



RIVER PLAN/SOUTH REACH

Volume 3: Natural Resources Protection Plan

Discussion Draft

October 2019



Bureau of Planning and Sustainability

Innovation. Collaboration. Practical Solutions.

City of Portland, Oregon



THE RIVER PLAN

Acknowledgements

Portland City Council

Ted Wheeler, Mayor, Commissioner in Charge
Chloe Eudaly, Commissioner
Nick Fish, Commissioner
Amanda Fritz, Commissioner
Jo Ann Hardesty, Commissioner

Portland Planning and Sustainability Commission

Kathryn Schultz, Chair
Chris Smith, Vice Chair
Eli Spevak, Vice Chair
Jeff Bachrach
Ben Bortolazzo
Mike Houck
Katie Larsell
Akasha Lawrence Spence
Oriana Magnera
Daisy Quiñonez
Steph Routh

Bureau of Planning and Sustainability

Andrea Durbin, Director
Joe Zehnder, Chief Planner
Sallie Edmunds, Central City, River & Environmental Planning Manager
Debbie Bischoff, Senior Planner, Project Manager
Jeff Caudill, City Planner II, Project Manager

Contributing staff:

Mindy Brooks, City Planner II
Krista Gust, Graphics Designer III
Neil Loehlein, GIS Technician
Carmen Piekarski, GIS Analyst

Previous contributing staff:

Leslie Wilson, Graphic Design

Inter-bureau Team

Maya Agarwal, Emily Roth and Brett Horner, Portland Parks and Recreation
Adam Barber, Multnomah County Planning
Courtney Duke, Portland Bureau of Transportation
Laura John, Tribal Liaison, Office of Government Relations
Paul Ketcham and Kaitlin Lovell, Bureau of Environmental Services
Morgan Steele, Bureau of Development Services

Previous staff:

Michael Cerbone, Multnomah County Planning;
Alex Howard, Office of Management and Finance

Consultants: Barney & Worth, facilitation services

Cover illustration by James Pettinari

And many thanks to all participants in the River Plan/South Reach planning process and whose contributions have helped shaped this draft plan.

HOW TO COMMENT

You may submit comments to Bureau of Planning and Sustainability staff on the Discussion Draft by:

Email

Send an email to riverplan@portlandoregon.gov

U.S. Mail

Bureau of Planning and Sustainability
1900 SW Fourth Avenue, Suite 7100
Portland, Oregon 97201
Attention: River Plan/South Reach

For more information

Visit the project website: <https://www.portlandoregon.gov/bps/42548>

Contact the project team: riverplan@portlandoregon.gov

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SUMMARY

BACKGROUND AND PROCESS

As part of the River Plan / South Reach, the City is updating its existing environmental information and management tools to protect and enhance natural resources. This update ensures that the City continues toward its watershed health goals and advances the City's compliance with local, regional, state and federal regulations.

The South Reach Natural Resources Protection Plan (SRNRPP) contains six chapters:

Chapter I: Introduction – Introduces the regulatory directives guiding the plan and provides background information.

Chapter II: Regulatory Context – Summarize the environmental regulations, policies and goals that relate to natural resource protection and management of the Willamette River and adjacent lands.

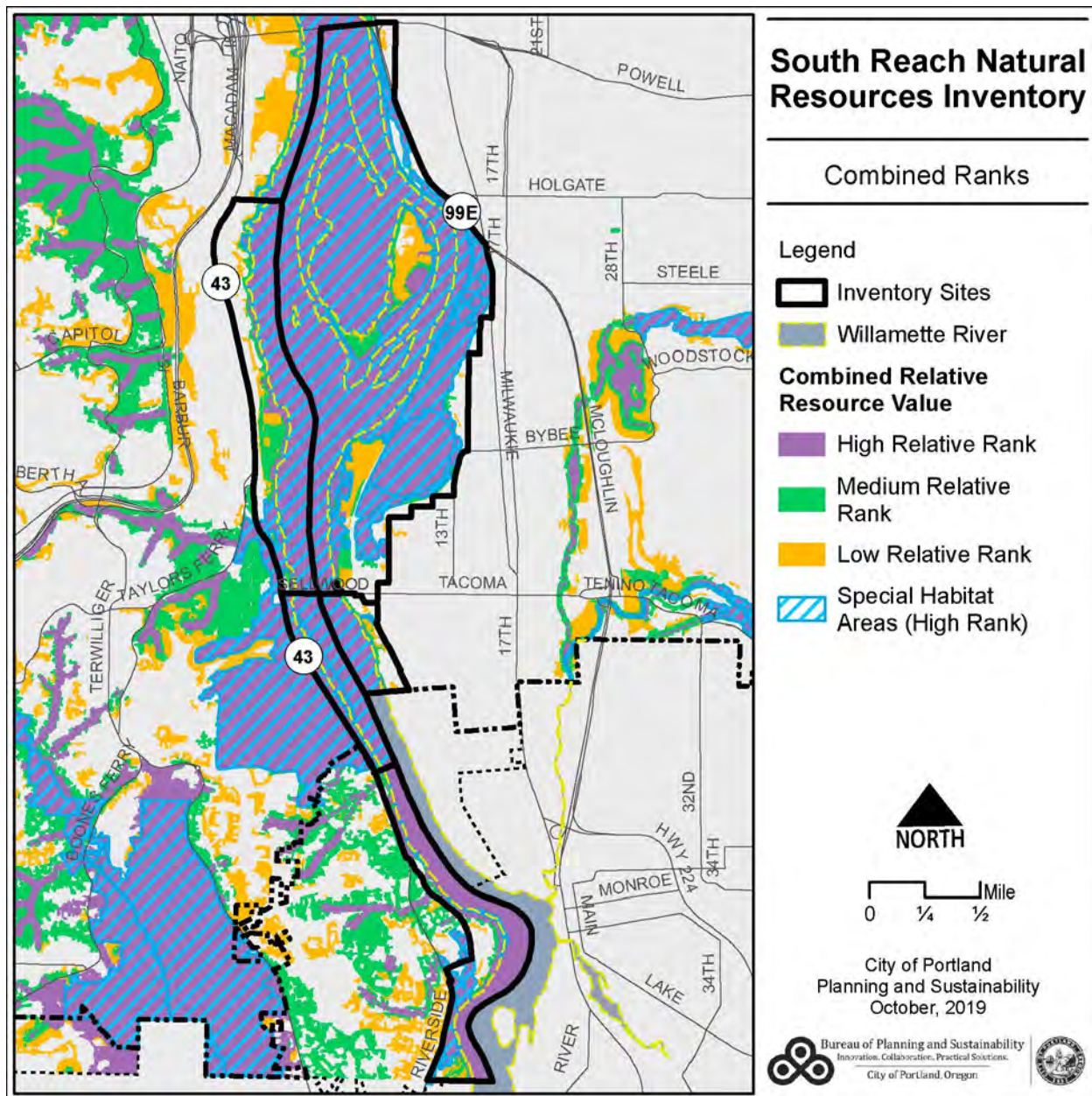
Chapter III: Inventory Approach and Methodology Overview – Describes the citywide Natural Resources Inventory approach and the methodology used to identify and evaluate riparian corridor functions and wildlife habitat attributes.

Chapter IV: Analysis of Protection Options and General Recommendations – Describes the trade-offs associated with different choices for protecting and managing natural resources in the study area and provides recommendations on what types of resources should be protected and the level of protection that is warranted for those resources.

Chapter V: Results – Provides additional detail on how natural resources should be managed within each of the five inventory sites of the SRNRPP (see the next page for a map of inventory sites). For each inventory site, an inventory of fish and wildlife species is presented, along with a series of maps highlighting key features and natural resource ranks. Depending on the unique characteristics of each inventory site, the general protection recommendations included in Chapter IV are applied and a map is provided to clearly identify areas where future development should be strictly limited or limited.

Chapter VI: Implementation Tools – Describes the available regulatory tools used to implement the natural resources protection recommendations in each inventory site.

The SRNRPP is based on an in-depth review of existing natural resources in the River Plan/South Reach study area that utilizes the citywide Natural Resources Inventory (NRI), relevant previous City research and inventory efforts, and other resources (e.g., journal articles, books, etc. focused on the Willamette River and the surrounding area) to understand the unique characteristics of each of the five identified inventory sites. The NRI 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&>.



RESULTS

For each of the five inventory sites, the SRNRPP provides narrative descriptions of the natural resource features and functions, as well as specific protection recommendations. Geographic information system (GIS) models are also used to map the functions provided by the features, rank the natural resources as high, medium or low to characterize the relative amount of function provided by any given feature and then depict the inventory site-specific protection recommendations. For example, a large stand of trees located adjacent to the river provides numerous functions, such as shading the in-water habitat and contributing leaf litter, structure and nutrients to the river. In this situation, the trees would receive a high relative rank for riparian corridor functions and the recommendation would be to strictly limit development impacts on those resources.

Below is a brief summary of the evaluation and determinations made for the four key natural resource areas that make up the River Plan / South Reach study area – the Willamette River, its riverbanks and adjacent, riparian corridors, floodplains and trees and landscape vegetation.

Willamette River

The Lower Willamette River flows through the South Reach and serves as a primary migration corridor for both fish and wildlife. The varied river banks and vegetation supports a diversity of fish and wildlife species. The Willamette River has been designated as Critical Habitat for seven species of salmon and steelhead designated as Threatened or Endangered under the Endangered Species Act (ESA). These fish depend on clean, cool water and shallow areas for resting and feeding as they migrate from their natal streams to the Pacific Ocean and back to spawn. The Willamette's South Reach has many areas of this important shallow water and beach habitat.



Salmon in the Willamette River.

Additionally, the Willamette River is part of the Pacific Flyway and is utilized by over 200 resident and migratory bird species. Birds use open water, wetlands, beaches, rocky outcrops, vegetated shorelines and human-made structures during migration, hunting and foraging and nesting. Vegetation on the banks, including trees and shrubs, are used by Neotropical migratory songbirds. Bridges that cross the Willamette River are commonly used by Peregrine falcons and cliff swallows for nesting.

Due to its unique role for both fish and wildlife, the Willamette River receives a high relative rank for both riparian corridor and wildlife habitat functions and is identified as a Special Habitat Area due to its role in the lifecycle of a number of ESA-listed fish. The protection recommendation for these areas is to strictly limit future development.

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 an essential transition between the river, stream banks and upland areas for wildlife. Much of the river bank in the South Reach is vegetated, though there are some areas of riprap and fill that impact shoreline function. There are also a few areas with natural rock outcroppings. Where there is residential and commercial development along the river, the banks generally have low structure vegetation.



Powers Marine Park.

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 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. Vegetated river banks receive a high or medium relative rank for riparian corridor functions.

All riverbanks in the South Reach receive at least a medium relative rank for riparian corridor functions because of the 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 a wider variety of functions, such as shading in-water areas, cover and nesting opportunities, and others. The protection recommendation for highly-ranked riverbanks is to strictly limit future development, while future development in medium-ranked areas should be limited.

Floodplains

With its many vegetated riverbanks and riparian corridors, the South Reach plays a crucial role in floodplain management within the city. A number of the parks and natural areas, including Oaks Bottom Wildlife Refuge, Willamette Park, Powers Marine Park and Sellwood Riverfront Park, provide substantial storage capacity during floods. This capacity benefits adjacent nearby properties by reducing the potential impacts of flooding as well as downstream development in the Central and North reaches by lessening flows in those areas (where natural riverbank conditions are not common). The open water and vegetated flood areas of the South Reach provide a host of other important functions, including, nutrient cycling, microclimate moderation and channel migration. The South Reach floodplain, which includes the FEMA 100-year floodplain and extent of the 1996 Flood Inundation Area. In a number of locations, the floodplain includes areas that are already developed with structures, parking lots and other impervious surfaces.



Oaks Bottom Wildlife Refuge provides substantial capacity for flood waters.

The vegetated floodplain 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 and no habitat. However, to ensure ongoing function and habitat improvements over time, a strictly limit determination is recommended for vegetated floodplains and a limit determination is recommended for developed floodplains. Applying a limit determination in developed floodplains, though they are defined as low value habitat in the NRI, will provide for habitat improvements as a part of future development activities and improve floodplain function over time.

Trees and Landscape Vegetation

Based on the NRI modeling protocol, only patches of trees that are at least one-half acre in size are assigned a relative rank for wildlife habitat in the SRNRPP. Patches of this size and larger provide habitat for a host of insects, birds, mammals, amphibians and reptiles. The South Reach includes large areas of tree canopy, both along the riverfront and in nearby upland areas and bluffs. Trees and landscaping along the riverfront are essential to riverine habitat function and due to their role as connectors to adjacent wildlife habitat corridors. Smaller landscaped areas and individual street trees, while not receiving a rank in the inventory, may 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.



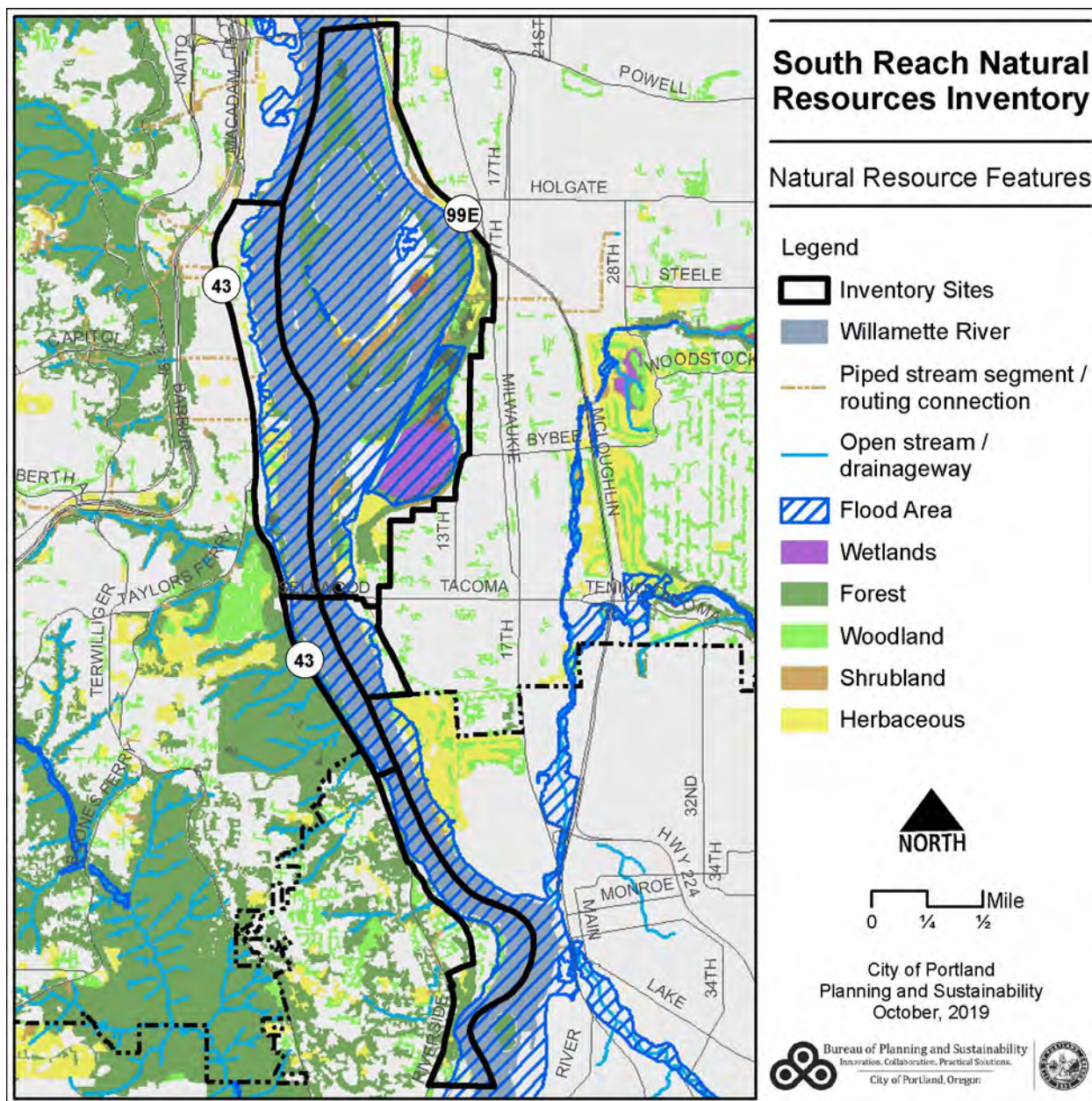
Large trees at the Garden at Elk Rock.

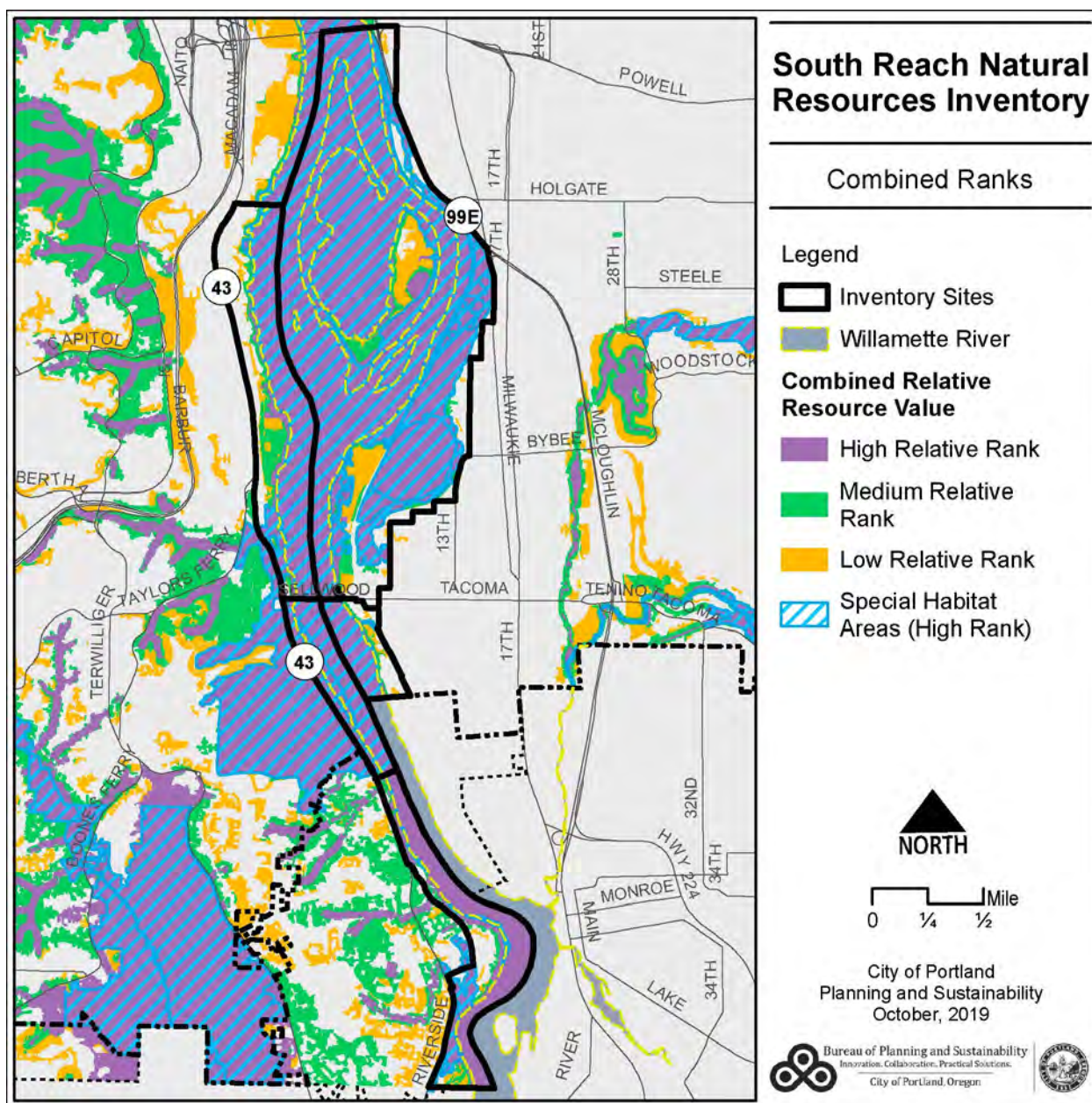
Ross Island/Oaks Bottom Complex, Willamette Moorage, Powers Marine and parts of Dunthorpe all have significant tree canopy and receive a medium relative rank for wildlife habitat. The protection recommendation for these habitat areas and other similarly-vegetated areas is to limit future development.

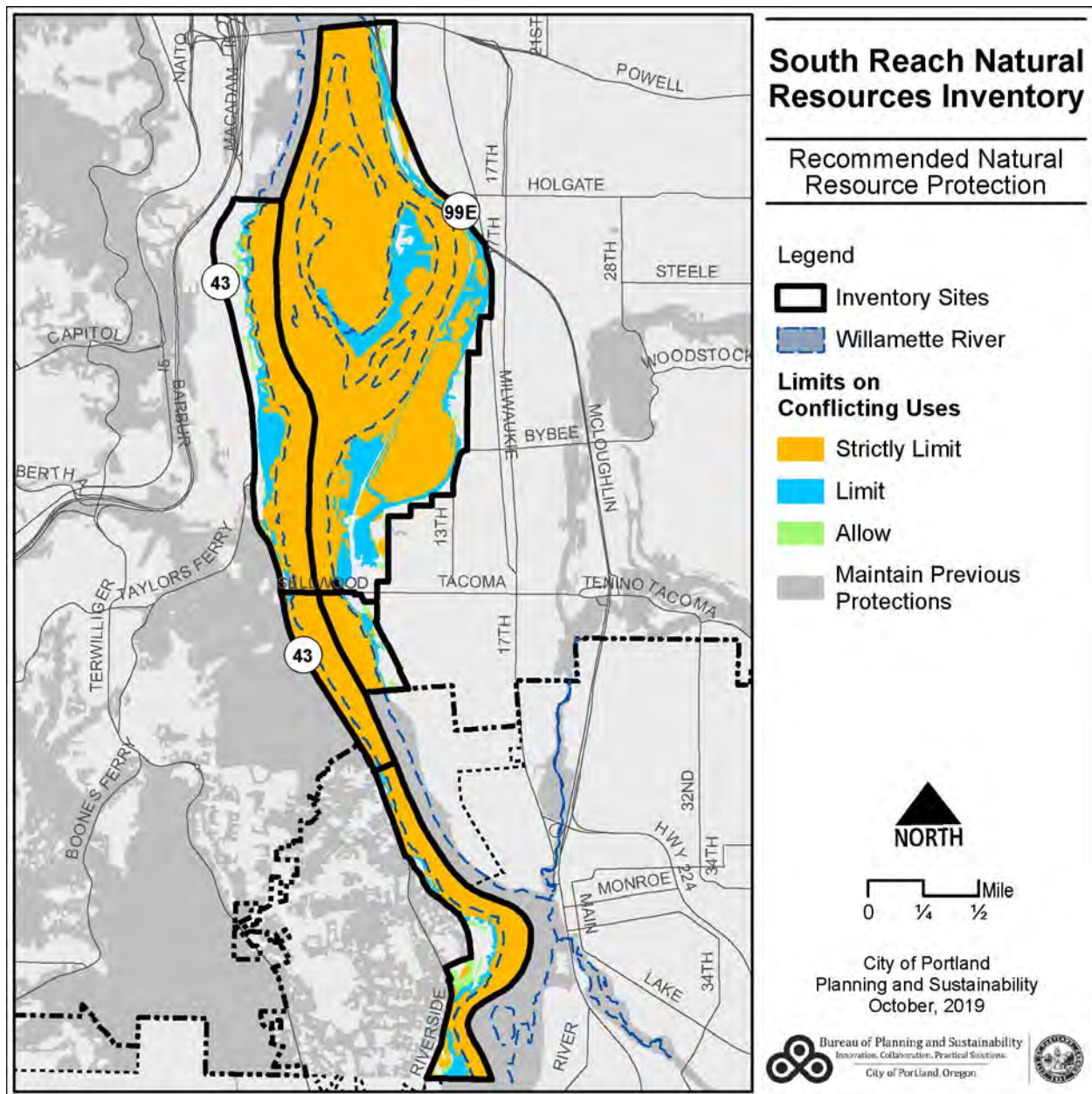
SRNRPP Results Summary

Below are three maps showing the natural resource features, the NRI combined ranking based on the natural resource functions and the protection recommendations for all resources in the River Plan / South Reach study area.

