Burlington Bottoms Wildlife Mitigation Site

Five Year Habitat Management Plan

Technical Report
2001 - 2005

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Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

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BURLINGTON BOTTOMS WILDLIFE MITIGATION SITE
Project #91-078

FIVE-YEAR HABITAT MANAGEMENT PLAN
2001-2005

Prepared for:

Bonneville Power Administration
905 NE 11th Avenue
Portland, Oregon 97232

Prepared by:

Susan G. Beilke
Oregon Department of Fish and Wildlife
Sauvie Island Wildlife Area
18330 NW Sauvie Island Road
Portland, Oregon 97231

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1. INTRODUCTION

Historically the lower Columbia and Willamette River Basins were ecologically rich in both the habitat types and the species diversity they supported. This was due in part to the pattern of floods and periodic inundation of bottomlands that occurred, which was an important factor in creating and maintaining a complex system of wetland, meadow, and riparian habitats. This landscape has been greatly altered in the past 150 years, primarily due to human development and agricultural activities including cattle grazing, logging and the building of hydroelectric facilities for hydropower, navigation, flood control and irrigation in the Columbia and Willamette River Basins.

The Burlington Bottoms (BB) wetlands contains some of the last remaining bottomlands in the area, supporting a diverse array of native plant and wildlife species. Located approximately twelve miles northwest of Portland and situated between the Tualatin Mountains to the west and Multnomah Channel and Sauvie Island to the east (Figure 1), the current habitats are remnant of what was once common throughout the region. In order to preserve and enhance this important site, a five-year habitat management plan has been written that proposes a set of actions that will carry out the goals and objectives developed for the site, which includes protecting, maintaining and enhancing wildlife habitat for perpetuity.

2.0 BACKGROUND

In 1991, Burlington Bottoms was one of the first sites in Oregon to be purchased by the Bonneville Power Administration (BPA) under the Willamette and Columbia River Basins Fish and Wildlife Programs, to provide partial mitigation for the impacts associated with the construction of hydroelectric facilities. The Northwest Power Act of 1980 established and charged the Northwest Power Planning Council (NPPC or Council) with the task of developing a comprehensive fish and wildlife mitigation program to protect, mitigate, and enhance fish and wildlife habitat in the Columbia and Willamette River Basins (Power Act 1980, Section 4 (H)(1)(A), page 12; NPPC 1994, Section 2, page 2-1). This program, initially adopted in 1982, was amended in 1984, 1987, 1991-1993, and 1994. Consistent with Section 1003(7) of the Council's Fish and Wildlife Program, BPA is authorized to fund implementation of projects that will help reach the Council's wildlife mitigation goals and objectives.

The Oregon Department of Fish and Wildlife (ODFW) was contracted by BPA in 1993 to conduct interim management of the BB site, which included completion of a habitat assessment or habitat evaluation procedure (HEP). The HEP, a process developed by the U.S. Fish and Wildlife Service (USFWS), utilizes a species/habitat approach to quantify relative habitat values for mitigation crediting (see the separate report titled *Burlington Bottoms Habitat Evaluation, August 1993,* for further information).

In addition to the HEP work, a hydrology and hydraulics assessment was completed in 1993. Results of the habitat and hydrology assessments were then incorporated into the writing of the Environmental Assessment/Management Plan in 1994. Implementation of the Management Plan began in 1995, which has included to date custodial oversight, removal of non-native invasive plant species and planting of native plants to increase the biological diversity on the site.

An assessment of both the current and desired future habitat conditions at BB was completed in November 1998, and was documented in the report titled *Current and Desired Future Habitat Conditions and Related Habitat Units at Burlington Bottoms, November 1998.* This report also identified maintenance and enhancement opportunities and associated costs that would benefit wildlife by 1) maintaining current habitat conditions (baseline habitat units), and 2) creating additional future habitat units (AAHUs).

The Five-Year Habitat Management Plan for BB incorporates information from all of the documents listed above. In addition, proposed enhancement actions and methodologies are based in part on a review of local and regional habitat management issues, current enhancement methods being used on projects on other sites (e.g., USFWS's Ridgefield Wildlife Refuge, USFW's Sandy River Delta), other BPA wildlife projects (e.g., Willamette Basin projects, Metro Parks and Greenspaces lands north of BB), ODFW's Sauvie Island Wildlife Area, and discussions with wildlife habitat managers and plant ecologists regarding the most effective and efficient methods for controlling/removing non-native plant species and enhancing native plant communities.

3.0 GOALS AND OBJECTIVES

The following project goal statement and general project objectives are consistent with the principles of the Council's Fish and Wildlife Program, and the Columbia Basin Fish and Wildlife Authority (CBFWA) Wildlife Caucus' Draft Guidelines for Enhancement, Operation, and Maintenance Activities for Wildlife Mitigation Projects (CBFWA 1998). Specific objectives designed to achieve the habitat enhancement goals are listed and described in Section 4.2.

3.1 Goal Statement

The overall goal of the Five-Year Habitat Management Plan is to protect, maintain and enhance fish and wildlife habitat at Burlington Bottoms. This will in turn satisfy a portion of the mitigation requirements of the Northwest Power Act of 1980, as amended. The project area will be maintained primarily as wetland and upland habitats typical of those found historically along the lower Willamette and Columbia River Basins. Any proposed future recreational, research, or other activity other than habitat maintenance and enhancement must be compatible with the goals and objectives of this Plan. Implementation of the 5-Year Habitat Management Plan will help achieve the project's overall goal to provide mitigation for the impacts associated with the hydropower system.

3.2 General Goals:

The general goals of the 5-Year Habitat Management Plan are to:

- Protect, maintain and enhance the biological diversity of the site.
- Maintain and enhance the six habitat types found on the site so that they more closely resemble bottomland habitats historically found in this area.
- Maintain consistency with the Council's Fish and Wildlife Program and Phase IV Resident Fish and Wildlife Program Amendments.

- Assist BPA in meeting their wildlife mitigation obligations in a cost-efficient manner.
- Assist BPA in finding a land management agency to assume ownership of the site.

3.3 General Objectives:

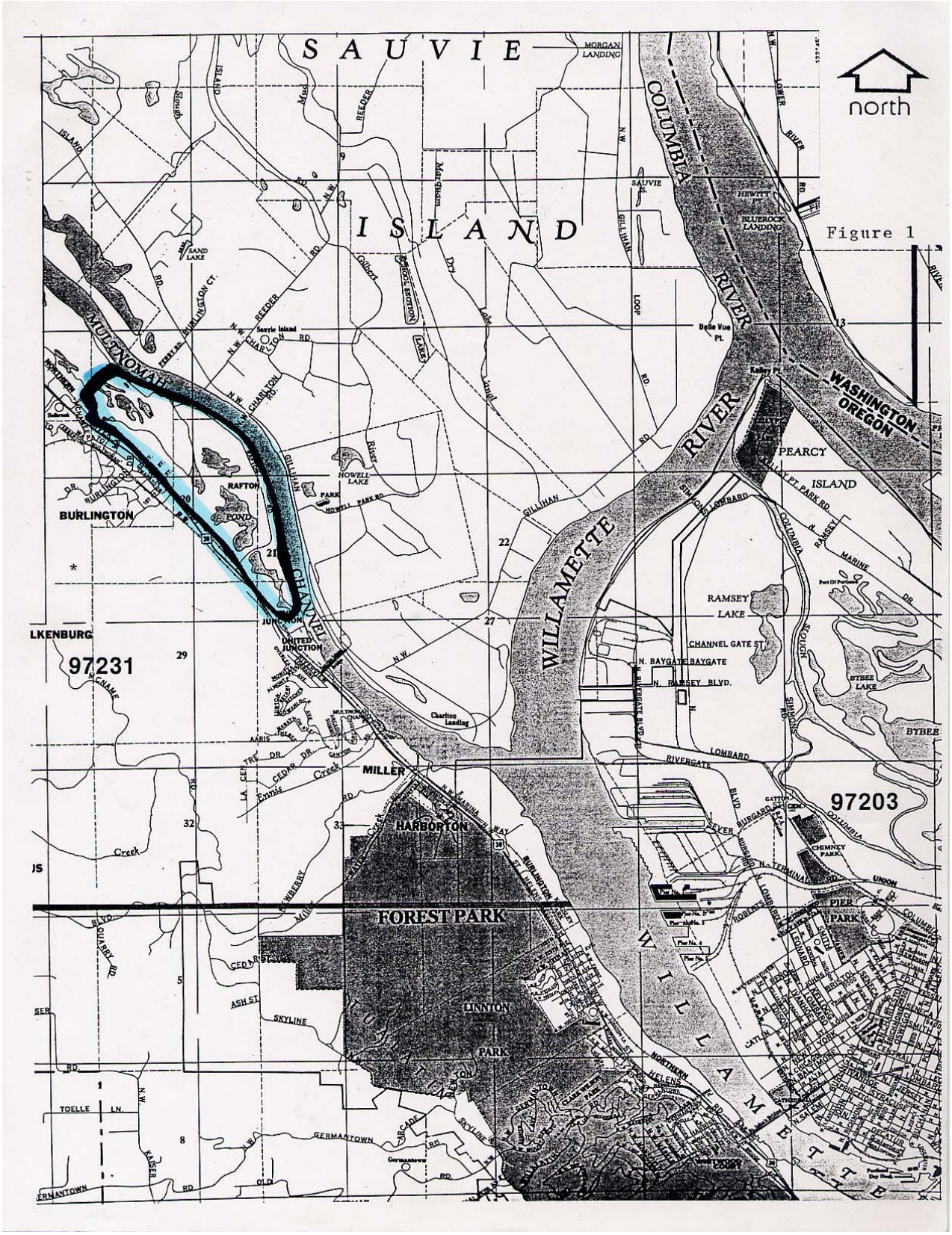
The general objectives of the BB wildlife mitigation project area are to:

- Protect and maintain 1,319 Habitat Units (HUs) for eight target and associated wildlife species through maintenance and enhancement of wildlife habitats (see 1993 BB HEP report).
- Provide an additional 105 or more future habitat units (AAHUs) by the year 2005, through enhancement of wildlife habitats (see 1993 BB HEP report). Determination of future AAHUs would be made by conducting a modified HEP after enhancement objectives have been met.

3.4 General Mitigation Principles:

This plan is based on and consistent with the following mitigation principles identified in the Council's Program (NPPC 1994) to help ensure that wildlife mitigation goals and objectives are met.

