myotis species are both widespread in forested habitats in Washington, although the long-eared myotis is typically more common east of the Cascade crest (Johnson and Cassidy 1997). The Washington gap analysis has records of both species in Clark County, south of Yale Dam (Johnson and Cassidy 1997) and WDFW has records of both species using caves in the Lewis River watershed but outside the Yale study area as winter hibernacula in the 1970s (pers. comm., L. Vigue, Biologist, WDFW, Olympia, Washington, February 4, 1999). There are, however, no records of either species using Moss Cave. It is likely that both species occur in the project vicinity.

6.0 RESERVOIR DRAWDOWN STUDIES

In their comments on the FSCD, several resource agencies requested that PacifiCorp evaluate the effects of reservoir drawdown on wildlife and fish. Under current operations, the water level is lowered 20 to 30 feet each winter for generation and flood control purposes. Daily fluctuations throughout the year are normally less than 2 feet. The exposed drawdown zone potentially affects wildlife that use the reservoir and surrounding habitats, as well as fish that occur in the reservoir. PacifiCorp agreed to initiate studies to evaluate reservoir level fluctuation on wildlife and fish in 1997; this section describes the studies conducted to assess effects to wildlife.

6.1 STUDY AREA

Drawdown studies were conducted within Yale Lake below the full-pool level and along the immediate shoreline of the reservoir. The normal full pool is 490 feet (msl); typical low pool levels are between 460 and 470 feet. The lake is normally drawn down between mid-September and mid-October each year and refilled in May by Memorial Day weekend. PacifiCorp generally maintains the lake at full pool throughout the summer recreation season (Memorial Day through Labor Day), but water levels often fluctuate from 1 to 3 feet, depending on precipitation and power demand.

6.2 METHODS

Information on the effects of drawdown on wildlife was collected from 6 studies, including the following: (1) bathymetry mapping, (2) analysis of recent drawdown patterns, (3) analysis of drawdown effects on wetlands, (4) mapping of shoreline bank heights, (5) surveying the drawdown zone for wildlife, and (6) literature review and consultation with other utilities. Methodologies for each of these studies are described below.

6.2.1 Bathymetry Mapping

The goal of the bathymetry mapping task was to develop an accurate map of the elevations and contours in the reservoir between low pool (460-465 feet) and maximum pool (490 feet). Existing U.S. Geological Survey (USGS) topographic maps of Yale Lake include 40-foot contour intervals that were mapped from 1980-1982 aerial photography. The USGS mapping does not account for the 44 years of sedimentation that has occurred since the Yale Project was completed (1953) and are not suitable to identify the location and extent of areas exposed by various drawdown levels.

The bathymetry of the drawdown zone of Yale Lake was developed from aerial photos. Aerial photographs (1:9,600 scale) of Yale Lake were taken 25 March 1997, when Yale Lake was drawdown to an elevation of 474 feet. Prior to taking the photos, surveyed horizontal and vertical control points were established. Using a fully analytical stereoplotter, the drawdown zone was saturated with spot elevations (± 0.5-ft accuracy). Two-foot contours were then generated from the spot elevations using the stereoplotter.

The resultant coverage was entered into the Yale GIS database to create bathymetry coverage for the reservoir drawdown area.

The GIS was used to analyze the bathymetry data, calculate the area exposed at selected reservoir water surface elevations, and identify relatively flat and wide areas within the drawdown zone. The results of this analysis were displayed graphically.

6.2.2 Analysis of Drawdown Levels, Timing, and Duration

The typical drawdown pattern of Yale Lake was assessed by analyzing daily lake elevation data from 1992-1997. These data were analyzed to evaluate the extent (feet), frequency, and duration of winter drawdowns. The percent of days that lake levels exceeded various elevations were expressed as cumulative frequency graphs.

6.2.3 Analysis of Drawdown Effects on Wetlands

The effects of lake level fluctuation on wetlands were assessed by monitoring the water level in 2 wetlands that are adjacent to Yale Lake and connected hydrologically. Transducers (PS 9000) were installed at Beaver Bay and the largest wetland along the IP Road to determine the relationship between water level fluctuations in the reservoir and wetlands. Each transducer was mounted on a post, set at a specific height in the water column, and calibrated to record water level in 1-inch increments. The transducer was wired to a polycorder (Omnidata 900 Series) powered by a 6-volt battery. Increases or decreases in water pressure (or depth) changed the current flow to the polycorder, which then measured the current and computed the pressure or water level.

Transducers measured the water surface elevation every 6 hours. Data from the polycorders were downloaded at 7- to 10-day intervals from April through June 1997; monitoring is continuing from October 1997 through March 1998. Records from these periods are used to evaluate the effects of reservoir water elevation on wetlands during the breeding and larval stage for amphibians as well as during the transition from full pool to low pool.

The results of the vegetation cover type mapping (Section 2.3), bathymetry mapping (Section 6.2.2), and shoreline cutbank mapping were also assessed to determine locations within or adjacent to the drawdown zone that either currently or potentially support wetland vegetation.

6.2.4 Cutbank Mapping

The shoreline along Yale Lake varies from a very steep cutbank to a more moderate transition to the reservoir. Similarly, some areas within the 20- to 30-foot drawdown zone are very steep, while others have a gentle grade. Cutbanks and steep areas exposed during drawdown may preclude access to water by many wildlife species; moderate banks and flat areas in the drawdown zone provide access. The purpose of the cutbank mapping was to identify the sections of shoreline that allow access to the reservoir during winter low pool as well as during the normal full pool (490 feet).

Shoreline bank heights were mapped on aerial photos from a boat during the fall of 1997. Three categories were used: (1) < 2 ft (gentle slope), (2) 2-6 ft (moderate slope), and (3) > 6 ft (steep slope). The information was transferred to a GIS base map and digitized into a coverage of bank heights. The GIS was then used to identify likely access locations and calculate the length of shoreline that precludes wildlife access to the reservoir.

6.2.5 Wildlife Track Surveys

Surveys of wildlife tracks and sign were conducted in selected areas within the drawdown zone to qualitatively assess wildlife use of this area during winter low pool. Two biologists walked along a series of transects located in 4 flat areas in the drawdown zone during February 19-20, 1997, when the lake level was approximately 467 feet. The transects extended from the normal full pool shoreline to the water, with 500-foot perpendicular transects connecting the end of 1 transect with the beginning of the next (Figure 6.3-1). This transect layout ensured that wildlife use near the vegetated shoreline and along the water line would be sampled. All wildlife or wildlife sign observed were recorded. In addition to wildlife tracks and sign, areas that appeared to support rooted aquatic plants or emergent vegetation were noted. The lengths of transect surveyed in each area is summarized below:

- Beaver Bay to Cougar Park - 7 perpendicular transects between the water and shoreline, 3 transects parallel and adjacent to the shoreline, and 3 transects parallel and adjacent to the water. Total length - 7,973 feet.

