

# South Reach Natural Resources Inventory

DRAFT - December 2018

THE RIVER PLAN



Bureau of Planning and Sustainability

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City of Portland, Oregon





## Acknowledgements

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## **EXECUTIVE SUMMARY**

### **BACKGROUND AND PROCESS**

As part of the River Plan / South Reach project, the City is updating the existing environmental information and management tools to protect and enhance natural resources. This update is needed to aide in meeting watershed health goals and advancing the City's compliance with local, regional, state and federal regulations. The first step is to produce an inventory of existing natural resources.

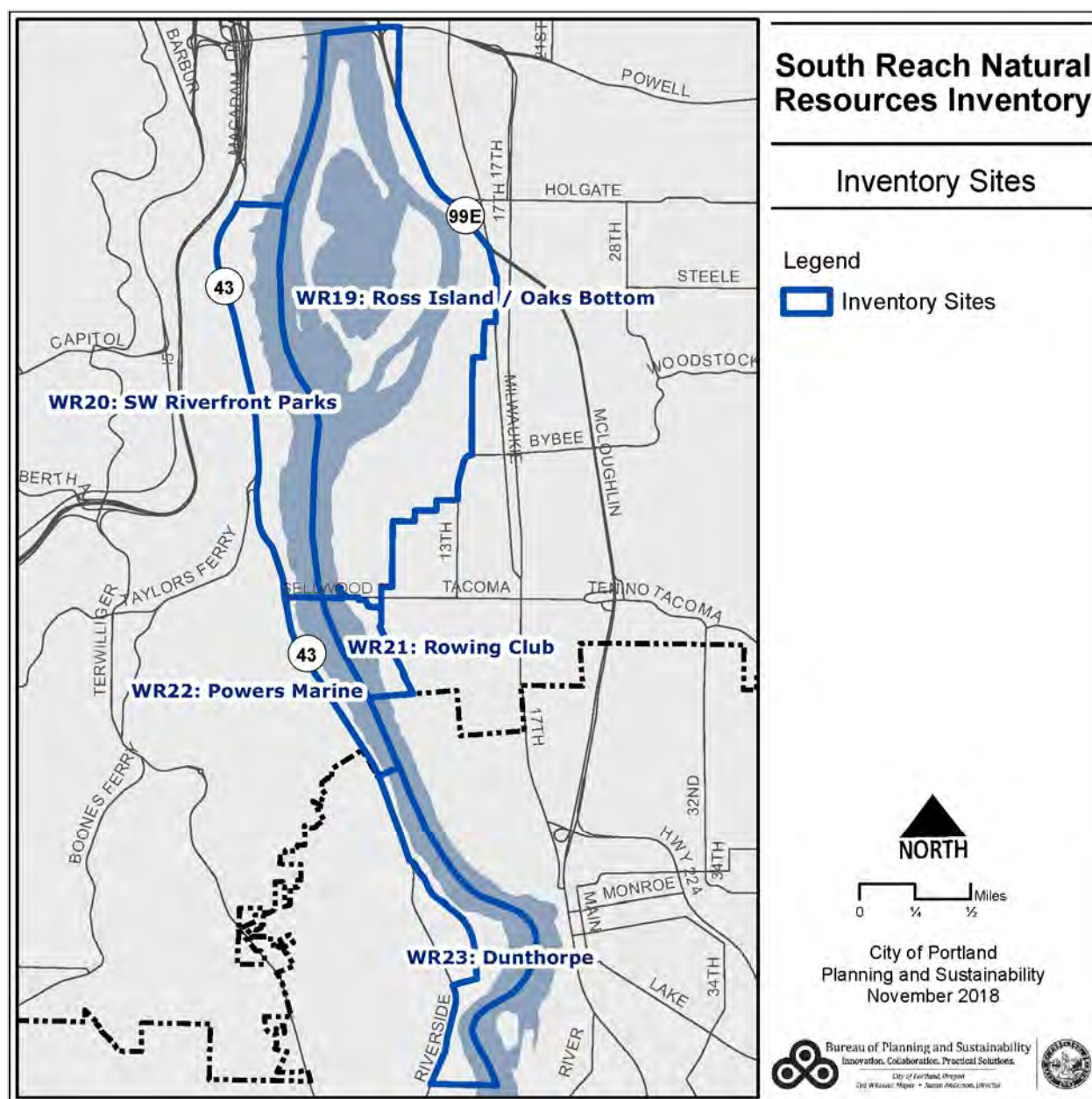
The South Reach Natural Resources Inventory (SRNRI) describes the existing natural features (e.g., vegetation, floodplain) and evaluates the functions and values they provide (e.g., flood storage, shade). The map below shows the inventory sites in the South Reach.

The inventory approach is based on the science and methodology that Metro used to produce a regional inventory of riparian corridors and wildlife habitat. Metro's inventory was adopted as part of Title 13, Nature in Neighborhoods.

The City has refined the regional inventory to include recent scientific information about resources in Portland. The City's inventory methodology is documented in the *Natural Resources Inventory Update, Riparian Corridors and Wildlife Habitat Project Report*, which was adopted by City Council in October 2012. The report is available online: <http://www.portlandonline.com/portlandplan/?a=400492&>.

The SRNRI is a technical document and does not propose any new programs or regulations. The SRNRI will inform discussions that take place as a part of the River Plan/South Reach regarding environmental policies, priorities and regulations.





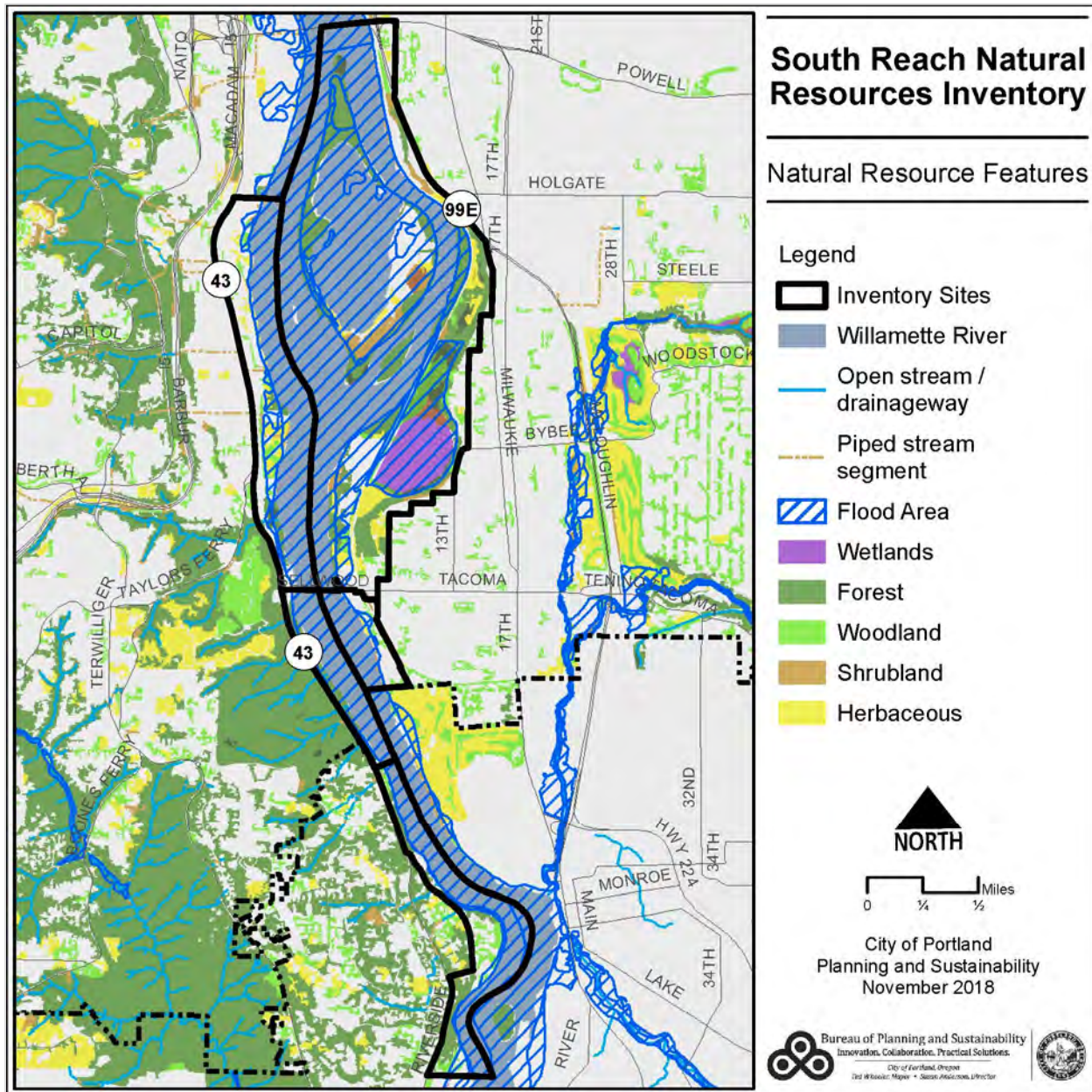
## RESULTS

The SRNRI contains narrative descriptions of the natural resource features and functions in the inventory areas. In addition to the narratives, two GIS models are used to display the functions provided by the features and produce ranks of high, medium and low that depict the relative amount of functions provided by any given feature. For example, a large stand of trees located adjacent to the Willamette River provides numerous functions, such as shading the in-water habitat and providing structure and nutrients to the river and riverbank. In these types of situation, the trees would receive a high relative rank for riparian corridor functions.



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The following map shows the features that are the basis of the geographic information system (GIS) modeling for the South Reach inventory area.



The SRNRI provides a description of the general characteristics of the Willamette River and the South Reach, as well as a more detailed description for each of the five identified South Reach inventory areas. Each of the inventory areas is ranked for riparian corridor and wildlife habitat functions. Additionally, many areas in the South Reach receive a Special Habitat Area designation for wildlife habitat. Special Habitat Areas may be wetlands, bottomland hardwood forests, oak escarpments or other habitats. The combination across the reach provides a mosaic of habitat types that is unique in Portland. All Special Habitat Areas receive a high relative rank. Below is a brief summary of the inventory results.

**DRAFT****Willamette River**

The Lower Willamette River flows through the South Reach, providing the primary migration corridor for Endangered Species Act (ESA) listed Chinook, coho, and chum salmon, and steelhead and bull trout, to the Columbia River. These fish depend on clean, cool water and shallow areas for resting and feeding during migration. The Willamette's South Reach has many areas of shallow water and beach habitat.

The Willamette River is part of the Pacific Flyway and is utilized by more than 200 resident and migratory bird species. Shorebirds and waterfowl use shallow water areas and exposed sand and mud. Waterfowl and gulls use the vegetated shoreline along the river. Peregrine falcons nest on Willamette River bridges and perch on pilings and buildings.



*Salmon in the Willamette River.*

The Willamette River receives a high relative rank for riparian corridor functions and wildlife habitat and it is identified as a Special Habitat Area for ESA-listed fishes.

**Riverbanks and Riparian Corridors**

The features and quality of the Willamette's river banks are directly tied to the river itself. These riparian corridors provide the transition between the river, stream banks and upland areas.

Vegetation on the banks, even in a narrow strip, is important to watershed health. Native plant species generally provide a broader suite of benefits – such as varied wildlife food sources and effective slope stabilization – than non-native plants. However, plants of all types, including invasive species, provide functions such as water storage, nutrient cycling and cover and nesting opportunities for wildlife. Vegetated river banks receive a high or medium relative rank for riparian corridor functions.



*Powers Marine Park.*

Much of the river bank in the South Reach is vegetated; although there are some areas of riprap and fill that impact shoreline functions. There are also natural rock outcroppings. Where there is residential and commercial development along the river, the banks generally have low structure vegetation. All riverbanks in the South Reach receive at least a medium relative rank for riparian corridor functions because of the direct impact and important relationship between the banks and in-water habitat. Riverbanks that have mature tree canopy receive a high relative rank for functions because large structure vegetation provides more varied functions, such as shading in-water areas.



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### Flood Area

Most of the flood area in the South Reach is comprised of the Willamette River itself and the river banks. At Ross Island, Oaks Bottom and Willamette Park the flood area extends over the bank into upland areas. Open water and vegetated flood areas provide a host of important functions, including water storage, nutrient cycling, microclimate and channel migration. In some locations, the flood area extends over the banks and into developed lands. The developed flood area provides for water storage during large storm events like the flood in early 1996.

The vegetated flood area receives a high or medium relative rank for riparian corridor functions, while the developed flood area receives a low relative rank because it only provides flood storage capacity.



*Streets sometimes provide flood storage.*

### Trees and Landscape Vegetation

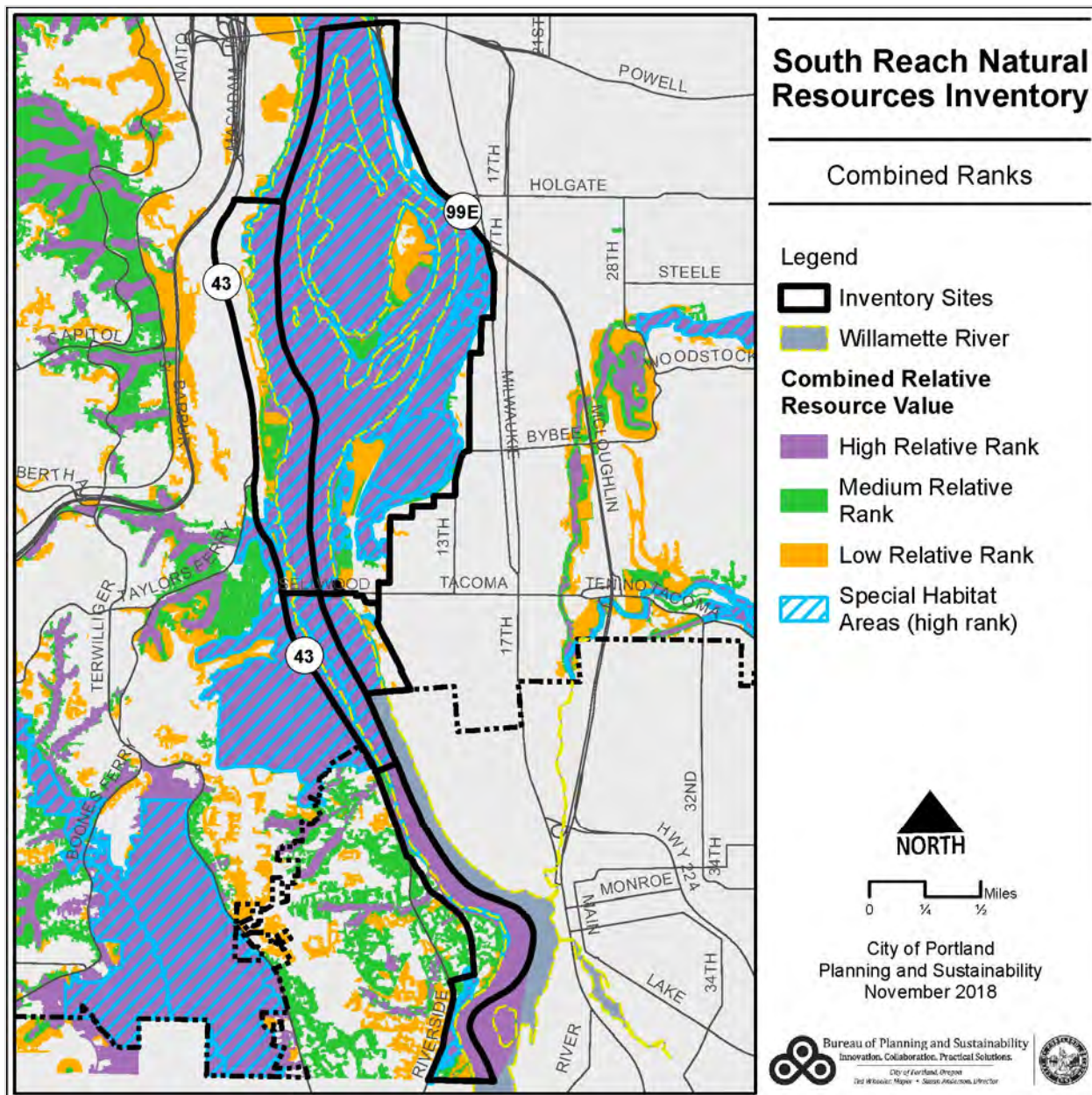
For purposes of the SRNRI mapping and modeling, only patches of trees that are at least one-half acre in size are assigned a relative rank for wildlife habitat. These areas provide habitat for a host of insects, birds, mammals, amphibians and reptiles. The Ross Island/Oaks Bottom Complex, Willamette Moorage, Powers Marine and parts of Dunthorpe all have significant tree canopy and receive a medium relative rank for wildlife habitat.

Even smaller landscaped areas and individual street trees, while not receiving a rank in the inventory, provide functions including cleaning and cooling the air and water, capturing greenhouse gases, capturing and up-taking stormwater, reducing energy demand and providing wildlife habitat.



The following map depicts the combined riparian corridor and wildlife habitat relative ranks.

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## NEXT STEPS

The next step is to use the SRNRI information, along with other technical data and studies, to evaluate the implications and trade-offs associated with different levels of natural resource management. The result of the evaluation will be a South Reach Natural Resources Protection Plan with determinations regarding under what circumstances significant natural resources will be recommended for protection or conservation.

The final step is to update the City's Environmental Program to implement the results of the evaluation. This may include updates to Greenway, Environmental or other overlay zones and regulations. Regulatory and non-regulatory programs to manage natural resources may also be identified.



# CHAPTER 1. INTRODUCTION

## REPORT PURPOSE, ORGANIZATION AND USES

The purpose of this inventory report is to provide useful, current and accessible information on the location of existing natural resource features and their functions for Portland's Willamette River South Reach. The report includes descriptions and maps of the current relative condition of riparian corridors and wildlife habitat located within the South Reach including the river, river banks, flood plains, tributary streams, wetlands and upland features.

The report is organized into chapters that provide a context for inventory work, describe the inventory methodology and present an inventory of natural resources for the South Reach. The following is a brief summary of the material contained in each chapter:

**Chapter 1: Introduction** – This chapter provides background information and describes the regulatory context for the inventory.