More specific detail on the considerations made to rank South Reach natural resources, along with more detail on the processes for determining the recommended protection levels for the various resources, can be found in Chapter III, Inventory Approach and Methodology, and in each of the inventory sites' descriptions and analysis.







CHAPTER I. INTRODUCTION

1. PURPOSE AND PLAN AREA

The South Reach Natural Resources Protection Plan (SRNRPP) 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, natural areas 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 Natural Area, Sellwood Riverfront Park and Powers Marine 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 goes beyond in some places, the area contained within the City's existing Greenway Overlay Zones. The inventory site boundaries were drawn to:

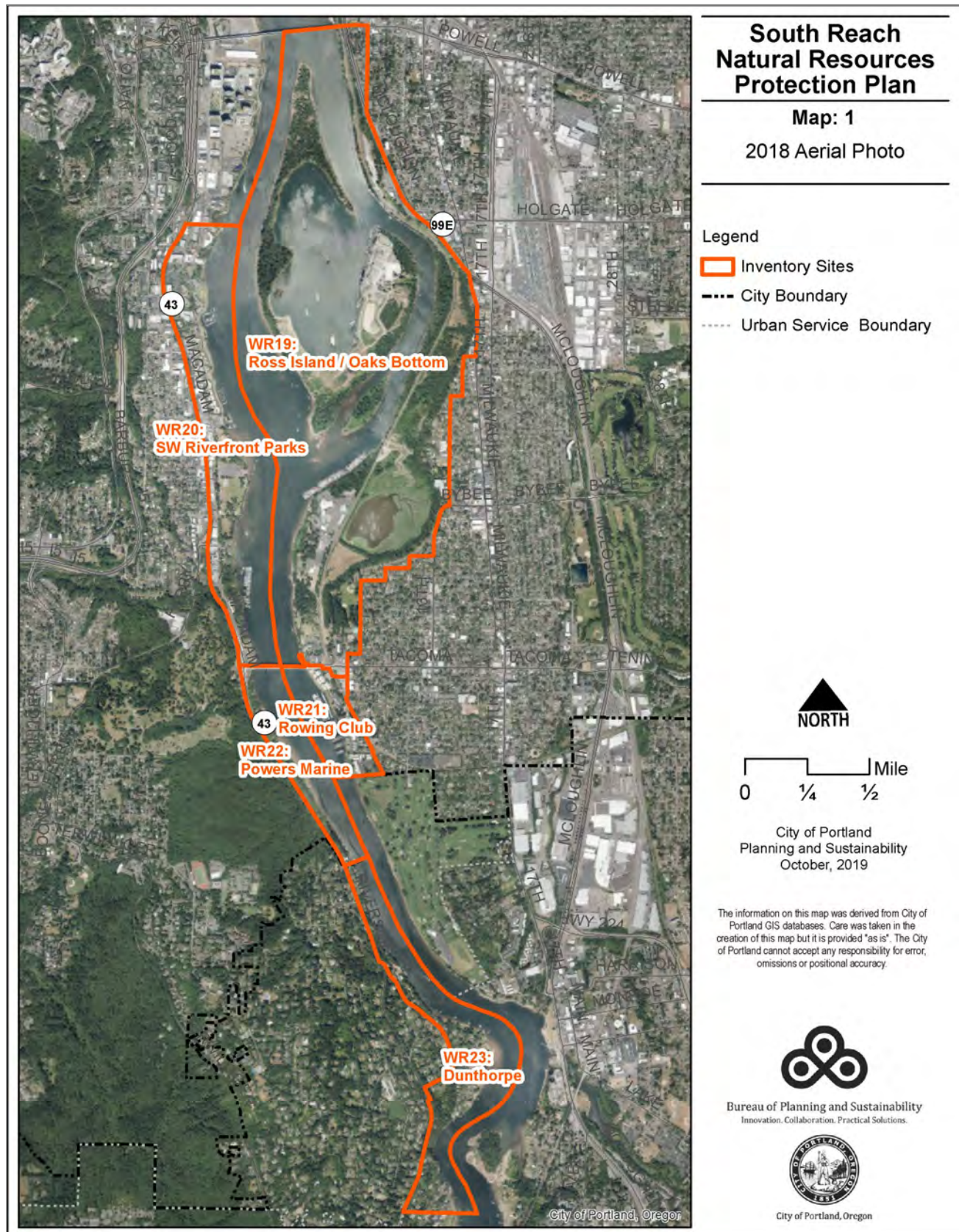
- Include contiguous natural resource features (e.g., floodplain)
- Follow major infrastructure like highways and rail roads
- Not bisect properties under the same ownership
- Use the river thalweg to divide east and west sites

2. RELATIONSHIP TO PREVIOUS PLANNING EFFORTS AND THE COMPREHENSIVE PLAN

The River Plan / South Reach is a multi-objective plan for the South Reach of the Willamette River that will establish a 20-year vision and concepts for land use and development, recreation, natural resources management, transportation, and other considerations within the area. The plan will update and replace the 1987 Willamette Greenway Plan, zoning code and design guidelines, which serve as Portland's compliance with State Planning Goal 15: Willamette River Greenway.

Planning for natural resources along the Willamette River has occurred through a number of citywide initiatives, starting with the adoption of the first Willamette Greenway Plan. Brief descriptions of a number of these efforts is provided below.

Willamette Greenway Plan – The Willamette Greenway Plan was first adopted in 1979 to fulfill the requirements of Statewide Planning Goal 15, Willamette River Greenway. The plan was updated in 1987. The purpose of Goal 15 is “to protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River as the Willamette River Greenway.” The Central Reach portion of the Willamette Greenway Plan was recently updated as a part of Central City 2035 Plan. The Willamette River North Reach is not updated by this SRNRPP and will continue to be protected under the existing Willamette Greenway Plan.



River Renaissance Vision and River Renaissance Strategy – In March 2001, the Portland City Council adopted the River Renaissance Vision by resolution. The Vision articulates a set of goals and aspirations for a revitalized river. It includes five mutually supportive and interrelated themes that proclaim Portland’s aspirations to:

- Ensure a clean and healthy river for fish, wildlife, and people
- Maintain and enhance the city’s prosperous working harbor
- Embrace the river and its banks as Portland’s front yard
- Create vibrant waterfront districts and neighborhoods
- Promote partnerships, leadership and education

In December 2004, the Portland City Council adopted the River Renaissance Strategy by resolution. The Strategy is intended to lead the City toward the future outlined in the River Renaissance Vision. The Strategy serves as the City’s blueprint for river-related activities and investments by establishing policy guidance, progress measures and an action agenda.

River Concept – The River Concept was adopted by the Portland City Council in April 2006 as a guiding document for the River Plan. The Concept synthesized river-related planning completed in the previous decade. Relevant guidance for the South Reach includes:

South Reach Vision

The South Reach will provide unique fish and wildlife habitat, parks and trails in the center of the city, easily reached from established neighborhoods.

Themes and Objectives

Clean and Healthy River

- Opportunities to protect, conserve and restore fish and wildlife habitat, including streams, wetlands, riparian areas and upland vegetation will be explored and implemented through public and private actions. In the South Reach restoration of Ross Island will result in the highest quality riverine habitat in Portland. Mitigation required of public and private parties will improve habitat functions.
- Stormwater quality and quantity will be managed at the source where practicable, using approaches that suit the site conditions and the type of development. In the south reach this will often be achieved through landscaping and pervious pavement.
- Innovative bank treatments and plantings that work for riverfront development and provide fish and wildlife habitat will be achieved through public and private investment.
- Riverfront and watershed actions achieved through public and private investments will improve water quality and help make the river swimmable.

Vibrant Waterfront Districts and Neighborhoods

- Sellwood will continue to be a vibrant neighborhood with both natural areas and parks on its waterfront. Connection to the waterfront will be improved with the completion of the Springwater Corridor, a new Sellwood Bridge, and commercial activity at the bridgehead on Tacoma Street.

Vibrant Waterfront Districts and Neighborhoods

- Existing floating home moorages, marinas, water related business, and recreation will play an important role in the vitality of Portland's waterscape through the acknowledgement and support of the City and its partners.
- River access in the John's Landing and Macadam area will improve as areas along the riverfront redevelop.

Portland Watershed Management Plan – The Portland Watershed Management Plan was adopted by the Portland City Council in March 2006. The Plan describes the approach that will be used to evaluate conditions in Portland's urban watersheds and recommends projects to improve watershed health. The overarching themes of the plan are to achieve improved watershed health through: (1) protection and enhancement of remaining natural resources, (2) low-impact development, (3) installation of innovative stormwater infrastructure, (4) modern and effective approaches to City repair and maintenance of existing infrastructure and (5) an integrated City response to local, state and federal environmental requirements.

The Comprehensive Plan – Local jurisdictions are required to develop and update Comprehensive Plans to demonstrate compliance with the statewide land use planning goals. Portland updated its Comprehensive Plan in 2016. Chapter 7: Environment and Watershed Health, contains five overarching goals. Goal 7.B: Healthy Watersheds and Environment states "Ecosystem services and ecosystem functions are maintained and watershed conditions have improved over time, supporting public health and safety, environmental quality, fish and wildlife, cultural values, economic prosperity and the intrinsic value of nature." The remaining five goals address (1) the City's climate targets, (2) ensuring long-term resilience in the face of climate change, (3) ensuring environmental equity by providing access to clean air and water and spreading environmental benefits to all Portlanders, and (4) supporting community stewardship to maintain and improve the environment. In addition to the five Environmental and Watershed Health goals, a number of other goals related to natural resource protection are included in the plan.

A broad range of policies support the Environment and Watershed Health goals. Of these, policies 7.19 and 7.21 provide overarching direction for the SRNRPP. Policy 7.19: Natural Resources Protection, states "Protect the quantity, quality and function of significant natural resources identified in the City's natural resources inventory" And policy 7.21: Environmental Plans and Regulations states "Maintain up-to-date environmental protection plans and regulations that specify the significant natural resources to be protect and the types of protections to be applied, based on the best data and science available" Overall, the SRNRPP advances the Comprehensive Plan goals and policies.

The SRNRPP is intended to inform and support an array of City and community activities in the River Plan / South Reach planning area. 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.

Over the long term, this SRNRPP can help the City achieve its River Renaissance Vision for clean and healthy rivers, and meet its watershed health goals. SRNRPP inventories and recommendations will inform the development of

regulatory and non-regulatory tools for future natural resource protection and restoration efforts. The SRNRPP is also part of the City's compliance with Metro's Title 13, Nature in Neighborhoods, program.

3. ORGANIZATION OF THE PLAN

The report is organized into chapters that describe the regulatory context for the SRNRPP and the methodology used to inventory and analyze natural resources in the South Reach. Based on the inventory and analysis, Chapter V provides general and inventory site-specific protection recommendations for the South Reach. A brief summary of the material contained in each chapter is provided below.

Chapter I: Introduction – This chapter introduces the regulatory directives guiding the plan and provides background information, including an overview of the Willamette River basin and Lower Willamette River, as well as a brief history of resource protection in the South Reach.

Chapter II: Regulatory Context – The purpose of this chapter is to summarize the environmental regulations, policies and goals that relate to natural resource protection and management of the Willamette River and adjacent lands. First, the chapter addresses the two groups of regulations that most directly relate to natural resources: Oregon State Land Use Planning Program and Metro Urban Growth Management Plan. Following those explanations are summaries of the City's Comprehensive Plan and other relevant environment regulations, goals and policies.

Chapter III: Inventory 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.

Chapter IV: Analysis of Protection Options and General Recommendations – This chapter describes the trade-offs associated with different choices for protecting and managing natural resources in the South Reach project area. The chapter ends with recommendations about what types of resources should be protected and the level of protection that is warranted.

Chapter V: Results – Building upon the information provided in Chapter IV, this chapter provides additional detail on how natural resources should be managed within each of the five inventory sites of the SRNRPP. For each inventory site, an inventory of fish and wildlife species with a focus on special status species is presented, along with a series of maps highlighting water-related features, vegetation features, riparian corridor relative ranks, wildlife habitat relative ranks and combined riparian/wildlife habitat relative ranks. Depending on the unique natural resources characteristics of each inventory site the general protection recommendations are applied and presented in a map that clearly identifies areas to strictly limit or limit.

Chapter VI: Implementation Tools – This chapter describes available regulatory tools used to implement the natural resources protection recommendations in each inventory site.

4. OVERVIEW OF THE WILLAMETTE RIVER

This section provides a general description of the current and historic natural resources conditions within the Willamette River Basin, as a whole, and the Lower Willamette River, more specifically. The Lower Willamette River extends from Willamette Falls to the confluence with the Columbia River. Key fish and wildlife species, vegetation composition, current and historic watershed functions and characteristics, and other elements are discussed.

A. 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 anadromous¹ 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 dam discharge (see Figure 1), Pacific Ocean tides and Columbia River flow conditions.



Figure 1. Map of the Willamette River basin, showing tributaries and existing flood control projects.

¹ Anadromous species are born in freshwater, spend most of their life in saltwater and return to freshwater to reproduce.

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 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 the largest flood in Portland in the last 50 years. 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 in the Willamette basin, 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).

Fish

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



Photo of Oaks Bottom Wildlife Refuge and Willamette River

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 floodplain; non-indigenous species; water quality degradation; urban development; and a wide range of fisheries management practices. Numerous non-native fish species were introduced into the river system in the period between 1890 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.

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. Friesen *et al.* (2005) 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. Significant growth has been observed in juvenile salmon and trout during rearing and migratory life stages (Friesen 2005). 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.

Birds

The Willamette River basin sustains a wide assortment of bird species, including a large number of resident species as well as migrants that travel through the area via the Pacific Flyway, which extends from Alaska to Argentina. According to the City's *Portland, Oregon's Bird Agenda* (2011), over 200 species of birds are regularly observed in the Portland-Vancouver metropolitan region. *Birds of the Willamette Valley Region* (2004) includes over 245 birds that may be observed in the Willamette Valley, more generally. A variety of bird types are commonly observed in the basin, including raptors, owls, various passerine birds, waterfowl, shorebirds, and others.

Many of these birds are species of concern at the state or federal levels. Of the birds known to occur in the Portland region, 23 are migratory species that have a state or federal designation due to population declines and on-going threats (City of Portland BES 2011). The streaked horned lark, federally listed as Threatened in October

of 2013, has historically used the Willamette River basin but its breeding and wintering sites in the area are very limited. Generally, the largest known populations of streaked horned lark are frequently found near airports and other locations where trees are limited due to the species' preference for breeding in areas of bare ground without tree canopy. Additionally, streaked horned larks have been known to utilize shorelines and mudflats (Intertwine Alliance 2012a). Oregon's state bird, the Western Meadowlark, is a state-listed Species of Concern that is on the verge of extirpation from the city due to loss of native grasslands. The Oregon vesper sparrow and yellow-breasted chat are also categorized by the State of Oregon to be "sensitive-critical"² from the valley (ODFW 2016). An additional species experiencing challenges within the Willamette Basin is the purple martin, which is classified as a federal Species of Concern and is listed as a State "sensitive" species. The availability of nest cavities and snags are the primary limiting factor for purple martins in the basin. Purple martin nesting sites have been observed in the South Reach of the Willamette River (Intertwine Alliance 2012b).

Willamette River basin habitats that support bird species include rivers and open waters, wetlands, native oak, riparian and bottomland hardwood forest, grassland habitat, and mudflats. Gulls, cormorants, osprey, bald eagles, kingfishers, and white pelicans, among others, frequently feed on fish and aquatic invertebrates in the streams, rivers and open waters of the basin. A wide assortment of geese, ducks, loons, grebes, and swans winter on local waters. For example, wood ducks and mergansers nest in the region in snags and cavities located in riparian habitat (Intertwine Alliance 2012a). Additionally, a number of species, such as acorn woodpeckers and slender-billed (white-breasted) nuthatch, depend on Oregon white oak habitat for long-term viability. Nearshore mudflats, shoals and beaches provide habitat for a number of migratory shorebirds, including least sandpipers, solitary sandpipers and greater yellowlegs. A final, uniquely urban habitat in the Willamette River basin is the City of Portland's bridges. Since the early 2000's, a number of peregrine falcons have been nesting on Portland's bridges. The Fremont Bridge has become the most common nesting site for peregrines, having fledged over 50 young in that time (Intertwine Alliance 2012b). According to the Intertwine Alliance's *Regional Conservation Strategy* (2012), all of the known nesting sites within the Portland area have fledged more than 140 young, exceeding the state and national averages for nest productivity.

Mammals

In addition to the large number of bird species found in the Willamette River basin, it is estimated that over 65 native mammal species are common in the basin (Intertwine Alliance 2012a, Sinclair 2005). Mammals in the basin play a role at every level of the food chain and include herbivores, insectivores, omnivores, and carnivores. The majority of mammals in the basin utilize rivers, streams or open water as a source of food, water or other resources at various points in their life. A number of species, including river otters, mink, muskrats, and beavers, live the majority of their lives in and near water bodies of the basin. A number of larger mammals, include the black-tailed deer (*Odocoileus hemionus*), Roosevelt elk (*Cervus canadensis roosevelti*), and coyote (*Canis latrans*), are closely associated with oak habitat (Intertwine Alliance 2012a). The lower Columbia population of the Columbia white-tailed deer (*Odocoileus virginianus leucurus*) is designated as a federal Endangered species and is identified as a Sensitive species at the state level.

² Oregon Department of Fish and Wildlife defines "Sensitive-Critical" species as those with "current or legacy threats that are significantly impacting their abundance, distribution, diversity, and/or habitat. They may decline to the point of qualifying for threatened or endangered status if conservation actions are not taken."

At least nine species of bats are present in the Willamette River basin. Of those, five are federal Species of Concern and have a state Sensitive designation, including Townsend's big-eared bats (*Corynorhinus townsendii*), hoary bat (*Eptesicus fuscus*), fringed myotis (*Myotis thysanodes*), silver-haired bat (*Lasionycteris noctivagans*) and California myotis (*Myotis californicus*). Bats in Oregon and Washington are insectivores.

Western pocket gophers (*Thomomys mazama*) in grasslands and American beaver (*Castor canadensis*) in wetland habitats have been identified as "keystone"³ species in their respective habitats. In grasslands and prairies, pocket gophers may turn tons of soil per acre every year. Their extensive excavations affect soil structure and chemistry, and their food caches and latrines enrich the soil, affecting plant community composition and productivity (WDFW 2019). In wetlands, beaver can contribute to the creation of a variety of water/land interfaces, resulting in greater plant and animal diversity in those areas (Intertwine Alliance 2012a).

More intensely-developed urbanized areas frequently support populations of a variety of non-native mammal species, including the house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), Virginia opossum (*Didelphis virginiana*), and eastern fox squirrel (*Sciurus niger*).

B. Lower Willamette River

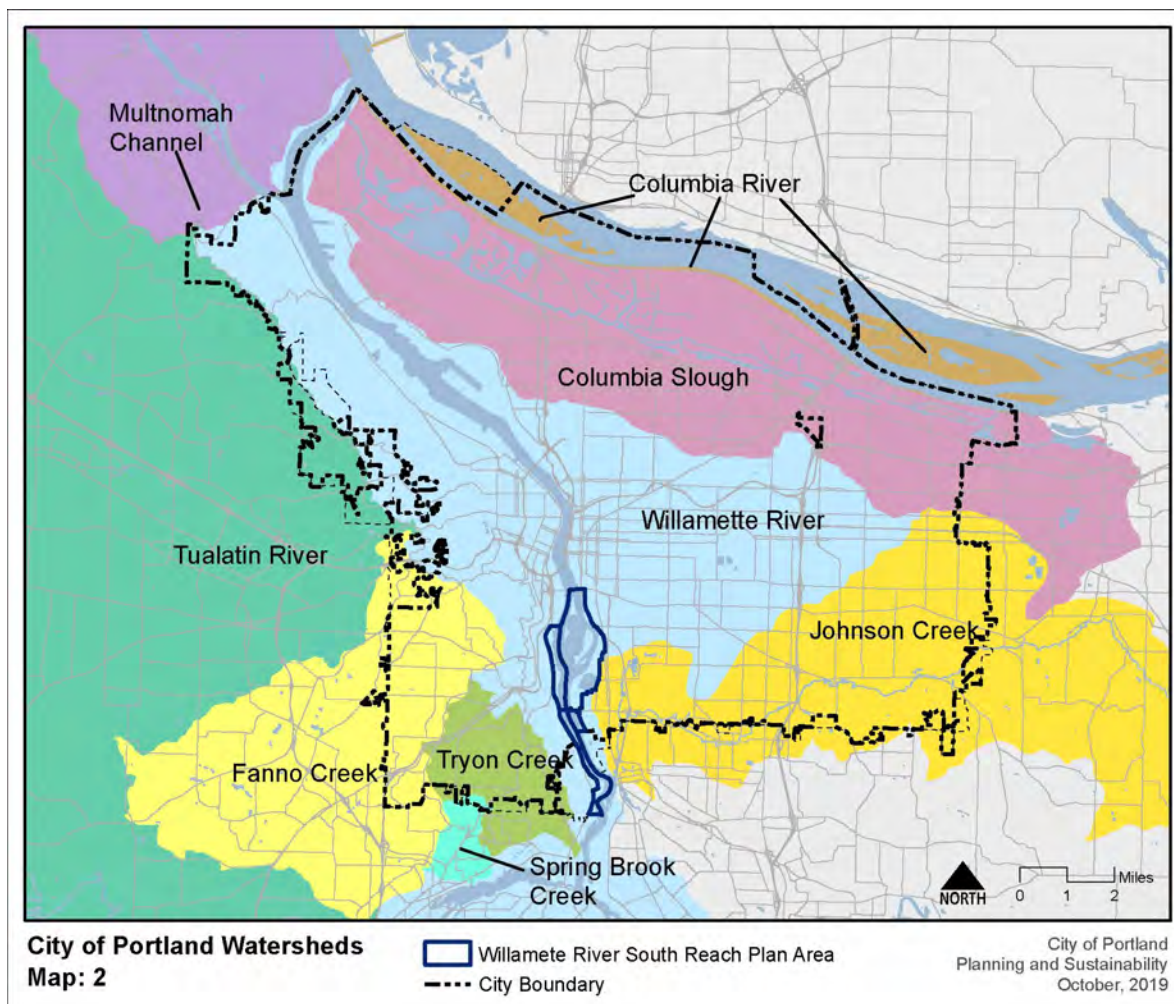
The 27 miles of river between Willamette Falls and the Columbia River are often referred to as the Lower Willamette River. The Lower Willamette River is a tidal freshwater system and its flow and water levels are influenced by a complex and dynamic set of factors, including tides, seasonally-variable 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. As stated above, the diurnal tides in the lower Willamette typically fluctuate on the order of two feet per day, but can increase up to eight feet depending on flow conditions in 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.

This portion of the Willamette basin connects directly with the regional ecosystem that includes Sauvie Island, Ridgefield and Shillapoo Wildlife Areas, Vancouver Lake, the Tualatin Mountains, Burlington and Oaks Bottom Wildlife Refuge, Smith and Bybee Wetlands, the 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. 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

³ A keystone species is one on which other species in an ecosystem largely depend, such that if it were removed the ecosystem function would be significantly affected.

escarpment runs along the east side of the river within the city. Similar escarpment features continue on the east side of the river at the Oaks Bottom Wildlife Refuge 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 2 shows Portland's watersheds and the boundary of the Willamette River South Reach Inventory Sites.

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.