- Speelyai Flats - 5 perpendicular transects between the water and shoreline, 3 transects parallel and adjacent to the shoreline, and 2 transects parallel and adjacent to the water. Total length - 4,836 feet.

- Siouxon Flats - 8 perpendicular transects between the water and shoreline; 4 transects parallel and adjacent to the shoreline; and 4 transects parallel and adjacent to the water. Total length - 11,665 feet.

- Swift Bypass Reach (just upstream of Swift No. 2 Powerhouse) - 2 transects, 1 surrounding the island and 1 along the southern shore. Total length - 5,240 feet.

6.2.6 Literature Review/Consultation

A literature review was conducted to obtain information on methods for establishing and maintaining native vegetation in reservoir drawdown zones. Specific topics included potential species and their germination requirements, planting and propagation methods, and inundation and drought tolerances. The review focused on species native to the study area and included consultation with local agency botanists and specialists at native plant nurseries. This information will be used to evaluate the potential for successfully establishing vegetation in the drawdown area for Yale Lake; results of the evaluation will be reported in the License Application.

In addition, interviews were conducted with biologists from other Northwest utilities (e.g., Snohomish County PUD, Tacoma City Light), water departments (e.g., King County Water Department, Portland Bureau of Water Works), the Corps of Engineers, and the U.S. Forest Service to obtain information on existing programs related to the establishment of native vegetation in reservoir drawdown zones. Similarities between conditions at reservoirs with existing successful programs were compared to those at Yale Lake.

6.3 RESULTS AND DISCUSSION

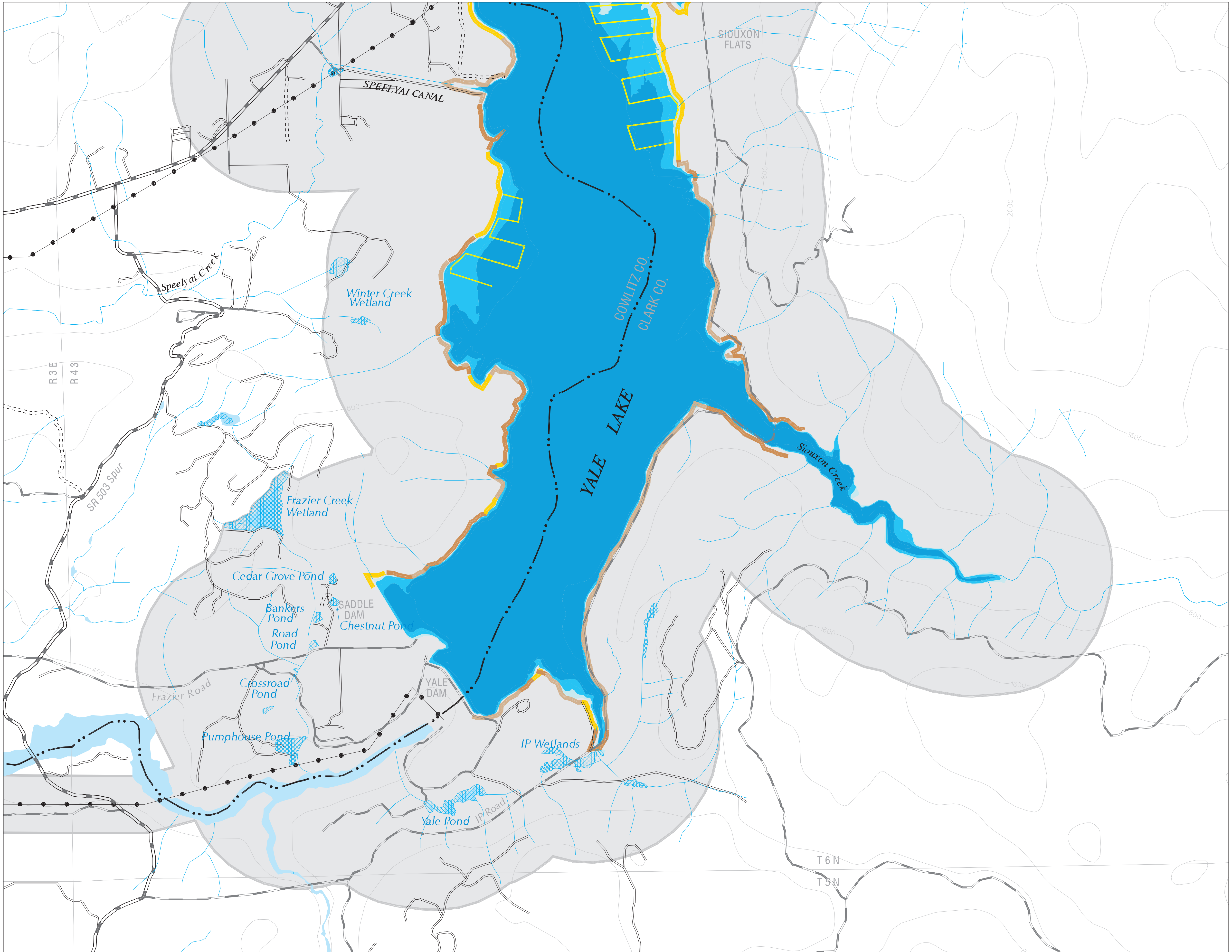
The following sections summarize the results of the 5 reservoir drawdown studies .

6.3.1 Reservoir Bathymetry

Because the lake level was at 474 feet when the aerial photographs were taken in 1997, bathymetry information is only available for elevations above this level. The 474-foot level does include for the majority of the typical drawdown zone (Section 6.3.2). The bathymetry map indicates that the vast majority of the drawdown zone is narrow and relatively steep, with only a few areas where the exposed lake bed is flat and wide (Figure 6.3-1). These larger areas include the following:

- 0.8 mile of the western shore south of Speelyai Canal,
- 1.1 miles of the northwestern shore area immediately south and north of Yale Park,
- 2.1 miles of the northern shore, from Beaver Bay to west of Cougar Creek,
- 0.4 mile of shoreline along the small island at the upstream end of the reservoir, and
- 1.2 miles of the eastern shoreline directly across from the confluence of Speelyai Canal with Yale Lake (Figure 6.3-1).