- Use the most cost efficient methods to achieve biological objectives.
- Have measurable benefits, such as the restoration of a given number of habitat units.
- Help protect or enhance natural ecosystems and species diversity over the long-term.
- Encourage the formation of partnerships with other persons or entities to reduce project costs, increase benefits, and/or eliminate duplicative activities.
- Do not impose on BPA the funding responsibilities of others, as prohibited by Section 4(h)(10)(A) of the Northwest Power Act.


north
Figure 1
SAUVIE
ISLAND
COLUMBIA
RIVER
WASHINGTON
OREGON
PEARCY
ISLAND
WILLAMETTE
RIVER
MULTNOMAH
CHANNEL
BURLINGTON
RAFTON
POND
HOWELL
LAKE
RAMSEY
LAKE
CHANNEL GATE ST.
N. BAYGATE BAYGATE
N. RAMSEY BLVD.
BYBEE
LAKE
BYBEE
97231
97203
MILLER
HARBORTON
FOREST PARK
LINNTON
PARK
PIER
PARK
CHIMNEY
PARK
Charlton
Landing
Sauvie Island
Belle Vue
Pt.
Kelley Pt.
HEWITT
PT.
BLUEROCK
LANDING
MORGAN
LANDING
SAUVIE
IS.
SAND
LAKE
Port Of Portland
Pier No. 2
Pier No. 3
Pier No. 4
Pier No. 5
LKENBURG
JS
ERNANTOWN

4.0 5-YEAR HABITAT ENHANCEMENT PLAN

In order to achieve the goals and objectives identified for the site, a combination of management strategies would be utilized over the five-year period. Enhancement methods would include manipulation of water levels, mechanical and hand removal of non-native vegetation and planting of native plants to increase diversity on the site.

Because the hydrology of the site is one of the major factors influencing both the character of the habitats and the wildlife species using those habitats, a water management plan has been developed that allows for control of the duration, amount, and timing of water in various areas. Water management is necessary on the site in order to mimic to the extent possible historic water conditions, which in turn allowed for native plant communities to flourish. Currently, control of water levels is one of the most widely accepted and successful methods of eliminating exotic plant species such as reed canary grass from wetlands. The water management plan is described in Section 4.1 along with other enhancement methods proposed for the site. Figure 2 depicts the areas (by elevation) that may be affected by water management activities.

Section 4.2 describes the four Zones (Figure 3) within BB, and the habitat types (Figure 4), enhancement actions and objectives specific to each zone. The four zones are essentially four sub-areas within the site which have been delineated for ease of planning and to more effectively monitor and evaluate enhancement actions over the long-term.

A five-year schedule of the enhancement actions is detailed in section 4.3. Other management actions such as maintaining/improving the infrastructure (e.g., improve existing roads) in order to access an area, are addressed in Section 6.0 under Infrastructure Needs.

4.1 Enhancement Strategies and Methods

The alteration of the water regimes and effects of long term cattle grazing at Burlington Bottoms in the past 50 years has had a substantial impact on native plant communities and wildlife species, allowing for an invasion of exotic plant and wildlife species over time and the overall loss of biological diversity in some areas on the site. Because of the complexity of the site and the difficulty in removing and/or controlling invasive plant species, a combination of methods, including water management, mechanical and hand removal, and native planting, would be utilized over the five-year period in order to restore native plant communities and species diversity in certain areas**.**

4.1.1 Water Management Plan

The installation and operation of a water control structure would be the primary method used to restore native plant communities on the site, by controlling the amount, timing and duration of water in various areas. The first phase of the water management strategy would include the following:

- Water levels would be manipulated through the installation of a water control structure on the outlet slough connecting Horseshoe Lake to Multnomah Channel (see Figure 2 for location), allowing for water availability and control in order to mimic natural hydrologic processes.

The water control structure will allow impoundment of an additional estimated 10-12 feet of water within the outlet slough; this is expected to overflow into the open water, emergent wetlands, wet meadow and forested wetland habitats. It is anticipated that the water control structure should flood approximately 125.0 acres (this will be determined after surveys are completed) in all four zones, in the following habitat types:

- Open water - approximately 60 acres; Emergent wetland - approximately 35 acres; Wet meadow - approximately 20 acres; and Forested wetland - approximately 10 acres.

These estimates are based on topographic features on the site and the anticipation that the water control structure may not affect any acreage at an elevation higher than 12 feet.

- Moist soil management techniques would be utilized to maintain and increase where possible the native plant diversity and to remove/control exotic plant species such as reed canary grass.
- The use of a high capacity pump to increase water flow (from the Multnomah Channel) into the southern portion of the site may be necessary, in order to augment existing water levels during a given year in order to control reed canary grass and other exotics. This technique may be necessary in years when water levels are low due to drought conditions and other unforeseen events, and there is insufficient water on the site to allow for proper water management.
- Habitat manipulations, including mowing, spraying, and disking may be used in conjunction with the water control structure, depending on conditions specific to a given area on the site.

Through the proper use of moist soil management techniques, it is expected that control/removal of exotic species including reed canary grass will be achieved in various habitats, allowing for the re-establishment of native plant species. Based on the habitat types and total acres that may be affected by water manipulation, it is estimated that:

- Approximately 125 acres of reed canary grass could be removed/controlled on the site, enhancing open water, emergent wetland, forested wetland and wet meadow habitats.
- In addition, other exotics such as Himalayan blackberry may also be affected, resulting in reduced number and vigor.
- Native plant communities would be restored in the wet meadow habitat and could provide an additional 105 or more future habitat units (AAHUs), to be measured by a future HEP.
- Existing native plant communities would be maintained in the affected habitats, protecting the baseline habitat units (HUs).

4.1.2 Future Needs

At a certain point in time, (e.g., after manipulation of water levels for 2 years), consideration of whether additional methods or structures are needed would be made. This could include:

- Installation of additional water control structure(s) on the site; possible future locations include: 1) the slough connecting Horseshoe Lake and South Pond; the wetlands south of the slough may not be affected by the first phase of the water management plan, hence the possible need for additional structures which could affect this area; and 2) installation of a water control structure on McCarthy Creek (see below).
- The use of a high capacity pump to increase water flow (from the Multnomah Channel) into the southern portion of the site, in order to augment existing water levels during a given year in order to control exotics. It is anticipated that pumping would not occur on a regular basis, but instead would occur on an as needed basis, depending on rainfall, etc.

- Obtain a water right for McCarthy Creek, a perennial stream located at the north end of the property and situated along the north access road. Analysis of historical aerial photos shows evidence that this creek once contributed flows to BB via various channels that were most likely cut off when the access road was built (date unknown). Given that currently there are no perennial streams contributing water to the site, the availability of water from this source would be highly beneficial for the enhancement of native plant communities.
- If a water right for McCarthy Creek is obtained, conduct a hydrologic assessment of the area to determine how to best use flows from the creek for enhancement purposes. This may entail construction of additional water control structure(s) on the north end, allowing for water availability on an as needed basis to control invasive non-native plant species.

4.1.3 Permits/Surveys

Prior to enhancement actions, permits would be needed for 1) water rights and 2) fill and removal from the Division of State Lands (DSL) and the Army Corp of Engineers. Various surveys (e.g., Threatened and Endangered (T&E) species, cultural resources) will be conducted prior to any ground-breaking or other significant management activity. For example, surveys for T&E fish species will be conducted prior to the design and installation of a water control structure. Consultation with the USFWS and the National Marine Fisheries Service (NMFS) would occur in regard to any T&E species present on the site. In addition, NEPA compliance will be achieved before any ground disturbance actions are taken.

4.1.4 Additional Enhancement Methods

In addition to the manipulation of water levels on the site, additional enhancement methods would be used to control exotic plant species and restore native plant communities on the site. Depending on the habitat type and zone-specific conditions (e.g, topography), enhancement methods used to achieve the enhancement actions would vary, depending in part on the degree of invasion by exotics and accessibility to a particular area. Since many areas that have exotic invasion occurring still contain native species, removal methods should be used that will preserve as much of the native plant communities as possible. In the long-term, this will preserve the diversity of a particular area and should help to reduce costs of planting and monitoring.

Additional methods used would include:

- <u>Mechanical methods:</u> Mechanical methods (disking, mowing, etc.) may be used in those areas that are accessible and where few or no native plant species are present; determination on where mechanical methods would be appropriate would be made on an area by area basis. For example, in wet meadow habitat dominated by exotics with less than 10% native species present, mechanical removal would be appropriate. Following removal, some areas may be spot sprayed with Rodeo or other herbicides to assist in the control of invasive plant species.
- <u>Herbicides:</u> Though herbicides have not been used on the site in the past, they should be considered where it is deemed appropriate (herbicides used would be USFWS approved products). Any application of herbicides must take into consideration impacts to wildlife species present in a particular area, including amphibian species such as the red-legged frog and Pacific chorus frog, which are particularly sensitive to herbicides.

- Hand control methods: Hand control methods, using local field crews such as Ameri-Corp, would be utilized in some areas, including dense riparian forest where English ivy is present. Hand control methods are currently used in areas such as Forest Park, where ivy has been removed from hundreds of trees in the past 5 years. Hand removal of non-native plants is best utilized in areas where native vegetation is already established, creating the least disturbance to native plant communities, and/or for areas that are accessible only on foot. Hand removal methods can also reduce the costs of purchasing and planting native plants in the long-term.
- Native planting/seeding: Planting of native species would occur at some point after removal/control of non-natives, in order to establish native trees, shrubs and forbs that are fast growing and to create a canopy to shade out invasive non-native species. Native planting will also increase the available food, cover, and reproductive habitat available over time. Planting density would vary, depending on the presence and abundance of native species.

In areas where there is low native plant species abundance and/or diversity, or where native species are absent altogether, planting density could be as high as 650 plants per acre (e.g. disturbed upland converted to forest habitat), or as low as 100 plants per acre depending on the percentage of native species already present in an area. Spacing of plants would vary, depending on area-specific conditions. All plants would be from local native plant nurseries. For some areas, species planted would include fast growing native tree species which produce high leaf litter (black cottonwood, Oregon ash, willow) to create a canopy to shade out invasive shrub and forb species (blackberry, thistle, etc.). Seed collection on site should be done where appropriate in order to maintain the local genetic diversity and reduce costs of planting. Also, several local nurseries carry native seed mixes that may be appropriate for the site, such as the disturbed upland where native shrubs and trees are not easily established.