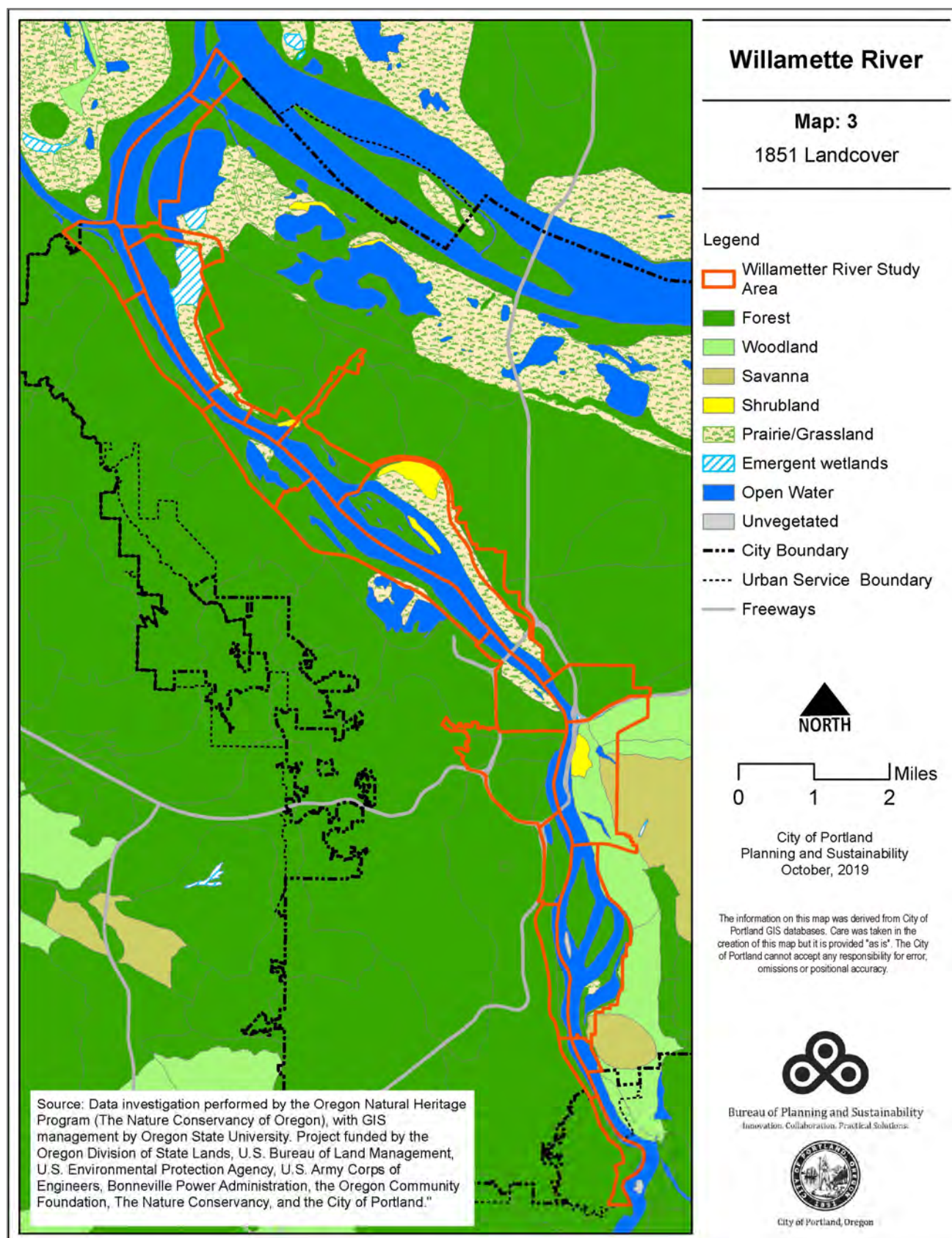


Twelve bridges cross the Willamette River in Portland. The Sellwood, Ross Island, Burnside, Hawthorne, Morrison, Burnside, Steel, Broadway and St. Johns bridges are all designed to accommodate automobiles, trucks, bicycles and pedestrians. The Marquam and Fremont bridges carry only highway automobile traffic. The recently-constructed Tilikum Crossing Bridge carries light rail (MAX) trains, streetcars, buses, bicycles and pedestrians. No automobile traffic is allowed on the Tilikum. Finally, just south of the St. Johns Bridge, a Burlington Northern railroad bridge crosses the Willamette River. Several of these bridges provide habitat for wildlife. For example, the St. Johns, Burlington Northern, Fremont and Marquam bridges provide nesting sites for Peregrine falcons.

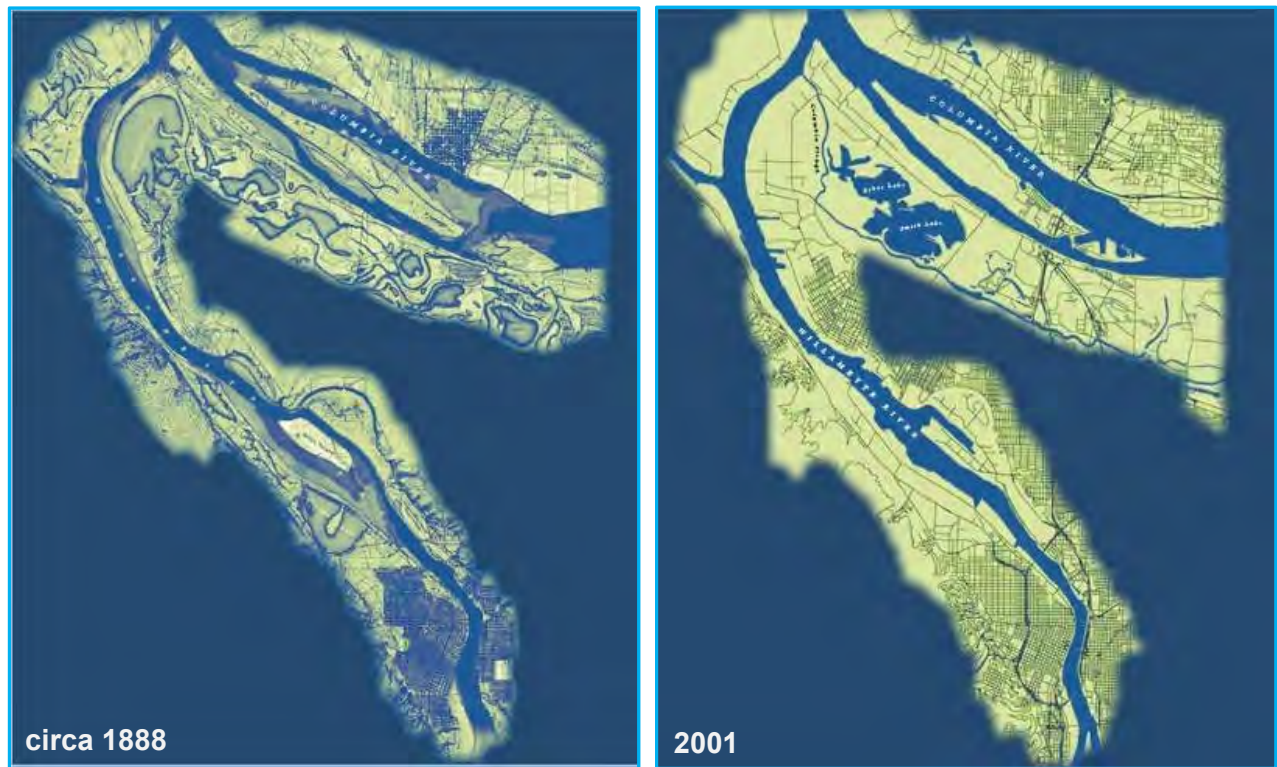
Historically, the Willamette River in the Portland area was comprised of an extensive interconnected system of active channels, open slack waters, emergent wetlands, riparian forests, mid-channel islands and adjacent upland forests. The historic floodplain and lowlands were located between the lower 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 3, vegetation along the Willamette River was historically predominantly comprised of bottomland forests and wetlands. Vegetation common in the area included 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 fir and red alder dominated the west hills and some parts of the east terrace. Woodland habitats were more common on the east side of the river, characterized by savannas of Oregon white oak, Pacific madrone, red alder and big leaf maple.



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.



Depictions of the extensive braiding of the Willamette River in 1888 compared with the much more channelized river in 2001.

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.

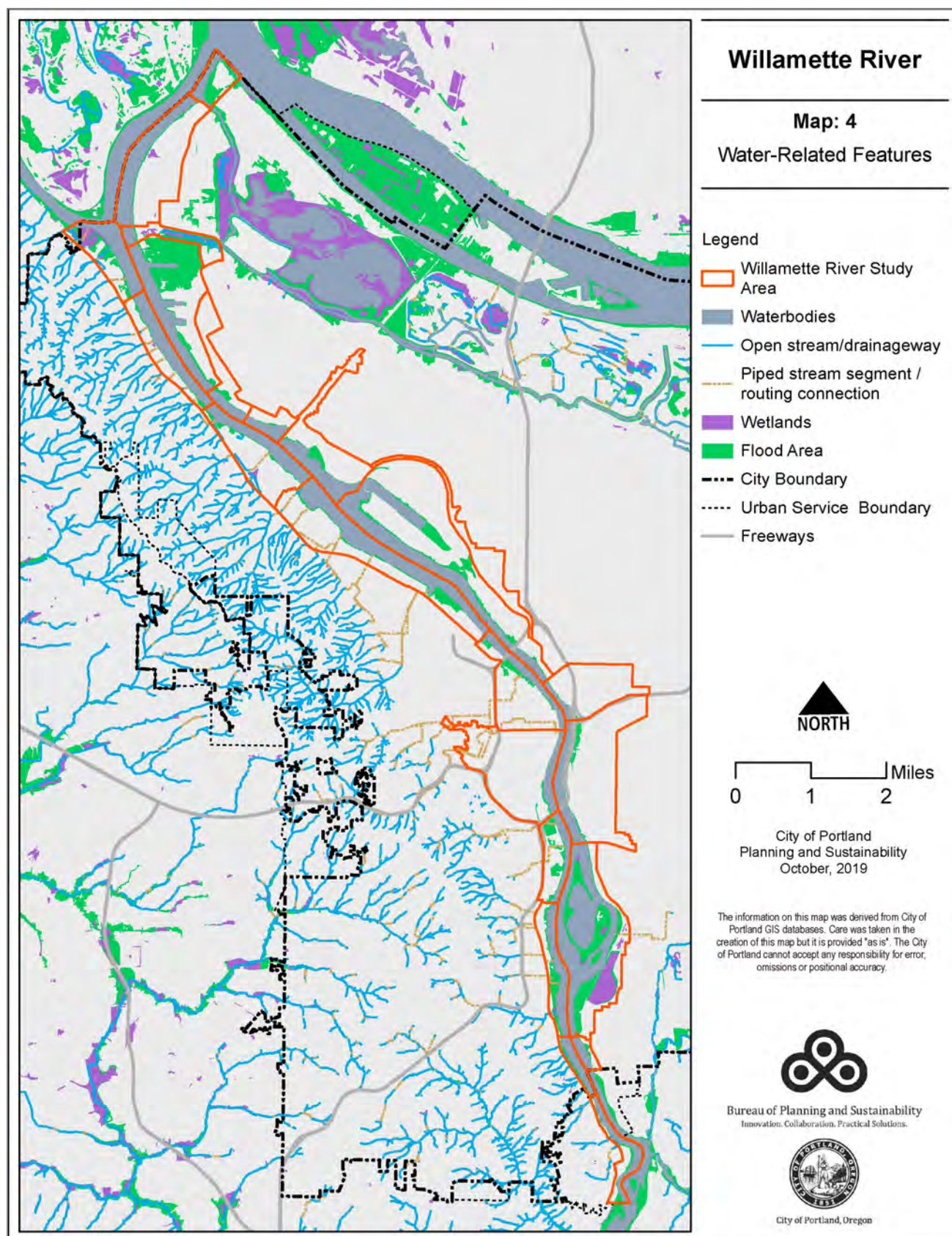
Substantial stretches of the river's banks have been hardened with riprap, seawalls and docks. Pilings, piers and other human-made structures extend out from the bank into the channel. Numerous structures related to marine cargo facilities are located along the river within the city. Shipping activities 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.

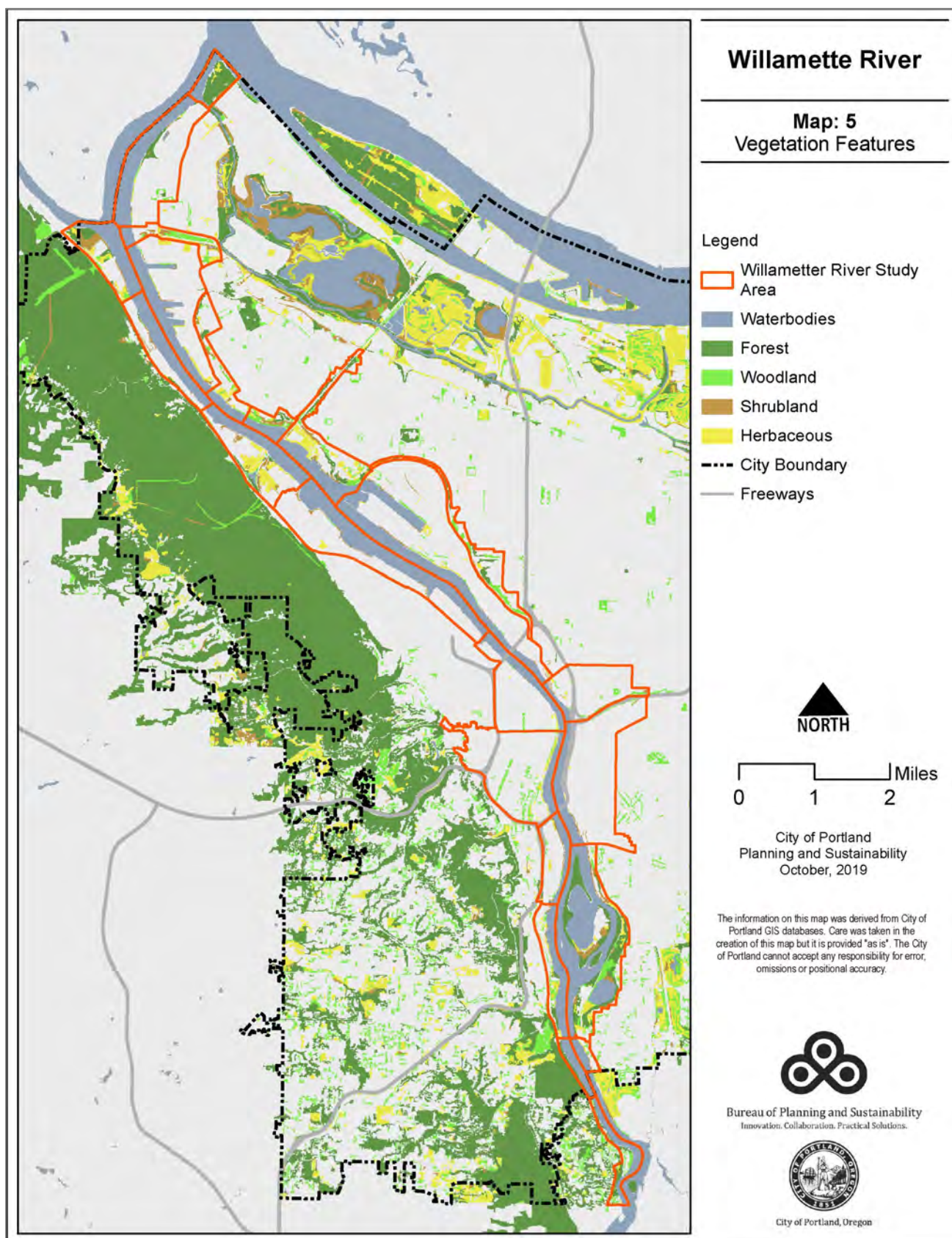
Maps 4 and 5 show the current water-related features and vegetation of the Lower Willamette River in Portland.



Photo of a barge parked in the Ross Island lagoon.

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.





Water Quality

The Lower Willamette River does meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 1). Total maximum daily loads (TMDL) for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

Table 1: Water Quality (303(d)) Listings in the Lower Willamette River and Tributaries				
Pollutant	Season	Year River was Listed for this Pollutant	River Miles¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Aquatic Weeds				
Harmful algal blooms (HAB)	Year-round	2012	14 to 15	Fish and other aquatic life Water contact recreation
Bacteria (Fecal Coliform)	Fall/Winter/Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at: <https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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 such 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. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

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 future.

5. HISTORY OF RESOURCE PROTECTION IN THE SOUTH REACH

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

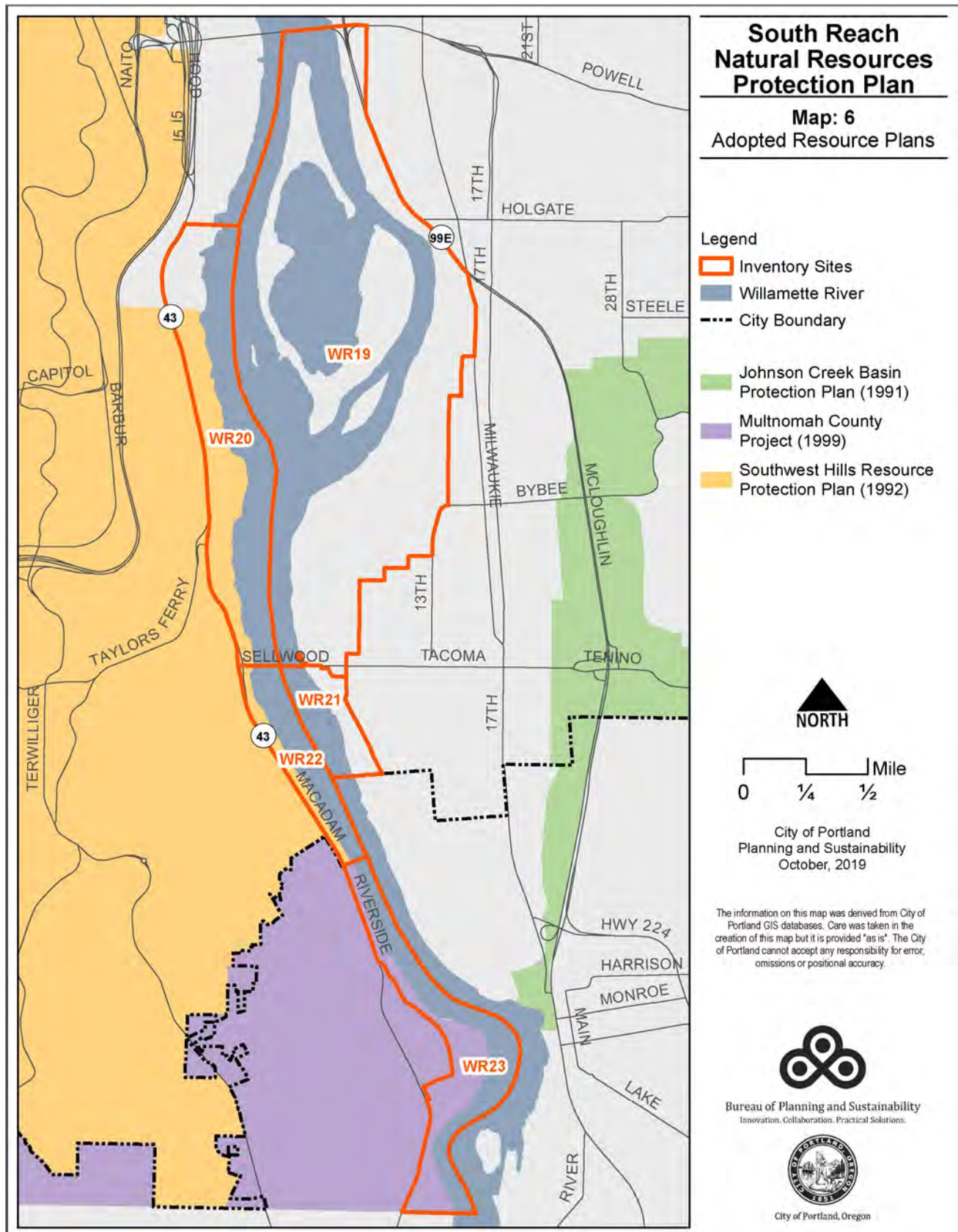
zoning, land uses, property ownership, natural resources, recreation opportunities and historic and cultural resources within the Greenway Overlay zone boundary. As the conditions and characteristics of the land adjacent to the river change over time, City staff will continue to update the *Willamette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

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 6):

- 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.



CHAPTER II. REGULATORY CONTEXT

Many federal, state, regional and local regulations and policies relate and are applicable to natural resources found in the River Plan/South Reach project area. Policies and regulations relating most directly to this Natural Resources Protection Plan are certain Oregon State Land Use Goals and portions of the Metro Urban Growth Management Functional Plan. Also, the City of Portland 2035 Comprehensive Plan is a critical guiding document for all land use and development in the city, including management of its natural resources.

A number of relevant local, state, and Federal programs, plans and policies are summarized below.

1. State, Regional and Local Land Use Planning Programs

Cities and counties in Oregon are required to comply with the State Land Use Planning Program and those jurisdictions in the Metro region are also required to comply with the Urban Growth Management Functional Plan. These two bodies of regulations set the framework for planning for natural resources in Portland. Portland complies with both programs by maintaining a Comprehensive Plan. All three programs are described below.

A. 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 and was most recently updated in June 2016.

The Willamette River South Reach is directly addressed in Goal 15: Willamette River Greenway. Other goals that also relate to natural resources are Goals 5, 6 and 7. Each of these goals is discussed in this section.

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 as well as economic and recreational uses. 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 potential 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

For all of these resources, the City maintains and updates (as necessary) the *Willamette River Greenway Inventory*, which addresses the characteristics of all three reaches of the river. The inventory portion of the SRNRPP builds on and further refines the information in the existing *Willamette River Greenway Inventory*. The *Willamette River Greenway Inventory* will be updated with new South Reach data after the completion of the *River Plan / South Reach*.

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, or ESEE, analysis) to understand how development and other uses (e.g. clearing land) impact natural resources. While local jurisdictions are not required to comply with Goal 5 within the Willamette Greenway Boundary, the SRNRPP draws on the Goal 5 conflicting use analysis to understand the trade-offs associated with protecting natural resources.

Because the Goal 15 inventory requires identification and consideration of water and land resources and flood plains, the SRNRPP can also be used to maintain comply with portions of Goal 6 and 7.

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. The methodology and evaluation of consequences utilized within this plan draws on Goal 5 guidance

Goal 6: Air, Water and Land Resources Quality – This goal requires local comprehensive plans and implementation measures “maintain and improve the quality of the air, water and land resources”, by ensuring consistency with state and federal regulations and effectively planning for and managing development and uses that may degrade these resources. Goal 6 provides guidelines for local jurisdictions, including buffering and separating those land uses which may create resource impacts. Further, the carrying capacity of the air, land and water resources should be considered in the planning process.

Goal 7: Areas Subject to Natural Hazards – Goal 7 addresses the planning and management of areas subject to natural hazards, such as flooding, landslides or wildfire. A primary focus of the guidance provided for this goal is to avoid development – both critical and non-critical facilities – in the floodplain when risk to people and property cannot be effectively mitigated. Per guidance in the goal, the Comprehensive Plan and its implementing measures should identify natural hazard risk and identify regulatory and non-regulatory strategies to address them. For flood management, the goal states that jurisdictions will be deemed in compliance by adopting local floodplain regulations that meet the minimum requirements of Federal Emergency Management Agency’s National Flood Insurance Program (NFIP). Going beyond these minimum requirements is encouraged.

B. 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 establishes a regional growth management approach 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 the SRNRPP.

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 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 many high value areas in the South Reach.

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. An update to the citywide Natural Resources Inventory was one of these key projects to be completed.

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/South Reach is referenced in the IGA.

Metro identified many of the natural resource areas addressed in this plan 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 SRNRPP study area and will, among other uses, inform City program updates affecting the management of natural resources within the South Reach.