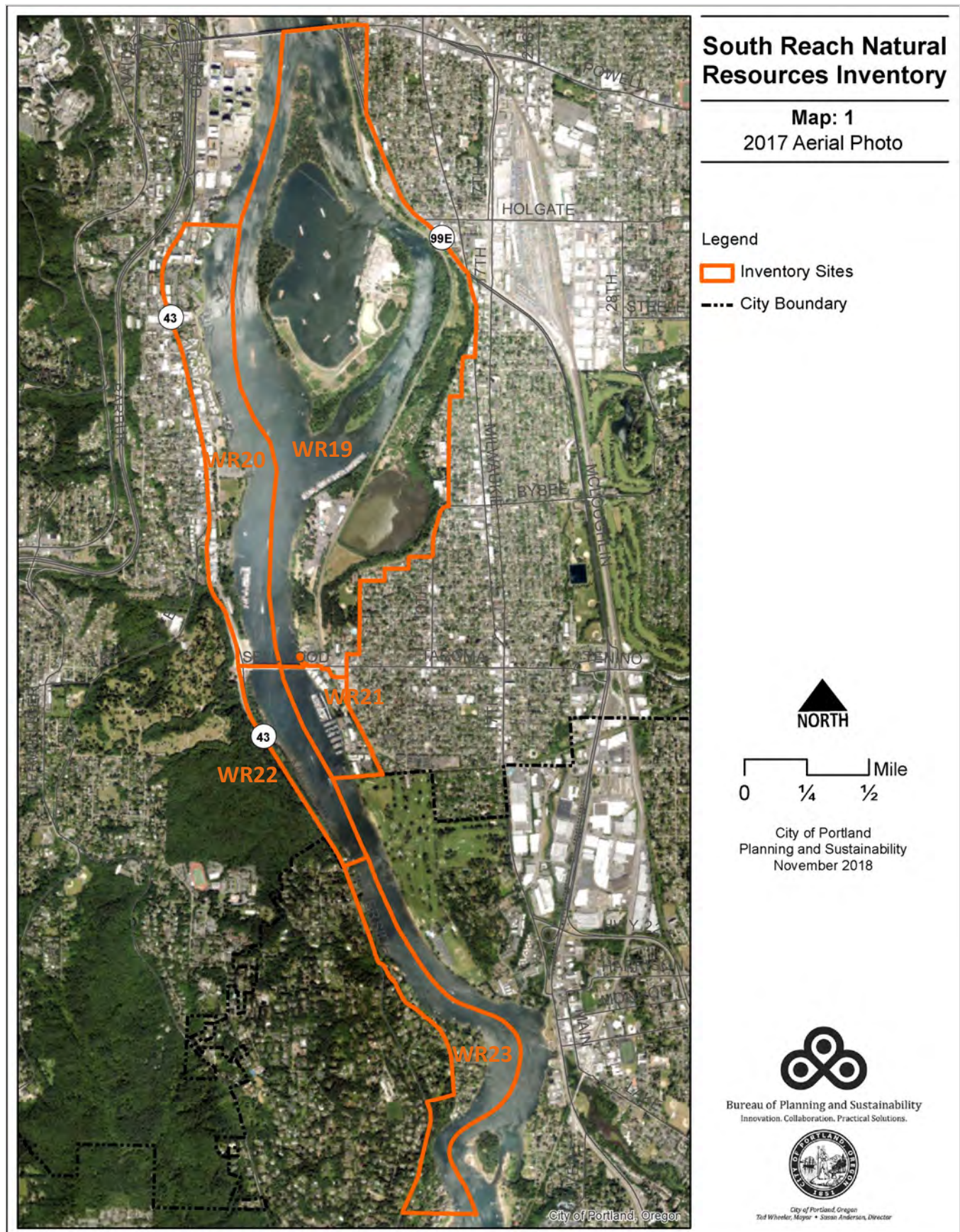
**Chapter 2: Project Approach and Methodology Overview** – This chapter provides an overview of the citywide inventory project approach and the methodology used to identify and evaluate riparian corridor functions and wildlife habitat attributes. There is also a section describing additional work done specifically for the South Reach Natural Resources report.

**Chapter 3: South Reach Natural Resources Inventory** – Includes a general overview of the Lower Willamette River basin in Portland. The overview describes general land uses, transportation, commerce and existing natural resources. Following the overview is a summary of the Willamette River in the South Reach. This summary includes hydrology, bathymetry, bank conditions, and fish and wildlife species using the river. A description of natural resources for each inventory site is presented. Descriptions include the presence, type and extent of existing waterways, flood areas, wetlands, vegetation, and fish and wildlife habitats and species. Alterations and disturbances, such as flood control and invasive species, are also discussed. For each inventory site, an evaluation of current riparian corridor functions and wildlife habitat is included, followed by a series of maps, aerial photographs, water-related features, vegetation features, riparian corridor relative ranks, wildlife habitat relative ranks and combined riparian/wildlife habitat relative ranks.

## INVENTORY AREA

The South Reach Natural Resources Inventory (SRNRI) area extends on the east side from the Ross Island Bridge to just south of the Sellwood Bridge and from the southern end of the South Waterfront district to the Dunthorpe neighborhood in unincorporated Multnomah County (see Map 1). The inventory area is comprised largely of publicly managed parks and open spaces and residential development. Parks, open spaces, and recreational facilities include Ross Island Natural Area, Oaks Bottom Wildlife Refuge, Springwater Corridor, Toe Island, Willamette Park, Willamette Moorage Park, Oaks Crossing, Sellwood Riverfront Park and Powers Marine

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Park. There are three floating home communities in the reach and there are commercial uses along the SW Macadam Ave. and SW Tacoma St transportation corridors.

The inventory includes the Willamette River, other natural resource features and developed lands adjacent to the natural resource features. The inventory area encompasses, and is somewhat larger than, the area currently contained within the City's Willamette Greenway Overlay Zones. The boundaries are also drawn to:

- Include contiguous natural resource features (e.g., floodplain)
- Follow major infrastructure like highways and rail roads
- Not bisect properties under the same ownership
- Use the river thalweg to divide east and west sites

## BACKGROUND

More than 40 years ago, the City began developing natural resource inventories to support natural resources planning and management decisions. The first Willamette River inventory was completed in 1975 for the Lower Willamette River Management Plan. The inventory provided generalized information about relative wildlife habitat values. It was the first of ten inventories the City completed for different areas in Portland to meet state land-use planning goals.

The second Willamette River inventory was adopted by the City in 1986. It provided more detailed information about specific habitat sites along the river, including information about existing conditions and potential restoration options. A Wildlife Habitat Assessment (WHA) methodology was used to document and rank existing conditions and identify potential opportunities for habitat improvement. The inventory was divided into 24 segments or zones along the Willamette River in Portland. Each zone included anywhere from two to 14 habitat sites, depending on the complexity of the zone. Highly ranked habitat sites were identified as Rank I, with lesser value habitat sites identified as Rank II, III, IV or V.

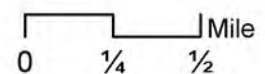
Both the 1975 and the 1986 Willamette River inventories were developed for the City's Willamette Greenway program. The Greenway program was established primarily to meet requirements of the Oregon State Land Use Goal 15: Willamette River Greenway. The program includes policies, design guidelines, overlay zone maps and regulations to meet multiple objectives along the Willamette River.

In 2012 the City of Portland adopted the citywide Natural Resources Inventory (NRI) methodology and maps as part of the factual basis to inform the 2035 Comprehensive Plan, completed in 2016. The City's NRI is based on Metro's regional inventory of riparian corridors and wildlife habitat.

In 2014, the City of Portland completed a comprehensive review and update of the Willamette River inventory and adopted the *Willamette River Greenway Inventory*. The *Willamette River Greenway Inventory* describes the zoning, land uses, property ownership, natural resources, recreation opportunities and historic and cultural resources within the Greenway Overlay zone boundary. As the conditions and characteristics of the land adjacent to the river change over time, City staff will continue to update the *Willamette River Greenway Inventory* to serve as a resource for understanding the river and its adjacent lands.

### Legend

- 



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Between 1991 and 2002, the City adopted several other natural resource inventories as part of a program to comply with Oregon State Land Use Goal 5. The following inventories address resources within or adjacent to the South Reach inventory area (see Map 2):

- Johnson Creek Basin Plan (1991)
- Southwest Hills Resource Protection Plan (1992)
- Multnomah County Unincorporated Urban Pocket Project (2002)

This inventory represents additional honing of the natural resource inventory update completed as a part of the recently-adopted 2035 Comprehensive Plan, focusing specifically on conditions in the Willamette River South Reach. The information presented in this report updates the existing inventories based on current natural resource data, recent field assessments and resource evaluations. The work is also consistent with and advances the goals outlined in the Portland Watershed Management Plan and the Framework for Integrated Watershed Management, both of which were adopted by the City Council in 2005. These documents establish key ecological principles, restoration priorities and recommended strategies to protect and restore watershed health. Portland's watershed goals and objectives are provided in Appendix A.

Along with updating the inventory as part of the River Plan/South Reach, the South Reach Natural Resources Inventory can inform and support a broad array of City and community activities relating to the Willamette River. Such activities include long-range planning, implementing and updating City programs to manage natural resources, identifying priority areas for restoration, enhancement, and public acquisition, designing development and redevelopment projects, and meeting regional, state and federal regulatory requirements.

## REGULATORY CONTEXT

Many federal, state, regional and local regulations and policies relate and are applicable to natural resources found in the South Reach NRI area. Policies and regulations relating most directly to the development of the inventory are certain Oregon State Land Use Goals and portions of the Metro Urban Growth Management Functional Plan. These requirements are summarized below; Appendix B provides additional information about key state and federal natural resources regulations and policies.

### State Land Use Planning Program

Comprehensive land use planning was mandated by the 1973 Oregon Legislature, primarily in response to population growth pressures on valuable farm and forest land. Since 1975, cities and counties in Oregon have been required to comply with Statewide Planning Goals. Today, there are 19 goals that Oregon cities and counties must comply with through the adoption and maintenance of local comprehensive plans. Portland adopted its first comprehensive plan in 1981 to satisfy the requirements of the state planning program.

Multiple state planning goals apply to the inventory area; however only those goals most directly relating to the natural resource inventory, Goals 5, 6, 7 and 15, are addressed in this section. Other goals may be addressed in separate documents that will be developed later as a part of the River Plan/South Reach.

- **Goal 15: Willamette River Greenway** – Goal 15 sets forth procedures for protecting the diverse qualities of the 300 miles of land along the Willamette River. Multiple uses and functions are to be conserved, enhanced and maintained, including significant habitat and economic and recreational uses.

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- **Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces** – Goal 5 addresses many types of resources. It establishes a process in which resources are inventoried and evaluated for significance. If a resource or site is found to be significant, the local government must evaluate the consequences of three policy choices: protecting the resource, allowing proposed uses that conflict with the resource, or establishing a balance between protecting and allowing uses that conflict with the resource. The local government must then adopt a program based on the results of this evaluation. Goal 5 does not apply to the area within the Goal 15 Willamette Greenway Boundary. However, local jurisdictions may use tools and approaches provided by Goal 5 to inform natural resources management within the Willamette Greenway Boundary.
- **Goal 6: Air, Water and Land Resources Quality** – This goal requires local comprehensive plans and implementation measures to be consistent with state and federal regulations on matters such as stream quality and groundwater pollution. Goal 6 provides guidelines for local jurisdictions, including buffering and separating those land uses which create impacts on air, water and other resources. Further, plans should consider the carrying capacity of the air, land and water resources within the planning area.
- **Goal 7: Areas Subject to Natural Hazards** – Goal 7 deals with development in places subject to natural hazards such as flooding, landslides or wildfire. It requires that jurisdictions apply “appropriate safeguards” (e.g., flood plain regulations) when planning for development.

The intent of Goal 15 is to determine which lands are suitable or necessary for inclusion within the Willamette Greenway Boundary and to develop the greenway management plan and acquisition program. Local jurisdictions must inventory the existing natural resources in the Willamette Greenway Boundary and consider uses that compete or conflict with natural resources when determining management and protection options.

Goal 15 requires that the following resources and land uses be inventoried:

- Fish and wildlife habitats
- Hydrological conditions
- Ecologically fragile areas
- Significant natural and scenic areas and vegetative cover
- Areas of annual flooding and flood plains
- All current public recreation sites, including public access points to the river and hunting and fishing areas
- Recreational needs as set forth in Goal 8
- Historical and archaeological sites
- All current aggregate excavation and processing sites, and all known extractable aggregate sources
- Land currently committed to industrial, commercial and residential uses
- The ownership of property, including riparian rights
- Other uses of land and water in or near the Greenway
- Acquisition areas, which includes identifying areas suitable for protection or preservation through public acquisition of lands or an interest in land

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The Goal 15: Willamette River Greenway inventory is used to determine which lands are suitable or necessary for inclusion within the greenway boundary and to develop the greenway management plan and acquisition program. Goal 15 does not specify an approach for considering competing or conflicting uses.

The Goal 5 Administrative Rule provides direction regarding a “conflicting use” analysis (also known as the Economic, Social, Environmental and Energy Analysis) to understand how development and other uses (e.g. clearing land) impact natural resources. While local jurisdictions do not need to comply with Goal 5 within the Willamette Greenway Boundary, the natural resources protection plan that will be developed from this inventory will draw on the Goal 5 conflicting use analysis approach to evaluate trade-offs associated with protecting natural resources.

The 1987 *Willamette Greenway Plan*, which complied with Goal 15, is currently being updated through plans such as River Plan/South Reach. These plans are comprehensive, multi-objective plans for the Willamette River waterfront and adjacent lands. River planning is being carried out in three phases, each focusing on a different reach of the Willamette River: North Reach, Central City (completed as a part of the Central City 2035 Plan) and South Reach.

Because the Goal 15 process requires identification and consideration of water and land resources and floodplains, this inventory and the future natural resources protection plan can also be used to maintain comply with portions of Goal 6 and 7.

**Metro’s Urban Growth Management Functional Plan and Titles 3 and 13**

The 1973 Legislature granted expanded powers for the Columbia Region Association of Governments (now called Metro) to “coordinate regional planning in metropolitan areas” and to “establish a representative regional planning agency to prepare and administer a regional plan.” During the 1990s, Metro worked with local jurisdictions to develop Regional Urban Growth Goals and Objectives (RUGGOs) and the Urban Growth Management Functional Plan.

The Urban Growth Management Functional Plan provides a regional approach to growth management by tailoring several key statewide land use goals to meet regional population growth expectations. This approach recognizes the interrelationship between housing, employment, clean air and water, natural resource protection, and transportation networks across jurisdictional boundaries. Metro developed the plan with input from the 24 cities and three counties within the Urban Growth Boundary at that time. The Urban Growth Boundary is one tool used to protect farms and forests from urban sprawl and promote efficient use of lands within the boundary. Uses of land within an Urban Growth Boundary support and are supported by urban services such as road, water and sewer systems.

Nine titles in the Urban Growth Management Functional Plan are derived from or relate to statewide planning goals and the rest are procedural. Title 3 and Title 13 pertain most directly to natural resources and the inventory information contained in this report.

**Title 3** is derived from portions of Oregon State Land Use Goals 6 and 7 and establishes regional requirements relating to water quality, erosion control and flood hazard management. In September 2002, the City of Portland completed the Title 3 Water Quality Compliance Report. The report explains how the

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City complies with Title 3 requirements through the existing Environmental Overlay Zoning program and newer regulations established by the Willamette River Title 3 Water Quality Compliance Project (adopted by the City Council in August 2002). Metro found the City in substantial compliance with Title 3 in December 2002.

**Title 13**, adopted by the Metro Council in September 2005, establishes the Nature in Neighborhoods program. The purpose of the program is to protect, conserve and restore important riparian corridors and wildlife habitat areas in the region and also serves as a supplement to Title 3 requirements relating to water quality, flood hazard and erosion control. Title 13 establishes provisions intended to prevent impacts or ensure mitigation of unavoidable impacts on identified Habitat Conservation Areas within the region. Habitat Conservation Areas are comprised of regionally significant riparian corridors and wildlife habitat identified in Metro's inventory, including substantial portions of Hayden Island. Title 13 also establishes specific planning requirements for West Hayden Island, namely the development of a district plan.

In January 2007, the Oregon Department of Land Conservation and Development acknowledged the new Title 13 program, finding it in compliance with Goals 5 and 6. This acknowledgement establishes new Goal 5 and 6 requirements for cities and counties in the Metro area, which had until January 2009 to show that their local programs meet the requirements of the regional program. In November 2009 and June 2011, Metro granted the City of Portland extensions to meet Title 13 requirements. The extension was granted to provide the City with time to complete or make progress on key projects that would update Portland's environmental policy direction and regulations. These projects include area-specific plans such as Airport Futures and citywide projects like the updated citywide Natural Resources Inventory.

In October 2012, the Portland City Council adopted the citywide Natural Resources Inventory methodology and maps as part of the factual basis to inform the City's Comprehensive Plan update. In November 2012, the City Council approved the City's *Request for Metro Determination of Substantial Compliance with Title 13* for submittal to Metro. In December 2012, Metro staff determined that the City is in substantial compliance with Title 13 and the Metro Council accepted this determination in February 2013.

The City and Metro entered into a voluntary Intergovernmental Agreement (IGA) that states the City's intent to complete a number of planning projects that will involve the development of area-specific inventory updates and evaluation of environmental program refinements based on the inventory findings and other new information. The River Plan North Reach, Central City and South Reach are referenced in the IGA.

Metro identified many of the natural resource areas addressed in this inventory in the regional Title 13 inventory. Metro documented these areas as providing important riparian functions and wildlife habitat attributes during development of Titles 3 and 13. As noted above, this updated inventory is intended to replace the regional inventory for the South Reach NRI study area and will, among other uses, inform City program updates affecting the management of natural resources within the South Reach.



**City of Portland 2035 Comprehensive Plan**

Portland's *2035 Comprehensive Plan* is a long-range plan that helps the City prepare for and manage expected population and employment growth, as well as plan for and coordinate major public investments. The *2035 Comprehensive Plan* guides how and where land will be developed and what infrastructure projects will be constructed to prepare for and respond to population and job growth. The plan was developed based on five guiding principles, including: Economic Prosperity, Human Health, Environmental Health, Equity and Resilience.

Key *2035 Comprehensive Plan* policies relevant to the Willamette watershed and South Reach, more specifically, include the following:

- Policy 7.33 Fish habitat.** Provide adequate intervals of ecologically-functional shallow-water habitat for native fish along the entire length of the Willamette River within the city, and at the confluences of its tributaries.
- Policy 7.34 Stream connectivity.** Improve stream connectivity between the Willamette River and its tributaries.
- Policy 7.35 River bank conditions.** Preserve existing river bank habitat and encourage the rehabilitation of river bank sections that have been significantly altered due to development with more fish and wildlife friendly riverbank conditions.
- Policy 7.36 South Reach ecological complex.** Enhance habitat quality and connections between Ross Island, Oaks Bottom, and riverfront parks and natural areas south of the Central City, to enhance the area as a functioning ecological complex.
- Policy 7.38 Sensitive habitats.** Protect and enhance grasslands, beaches, floodplains, wetlands, remnant native oak, bottomland hardwood forest, and other key habitats for native wildlife including shorebirds, waterfowl, and species that migrate along the Pacific Flyway and the Willamette River corridor.
- Policy 7.39 Riparian corridors.** Increase the width and quality of vegetated riparian buffers along the Willamette River.
- Policy 7.40 Connected upland and river habitats.** Enhance habitat quality and connectivity between the Willamette riverfront, the Willamette's floodplain, and upland natural resource areas.
- Policy 7.41 River-dependent and river-related uses.** Develop and maintain plans and regulations that recognize the needs of river-dependent and river-related uses, while also supporting ecologically-sensitive site design and practices.