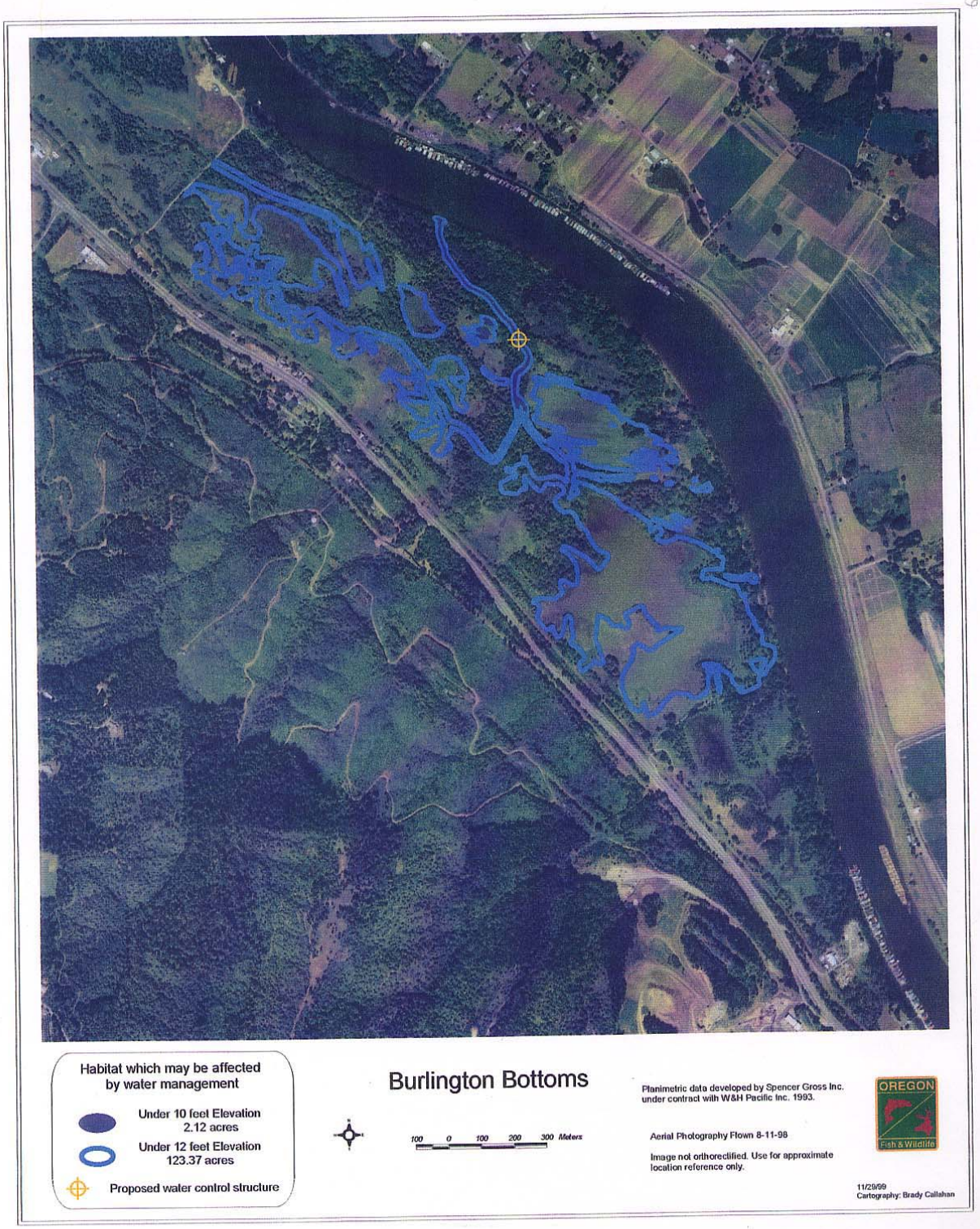

Habitat which may be affected by water management
Under 10 feet Elevation 2.12 acres
Under 12 feet Elevation 123.37 acres
Proposed water control structure
Burlington Bottoms
100 0 100 200 300 Meters
Planimetric data developed by Spencer Gross Inc. under contract with W&H Pacific Inc. 1993.
Aerial Photography Flown 8-11-98
Image not orthorectified. Use for approximate location reference only.
OREGON
Fish & Wildlife
11/29/99
Cartography: Brady Callahan

Figure 2

4.2 Descriptions of Zones 1-4; Associated Objectives and Enhancement Actions

Described below are the four zones (see Figure 3, page 13), along with management objectives for each zone and the recommended enhancement actions, based on the habitat types that occur within each zone and the current and desired future habitat conditions (a brief description of each of the habitat types along with current and desired future habitat conditions is included in Appendix A). Figure 4 (page 14) illustrates the location of the habitat types. The boundaries of the zones are based on physical features of the site (natural or man made), such as a slough or road.

A five-year schedule (Section 4.3) has been developed whereby enhancement actions can be implemented in a manner that meets BPA's mitigation requirements, protecting and maintaining the current wildlife habitat values while also enhancing habitat over time and creating additional future habitat values (AAHUs). All acreage figures listed are approximate and will be more accurately determined using GIS at some point in the near future.

4.2.1 - Zone 1. This area (total of 128 acres) encompasses all of the open water habitat located in the south half of the site including Horseshoe Lake and the large ponds to the south, South Pond and Deep Pond. Currently water levels in the lake and ponds are controlled by at least six known beaver dams, two on the slough connecting South Pond to Horseshoe Lake and four on the outlet channel connecting Horseshoe Lake to Multnomah Channel. Intermixed along the margins of these bodies of water are narrow bands of riparian forests of mixed age, riparian shrub, forested wetland, wet meadow, and emergent wetland habitats.

In addition, approximately 14.0 acres of disturbed upland habitat exists along the southwest margin of South Pond and the northwest margin of Deep Pond. The disturbed upland includes areas of gravel fill, part of which is dominated by blackberry and exotic grasses, with some patches of native shrubs and trees (primarily black cottonwood, big-leaf maple, nootka rose and spiraea), and several unique vernal pools that contain a diverse array of native plant species. This open, sunny upland area is important habitat for several species of reptiles, raptors (red-tailed hawks, turkey vultures) and songbirds. Five patches of English ivy are located on the east and southwest sides of South Pond and the east and west sides of Deep Pond.

Enhancement actions for this zone are designed to protect and maintain the baseline HUs and to increase both the quality and quantity of available wildlife habitat. Over time, these actions should show an increase in HEP values (AAHUs) for some of the target species, including the red-tailed hawk and valley quail. It is estimated that enhancement actions could be accomplished within the five-year period. However, some actions such as blackberry removal will be ongoing and should be considered part of the long-term operations and maintenance (O&M) for the site.

The management objectives for Zone 1 are:

- Enhance approximately 40 acres of open water, emergent wetland, forested wetland and wet meadow habitats.
- Enhance approximately 15 acres of riparian shrub and forest habitats along the margins of South Pond and Deep Pond.
- Restore approximately 5 acres of disturbed upland to riparian shrub and forest habitats.
- Maintain the current baseline habitat units (HUs) for all target wildlife species.
- Provide additional habitat units (AAHUs) through enhancement actions.

The habitat enhancement actions for Zone 1 are:

- Management of water levels affecting open water, emergent wetland, forested wetland and wet meadow habitats; approximately 40 ac.
- Removal of English ivy from riparian forest habitat: approximately 5 acres.
- Removal of Himalayan blackberry and other exotics from the disturbed upland and portions of the riparian shrub and forest habitats; approximately 15 acres.
- Planting of native trees and shrubs in portions of the disturbed upland and riparian forest habitat; approximately 15 acres.
- Increase habitat diversity by creating additional vernal pools and rock piles in the open, grassy areas.
- Mow (on an annual basis) portions of the disturbed upland to control exotic grasses and other non-natives; approximately 3 acres.

4.2.2 - Zone 2. This area encompasses a total of approximately 108.0 acres and includes all of the habitats east of Horseshoe Lake and the slough connecting the lake to Multnomah Channel, which is the eastern boundary of this zone. Habitats within this zone include riparian forest (primarily mature stands of Oregon ash and black cottonwood), small, narrow bands of riparian shrub and approximately 22 acres of upland and wet meadow habitats (the latter includes a temporary pond and emergent wetland habitats heavily used by waterfowl and other species including amphibians in the winter and spring months). Past human use of this area has included a high degree of disturbance (commercial use and cattle grazing), with the result that over time a large percentage of the habitats in this zone have become heavily invaded by exotics, primarily reed canary grass and Himalayan blackberry.

Enhancement actions for this zone are designed to restore the understory of the riparian forest to native shrubs and forbs, and to eliminate the exotics in the upland and wet meadow habitats, restoring the native plant communities for increased diversity and wildlife values. This would be accomplished primarily through the installation of a water control structure at the western edge of this zone, on the outlet slough, which would allow for the manipulation of water levels to control or eliminate exotic plant species (see Section 4.1). In addition, mechanical, spraying and hand removal of exotics in some habitats would occur, followed by planting of native species, including shrubs and forbs such as willow, red-osier dogwood, spiraea and rushes and sedges.

With enhancement, it may be possible to some degree to restore habitats to what was historically found in the bottomlands in this region. Because of the high degree of disturbance in this zone, it is estimated that some of the enhancement actions may need to continue beyond the proposed 5-year schedule for this Plan. Additional water control measures (e.g., water pump, supplementary water control structures) may be needed in the future to effectively carry out enhancement objectives.

The management objectives for Zone 2 are:

- Enhance approximately 30 acres of open water, emergent wetland and wet meadow habitats.
- Enhance approximately 20 acres of riparian shrub and forest habitats.
- Maintain the current baseline habitat units (HUs) for all target wildlife species.
- Provide additional future AAHUs through enhancement actions.

The habitat enhancement actions for Zone 2 are:

- Management of water levels affecting open water, emergent wetland and wet meadow habitats; approximately 30 acres.
- Widen and deepen the small channel that connects the outlet slough to the wet meadow and riparian shrub habitats to enhance water flow to these areas.
- Removal of Himalayan blackberry and other exotics from the riparian forest and shrub habitats; approximately 20 acres.
- Removal of exotics in the wet meadow habitat through disking, etc., to prepare the area for planting of native plants; approximately 5 acres.
- Planting of native trees and shrubs in portions of the riparian shrub and forest habitats; approximately 20 acres.
- Plant native shrubs and forbs in the wet meadow habitat; approximately 5 acres.