C. 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 3.64 Urban habitat corridors. Establish a system of connected, well-functioning, and diverse habitat corridors that link habitats in Portland and the region, facilitate safe fish and wildlife access and movement through and between habitat areas, enhance the quality and connectivity of existing habitat corridors, and establish new habitat corridors in developed areas.

- Policy 7.9 Habitat and biological communities.** Improve, or support efforts to improve, fish and wildlife habitat and biological communities. Use plans and investments to enhance the diversity, quantity, and quality of habitats habitat corridors, and especially habitats that:
- Are rare or declining.
 - Support at-risk plant and animal species and communities.
 - Support recovery of species under the Endangered Species Act, and prevent new listings.
 - Provide culturally important food sources, including those associated with Native American fishing rights.
- Policy 7.19 Natural resource protection.** Protect the quantity, quality, and function of significant natural resources identified in the City’s natural resource inventory, including:
- Rivers, streams, sloughs, and drainageways.
 - Floodplains.
 - Riparian corridors.
 - Wetlands.
 - Groundwater.
 - Native and other beneficial vegetation species and communities.
 - Aquatic and terrestrial habitats, including special habitats or habitats of concern, large anchor habitats, habitat complexes and corridors, rare and declining habitats such as wetlands, native oak, bottomland hardwood forest, grassland habitat, shallow water habitat, and habitats that support special-status or at-risk plant and wildlife species.
 - Other resources identified in natural resource inventories.
- 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.

Policy 8.77 Floodplain management. Manage floodplains to protect and restore associated natural resources and functions and to minimize the risks to life and property from flooding.

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.

2. Local Environmental Regulations, Policies, Goals and Programs

There are a variety of other City of Portland regulations, policies and programs that relate either provide guidance for natural resource management or serve as mechanisms to implement the City’s natural resource goals and policies. A selection of those documents and programs are described below.

A. Portland Watershed Management Plan

The Portland Watershed Management Plan (PWMP), adopted by City Council in 2005, describes the approach that will be used to evaluate conditions in the City’s urban watersheds and implement projects to protect and improve watershed health. The approach is used by the Bureau of Environmental Services, other City bureaus, agencies, and citizens’ groups that all share a common goal to protect Portland’s natural resources, restore critical ecosystems and implement stormwater management solutions that integrate the urban area with the natural environment. Its overarching theme is to improve watershed health through new watershed friendly (more sustainable) development and redevelopment, installation of new stormwater infrastructure, maintenance and retrofitting of existing infrastructure in new ways that will improve watershed health, and extensive restoration and rehabilitation of key habitats both in-water and routine work of all City bureaus.

The Watershed Management Plan presents an integrated City response to local, state, and federal environmental requirements, providing the flexibility to respond to regulatory requirements in a manner that addresses the root causes of problems rather than the more traditional mandate-by-mandate approach that only addresses the symptoms. The Watershed Management Plan includes a description of a management system that is used to track City progress toward well-defined watershed health goals and to help the City adapt their strategies as needed to maximize effectiveness. An annual report is developed that tracks the progress toward achievement of the watershed health goals.

The Watershed Management Plan includes strategies and actions that will be implemented to achieve these goals. There are a number of related initiatives, including the River Plan and the Willamette River Natural Resources Inventory that advance the goals, strategies and actions of the Watershed Management Plan.

<http://www.portlandonline.com/bes/index.cfm?c=38965>

B. Terrestrial Ecology Enhancement Strategy (TEES)

The Portland Watershed Management Plan gave high priority to developing and integrating a terrestrial component into watershed management, which led to the development of a Terrestrial Ecology Enhancement Strategy (TEES). The purpose of the Terrestrial Ecology Enhancement Strategy (TEES) is to have a common body of information and agreed-upon priorities for conservation and restoration of terrestrial plant and animal species and habitats in Portland, within a regional and state context. TEES is designed to help achieve the watershed health goals and objectives in the PWMP.

The information assembled during the development of the TEES (updated June 2011) is available to BES watershed teams to supplement existing watershed characterizations, inform the selection and prioritization of actions, add value to projects and other actions, and determine monitoring priorities. TEES also supports and informs an array of other City programs, plans, activities, projects, and decision-making processes.

Additionally, TEES supports efforts of Metro (e.g., Nature in Neighborhoods, Intertwine and the Regional Conservation Strategy), the U.S. Fish and Wildlife Service, the Oregon Department of Fish and Wildlife (e.g., the Oregon Conservation Strategy), the Oregon Watershed Enhancement Board and the Northwest Power and Conservation Council's sub-basin planning.

The main elements of TEES include:

- Identification of plant and animal species and terrestrial habitats needing protection, conservation, and/or restoration (Special Status Species and Habitats)
- Identification of key management issues (e.g., invasive species)
- Articulation of watershed-specific objectives for terrestrial habitats and biological communities
- Identification and implementation of priorities and actions for the next 2 to 5 years, as well as identification of long-term actions
- Guidance to City bureaus and citizens for improving habitat and addressing plant and wildlife management issues
- Selection of species and habitats to be monitored over time to determine the health of biological communities in Portland's urban watersheds

<https://www.portlandoregon.gov/bes/51052>

C. Stormwater Management Manual

The Stormwater Management Manual (SWMM) is a technical document originally adopted in 1999 that outlines the City's stormwater management requirements to comply with the National Pollution Discharge Elimination System (NPDES) permit and Safe Drinking Water Act. The SWMM was recently updated 2016. The requirements defined in the manual apply to all development and redevelopment projects within the City of Portland on both private and public property. The SWMM applies to the following:

- Properties that proposed new offsite discharges or new connections to the public system; or
- Projects that develop or redevelop over 500 square feet of impervious area.

The City's approach to stormwater management emphasizes the use of vegetated surface facilities to treat and infiltrate stormwater on the property where the stormwater is created. This approach provides a number of

benefits in protecting stormwater infrastructure and improving watershed health, including pollutant reduction, volume and peak flow reduction, and groundwater recharge. If an entity cannot meet the requirement for managing stormwater onsite to the maximum extent feasible, the City may allow the entity to either construct an offsite facility or compensate the City for the future development of offsite facilities through payment of a fee. In this case, a filing of “special circumstances” must be done by the applicant, which will be reviewed and approved by the City before an alternative approach would be allowed.

The SWMM complements and supports the City’s Portland Watershed Management Plan, System Plan, Revegetation Program, Sustainable Stormwater Program, and other City standards and practices.

<https://www.portlandoregon.gov/bes/64040>

D. City of Portland Streamlining Agreement

While not a regulation in and of itself, the City of Portland has a signed agreement with federal agencies that agrees to a shared and cooperative streamlining process for federal ESA consultations. This streamlining agreement process was extended to state and local agencies in 2006 to ensure better coordination and communication between all permitting and consulting agencies.

A Streamlining Team consisting of all participating federal, state and local agencies was created along with standard operating protocols with the purpose of sharing of information needed by the agencies for their review and approval of the proposed activity. In addition to assisting City project teams, the procedures are designed to improve coordination and communication among the agencies. Through this approach, the hoped-for outcome is consistent decisions between the different agencies that occur within the same time period, whenever possible.

The streamlining agreement was originally designed to facilitate the permitting of City-sponsored projects. The process has been extended to private and other public entities whenever it is determined that the City has a strong interest or connection with the proposal.

Projects that participate in the streamlining process must present a purpose and need statement and a range of alternatives to meet the project’s goals, including looking at the practicable alternative with the least impacts to natural resources. If the selected option has unavoidable impacts to natural resources, mitigation requirements can also be identified early in the process. The Corps, DSL and BDS require that a mitigation sequence be explored which generally includes analyzing the following options: Avoidance, Minimize, Mitigate (Compensatory or In-kind functional replacement).

<https://www.portlandoregon.gov/bes/58878>

E. City of Portland Title 11, Trees

The City of Portland adopted a new tree code (Title 11, Trees) in 2011 and implementation began in early 2015. Title 11 consolidated the majority of the City’s tree rules into a cohesive framework that addresses trees on public and private property in development and nondevelopment situations. The tree code establishes a permitting system for removal of trees when not associated with a development project and allowed for programmatic permits issued by Parks and Recreation’s Urban Forestry department. These rules apply to trees

that are not addressed through the environmental overlay zone regulations (City of Portland Title 33). In general, the tree code encourages preservation of large healthy trees, ensures trees are managed to expand tree canopy in the city by requiring tree replacement when trees are removed and mandates that trees are planted as a part of new development.

<https://www.portlandoregon.gov/citycode/66002>

F. Urban Forestry Management Plan and Urban Forest Action Plan

The Urban Forestry Management Plan (UFMP), last updated in 2004, provides direction for the maintenance and improvement of Portland's urban forest and makes recommendations to enhance and improve the urban forest now and for the future. Its three main goals are:

- Protect, preserve, restore and expand Portland's urban forest;
- Develop and maintain support for the urban forest; and
- Manage the urban forest to maximize benefits for all residents.

The UFMP responds to recent environmental mandates, clarifies resource management and authority, better coordinates the roles of different agencies and bureaus and provides tree canopy targets for the city. It divides Portland's urban forest into five basic categories called Urban Land Environments (ULEs). Each ULE has particular physical characteristics and issues, provides various benefits and serves different needs. Each ULE is managed by different bureaus, agencies or individuals to achieve different results. The UFMP provides a description of each ULE, management goals, information about property owners/managers, and an analysis of the strengths, weaknesses, opportunities, threats and issues for the ULE. This is followed by specific objectives, recommended actions, and performance measures for assessing progress.

An implementing document for the UFMP, the Urban Forest Action Plan was developed by an interbureau committee and accepted by City Council in 2007 to ensure attainment of the goals and recommendations of the UFMP. The Action Plan, most recently updated in 2016, describes the full array of benefits and services that trees provide across the urban landscape. The prioritized actions are those that can be done by City of Portland bureaus. Achieving all of the UFMP's goals will require participation from private organizations, individuals, and other public agencies.

<https://www.portlandoregon.gov/parks/38306?a=184641>

<https://www.portlandoregon.gov/parks/article/658571>

3. State Environmental Regulations, Policies, and Programs

In addition to the State Land Use Planning Program, there are a number of other policies, regulations and programs that provide direction to local governments on actions that may impact natural resources within the state waterways and other habitat. Descriptions of the most relevant to the SRNRPP are provided below.

A. Oregon Department of State Lands Removal-Fill Permit

In Oregon, a state permit issued by the Department of State Lands (DSL) is required in most cases if activities involve filling or removing more than 50 cubic yards of material in waters of the state. In areas determined to be

Essential Salmonid Habitat, a State Scenic Waterway or a State compensatory mitigation site, a permit is required for any amount of fill or removal. DSL regulates all wetlands, including isolated or seasonally inundated wetlands. DSL may also regulate vegetation removal at compensatory mitigation sites.

Currently, DSL and the USACE use a joint permit application form for most applications proposing impacts to wetlands and waterways so that in many cases applicants need to prepare only one application to obtain both permits. However, all projects require separate authorizations (or permits) from DSL and the USACE, and some applications may require involvement from other federal, state or local agencies. Each agency may request information in addition to the application.

The analysis for the permit must include a purpose and need statement and each alternative must meet the purpose and need. If the alternative chosen includes unavoidable impacts to natural resources, then the analysis includes an evaluation of how impacts can be minimized and if compensatory mitigation is necessary. Compensatory mitigation means activities conducted to restore, create or enhance wetland and waterway impacts (tidal and non-tidal) to compensate for the adverse effects of the project. The ecological functions (biotic and abiotic) that are impacted by the project must be replaced. The amount of compensatory mitigation required by DSL varies depending on the functions and values impacted, temporal loss impacts, and other considerations. DSL prefers mitigation within the same watershed; payment in lieu of mitigation may be possible or by acquiring mitigation credits from a DSL approved mitigation bank.

<https://www.oregon.gov/dsl/WW/Pages/Permits.aspx>

B. National Pollutant Discharge Elimination System (NPDES)

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or human-made ditches. Industrial, municipal, and other facilities must obtain permits if their discharges go directly into surface waters. In Oregon, the NPDES permit program is administered by Oregon Department of Environmental Quality (DEQ).

The NPDES 1200-C, 1200-CN and 1200-CA general permits apply to construction activities including clearing, grading, excavation, materials or equipment staging and stockpiling that will disturb one or more acres of land. These permits also apply to construction activities that will disturb less than one acre that are part of a common plan of development or sale, if the larger common plan of development or sale will ultimately disturb one acre or more. In addition, DEQ may require registration for any other construction activity based on the potential for contribution to an excursion of a water quality standard or potential for significant contribution of pollutants to waters of the state.

DEQ issues stormwater discharge permits to industries that discharge stormwater into rivers, lakes and streams from pipes, outfalls or other point sources at a site. Based on federal regulations, NPDES permit coverage is required for industrial facilities that discharge stormwater from their industrial areas to surface waters of the state or to storm drains that discharge to surface waters. Examples of industrial activities that require a permit include manufacturing, transportation, mining, and steam electric power industries, as well as scrap yards, landfills, certain sewage treatment plants and hazardous waste management facilities.

A municipal separate storm sewer system (MS4) is a conveyance or system of conveyances (e.g., roads with drainage systems, municipal streets, catch basins, curbs, gutters, human-made channels or storm drains) owned or operated by a governmental entity that discharges to waters of the state. Sources that need to obtain an MS4 permit are classified as either "Phase I" or "Phase II". Phase I MS4s are those with populations greater than 100,000, while regulated Phase II (or "small") MS4s serve populations less than 100,000 located within Census Bureau -defined Urbanized Areas.

<https://www.oregon.gov/oda/programs/Pesticides/Water/Pages/NPDES.aspx>

<https://www.oregon.gov/deq/wq/wqpermits/Pages/Stormwater-Construction.aspx>

<https://www.oregon.gov/deq/wq/wqpermits/Pages/MS4-Permits.aspx>

C. Oregon Use of State-owned Waterways Authorization Program

The Oregon Department of State Lands (DSL) is responsible for establishing rules controlling public use of submerged and submersible land underlying state-owned waterways. State-owned waterways are navigable waterways below ordinary high water. Many uses of and structures occupying state-owned waterways require DSL's written approval. Types of uses that require authorization include but are not limited to:

1. Waterway Lease for commercial and non-commercial marina/moorages, industrial, non-marine uses, floating homes, and large (more than 2,500 square feet) non-commercial docks, and boathouses.
2. Waterway Structure Registration for non-commercial docks, and boathouses under 2,500 square feet.
3. Waterway Registration of a structure that is actively and exclusively used to accommodate ships, boats, or vessels engaged exclusively in the receipt and discharge of goods or merchandise, or in the performance of active government functions on the waterway.
4. Public Facility License for public agency owned, operated, and maintained docks/floats, boat ramps, boat landings, floating restrooms, navigational aids, and viewing structures with no, or a nominal, fee.

<https://www.oregon.gov/dsl/WW/Pages/Waterways.aspx>

D. Oregon Department of Fish and Wildlife Fish Passage Program

In Oregon, providing fish passage over man-made dams and diversions has been required since before statehood in 1859. Fish passage statutes have evolved over the past 150 years. In 2001, House Bill 3002 (HB 3002), which addresses fish passage at artificial obstructions, was signed into law.

As a state policy, upstream and downstream passage is required at all artificial obstructions in Oregon waters where migratory native fish are currently or have historically been present, except under certain clearly defined circumstances. Overwater structures, such as a dock or pier, would be evaluated under this rule.

HB 3002 requires the Oregon Department of Fish and Wildlife (ODFW) to complete and maintain a statewide inventory of artificial obstructions, which will be used to prioritize artificial barriers. The primary method for implementing this policy should be through active collaboration and cooperation between the ODFW and owners or operators of artificial obstructions. HB 3002 provides the Fish and Wildlife Commission with emergency authority to require installation of fish passage at the owner/operator's expense if a population of native migratory fish is adversely impacted.

The ODFW will review fish passage in consultation to the DSL permit. ODFW also establishes the in-water work windows.

<http://www.dfw.state.or.us/fish/passage/>
<https://www.dfw.state.or.us/fish/passage/background.asp>

E. The Oregon Conservation Strategy

The Oregon Conservation Strategy (Strategy) is a non-regulatory statewide approach to species and habitat conservation. The Strategy provides a framework for limited conservation resources, to leverage investments in a more efficient and effective manner. The Strategy was developed by the Oregon Department of Fish and Wildlife (ODFW) in conjunction with a broad base of stakeholders, including, federal, state, and local agency personnel, biologists, citizens, and elected officials. A primary goal of the Strategy is to help recover currently-listed species and prevent additional species listings. The approach taken by ODFW in the Strategy is to identify “Strategy Species” which include those most in need of conservation, and “Strategy Habitats” which benefit a broad suite of species and map Conservation Opportunity Areas (COAs) for those habitat areas where conservation activities would have the greatest benefit.

Actions recommended in the Strategy include protect and maintain priority habitats where they remain; restore and expand habitats to improve conditions and value to fish and wildlife; protect and restore river floodplain interactions; and control invasive species.

<http://www.oregonconservationstrategy.org/>

4. Federal Environmental Regulations, Policies, and Programs

Finally, there are a host of federal regulations and programs that provide critical guidance on natural resources management to local jurisdictions. The regulations and programs described below represent an important foundation for many City of Portland actions. Many of these requirements provide important direction for future action within the SRNRPP study area. ...

A. Clean Water Act (CWA) Section 404 Permit

CWA Section 404 establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the US Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA).

Permit review and issuance follow a sequential process that encourages avoidance of impacts first, followed by minimizing impacts and, finally, requiring mitigation for unavoidable impacts to the aquatic environment. This sequence is described in CWA Section 404(b)(1). Only after avoidance and minimization criteria are satisfied can the USACE consider compensatory mitigation. The USACE or EPA has the right to require the developer to mitigate any unavoidable impacts on waters of the United States as a condition of an individual 404 permit. The developer can be required to enhance, restore, or create wetlands or aquatic habitat on or near the development site. In establishing mitigation requirements, the USACE must strive to achieve a goal of no overall net loss of functional values and functions, meaning a minimum of one -for- one functional replacement with an

adequate margin of safety to reflect scientific uncertainty. Mitigation banking, using a mitigation bank that has been approved by EPA and the USACE for this purpose, is encouraged.

Common activities that take place in waters of the US and require a federal permit include:

Excavation or dredging in waters of the US

- Channel changes, realignments or relocations;
- Construction of a dock, pier, wharf, seawall, boat ramp, intake or outfall structure;
- Placement of fill, riprap or similar material;
- Placing fill to construct levees, roadways and bridges; and
- Bank or shore stabilization projects including jetties and revetments.

A federal permit is required regardless of the amount of area affected by the activity and amount of fill used. Under the CWA, the EPA and USACE follow the mitigation framework set out in the Section 404(b)(1) guidelines to evaluate applications for Section 404 dredge and fill permits.

The issuance of this permit is a federal action that triggers consultation with National Marine Fisheries Services (NMFS) under the Endangered Species Act, tribal governments, US Fish and Wildlife Services (USFWS) and historic preservation delegated to State Historic Preservation Office (SHPO). (See also Oregon Department of State Lands Removal - Fill Permit).

<http://water.epa.gov/lawsregs/guidance/wetlands/sec404.cfm>

B. Clean Water Act (CWA) Section 401 Certification

Section 401 of the federal Clean Water Act (CWA) requires that any federal license or permit to conduct an activity that may result in a discharge to waters of the United States must first receive a water quality certification from the state in which the activity will occur. In Oregon, DEQ is the agency responsible for reviewing proposed projects under this requirement.

A federal permit is required to conduct any activity, including, but not limited to, the construction or operation of facilities which may result in any discharge into navigable waters. Federal permits that are most frequently subject to Section 401 water quality certification include CWA Section 402 (NPDES) permits issued by EPA, Section 404 (dredge and fill) permits issued by the USACE, and Rivers and Harbors Act (RHA) Section 9 and 10 permits issued by the USACE.

There is no compensatory mitigation required under CWA Section 401. However, because water quality certifications are attached to the USACE permit, conditions accompanying Section 401 certifications may be included in the USACE permit conditions. These conditions generally include monitoring and reporting requirements to help the state determine whether water quality is being degraded and may halt operations if conditions are not met during permitted activities and allows for assessment of the effect of operational practices and conditions on water quality to help shape future certification decisions and conditions.

<http://water.epa.gov/lawsregs/guidance/wetlands/sec401.cfm>

C. National Environmental Policy Act (NEPA)

In enacting NEPA, Congress recognized that nearly all federal activities affect the environment in some way and mandated that before federal agencies make decisions, they must consider the effects of their actions on the quality of the human environment. Under NEPA, the Council on Environmental Quality was established to work with agencies to balance environmental, economic, and social objectives in pursuit of NEPA's goal of "productive harmony" between humans and the human environment (42 U.S.C. §4331(a)). NEPA assigns CEQ the task of ensuring that federal agencies meet their obligations under the Act. CEQ NEPA regulations require an analysis of environmental impacts and, if necessary, identification of mitigation to minimize those impacts.

CEQs regulations (40 C.F.R. Parts 1500-1508) set the standard for NEPA compliance. They also require agencies to create their own NEPA implementing procedures. These procedures must meet the CEQ standard while reflecting each agency's mandate and mission. The NEPA analysis bears similarities with other federal agencies review requirements and can be used to inform review under the Endangered Species Act and National Historic Preservation Act, Executive Orders on Environmental Justice, and other Federal, State, tribal, and local laws and regulations.

The NEPA process begins when a federal agency proposes to take an action, which may include rule making, regulations, plans, funding or specific projects (40 C.F.R. § 1508.18). For example, Department of Transportation funding for a bridge or rail improvement is an action that would trigger the NEPA process. The NEPA process is begun when an action or project is at 10% design. A concept plan, which may not be the preferred design by which permits are acquired, is not considered a 10% design and the NEPA process would not start.

Under NEPA, the agency determines whether the action is a Categorical Exclusion (CE) or if additional analysis is necessary. To perform an analysis, the applicant must identify the purpose and need of the action and alternatives that meet the purpose and needs. Through an Environmental Assessment (EA) or Environmental Impact Statement (EIS), the applicant identifies measures that will be taken to mitigate (avoid, minimize or compensate for) environmental impacts.

The EIS process includes a statement of purpose/need, identification of alternative solutions (including no action), and impacts of the preferred alternative. The Draft EIS is published for public review and comment for a minimum of 45 days. The agency must consider all substantive comments, conduct further analysis if necessary, and prepare a Final EIS, which is available for public review for 30 days. This review period must be completed before the agency makes a decision on the proposed action. The EIS process ends with the completion of a Record of Decision. The ROD explains the agency's decision, describes the alternatives the agency considered (including the environmentally preferred alternative), and discusses plans for mitigating potential environmental effects and monitoring those commitments.

<http://www.epa.gov/compliance/nepa/index.html>

D. Endangered Species Act

NOAA National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) use the Federal Endangered Species Act (ESA) to protect species including many listed species found in the Willamette River. NMFS is responsible for protecting salmon and other ocean -migrating fish, as well as marine animals. USFWS is

responsible for protecting wildlife, bird species and inland (primarily freshwater) fish, such as bull trout and coastal cutthroat trout. Currently, salmon species and trout are federally listed and present in the South Reach.

Under Section 7 of the ESA, federal agencies must use their authorities to protect listed species and habitats that are critical to their survival. Section 7 also requires federal agencies to ensure that their actions, including any actions they authorize, fund or carry out, do not jeopardize listed species or destroy or adversely modify their critical habitat.

NMFS and USFWS designate “critical habitat” for species that are listed under the ESA. “Critical habitat” is the “specific areas within the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological considerations or protection.” NMFS has designated critical habitat for most of their species that are listed under the ESA that may be found in the South Reach. For several species, it extends 300’ from the top of bank, for others to top of bank.