There are a variety of other important *2035 Comprehensive Plan* goals and policies that will inform the development of the River Plan/South Reach but they are not listed here due to space constraints.

## CHAPTER 2. PROJECT APPROACH AND METHODOLOGY

The inventory presented in this report was produced by integrating information from several sources. Some of the information presented later in this report was taken directly from Portland's citywide inventory of riparian corridors and wildlife habitat. Other key information was produced specifically for the SRNRI, including the delineation of inventory sites and field observations. The following chapter describes the key information that makes up this inventory and how the information was developed.

### BACKGROUND AND RELATIONSHIP TO METRO'S REGIONAL INVENTORY

The Bureau of Planning and Sustainability (BPS), in consultation with other City bureaus and other technical experts, has recently produced substantial new inventory information for riparian corridors and wildlife habitat in Portland. Products include new natural resources descriptions, geographic information system (GIS) layers, natural resource data and models, maps, and a report documenting the project approach (Appendix C: City of Portland *Natural Resource Inventory Update: Project Report*).

BPS used Metro's inventory of regionally significant riparian corridors and wildlife habitat as a starting point for citywide inventory development. The new citywide inventory incorporates and builds on the extensive research, analysis, technical review and public scrutiny that went into the development of Metro's regional inventory. Metro's inventory was reviewed by the Independent Multidisciplinary Science Team (a group of leading scientists in the Pacific Northwest) and other local experts. Public workshops were held and a public hearing was conducted before the Metro Council. The Metro Council endorsed the Regional Natural Resources Inventory in December 2001 and directed Metro staff to develop a regional program to protect, conserve and restore regionally significant riparian corridors and wildlife habitat. The Metro Council adopted the inventory as part of the Title 13, Nature in Neighborhoods, program in September 2005. The development of Metro's inventory is documented in the Technical Report for Fish and Wildlife (Metro, 2005), Riparian Corridor and Wildlife Habitat Inventories (Metro, 2005) and Addendum and Update to Metro's Riparian Corridor and Wildlife Habitat Inventories (Metro, 2005).

In 2007, the Oregon Department of Land Conservation and Development acknowledged Title 13 as in compliance with Oregon State Land Use Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces, and Goal 6: Air, Water and Land Resources Quality. As such, Title 13 establishes new regional requirements that Metro area cities and counties must meet to achieve compliance with specified elements of Oregon Land Use Planning Goals 5 and 6.

Both the City's and Metro's inventories reflect fundamental information from Metro's extensive review of scientific literature pertaining to riparian corridors and wildlife habitat. The scientific foundation upon which both inventories are based can be summarized as follows:

**Riparian corridors** are comprised of rivers and streams, drainageways, riparian vegetation and off-channel areas, including wetlands, side channels and floodplains. Riparian corridors usually contain a complex mix of vegetation consisting of trees or woody vegetation, shrubs and herbaceous plants. Portland's urban riparian corridors also include riprap or other types of bank hardening, invasive species and development. Riparian corridors include the transition between the water bodies and upland areas.

The predominance of riparian corridor functions occurs within 100 to 300 feet of a water body but some functions, such as the microclimate effect associated with forest vegetation, can occur up to 780 feet from a water body (Metro, 2005). Functions provided by natural resources located in riparian corridors include:

- **Microclimate and shade** – Open water bodies, wetlands, flood areas, and surrounding trees and woody vegetation are associated with localized air cooling, soil moisture and increased humidity.
- **Bank function and control of sediments, nutrients and pollutants** – River, stream, drainageway channels and flood areas have a direct relationship to bank functions and the conveyance of sediments, nutrients and pollutants. Trees, vegetation, roots and leaf litter intercept precipitation; hold soils, banks and steep slopes in place; slow surface water runoff; take up nutrients; and filter sediments and pollutants found in surface water. Structures, such as pilings, can also help stabilize banks and contain contaminants.
- **Stream flow moderation and flood storage** – Waterways and floodplains provide for conveyance and storage of stream flows and floodwaters in channel and above and below the ground surface; trees and vegetation intercept precipitation and promote infiltration which tempers stream flow fluctuations or “flashiness” that often occurs in urban waterways.
- **Organic inputs, nutrient cycling and food web** – Water bodies, wetlands, flood areas and nearby vegetation provide food (e.g., plants, leaves, twigs, insects) for aquatic and terrestrial species and are part of an ongoing chemical, physical and biological nutrient cycling system.
- **Large wood and channel dynamics** – Rivers, streams, drainageways, riparian wetlands, flood areas and large trees and woody vegetation contribute to natural changes in location and configuration of the waterway channel over time.
- **Wildlife movement corridors** – Rivers, streams, drainageways, wetlands, floodplains and vegetated corridors along waterways allow wildlife to migrate and disperse among different habitat areas and provide access to water.

**Wildlife habitats** provide food, cover, and roosting and nesting sites for a broad array of insects, birds, mammals, reptiles and amphibians. The terrestrial habitat features that provide these functions include forests, woodland, shrubland, grassland and meadows, wetlands, rocky slopes and uplands, buttes and other topographic features. (For the purposes of this inventory, rivers, streams and drainageways are included in the riparian corridor.) The following wildlife habitat attributes are indicators of habitat function and habitat fragmentation due to urbanization:

- **Habitat patch size** – Larger habitat patches generally provide more food, cover, dispersal and nesting/denning opportunities for multiple wildlife species.
- **Interior habitat area** – Larger, rounder-shaped habitat patches experience less “edge effect” (disturbance from urban land uses such as noise/light/vibration, predation and invasive species) and provide more interior habitat area, a requirement for some sensitive wildlife species, than narrow patches.



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- **Connectivity between habitat patches (including distance and edge effect)** – Patches located closer together allow for species dispersal and migration, and provide additional access to food, cover, nesting sites and reproduction opportunities.
- **Connectivity/proximity to water** – Access to water is vital to wildlife survival.
- **Special Habitat Areas** – The inventory recognizes specific habitat types or features that provide important functions for wildlife, including habitats and species at risk, rare or declining habitat types such as native oak assemblages, critical habitat for threatened or endangered species, and urban structures such as bridges that are utilized by Peregrine Falcons for nesting.

Within the city, natural resources generally reflect the impacts of urbanization; however, even impacted resources still provide critical riparian and wildlife habitat functions. For example, vegetated areas in riparian corridors and upland habitats are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as varied wildlife food sources and effective slope stabilization. However, plants of all types, including non-native species, provide important watershed functions such as water storage, nutrient cycling and cover and nesting opportunities for wildlife. Other examples of the effects of urbanization include rivers and streams with constrained or altered channels, wetlands with soil contamination and developed flood plains. In each of these cases, the resource has experienced some degradation but still provides important functions such as water conveyance and storage, and fish and wildlife habitat.

## CITY INVENTORY METHODOLOGY

Below is a summary of the steps BPS used to produce the new citywide inventory of riparian corridors and wildlife habitat (also see Figure 1 on page 24). More detail regarding the inventory approach and methodology, including citations, can be found in Appendix C: City of Portland *Natural Resource Inventory Update: Project Report*. BPS staff completed these five actions:

1. Compiled GIS data and mapped key natural resource features, including rivers, streams, drainageways, wetlands, flood areas, vegetation and topography.
2. Developed criteria and GIS models to rank and map the relative functional value of existing natural resources.
3. Designated Special Habitat Areas and updated regional species lists.
4. Produced Combined Relative ranks and maps.

Below is a detailed explanation of each action.

### 1. Compiled GIS data and mapped key natural resource features, including rivers, streams, drainageways, wetlands, flood areas, vegetation and topography.

The natural resource feature data are the primary inputs into the GIS inventory models for riparian corridors and wildlife habitat. BPS improved the regional natural resource feature GIS data by:

- Remapping more than 160 miles of stream/drainageway centerlines and adding 100 stream/drainageway miles to the maps.

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- Mapping smaller vegetation units (1/2-acre minimum) and classifying forest, woodland, shrubland and herbaceous vegetation over a wider area (using the National Vegetation Classification System, as shown below). Vegetation mapping does not include land that is sparsely vegetated.<sup>1</sup>
  - Forest: Trees with their crowns overlapping, generally forming 60-100 percent of cover.
  - Woodland: Open stands of trees with crowns not usually touching, generally forming 25-60 percent of cover. Tree cover may be less than 25 percent in cases where it exceeds shrubland and herbaceous vegetation.
  - Shrubland: Shrubs generally greater than 0.5 meters tall with individuals or clumps overlapping to not touching, generally forming more than 25 percent of cover with trees generally less than 25 percent of cover. Shrub cover may be less than 25 percent where it exceeds forest, woodland, and herbaceous vegetation. Vegetation dominated by woody vines (e.g., blackberry) is generally included in this class.
  - Herbaceous: Herbs (graminoids, forbs, ferns and shrubs less than 0.5 meters tall) dominant, generally forming at least 25 percent of cover. Herbaceous cover may be less than 25 percent where it exceeds forest, woodland and shrubland vegetation.
- Verifying the existing wetland data using state and city permits and site visits; modifying some wetland boundaries where there was sufficient data.
- Updating the City's flood area data for use in the inventory, including incorporation of the 2004 and 2010 FEMA 100-year floodplain.
- Using Light Detection and Ranging (LiDAR), a method for precisely measuring the elevation of the Earth's surface, and objects on the surface (trees, buildings, etc.).

## 2. Developed criteria and GIS models to rank and map the relative functional value of existing natural resources.

Like Metro, the City produced GIS models to assess the relative functional value of riparian corridors and wildlife habitat. The riparian corridor and wildlife habitat GIS models assign relative ranks of high, medium, low or no rank to natural resource features. The relative ranks are produced using a consistent and replicable scoring method based on the number and types of functions provided by specific natural resource features in the city. The ranks are not tied to a reference or baseline condition, but allow comparison of the relative condition of natural resources within the region or city.

Science-based model criteria were developed to score, assign relative ranks and map the natural resources that provide the specific riparian functions and wildlife habitat attributes listed above. The City's model criteria focus on the presence, type and extent of specific natural resource features. Additional descriptive information on natural resources and disturbances (e.g., development, contamination and invasive species) are provided in the inventory site narratives.

The City's inventory models apply the same general sets of evaluation criteria that Metro developed. However, BPS refined some of the regional criteria to reflect additional detail, more recent data and studies, and local conditions. For example, the City's wildlife habitat model was refined to assign a higher value to somewhat

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<sup>1</sup> Sparse vegetation is defined as areas with a predominance of boulders, gravel, cobble, talus, consolidated rock and/or soil with unconsolidated, low-structure vegetation.

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smaller habitat patches than Metro's model. Shifts in the patch size scoring thresholds were based on additional scientific studies and recent wildlife studies conducted in Portland's natural areas.

The City worked closely with Metro and technical experts to ensure that refinements to the regional inventory would be consistent with Metro's work and would support the City's watershed health goals. For more detail on the inventory refinement, see Appendix C: *City of Portland Natural Resource Inventory Update: Project Report*.

**Riparian Corridor Model**

The riparian corridor GIS model assigns primary and secondary scores to natural resources for six riparian functions. The scores reflect the types of landscape features present and the proximity of those features to a river, stream or wetland. Primary scores are applied to features that provide the most direct and substantial contribution to a particular riparian function. Secondary scores are assigned to features that provide lesser, but still important, contribution to riparian functions. The scientific literature indicates that the preponderance of riparian functions, such as nutrient cycling, occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body. The microclimate effect associated with forest vegetation can occur up to several hundred feet from a water body. The model criteria are not sensitive to the species of vegetation present or whether vegetation is native or non-native. However, the model criteria do assign different riparian functional values to cultivated, heavily manicured and managed landscapes versus semi-natural and natural vegetation.

Table 1 presents the riparian corridor GIS model criteria. The criteria reflect some refinements to the criteria Metro used to map riparian corridors across the region. The criteria refinements are explained in Appendix C: *City of Portland Natural Resource Inventory Update: Project Report*.

For example, Metro assigned a medium or high rank to all river banks and land within 50 feet of rivers and streams to recognize the direct and important impact of those areas on the river. This methodology was reviewed by independent experts and adopted as part of Title 13, Nature in Neighborhoods. The City refined the regional inventory to further recognize the variability of riverbank conditions in Portland. The refinement resulted in a lesser level of function being assigned to hardened, non-vegetated banks along Willamette River North Reach and Central City and Columbia River. Initially, this refinement was made to recognize the impact of extensive river bank hardening associated with Portland Harbor marine terminal facilities in the Willamette River North Reach. In the North Reach, land within 50 feet of the river where the river bank is hardened and not vegetated is assigned a low relative rank, recognizing a lower level of function but continuing to highlight the importance of the banks and adjacent land to overall riparian function.

Through the Central City Natural Resource Inventory, the Willamette River North Reach refinement was applied to non-vegetated, hardened banks of the Central Reach. The model continues to assign a medium or high aggregated relative riparian rank to vegetated, non-hardened river banks.

This refinement is not proposed to extend to the Willamette River South Reach.



**DRAFT****TABLE 1. RIPARIAN CORRIDOR GIS MODEL CRITERIA**

<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Microclimate and Shade	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Forest vegetation within the flood area (except within a drainage district)	3, 4	Woodland vegetation within the flood area (except within a drainage district)	3, 4
		Forest vegetation that is outside the flood area and contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2	Forest vegetation that is outside the flood area, contiguous to primary vegetation and between 100 feet and 780 feet of a river, stream/drainageway or wetland	1, 2
				Woodland vegetation that is outside the flood area and contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2
				Shrubland vegetation that is contiguous to and within 50 feet of a stream/drainageway or wetland	1, 2
Stream Flow Moderation and Water Storage	Water bodies	River, stream/drainageway or wetland	2, 5		
	Flood area	Vegetation within the flood area (except within a drainage district)	3, 4	Non-vegetated land within the flood area (except within a drainage district)	3, 4
	Vegetation			Woodland or shrubland vegetation that is outside the flood area and within 300 feet of a river, stream/drainageway or wetland	1, 2
				Forest vegetation that is contiguous to primary forest vegetation or starts within 300 feet of a river, stream/drainageway or wetland and is within 780 feet of a river, stream/drainageway or wetland	1, 2
				Herbaceous vegetation that is outside the flood area and within 100 feet of a river, stream/drainageway or wetland	1, 2
				Where the slope is at least 25%: herbaceous vegetation that is outside the flood area, that starts within 100 feet and is within 200 feet of a river, stream/drainageway or wetland	1, 2

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<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Bank Function, and Sediment, Pollution and Nutrient Control	Water bodies	River, stream/drainageway or wetland (except Willamette River North and Central Reach)	2, 5	Willamette River North and Central Reach	
	Land	Land within 50 feet of a river, stream/drainageway or wetland except land within 50 feet of a hardened, non-vegetated river bank in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	1, 2, 7	Land within 50 feet of a hardened, non-vegetated river bank in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	7
	Vegetation	Forest, woodland or shrubland vegetation within the flood area (except within a drainage district)	3, 4	Herbaceous vegetation within the flood area (except within a drainage district)	3, 4
		Forest and natural/semi-natural woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a river	1, 6, 8	Herbaceous or cultivated woodland or shrubland vegetation outside the flood area and between 50 feet and 100 feet of a river	1, 6, 8
		Forest, woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2	Herbaceous vegetation outside the flood area and between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2
		Where the slope is at least 25%: forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area and between 100 feet and 200 feet of a river	1, 6, 8		
		Where the slope is at least 25%: forest, woodland or shrubland vegetation that is outside the flood area and between 100 feet and 200 feet of a stream/drainageway or wetland	1, 2	Where the slope is at least 25%: forest, woodland or shrubland vegetation that is outside the flood area, contiguous with primary vegetation and more than 200 feet of a river, stream/drainageway or wetland, but does not extend beyond the area with at least 25% slope.	1, 2
				Where the slope is at least 25%: herbaceous vegetation that is outside the flood area, contiguous to vegetation within 100 feet and between 100 feet and 200 feet of a river, stream/drainageway or wetland	1, 2

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<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Large Wood and Channel Dynamics	Water bodies	River (including Willamette and Columbia River beaches) or stream/drainageway	2, 5		
	Land	Land within 50 feet of a river, stream or wetland, except land within 50 feet of a river in the Willamette River North and Central Reaches and the Columbia River within the Hayden Island NRI study area	1, 4		
	Vegetation	Forest vegetation within 50 feet of a river in the Willamette River North Reach and Columbia River surrounding Hayden Island		Woodland, shrubland, herbaceous or non-vegetated land within 50 feet of the river within the Willamette River North Reach and Columbia River surrounding Hayden Island	
		Forest vegetation within the flood area (except within a drainage district)	3, 4	Woodland, shrubland or herbaceous vegetation within a flood area (except within a drainage district)	3, 4
		Forest vegetation that is outside the flood area, contiguous to and within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 3, 4	Where the slope is at least 25%: forest vegetation that is outside the flood area, contiguous with primary forest vegetation and between 150 feet and 260 feet of a river or stream/drainageway (except within a drainage district)	1, 3, 4
				Within a drainage district, forest vegetation that is contiguous to and within 150 feet of stream/drainageway	1, 4
		Forest that is contiguous to and within 150 feet of a wetland that is located completely or partially within the flood area or 150 feet of a river or stream (except within a drainage district)	1, 2, 3, 4	Where the slope is at least 25%: forest vegetation that is contiguous with primary forest vegetation and is between 150 feet and 260 feet of a wetland, where the wetland is located completely or partially in a flood area or within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 2, 3, 4
	Water bodies	Wetland located completely or partially within the flood area or within 150 feet of a river or stream/drainageway (except within a drainage district)	1, 2, 3, 4		



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<b>Riparian Function</b>	<b>Landscape Feature</b>	<b>Features Assigned a Primary Score</b>	<b>Footnotes</b>	<b>Features Assigned a Secondary Score</b>	<b>Footnotes</b>
Organic Inputs, Food Web and Nutrient Cycling	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Forest and natural/semi-natural woodland or shrubland vegetation within the flood area (except within a drainage district)	3, 4, 8	Cultivated woodland and shrubland vegetation within a flood area (except within a drainage district)	3, 6, 8
		Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area and within 100 feet of a river	1, 2, 6	Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area, contiguous to primary or secondary vegetation and within 170 feet of a river	1, 2, 6
				Cultivated woodland or shrubland vegetation that is outside the flood area and within 100 feet of a river	1, 2, 6, 8
		Forest, woodland or shrubland vegetation that is outside the flood area and within 100 feet of a stream/drainageway or wetland	1, 2	Forest, woodland or shrubland vegetation that is contiguous to primary vegetation and within 170 feet of a stream/drainageway or wetland	1, 2
Riparian Wildlife Movement Corridor	Water bodies	River, stream/drainageway or wetland	2, 5		
	Vegetation	Vegetation that is contiguous to and within 100 feet of a river, stream/drainageway or wetland	1, 2	Vegetation that is contiguous to primary vegetation and within 300 feet of a river, stream/drainageway or wetland	1, 2

**Footnotes:**

1. Rivers, streams/drainageways and wetlands are primary features for riparian functions under evaluation. The model produces functional rankings for such features if open water area has been mapped. Map notations will indicate relative riparian function levels associated with streams or drainageways where only centerline data are available.
2. All search distances are measured from either a) the edge of the mapped water body or b) the stream/drainageway centerline.
3. "Wetland" refers to all mapped regional wetlands fully or partially within 1/4 mile of a river or stream/drainageway, unless otherwise specified.
4. "Flood area" is comprised of the combined FEMA 100-year floodplain (2004/2010) and the 1996 flood inundation area as initially adjusted, and to reflect recent permitted activities affecting site elevation.
5. Portland-area drainage districts: Peninsula Drainage District #1, Peninsula Drainage District #2 and Multnomah County Drainage District #1.
6. Hardened, non-vegetated banks are defined as seawalls, pilings and non-vegetated riprap and adjacent land within 50 feet of the North or Central Reach of the Willamette River.
7. Natural/semi-natural vegetation has a composition or structure that is self-maintaining, can include native and non-native species, or is managed as a natural area or restoration/enhancement project. Cultivated vegetation is consistent with traditional landscaping and is highly manicured and regularly managed and maintained. Cultivated vegetation is often dominated by turf grasses and ornamental shrubs and trees and may be managed using a combination of mowing, pruning, fertilizers and pesticides. Residential yards, common areas, golf courses, parks and right-of-ways are typically considered cultivated.