4.2.3 - Zone 3. With a total of 100.0 acres, this zone includes the most diverse mix of all six habitats found on the site, including at least ten shallow, temporary bodies of water that provide habitat for a diverse array of fish and wildlife species, including the State Sensitive listed northern red-legged frog, and western painted and pond turtles. The northern boundary is the north road and legal boundary of the site, the Multnomah Channel is found along the east side of the site, and two sloughs make up the southeast, south, and west boundaries of Zone 3. The largest and most contiguous stand of mature riparian forest found on the site is located in the northeast and east portions of this zone, and as evidenced from wildlife survey and monitoring efforts, provides important habitat for many species, including migratory songbirds such as the Swainson's thrush and red-eyed vireo, and the State Sensitive listed red-legged frog. Much of the wet meadow habitat and portions of the understory of the riparian forest habitat (at lower elevations) is dominated by reed canary grass. The predominant historic use of this area was cattle grazing.

Enhancement actions for Zone 3 are designed to protect and maintain the existing diverse wildlife habitats and their associated HEP values. In addition, enhancement of the wet meadow, open water, and riparian forest habitats would create additional habitat units (AAHUs) for species such as the valley quail, red-tailed hawk and black-capped chickadee. Through the management of water levels (see Section 4.1), mechanical, spraying and hand removal of exotics and planting of native plants in some areas, an estimated 50-75% of the management objectives could be achieved within 5 years of implementation. Because of the difficulty in removing exotics such as reed canary grass, additional water control structures or other measures may be proposed in the future.

The management objectives for Zone 3 are:

- Enhance 35 acres of open water, emergent wetland and wet meadow habitats.
- Enhance approximately 20 acres of riparian shrub and forest habitats.
- Maintain the baseline habitat units (HUs) for all target wildlife species.
- Provide additional future habitat units (AAHUs) through enhancement actions.

The habitat enhancement actions for Zone 3 are:

- Management of water levels to control/remove exotics in the open water, emergent wetland and wet meadow habitats: approximately 35 acres.
- Removal of Himalayan blackberry and other exotics from the riparian forest and shrub habitats; approximately 20 acres.

- Removal of exotics in the wet meadow habitat in some areas by disking, etc., for site preparation for planting of native plants; approximately 10 acres.
- Planting of native trees and shrubs in portions of the riparian shrub and forest habitats; approximately 15 acres.
- Plant native shrubs and forbs in the wet meadow habitat; approximately 10 acres.

4.2.4 - Zone 4. Located in the northwest, west and central portions of the site, this zone encompasses all six habitats found on the site, for a total of 81.0 acres. A large portion of the area is wet meadow and riparian shrub habitats dominated by reed canary grass, with numerous swales and small, temporary ponds found on the west side of the slough that make up the eastern boundary of Zone 4. The southern and southeastern portions are predominantly mature riparian forest, primarily Oregon ash with several large white oak trees at the higher elevations. The understory in the riparian forest is diverse and relatively undisturbed, with blackberry and reed canary grass just beginning to invade this habitat. At the present time, two streams flow into this zone from the Tualatin Mountains; a third stream (McCarthy Creek) historically flowed into the site at the northern end, but has been diverted and now contributes relatively little flow due to a non-maintained culvert under the north access road.

Similar to Zones 1-3, enhancement actions for this zone are designed to protect the existing high quality habitat values, in addition to restoring native plant communities in highly disturbed areas. Manipulation of water levels would be a primary means to accomplishing management objectives (see Section 4.1), as well as removal of exotics and planting of native trees, shrub, and forbs in the wet meadow and riparian shrub habitats. An estimated 50-75% of the management objectives could be achieved within 5 years of implementation. Because of the degree of difficulty in removing exotics such as reed canary grass, additional water control structures or other measures may be necessary in the future**.**

The management objectives for Zone 4 are:

- Enhance approximately 20 acres of open water, emergent wetland and wet meadow habitats**.**
- Enhance approximately 20 acres of riparian shrub and forest habitats.
- Maintain the baseline habitat units (HUs) for all target wildlife species.
- Provide additional future habitat units (AAHUs) through enhancement actions.

The habitat enhancement actions for Zone 4 are:

- Management of water levels to control/remove exotics in the open water, emergent wetland and wet meadow habitats: approximately 20 acres.
- Removal of Himalayan blackberry and other exotics from the riparian shrub and forest habitats; approximately 20 acres.
- Removal of exotics in the wet meadow habitat by disking, spraying, etc., for site preparation for planting of native plants; approximately 10 acres**.**
- Planting of native trees, shrubs and forbs in portions of the wet meadow, riparian shrub and forest habitats; approximately 15 acres.

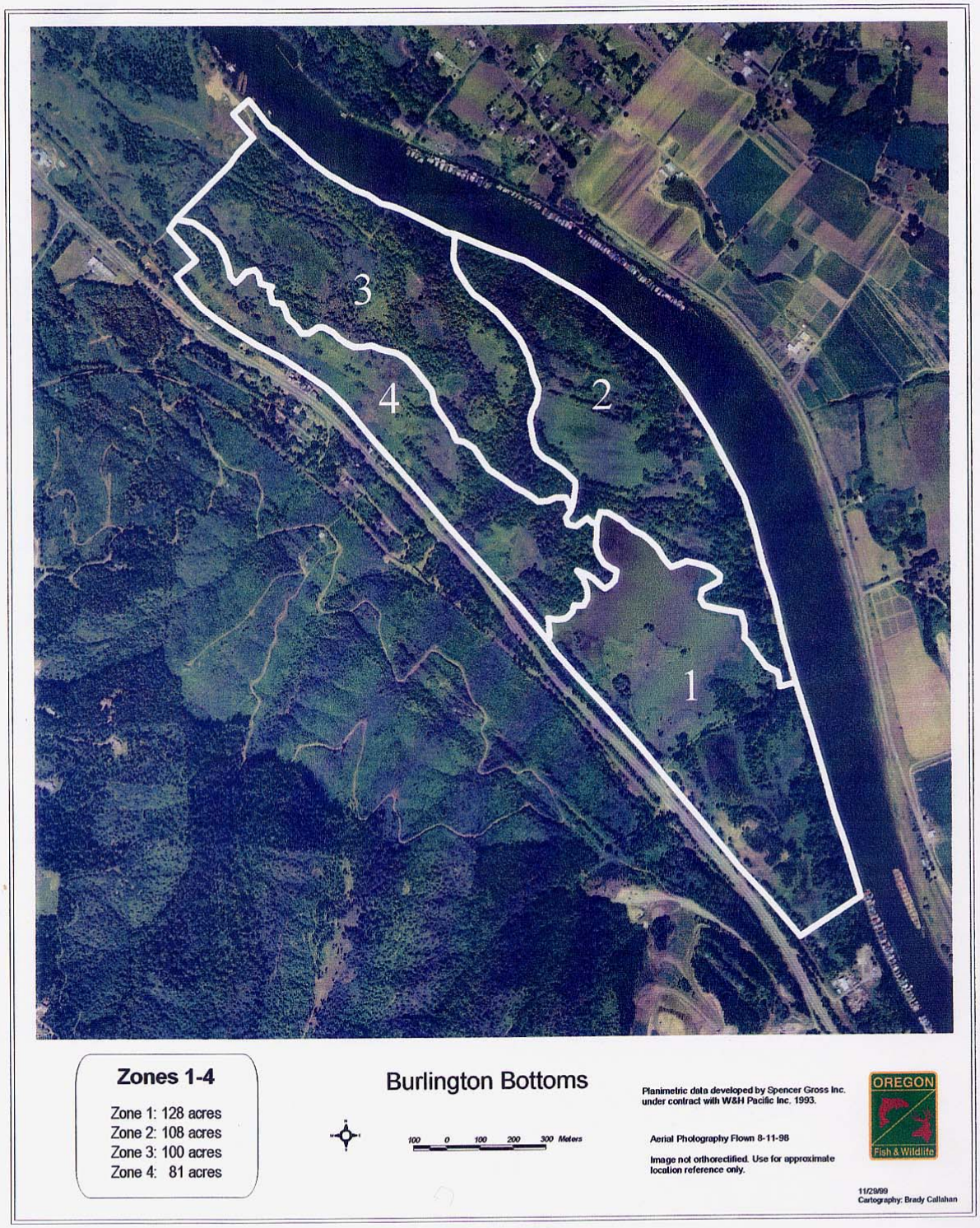
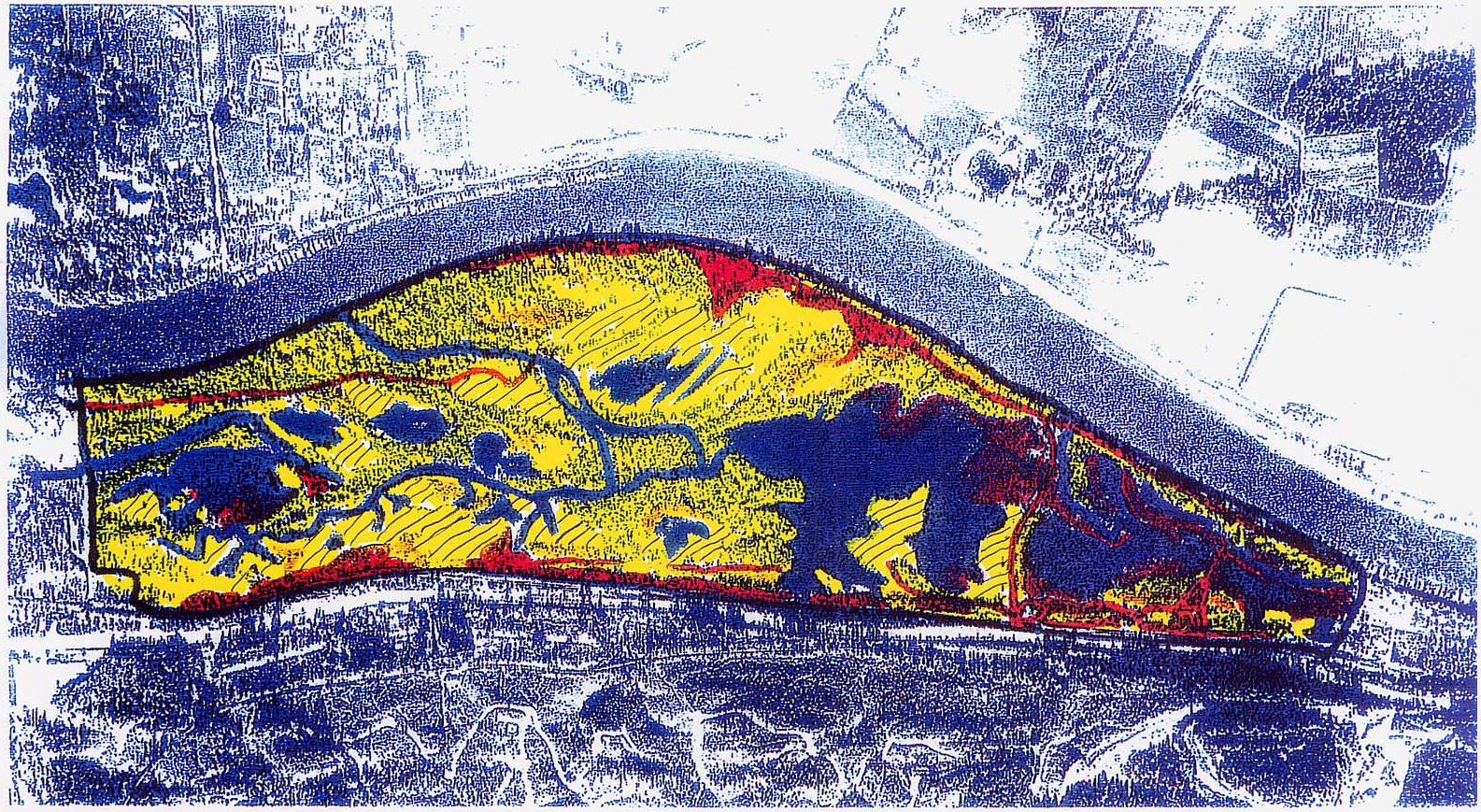