Section 7 requires all federal agencies, including the US Army Corps of Engineers (USACE), to assess whether federally listed threatened or endangered species and/or critical habitat may be affected by a project under their jurisdiction. The USACE requires the applicant to prepare a Biological Assessment to evaluate if such an effect is possible, and if it is, are required to consult with USFWS and/or NMFS before approving a permit that might affect species in these ways. This process is called “consultation”. This serves as consultation for the Magnuson -Stevens Act on Essential Fish Habitat (see below).

If no impacts on federally listed threatened or endangered species and/or critical habitat are found to be associated with the proposed project, the USACE will be able to issue a permit without consultation. If there will be adverse effects to listed species or critical habitat, consultation with NMFS is required. NMFS evaluates the project as proposed for its impacts to ESA listed species. If NMFS determines that the project will not result in jeopardy to the species it will issue an “Incidental Take Statement” that includes reasonable and prudent measures with terms and conditions to minimize incidental take. If NMFS finds that the project will result in jeopardy to the species it will provide a “reasonable and prudent alternative” that would not result in jeopardy.

If the project design and implementation plan are deemed adequate, the USACE issue a permit to the applicant. The permit may include conditions to avoid, minimize, and compensate for expected impacts of the project. Conditions are designed to protect water quality, fish and wildlife and their habitats, and adjacent properties.

Section 9 of the ESA states that no one may “take” an animal that is listed as endangered. “Take” includes the harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capture, or collection of any threatened or endangered species. “Harm” may include habitat modification that results in the death or injury of a listed species. This is referred to as a “take prohibition”. For species listed as threatened, Section 4(d) of the ESA (referred to as the “4(d) rules”) requires NMFS to issue rules that citizens, organizations and governments must follow in order to protect the species. The rules may include any or all of the general take prohibitions that apply to endangered species. By regulation, NMFS applies take prohibitions to all threatened species (except plants) at the time of listing or later. The ESA provides some exceptions to general take prohibitions and 4(d) rules, and under section 10 landowners can obtain permits for work that incidentally affects listed species (Incidental Take Permit). These permits can only be issued for:

- Scientific work;
- Projects designed to enhance the survival of the species; or
- Activities that may only incrementally take or harm species during the course of the work.

Incidental Take Permits require development of a Habitat Conservation Plan (HCP) that specifies how impacts to a listed species and its habitat will be minimized. In issuing Incidental Take Permits, USFWS and NMFS must comply with NEPA, as well as state and local environmental laws. For these reasons, HCPs also require an Environmental Assessment or Environmental Impact Statement for the proposed activity.

<https://www.fisheries.noaa.gov/topic/laws-policies#endangered-species-act>

E. Magnuson-Stevens Act – Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act is the federal law that governs U.S. marine fisheries management. In 1996 Congress added new habitat conservation provisions to that act in recognition of the importance of fish habitat to productivity and sustainability of U.S. marine fisheries. The re-named Magnuson-Stevens Act mandated identification of Essential Fish Habitat for managed species. The act also requires measures to conserve and enhance the habitat needed by fish to carry out their life cycles. Essential Fish Habitat (EFH) for the Pacific salmon means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The definition for EFH includes currently viable aquatic habitat and most of the habitat historically accessible to Pacific Salmon.

The federal agency taking an action can use existing processes to support EFH consultations. For example, as part of ESA Section 7, NMFS and USFWS consult on the conservation of species and assist the agency taking an action to meet their responsibilities under Section 7. This serves as consultation for the Magnuson-Stevens Act on EFH. NMFS/USFWS would evaluate the effects of the action, determine jeopardy and adverse habitat modification and estimate incidental take and issues a take permit if necessary.

<https://www.fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat>

F. Federal Emergency Management Agency (FEMA) Floodplain Management

The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP), which includes regulatory components for floodplain management, floodplain mapping and flood insurance. NFIP floodplain management regulations (44 CFR 60) are implemented through local jurisdictions. The City of Portland's local floodplain ordinance is found in Portland City Code 24.50, Flood Hazard Areas. FEMA identifies the nation's floodplains and publishes Flood Insurance Rate Maps (FIRMs). In the FIRM, FEMA maps the area that has a one percent chance of being flooded in any given year. This establishes the 100-year floodplain, which is the standard used by the NFIP and most federal and state agencies for floodplain management and to determine the need for flood insurance. FEMA most recently updated the FIRMs for the Willamette River in 2009.

Current regulatory requirements for development in the 100-year floodplain include, but are not limited to, the following:

- Development within the Floodway is prohibited unless hydraulic engineering analysis demonstrates the development will result in no increase in 100-year flood elevations.
- Floodway is the channel of the watercourse and that portion of the adjacent floodplain that must remain open for passage of the 100-year flood without significantly increasing flood elevations. Floodway boundaries are depicted on the FIRMs.
- Occupied or inhabited structures must be built at least one foot above the 100-year flood elevation. This is often achieved by placing fill within the 100-year floodplain to raise the ground elevation and allow development in that area. Other site improvements such as parking or exterior storage, may be below the base flood elevation.
- Fill material placed below the 100-year flood elevation must be balanced with an equal or greater volume of excavation below the 100-year flood elevation such that the flood storage capacity of the floodplain is maintained; this is often referred to as flood storage compensation or “balanced cut and fill”. (See also Metro Title 3.)

In 2016 the National Marine Fisheries Service (NMFS) issued a Biological Opinion on FEMA’s National Flood Insurance Program (NFIP) in Oregon. NMFS and the US Fish and Wildlife Service are the agencies responsible for ensuring that federal actions or programs, such as the NFIP, comply with the Endangered Species Act (ESA). A “Biological Opinion” is the report the agencies issue after they have completed formal consultation of a program under Section 7 of ESA.

In the Biological Opinion, NMFS determined that implementation of the NFIP in Oregon violates the ESA by jeopardizing the health and habitat of 16 different protected salmon and steelhead species. Jeopardy occurs when an action is reasonably expected, directly or indirectly, to diminish a species’ numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced. NMFS directed FEMA to implement changes to the NFIP to stop the loss of natural floodplain functions and salmon and steelhead habitat in Oregon floodplains. NMFS provided recommendations for both interim and long-term steps FEMA could take to avoid jeopardy. Changes to the NFIP will be both regulatory (FEMA will need to update site development standards), and map-based (FEMA will re-examine and update mapping rules and work on new maps).

FEMA is developing guidance on how local jurisdiction actions must be modified to meet the requirements of the Biological Opinion. The date for the release of this guidance has not yet been determined.

Once finalized, Oregon jurisdictions that participate in the NFIP, including Portland, will need to implement an updated local compliance plan, including updated development regulations, to maintain access to federally-backed flood insurance through the NFIP.

<https://www.fema.gov/national-flood-insurance-program>

<https://www.oregon.gov/lcd/NH/Pages/BiOp.aspx>

G. Rivers and Harbors Act of 1899

The Rivers and Harbors Act addresses projects and activities in navigable waters and harbor and river improvements. The USACE administers Section 9 and Section 10 of the Rivers and Harbors Act.

Section 9 of the Rivers and Harbors Act (33 U.S.C. 401) prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the USACE. Section 9 also pertains to bridges and causeways; however, the authority of the USACE is transferred to the Secretary of Transportation under the Department of Transportation Act.

Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been recommended and authorized by USACE. This work includes excavation or fill, which could contain contaminated sediments. (See also NPDES permits.)

<https://www.fws.gov/laws/lawsdigest/riv1899.html>

H. The Migratory Bird Treaty Act and the Urban Conservation Treaty for Migratory Birds Program

The Migratory Bird Treaty Act (MBTA), passed in 1918, established the United States' commitment to implement four bilateral treaties, or conventions for the protection of a shared migratory bird resource. The MBTA protects over 800 species of birds. Over 200 migratory bird species migrate through Portland every year and Portland provides critical resting, feeding and nesting habitat for numerous types of migratory and resident birds.

The MBTA uses very broad language to prohibit at any time or in any manner the pursuit, hunting, taking, capturing or killing of any migratory bird. It does not have an incidental take permit or its equivalent. The unauthorized killing of any of approximately 800 identified migratory birds constitutes a violation of the MBTA. The MBTA has no specific mitigation requirements. It is enforced by USFWS, although its enforcement is viewed as somewhat selective because of MBTA's expansive scope. The MBTA's applicability to habitat modification and destruction is unclear; the definition of "take" in the MBTA does not include "harm" or "harass", unlike the ESA. Due diligence with MBTA requirements is typically done by providing baseline studies and preconstruction surveys that document site characteristics and development of a protection plan for species known to be present.

Portland joined four other U.S. cities in 2003 in establishing a local commitment to help migratory birds and enhance their habitats within urban environments by participating in the Urban Conservation Treaty for Migratory Birds program. USFWS selected Portland as a pilot project city due to its location along the Pacific Flyway. The program was designed by USFWS in 1999 to help municipal governments conserve migratory birds that nest or fly through their cities. The Treaty sponsors public education and outreach projects to help increase public understanding of the importance of migratory bird conservation. It also helps finance the creation and restoration of city parks and greenways. Portland has developed guidelines for protecting migratory birds during construction activities.

<https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php>

<https://www.fws.gov/birds/grants/urban-bird-treaty/urban-bird-treaty-portland.php>

CHAPTER III. INVENTORY 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. The following chapter describes the key information that makes up this inventory and how the information was developed.

1. 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 B: 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.

- **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.

2. 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 2 on page 53). More detail regarding the inventory approach and methodology, including citations, can be found in Appendix B: 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.
- 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.⁴
 - 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.

⁴ Sparse vegetation is defined as areas with a predominance of boulders, gravel, cobble, talus, consolidated rock and/or soil with unconsolidated, low-structure vegetation.

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 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 B: *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 2 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 B: *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.

TABLE 2. RIPARIAN CORRIDOR GIS MODEL CRITERIA

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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		

Riparian Function	Landscape Feature	Features Assigned a Primary Score	Footnotes	Features Assigned a Secondary Score	Footnotes
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 3).

Table 3: Riparian Corridor Aggregated Relative Ranking Formula		
Riparian Corridor Relative Rank	Ranking Formula	
	Primary Functions	Secondary Functions
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.⁵

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 4 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.⁶ 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,

⁵ Hardened, non-vegetated river banks include seawalls, pilings and non-vegetated riprap.

⁶ 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.

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 B: *City of Portland Natural Resource Inventory Update: Project Report*.

Table 4: Wildlife Habitat GIS Model Criteria		
High Value (3 points)	Medium Value (2 points)	Low Value (1 point)
Habitat Patch Size¹		
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.
Interior Habitat Area²		
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.
Proximity to Other Patches³		
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.
Proximity to Water⁴		
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>.

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 5).

Table 5: Wildlife Habitat Aggregated Relative Ranking Formula	
Wildlife Habitat Relative Rank	Ranking Formula
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 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 C.

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 of 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.

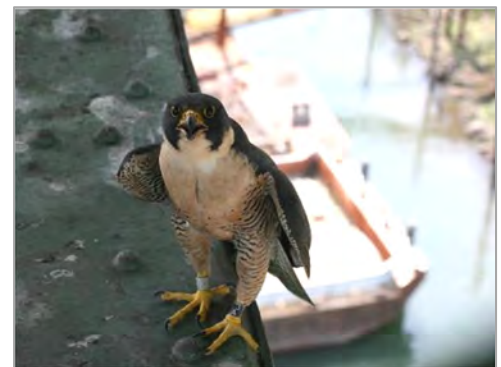


Photo by Bob Sallinger

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 D.

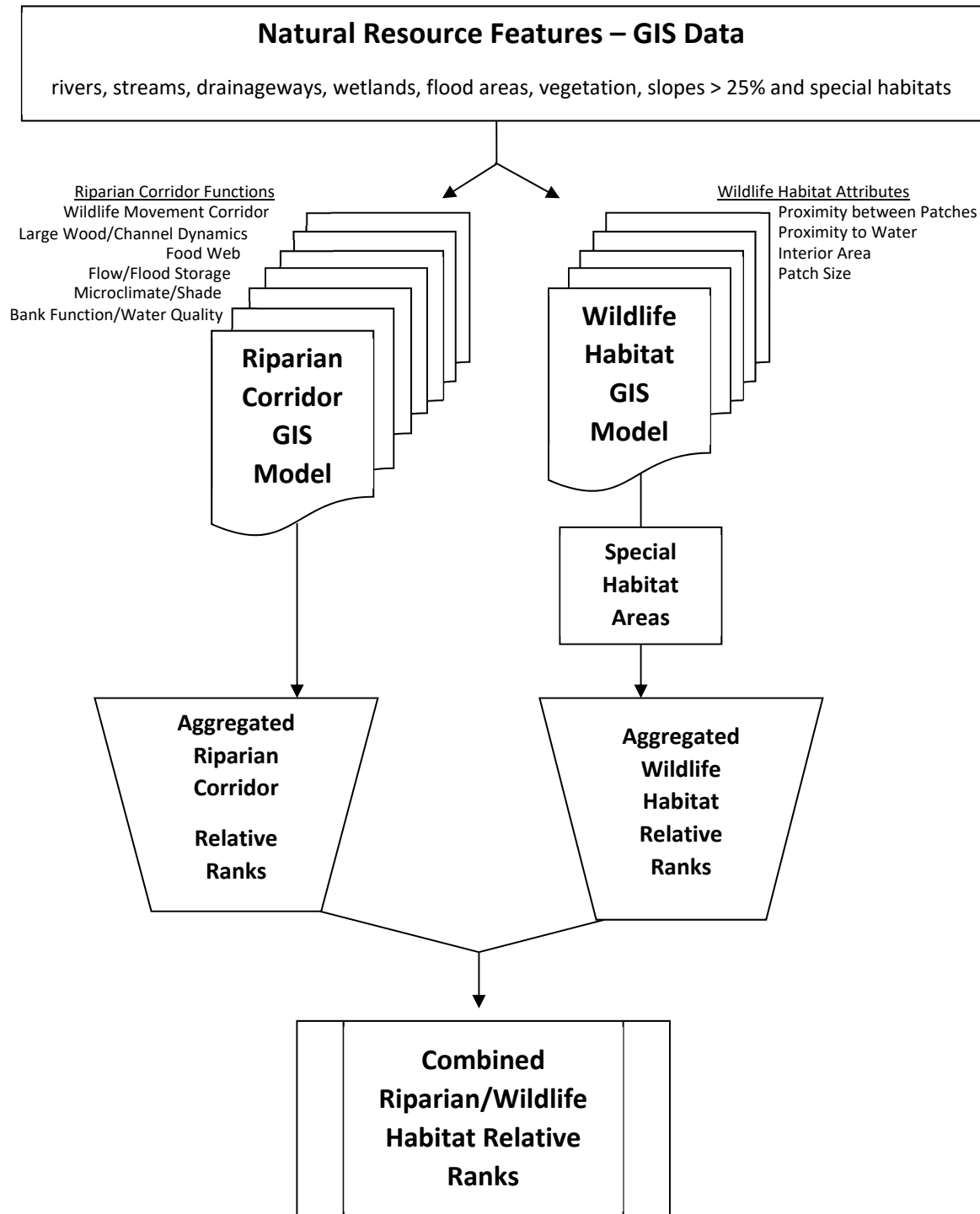
4. Produced Combined Relative Ranks and Maps.

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 2: Natural Resources Inventory GIS Model Flow Diagram

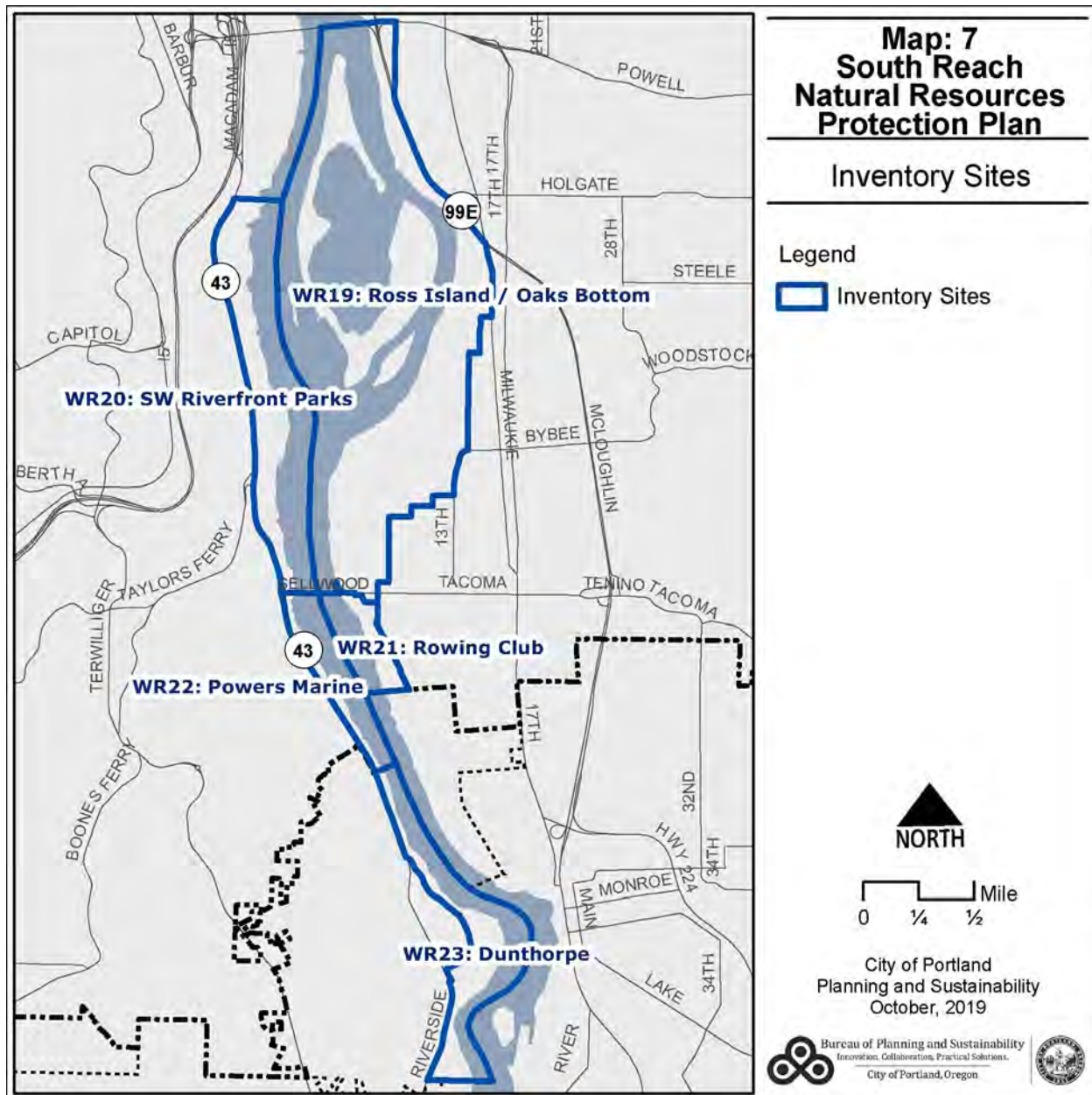


3. Work Conducted for the South Reach Natural Resources Inventory

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.

A. Delineation of Inventory Sites

The City has delineated five inventory sites for the SRNRI (see Map 7). 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.



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.

B. 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

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

C. Incorporating Information from the Characterization of Current and Historical Habitat and Biological Conditions in the Lower Willamette River through Portland (Bureau of Environmental Services, 2016)

The Bureau of Environmental Services (BES) plans to develop an ecological characterization of the Lower Willamette River in Portland that will be organized around the four *Portland Watershed Management Plan* (2005) goal, which includes hydrology, habitat, water quality and biological communities. For the *Central City 2035 Plan*, a memo was prepared to summarize the early findings of the habitat and biological communities sections. The characterization will address all three Willamette River reaches. Much of the information gathered thus far was used in the SRNRPP inventory. Information is incorporated into the inventory as appropriate.

<https://www.portlandoregon.gov/bps/article/581166>

CHAPTER IV. ANALYSIS OF PROTECTION OPTIONS AND GENERAL RECOMMENDATIONS

This chapter evaluates applying various levels of protection to natural resources in the South Reach study area. The overall purpose is to identify and assess the trade-offs associated with the different levels of natural resources protection and management to inform the protection decisions for each of the South Reach NRPP inventory sites (see Chapter V).

1. Analysis Approach

This general analysis of different protection options conducted for South Reach natural resources is qualitative and relies on existing data and information. The analysis is completed in three steps:

Step 1 – Identifying conflicting uses. Conflicting uses are actions that are allowed within the NRPP study area which could result in negative impacts on natural resources. For example, clearing and grading a site in preparation for development of a structure is a use of the land that would conflict with, or have negative impacts on, natural resources.

Step 2 – Understanding consequences of the protection options. Any choice to protect or not protect the natural resources may have consequences for the conflicting uses and/or the resources themselves. For example, prohibiting development within the riparian area would be expected to result in positive consequences for the resources but may also have negative consequences for development, including reducing job capacity or housing options. Relevant environmental, economic and social consequences are described for each topic below. Each section has a general analysis of the consequences followed by a summary. The summaries are balanced to make a general recommendation.

Step 3 – Making general recommendations. Based on the analysis of conflicting uses and the consequences of natural resource protection options, recommendations are made for broad categories of natural resources. These general recommendations are intended to set the policy direction for inventory site-specific decisions regarding the protection of natural resources. The site-specific decisions are presented in Chapter V, Results.

2. Conflicting Uses

Within the SRNRPP study area there are uses, such as development of structures, that if allowed would negatively impact natural resources. These are called conflicting uses. Conflicting uses are identified by evaluating what is allowed outright or conditionally by the base zones applied to South Reach properties. Below are descriptions of the conflicting uses allowed in the South Reach and how those uses may negatively impact natural resources.

A. Common Impacts of Conflicting Uses

Development and disturbance activities can adversely affect natural resources occurring within each of the City's base zones; however, the degree or intensity of the impacts may vary depending on the intensity of the land

use, the form, layout or design of the development, construction protocols or ongoing operation and maintenance activities. Below is a description of activities associated with the conflicting uses, and their related impacts on natural resources.

The following impacts are site specific and cumulative with respect to other impacts and conditions in the watershed.

Clearing vegetation

Rainwater is intercepted and taken up by vegetation. The amount of rainwater interception and up-take depends on the type and character of the vegetation. For example, native vegetation in Portland is generally better at managing stormwater than non-native or turf species. This function is often impaired when vegetation is cleared, resulting in increased surface stormwater runoff. In many cases this increase will result in higher runoff volume and flows into receiving water bodies following storm events. Increased streamflow volume and rate can cause bank erosion, undercutting, slumping, and flooding. Vegetation also filters surface stormwater flows by removing pollutants and sediment. Vegetation removal can affect these functions in streams that are far from the development site as stormwater is often piped great distances within the city.

Tree canopy and associated understory vegetation create shade and local microclimate effects that cool air and water and maintain humidity and soil moisture. Trees and vegetation also help capture carbon dioxide; carbon dioxide is a contributing factor to climate change. All of these functions are affected when vegetation is removed.

Clearing vegetation also removes important structural features of the forest, such as the presence of multiple canopy layers, snags and downed logs, large trees, and root systems that hold soils in place. This can result in soil erosion and impaired habitat for native wildlife. Vegetation removal reduces food, nesting opportunities, cover and perching and roosting opportunities for wildlife. Removing streamside or shoreline vegetation also eliminates sources of leaf litter, which provide food and nutrients for aquatic organisms, and woody debris, which provides river habitat structure and food resources for fish.

Wildlife affected by vegetation removal includes mammals, birds, reptiles, amphibians, fish and insects. Removal of vegetation can fragment riparian and upland wildlife movement corridors, isolate remaining vegetation patches and limit wildlife access to water. These impacts impede wildlife migration and can limit recruitment from other areas, making wildlife populations more vulnerable to disease, predation and extirpation.

Some native plant communities have been declining in the Portland area due to clearing and grading for development and the use of ornamental vegetation in landscaping (not replacing cleared vegetation with similar native species). Certain plant communities, such as native bottomland hardwood forests and native oak stands, require specific soil, water and sun exposure to survive and are slow growing, taking many years to become established. These communities still exist including bottomland forest along the Lower Willamette River. Removal not only reduces habitat functions as discussed previously, but also contributes to the decline in these unique vegetation types and potentially extirpation within the city.