The primary and secondary scores for each function are combined to produce aggregated relative riparian corridor rankings of high, medium or low. The formula is similar to what Metro used for the regional inventory and also reflects the distribution of primary scores assigned to features in the city (Table 2).

<b>Table 2: Riparian Corridor Aggregated Relative Ranking Formula</b>		
<b>Riparian Corridor Relative Rank</b>	<b>Ranking Formula</b>	
	<b>Primary Functions</b>	<b>Secondary Functions</b>
High	4-6	0-6
Medium	1-3	0-6
Low	0	1-6

Features that receive any score, whether primary or secondary, provide significant riparian corridor functions. Features that receive at least one secondary score and no primary scores receive a low relative rank. Features that receive one or more primary scores receive a medium or high relative rank. The number of secondary scores does not affect medium and high ranks.

Typically, the riparian corridor model assigns aggregated relative ranks to natural resource features as follows:

- **High** – Rivers, streams, drainageways and wetlands; forest or woodland vegetation within a flood area or in close proximity to a water body; and woody vegetation on steep slopes.
- **Medium** – Shrubland and herbaceous vegetation within a flood area or in close proximity to a water body.
- **Low** – Vegetation outside the flood area and further from a water body; developed flood areas; and hardened, non-vegetated banks of the Willamette River North Reach and South Reach and Columbia River surrounding Hayden Island.<sup>2</sup>

Within the city, natural resources generally reflect the impacts of urbanization; however, the resources still provide critical riparian functions. For example, vegetated areas in riparian corridors are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as more effective slope stabilization. However, non-native plants still provide important watershed functions such as water storage, nutrient cycling, erosion control and organic inputs. Other examples of the effects of urbanization include constrained or altered river and stream channels, contaminated wetlands and soil, and developed floodplains. In each of these cases, the resource has experienced some degradation but still provides important functions such as water conveyance and storage.

#### Wildlife Habitat Model

The wildlife habitat GIS model assigns scores to mapped habitat patches based on their size, shape and connectivity to other patches or water bodies as shown in Table 3 below. For purposes of the inventory model, habitat patches are defined as areas of forest vegetation and wetland that are at least 2 acres in size, plus adjacent woodland vegetation.<sup>3</sup> The model does not assign scores to habitat areas smaller than 2 acres, or to shrubland or grassland habitats or woodland that is not associated with a 2 acre forest/wetland patch. However,

<sup>2</sup> Hardened, non-vegetated river banks include seawalls, pilings and non-vegetated riprap.

<sup>3</sup> Woodland vegetation that is contiguous to a forest/wetland patch that is greater than 2 acres in size is evaluated for wildlife habitat. Woodland vegetation independent of a forest/wetland patch is not evaluated by the wildlife habitat model.

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these habitats may be designated Special Habitat Areas if the habitats meet specific criteria (described in Step 3 below). Additional detail regarding the wildlife habitat methodology can be found in Appendix C: *City of Portland Natural Resource Inventory Update: Project Report*.

<b>Table 3: Wildlife Habitat GIS Model Criteria</b>		
<b>High Value (3 points)</b>	<b>Medium Value (2 points)</b>	<b>Low Value (1 point)</b>
<b>Habitat Patch Size<sup>1</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is 585 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 30 acres and smaller than 585 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres and smaller than 30 acres.
<b>Interior Habitat Area<sup>2</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is 500 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 15 acres and smaller than 500 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 2 acres and smaller than 15 acres.
<b>Proximity to Other Patches<sup>3</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is 100 or more.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is at least 30 and less than 100.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres and the patch proximity index value is less than 30.
<b>Proximity to Water<sup>4</sup></b>		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 25% and less than 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and less than 25% of the patch area is within 300 feet of a river, stream/drainageway or wetland.

## Footnotes:

1. A "habitat patch" is defined as an area of contiguous forest and/or wetland greater than 2 acres in size, plus any woodland vegetation adjacent and contiguous to the core forest/wetland area.
2. "Interior area" is defined as the area within the forest and/or wetland portion of a habitat patch that is situated at least 200 feet from the edge of that portion of the patch.
3. Proximity to water relative value thresholds were determined by identifying "natural breaks" in the distribution of the values using the Jenk's Natural Breaks method, which determines the best arrangement of values into a specified number of classes by comparing and minimizing the sum of the squared differences of values from the means of potential classes.
4. Proximity to other patches is calculated using the Fragstats 3.3 proximity index (PROX). The specified search radius is ¼ mile. The proximity index is a dimensionless measure of the relative size and distance of all patches whose edges are within the specified search radius of each vegetation patch. For more information on Fragstats and the proximity index, refer to <http://www.umass.edu/landeco/research/fragstats/fragstats.html>.



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Features that receive scores for one or more attributes provide significant wildlife habitat functions. Individual scores for each attribute are combined to produce an aggregated relative ranking of high, medium or low for each wildlife habitat patch. As with the riparian corridor model, the formula used to generate the aggregated wildlife habitat rank is similar to those Metro used for the regional inventory (see Table 4).

<b>Table 4: Wildlife Habitat Aggregated Relative Ranking Formula</b>	
<b>Wildlife Habitat Relative Rank</b>	<b>Ranking Formula</b>
High	9 or more points
Medium	4-8 points
Low	1-3 points

Natural resource features that receive points for one or more of these attributes provide important wildlife habitat functions. Typically, the wildlife habitat model assigns aggregated relative ranks to natural resource features as follows:

- **High** – Large forest and wetland areas, such as Forest Park, Smith and Bybee Wetlands, and Tryon Creek State Natural Area.
- **Medium** – Moderate-sized forest and wetland areas, such as those at Kelley Point Park, Oaks Bottom Wildlife Refuge and Powell Butte.
- **Low** – Numerous smaller forest and wetland areas throughout the city.

Within the city, natural resources generally reflect the impacts of urbanization; however, the resources still provide critical wildlife habitat functions. For example, vegetated areas in upland habitats are often comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as varied wildlife food sources. However, non-native plants still provide important watershed functions such as cover and nesting opportunities for wildlife. Other examples of the effects of urbanization include rivers and streams with constrained or altered channels, wetlands with soil contamination and developed floodplains. In each of these cases, the resource has experienced some degradation but still provides important functions, such as fish and wildlife habitat.

### 3. Designated Special Habitat Areas and Updated Regional Species Lists.

As part of the regional Title 13 inventory, Metro designated Habitats of Concern for areas with documented sensitive/threatened fish or wildlife species, sensitive/unique plant populations, wetlands, native oak, bottomland hardwood forests, riverine islands, river deltas, migratory stopover habitat, connectivity corridors, upland meadow and other unique natural or built structures or resources (such as bridges that provide habitat for Peregrine Falcons).

Portland began with Metro's Title 13 inventory of designated Habitats of Concern, which are referred to in the city as Special Habitat Areas (SHA), and expanded the documentation, refined the mapping, and honed the eligibility criteria explanations. The City has also added and removed SHA designations for certain areas based on additional analysis.

Like the Title 13 Habitats of Concern, SHAs are mapped more generally than the landscape feature data used in the riparian and wildlife GIS models. The SHA boundaries may extend beyond the specific landscape features to

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capture seasonal variations in conditions (e.g., water levels) or a feature containing one or more habitat points, such as nesting areas on a bridge. Boundaries are determined on a case-by-case basis rather than through the use of model criteria. The rationale for the boundary is described in the natural resource descriptions for each inventory site.

The City has updated the SHA criteria to include National Oceanic and Atmospheric Administration (NOAA) designated Critical Habitat for anadromous salmonids. Within this inventory study area the Willamette River is designated as Critical Habitat for multiple fish species. The City has also designated certain urban structures as SHAs, including chimney roosting sites for Vaux's Swifts and several bridges on the Willamette and Columbia rivers that provide nesting sites for Peregrine Falcons. A full list of SHA criteria is available in Appendix D.

Like Metro Title 13 Habitats of Concern, SHAs receive a high relative rank for wildlife habitat, which supersedes medium or low ranks assigned by the Wildlife Habitat Model.

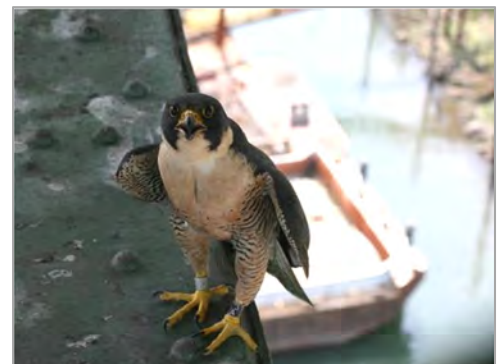
The citywide inventory also includes up-to-date plant and wildlife species lists. The list does not include all the plant and wildlife species found in the city, focusing instead on "special status" species. Special status species include fish, wildlife and plant species that are officially listed under the Endangered Species Act by the NOAA Fisheries or the U.S. Fish and Wildlife Service, and species receiving specific designations from:

- Oregon Natural Heritage Information Center ranked or listed species
- Oregon Watershed Enhancement Board priority species
- Partners In Flight focal species
- National Audubon Society and American Bird Conservancy Watch List species
- Northwest Power and Conservation Council Willamette and Columbia Sub-basin Plans focal species

Special status species are identified by these entities for a variety of reasons. For example, the species may be:

- Experiencing local, regional, state or national population declines.
- Endemic to Oregon.
- Vulnerable to local extirpation.
- A focal or indicator species (a species that encompasses structural and functional needs of broader ecological communities).
- A keystone species (a species that physically alters environments and whose absence is detrimental to ecosystem function).

The City uses this information to track species trends at different scales and to provide context for evaluating management options and prioritizing local habitat protection and enhancement efforts. Information about special status species is included in the natural resource descriptions for each inventory site.



*Photo by Bob Sallinger*

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The City also maintains a list of at-risk wildlife species. The at-risk species list is a subset of the full special status species list, and includes only those species that are:

1. Listed by USFWS or NOAA Fisheries as:
  - a. LE: Listed Endangered
  - b. LT: Listed Threatened
  - c. PE: Proposed Endangered
  - d. PT: Proposed Threatened
  - e. SoC: Species of Concern
2. C: Candidate Listed by ODFW as:
  - a. LE: Listed Endangered
  - b. LT: Listed Threatened
  - c. SC: Critical
  - d. SV: Vulnerable
3. Received an Oregon Biodiversity Information Center rank or list 1, 2 or 3:

These at-risk species are the most vulnerable of the special status species. The at-risk species list, not the full sensitive species list, is used to designate SHA based on the (S) criteria. The full special status species list and the list of at-risk species are included in Appendix E.

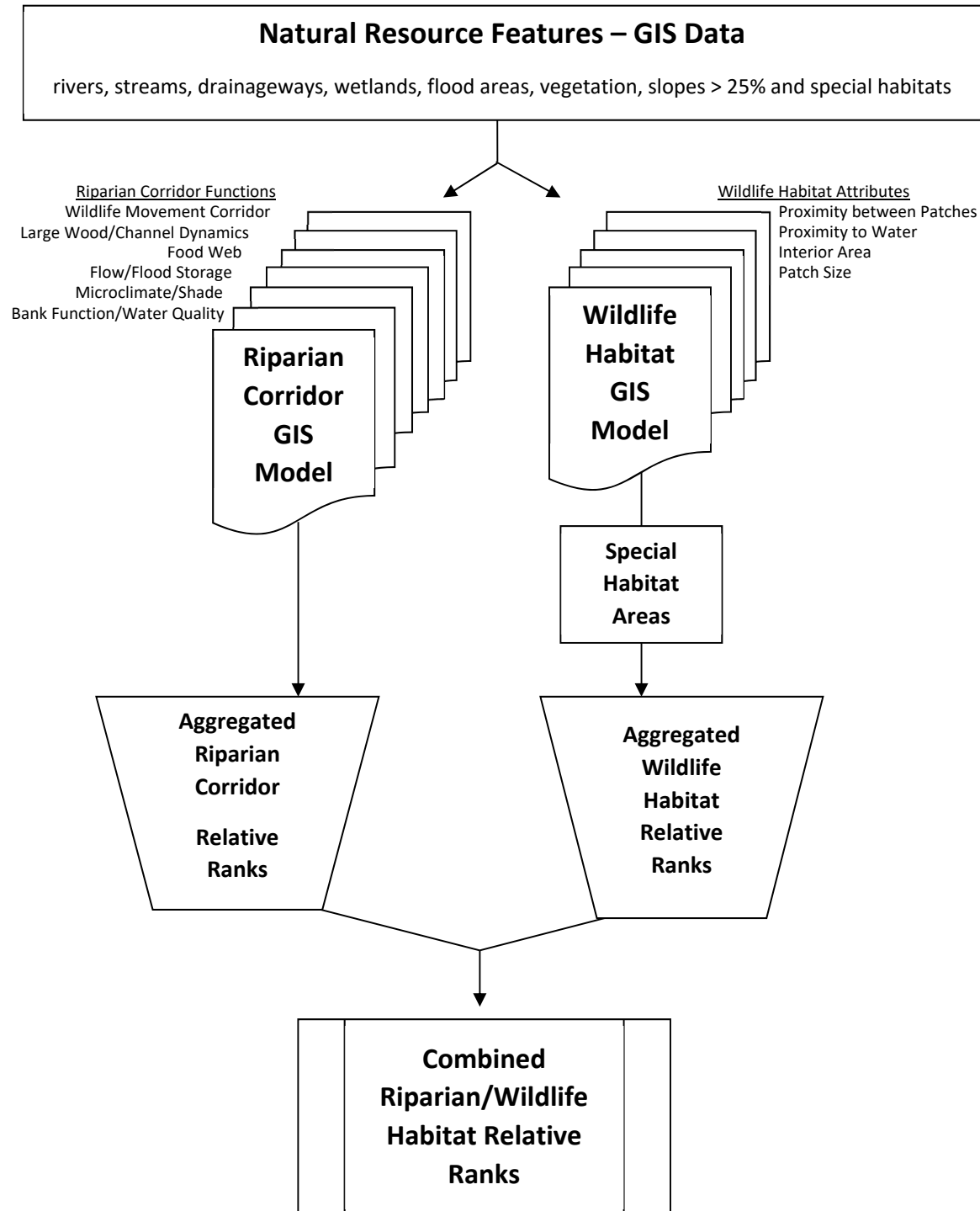
#### 4. Produced Combined Relative Ranks and Maps.

Once the GIS models produce the aggregated riparian corridor and wildlife habitat ranks and Special Habitat Areas are designated, a single combined relative rank for riparian corridor/wildlife habitat areas is produced. Where ranked riparian corridors and wildlife habitat areas overlap, and if the two aggregated relative ranks differ, the higher of the two ranks becomes the overall combined rank for that resource area. For example, a feature that ranks medium for riparian corridor functions and low for wildlife attributes, would receive a medium combined relative rank.

As noted in previous sections, it is important to keep in mind that natural resource features can rank high based on the specific inventory criteria and also be impacted by land management activities, invasive plants or animals or contamination as discussed in the natural resource description for each inventory site.

The City can produce different inventory maps displaying the GIS model results for individual riparian and wildlife habitat functions and attributes, the Special Habitat Areas, the aggregated riparian corridor and wildlife habitat relative ranks, and the combined riparian corridor/wildlife habitat relative ranks. Maps of the aggregated riparian corridor and wildlife habitat ranks and combined riparian/wildlife habitat relative ranks are presented in this report for each inventory site.