3
4
2
1
Zones 1-4
Zone 1: 128 acres
Zone 2: 108 acres
Zone 3: 100 acres
Zone 4: 81 acres
Burlington Bottoms
100 0 100 200 300 Meters
Planimetric data developed by Spencer Gross Inc. under contract with W&H Pacific Inc. 1993.
Aerial Photography Flown 8-11-98
Image not orthorectified. Use for approximate location reference only.
OREGON
Fish & Wildlife
11/29/99
Cartography: Brady Callahan

Figure 3

BURLINGTON BOTTOMS



Habitat Types

(215.32 ac) Riparian tree
(14.10 ac) Riparian shrub
(49.96 ac) Pasture (seasonally flooded)
Forested wetland (16.24 ac)
Emergent wetland (82.19 ac)
Disturbed areas (14.19 ac)
Open water (25.00 ac)

Figure 4

4.3 Five-Year Enhancement Schedule

The following multi-year enhancement schedule has been developed in order to carry out the proposed enhancement actions for BB in a manner that will afford the greatest habitat protection and mitigation benefits within a reasonable level of time and funding. Estimates of where enhancement will occur and acreage figures are tentative and may change based on available funding for a given year. Once funding has been finalized, a scope of work, budget, and detailed work plan would be developed on a yearly basis. Enhancement actions are described and organized by years 2001 through 2005, with a breakdown of number of acres, miles of road, etc. targeted for each of the four zones (see Table 1).

YEAR 2001:

1. Installation of water control structure: All Zones, (approximately 125.0 ac.); this action is ranked at the top since it may be the most effective method of controlling/removing reed canary grass and other exotics from the open water, forested wetland, emergent wetland and wet meadow habitats. Over time it would maintain the baseline wildlife values (HUs) and should also increase habitat units (AAHUs) in these habitats.
   - Schedule: construct in late summer, 2000, then maintain in following years (additional water control structures, pump, etc, may be needed in the future).
2. Removal of English ivy: Zone 1 (5ac.); Remove ivy from several areas in Zone 1.
   - Schedule: begin in year 2000 and complete by end of 2000 if possible.
3. Removal of exotic plant species: Zones 1 (5 ac.), 3 (5 ac.); Continue removal in several areas of riiparian shrub and forest habitats. Disturbed upland habitat (Zone 1, 2 ac.) will be mowed to
   control exotic grasses, etc.
   - Schedule: remove plants in fall, winter, grub/clip new sprouts in spring; spot spray with herbicide if needed.
4. Native planting**:** Zones 1 & 2 (7 ac.); Plant native species in riparian shrub and forest habitats.
   - Schedule: plant in late fall and winter.
5. M&E: Zones 1 & 3 (10 ac.); Monitor and evaluate exotic plant removal and planting projects from 1998-1999. Determine success/failure of activities, alter strategies where needed.
   - Schedule: late spring and summer.
6. M&E: Zones 1, 3, & 4; Begin establishment of additional transects, plots, etc. for future M&E activities related to water control structure, future plantings, etc.
   - Schedule: late spring, summer, fall.

YEAR 2002:

1. Maintain water control structure: Zones 1-4 (125 ac.); Continue to operate and maintain water levels as needed in order to control exotics.
   - Schedule: check water depths monthly; add or remove stop boards as needed. Routine maintenance on structure may be needed.
2. Removal of exotic plant species: Zones 1-3 (15 ac.); Riparian shrub and forest and open meadow habitats would be targeted. Continue to mow disturbed upland habitat (Zone 1).
   - Schedule: remove plants in fall, winter, grub/clip new sprouts in spring; spot spray with herbicide if needed; mow upland in summer.

3. Native planting: Zones 1-3 (15 ac.); Plant natives in riparian shrub, forest and open meadow habitats.
   - Schedule: plant in late fall/winter.
4. M&E: Zones 1-3; Monitor and evaluate previous exotic species removal and native planting from 1999-2001. Determine success/failure of enhancement activities, alter strategies where needed.
   - Schedule: late spring and summer.
   M&E: Zones 1-4; Continue establishment of additional transects, plots, etc. for future M&E activities related to water control structure, future plantings, etc.
   - Schedule: late spring, summer, fall.

YEAR 2003:

1. Maintain water control structure: Zones 1-4 (125 ac.); Continue to operate and maintain water levels as needed in order to control reed canary grass, etc.
   - Schedule: check water depths monthly; add or remove stop boards as needed. Routine maintenance on structure may be needed.
2. Removal of exotic plant species: Zones 1-3 (20 ac.); Continue removal of exotics in riparian shrub, forest and open meadow habitats. Mow uplands to control grasses.
   - Schedule: remove plants in fall, winter, grub/clip new sprouts in spring; spot spray with herbicide if needed; mow upland in summer.
3. Native planting: Zones 1-3 (10 ac.); Plant natives in open meadow, riparian shrub and forest habitats.
   - Schedule: plant in late fall/winter.
4. M&E: Zones 1-3; Monitor and evaluate previous exotic species removal and native planting from 2000-2002. Determine success/failure of activities, alter strategies where needed.
   - Schedule: late spring and summer.

YEAR 2004:

1. Maintain water control structure: Zones 1-4 (125 ac.); Continue to operate and maintain water levels as needed in order to control reed canary grass, etc.
   - Schedule: check water depths monthly; add or remove stop boards as needed. Routine maintenance on structure may be needed.
2. Removal of exotic plant species: Zones 1-4 (20 ac); Continue removal of blackberry and other exotics in open meadow, riparian shrub and forest habitats. Mow disturbed upland.
   - Schedule: remove plants in fall, winter, grub/clip new sprouts in spring; spot spray with herbicide if needed.
3. Native planting/seeding: Zones 1-4 (15 ac.); Plant natives in open meadow, riparian shrub and forest habitats.
   - Schedule: plant in late fall/winter.
4. M&E: Zones 1-4; Monitor and evaluate previous exotic species removal and native planting/ seeding from 2001-2003. Determine success/failure of enhancement activities, alter strategies where needed.
   - Schedule: late spring and summer.

YEAR 2005:

1. Maintain water control structure: Zones 1-4 (125 ac.); Continue to operate and maintain water levels as needed in order to control reed canary grass, etc.
   - Schedule: check water depths monthly; add or remove stop boards as needed. Routine maintenance on structure may be needed.
2. Removal of exotic plant species: Zones 1-4 (20 ac.); Continue removal of exotics in riparian shrub, forest and open meadow habitats. Mow uplands to control exotic grasses, etc.
   - Schedule: remove plants in fall, winter, grub/clip new sprouts in spring; spot spray with herbicide if needed; mow upland in summer.
3. Native planting/seeding: Zones 1-4 (15 ac.); Plant natives species in open meadow, riparian shrub and forest habitats. Seed native grass mix in wet meadow habitat.
   - Schedule: plant in late fall/winter.
4. M&E: Zones 1-4; Monitor and evaluate previous exotic species removal and native planting from 2002-2004. Determine success/failure of enhancement activities, alter strategies where needed.
   - Schedule: late spring and summer.

5.0 MONITORING AND EVALUATION

Monitoring and evaluation (M&E) of habitat management actions would occur in order to determine whether the stated goals and objectives for the habitat management plan have been met. Depending on the enhancement action in a particular habitat type, M&E may include the use of more than one monitoring method and success criteria, with monitoring occurring on a yearly basis (for each of the five years) and for the long-term life of the project as part of operations and maintenance (O&M). Wildlife surveys are expected to last five years with the opportunity for additional years if data analysis can justify such action. Fish surveys are required by the National Marine Fisheries Service (NMFS) to determine the effects on anadromous fish of constructing and operating a water control facility at BB. M&E will also include conducting a modified HEP upon completion of the five-year habitat management plan, in order to analyze the changes in habitat types (from baseline conditions) and related habitat units in response to enhancement actions.

5.1 Enhancement Monitoring:

- Upon installation of the water control structure, water depths will be recorded monthly (to meet water resources requirements). Storage in acre feet would be calculated and the extent of inundation on the ground would be delineated using staff gauges and topographic maps; all of this information would be recorded and mapped. It is anticipated that monitoring will occur on a weekly or monthly basis depending on the time of year and flow regime. Long-term monitoring will include water level manipulation as part of moist soil management techniques and a water rights form filed annually.
- Aerial photography (BPA provided aerial equipment, e.g., BPA helicopter) may also be used to document extent of inundation, vegetation changes etc.; this information would then be scanned into computer format and managed as part of the GIS database component.