Grading, excavation, filling and soil compaction

Grading activities and soil compaction can reduce the capacity of soil to support vegetation by disturbing the soil structure, accelerating erosion and decreasing soil fertility, microorganisms, seeds and rootstocks. Soil porosity and stormwater infiltration can be reduced by grading, excavating, filling and soil compaction. This in turn can reduce groundwater recharge and in-stream summer and fall low flows, which adversely affects aquatic species.

Adding impervious surfaces (e.g. buildings, parking areas, roads, sidewalks, driveways)

Impervious surfaces alter the hydrologic cycle by preventing natural stormwater infiltration into the ground and concentrating surface flow. This results in increased stormwater runoff and decreased groundwater recharge. Increased stormwater runoff can result in increased volume and flows into receiving water bodies (see vegetation clearing). Decreased groundwater recharge can reduce in-stream summer low flows (see grading, excavation, filling and soil compaction). Impervious surfaces also contribute to urban heat island effect, which can increase localized temperatures and affect air quality. Increased impervious surfaces can also cause wildlife habitat fragmentation and create hazards or barriers to wildlife movement (see vegetation clearing).

Modifying rivers and floodplains (e.g. filling, bank armoring)

Altering the natural configuration, geomorphology, and structure of river banks and the floodplain may result in:

- increased in-stream flow velocity, which can cause bank erosion, undercutting and slumping on-site or at upstream or downstream locations;
- a decrease in aquatic habitat area and simplified remaining habitat when side channels, wetlands and oxbows are disconnected from the main river channel;
- a decrease in areas of wood deposition where side channels and wetlands are filled in;
- reduced flood storage capacity and other benefits associated with active flood areas (e.g., nutrient transport, off-channel habitat);
- reduction in vegetation that attenuates flows and provides important fish habitat during flood events

Generating pollution

Oil, gas, tar, antifreeze, dissolved metals, pesticides, herbicides, fertilizers and other contaminants degrade habitat and water quality. These non-point source pollutants are transported to water bodies in stormwater via runoff from streets, driveways, parking lots, and buildings. Dirt and sediments from eroded areas or deposited from vehicles can also be transported via stormwater to water bodies and degrade aquatic habitat. Pesticides, herbicides and fertilizers used in landscaping can pollute ground and surface waters, degrade habitat and harm fish and wildlife.

Landscaping with non-native and/or invasive vegetation (e.g., ornamental trees)

The removal of native vegetation and establishment of cultivated landscapes can change or reduce food, cover and nesting opportunities for native wildlife. Manicured landscaped areas generally lack complex vertical structure – little, if any, multi-layered canopy, large trees, snags, thick understory vegetation, and downed logs are retained in landscaped areas. The reduction in vertical structure impairs wildlife habitat and alters microclimate effects and hydrology. Some non-native plants used in landscaping are invasive (e.g. ivy, morning glory, holly and laurel) and can out-compete native plants, reducing biodiversity. Non-native landscapes may also require irrigation and may be treated with chemical fertilizers and pesticides, which can run-off into local waterways and wetlands or may be ingested by wildlife.

Building fences and other wildlife barriers

Barriers to wildlife movement can include buildings, roads, rail lines, fences and other human-made features. These barriers fragment connectivity between wildlife habitats and reduce the ability of native wildlife species to thrive (see clearing vegetation). Some barriers, such as roads and rail lines, may create hazards that increase the risk of wildlife mortality.

Other impacts: pets, light, noise, litter, etc.

Other human activities create noise and light impacts that may disrupt the competition, communication, reproduction, and predation habits of wildlife. For example, night-time lighting can interrupt the navigation of migrating birds and bats. Loud noises and increased levels of ambient noise have been shown to influence bird behavior, in some cases resulting in changes in behavior to avoid or overcome the din. Examples of responses include changing the frequency of calls, adjusting timing of singing during the day, and others

Domestic pets can also significantly impact wildlife and their habitats. Domestic pets may kill or injure native wildlife or compete for limited space. For example, allowing dogs to run freely in a grassland area can disrupt grassland-associated wildlife that build nests on the ground. Domestic pet waste, litter and garbage can degrade natural resources, including damaging soil and water quality.

B. Impacts of Specific Conflicting Uses

The previous section outlines the impacts generally associated with conflicting uses like clearing and grading. This section evaluates the impacts associated with specific land uses, such as residential or industrial development.

Commercial, Employment and Residential Uses

Retail office, commercial parking lots, event facilities, daycare facilities, churches, apartments, condos and single-dwelling housing are examples of uses that are allowed in the South Reach. Development of new uses would involve vegetation clearing, grading, filling and soil compaction, as well as the addition of impervious surfaces and landscaping with non-native plants, with associated impacts on natural resources.

The majority of existing land uses in the South Reach are recreation, natural areas, open space, or residential uses (representing over 60 percent of the land area). Approximately 30 percent of the land is commercial or industrial. Base zoning in the South Reach generally falls into four categories: single-dwelling residential, multi-dwelling residential, commercial/mixed use, and open space. All single-dwelling and most multi-dwelling residential uses are required to setback structures from the property line and incorporate landscaping around them. Existing overlay zoning requirements in the South Reach aim to ensure that vegetation is preserved and expanded within the river setback and any loss of habitat features and functions are mitigated. However, in many cases adjacent property owners remove or significantly cut back riverbank vegetation as a part of general property maintenance and to maintain views of the river, in violation of overlay zoning requirements (see vegetation clearing above).

Industrial Uses

Industrial uses have similar negative impacts as other uses, including vegetation clearing, grading, filling and soil compaction, impervious surfaces and landscaping with non-native plants.

Some industrial activities require the use of water in the manufacturing processes (e.g. cooling equipment) and draw substantial amounts of water from wells and public water sources. The resulting effluent, which is typically warm, may be discharged to receiving waters, such as a river, and influence in-water temperature. Cool water temperature is a fundamental requirement for many native aquatic species in this region, particularly federal Endangered Species Act-listed fishes. Industries that discharge effluent into water bodies are generally required to obtain a discharge permit through the Oregon Department of Environmental Quality.

Industrial areas can contribute high quantities of heavy metals and other toxic material to the soil, water and air are regulated to manage the impacts. In addition, the use, storage and transport of hazardous materials, waste storage and recycling and similar activities often occurs in industrial areas and can require special permitting.

Approximately 19 percent of the land area in the SRNRPP project area is industrial. Ross Island Sand and Gravel owns the large majority of that area, with on-going aggregate processing on Hardtack Island and a headquarters facility with a large parking area on the east side of the river along SE McLoughlin Blvd.

Parks and Natural Areas

Impacts associated with parks and natural areas can vary significantly depending on the types of structures and uses allowed in the area. Impacts associated with active park uses are, in some ways, similar to residential or commercial development. For example, sports fields generally require significant grading and vegetation management. Landscaping with non-native plants and use of irrigation, herbicides, pesticides and fertilizers in developed parks can have a detrimental effect on natural resources. Through the use of an Integrated Pest Management Program, Portland Parks and Recreation reduces the application of herbicides, pesticides and fertilizers to minimize the impacts of park management. In recognition of that management, Portland Parks and Recreation activities are Salmon-Safe certified, meeting the organization's robust park standards. Areas used for large-scale events often experience significant soil compaction, resulting in areas that function similar to impervious surfaces.

Natural areas have a limited amount of disturbance when compared with other urban uses. However, natural areas can be developed with formal trails and other supporting uses. Trails can create different levels of impact on natural resources depending on trail design and location. An example of a trail-related impact is fragmenting habitats and creating opportunities for invasive plant intrusion into a habitat area. Some natural areas may have nearby parking areas to improve access. These impervious surfaces may result in increased stormwater runoff, potentially into the natural area itself.

It is noted that Portland Parks and Recreation works to minimize the impact of trail users on natural areas through a variety of techniques, including utilizing narrow, soft surface trails, ensuring stormwater is managed per the City's stormwater manual and others. The City's main goal for the management of natural areas is to protect, enhance and sustain native vegetation and wildlife life and then to have compatible, sustainable recreation.

Basic Utilities

Basic utilities are infrastructure services such as water and sewer pump stations, electrical substations, and power line corridors that need to be located in or near areas where the utility service is provided. Construction and maintenance of utilities can have negative impacts on natural resources. Corridors cleared of vegetation can

increase wind and light penetration into adjacent habitat areas and can provide opportunities for intrusion of invasive, non-native plant species. Construction of basic utility facilities often fragments wildlife habitat. Operation of existing facilities has few adverse impacts on natural resources, except in the case of overhead electrical lines, which must be cleared of high structure vegetation.

Mining

Mining is allowed as a conditional use in the Open Space (OS) base zone and is prohibited in all other zones. Mining has the most severe environmental impacts of all uses allowed in the OS zone as it generally eliminates all natural resources from the area being mined and often results in long-term water quality degradation. Once the mining operation is closed, enhancement of soil and vegetation is possible, but natural resources often cannot be fully restored. Mining activities are not expected to occur in any of the properties zoned OS in the South Reach.

Radio and Television Broadcast Facilities

Powerful and larger radio, television and cell phone broadcast facilities are allowed in all zones within the City, subject to limitations or as conditional uses. The impacts of these facilities are general minimal as compared to other uses, except open space. Some facility types can pose hazards to migratory birds. During bad weather birds fly lower and may be disoriented by the lights of the towers and may run into towers or guy wires. There may be a visual impact of these broadcast facilities from the surrounding area. Most low powered transmitters, such as radio transceivers, navigation systems and citizen band radios, are allowed in the South Reach.

Rail Lines and Utility Corridors

Construction of rail lines often requires substantial quantities of excavation and fill to meet the 0-3 percent slope standards. Generally, additional grading results in natural resource disturbance and degradation of soil, vegetation and wildlife habitat. Most rail corridors are maintained by extensive chemical vegetation treatment with a potential for ground and surface water impacts. Rail corridors can also create wildlife hazards or barriers to wildlife movement.

Rail and utility corridors can pose additional risk of wildfire. Rail lines can cause sparks that can ignite dry vegetation. Utility corridors typically must be kept clear of tall vegetation that could harm overhead facilities. Topping or removal of trees is a common practice in utility corridors. Topped trees are more susceptible to disease and are less inhabitable by wildlife.

The South Reach contains existing rail right-of-way on both the west and east sides of the river. The westside right-of-way serves the Willamette Shore Trolley, which runs on weekends from May to October. On the eastside, the former Portland Traction Company's freight railroad still exists and is used for limited purposes throughout the year, including short locomotive trips from the Oregon Rail Heritage Center to Oaks Amusement Park.

Other Land Use and Enabling Procedures

There are certain allowed uses and enabling procedures that are not assigned to a single category by the City zoning code. These include infrastructure, nonconforming situations, land divisions, partitions and property line adjustments.

Infrastructure

Infrastructure uses are accessory to urban development and include roads, water, sewer, electric, television lines and other public and private utilities not described by the zoning code category “basic utilities.”

Infrastructure is allowed in all city zones. Some of these uses are regulated by city public works and building codes. The uses generally have similar impacts as other development activities like vegetation clearing, soil grading, piping streams, etc.

Land Divisions, Partitions and Property Line Adjustments

These are procedures that establish lots or relocate property lines within a zone. While the act of adjusting or creating lot lines does not directly impact resources, the new or modified lots may allow more conflicting uses or a greater intensity of development than the original lots. Often the outcome of adjusting lot lines or creating lots is to increase development opportunities thus increasing impacts on natural resources.

3. Environmental Consequences

This portion of the analysis summarizes the environmental consequences of protecting natural resource areas. The natural environment in urban areas is altered and disturbed by human activities. However, human welfare depends in part on vital ecosystem services provided by natural resources such as fresh air, clean water, slope stability, food supply, shade, and access to nature. Fish and wildlife also depend on having adequate quantity and quality of habitat, especially in urban areas where habitat is limited.

A. Environmental Analysis

Natural resources provide a multitude of services to surrounding development and society as a whole; these are called ecosystem services. Examples of ecosystem services include air purification, maintenance of water quality and quantity, flood storage, cooling, aesthetics, screening and buffering, and employee benefits such as opportunities for recreation and exercise. Some of these services, when displaced by development, must be replaced using infrastructure. For example, when a site is converted from a natural area to a parking lot, the hydrologic and water quality functions provided by the natural area must be replaced in the form of stormwater management and/or landscaping. Another example is flood storage. When the floodplain is filled to allow for development, the change in hydrology can increase the risk of flooding off-site and may require mitigation to create additional flood storage elsewhere. Additionally, floodplain development can reduce habitat available to Federally-designated Endangered or Threatened fish species, including salmon and steelhead, or at-risk species, such as Pacific lamprey.

Development can have many negative impacts on natural resources. Development frequently reduces the overall size and complexity of existing natural resources features. Often mitigation for these impacts is required through federal, state or local regulations; however, mitigation actions rarely can replace all impacted features or functions in full (ECONorthwest, 2012).

Development also has negative impacts to adjacent remaining habitat. Reducing the size of the habitat increases the edge to interior habitat ratio. As a result, noise, light, dust and vibration from nearby development can penetrate into the edge of the remaining habitat. Reducing the riparian area around a river, stream or wetland has negative impacts, such as increased runoff volumes and velocity coming into the connected water body. Impacts from actions like construction can last long after the action is completed. Physical pollution, such as

chronic noise, light and vibration, have negative environmental impacts, including significant changes in migration, foraging, predator-avoidance behaviors, reproductive success, and community structure of many fish and wildlife species (Barber et.al., 2010). Light pollution can affect salmon migration (Tabor et al., 2011) and noise pollution can have impacts on bats. Chemical pollution from industrial accidents, effluent discharge, and particulate releases may also disrupt behavior and life history strategies of fish and wildlife. Some species can adapt to such changes to their environment, but many cannot.

Fragmentation of natural resources by trails and maintenance roads increases the chance of invasive plants intruding into and establishing within the habitat by outcompeting native vegetation. People using these facilities can also have a negative impact on the resources. For example, people hiking on trails cause noise that can disturb wildlife. Hikers may also leave behind trash and pet waste, or trample vegetation.

Climate change impacts are already evident, both globally and in Oregon, and more impacts are expected. To adapt, the region must understand and prepare for change. Portland's Climate Action Plan calls for a comprehensive review to better understand the possible and likely impacts of climate change. The purpose is to assess climate-related vulnerabilities and the strengths and resiliency of: local food, water and energy supplies, infrastructure, transportation and freight movement, floodplains, watersheds, public health, public safety, social services and emergency preparedness.

Decision-making in the face of uncertainties in climate change projections, especially in regional downscaling of global climate change models, remains a challenge. Climate projections work well for some variables and poorly for others. For example, currently available model projections for the Pacific Northwest have a higher degree of certainty related to expected changes in precipitation patterns and temperature increases but are inconclusive about what should be expected for total annual precipitation or extreme weather events.

That being said, there is a high degree of certainty that the Portland region will experience the following changes:

- Increased temperatures overall, including average, maximum and minimum temperatures in the summer and winter months (projected 0.7° F increase per decade).
- Changes in precipitation patterns, with modest increases in precipitation falling winter and modest reductions in precipitation in summer months. More precipitation is expected to fall as rain rather than as snow in lower elevation watersheds.
- Fire risk will increase across the entire state by midcentury, with the some of the largest increases expected in the Willamette Valley (Oregon Climate Change Research Institute, 2019).

In addition, the Portland region may also experience:

- Changes in total annual precipitation amounts (increases or decreases).
- A change in the frequency, magnitude or duration of extreme weather events (intense rainfall, wind storms, ice and snow).

Non-developed areas that provide multiple ecosystem functions can play an important role in adapting to climate change in the region. Flood storage provided by active floodplains will become even more important to accommodate potential changes in flows, flood regimes and extreme events. Maintaining diverse habitats and

habitat corridors will be critical for resident and migratory wildlife that may be required to adapt their behaviors and life cycles to changes in air and water temperature, weather patterns, habitat ranges and food sources.

B. Environmental Consequences

Habitat and biological communities – Protecting natural resources will have positive consequence for habitat and biological communities. These consequences are more pronounced in the South Reach due to the extent and diversity of natural resources within the reach. Given the highly developed nature and limited unaltered natural resources present in the North and Central reaches, ensuring the long-term preservation and restoration of South Reach natural resources will continue to contribute significant ecosystem services to the adjacent areas and the city as a whole. When impacts to existing habitat and biological communities are unavoidable, impacts should be offset by mitigation.

Climate change – Protecting natural resources will have positive consequences for the city with regards to climate change. Maintaining and expanding areas with substantial flood capacity will reduce the risk of flooding to properties and people in adjacent neighborhoods. Maintaining riverbank and adjoining vegetation will reduce the impacts of increased air temperature on human health. And maintaining and expanding habitat areas will enable fish and wildlife to move through the urban environment to more effectively adapt to climate change.

Avoided replacement of functions – Protecting natural resources reduces the need for development to replace the functions provided by the resources including flood mitigation, stormwater management and heating/cooling. When replacement of functions is conducted as a part of mitigation, the full maturity of those functions may take many years, if not decades, to be achieved. This time-lag in replacing the benefits lost to development emphasizes the need to avoid impacts to natural resources to the extent possible.

4. Economic Consequences

This portion of the analysis summarizes the economic consequences of protecting natural resource areas. The economic consequences are expressed as the qualitative and relative costs, benefits, and impacts on conflicting uses and natural resources.

A. Economic Analysis

The SRNRPP study area is characterized by limited economic activity due to the predominance of parks and natural areas, single-dwelling and multi-dwelling residential in the area. The large majority of commercial, industrial and office uses are located along SW Macadam Blvd (Highway 43). Ross Island Sand and Gravel properties contain almost all of the industrial uses in the SRNRPP study area. Ross Island Sand and Gravel continues to process aggregate on Hardtack Island and its headquarters are located on the east side of the river along SE McLoughlin Blvd.

Specific estimates of the economic characteristics of the SRNRPP study area are not available. However, a description of overall economic trends provides some context for the future of the South Reach economy. The City of Portland *Economic Opportunity Analysis* (June 2016) describes the recent history and trends of economic development and employment in the city. In 2013, there were 393,742 jobs in Portland, the equivalent of 38% of the 1.02 million employment base of the Portland-Metro Service Area. Multnomah County's long-term linear

job growth pattern predicts 184,000 new jobs countywide will be added between 2010 and 2035. The projections for 2035 include 45,000 additional jobs in the Central City, one third of the total jobs projected for the City of Portland⁷. These projected jobs within the Central City are estimated to play a key role in the South Reach economic trends, since many South Reach residents likely work in the Central City and Central City employees often commute to and from work along the SW Macadam Avenue corridor and via the major bike/ped trails located in the South Reach.

An important consideration is the potential consequence of new regulations on the development potential of South Reach properties. To support the development of the *2035 Comprehensive Plan* (2016), the City's Buildable Lands Inventory (BLI) was updated to depict current market conditions. The primary goal of the BLI is to identify properties within the city that are vacant or "underutilized" and would be expected to be redeveloped within the 20-year timeframe of the analysis. Underutilized is defined differently depending on the existing land use but it identifies properties where the current development or land use is significantly below the development potential, based on the applicable zoning and other considerations. The 2016 BLI identified a number of redevelopable parcels in the SRNRPP study area. However, the majority of those parcels have either already been redeveloped or are unlikely to be redeveloped due to the unique characteristics of the current use. For example, a number of "vacant" parcels are lands along the Willamette River surrounding the Greenway and Springwater Corridor trails. Additionally, many of the existing uses were established many years ago and are still viable activities, though the applicable zoning would allow a greater density of development. As a result of these characteristics it is expected that the economic consequences of regulations on new development would be negligible.

Ecosystem Services provided by Natural Resources

Natural resources provide ecosystem goods and services, which in turn provide economic and social value. Ecosystem services include water conveyance, purification, and flood control, air cooling and purification, carbon sequestration, soil fertilization and pollination. Ecosystem goods include commodities like food, fuel, fisheries, timber, minerals, etc. Ecosystem goods also include supporting recreation and tourism.

Riparian Forests and Woodlands

Riparian forests provide several different types of ecosystem services. One way to estimate the values of these ecosystem services is to evaluate the avoided cost of preserving the functions provided by natural resources. The City of Portland, for example, previously avoided purchasing a \$200 million filtration treatment system for its water supply by protecting 102 square miles of the Bull Run watershed. Similarly, Clean Water Services, a water-resource management utility in northwestern Oregon avoided investing in a chiller for a water treatment plant on the Tualatin River by planting riparian vegetation to shade and cool the river, for a savings of \$50 million.

Forests and woodlands also provide air quality benefits from purification and pollutant removal. The annual kilograms of pollutant removal by acre of forestland per year ranges from 2.03 kg to 14.57 kg and the economic value of those pollutants in avoided health care costs ranges from \$3 per acre per year to \$144 per acre per year (EcoNorthwest, 2012). This would represent between approximately \$740 and over \$35,000 of avoided health care costs per year in the South Reach.

⁷ <https://www.portlandoregon.gov/bps/59297>

Shrubland and Grassland

One estimate of shrubland value, based on the net primary productivity of various landscapes in the U.S. National Wildlife Refuge System, suggests that the ecosystem service value may be about \$600–\$800 per acre per year (Ingraham and Foster, 2008). The same study estimated the value of grasslands and suggests that the ecosystem service values of grassland, generally, may be about \$30–\$140 per acre per year.

Shrublands and grasslands provide air quality benefits from purification and pollutant removal. The annual per acre pollutant removal by shrubland and grassland range from 0.79 kg to 6.05 kg per year and a range of economic values of removal of those pollutants in terms of avoided health care costs is \$1 per acre per year to \$60 per acre per year (EcoNorthwest, 2012).

Value of Wildlife

Economic research has shown that people place considerable value on the continued survival of sensitive species, such as those listed as Threatened or Endangered. Such studies also suggest that the value associated with protecting threatened, endangered and rare species similar to those found in Portland ranges from an annual payment of \$11 per household to a one-time payment of nearly \$400 per household (EcoNorthwest, 2012).

It is important to note that willingness to pay is a different measure than estimating the economic value associated with maintaining individual species and biodiversity. For example, the courts have interpreted Congress to say that the value of threatened and endangered species is incalculable (*TVA v. Hill*, 1978).

Development-related threats to sensitive species also may lead to higher future costs for governments, firms and households engaging in activities that affect the species. Such costs might be associated with required or voluntary species monitoring, as well as measures to ensure their protection. Avoiding such costs could support the decision to implement pre-emptive measures to protect sensitive species and prevent future threatened and endangered species listings.

Flood Area

Dams along the Willamette and Columbia rivers are managed, in part, to control flooding the Lower Willamette River. Flood storage capacity in the South Reach is sizeable relative to Portland's other Willamette River reaches. As the most upstream reach, the South Reach provides valuable flood storage capacity that serves to limit the potential impact of flood events downstream. Maintaining and expanding South Reach flood capacity will produce significant benefits for the city as a whole. However, the economic value of the floodplain to minimize localized and downstream flood impacts has not been specifically determined.

The substantial amount of natural resources adjacent to the Willamette River in the South Reach would also be expected to improve water quality and lessen increases in water temperature over time.

B. Economic Consequences

Development – Protecting natural resources would have a negative consequence on future development by limiting the extent of development allowed when resources can't be avoided. Avoiding the natural resources

could add cost to the development or reduce the size or extent of the development. Requiring the minimization of impacts and mandating mitigation could also add to the cost of development.

Employment – Given the limited amount of commercial and industrial land in the SRNRPP study area, the consequences on employment in the area are estimated to be negligible.

Ecosystem services – Protecting natural resources would have positive consequences on ecosystem services, property and people. This results in economic benefits both in maintaining the services and avoiding replacement costs when an ecosystem service is impacted through development.