**Figure 1: Natural Resources Inventory GIS Model Flow Diagram**



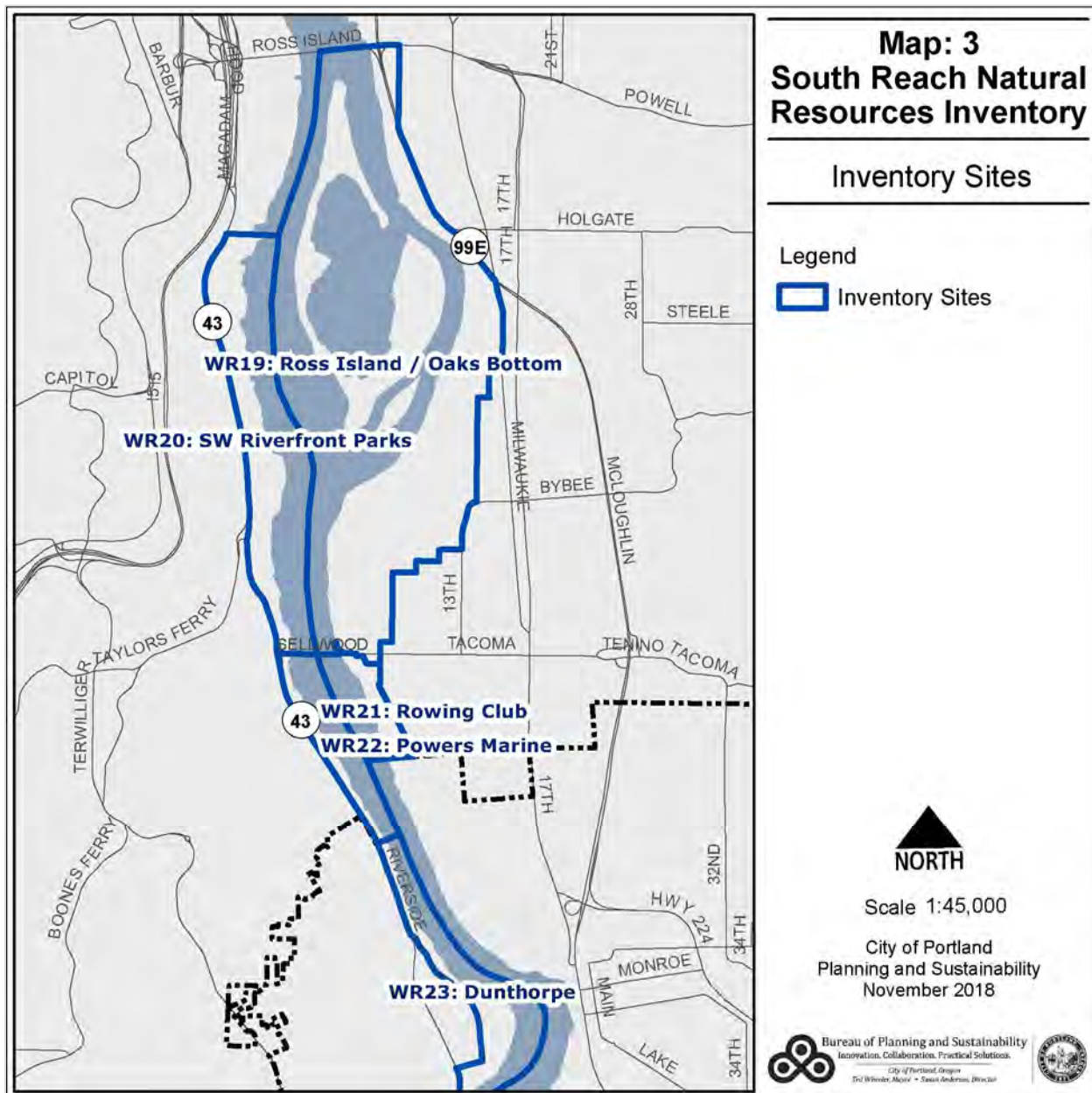


## WORK CONDUCTED FOR THE SOUTH REACH NATURAL RESOURCES INVENTORY

The SRNRI presented in this report reflects the citywide inventory work discussed in the previous section and additional work conducted specifically for the inventory study area, as described below.

### Delineation of Inventory Sites

The City has delineated five inventory sites for the SRNRI (see Map 3). Consistent with more recent City inventories, the inventory sites are contiguous and include not only natural resource features but their surrounding land uses as well.



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Specifically, the inventory site boundaries are intended to:

- Capture similar and contiguous landscape features (natural and human-made) in the same inventory site.
- Abut one another (no gaps between inventory sites).
- Address areas included in Metro’s inventory of regionally significant riparian corridors and wildlife habitat.

In the South Reach, the inventory site boundaries also:

- Contain the City’s Willamette Greenway Overlay Zones;
- Follow major infrastructure like highways and rail roads;
- Do not bisect properties under the same ownership; and
- Use the river thalweg to divide east and west sites.

The term “inventory site” or “site” is used, rather than “resource site” or “habitat site” which has been used in previous City inventories. The terms have been updated for clarity given that the current inventory sites contain and address natural resource areas and surrounding land uses, including developed areas.

### **Incorporating Information from the Draft Lower Willamette Inventory: Natural Resources (Adolfson Associates, Inc. 2000, Updated by City Staff, 2003)**

The City contracted with Adolfson Associates, Inc. to produce habitat inventory information for the Willamette Corridor. An initial draft *Willamette River Inventory: Natural Resources* report was produced in 2000. The report identified 24 habitat sites throughout the study area – 15 terrestrial and nine aquatic (Willamette River) sites. Site boundaries were generally concurrent with the natural resources themselves and did not encompass surrounding developed areas.

The study involved extensive field visits conducted on land and by boat on the Willamette River itself. Wildlife habitat assessments (WHAs) were performed for each site. These assessments involved evaluating the presence and availability of water, food and cover for wildlife. Observations regarding water quality, riparian vegetation, wildlife use and habitat connectivity were recorded, as well as disturbance impacts and connection with other natural areas. Unique or rare occurrences of plant and animals were also noted. A Riverine Habitat Assessment methodology, adapted from the WHA protocol, was developed to assess the riverine habitat of the Willamette River. Habitat sites received a numeric score, which provided a relative rank compared to other sites within the Willamette River Inventory study area. The *Lower Willamette Inventory: Natural Resources* report contained habitat descriptions, including observational data collected using the WHA, and the numeric score for each site.

In 2003, the City updated the draft *Lower Willamette Inventory: Natural Resources* report to reflect input from City bureaus and key stakeholders, including information about recent development that altered the presence and condition of natural resources. Site boundaries were modified slightly, but the habitat descriptions and WHA scores were not updated.

The data and information from the updated *Lower Willamette Inventory: Natural Resources* (2003) were never formally adopted but are still relevant and have been incorporated into the inventory site descriptions presented in this report. The numeric scores were not used to develop the relative rankings because they do not

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address the full array of riparian functions evaluated in this inventory and they were not developed for all identified resources in the inventory.

## **TECHNICAL AND PUBLIC REVIEW SUMMARY**

**Note – A summary of the technical and public review process and comments will be included in a later draft of the report.**

## CHAPTER 3. SOUTH REACH NATURAL RESOURCES INVENTORY

### INTRODUCTION

Chapter 3 begins with a general description of the Willamette River Basin, then focuses in on the Lower Willamette River that flows through Portland and further into the South Reach inventory area. Following these descriptions are chapter sections for each of the inventory sites in the South Reach. The inventory site sections include detailed descriptions of the natural resource features and functions within the sites.

### SECTION 3.A: THE WILLAMETTE RIVER BASIN

Regionally situated in the Lower Columbia River Basin, the Willamette River Basin is an 11,500 square mile watershed located between the Cascade Mountains to the east and the Coast Range to the west. The 187-mile long Willamette River flows north through 128 jurisdictions including Eugene, Corvallis, Salem and Portland, as well as eight counties: Lane, Linn, Benton, Marion, Polk, Yamhill, Clackamas and Multnomah. Nearly 70 percent of Oregon's population lives in the Willamette River Basin. The basin contains a broad range of land uses including forestry, agriculture and urban uses.

The basin occupies roughly 12 percent of Oregon's land area and plays an important role in the ecology of the region. The basin extends from mountains, approximately 10,000 feet in elevation, to the Columbia River, which is just 10 feet above sea level. The Willamette Basin's 12 tributary sub-basins are diverse in terms of elevation, hydrology and landscape character. The Willamette Basin helps to disperse aquatic and avian species among rivers and streams, upland forests, valleys, floodplains and to and from the Columbia River and the Pacific Ocean. It is part of the Pacific Flyway for migratory birds, and is a key component of the extensive network of spawning streams for anadromous salmon and steelhead.

The Lower Willamette River is a tidal freshwater system with water levels that are influenced by a complex and dynamic set of factors, most notably discharge, Pacific Ocean tides and Columbia River flow conditions. Willamette River flows are governed by seasonally variable rainfall patterns, snowmelt in the Willamette Valley's Coast and Cascade mountain ranges and the operation of dams on many of the major tributaries. Diurnal tidal fluctuations in the lower Willamette are typically on the order of 2 feet per day, but can range from 0 to 8 feet depending on the influence of flow conditions in the Willamette and Columbia Rivers. The Pacific Ocean's tidal prism runs up the Columbia River estuary and into the Willamette River, where it exerts force against

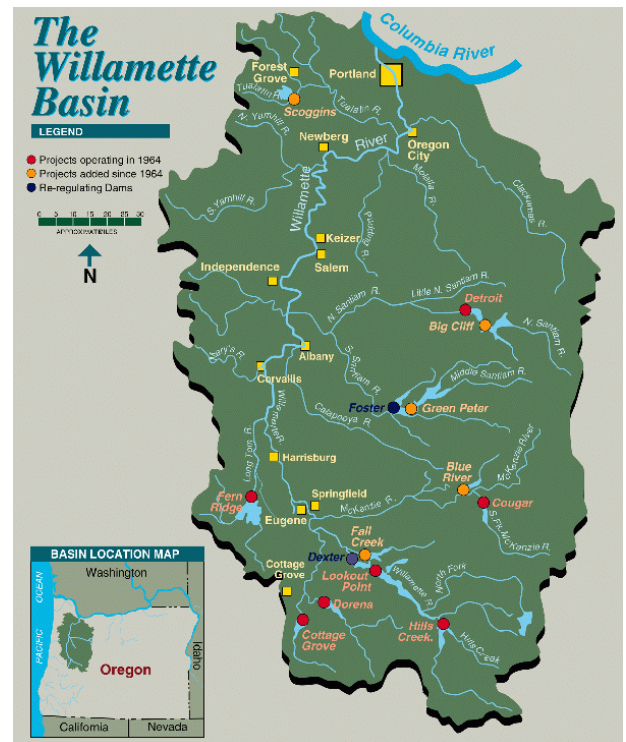


Figure 2. The Willamette River basin



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downstream flows and influences water surface elevation up to Willamette Falls near Oregon City at river mile (RM) 27.

The flows in the Willamette River are highest between December and February, with a 40-year monthly average between 50,000 and 70,000 cubic feet per second (cfs). The maximum flow over the period of record is 420,000 cfs and it occurred on February 9, 1996, during what was nearly a 100-year flood event. Columbia River water levels rise in mid-spring due to spring freshets that occur in the Columbia system east of the Cascades. This results in a higher river stage in the Willamette. Under certain conditions, Willamette river flows reverse as rising tides back water up into the Lower Willamette.

It is important to note that flow patterns in both the Willamette and Columbia basins have been dramatically altered over time, largely due to dam and reservoir operations. Following floods in 1943 and 1945, the U.S. Army Corps of Engineers constructed 13 reservoirs, 11 of which have flood control functions. Operation of the reservoirs reduces winter peak flows in the Willamette River by as much as 30 to 50 percent and augments summer flows to approximately double historical low-flow levels. The reservoirs also provide water for irrigation, navigation, recreation, power generation, public water supply, pollution abatement and anadromous fish propagation. These are important social, economic, and environmental benefits; however, the disruption of the river's flow regime has reduced the periodic flooding that sustains the functions of side channels, sloughs, flood plain areas, wetlands and riparian vegetation. Seasonal flooding and fluctuating currents are known to play an important role in shaping the aquatic environment by distributing nutrients and sediment to maintain gravel bars, deep channel pools, in-channel wood and other characteristics that create diverse aquatic habitats.

The Willamette River provides important habitat for fish and other aquatic and terrestrial species. Beach, near-shore shallow water areas, undercut banks, and large woody debris provide refugia habitat for salmonids that are listed as threatened species under the Endangered Species Act, as well as feeding areas for shorebirds and other wildlife (ODFW, 2005).

The Willamette River supports a diverse assemblage of fish. Farr and Ward (1993) identified 39 different fish species occurring within the study area. Species include resident fish, seasonal migrants, and opportunistic migrants representing 17 different families. Resident fish include both warm water and cold water species. Seasonal migrants include salmon, steelhead, sturgeon and shad. Opportunistic migrants include white sturgeon and starry flounder. Fish assemblages within the Lower Willamette River are in a state of flux and have been for most of this century. Factors contributing to this constant state of change include the introduction of, and colonization by, hatchery fish; altered flow regimes from hydroelectric dam operations; removal of riparian bottomland forests; filling and diking within the flood plain; non-indigenous species; water quality degradation; urban development; and a wide range of fisheries management practices. Numerous non-indigenous species were introduced into the river system in the period between 1890



*Photo of Oaks Bottom Wildlife Refuge and Willamette River*

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and 1910. Soon after, overall fish abundance and diversity decreased to historically low levels during the 1940s due to high pollution levels (Farr and Ward, 1993). Many of the introduced species tolerate warmer, more polluted water, and have thrived better in the mainstem and large tributaries — sometimes to the detriment of salmonids.

The lower Willamette River is designated critical habitat for several evolutionarily significant units (ESU) of anadromous salmonids listed as threatened under the federal Endangered Species Act (ESA). These include: lower Columbia River coho salmon, upper Willamette River Chinook salmon and steelhead trout, and lower Columbia River Chinook salmon and steelhead trout. In addition, the lower Willamette River is key migratory habitat for Pacific lamprey, a federal species of concern (Chilcote, 1999). Critical habitat designated for most Columbia River ESUs includes the lower Willamette River up to Willamette Falls because it serves the Columbia River as a tributary stream and provides rearing and refuge habitat to its migrating salmon and trout populations (NOAA, 2013).

Studies have evaluated salmonid and salmonid predator use of the Willamette River in Portland. Ward *et al.* (1994) found that juvenile salmonids use near-shore habitats in Portland. In particular, most salmonids were caught in waters 18 feet or less in depth. Significant growth has been observed in juvenile salmon and trout during rearing and migratory life stages (Friesen *et al.* 2005).

Friesen *et al.* (2004) conducted comprehensive fish sampling within Willamette River in Portland and found that natural substrate beaches appeared to be an important habitat for younger salmonids, particularly Chinook salmon. Beaches were also preferred by radio-tagged coho salmon. Friesen *et al.* (2004) also found that densities of large predators were consistently highest at sampling sites dominated by rocky habitats (both natural and riprap) and pilings and that radio-tagged predators are prevalent at sites with riprap in summer and autumn. Radio-tagged coho salmon, and to a lesser extent Chinook salmon, are less prevalent at sites with riprap.

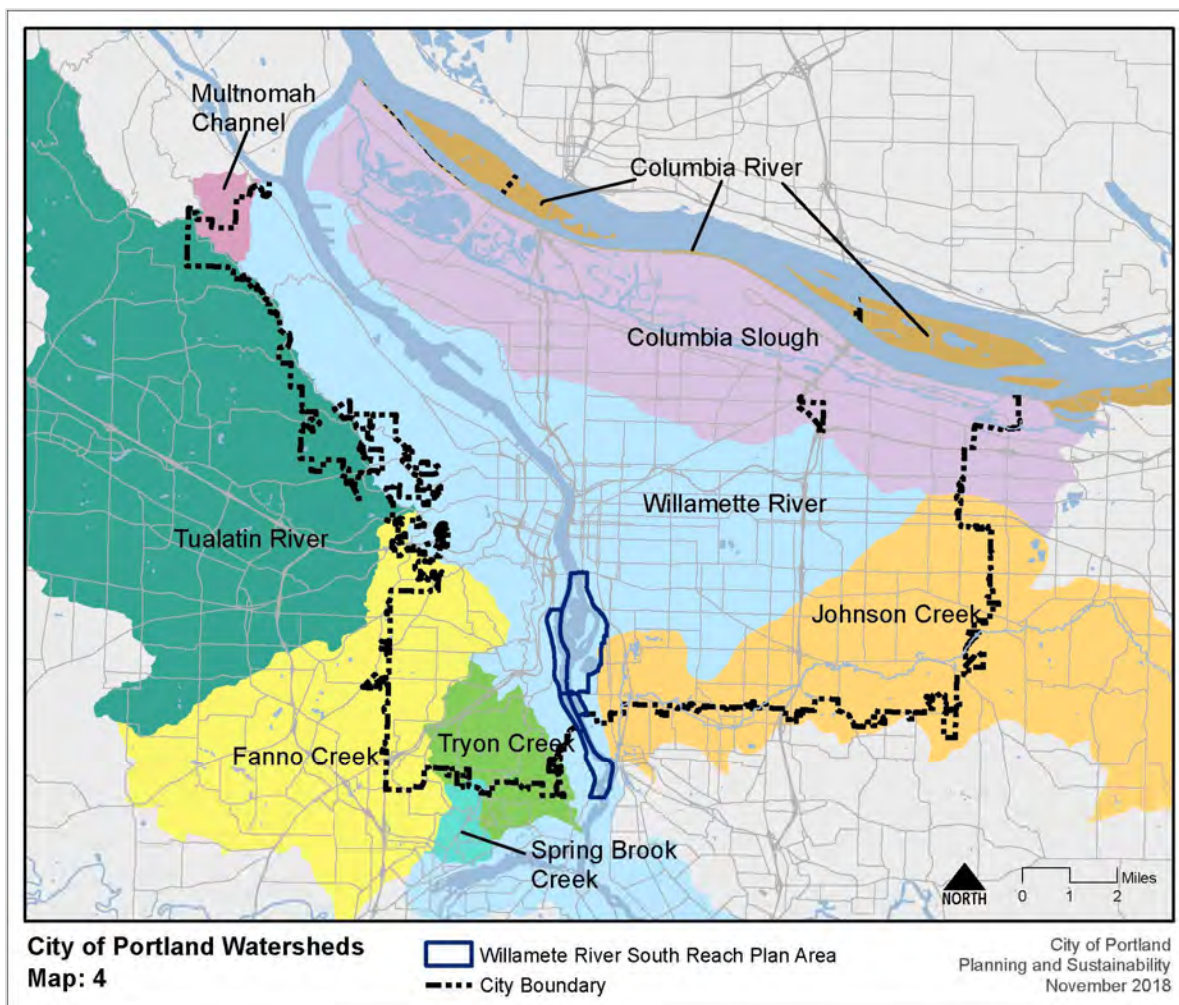
The Willamette River is also part of the Pacific Flyway. Nearshore mudflats, shoals and beaches provide habitat for migratory shorebirds: least sandpipers, solitary sandpipers and semi-palmated plovers.

**SECTION 3.B: THE LOWER WILLAMETTE RIVER**

The 27 miles of river between Willamette Falls and the Columbia River are often referred to as the Lower Willamette River. The Lower Willamette River is a tidal freshwater system and its flow and water levels are influenced by a complex and dynamic set of factors, including tides, seasonally-variable rainfall patterns, snowmelt in the Willamette Valley's Coast and Cascade mountain ranges and by the operation of a number of dams on many major tributaries of the Willamette upstream of Portland. Tidal flows are transmitted from the Pacific Ocean and Columbia River estuary to the Willamette River by way of the Columbia River, and the tidal influence extends up to Willamette Falls near Oregon City at RM 27. The diurnal tidal fluctuations in the lower Willamette are typically on the order of two feet per day, but can range from 0 to eight feet depending on the influence of flow conditions in both the Willamette and Columbia rivers. These fluctuations contribute to unique habitats that support a broad array of native flora and fauna, as well as migratory species. The Willamette River channel within Portland is generally wide, although in the southern portions of the city and in Multnomah County the river is constrained by historic basalt flows.