- Water quality would be monitored (turbidity, temperature, pH levels, etc.) on a seasonal basis throughout the life of the project.
- Vegetation surveys would be conducted in all habitat types to determine general vegetation and habitat response to enhancement activities. In addition to the HEP transects established and marked in 1993, plots and transects would be established in 2001-2002 in areas not adequately addressed by the HEP surveys. 2001-2002 surveys would be conducted in order to establish baseline data, collecting information on species of trees, shrubs, forbs and grasses present, height, density and distribution of these species, percent canopy cover, etc. For areas where reed canary grass is present (e.g., wet meadow) stem counts would also be conducted. Control sites would be established to evaluate untreated areas and in some areas to serve as indicators of what the desired future habitat conditions should be, based on presence of native and non-native plant species. Location and placement of transects and plots will be based on the size (acreage) of a given area/habitat type and topographic features (e.g., elevation). All transects, etc. would be permanently marked. Monitoring would be conducted at least once per year (late summer/early fall) beginning in 2001 and continuing through 2005, and thereafter conducted as needed or as part of O&M.
- Determine annual planting success and causes of planting failure (poor stock, poor planting methods). Alter site preparation and/or planting methods as monitoring indicates. Document in annual report.
- Measure seeding survival twice per year and assess causes of seeding failure (e.g., poor conditions, poor seed source). Alter site preparation and/or planting methods as monitoring indicates. Document in annual report.
  - Photo monitoring points would be established to document significant changes in plant species composition/habitat changes over time, in particular in areas where exotics dominate the landscape prior to enhancement activities (e.g., where disturbed upland is converted to riparian forest habitat; where wet meadow is converted from reed canary grass dominated area to native forbs). Photos would be taken yearly at designated points to document changes at 1) the landscape level and 2) at the transect/plot level, documenting changes in species composition, height, etc. over time. It is expected that changes should be noted after one year of management activity(s). Photo points would be established at least one point per 10-20 acre (dependent on site conditions) in each direction. Analysis of photo points would coincide with analysis of data from vegetation surveys, by noting visual changes in the landscape due to enhancement activities. Photo point data will also be useful for presentations to agencies, etc. when presenting results of project activities.
  - Monitoring for salmonid use and maintain fish passage would occur using the protocol, success criteria and time line established by ODFW, National Marine Fisheries Service and Ducks Unlimited (DU), for the nearby sites, Sauvie Island and Multnomah Channel (see Appendix C). Data collected would include collecting detailed information on fish passage (species and numbers of fish, etc.) and surrounding habitat (dominant vegetation, water depth, turbidity, temperature, etc.). Photographs would be taken of a typical shoreline representative of each stratum at each season. Existing information on fish species present on the site includes fish surveys conducted by ODFW in 1994 and 1995.
- Using GIS technology, much of the data collected would become part of a database that would allow for producing accurate and timely maps of the results of enhancement activities and subsequent M&E.

- Surveys and monitoring of wildlife would include pond-breeding amphibians and neotropical migratory landbirds (NTMB). Surveys for both guilds are habitat based, and will provide a measure of the floristic and structural diversity of the associated habitats (see Appendix B). Data collected will include:

  Amphibians: surveys would be conducted from late January through early April, noting species and number of egg masses for each, type of attachment brace, water depth, distance to shoreline, overall vegetation species and composition in each pond and other pertinent information.

  NTMB: surveys would be conducted during the breeding season, typically mid-May through the end of June. Data collected would include noting all species and total number of detections at each point count, weather, vegetation type, % canopy cover, structural diversity and overall vegetation species and composition at each point count station, and other pertinent information.

  Surveys and monitoring for both amphibians and NTMB would be conducted using established regional protocols, with results and information applicable and available to other agencies and entities managing for similar species and habitat. Results would be compared to other local sites such as Ridgefield National Wildlife Refuge and Sandy River Delta where similar enhancement projects are being conducted.
- Results of wetland enhancement monitoring would be documented in the quarterly and annual reports.

5.2 Evaluation: The success of enhancement actions would be measured primarily by 1) conducting a modified HEP at some point in time after completion of the five-year plan, and 2) evaluating changes in habitats over time that would not be measured by the HEP. If a particular area or habitat type showed only a modest or no increase in native species, enhancement actions would need to be altered to achieve the desired objectives. In addition, fish and wildlife presence (HEP and T&E species, salmonids) and their use of various habitats will also be considered and evaluated. All acreage figures given are approximate and would be finalized once funding has been determined.

- ***Open water, emergent wetland, forest wetland and wet meadow habitats:*** following yearly vegetation surveys, evaluate enhancement activities (water management techniques, disking, planting) by using the following performance criteria:
  - Flood approximately 125 acres through June (based on precipitation and runoff).
  - Plant surveys should show an increase in native species presence and abundance and a decrease in non-natives (e.g., reduction of reed canary grass in number and vigor), particularly in those areas that were dominated by exotics prior to enhancement. Specific changes would be area specific depending on elevation, extent of inundation, etc. If a particular area or habitat type showed only a modest, no increase or decrease in native species, enhancement actions would need to be altered to achieve the desired objectives.
  - Approximately 25 acres of exotics would be treated (mechanically cleared, then sprayed with acceptable herbicide) by the end of the five-year plan.

- Approximately 25 acres of wet meadow habitat would be planted with native shrubs, forbs and grasses at a density of 650 plants per acre, depending on site conditions, by the end of the five-year plan.
- 70-80% seeding success the first year, 50-60% success by the third year in the wet meadow habitat.
- Transects and photo points from the 1993 HEP, as well as additional transects and photo points established in 2000-2001, would be evaluated on a yearly basis, noting visual changes at both the landscape and transect/plot levels. Photos should visually record and show significant changes in vegetation (e.g., species composition, height) at all points, and in addition should reflect plant and habitat changes at the landscape level. If after three years of photo point monitoring results are insignificant and do not visually record changes, this method would be evaluated and possibly dropped as part of the M&E efforts.
- Pond-breeding amphibians: the use of aquatic habitat by four species of amphibians will be documented by observation of egg masses during the breeding season for each year of the five-year monitoring period. Results of surveys (total number of egg masses, water depth, attachment brace (native vs non-native), distance to shoreline etc.) will be compared to previous years' data, and will be correlated with changes in the aquatic habitat, due to natural environmental variation and management action. Management activities that alter the aquatic vegetative communities, as well as altering the hydrologic regime, may have a significant effect on amphibian populations, and this should be evident in survey results. Water management should improve both the quality and quantity of habitat for pond-breeding amphibians over time.

  Performance criteria: The following criteria are based on the assumption that the effects of management actions (e.g., change in number of egg masses) can be differentiated from the effects of environmental variation and that the changes in number of egg masses can be correlated to the increase in number of areas inundated by water at critical times of the year.
  - The increase in the number of amphibian egg masses at the end of five years of data collection will be proportional to the total increase in number of acres inundated by water at critical times of the year.
  - The increase in the number of amphibian egg masses at the end of five years of data collection and management plan implementation will also be proportional to the increase in native vegetation in ponds at the site.

Riparian shrub, forest and disturbed upland habitats: following yearly vegetation surveys, evaluate enhancement activities (mechanical and hand removal, spraying, planting) by using the following performance criteria:

- Removal of 5 acres of English ivy in riparian forest habitat.
- Plant surveys should show an increase in native species presence and abundance, and a reduction in number and vigor of non-natives (e.g., Himalayan blackberry), particularly in those areas that were dominated by exotics prior to enhancement.
- Approximately 50 acres of exotics would be treated (mechanical and hand removal, herbicide spraying if appropriate) by the end of the five-year plan.
- Approximately 55 acres would be planted in the riparian shrub, forest, open meadow and disturbed upland habitats by the end of the five-year plan, with an expected 60-70% survival of trees and shrubs.

- Conduct a modified HEP at the completion of the five-year plan. It is expected that habitat values for some wildlife species would increase after enhancement actions have occurred, with a resulting increase in future habitat units (AAHUs) for some of the HEP wildlife species (see 1993 HEP report for Burlington Bottoms). Success/measurable criteria are built into the HEP models and will not be addressed in this document.
- Transects and photo points from the 1993 HEP, as well as additional transects and photo points established in 2001-2002, would be evaluated on a yearly basis, noting visual changes at both the landscape and transect/plot levels. Photos should visually record and show significant changes in vegetation (e.g., species composition, height) at all points, and in addition should reflect plant and habitat changes at the landscape level. If after three years of photo point monitoring results are insignificant and do not visually record changes, this method would be evaluated and possibly dropped as part of the M&E efforts.
- Neotropical migratory landbirds: the use of the riparian forest habitat will be documented for each year of the five-year plan, by estimating species abundance and diversity, including for HEP species black-capped chickadee and yellow warbler. At the end of the five-year plan, observations will be made on trends in abundance that may be evident from five years of data. Results will be correlated with changes in habitat due to management activities, including non-native plant removal and native planting.

  Performance Criteria: The following criteria are based on the assumption that the effects of management actions (e.g., increase in the number and diversity of NTMB) can be differentiated from the effects of environmental variation and that the increase in number and diversity of NTMB can be correlated to the increase and diversity of native plant species in the riparian forest habitat.
  - The increase in NTMB species diversity and abundance will be proportional to the increase and diversity of native plant species in the riparian forest habitat over the five-year period.

An adaptive management approach would be utilized in order to effectively respond to the success or failure of enhancement actions. If the performance criteria are not met, then the current management actions would need to be re-evaluated and modified in order to provide high quality habitat for both amphibians and NTMB. In addition, a consideration would need to be made whether other factors (e.g., drought) could be affecting habitat quality, and these would need to be addressed. An analysis of the M&E results could indicate that the assumptions upon which the performance criteria are based are not appropriate. An M&E report following the five years of data collection and analysis will address these factors.

6.0 INFRASTRUCTURE NEEDS

6.1 Access roads

In order to achieve the habitat enhancement goals and objectives for the site, access will be needed into all habitats where management actions are prescribed. Currently, there are four roads and several trails on the property which allow access to many but not all areas of the site. Yearly maintenance of the existing roads/trails would include removal of vegetation where appropriate to ensure access for management activities.

Several former primitive roads/trails that were open in 1993 have not been maintained, and have since been overtaken by non-native plants such as Himalayan blackberry. It is recommended that the former roads/trails be reopened and improved to allow for access into some areas in order to carry out enhancement activities including removal of invasive plant species.

Other than those listed above, it is not recommended that additional roads be built at this time. It is believed that through a combination of using the existing roads, improving the former primitive roads/trails, and with the installation and operation of a water control structure, all areas that require maintenance and enhancement will be accessible. Costs for additional roads would be prohibitive and it is unlikely that funding would be available in the future.

6.2 Equipment, storage facilities, etc.

Beginning in 1999, a tractor, mower and other equipment will be available for use at BB. A weed trimmer was purchased in 1997; hand tools and other supplies needed are available. All supplies and equipment will be stored at the ODFW/Sauvie Island Wildlife Area office on Sauvie Island.