Analysis of the bathymetry data from 490 feet to 474 feet indicates a nearly straight-line relationship between reservoir level and acres of exposed drawdown area (Figure 6.3-2). This relationship can be characterized by the equation $y = 13{,}061-26.6755(x)$, where “y” is the area of drawdown zone in acres and “x” is the lake level in acres. If this equation is used to estimate drawdown acreage at lower pool levels, approximately 1,004 acres would be exposed at a pool level of 452 feet, the lowest level that has occurred since 1992. This assumes that the terrain between 452 feet and 474 feet has slopes similar to the area exposed during the 1997 photography (474 feet to 490 feet).



Legend

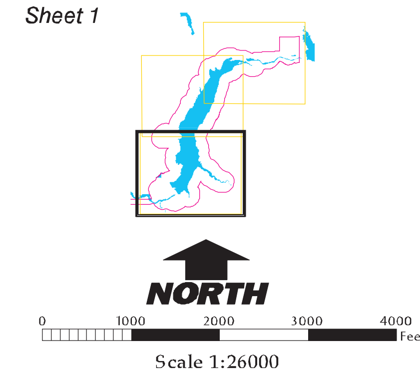
- Drawdown Wildlife Survey Transect
- Cutbank Height (< 2 ft.)
- Cutbank Height (2 - 6 ft.)
- Cutbank Height (> 6 ft.)

YALE LAKE BATHYMETRY
- 490 ft., Full Pool
- 480 ft.
- 474 ft.
- Topography
- County Line
- Township/Range Line
- Transmission Line
- Study Area

HYDROGRAPHY
- Waterbody
- Stream

TRANSPORTATION
- Primary Road
- Light Duty Road
- Unimproved Road
- Secondary Road

Sheet 1



Yale Hydroelectric Project

Figure 6.3-1 Yale Lake Drawdown Zone and Shoreline Condition

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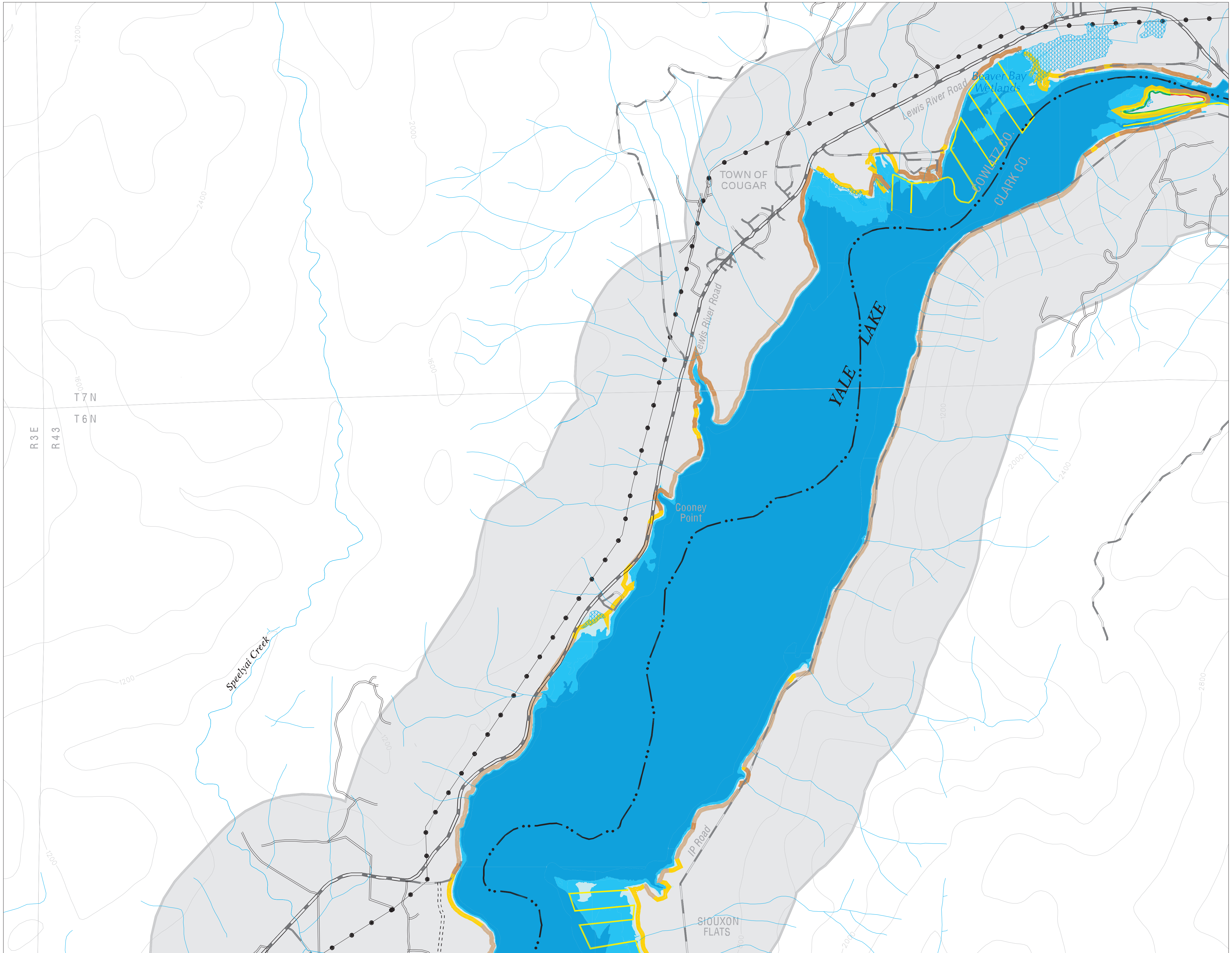

Legend

- Drawdown Wildlife Survey Transect
- Cutbank Height (< 2 ft.)
- Cutbank Height (2 - 6 ft.)
- Cutbank Height (> 6 ft.)