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This portion of the Willamette basin connects directly with the regional ecosystem that includes Sauvie Island, Ridgefield and Shillapoo Wildlife Areas, Vancouver Lake, Tualatin Mountains, Burlington and Oaks Bottom, the Smith and Bybee Wetlands, Sandy River and estuarine islands in the Columbia River, as well as the Columbia River Estuary. The Lower Willamette River corridor provides connectivity for north/south and east/west wildlife movement. For example, the river connects to Forest Park and further west to the Tualatin Mountains and Coast Range. These large, forested areas provide a major wildlife migration corridor for deer and elk and are a source of species recruitment. The Lower Willamette River corridor provides important wintering habitat for waterfowl and raptors, migration stopover sites and breeding habitat for Neotropical migratory songbirds. To the east, the Willamette River corridor connects to the East Buttes in the Johnson Creek watershed and the Sandy River delta via the Columbia Slough and the Columbia Gorge. In the northern portion of the Lower Willamette, a seven-mile escarpment runs along the east side of the river within the city. Similar escarpment features continue on the east side of the river at Oaks Bottom and southward toward the City of Milwaukie, and on the west side of the river south of Ross Island and extending into the City of Lake Oswego. These escarpments support remnants of rare and declining stands of Oregon white oak and Pacific madrone trees, as well as other native and non-native vegetation, which are important wildlife habitat corridors. Local neighborhoods contain tree canopy and vegetation that help manage stormwater by intercepting rain and filtering pollutants from overland flow. Neighborhood vegetation can also provide important wildlife habitat areas and corridors. Map 4 shows Portland's watersheds and the boundary of the Willamette River Inventory Sites.





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The Lower Willamette River does not meet water quality standards for bacteria, mercury, dioxin, temperature and various other toxics and heavy metals (see Table 5). Total maximum daily loads (TMDLs) for bacteria and temperature as well as a phased TMDL for mercury were established in 2006. Oregon Water Quality Index values from 2001 to 2015 for the Lower Willamette River in Portland have been fair and the trend is steady. High in-stream temperatures in the Lower Willamette River during the summer months are a concern for migrating anadromous salmonids. Tributary streams can have mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many tributaries to the river do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

<b>Table 5: Water Quality (303(d)) Listings in the Lower Willamette River and Tributaries</b>			
<b>Pollutant</b>	<b>Season</b>	<b>Year River was Listed for this Pollutant</b>	<b>Risk Factors</b>
<b>Pesticides and Toxics</b> (DDT/DDE, Dieldrin, Aldrin, Pentachlorophenol, PCB, PAH, Total Chlordane, Cyanide, Hexachlorobenzene)	Year-round	1998, 2002, 2012	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
<b>Heavy Metals</b> (iron, manganese, mercury)	Year-round	1998, 2002	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
<b>Nutrients</b> (Chlorophyll a) <sup>1</sup>	Summer	2012	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
<b>Bacteria</b> (Fecal Coliform)	Fall/Winter/Spring	1998	Water contact recreation
<b>Temperature</b>	Summer	1998	Salmonid fish rearing, anadromous fish passage
<b>Biological Criteria</b>	N/A	1998	Resident fish and aquatic life

(ODEQ, 2015)

The entire Portland Willamette River inventory study area (North, Central and South reaches combined) includes 19 miles of the Lower Willamette River from Elk Rock Island northward through Portland to its confluence with the Columbia River. Of this, 17 miles are within city limits. Many smaller tributary streams originate in Forest Park and the West Hills and are piped through the study area.

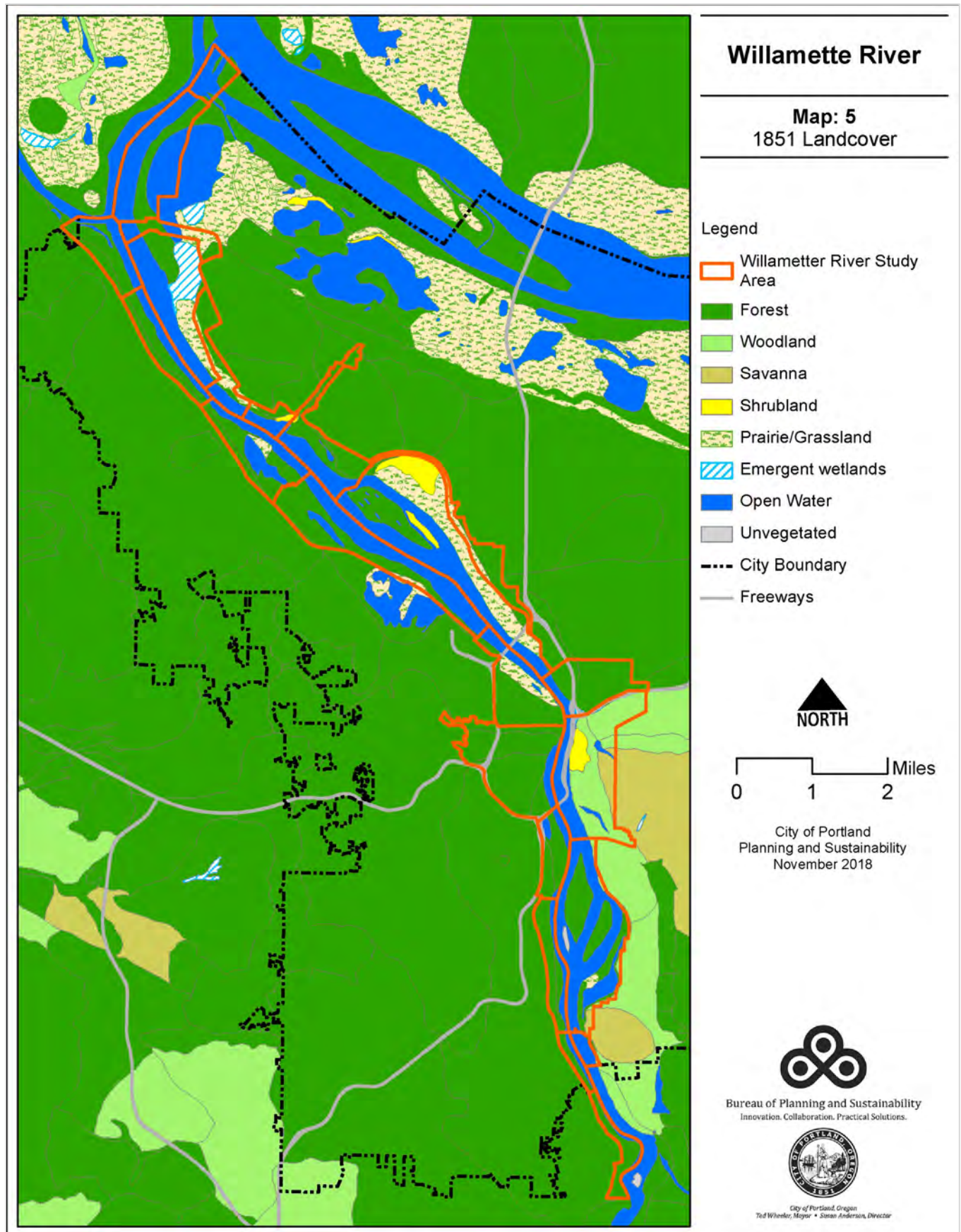
Historically, the Willamette River in the Portland area was comprised of an extensive interconnected system of active channels, open slack waters, emergent wetlands, riparian forests, mid-channel islands and adjacent upland forests. The historic floodplain and lowlands were located between the lower Tualatin Mountains/Southwest Hills on the west and the remnant oak bluffs above the Swan Island corridor on the east.

Prior to European settlement of the Willamette Valley, the river was used by Native Americans for travel, trade, hunting, fishing and gathering of plant materials. Permanent and seasonal villages existed on both sides of the river to facilitate these uses and many of these traditional uses are carried on today by local Native Americans.

As shown in Map 5, historically, the vegetation in bottomland and wetland forests was dominated by black cottonwood, Oregon ash and willow, and associated native understory assemblages of shrubs, grasses and herbs. Denser, mixed-conifer forests of Douglas fir, big leaf maple, western red cedar, western hemlock, grand



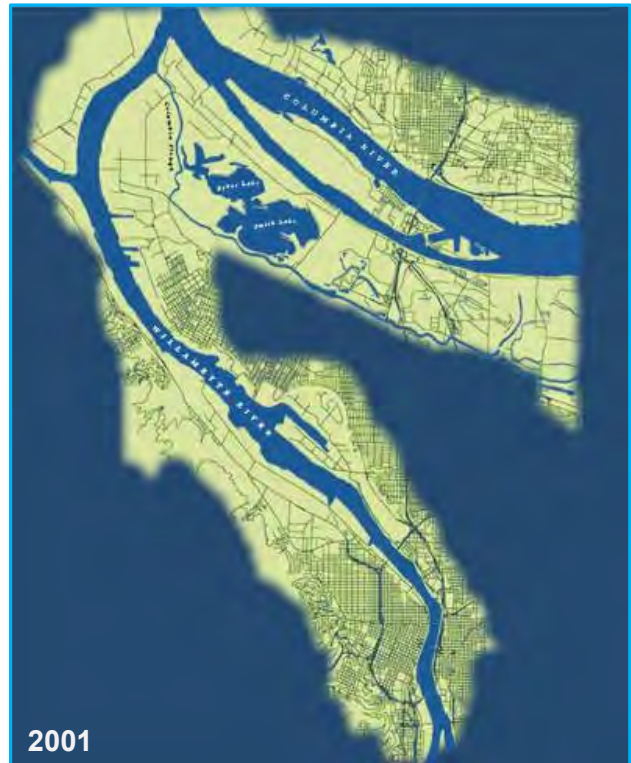
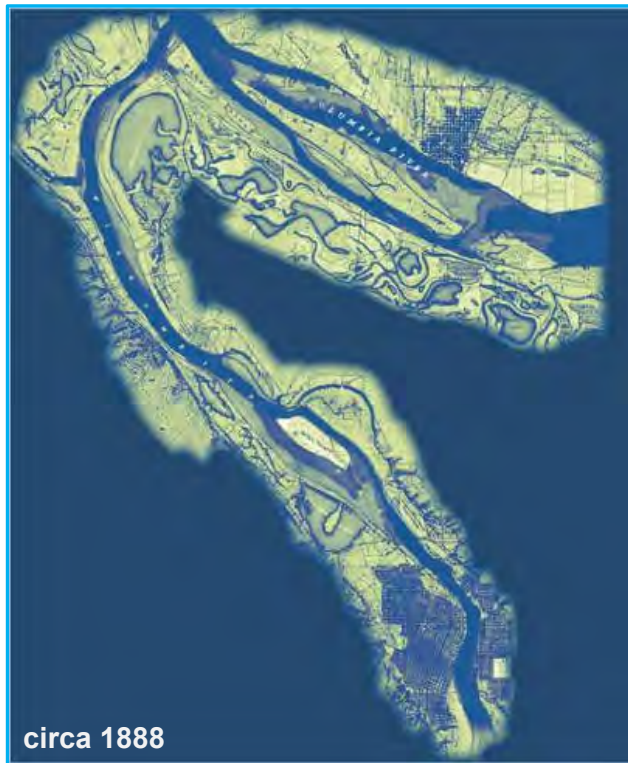
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fir and red alder dominated the west hills and some parts of the east terrace. Foothill savannas of Oregon white oak, Pacific madrone, red alder and big leaf maple were found on the eastern side of the river.

Over the last 150 years, many floodplain areas, bottomland forests and wetlands were filled or drained, and developed. Few large, connected and intact habitats remain in the floodplain in Portland, as multiple jurisdictions and private landowners manage it to meet various objectives. Below are images from the Willamette River Atlas (City of Portland, 2001) that depict the historic (circa 1888) and more recent conditions of the Willamette River.



Today, the Willamette River in Portland provides for many uses, including shipping; industrial and commercial enterprises; residential uses; subsistence, commercial, and recreational fishing; other types of recreation; and fish and wildlife habitat. The Lower Willamette River channel has been substantially altered in Portland. The river bottom is occasionally dredged to improve navigation and allow large barges and ships to access Portland terminals. The Willamette River federal navigation channel extends from the mouth of the Willamette River upstream 11.5 miles to the Broadway Bridge in Portland. The width of the channel varies between 600 and 1,900 feet and the maintained depth is approximately 40 feet. The authorized channel depth is 43 feet. The Portland District U.S. Army Corps of Engineers maintains this federal navigation channel. New construction projects have been suspended until after resolution of cleanup issues associated with Portland Harbor Superfund site.

Eleven bridges cross the Willamette River in Portland. The Sellwood, Marquam, Ross Island, Hawthorne, Morrison, Steel, Broadway, Fremont and St. Johns bridges are designed to accommodate automobile and truck traffic. Just south of the St. Johns Bridge, a railroad bridge crosses the Willamette River. Several of the bridges



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provide habitat for wildlife. For example, the St. Johns, Railroad, Fremont and Marquam bridges provide nesting sites for Peregrine falcons.

Substantial stretches of the river's banks have been hardened with riprap, seawalls and docks. Pilings, piers and other human-made structures extend out from the bank into the channel. Numerous structures related to marine cargo facilities are located along the river within the city. Shipping activities are common in the North Reach and a portion of the Central Reach of the Willamette River, with large vessels docking at berths between the Broadway Bridge at RM 11.5 and the mouth where it converges with the Columbia River.

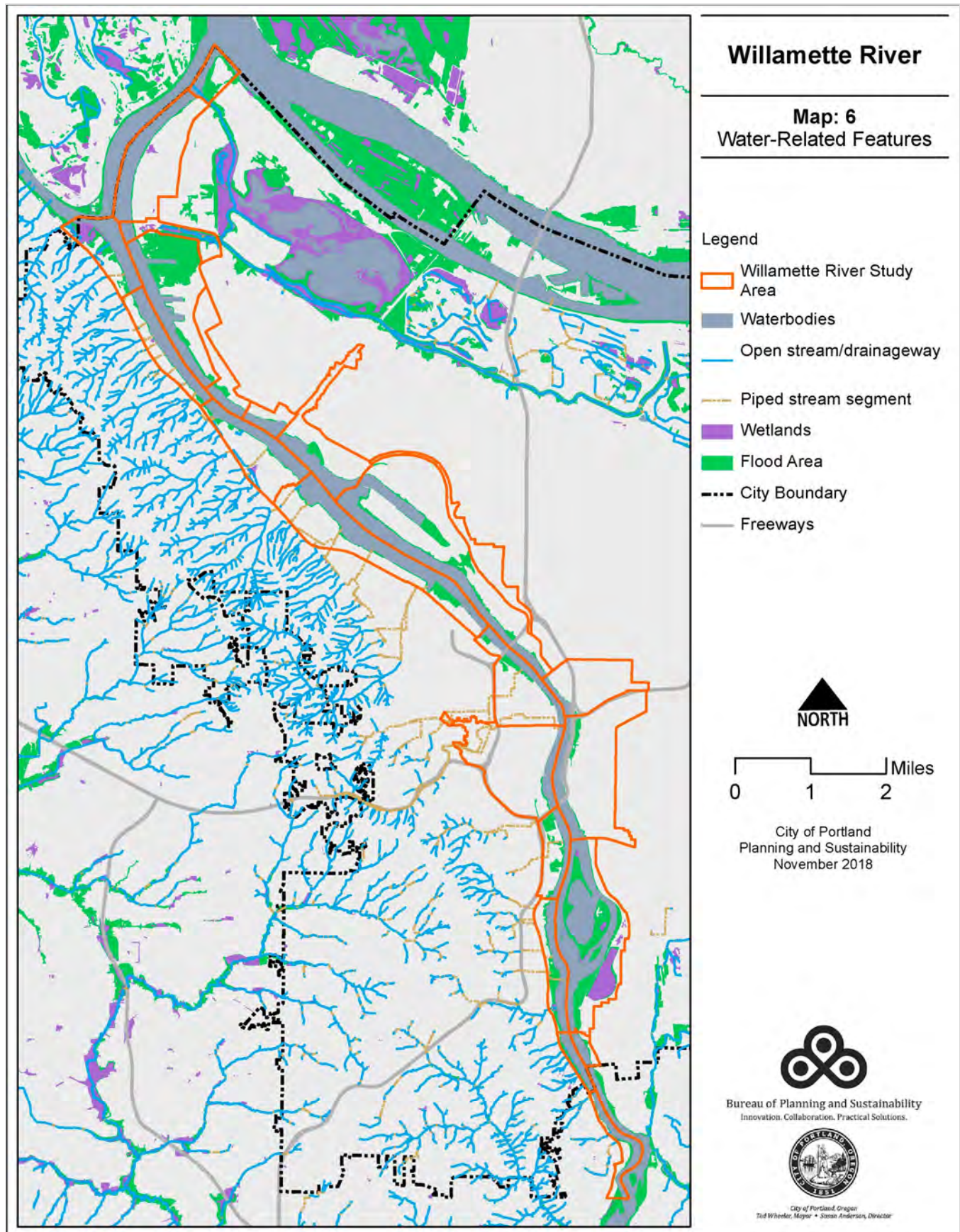
Maps 6 and 7 show the current water-related features and vegetation of the Lower Willamette River in Portland.



