Boundary Hydroelectric Project (FERC No. 2144)

Aquatic Invasive Species Control and Prevention Plan Annotated Outline

Seattle City Light

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TABLE OF CONTENTS

List of Tables

Aquatic Invasive Species Control and Prevention Plan
Annotated Outline
Boundary Hydroelectric Project (FERC No. 2144)

1 INTRODUCTION

This document provides an outline of Seattle City Light's (SCL) proposed Aquatic Invasive Species Control and Prevention Plan (plan) for the Boundary Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 2144. The plan will direct the implementation of measures undertaken to prevent the introduction and/or spread of introduced invasive aquatic submerged macrophytes (mainly Eurasian watermilfoil) and zebra and quagga mussels. The Washington Department of Ecology (Ecology) recognizes the need to develop long-term management measures for the aforementioned aquatic nuisance species in the region, including the Project area.

The following sections provide a description of SCL's proposed approach to post-license implementation of measures to reduce the abundance of invasive aquatic submerged macrophytes, as well as monitoring to assess the success of those measures. Also addressed are monitoring methods for zebra and quagga mussels, an Information and Education (I&E) program to help prevent the spread of aquatic invasive species, and Best Management Practices (BMPs) to be implemented during construction/maintenance in aquatic environments to prevent the dispersal of invasive macrophytes.

2 BACKGROUND

On April 12, 2005, SCL met with Ecology at its Spokane office to discuss issues related to Section 401 water quality certification of the Project (Item 81, Appendix 6-1 of SCL's Pre-Application Document [PAD] [SCL 2006]). During this pre-relicensing consultation meeting, Ecology identified Eurasian watermilfoil (*Myriophyllum spicatum)*, currently found in the Project area, and zebra mussels (*Dreissena polymorpha)*, which have the potential to be introduced to the State of Washington, as the two invasive species of concern for the Project area. Ecology specifically identified boat ramps and the dam structure as two locations where zebra mussels could become an issue if they were to be introduced.

The quagga mussel (*Dreissena rostriformis bugensis*), a species similar to the zebra mussel, is also an invasive species of concern to resource agencies in the State of Washington, and curly pondweed (*Potamogeton crispus*), also an introduced aquatic macrophyte species, is present in the Project area and may respond to measures implemented for the control of Eurasian watermilfoil.

2.1. Aquatic Invasive Species of Concern

2.1.1. Eurasian Watermilfoil

Eurasian watermilfoil (referred to henceforth as milfoil), an aquatic plant native to Europe, Asia, and North Africa, was first collected from a pond in the District of Columbia during the fall of 1942. By 1985, it had been found in 33 states, the District of Columbia, and the Canadian provinces of British Columbia, Ontario, and Quebec (Ecology 2007). Milfoil was first documented in the State of Washington in 1965, and in spite of efforts to stop its spread, it dispersed through the Okanogan Lakes and into the Okanogan and Columbia rivers in 1974 (Duke 2001).

Milfoil is highly adaptable, tolerating a variety of environmental conditions. It is a rooted plant that grows in water depths from 1 to 10 meters, can survive under ice, and can grow under a wide range of temperatures (Ecology 2007). Milfoil exhibits an annual growth pattern, with shoots beginning to proliferate rapidly as water temperatures approach 15 ˚C in the spring. When plants near the surface, shoots branch out, often forming a dense canopy (Ecology 2007). Plants flower at the surface and die back to root crowns in the fall, which sprout again in the following spring. Vegetative reproduction is the primary means of the species' dispersal. During the growing season the plant undergoes fragmentation, and these fragments have the potential to develop into new plants (Ecology 2007). Milfoil can adversely impact aquatic ecosystems by outcompeting native submerged aquatic macrophytes and when abundant can affect aquatic habitat and water quality. It can also impact power generation by clogging intake structures and can interfere with recreational activities.

Milfoil is classified as a class B noxious weed by the Washington State Noxious Weed Control Board (WNWCB 2007), and is designated for control in Pend Oreille County. Class B noxious weeds are introduced species of limited distribution in Washington State. Milfoil is also identified as a nuisance species in the Washington State Aquatic Nuisance Species Management Plan (ANSC 2001).

2.1.2. Zebra Mussel and Quagga Mussel

Zebra and quagga mussels are freshwater, bivalve mollusks that are native to Eurasia. Both species were introduced into the Great Lakes in ballast water discharge from transoceanic ships (USGS 2007). Zebra mussels first invaded North America in the mid-1980s and quagga mussels invaded a few years later in 1989 (USFWS 2007). These two species are closely related with subtle morphological differences. The North American distribution of these species has been concentrated in the Great Lakes region, although zebra mussel distribution extends into the southern and mid-western states. Despite measures to prevent their westward expansion, quagga mussels have been found in Lake Mead and other reservoirs serving southern California.