5. Social Consequences

This section examines the social consequences of protecting natural resource areas. The social analysis focuses on the following topics:

- Human Health and Welfare
- Historic, Heritage and Cultural Values
- Regulatory Compliance

A. Social Analysis

Human Health and Welfare

Access to natural areas and parks has been shown to result in substantial benefits for overall human health indicators, including human behavior and psychological wellbeing. Access can mean a range of experiences from viewing vegetation to bird watching to hiking or boating. Dr. Roger Ulrich of Texas A&M's Center for Health Systems and Design found that passive scenic values, such as looking at trees, reduce stress, lower blood pressure and enhance medical recovery (Ulrich et al., 1991). The presence of trees and grass can lower the incidence of aggression and violent behavior. Studies have shown a variety of benefits with "forest bathing," which involves walking slowly through the forest, breathing and taking in one's surroundings, include reduced stress, improved immunity, and reductions in blood pressure (Aubrey, 2019). A study of residents in public housing in Chicago found that compared with apartment buildings that had little or no vegetation, buildings with high levels of greenery had 52% fewer total crimes, including 48% fewer property crimes and 56% fewer violent crimes (Kuo and Sullivan, 2001). Common green areas in neighborhoods can also increase community ties and support networks. Studies have shown that exposure to the natural environment enhances children's cognitive development by improving their awareness, attention, reasoning and observational skills (Louv, 2005).

Recreation has also been shown to have multiple health benefits. For people who are inactive, even small increases in physical activity can yield numerous health benefits (Mult. Co. Health Department, 2012). Exercise improves overall health, which reduces public and private health care costs, improves quality of life, and may help people live longer (Nieman, 1998). Activities such as walking in forested areas help boost the immune system (Sachs and Segal, 1994). In addition, the Centers for Disease Control and Prevention strongly recommends physical activities, such as biking or hiking trails, to reduce the risk of cardiovascular disease, diabetes, obesity, selected cancers and musculoskeletal conditions.

Parks and natural areas provide space to recreate and also provide an opportunity for Portlanders to learn about environmental science, natural history and the cultural history of the Willamette River and the Pacific Northwest. Natural areas and open spaces provide “living laboratories” for active educational programs. Many schools use natural areas as a focal point of interdisciplinary studies. This model of learning has been shown to improve critical thinking skills, achievement on standardized tests and student attitudes about learning and civility toward others (Leiberman and Hoody, 1998).

Vegetated landscapes, parks and views of natural features each contribute a “sense of place” and personal attachment to particular locations. People are socially connected to the entirety of the built and natural environment by walking, biking and driving through areas with street trees, gardens, parks and other open spaces. Natural areas and parks create a sense of identity and visual variety in the city. Trees, natural areas and water bodies help define the visual appeal of the Portland area. People also identify with urban landscapes including river harbors and marinas, airports, new and old structures, workplaces, museums, restaurants and stores, parks and golf courses, and other gathering spaces. Portland is often identified by pictures of the cityscape, Mt. Hood, the Willamette River and bridges crossing the river. This identification with nature has been demonstrated to improve mental health (Mult. Co. Health Department, 2012).

Historic, Heritage and Cultural Value

The first Europeans to explore the Columbia and Willamette Rivers arrived in the late 18th century. Prior to that, the area was populated by various indigenous tribes who had camped, fished, hunted and gathered foods along the Willamette River for centuries. Native American settlements were established in the Portland area with populations of several thousands in the early 19th century. Settlements were documented by the first explorers of this area in the late 18th century, by Lewis and Clark in their exploration of the Lower Willamette River in 1804-06 and by other historians more recently. The rivers provided a travel route for trade of goods among tribes and also provided a rich diversity of food that was generally available for most of the year. Besides fish that could be caught over a period of several months a year and game and fowl that could be hunted, Native peoples also gathered plants that were available much of the year in the temperate climate. Among the most common and well-known were wapato, a bulb that was gathered and also traded as European traders and settlers arrived, and camas root, which were dried or slowly cooked and then eaten. There are a number of Pacific Northwest tribes that have treaty rights and/or a continued interest in the Willamette River South Reach area as a place where tribal history, culture and practices are preserved and maintained.

Over the past 200 years, the Willamette and Columbia rivers have played a critical role in Portland’s development. Beginning in the early 1800s, European settlement occurred at the confluence of the Willamette and Columbia rivers due to the abundant natural resources and opportunities for trade. The development of the railroad in the early 1900s continued to spur development and jobs related to World War II drew people to Portland. The Willamette River was a focus of industrial use and commerce throughout all of Portland’s history. However, that development removed many of the natural resources that existed historically.

Portlanders place a high value on the environment and quality of life. The Oregon state symbols reflect this value. The Oregon state bird is the Western Meadowlark, which is currently a state-listed Species of Concern and has been nearly extirpated from the city due to loss of native grasslands. Portland’s City Bird, the Great Blue Heron, is commonly found in the South Reach. The state fish, the Chinook salmon, is found in the Willamette

River and is federally listed as Threatened. The beaver is Oregon's state animal and still resides in many of Portland's waterways, including in the South Reach.

Portland's identification with nature and wildlife is reflected in many ways. The Audubon Society of Portland is over 100 years old and is the largest chapter of the national Audubon Society. Many Portlanders are avid bird-watchers. Oaks Bottom Wildlife Refuge is one of the most popular birding locations in the city.

Metro has recognized the importance of fish and wildlife and their habitats by adopting the regional "Nature in Neighborhoods" program in 2005. This program establishes regional baseline requirements to protect fish and wildlife habitat and water quality. The requirements focus on protecting, conserving and restoring natural resource functions and values in riparian corridors. Establishing this program reflects the importance of environmental quality to the residents of the Metro region, including Portlanders.

Regulatory Compliance

Regulatory compliance is important for the City of Portland to avoid cost and liability, and because Portland values its role as a leader in sustainability and environmental management. There are multiple regulations described in Chapter II for which Portland must maintain compliance. Below are summaries of three regulations for which Portland has specific programs.

ESA Preventing Harm and Supporting Recovery of At-risk Species

After the 1998 listing of steelhead trout in the Lower Columbia River, the City of Portland began developing a comprehensive, coordinated citywide response to threatened and endangered species for City Council adoption (Resolution No. 35715). The City Council established an intent to avoid "take" of a listed species (i.e., harming individuals or populations or their habitat), and to assist with recovery of listed fish species. The City has since taken actions such as identifying and prioritizing City programs that could affect listed species, providing technical support to bureaus, providing oversight for activities involving federal permitting or funding and developing a watershed management plan to help guide city actions. The protection and enhancement of habitats critical to threatened and endangered species are important actions to aid in the recovery of listed species.

FEMA National Flood Insurance Program

FEMA manages the NFIP which includes regulatory components for floodplain management, floodplain mapping and flood insurance. The NFIP floodplain management regulations (44 CFR 60) are implemented through local jurisdictions. The City of Portland's local floodplain ordinance is found in Portland City Code 24.50. The National Marine Fisheries Service (NMFS) recently released a biological opinion about the impacts of NFIP on listed species in the Willamette River. FEMA will provide direction to local jurisdictions regarding the implementation of a "Reasonable and Prudent Alternative" to avoid harm to listed species. The outcomes of this consultation will likely result in required changes to the local regulations related to implementation of NFIP.

Metro Title 13

Metro Title 13: Nature in Neighborhoods is the regional program that complies with portions of State Land Use Goals 5 Natural Resources, Scenic and Historic Areas, and Open Spaces and 6 Air, Water and Land Resources Quality. By complying with Title 13, local jurisdictions are complying with Goals 5 and 6 as well.

Title 13 calls for programs to avoid adversely affecting significant natural resources and mitigating for unavoidable impacts on those resources. The Willamette River and its riparian areas are identified in Title 13.

B. Social Consequences

Human health and welfare – Protecting natural resources would have positive consequences for human health and welfare. The many benefits created by access to natural areas are described above. These benefits would be transmitted to both residents who live nearby as well as others throughout the city and region, due to the role of the South Reach as a regional amenity.

Historic, heritage and cultural values – Protecting natural resources would have positive consequences for historic, heritage and cultural values by maintaining the river and riparian areas that form the basis of those values. Throughout Portland's history (prior to and since European contact), the Willamette River has played a defining role in the culture and identities of the region's people.

Regulatory compliance - Protecting natural resources would have positive consequences by helping Portland maintain compliance with applicable local, regional, state and federal regulations.

6. General Protection Recommendations

The Willamette River South Reach and associated floodplain and riparian areas includes some of the only remaining contiguous high-value natural resources within the City of Portland. Due to the extent of parks and natural areas along this stretch of the river, the South Reach provides many ecosystem services not observed in other reaches, including numerous sites containing shallow water habitat, bottomland hardwood forests and native oak stands and rare plant species. These natural resource areas provide unique habitat opportunities for fish and wildlife that reside in and migrate through this highly urbanized environment. The importance of South Reach natural resources is reinforced by its relationship to the regional ecosystem and connections to adjacent migration corridors.

The South Reach's natural bounty has long played a key role in the culture and social identity of Portlanders. Prior to European settlement in the Portland region, the Willamette River served as a critical transportation corridor for Native American tribes traveling to Willamette Falls. Native peoples harvested berries, seeds, and plants found along the river, with the braided channels of Oaks Bottom and adjacent floodplains supporting this abundance. Current Portland residents also identify closely with the City's and the surrounding area's unique natural resources and consistently support the protection and expansion of these natural resources.

Beyond the social connection to the river, access to nature areas has been shown to provide extensive human health and welfare benefits, as described above. The South Reach provides a variety of opportunities for outdoor recreational activities and connections to nature. Ensuring the continued protection and support for those activities and connections will strengthen the social fabric of the area.

Economic considerations in the South Reach are limited, as land uses within the SRNRPP study area are predominantly single-dwelling and multi-dwelling residential. The existing character of the South Reach is expected to continue into the future, with the large majority of zoning designations providing for residential and

mixed-use development. Updates to development regulations may have some impact on the development potential of project sites in the South Reach but that negative consequence is expected to be negligible.

The general recommendation balances the environmental, economic and social consequences of protecting natural resources. The potential impacts from conflicting uses in the South Reach cannot be fully avoided but efforts should, to the extent possible, direct future development away from existing natural resources and floodplains or provide adequate mitigation to offset impacts when development on natural resources is unavoidable.

The general recommendation is to:

1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land and water located below the top of bank of the Willamette River, within tributaries to the river, land within the undeveloped floodplain and in Special Habitat Areas (see Chapter III for more information on Special Habitat Areas).
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked natural resources, including undeveloped riparian areas and developed floodplains.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

CHAPTER V. RESULTS

1. Introduction

Chapter V begins with an overview of the Willamette River South Reach. The overview describes the general conditions of the South Reach, including hydrology, water quality and fish and wildlife habitat. Following the overview are results for the inventory sites. Each inventory site includes:

- An inventory (description and maps) of the existing natural resources features
- Identification and ranking of the riparian corridor and wildlife habitat functions provided by the inventoried features
- Recommended protection of the natural resources

2. Willamette River South Reach Overview

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, natural areas and open spaces and residential development. Parks and natural areas include Ross Island Natural Area, Oaks Bottom Wildlife Refuge, Springwater Corridor, Willamette Park, Willamette Moorage Park, Oaks Crossing Natural Area, 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. The Springwater Corridor and Willamette Greenway trails are also in this inventory site. Motorized and non-motorized boating are common in this stretch of the river as well as fishing and swimming.



Historic photo of Willamette River looking south, showing Ross Island (at right) and Hardtack Island (at left) with Oaks Bottom in the distance (1926)

A. River Bank Character and Vegetation

The Willamette River is comprised of a diverse mix of river bank types and vegetation. The water, river banks, riparian vegetation and upland vegetation in the South Reach serve key functions. The description below provides detail on the makeup of the river bank and vegetation within the Willamette South Reach as a whole.

River Bank Character

The river banks in the South Reach are less altered than in Portland’s North and Central reaches. 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.

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. At the same time, the built environment can create challenges for fish and wildlife due to elevated temperatures and heat island effects, interrupted or disconnected hydrology due to impervious surfaces, excessive or contaminated stormwater runoff from impervious surfaces, and other effects.

As noted, the effects of urbanization include constrained or altered river and stream channels, increased temperatures, expansion of invasive species, filling of wetlands, contamination of river sediments and development in the floodplain. In each of these cases, the resource has experienced some degradation but may still provide important functions, such as water conveyance and storage and fish and wildlife habitat.

Vegetation

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.

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

Table 6: South Reach Willamette River Bank Character	
Bank Type	Linear Feet
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
Total	66,258

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 Wildlife Refuge, and resource areas to the north such as Swan Island Lagoon, Waud Bluff and Forest Park and Harborton Wetlands.

B. Fish and Wildlife

The Willamette River is a primary migration corridor for both fish and wildlife. The varied river banks and vegetation described in the previous section serve a diversity of fish and wildlife species. Below is additional information about fish and wildlife species in the Willamette River South Reach.

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. In 2005, the National Oceanographic and Atmospheric Administration (NOAA) has designated the Willamette River within the South Reach as Critical Habitat for the following species:

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.

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.

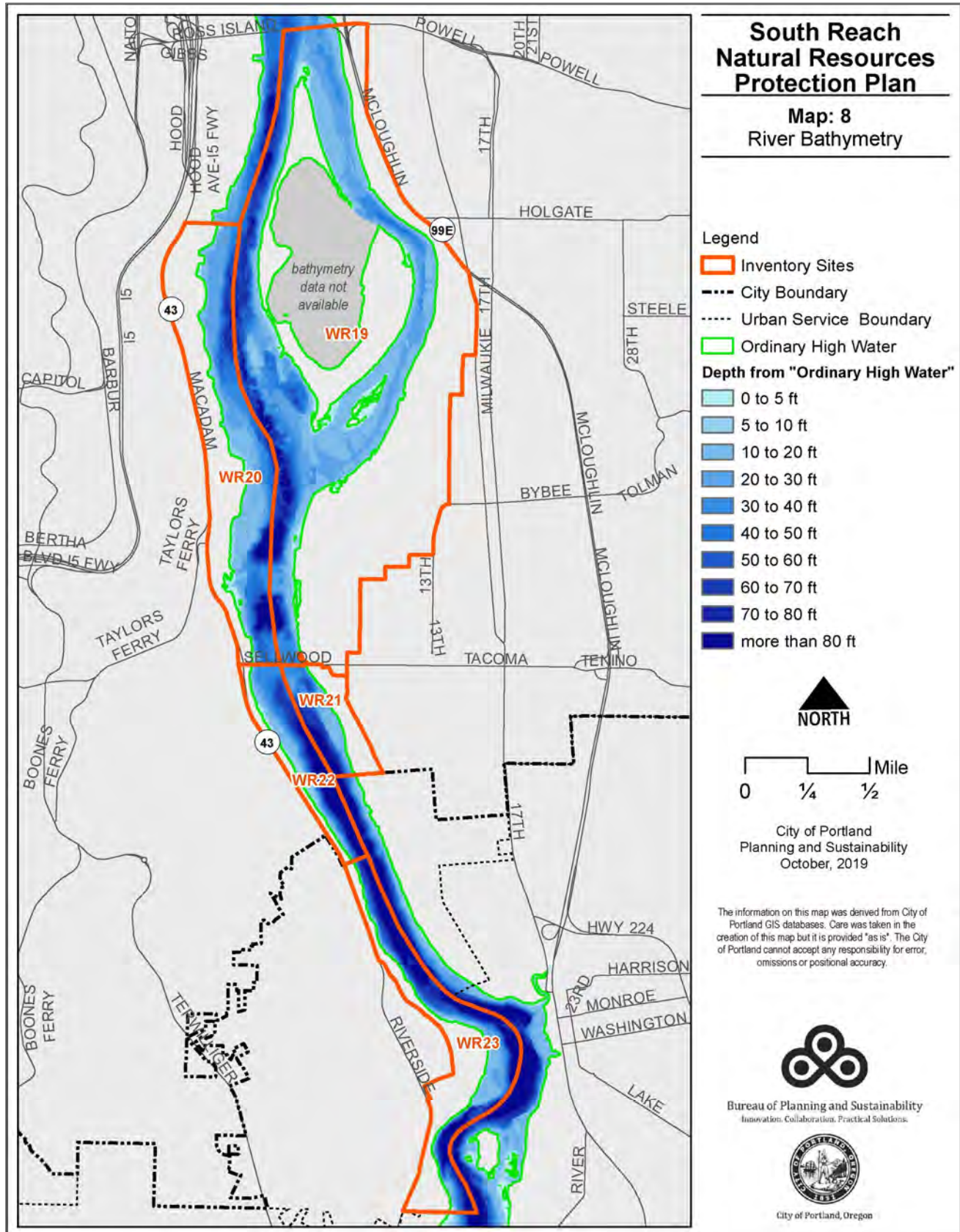
All of these anadromous fish enter the Lower Willamette River system to forage and spawn in tributaries downstream of Willamette Falls. Meyers et al. (1998) identified habitat modification, dams and hatchery management as factors for salmonid decline in the Willamette River basin. Immediately downstream 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. Water depths in the South Reach are depicted in Map 8.

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 shoreline, Holgate Channel, the Stephens Creek confluence with the Willamette River, Powers Marine Park and the mudflat north of the Willamette Park boat ramp. Additionally, the recently-completed culvert replacement project at Oaks Bottom Wildlife Refuge opens 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, when funded and implemented, create new shallow water habitat and increase the function of the riparian corridor.



Birds

The South Reach is part of the Pacific Flyway and is used by numerous bird species during spring and fall migrations. Over 200 species regularly occur in Portland, many of which are resident or migratory in the South Reach.

Birds use open water, wetlands, beaches, rocky outcrops, vegetated shorelines and human-made structures during migration, hunting and foraging and nesting. Trees and shrubs, found in natural areas 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 South Reach bird populations and activity is included in the inventory site descriptions.



Osprey perched on derelict piling.

Mammals

As described in Chapter I, the Willamette River basin is home to over 65 mammal species that play a role at all levels of the food chain, including herbivores, omnivores, insectivores and carnivores. Mammals in the South Reach range from small rodents and bats to larger species like black-tailed deer. A number of water-dependent species, including American beavers (*Castor canadensis*), Northern river otters (*Lontra canadensis*), mink (*Mustela vison*), muskrats (*Ondatra zibethicus*) and the non-native nutria (*Myocastor coypus*), are all common in the South Reach. Coyotes (*Canis latrans*) are also frequently observed in the South Reach, most commonly on the east side of the river.

At least nine species of bats can be found in the Willamette River basin. Of those, five are federal Species of Concern and have a state Sensitive designation, including Townsend's big-eared bats (*Corynorhinus townsendii*), hoary bat (*Eptesicus fuscus*), fringed myotis (*Myotis thysanodes*), silver-haired bat (*Lasionycteris noctivagans*) and California myotis (*Myotis californicus*). Of these, the hoary bat is the most frequently observed in and near the South Reach study area.

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. The



Source: Xerces Society

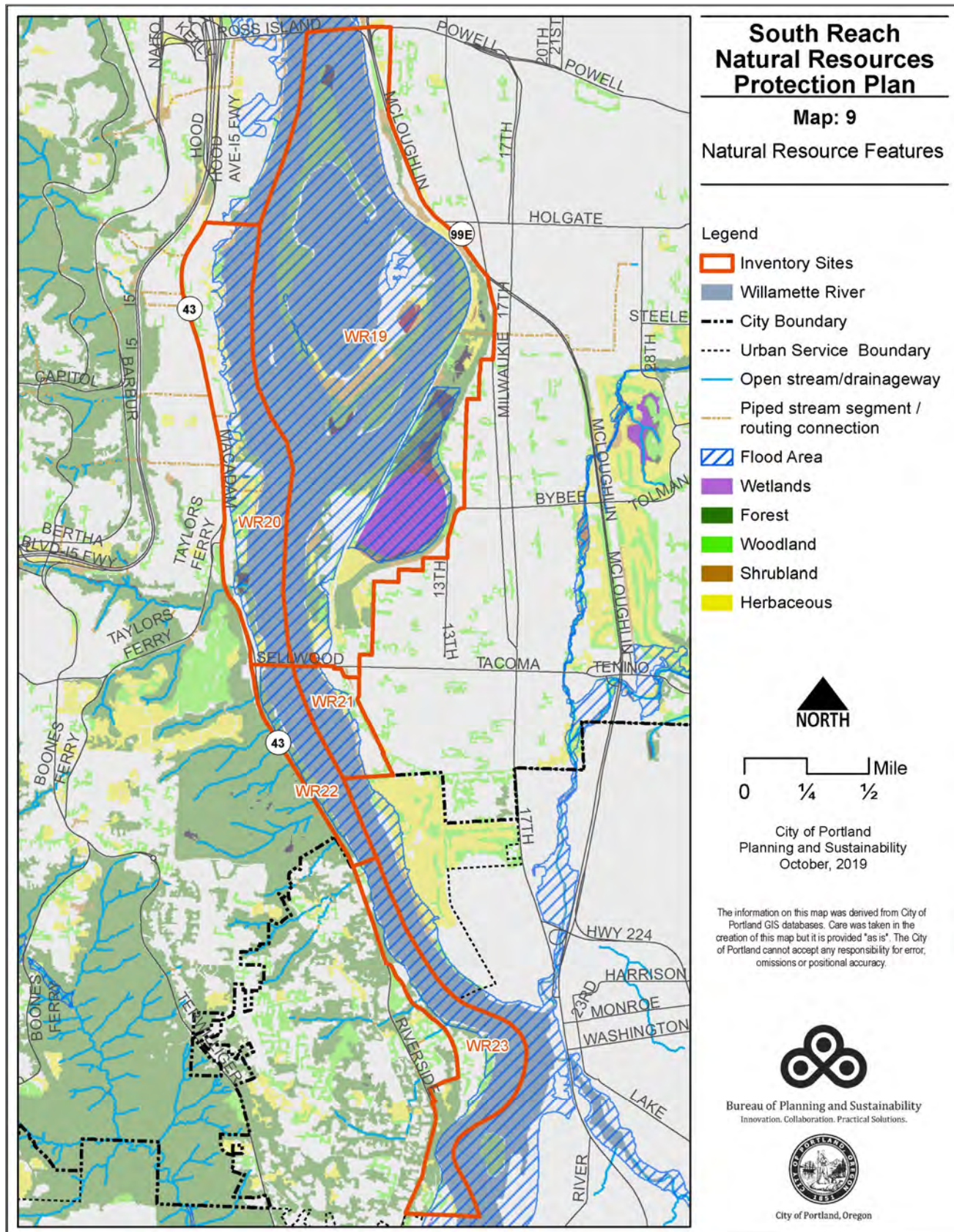
images to the right are representative of taxa found in the Lower Willamette River: (A) copepods (Calanoida), (B) chironomids (Diptera), (C) *Daphnia* spp. (Cladocera), (D) *Eogammarus* spp. (Amphipoda), (E) *Corophium* spp. (Amphipoda), (F) *Bosmina* spp. (Cladocera), (G) caddisfly (Trichoptera), (H) mayfly (Ephemoptera) and (I) stonefly (Plecoptera).

C. Natural Resource Features Summary

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 painted turtles 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 200 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.

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

Table 7: Summary of Natural Resource Features in the South Reach	
	Study Area (miles/acres)
River (miles/acres)	7.5/866
Stream/Drainageway (miles)	0.3
Wetlands (acres)	95
Flood Area (acres)*	
Vegetated (acres)	291
Non-vegetated (acres)	97
Open Water** (acres)	866
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	269
Woodland (acres)	78
Shrubland (acres)	49
Herbaceous (acres)	61
Impervious Surfaces (acres)	215
* 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.	