YALE LAKE BATHYMETRY
- 490 ft., Full Pool
- 480 ft.
- 474 ft.
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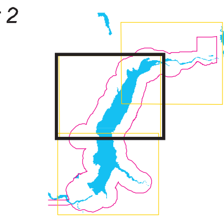
HYDROGRAPHY
- Waterbody
- Stream

TRANSPORTATION
- Primary Road
- Light Duty Road
- Unimproved Road
- Secondary Road

Sheet 2



NORTH

0 1000 2000 3000 4000 Feet

Scale 1:26000

Yale Hydroelectric Project

Figure 6.3-1
Yale Lake Drawdown Zone and Shoreline Condition

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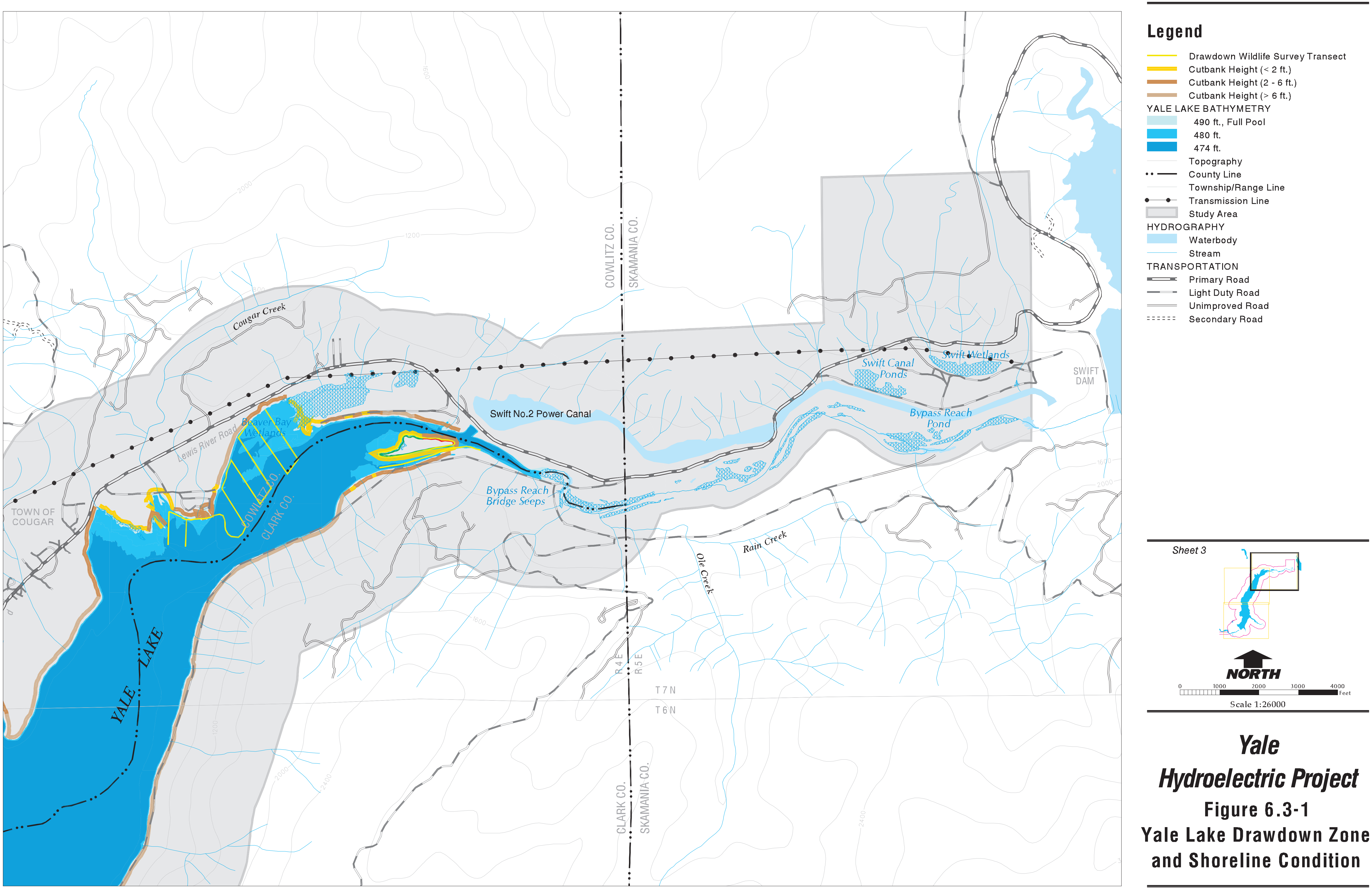

Yale Hydroelectric Project

Figure 6.3-1
Yale Lake Drawdown Zone and Shoreline Condition

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March 25, 1999

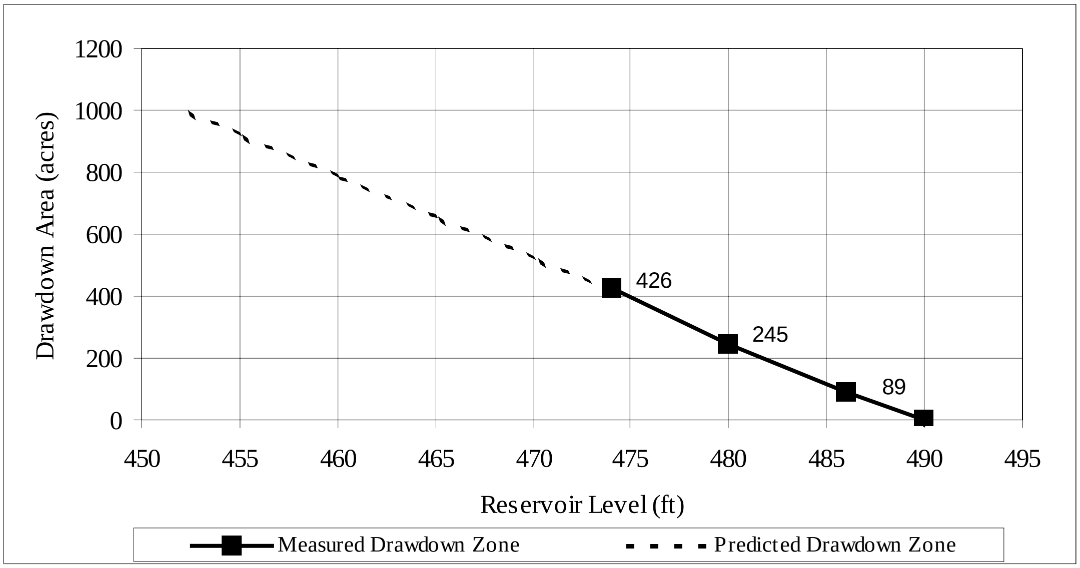

Figure 6.3-2. Area of drawdown zone exposed at different Yale Lake levels.