6.3 Fencing

Fencing is recommended to protect the area from stray cattle wandering onto the site, and to reduce trespassing, both of which have been problems at BB in the past five years. Fencing was present along the north boundary until 1991 but was removed by BPA after purchase of the site. Fencing is recommended along the north boundary, along with relocating the existing gate on the north trail so that it is parallel to the fence line. The boundary corners of BPA property on the north end should be marked with steel angle iron.

7.0 ADAPTIVE MANAGEMENT STRATEGY

An adaptive management approach for Burlington Bottoms would afford the opportunity to alter management activities over time, in response to the success or failure of enhancement actions. Due to the high degree of disturbance resulting from past altered hydrologic conditions and the invasion by exotic plant species in many of the native plant communities, both proven and experimental techniques may be utilized for enhancement activities. As the plan proceeds, enhancement techniques may be altered based on results of M&E and determination of success or failure of particular method(s) used in particular habitat(s). Various local and regional efforts are underway at other sites, and information from these activities should be incorporated into management strategies for BB in the future if applicable.

8.0 OPERATIONS AND MAINTENANCE

Operations and maintenance activities would include the following: O&M of any water control structure(s), pumps, etc.; O&M of all roads and trails to ensure management access; fence maintenance (if applicable); debris removal; and control of exotics plant species such as Himalayan blackberry. It is assumed that in most cases, O&M would be required for the lifetime of the project.

9.0 RECOMMENDATIONS

The following recommendations have been made in order to improve implementation of the habitat plan, or to add value to the existing wetland habitats through consideration of purchase of several adjacent wetland habitats.

- Using GIS technology, redo all maps relating to habitat types and boundaries, location of exotic plant species, locations of past enhancement actions, and specific acreage figures.
- Replace the existing culvert in the slough under the north access road in order to restore flows from McCarthy Creek into BB. From observations of this culvert and of water flow in the past two years it appears that the culvert has collapsed and thus impedes water flow into the slough on the BB side. The increase in water flow should be helpful in habitat restoration efforts. This slough provides important habitat for many species of wildlife, including red-legged frogs, great blue herons, wood ducks and hooded mergansers.
- Consider purchase of the wetlands just beyond the southern property boundary and north of the commercial buildings (wrecking yard) and houseboat moorage facilities. Total acreage is estimated at 10.0 acres of wetland habitats; approximately 2.0 acres of emergent wetland and approximately 8.0 acres of a mature and diverse ash/cottonwood forest. The addition of these wetlands would: 1) complement and enhance the existing wetlands on the southern edge of BB since they are all part of the same wetland complex; and 2) move the southern property boundary to the north edge of the commercial buildings/moorage facilities, making a clear distinction between the wetlands and these developed lands.
- Continue discussions with the landowner directly north of BB, regarding the purchase or trade of the section of property they own that lies between the railroad tracks and BB's northwest boundary.

10.0 CONSISTENCY WITH OTHER PLANS, PROGRAMS, ETC.

This habitat enhancement plan is designed to be consistent with the following plans and programs:

- The Northwest Power Planning Council's Fish and Wildlife Program
- Willamette Basin Mitigation Program (Project No. 9206800)
- The Oregon Trust Agreement Planning Project (92-84)
- Assessing Oregon Trust Agreement Using GAP Analysis (95-65)
- Securing Wildlife Mitigation Sites-Oregon (Project No. 9705900).

11.0 ACKNOWLEDGEMENTS

The author of this plan (Susan Beilke) wishes to thank the following for their valuable insight and recommendations during the writing of this plan; Susan Barnes, John Beck, Mark Nebeker, and Greg Sieglitz, ODFW; and Tom Morse, BPA.

APPENDICES

APPENDIX A

DESCRIPTION OF HABITAT TYPES AND CURRENT AND DESIRED FUTURE HABITAT CONDITIONS
November, 1998

- **Riparian Forest Habitat** (215 acres; Present in Zones 1-4)

The riparian forest habitat is comprised of mature and mixed aged stands of Oregon ash and black cottonwood, with a well-developed shrub layer in most areas, and a ground cover of shade-tolerant forbs. This habitat type (Figure 3) is found throughout the site and is concentrated in long, narrow, bands interspersed among the numerous ponds and sloughs. Due in part to natural plant succession and a change in the historic water regimes of the Willamette and Columbia Rivers, which in turn has produced somewhat drier on-site conditions in the past 50 years, this habitat type is expanding into the upland meadow (pasture) habitat.

Encroachment of non-native plant species such as Himalayan blackberry, reed canary grass, and English ivy is occurring, with an estimated 150 acres of this habitat type throughout the site showing varying degrees of invasion by exotics. The three known patches of English ivy are concentrated in the southern portion of the site in Zone 1. Previous management actions in this habitat type in the past three years have included removal of Himalayan blackberry, Scot's broom, and English ivy on approximately 15-20 acres.

- **Forested Wetland Habitat** (16 acres; present in Zone 1)

The forested wetland provides important habitat for many wildlife species, including the three HEP species sampled for, wood duck, great blue heron, and beaver. It is dominated by Oregon ash and Pacific willow, with creek dogwood, red elderberry and Sitka willow common in the shrub layer. Native forbs include slough sedge and juncus spp. Historically, this habitat was inundated seasonally but flood control and other activities in the region have changed the water regime over time. Because of drier on site conditions, exotics such as reed canary grass have invaded the herbaceous layer; this was evident in all areas sampled during plant surveys in 1993 and 1995. Overall, there is probably less forested wetland habitat now as compared to historic levels, again due to diking, flood control, etc. No previous management activities have occurred in this habitat type.

- **Riparian Shrub Habitat** (14 acres; present in Zones 1-4)

This habitat type is well dispersed throughout the site and can be found along the edges of the numerous ponds and sloughs. Dense stands of willow, red-osier dogwood and other native shrub species provide habitat for many species of wildlife, including yellow warbler and beaver, both target HEP species analyzed in this habitat type. Cavities in the older Pacific willow trees along Horseshoe Lake provide important nesting habitat for swallows and other migratory songbirds.

Historically this habitat type was well adapted to frequent flooding, but to due to diking, flood control, and other human activities, conditions have dramatically changed, resulting in degraded conditions and in some cases a loss of this habitat type all together. During plant surveys conducted in 1993 and 1995, almost all areas sampled contained reed canary grass and/or other exotics such as Himalayan blackberry. In the past two years, management activities have included removal of blackberry and Scot's broom. Planting of native plants including willow, nootka rose, red-osier dogwood and Douglas spiraea, has occurred along pond and creek margins, on approximately 4 acres.

- **Wet Meadow (formerly pasture) Habitat** (50 acres; present in Zones 1-4)

Many species of wildlife, including songbirds, raptors, small and large mammals, amphibians and reptiles use this habitat type. Historically, much of this habitat would have been dominated by native grasses and sedges, including Columbia sedge and sweet vernal grass, with scattered patches of shrubs such as Douglas spiraea and nootka rose.

Up until 1991, most of the wet meadow habitat at BB was heavily grazed, with several areas having been seeded with reed canary grass in the past to provide a wetland forage species palatable only to cattle and a few wildlife species such as Canada geese. This grass has since spread and now dominates most of the wet meadow habitat on the site. Growing up to 8 feet in height in some areas, it has adapted well and forms a dense monoculture with low wildlife habitat value.

Habitat values for several of the HEP wildlife species (great blue heron, red-tailed hawk, valley quail, and spotted sandpiper) analyzed in the wet meadow were below optimal due to the dense stands of reed canary grass, which reduces prey availability for raptors, impedes movement for some species such as valley quail, and eliminates nesting habitat for turtles and other wildlife species. Other non-native plant species present include bull thistle and Himalayan blackberry. Management activities that have occurred in the past 4 years include hand removal of blackberry and mowing of reed canary grass during the late summer and fall, on approximately 4 acres.

- **Emergent Wetland Habitat** (82 acres; present in Zones 1-4)

Native plant species in the emergent wetland habitat include wapato, smartweed, and bur-reed, which provide important food, cover, and reproductive habitat for many species of waterfowl, wading birds, turtles, small and large mammals, and amphibians. HEP wildlife species analyzed in this habitat type include wood duck, great blue heron, beaver, and spotted sandpiper.

Most of the areas sampled in the emergent wetland habitat in 1993 and in subsequent surveys show varying levels of invasion by reed canary grass, depending on water depth and length of seasonal inundation. Some areas that were predominantly reed canary grass in the 1993 surveys had changed dramatically after the 1996 flood and the 1997 spring freshets; reed canary grass was absent or had died back considerably, with a notable increase in native plant diversity. No management activities have occurred in this habitat type to date.

- **Open Water Habitat** (25 acres; present in Zones 1-4)

Numerous ponds and sloughs are scattered throughout BB, with the largest body of water, Horseshoe Lake, located in the central portion of the site. Water levels are affected by runoff from the surrounding hillsides and U.S. Highway 30, nearby river levels, tidal changes, and beaver activity. Three beaver dams on the slough connecting Horseshoe Lake to Multnomah Channel currently serve as the principal water control structures on the site.
This habitat type supports a vast array of wildlife species, including the HEP wildlife species, wood duck, great blue heron, beaver, and spotted sandpiper. In addition, several State Sensitive listed species utilize this habitat, including the northern red-legged frog and both the western painted and pond turtles.

A comparison of aerial photos dating from the 1940's to the present indicates a significant loss of open water habitat in the past 50 years. This loss is a result of both on and off site human activities including diking, draining, and flood control. The continuous encroachment of reed canary grass at the edges of ponds and sloughs and the deposition of silts into these areas, may ultimately cause their transition to a wet marsh, with the resulting loss of additional open water habitat. No management activity has occurred in this habitat type to date.

- **Disturbed Areas** (14 acres; present in Zones 1-4)

The disturbed areas currently consist of several trails, roads and a gravel filled upland area located on the southwest portion of the site. Roads and trails would be maintained for access, and the upland fill area would be managed to provide a mosaic of habitats over time**.** In portions of the upland fill, vegetation consists primarily of non-native shrubs and grasses including Scot's broom, Himalayan blackberry, reed canary grass, and meadow foxtail. Native species have become established in recent years, and includes young stands (< 30 years old) of black cottonwood and other species of trees and shrubs. Because this area is relatively open and dry, it provides excellent habitat for many species of reptiles, including the common (red-spotted) garter snake (*Thamnophis sirtalis concinnus*), northern alligator lizard (*Elgaria coerulea*), and western painted turtle (*Chrysemys picta bellii*).