Zebra and quagga mussels can spawn throughout the year if conditions are favorable, but peak spawning generally occurs in spring and fall. Fecundity is high, with a few individuals having the ability to produce millions of gametes (USFWS 2007). After fertilization, microscopic larvae (veligers) develop, and these planktonic larvae are transported by currents for three to four weeks until settling on suitable substrate. Adults generally attach to hard surfaces (although

quagga mussels can live in soft sediments) but can detach and move if conditions become unfavorable. Both species tolerate a wide range of water temperatures (1-30 ˚C) and low water velocities (< 2 meters/second) (USFWS 2007). Zebra mussels are typically found just below the water's surface to depths of about 12 meters, and quagga mussels can live at any depth where oxygen is available (USFWS 2007).

Both zebra and quagga mussels can clog water intake structures such as pipes and screens, thereby interfering with hydropower generation and water treatment. Recreation facilities, such as docks, breakwaters, and buoys, are also susceptible to colonization (USGS 2007).

2.2. Submerged Macrophyte Surveys in the Project Area

Mapping surveys of submerged aquatic macrophytes in the Project area were conducted in August 2007, i.e., during the period of peak macrophyte growth (Mainstem Aquatic Habitat Modeling [SCL 2009a]). The entire shoreline from Box Canyon tailrace to Boundary Dam was surveyed for the presence of macrophytes. A GPS point was taken every 1,000 meters or when macrophytes were encountered. When macrophytes were present, GPS points were taken at the boundaries of the macrophyte beds and every 300 feet along the outside of the beds. A sufficient number of points was recorded to clearly define the limits of each bed. At each GPS point within the beds, species present and their respective percent cover were recorded. If dewatered and dry macrophytes were encountered, the species identification and their respective percent cover were estimated.

For the purpose of conducting relicensing studies in 2007 and 2008, the Project area was divided into the following reaches. Results of macrophyte surveys are reported below for each of these reaches.

- The Tailrace Reach, which extends from Boundary Dam downstream to the US-Canada border, is characterized by deep pools (> 75 feet) in the spillway and turbine afterbays but is generally less than 30 feet deep elsewhere. Downstream of the spillway and afterbay pools, the tailrace is relatively swift, with cobble and boulder substrates.

- The Forebay Reach, which extends from Boundary Dam upstream to the lower end of Z-Canyon, is wide and deep, with steep-walled banks, and water depths to approximately 260 feet. There is little shallow littoral habitat in this area.

- The Canyon Reach, which extends from the downstream end of Z-Canyon to Metaline Falls, is predominantly narrow with steep rock walls. A few large embayments and backwater channels provide localized shallow habitats, and areas of rock outcroppings provide habitat complexity. Depths in this reach are typically 80 to 100 feet.

- The Upper Reservoir Reach, which extends from Metaline Falls to Box Canyon Dam, is relatively wide and shallow, with a combination of silt, sand, and hard substrates, and water depths typically ranging from 10 to 25 feet.

Submerged macrophyte species found in the Project area are listed in Table 2.2-1. Eurasian watermilfoil and coontail (*Ceratophyllum demersum)* were the dominant macrophyte species, although curly pondweed appeared to be invading areas of established milfoil beds, displacing both milfoil and coontail in some areas.

Table 2.2-1. Macrophyte species in Boundary Reservoir during 2007 surveys.

Scientific Name	Common Name	Status
Myriophyllum sibericum	northern milfoil	Native
Myriophyllum spicatum	Eurasian watermilfoil	Non-native
Ceratophyllum demersum	coontail	Native
Elodea canadensis	common waterweed	Native
Potamogeton crispus	curly pondweed	Non-native
Potamogeton pectinatus	sago pondweed	Native
Potamogeton vaginatus	sheathing pondweed	Native
Potamogeton richardsonii	Richardson's pondweed	Native
Potamogeton zosteriformis	flat-stem pondweed	Native
Ranunculus aquatilis	white water buttercup	Native

In 2007, 33 macrophyte beds existed in the Upper Reservoir Reach, 27 in the Canyon Reach, 12 in the Forebay Reach, and zero in the Tailrace Reach (Table 2.2-2). Macrophyte beds covered 20.7 acres in the Canyon and Forebay reaches and 202.5 acres in the Upper Reservoir Reach.

Table 2.2-2. Number and size of macrophyte beds in the Project area during 2007.