6.3.2 Drawdown Levels, Timing, and Duration

Each year, PacifiCorp lowers Yale Lake beginning in September to help prevent winter and spring floods. The lake level then fluctuates in response to generation demands and runoff events (precipitation and/or significant snowmelt), which can happen at any time during fall, winter, or spring. Therefore, in recent years there is no clear pattern in the timing of the minimum pool level, or the length of drawdowns below the typical levels (Table 6.3-1). Over the past 5 years, the winter level of Yale Lake has typically fluctuated between near the full pool level and 465 feet (Figure 6.3-3). However, in February 1993, the water level in Yale Lake was lowered to 452 feet; this extreme low pool lasted for only a few days, although the reservoir level was below 465 feet for over 1 month.

Table 6.3-1. Summary of 1992-1997 Yale Lake drawdowns, October through May (243-244 days).

Year	Minimum Pool Level (ft)	Date of Minimum Pool	# of Days below 480 ft. (%)	# of Days below 474 ft. (%)	# of Days below 465 ft. (%)
1992-93	451.6	2/22/93	178 (73)	127 (52)	29 (12)
1993-94	464.3	10/31/93	196 (81)	148 (61)	1 (0)
1994-95	466.7	10/26/94	97 (40)	48 (20)	0 (0)
1995-96	469.1	3/23/96	85 (35)	35 (14)	0 (0)
1996-97	462.8	11/12/96	224 (92)	189 (78)	23 (9)
Average	462.9	--	156 (64)	109 (45)	10 (4)

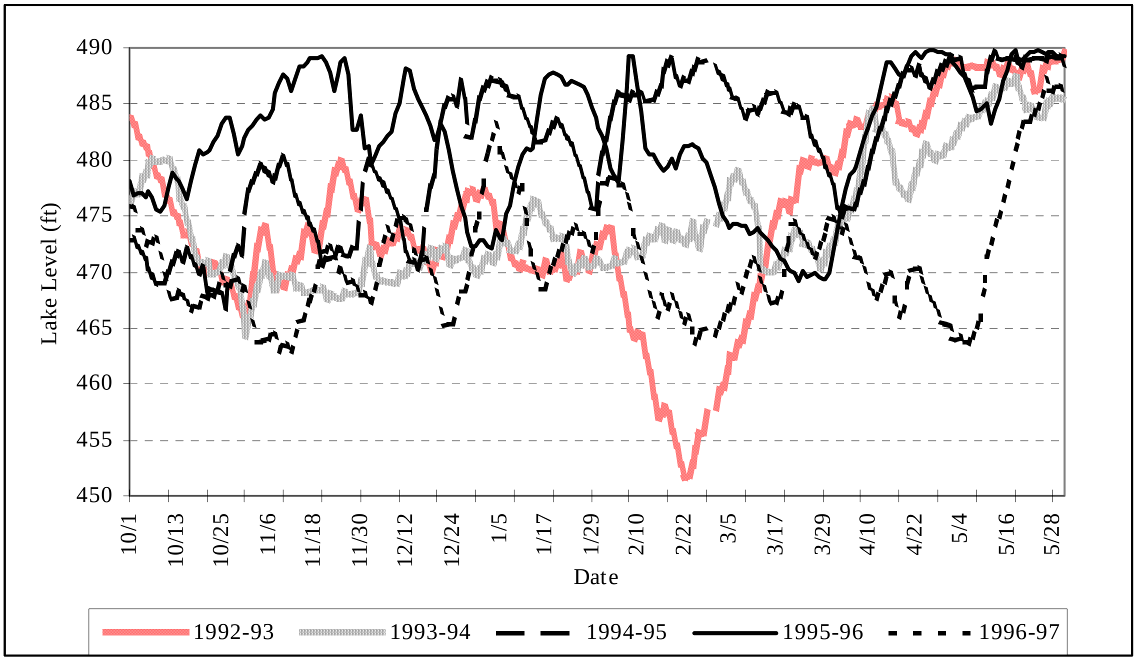

Figure 6.3-3. Yale Lake water level fluctuations during the fall, winter, and spring, 1992-1997.

Overall, Yale Lake was most frequently between 470 and 475 feet during the 1992-1997 winter drawdown periods (Table 6.3-2). Water levels were above 475 feet and 465 feet approximately 52 and 96 percent of the days, respectively, between October and May.

6.3.3 Drawdown Effects on Wetlands

Monitoring of water levels in the 2 large wetlands that are hydrologically connected to Yale Lake–Beaver Bay and IP–indicated no obvious pattern of water fluctuation in relation to Yale Lake water levels. Two other small wetlands adjacent to the lake were also examined qualitatively for effects of reservoir fluctuations. In addition, the effects of water level fluctuations on amphibians that use wetland habitats were assessed.

Table 6.3-2. Frequency of daily pool levels at Yale Lake during the October to May drawdown period, 1992-1997.

Lake Level (ft)	Frequency (days)	Percentage
<450	0	0
450-455	6	0
455-460	12	1
460-465	35	3
465-470	197	16
470-475	341	28
475-480	190	16
480-485	190	16
485-490	245	20
Total	1216	100

6.3.3.1 Beaver Bay Wetland

Between April and June 1997, the water level in Beaver Bay wetland fluctuated an average of 0.9 inch on a daily basis, with a maximum daily fluctuation of 2.2 inches. The only multi-day pattern was a brief 2.5-inch drop in May that lagged behind a 6-foot drop in lake level (Figure 6.3-4). This was followed by a rapid 3-inch rise that may have been in response to a 23-foot rise in lake level. Overall, the water level remained within ± 3 inches of the average water level (30.3 inches) during the entire spring and early summer.

Site visits made during October and November 1997 indicated that the transducer in Beaver Bay wetland was not operating correctly. Therefore, the only data available are the manual gauge depth recordings made once per week from October 1 to November 11. These readings indicated that although Yale Lake had been drawn down, the water level in Beaver Bay wetland actually increased by nearly 6 inches. Monitoring will continue through the 1997-1998 winter.

Overall, there is no indication of a strong relationship between water levels in Beaver Bay wetland and the lake. Water levels in Beaver Bay wetland appear to be maintained by a series of large beaver dams, water from the tributary that flows through the wetland, and precipitation. It is possible that wetland water levels may be more sensitive to reservoir fluctuations during drought conditions, which would be rare in the Lewis River drainage during the fall-winter-spring period when low pool occurs. The stability of water levels at Beaver Day seems to provide highly suitable amphibian breeding habitat for species such as the red-legged frog (see Section 4.3.2). Water stability has been shown to be positively correlated with amphibian abundance (Richter and Azous 1995).