Management activities since 1995 have included the removal of exotics from approximately 10 acres of the disturbed areas. Scot's broom has been removed from all of the road edges and the upland fill site; blackberry has been removed along the roads and trails by several methods but continues to be a problem. Mowing of the open areas has occurred for the past two years to control non-native grasses that have become established since the flood of 1996. Several areas have been planted with native shrubs and trees with the intent to eventually shade out some of the non-native plant species, and to increase the quality and quantity of available wildlife habitat in this area.

APPENDIX B

WILDLIFE MONITORING PROTOCOLS

PROTOCOL FOR SURVEY AND MONITORING OF NEOTROPICAL MIGRATORY LANDBIRDS

SURVEY METHODS

Bird Populations: The point count method will be used for sampling bird populations. This method is the most commonly used, most cost effective, and provides a way in which to study the abundance patterns of species and the yearly changes of bird populations at fixed points (Ralph et al. 1993).

Point count stations will be established in the ash/cottonwood habitat. Stations will be spaced a minimum of 150 meters apart, with a fixed radius of 50 meters within a forested area. The stations will be chosen and located to minimize openings and the effect of edge. However, due to the configuration of the various habitat types (at Burlington Bottoms, forested habitat tends to occur in narrow, linear bands interspersed with open meadow and backwater slough habitats), most stations may have one or two openings, and it is possible that a station may have little or no forest beyond the 50 meter radius of the circle, therefore edge effect will be unavoidable for some of the stations.

Censusing will occur during the breeding season only, with one census at each point count station every 10 days. The 10-day census periods will begin in mid-late May and will continue through the month of June.

Surveys will occur between official sunrise and the following 3-5 hours as recommended by Ralph et al. (1993). The time of censusing will vary for each point count during the 10-day periods to avoid potential time-of-morning effects, and surveys will not be conducted after 10:30 a.m.

Observer(s) will approach each point count station making as little noise as possible, and upon arriving at the station will begin the 5-minute census. After the census is completed, observer(s) will continue on to the next point count station until all are completed.

Surveys will only occur if weather conditions are considered favorable (i.e. no rain or heavy wind). If a train passes or a plane flies over, censusing will stop until it has passed and will resume when it is gone. Each station will be surveyed for a total of 5 minutes for each of the four counts during the breeding season.

Data collected at each point count station will include date, start and end times, observers, weather conditions, station number, habitat type, all birds detected (seen and/or heard) both within the 50 meter radius and outside, and total numbers of birds per species.

PROTOCOL FOR SURVEY AND MONITORING OF POND-BREEDING AMPHIBIANS

SURVEY METHODS

Surveys and monitoring of pond-breeding amphibians will occur from January through early April to cover the breeding season for the following species: the Northern red-legged frog (*Rana aurora aurora*), Northwestern salamander (*Ambystoma gracile*), Long-toed salamander (*Ambystoma macrodactylum*), and Pacific chorus frog (*Pseudaris regilla*). Surveys will be conducted on a weekly basis through the breeding season in order to track onset and cessation of the breeding season, with red-legged frogs as the main focus species due to their current Sensitive species listing by the State of Oregon.

Areas to be surveyed include seven temporary ponds on the site, some of which have been surveyed and monitored since 1997 on a yearly basis by volunteers; these ponds were originally chosen because of their variability (percent native and non-native) in emergent vegetation (used by amphibians for ovipositing), and other factors. All ponds included in the study will be surveyed at least four times (to be spread out during the survey period) during the breeding season in order to ensure that all egg masses have been counted. If time and funding allows, additional ponds will be surveyed.

In order to adequately survey each pond each census time, a minimum of three people will be needed to cover the entire pond area. A spacing of approximately five feet will occur between each surveyor (arms length) as the surveyors slowly walk across each pond, counting and then assigning a number to each egg mass found. Upon encountering an egg mass, the following data will be recorded:

- species
- number
- attachment brace (vegetation species)
- water depth
- position in the water column (or distance below the water surface)
- distance to shoreline
- distance to cover (e.g., forest habitat)
- development stage (if possible)
- air and water temperatures
- note location of each egg mass on map to show approximate location in pond (locations will later be entered using GPS)

Only the red-legged frog and northwestern salamander egg masses will have the above data recorded. If present, egg masses of the long-toed salamander and Pacific chorus frog will be noted but the above data will not be taken for each since they are typically too numerous to count and are not currently considered a species of concern.

Additional information that will be recorded includes any beaver activity, changes in the pond or surrounding area (fallen trees, blocked stream due to beaver activity) and other pertinent activity. Photo documentation of the ponds and surrounding habitat will also occur at set photo points that were established in 2000.

APPENDIX C

FISH MONITORING PROTOCOL

PROTOCOL FOR MONITORING ANADROMOUS FISH

The Lower Columbia River ecoregion has experienced severe floodplain and estuarine habitat alteration and degradation as evidenced by declining salmon stocks and degraded water quality. Channelization activities and subsequent development of the area for timber, agriculture and commercial development have reduced the amount of wetland and estuarine habitat and compromised the quality of the remaining habitat. The rapid growth of urban areas in the northwest adds to the plight of wetlands and emphasizes the urgent need for a focused and coordinated conservation effort.

The evaluation of fish use and passage from restored wetlands is critical to understanding and implementing a holistic wetland conservation strategy. Monitoring of wetlands would occur to assess their importance to anadromous fish, and to evaluate the effectiveness of fish passage strategies. Sampling will consist of seasonal (early winter, late winter, and spring) surveys to document fish distribution and abundance within wetlands, and regular trapping of both sides of fishway structures to evaluate fish immigration/emigration patterns.

Survey Methods

Season-specific, intensive sampling is necessary to maximize the detectability of all fish species, and provide sufficiently low sampling variance to detect differences in Catch per unit effort (CPUE = a gear-specific index of abundance density) among treatments, and across systems, by season. A "Regular Fish Monitoring Program" (RFMP) is described in Appendix A to achieve this.

Temperate floodplains are characterized by frequent water level changes, especially during the winter and spring, and movements of fish may occur between RFMP samples. Also, understanding fish movements, especially of migratory, anadromous fishes, is important in interpreting seasonal habitat use. To this end, 2-way traps (based on a vertical slot design that is operational over a range of water levels (Bayley and Baker 2000)) will be employed at each of the three units. Apart from continuous monitoring at a strategic position at each site, traps will also be employed periodically upstream and downstream to control structures to test their effectiveness in permitting free passage of marked fish.

Continuous monitoring will not be possible at all water levels at all sites, because at high levels many access points are available and fish are more dispersed. However, strategic gill net sets have been very successful at sampling fish at very high water levels (Bayley and Baker 2000), and standard fleets used in the RFMP will also be employed in this manner.

All fish captured will be identified and measured to fork length. Selected specimens will be weighed to augment existing length-weight data sets. External anomolies, including parasites, will be recorded, as well as external or internal (pit) tags, and fin clips to denote hatchery fish. Scales will be sampled from salmonids for age determination. Samples of fishes will be sacrificed for age verification using otoliths and for diet analysis. When a standard pre-selected area for sampling is encountered dry, it will be recorded as a zero sample.

Habitat monitoring

Dominant vegetation, water depth, transparency (Secchi and/or tubidity meter) temperature, and electrical conductivity will be recorded at each site corresponding to each fish sample. A photograph will be taken of a typical shoreline representative of each stratum at each site and season, and the GPS position and direction of each photograph recorded. Temperature will also be continuously recorded using Hobo Temperature Probes (Onset Corp.) set to take readings every 1.6 hours. Probes will placed just below the surface and just above the bottom of lakes in each unit. Probes will also be placed in connecting rivers or sloughs.

APPENDIX A

Regular fish monitoring program (RFMP) - An affordable, consistent monitoring system is essential for estimating changes in fish populations during different seasons and among floodplain units. A protocol, RFMP, has been successfully implemented for floodplain restoration monitoring in aggregate-mined areas (Bayley and Baker 2000) and is recommended for the restoration units in this project. The methods include: 1. Boat electrofishing unit, 2. Standard gill net fleet, 3. Hoop net, and 4. Gee minnow trap, that are described in detail below.

1. Boat electrofishing unit.- (not applicable for Burlington Bottoms) Oregon Department of Fish and Wildlife (ODFW) will provide the electrofishing boat and personnel. Consistency in protocol, and the likelihood of maintaining it into the future, is more important than maximizing catch during particular sampling trips. The unit uses a Smith-Root GPP5 model powered by a 5000-W generator. All strata in all units will be sampled by a single pass per season. Although times of runs are recorded, effort is most appropriately measured as the distance of shoreline sampled; CPUE is here expressed as catch in numbers per 100-m of shoreline.

2. Standard gill net fleet.- (not applicable to BB) The remaining methods, 2, 3, and 4, use passive (set) gear, and therefore sets will be positioned randomly within each stratum (shore section) prior to each trip. The order in which the sections will be fished will also be randomized.

Each gill net fleet will be 6-ft deep and 125-ft-long with 5 panels (25-ft each) of 3/4, 1, 1.5, 2, 2.5-in square mesh sizes of multifilament nylon. It will have a polycore floatline and leadcore line weighted for fishing on the bottom. Fleets will be set roughly perpendicular to the shoreline with the finest mesh adjacent to shore. The mesh size in which each fish was entangled will be recorded.

3. Hoop net.- Each hoop net will be 2.5-ft diameter and 1" square mesh with a short 1" square mesh lead net attached to the middle of the opening for guiding fish in from either direction. Each set (one unit per stratum) will be arranged with the lead net towards the shore.

4. Gee minnow trap.- Three Gee minnow traps (1/4 inch mesh) will be randomly set each season in each stratum in shallow water, covered with macrophytes. Methods are to some extent complementary with respect to their ability to catch different species or sizes of fish from the common members of the community, and the joint sampling effort (in addition to vertical slot traps and strategic gill nets described above) will maximize the chance of encountering rarer species.

Each gear has a characteristic catchability range depending on species, size, and environment, that relates actual abundance or biomass density to catch-per-unit-effort (CPUE) with catch as numbers or weight of fish, respectively. A consistent protocol does not guarantee constant catchability, but makes it minimally variable in given habitats across floodplain units. Maintaining protocols will also permit the future application of catchabilities estimated from efficiency calibrations on-site, or with similar gear, species, and habitats elsewhere. This would transform CPUE data to actual abundance or biomass estimates. Where smaller water bodies exist, standardized protocols using backpack electrofisher or electric seine will be employed and maintained at those sites and seasons.