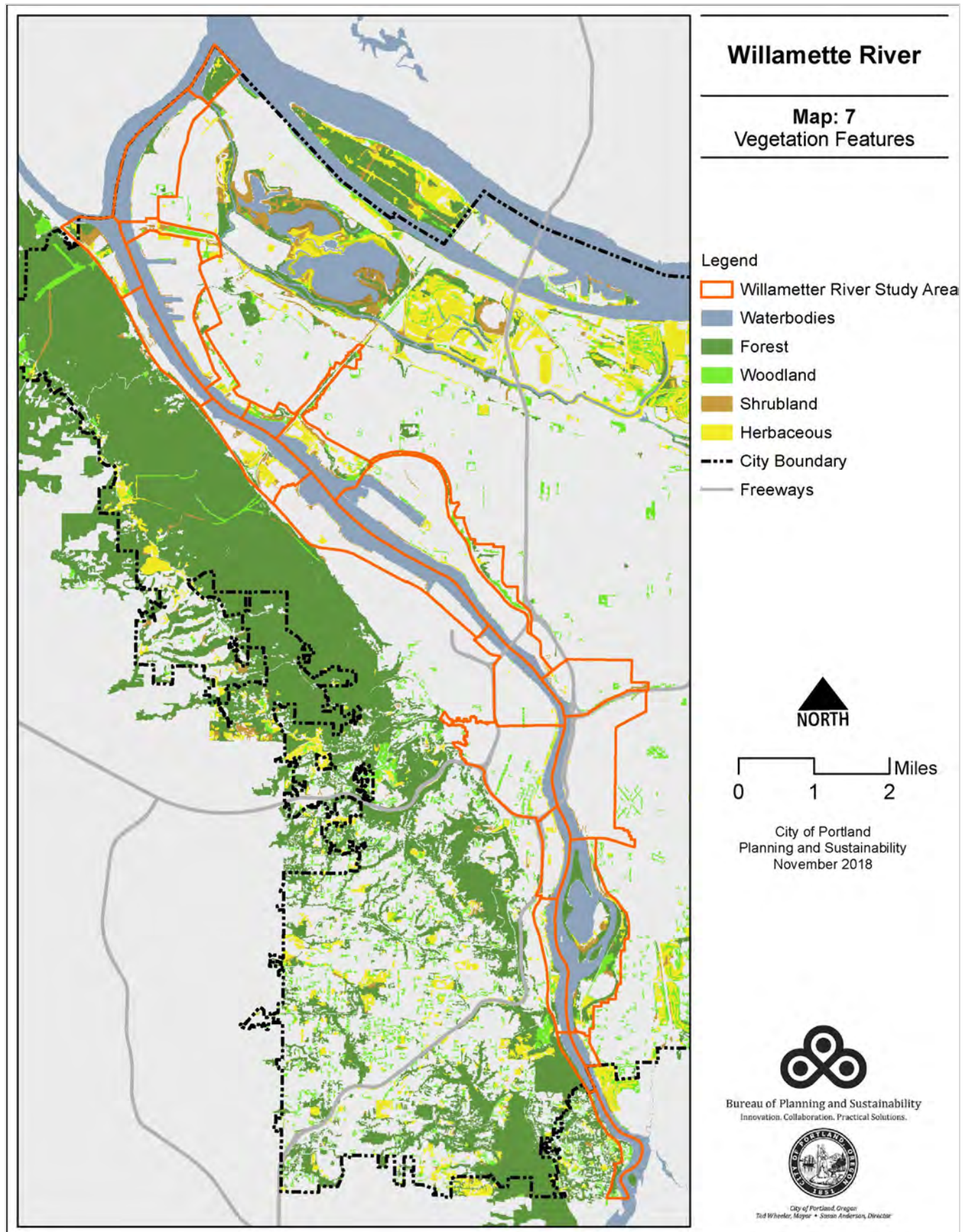
*Photo of a barge parked in the Ross Island lagoon.*

The City of Portland's combined sewer overflow reduction program and Clean Water Act program implemented by the Oregon Department of Environmental Quality have been credited with most of the water quality improvements in the Lower Willamette River. Further cleanup mandated through the EPA Superfund process is expected to improve conditions in the lower river in the near future.

Despite changes to the Lower Willamette River's physical, chemical and biological habitats, remaining processes continue to shape and maintain a host of beneficial watershed functions. Within Portland, significant riparian and wildlife habitat resources still exist at Kelley Point Park, Harborton Wetlands, South Rivergate Corridor, Ross Island, the Oaks Bottom Wildlife Refuge, numerous smaller tributaries, wetlands, active flood plain and other vegetated areas along the Willamette corridor, and the Willamette River itself. These areas provide flood storage, water cooling and sediment filtering and fish and wildlife habitat. These areas also include important connections to wildlife corridors and other significant natural resources within Portland and the region.







### SECTION 3.C: THE SOUTH REACH

The South Reach Natural Resources Inventory (SRNRI) area extends on the east side from the Ross Island Bridge to just south of the Sellwood Bridge and from the South Waterfront district to the Dunthorpe neighborhood in unincorporated Multnomah County. The South Reach is approximately 1,615 total acres. Open water, including the Willamette River and other waterways, make up roughly 54 percent (866 acres) of that area.

Historically, the South Reach was comprised of an active channel, open slack waters, emergent wetlands, riparian forests and adjacent upland forests. Vegetation in bottomland and wetland forests consisted of black cottonwood, Oregon ash and willow, with associated native understory. Denser, mixed-conifer forests of Douglas fir, Bigleaf maple, western red cedar, western hemlock, grand fir and red alder dominated the west hills and some parts of the east terrace. Savannas of Oregon white oak, Pacific madrone, red alder and bigleaf maple were found in the foothills on the east side of the river.

Today, the land within the South Reach inventory area is comprised largely of publicly managed parks and open spaces and residential development. Parks, open spaces and recreational facilities include Ross Island Natural Area, Oaks Bottom Wildlife Refuge, Springwater Corridor, Willamette Park, Willamette Moorage Park, Oaks Crossing, Sellwood Riverfront Park, Sellwood Park and Powers Marine Park. There are three floating home communities in the South Reach, including Oregon Yacht Club, Macadam Bay Club, and the Portland Rowing Club. Generally, commercial uses are concentrated along the SW Macadam Avenue (Hwy 43) and SW Tacoma Street corridors.



*Historic photo of Willamette River, Ross Island and Oaks Bottom (1926)*

The river banks in the South Reach are less altered than in Portland's North and Central reaches of the Willamette River. More than 83 percent of the river banks, including the banks of Ross Island, are comprised of beach or natural rock, while 13 percent are comprised of vegetated riprap and the remaining 4 percent are unclassified fill and seawall (see Table 6). The existing floodplain is naturally confined by topography to the Willamette River itself with the exception of the Oaks Bottom wetland.

The South Reach is primarily characterized by recreational and open space uses. There are 11 parks and natural areas and the Springwater Corridor and Willamette Greenway trails in the inventory area. Boating, motor and hand crafts are common in this stretch of the river, as is fishing and swimming.

<b>Table 6: South Reach Willamette River Bank Treatments</b>	
<b>Bank Treatment</b>	<b>Linear Feet</b>
Beach	44,103
Rock/Rock Outcrop	10,987
Bioengineered	0
Non-Vegetated Riprap	0
Vegetated Riprap	8,398
Pilings	0
Seawall	398
Unclassified Fill	2,373
<b>Total</b>	<b>66,258</b>

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There are a number of suspected and confirmed contamination sites in the South Reach (see Map 8). The level of risk to humans and wildlife varies depending on the type of contaminant and exposure. The inventory site descriptions provide an overview of contaminated areas, types of contaminants, risk and status of clean-up activities. For more information, see the Department of Environmental Quality's website:

[www.deq.state.or.us/lq/ECSI/ecsi.htm](http://www.deq.state.or.us/lq/ECSI/ecsi.htm).

Currently, the Lower Willamette River, which includes the South Reach, does not meet state water quality standards for bacteria, mercury, dioxin and temperature. Oregon Water Quality Index values from 1986 to 1995 for the Lower Willamette Basin in Portland range from fair to very poor. Cool water is one of the necessities for many aquatic species, including salmonids. Tributary streams can influence water temperature in portions of the Willamette by providing cool water. However, many tributaries to the Lower Willamette do not meet standards for temperature and other pollutants, such as sediment and heavy metals.

Due to the documented presence of mercury, PCBs, dioxins and pesticides in Lower Willamette River fish, there is a fish advisory for the mainstem of the river. The advisory recommends that people, especially pregnant or breastfeeding women, limit or avoid consuming fatty fish such as carp, bass and catfish. There is no restriction on the consumption of salmon or steelhead. The Lower Willamette River in Portland is deemed unsafe for swimming when sewers overflow into the mainstem during large storm events. The City has worked to curtail overflows over the past decade and completed a multi-million dollar sewer pipe retrofit and upgrade project in 2011 that now captures 94 percent of sewer overflows and transports it to treatment facilities.

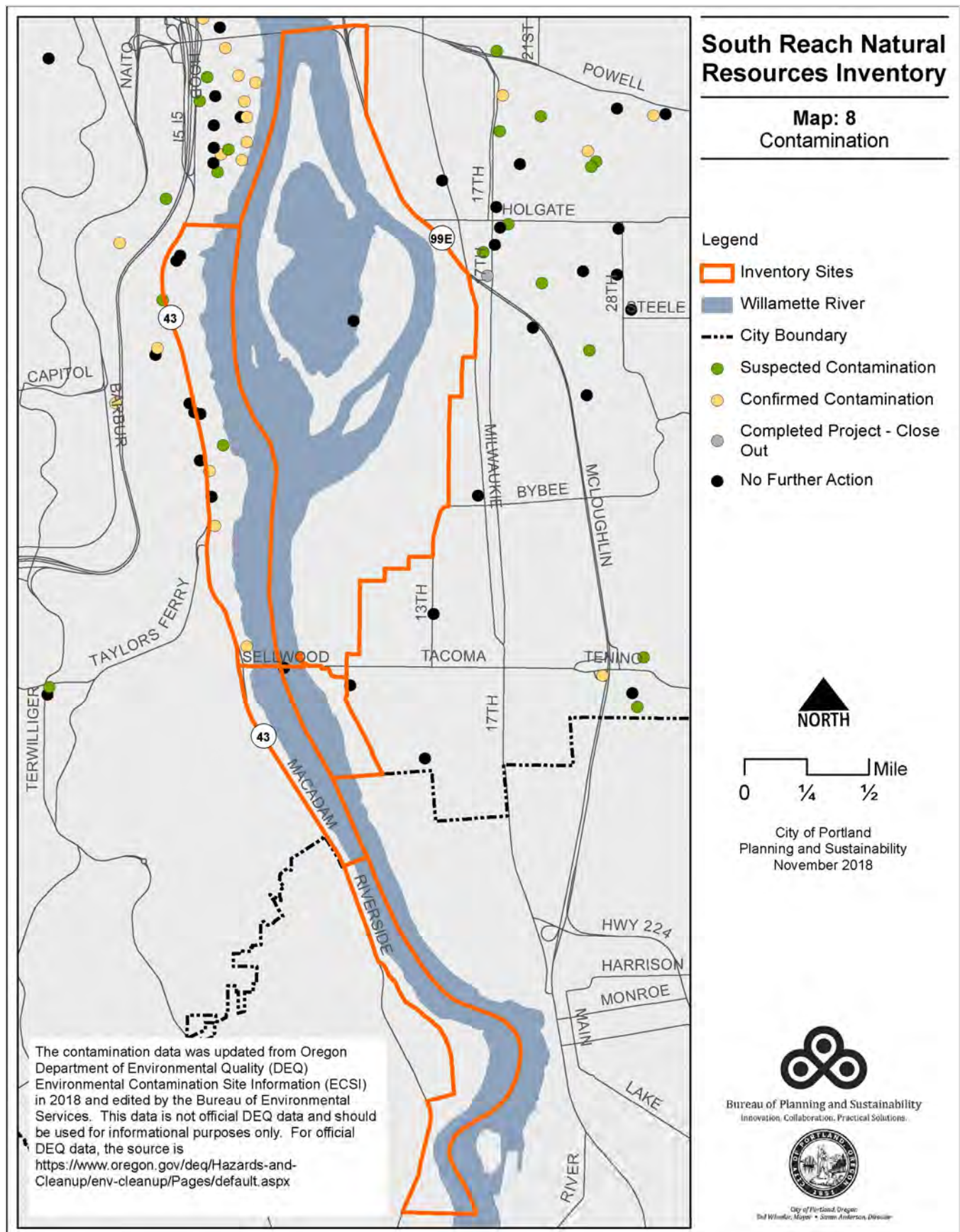
As noted, the effects of urbanization include constrained or altered river and stream channels, wetlands with soil contamination and the developed floodplain. In each of these cases, the resource has experienced some degradation but still provides important functions, such as water conveyance and storage and fish and wildlife habitat.

Even with the impacts of development, the South Reach contains some of the most important and unique natural resources in Portland. The Willamette River provides significant habitat for Chinook and coho salmon, rainbow/steelhead trout, Pacific Lamprey, beaver, river otter, red-legged frog, western pond turtle and bats. The Willamette River is part of the Pacific Flyway and is used by numerous bird species; some are year-round residents, while others pass through the city during spring and fall migrations. Over 210 resident or migratory species regularly occur in Portland and many are found in the South Reach. Iconic species, such as great blue heron, osprey, Peregrine falcon and bald eagle, are commonly seen in the South Reach. More detailed information on South Reach fish and wildlife is provided below.

Approximately 28 percent of the South Reach is vegetated. Vegetated areas at least ½ acre in size include 61 acres of herbaceous species, 49 acres of shrubland, 78 acres of woodland and 269 acres of forest vegetation. The reach also contains street trees and smaller, fragmented patches of trees, landscaped areas and non-managed vegetation. Impervious surfaces (e.g., roads, buildings, parking lots) make up roughly 13 percent of the study area. The remaining areas of the reach include the river, beaches, streams, wetlands and sparsely vegetated areas.



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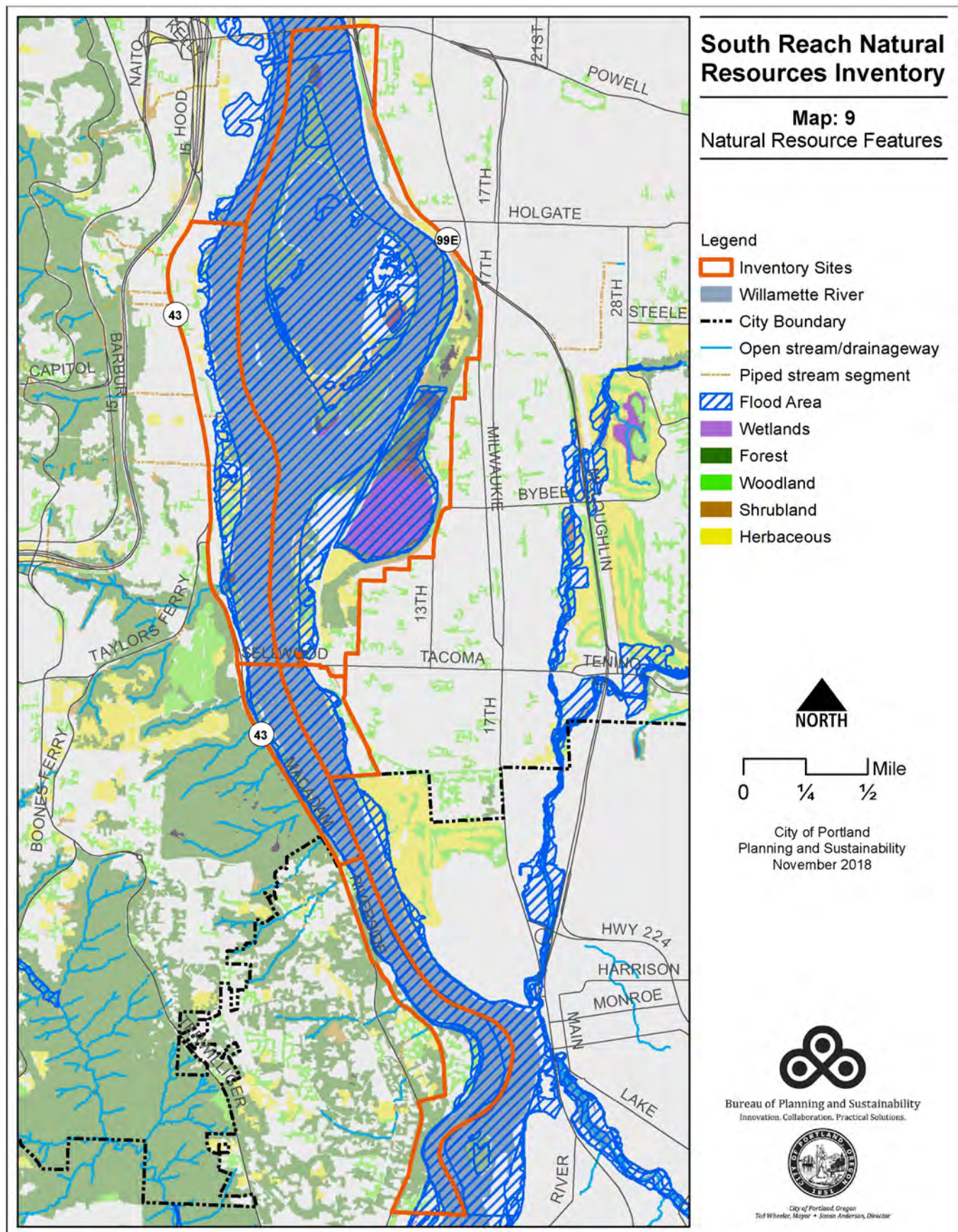
Vegetated areas in the urban riparian corridors and upland habitats of the South Reach are typically comprised of a mix of native, non-native and invasive plants. Native plant species generally provide a broader suite of benefits, such as more varied wildlife food sources and more effective slope stabilization. However, plants of all types, including non-native and even invasive plant species, provide important watershed functions such as water storage, nutrient cycling and cover and nesting opportunities for wildlife. Riparian trees and plants intercept rainfall and help to prevent erosion, while their roots stabilize river banks and trap sediments. Trees and shrubs that overhang the water provide shade that can create localized areas of cooler water. Vegetation along the river provides food sources and perching, nesting and resting areas for resident and migratory birds. The riparian area, and the Willamette River itself, create a wildlife movement corridor between larger nearby resource areas to the south, including Elk Rock Island, Ross Island and Oaks Bottom, and resource areas to the north such as Swan Island Lagoon, Waud Bluff and Forest Park and Harborton Wetlands.

Elements of the built environment influence resource features and functions of the Willamette River and riparian area. For example, street trees, ecoroofs and other vegetated landscaping intercept rainwater and reduce runoff, provide shade, cool and filter the air, and provide habitat for birds, small mammals (e.g., squirrels) and pollinators. The bridges that cross the Willamette River provide nesting opportunities for Peregrine falcons.

Table 7 and Map 9 provide a summary of natural resource features found in the South Reach.

<b>Table 7: Summary of Natural Resource Features in the South Reach</b>	
	<b>Study Area (miles/acres)</b>
<b>River (miles/acres)</b>	<b>7.5/866</b>
<b>Stream/Drainageway (miles)</b>	<b>0.3</b>
<b>Wetlands (acres)</b>	<b>95</b>
<b>Flood Area (acres)*</b>	
Vegetated (acres)	291
Non-vegetated (acres)	97
Open Water** (acres)	866
<b>Vegetated Areas &gt;= ½ acre (acres)*</b>	
Forest (acres)	269
Woodland (acres)	78
Shrubland (acres)	49
Herbaceous (acres)	61
<b>Impervious Surfaces (acres)</b>	<b>215</b>
* The flood area includes the FEMA 100-year flood plain plus the adjusted 1996 flood inundation area. ** Open Water includes portions of the Willamette River. + The vegetation classifications are applied in accordance with the National Vegetation Classification System specifications developed by The Nature Conservancy. The data within the primary study area and within 300 feet of all open water bodies in Portland is draft and is currently being updated based on 2008 aerial photography.	

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Below is additional information about fish and wildlife use in the South Reach inventory area as a whole.

## **Fish and Wildlife Use**

The Willamette River is the primary migration corridor for both fish and wildlife. The water, river banks, riparian vegetation and upland vegetation in the South Reach serve key functions.