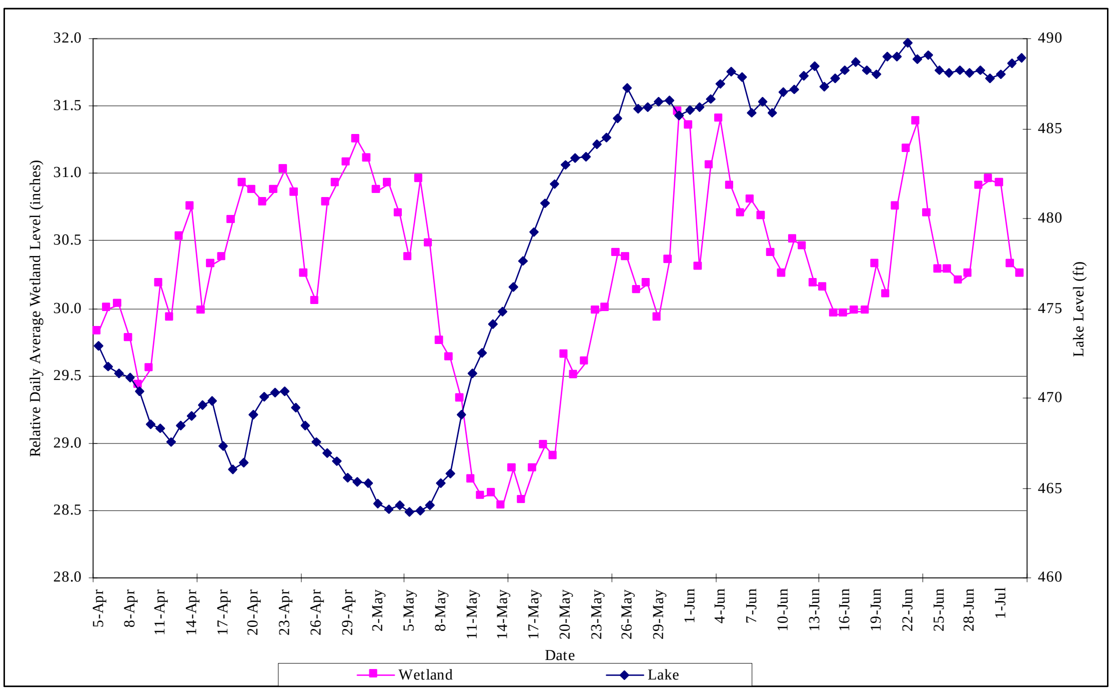

Figure 6.3-4. Beaver Bay wetland water level in relation to Yale Lake water level, April-July 1997.

6.3.3.2 IP Wetlands

Due to transducer problems, reliable water level data were available for the IP wetland only from April 5 to approximately May 24. After this date, the transducer recorded rapidly increasing water levels, even though manual gauge readings during weekly site visits indicated a relatively stable water level. Using the seemingly correct transducer data for April and May, the IP wetland water fluctuated an average of 0.9 inch on a daily basis; the maximum daily fluctuation recorded was 3.4 inches. During April and May, the wetland remained fairly stable, fluctuating no more than ± 2 inches from the average level of 19.8 inches during the entire period (Figure 6.3-5). During site visits, it was noted that the culvert that typically drains the IP wetland into Yale Lake was exposed and dry on the lake side. However, the mouth of the culvert in the wetland is obstructed by a beaver dam and other debris, which apparently maintains the water level in the wetland. It appears that the wetland water level may have increased by a few inches beginning around May 11, as the lake level increased to near its full-pool level (Figure 6.3-5). The IP wetland seems potentially susceptible to a rapid de-watering if the culvert were to become unplugged during a drawdown period. This could result in loss of the amphibian habitat currently provided by the wetland and probable elimination of the populations that occur in the 2 portions immediately adjacent to the IP Road.

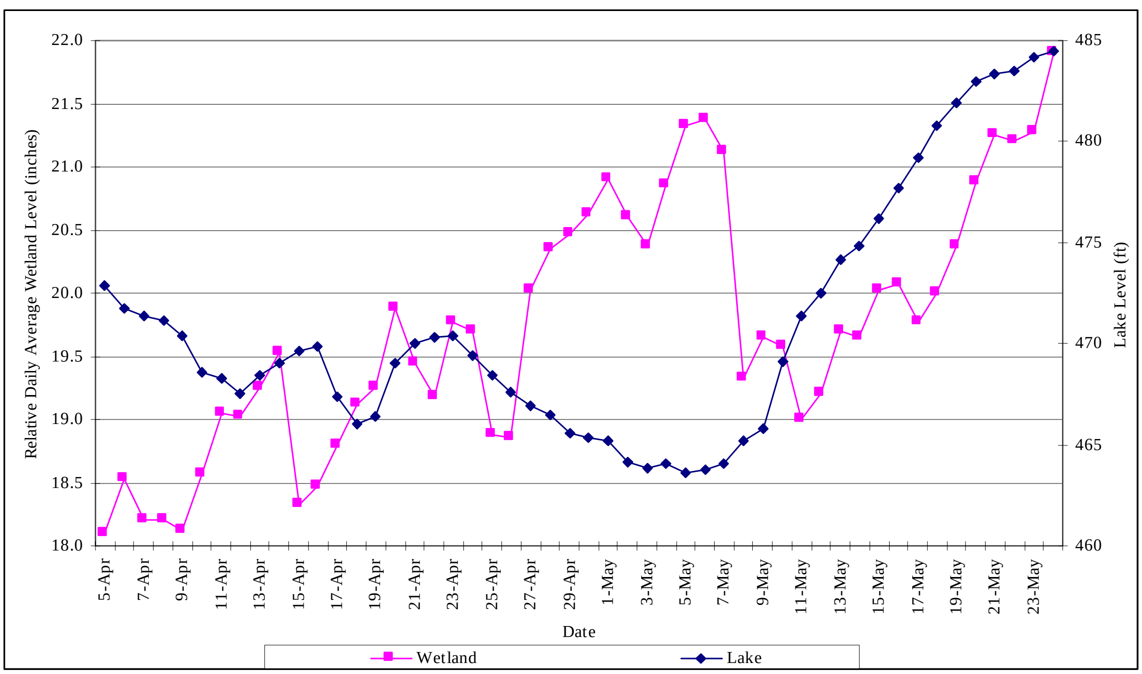

Figure 6.3-5. IP wetland water level relative to Yale Lake water levels, April-May 1997.