Reservoir Zone	Number of Macrophyte Beds	Macrophyte Bed Size Range (acres)	Total Macrophyte Area (acres)
Upper Reservoir Reach	33	0.02-61.7	202.5
Canyon Reach	27	0.001-7.9	12.3
Forebay Reach	12	0.001-8.4	8.4
Tailrace Reach	0	0	0
		Total	**223.2**

3 INVASIVE SPECIES CONTROL AND PREVENTION MEASURES

3.1. Control and Prevention Measures

3.1.1. Macrophyte Control

SCL has agreed to undertake measures aimed at reducing the abundance of introduced submerged aquatic macrophytes (chiefly Eurasian watermilfoil) in Boundary Reservoir. As part of the Integrated Resource Analysis (IRA) process, SCL will use aquatic habitat modeling to investigate potential operational measures designed to reduce the distribution and abundance of introduced macrophytes. The rationale for the modeling scenario will be to produce the maximum amount of sediment exposure in areas where aquatic macrophytes take root and begin to grow in the spring. A summer macrophyte control scenario may also be an option, but preliminary analysis indicates that a spring drawdown would be more effective in desiccating and reducing the spread of milfoil. If an operational approach is selected, a multiple-year program could be most effective, with two to three years of repeated, effective drawdown potentially resulting in two to three years of control.

If operational measures are determined to be infeasible or undesirable due to adverse effects on other resources, SCL will implement non-operational measures to control introduced macrophytes. Bottom barriers that prevent light from reaching macrophytes may be deployed in target areas, such as boat launches or other locations of concern (e.g., fish stranding/trapping pools where effects on fish may be increased by macrophyte presence). Macrophyte harvest methods may also be applied. If non-operational measures are selected as the appropriate approach to macrophyte control, SCL will work with Ecology and other relicensing participants during the IRA process to identify the specifics of the control program, including target locations for macrophyte control, the area over which control measures are to be applied, and the frequency and duration of treatment.

3.1.2. Monitoring for Zebra and Quagga Mussels

SCL staff at the Boundary Dam routinely survey facilities for any abnormalities. An option being considered by SCL is the training of staff members at the dam to identify zebra and quagga mussels so that they can report the presence of these species if they are observed on facilities associated with the dam or at the Forebay Recreation Area, including the boat launch. If zebra or quagga mussels were detected during monitoring of Project facilities, SCL would notify the appropriate regional and state agencies and assist in the implementation of reasonable and appropriate measures to address the mussels' presence, as is consistent with Aquatic Nuisance Species Management protocols.

3.1.3. Information and Education Program

SCL proposes to implement an I&E program aimed at reducing the potential for the spread of invasive macrophyte species and zebra and quagga mussels. Signs will be installed at boat launches as part of a larger public education program, which will be outlined in SCL's Recreation Resources Management Plan (SCL 2009b). SCL will also provide literature produced by appropriate state entities (Ecology and WDFW) for distribution at the visitor centers

of local communities in towns near the Project (Metaline, Metaline Falls, and Ione) and at Boundary Dam.

3.1.4. Implementation of Best Management Practices

When construction, improvement, or maintenance actions conducted at recreation areas, boat launches, and swim areas require removal or disturbance of aquatic macrophyte beds containing Eurasian watermilfoil or curly pondweed, SCL will implement containment efforts as dictated by BMPs agreed to by the SCL, Ecology, and other relevant resource agencies.

3.2. Monitoring Macrophyte Response

SCL will work with Ecology and other resource agencies during the IRA process to identify metrics and methods for assessing the success of the macrophyte control program. These are likely to include assessments of changes in the stem density of Eurasian watermilfoil at treatment sites and monitoring of shifts in species composition away from introduced macrophyte species toward native species.

In addition, SCL will monitor dissolved oxygen (DO), as described in the Dissolved Oxygen Attainment Plan for the Project (SCL 2009c), to assess potential changes in DO as a function of reductions in the abundance of macrophytes, chiefly milfoil. Although data from relicensing studies (conducted in 2007 - 2008) designed to assess the effects of macrophyte beds on DO showed that DO fluctuations within macrophyte beds did not influence reservoir-wide DO concentrations (Evaluation of the Relationship of pH and Dissolved Oxygen to Macrophytes in Boundary Reservoir Final Report [SCL 2009a]), respiration linked to the decomposition of plant matter in the reservoir may contribute to DO declines.

3.3. Implementation Schedule

Macrophyte control measures could be implemented as early as the second summer following license issuance. SCL will coordinate with Ecology and other resource agencies to identify treatment frequency, an important element of a comprehensive schedule. Surveys to assess the effect of control measures, as noted in the previous section, will take place immediately following treatment and then in subsequent years as dictated by treatment regime. DO monitoring will begin the first summer after license issuance. SCL will summarize each year's data in a brief technical memorandum, which will be submitted to Ecology in December of each year. A more detailed schedule will be provided in the Aquatic Invasive Species Control and Prevention Plan submitted to Ecology with the final 401 application.

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