### Anadromous Fish Species

Several fish species that use the Willamette River South Reach have been listed under the Endangered Species Act. Although most of the rearing and migratory habitats of these fish have been heavily developed in this reach, many of these fish continue to use the Willamette River South Reach as they migrate from their natal streams to the Pacific Ocean and back to spawn and die. The area identified as Critical Habitat under ESA includes designated rivers and streams up to the ordinary high water mark (OHWM). The OHWM for the Willamette River in the South Reach is 20 feet, NAVD88. The National Oceanographic and Atmospheric Administration (NOAA) has designated the Willamette River within the South Reach as Critical Habitat for the following species (NOAA/NRMF, 2005):

#### Chinook Salmon

- Lower Columbia River Chinook – listed as Threatened
- Upper Willamette River Chinook – listed as Threatened
- Snake River spring-summer Chinook – listed as Threatened

#### Coho Salmon

- Lower Columbia River (the Lower Willamette River is included for this species) – listed as Threatened

#### Sockeye Salmon

- Snake River Sockeye – listed as Endangered

#### Steelhead Trout

- Lower Columbia River Steelhead – listed as Threatened
- Upper Willamette River Steelhead – listed as Threatened

The Oregon Department of Fish and Wildlife has identified white sturgeon as a conservation priority in the Willamette River. The current status of these fish is largely unknown, though distribution appears to cover the extent of the mainstem Willamette River (ODFW, 2011).

Seasonal migrating anadromous fish are present within the Willamette River South Reach for short periods and are usually observed at predictable seasonal peaks:

- Juvenile salmon and steelhead out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead, and Coho out-migration peaks in May and June.
- White sturgeon generally move from the Columbia River estuary into the Willamette River in the spring and summer.

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Pacific Lamprey are also found in the South Reach. The Willamette Basin is one of the most important production areas for Pacific Lamprey in the entire Columbia River Basin (ODFW, 2002). The sand and small-sized gravel substrate in the Lower Willamette River is used by lamprey ammocetes for rearing and migration out to the sea; as well as by adults migrating upstream to spawning grounds.

All of these anadromous fish enter the Lower Willamette River system to forage on the annual shad run and to spawn downstream of Willamette Falls. Meyers et al. (1998) identified habitat modification, dams and hatchery management as factors for salmonid decline in the Willamette River basin. Immediately downstream from the South Reach, urban development, river bank armoring, river dredging and filling within the flood plain have substantially altered habitat availability and habitat quality for salmonid fishes. These impacts affect fish as they travel through the South Reach.

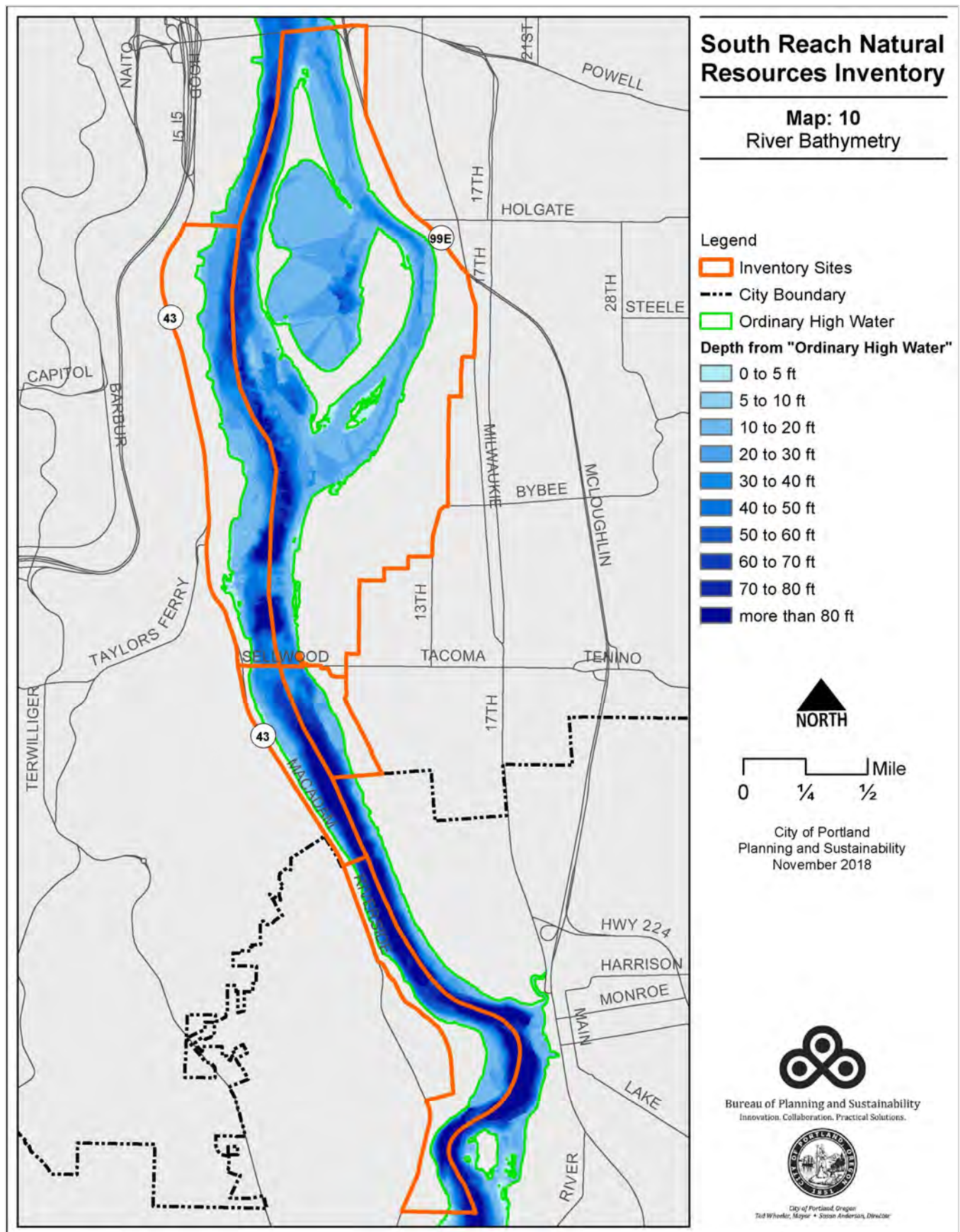
Habitat connectivity along the shoreline is crucial to the salmon's survival. As both juveniles and adults move along the shoreline they seek refugia habitat that provides opportunities to feed, rest and hide from predators. Refugia habitat, in this context, includes shallow water areas, defined as -21.0 feet to +9.5 feet (NAVD88 vertical datum), with sandy substrates and overhanging vegetation that provide food, resting and recharging opportunities for juvenile salmonids. Shallow water areas also provide important habitat for shorebirds and waterfowl.

The distance between shallow-water refugia is important to the health and survival of salmonids. Long periods of sustained swimming between refugia deplete energy reserves. Fish with low energy resources migrating between refugia are more vulnerable to predation, as their flight response diminishes with a reduction in stamina. The more "rest stops" a fish has the more likely they will complete their migrations in good health. Therefore, salmonid productivity and survival is expected to be greater in locations with the shortest distance between refugia, where the fish can rest, feed and rebuild their energy supplies. (Groot et al. 1995; M.B. Foreman, 1990; R.C. Eaton, 1991; Sauter, 2001; Sedell, 1990).

Important shallow water areas include: Ross Island, Holgate Channel and the Stephens Creek confluence. The recently-completed culvert replacement project at Oaks Bottom Wildlife Refuge will open up the wetland as off-channel habitat for salmonids. Some of these refugia are the last stop before juvenile fish move through the Central City and Portland Harbor. The bank layback identified in the *Willamette Park Redevelopment and Phasing Plan* will also create additional shallow water habitat and increase the function of the riparian corridor.

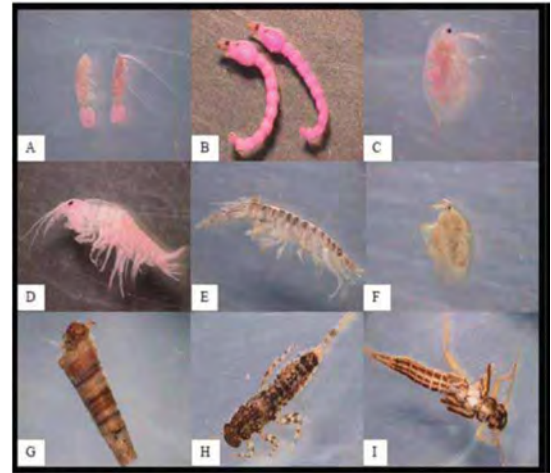


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**DRAFT**Macroinvertebrates

Macroinvertebrates (aquatic insects), zooplankton and phytoplankton are significant food sources for fish and other aquatic species. The invertebrate community in the Lower Willamette is relatively homogenous, consisting primarily of oligochaetes, cladocerans, amphipods and chironomids (Friesen 2005). The highest species diversity and taxa richness tends to be found at beaches. High densities of invertebrates usually exist at riprapped banks, but the species diversity and richness varies greatly. Seawalls tend to have the lowest species densities, diversity and richness, likely caused by the lack of interstitial spaces or other complex microhabitats. Figure 3 is representative of taxa found in the Lower Willamette River: (A) copepods (Calanoida), (B) chironomids (Diptera), (C) *Daphnia* spp. (Cladocera), (D) *Eogammarus* spp. (Amphipoda), (E) *Corophium* spp. (Amphipoda), (F) *Bosmina* spp. (Cladocera), (G) caddisfly (Trichoptera), (H) mayfly (Ephemoptera) and (I) stonefly (Plecoptera).



Source: Xerces Society

Birds

The South Reach is part of the Pacific Flyway and is used by numerous bird species during spring and fall migrations. Over 210 species regularly occur in Portland, many of which are resident or migratory in the South Reach.

Birds use open water, beaches, rocky outcrops, vegetated shorelines and man-made structures during migration, hunting and foraging and nesting. Trees and shrubs, found in open spaces but also in developed areas, provide foraging and resting opportunities for neotropical migrant songbirds as they move through the region. Even some built features provide habitat. Bridges that cross the Willamette River are commonly used by Peregrine falcon and cliff swallows for nesting.

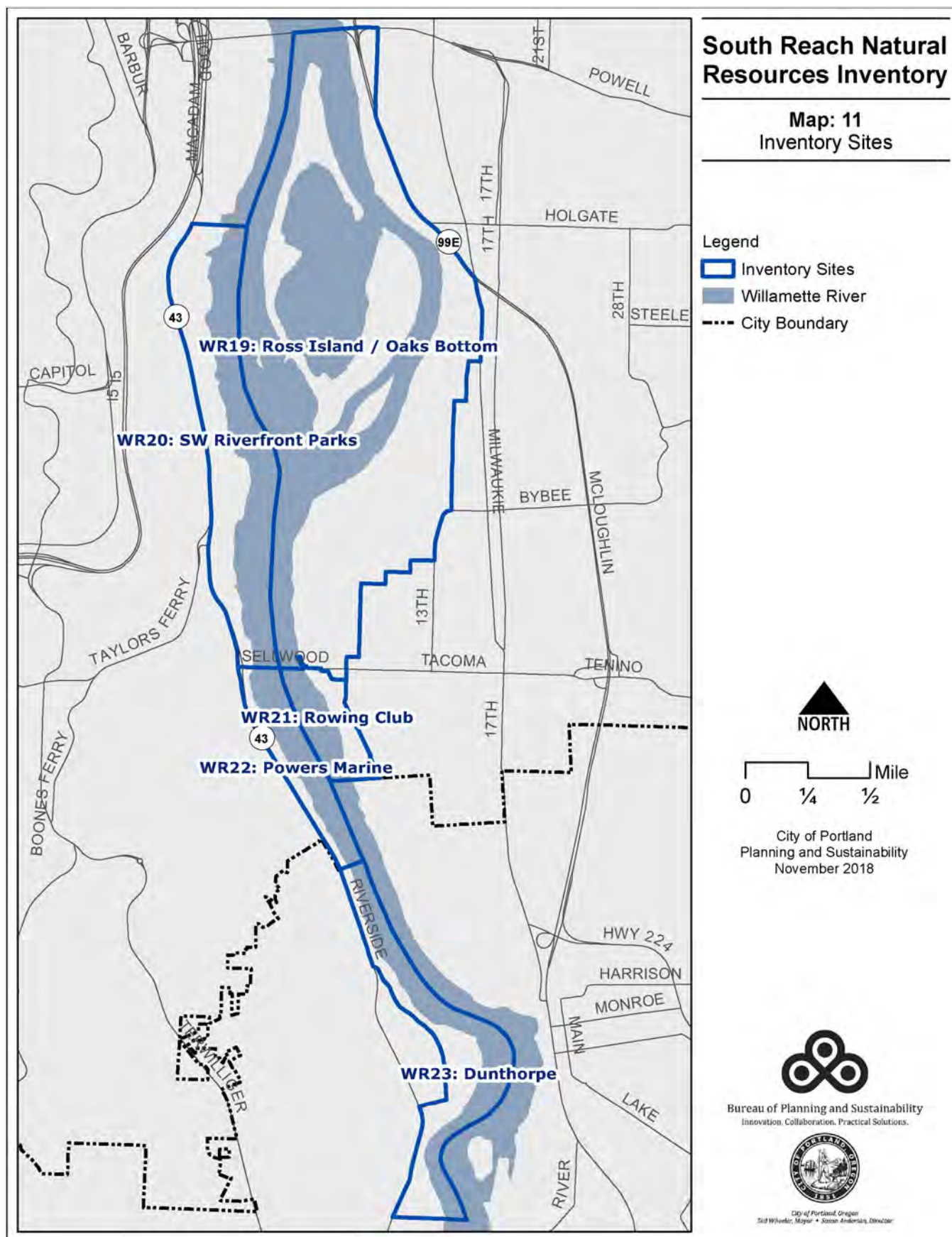
Additional information about birds use is included in the inventory site descriptions.

*Osprey perched on derelict piling.***SECTION 3.D: SOUTH REACH INVENTORY SITES**

There are 5 inventory sites in the South Reach Planning Area (see Map 11). Each site includes portions of the Willamette River channel, banks, and riparian and upland areas, as well as relevant land uses, primarily recreational and residential use, with some commercial around the major transportation corridors.



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The following report sections provide information for each inventory site. Each site section starts with a summary of site characteristics (Table 8) and is followed by a description and evaluation of natural resources.

<b>Table 8: Explanation of Inventory Site Summary Information</b>	
<b>Characteristic</b>	<b>Explanation</b>
<b>Watershed:</b>	The name of the watershed(s) in which the resource site is located.
<b>Neighborhood:</b>	The name of the neighborhood(s) in which the resource site is located.
<b>Legal Description:</b>	US Geological Survey (USGS) quadrangle maps and quarter section maps.
<b>River Mile:</b>	USGS river mile, beginning at the confluence with the Columbia River.
<b>Site Size:</b>	Size estimates include land features, streams and drainageways, wetland and river.
<b>Previous Inventory:</b>	City-adopted natural resource inventories in which the site or portions of the site were addressed.
<b>Zoning:</b>	Zone designations within the site, including overlays (e.g., height, design, open space, scenic, greenway and environmental).
<b>Existing Land Use:</b>	Primary land uses currently within the site.
<b>General Resource Description:</b>	Brief description of the site, its geographic location, natural resources and other key features.
<b>Resource Features:</b>	Specific natural resource features found within the site (e.g., stream, drainageway, wetland, flood area, vegetation, beach, steep slopes and open water). Features may be in relatively good or poor/degraded condition.
<b>Resource Functions:</b>	Riparian and wildlife habitat resource functions relate directly to the resource features found within the site; these are the functions that may be performed by the resources present.
<b>Special Habitat Area:</b>	Special Habitat Areas (SHAs) are designated where natural resources have been documented to include critical, rare or declining habitat types, or critical habitats for special status species.
<b>Special Status Species:</b>	Special status species are wildlife (including fish) or plant species known or reasonably expected to occur within or use the site and that have been officially listed by the NOAA Fisheries or the U.S. Fish and Wildlife Service (Candidate, Threatened, Endangered, Species of Concern), or the Oregon Department of Fish and Wildlife (Threatened, Endangered, State Sensitive, State Strategy), or ranked by Oregon Natural Heritage Information Center (Ranked or Listed Species), Oregon Watershed Enhancement Board (Priority Species), Partners In Flight (Focal Species), the National Audubon Society & American Bird Conservancy (Watch List), and the Northwest Power and Conservation Council Willamette and Columbia Subbasin Plans (Focal Species). Special status species lists for Portland can be found in Appendix E.
<b>Hazards:</b>	Indicates whether any portion of the site is within City-designated Wildfire Hazard Zone, Landslide Hazard Zone or the Flood Area (FEMA 100-year flood plain and/or adjusted 1996 Flood Inundation Area).
<b>Contamination:</b>	Indicates whether any portion of the site is contaminated per the Oregon Department of Environmental Quality, Environmental Cleanup Site Information (ECSI) database.



Following the inventory site summary, the following information is provided:

#### Site Description

The site description is a brief, general description of site boundaries, current and historic land uses, development characteristics, natural resource features, and other issues, such as known contamination, mitigation sites, revegetation projects and natural hazards, if applicable. This section is intended to provide important context for the following descriptions and evaluations of the natural resources on the site.

#### Natural Resource Description

The natural resource description provides an account of the types and condition of natural resources present within the site, including information on water bodies, wetlands, water quality, plant assemblages, habitat types and wildlife species found within the site. Natural resource functions are addressed, as are factors that may affect the overall function of these resources. Such factors include invasive species, development-related disturbances, impervious surfaces and contamination.

The natural resource descriptions, in conjunction with the natural resource evaluations, are intended to provide a general understanding of the presence, functions and relative value or quality of the natural resources. The descriptions are based in part on research and site visits completed by City staff between 2010 and 2011. Other information sources used to develop these descriptions include: Department of Environmental Quality information on contaminated sites; City data on natural resources and landslide and wildfire hazard areas; and various other documents.

#### Natural Resource Evaluation

This section presents and describes key natural resource functions and values that currently exist in each inventory site. The resource evaluations are presented in three sub-sections: (1) riparian areas, (2) wildlife habitat, and (3) combined riparian and wildlife habitat areas. The methodology used to produce the relative rankings, including the process listed below, is summarized in the previous chapter and a more detailed description is found in Appendix C: *City of Portland Natural Resource Inventory Update: Project Report*.

The natural resource evaluation process includes:

1. Mapping key resource features associated with riparian corridors and wildlife habitat.
2. Applying science-based criteria using GIS models to assess functions and attributes and generate initial relative ranks for natural resource features in the site.
3. Incorporating Special Habitat Areas.
4. Combining Relative Rankings.

It is important to emphasize that the relative rankings denote the current conditions and the relative functional quality of natural resources in a given site. The relative quality of existing natural resources in the study area ranges from relatively functional to highly degraded. This information is intended to inform, but not dictate, how these areas could be managed. For example, understanding the relative quality of existing resources can inform planning efforts, design of development projects, and priority-setting for natural resource protection or restoration.

It should also be noted that all ranked resources provide important watershed values and functions that should be taken into consideration when making management decisions to protect, restore or disturb these areas.