6.3.3.3 Other Sites

The only other sites adjacent to the reservoir that support any wetland vegetation are an area near Yale Park, which was mapped as an emergent wetland, and a very narrow fringe of emergent wetland that occurs on the opposite shore (not mapped). The former site is dominated by a mixture of rushes, sedges, and spike-rush, and appears to be seasonally or semi-permanently flooded by the lake. This wetland seems to be fairly stable but probably does not provide breeding habitat for amphibians.

The narrow fringe of rushes and sedges along the eastern shoreline occurs at the up-slope edge of a relatively wide drawdown zone. Again, it appears that the vegetated area is seasonally or semi-permanently flooded. The wide, shallow bench may provide protection from wave action and boat and personal watercraft disturbances.

6.3.4 Wildlife Use of the Drawdown Area

Existing and potential wildlife use of the drawdown zone was assessed through 2 studies: cutbank mapping to identify likely accessible and inaccessible sections, and surveys of drawdown zones to document wildlife use. The results of these 2 studies are described in the following sections.

6.3.4.1 Cutbank Mapping

Results of the cutbank mapping indicate that over 50 percent of the reservoir shoreline, excluding the upstream portion of Siouxon Creek arm and the dam, is greater than 6 feet high during full pool (Table 6.3-3). The majority of the steep and high cutbank occurs along the eastern and southern shores, although several sections occur along the west side as well (Figure 6.3-1). Most of the sections with banks less than 2 feet high occur adjacent to the areas within drawdown zones that are relatively flat and therefore exposed during small decreases in water level (Figure 6.3-1). Consequently, it appears that wildlife can easily access these larger exposed areas.

Table 6.3-3. Length of Yale Lake shorelines with various heights.

Shoreline Height (ft)	Length (ft)	Percent
<2	26,115	21.5
2-6	33,856	27.9
>6	61,244	50.5
Total [1]	121,214	100.0
[1] Excludes 24,936.39 ft of dam and Siouxon Creek arm.		

6.3.4.2 Drawdown Wildlife Survey

The 19-20 February 1997 survey of the drawdown zone indicated very low use of the area by wildlife (Figure 6.3-1). However, the weather was inclement and probably reduced wildlife activity. Observations at each of the surveyed areas are summarized below.

- In the approximately 1,000-ft-wide drawdown zone adjacent to Beaver Bay, the following species were noted: 2 killdeer, 3 crows, 1 bald eagle (foraging in river), and numerous elk and a few deer tracks. Most of the elk and deer tracks were noted near the eastern edge of the drawdown where sparse emergent sedges and an unknown species of moss occurred near the braided and incised creek channel flowing from Beaver Bay wetland to the drawn down lake.

- The small bay near the mouth of Cougar Creek had a drawdown zone that was approximately 600 feet wide on the date of survey. A coyote track was the only evidence of wildlife use noted.

- The drawdown area on the southern shore across from Yale Park was quite extensive on the date of survey, ranging from 400 to 2,000 feet wide. Deer tracks, 4 rough-skinned newts (in a puddle of ORV track), and 1 killdeer were observed.

- South of Speelyai Canal, the drawdown zone was up to 1,038 feet wide. Deer tracks were relatively common, although it is estimated that no more than 4 individual deer left all the tracks that were observed. The only other wildlife sign observed was a coyote track.

- The drawdown zone surrounding the small island near the upstream end of the reservoir extended from the southern shoreline to the island and from the island to the river. One set of raccoon and several sets of deer tracks were observed in this area.

Overall, wildlife use of the drawdown zone appears to be low. However, the exposed area does provide potential foraging habitat for birds (primarily shorebirds and gulls). Elk use appears to be restricted to sites near Beaver Bay; small numbers of deer venture out onto the exposed area, possibly to search for drinking water or to travel (along vegetated shoreline). Most of the drawdown zone is bordered by steep banks that likely minimize access by most mammals (especially deer and elk).

6.3.5 Potential Methods of Establishing and Maintaining Native Vegetation in Drawdown Areas

The annual 20- to 30-foot water level fluctuation in Yale Lake, along with wave action from wind and boat activity, have resulted in a drawdown zone that is virtually devoid of vegetation and steep cutbanks along 50 percent of the shoreline. Cutbanks and unvegetated drawdown areas are very common along large reservoirs, such as Yale Lake, that are used for power peaking operations and flood control. Various utilities, in the Pacific Northwest and throughout the country, and the U.S. Army Corps of Engineers (ACOE) have conducted studies on establishing vegetation to control shoreline erosion, abate dust, and improve wildlife habitat. In many cases the experiments have had limited or no success. However, in some situations, researchers have been able to establish plants in drawdown zones or along reservoir shorelines.

Revegetating shorelines and controlling erosion along a reservoir requires a great deal of planning to maximize success. Allen and Lazor (1989) reported 5 primary tasks in a revegetation process. These include: (1) site selection, (2) plant species selection, (3) site preparation, (4) selection of proper planting methods, and (5) post-planting operations and maintenance. Sites should be selected based on a set of clearly defined priorities and environmental constraints. Vegetation establishment has the greatest chance of succeeding at sites that are at least partially protected from wave action, have a gradual slope, have suitable substrate, and are adjacent to naturally occurring vegetated areas.

Once sites are selected, appropriate plant species need to be chosen. Of primary importance, is the selection of native species that meet the desired objectives (e.g., erosion control, wildlife habitat, etc.). Site preparation is the next important step in attempting to revegetate a site along a reservoir. Site preparation requires a detailed landscape plan and may include such activities as grading, treating the soil, irrigation, protecting the site from humans and wildlife, and deciding where to plant each species. There are numerous methods for planting vegetation in drawdown areas and along reservoir shorelines. However, the most common methods include seeding, transplanting cuttings, or using plant rolls. Plant rolls are cylinders of plant clumps in soil, which are wrapped in burlap and secured by wire and can reportedly withstand 2-foot waves. Previous efforts have shown that seeding in mudflats shortly after lowering water levels has been most successful (Allen and Lazor 1989). After planting, monitoring the survival and growth are important. Additional site protection measures and supplemental planting are also often required.

The following is specific information regarding a small sample of reservoir drawdown/ shoreline revegetation efforts in the Pacific Northwest.

- **Jackson Hydroelectric Project–Snohomish County** - As part of mitigation for the Jackson Hydroelectric Project, Snohomish County PUD conducted test-plantings to evaluate the feasibility of more extensive plantings to provide winter wildlife forage and fish habitat in the drawdown area. The Jackson Project, which was completed in 1984, is located in western Washington at an elevation of 1,800 feet msl. Beginning in September, Jackson reservoir is drawn down 30 to 40 feet. Promising sites near the upstream end of the reservoir were selected to test 5 plant species. The results indicated that the most promising areas did not require supplemental planting and were colonized on their own by bulrushes (*Scirpus* spp.) and sedges (*Carex* spp.). The test program did result in the successful establishment of slough sedge and beaked sedge (*Carex rostrata*) at sites that were inundated with up to 10 feet of water at full pool. Sites subjected to wave action and debris were not colonized successfully by any plants (phone conversation with B. Tannebaum, Biologist, Snohomish County PUD, Everett, Washington, December 16, 1996).

- **Tacoma City Light** - Between 1966 and 1976, Tacoma City Light worked with the Northwest Weed Service and U.S. Department of Agriculture Soil Conservation Service to identify plant species that would tolerate the water level fluctuations in reservoirs used for power generation and flood control. Reed canarygrass *(Phalaris arundinacea)*, native sedges, lilyturf, various grasses, bald cypress *(Taxodium distichum)*, cottonwood *(Populus trichocarpa)*, and willow *(Salix* spp.)were planted along the margins of Alder Lake, the reservoir for the Nisqually Hydroelectric Project, which is located on the Nisqually River in western Washington. These species were planted alone and in combination with chemical stabilizers. None of the species or planting methods resulted in the successful establishment of vegetation in the drawdown area at Alder Lake (Tacoma City Light 1995).

Tacoma City Light also owns the Cowlitz Hydroelectric Project, which includes 2 reservoirs—Riffe and Mayfield lakes. These reservoirs are located on the Cowlitz River, which is south of the Nisqually River and north of the Lewis River. Riffe Lake has about 2,000 acres of mudflats that are exposed or shallowly flooded (< 1 foot of water), typically from November through February. Portions of this mudflat naturally supported emergent and aquatic vegetation, reed canarygrass, and stands of fall and winter-germinating grasses and forbs (Oakerman and Tipping 1983). Beginning in the early 1980s, the WDFW began seeding up to about 300 acres of the Riffe mudflats with winter wheat and rye. This planting effort was part of the wildlife mitigation program for the Cowlitz Project, with the purpose of providing winter feed for waterfowl and big game in this area. Hydrophytic shrubs, primarily willow, were also planted in several sites within the drawdown zone of Riffe Lake (Oakerman and Tipping 1983).

Information is lacking on the success of establishing willow in the drawdown zone, and the program of planting winter wheat and rye has recently been discontinued (phone conversation with S. Berstead, WDFW, Cowlitz Fish Hatchery, January 7, 1998). Off-road vehicles often destroyed much of what was planted and winter waterfowl use of the reservoir was considered too variable to warrant continued provision of winter feed. In addition, it appears that emergent and aquatic vegetation is naturally reestablishing in the areas that were once planted; species recently observed include duckweed (*Lemna* sp.), elodea (*Elodea* sp.), pondweed (*Potamogeton* sp.), and coontail (*Ceratophyllum demersum*). Reed canarygrass still occurs but its spread appears to be controlled by the fluctuations of the reservoir (phone conversation with S. Berstead, WDFW, Cowlitz Fish Hatchery, January 7, 1998).

- **Blue River Reservoir -** Blue River Reservoir is located in Willamette National Forest, on the Blue River, a tributary to the MacKenzie River, which flows into the Willamette River at Springfield, Oregon. The reservoir is used to augment flows and control late summer temperatures in the Willamette River. The drawdown begins in July, with low-pool occurring in September. The reservoir refills in February and peaks in May. In 1969, the USFS conducted trials with plantings of bald cypress, silky dogwood (*Cornus amonum*), reed canarygrass, Columbia sedge (*Carex aperta*), and slough sedge in the drawdown zone of the Blue River reservoir (record of telephone conversation between D. Skeesick, Biologist, Willamette National Forest and J. Baerment, Beak Consultants, December 17, 1986). The 2 sedge species are native to the Pacific Northwest; bald cypress, reed canarygrass, and silky dogwood are not.

  No documentation of the experimental plantings at Blue River reservoir occurred until the mid-1980s, when a USFS biologist noticed vegetation in the drawdown zone and determined that the bald cypress had survived. Investigations revealed that trees planted in areas that were flooded by up to 50 feet of water were 3 feet tall; those planted at the 10-foot depth contour were 10 to 15 feet tall. The cypress were successful at controlling erosion but have essentially no wildlife value. The survival rate of silky dogwood was low because of browsing by deer. Reed canarygrass, however, established successfully, and Columbia sedge and slough sedge were also found to survive relatively well in the drawdown area. Both sedge species began to grow immediately after the water level drops, and died back in the winter. Deer, elk, and geese all foraged heavily on these species. Columbia sedge was planted by transplanting 2- to 3-inch sod plugs from a nearby lake; planted material slowly spread laterally in all soils except those composed of heavy clay. Overall, however, slough sedge was found to be more winter tolerant than Columbia sedge and spread much more rapidly. Experimentation with willows (*Salix* spp.) was also fairly successful (record of telephone conversation between D. Skeesick, Biologist, Willamette National Forest and J. Baerment, Beak Consultants, December 17, 1986).

- **Lower Snake River Hydroelectric Projects** - During an experimental drawdown of the 4 reservoirs on the lower Snake River, the Corps of Engineers planted 5 species in the drawdown zones of Lower Granite and Little Goose reservoirs. Planting occurred in March 1992, just as the water levels began to rise. The 5 species included creeping spike-rush (*Eleocharis palustris*), Columbia sedge, slough sedge, softstem bulrush (*Scirpus validus*), and tufted hairgrass (*Descampsia caespitosa*). All 5 species established and grew well but slough sedge was not grazed by geese and showed the best establishment after planting (Phillips 1992).

- **Cedar River –** No drawdown/shoreline revegetation has been attempted by Seattle Public Utilities (SPU). The reservoir on the Cedar River was drawn down during winter in the 1970s and 1980s, which exposed large areas of sedge (*Carex* spp.) dominated delta. Since the 1980s, reservoir water levels have been held at a higher elevation. This has resulted in a loss of over 30 percent of the sedges at depths of up to 15 feet. Many species may not recolonize naturally if seeds or rhizomes are not available. SPU has planted sedges on floating goose nesting platforms with good success (pers. comm., D. Paige, Wildlife Biologist, SPU, North Bend, Washington, January 15, 1998).

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