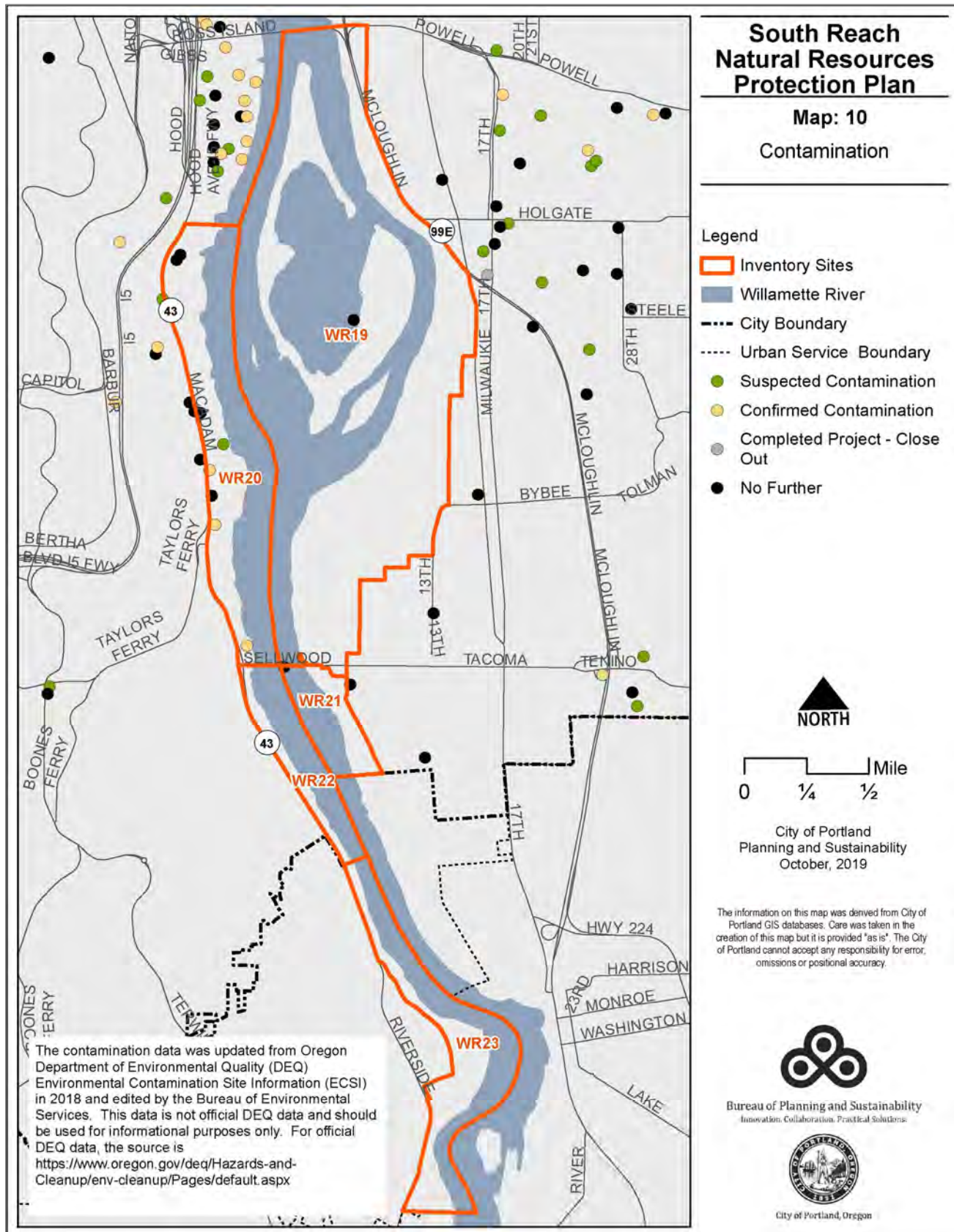


D. Water Quality and Soil Contamination

There are a number of suspected and confirmed contamination sites in the South Reach (see Map 10). 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:

<https://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/ecsi.aspx>.

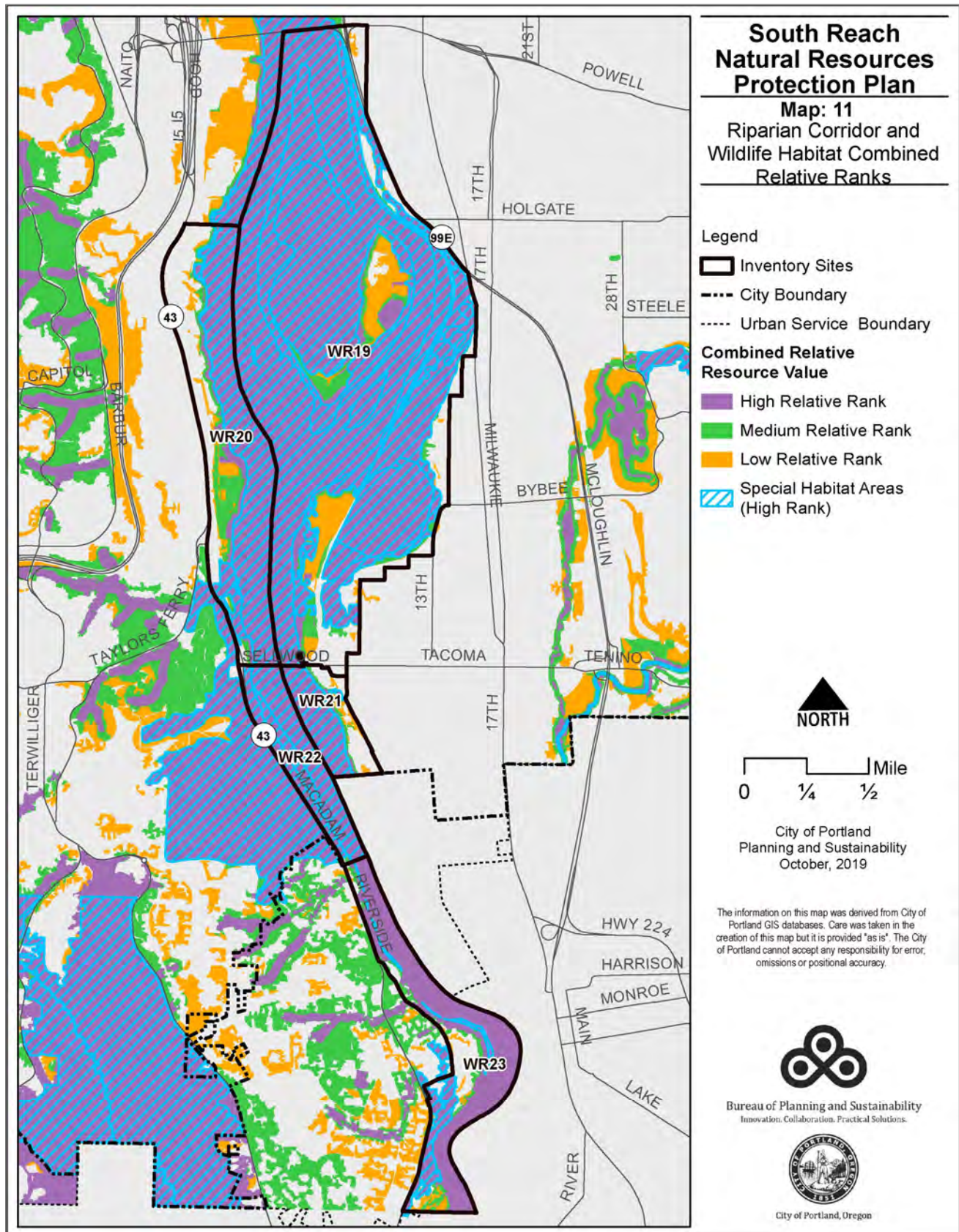
Currently, the Lower Willamette River, which includes the South Reach, does not meet state water quality standards for bacteria, mercury, dioxin and temperature. Oregon Water Quality Index values from 1986 to 1995 for the Lower Willamette Basin in Portland range from fair to very poor. Cool water is 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.

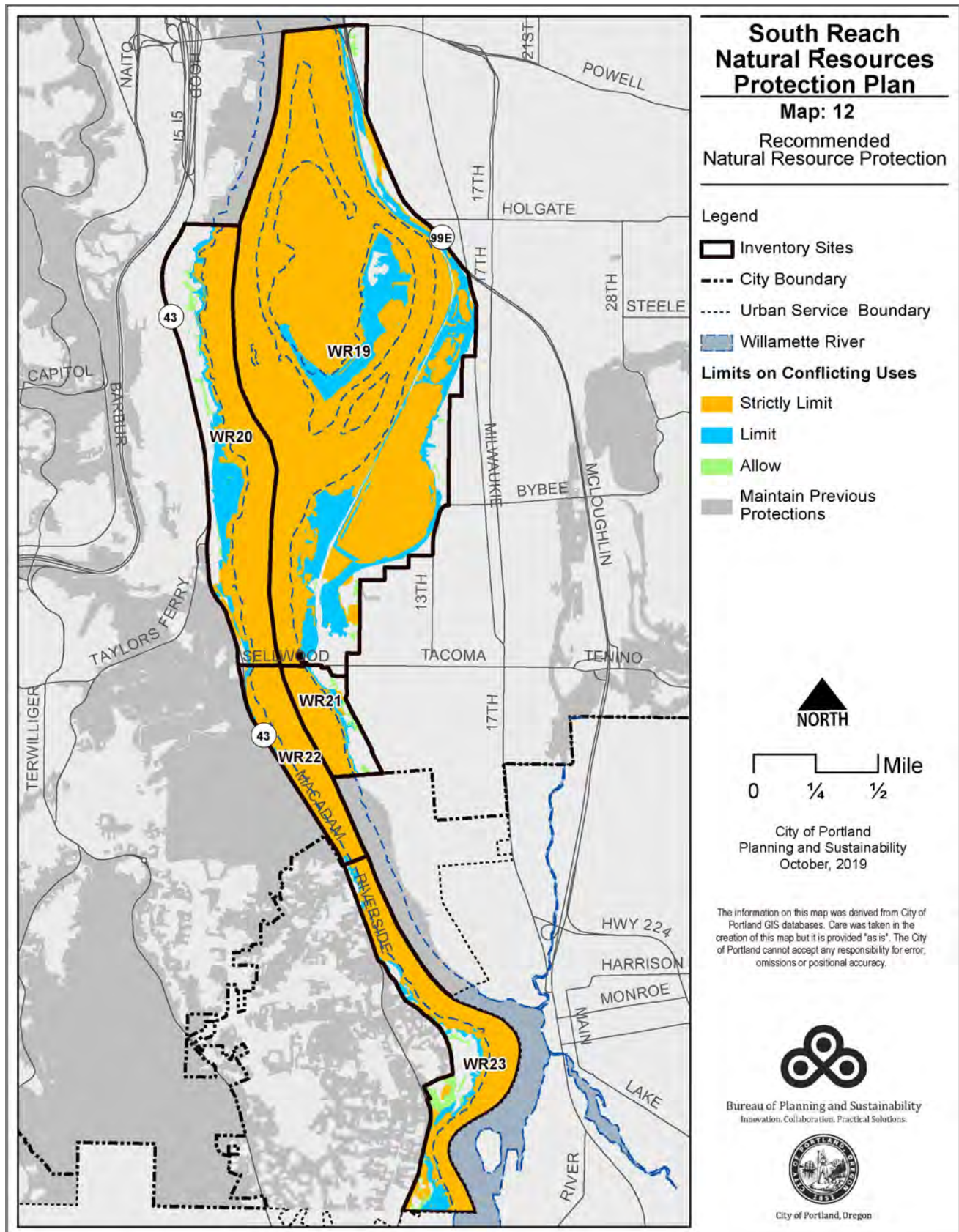


3. NRPP Results Summary

This section of the document consolidates the NRI rankings and the combined protection recommendations for all five inventory sites into two South Reach-wide maps (see next page). Map 11 gives a snapshot of the overall character of the reach and Map 12 provides a full picture of the areas recommended for protection and their recommended protection levels.

Additional detail on each of the five inventory sites is provided in the next section (Section 4) of this chapter.





4. Inventory Site Results and Recommendations

There are 5 inventory sites in the South Reach Planning Area (see Map 11):

WR19 Ross Island/Oaks Bottom

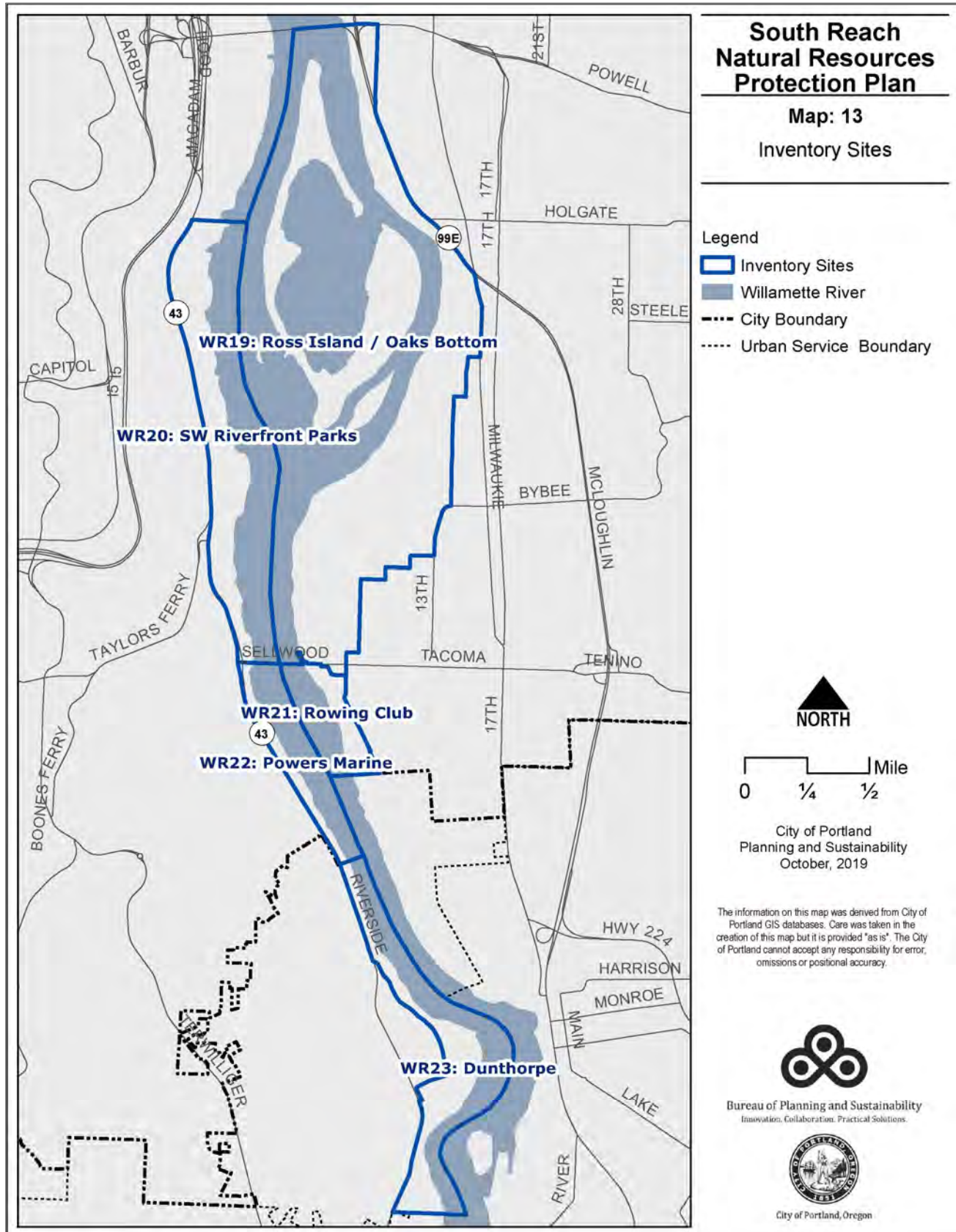
WR20 SW Riverfront Parks

WR21 Rowing Club

WR22 Powers Marine

WR23 Dunthorpe

Each site includes portions of the Willamette River channel, banks, and riparian and upland areas, as well as adjacent land uses. Land uses within the SRNRPP study area are primarily recreational and residential, with some commercial around nearby established corridors and a small amount of industrial uses, primarily in the northeastern portion of the study area.



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.

Table 8: Explanation of Inventory Site Summary Information	
Characteristic	Explanation
Watershed:	The name of the watershed(s) in which the resource site is located.
Neighborhood:	The name of the neighborhood(s) in which the resource site is located.
Legal Description:	US Geological Survey (USGS) quadrangle maps and quarter section maps.
River Mile:	USGS river mile, beginning at the confluence with the Columbia River.
Site Size:	Size estimates include land features, streams and drainageways, wetland and river.
Previous Inventory:	City-adopted natural resource inventories in which the site or portions of the site were addressed.
Zoning:	Zone designations within the site, including overlays (e.g., height, design, open space, scenic, greenway and environmental).
Existing Land Use:	Primary land uses currently within the site.
General Resource Description:	Brief description of the site, its geographic location, natural resources and other key features.
Resource Features:	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.
Resource Functions:	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.
Special Habitat Area:	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.
Special Status Species:	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 D.
Hazards:	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).
Contamination:	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:

A. Site Description

The site description is a brief, general description of site boundaries, current and historic land uses, development characteristics, natural resources 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.

B. 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 notable 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 conducted at various times between 2010 and 2019. 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.

C. 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 B: *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. Understanding the relative quality of existing resources can inform planning efforts, design of development projects and priority-setting for natural resource protection or restoration.

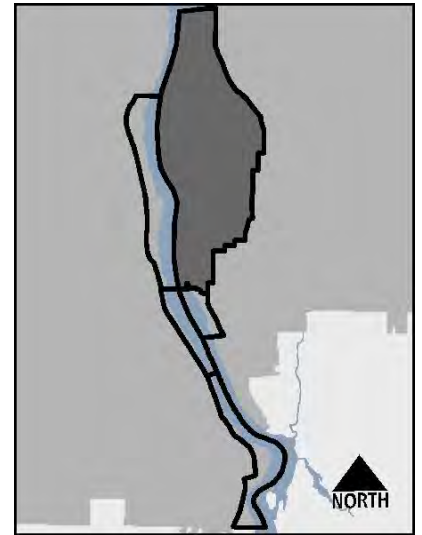
D. Natural Resource Protection Recommendations

Based on an assessment of potential environmental, social, economic and energy impacts, general natural resource protection recommendations were provided at the end of Chapter IV. Those recommendations are applied to the specific inventory site, as relevant, and refined to address inventory site-specific characteristics, as appropriate. For each inventory site, a map of the protection recommendations is provided.

43.i: INVENTORY SITE WR19 ROSS ISLAND/OAKS BOTTOM

Summary Information

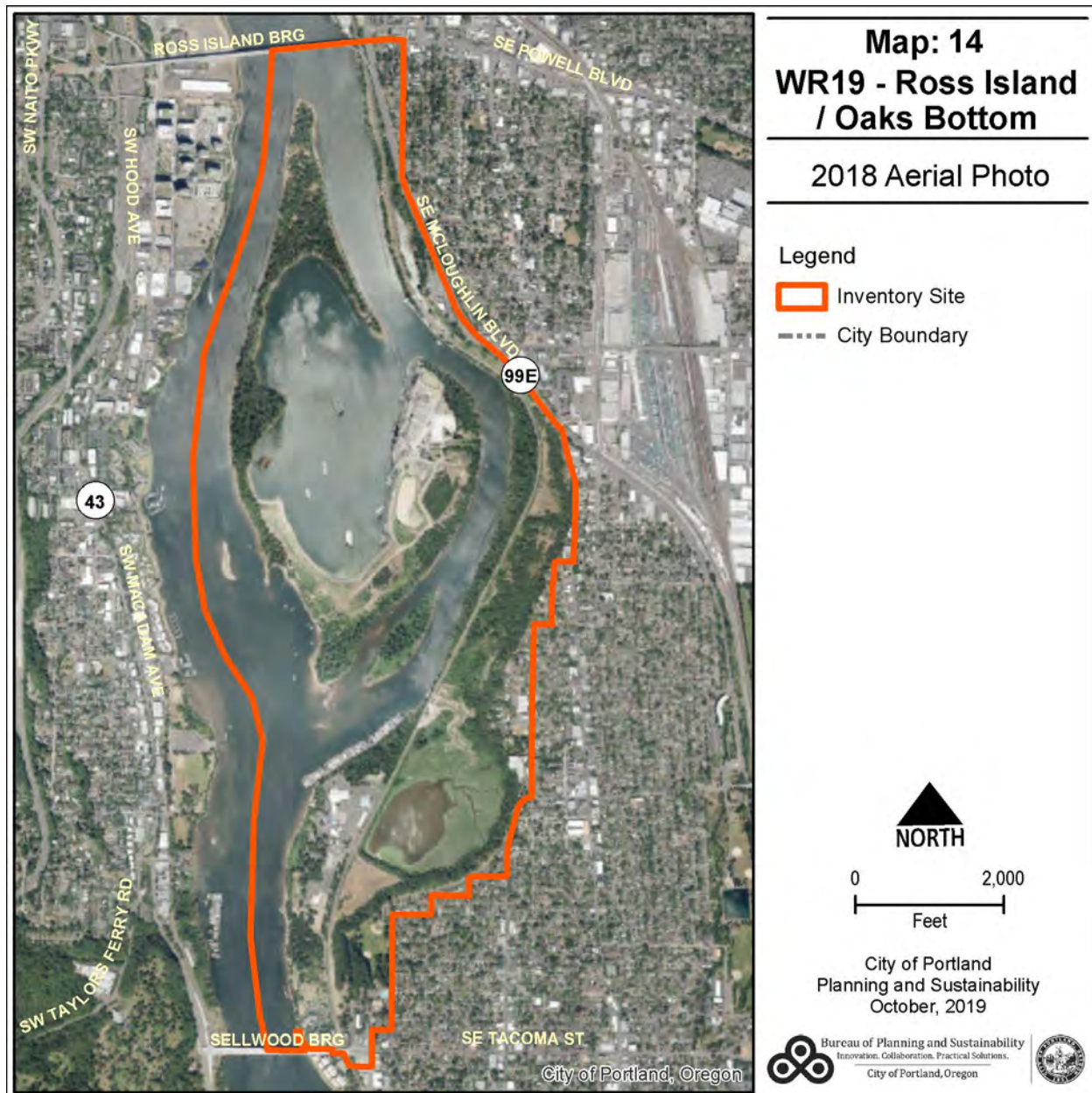
Watershed:	Willamette River Watershed
Neighborhood:	Brooklyn Action Corps; Sellwood-Moreland Improvement League
USGS Quadrangle and Quarter Section Maps:	1S1E10A, 1S1E10D, 1S1E11B, 1S1EC, 1S1E 14A, 1S1E14B, 1S1E14C, 1S1E14D, 1S1E15A, 1S1E15D, 1S1E22A, 1S1E22D, 1S1E23B, 1S1E23C
River Mile:	13.9 – 16.5
Site Size:	1,031 acres (land and water)
Previous Inventory:	Lower Willamette River Wildlife Habitat Inventory, March 1986
Zoning:	General Employment 2 (EG2) Commercial Employment (CE) Commercial/Mixed Use 1 (CM1) Commercial/Mixed Use 2 (CM2) High Density Residential (RH) Residential 1,000 (R1) Residential 2,000 (R2) Residential 2,500 (R2.5) Residential 5,000 (R5) Residential Farm/Forest (RF) Open Space (OS) Alternative Density Overlay Zone (a) Design Overlay Zone (d) Scenic Overlay zone (s) Willamette Greenway River General Overlay (g) Willamette Greenway River Natural Overlay (n) Willamette Greenway River Recreational Overlay (r) Willamette Greenway River Water Quality Overlay (q)
Existing Land Use:	Parks and natural areas, commercial, employment, residential, railroad, highway
General Description:	There are multiple natural areas and parks in this site, including Oaks Bottom Wildlife Refuge, Ross Island Natural Area, Oaks Crossing Natural Area, Sellwood Riverfront Park and the Springwater Trail. There is a floating home community at the beginning of Holgate Channel, just north of Oaks Amusement Park. Ross Island Sand and Gravel has locations on the island and mainland. McLoughlin Blvd and the Oregon Pacific Railroad run through the site.



Resource Features:	Open water, shallow water habitat, river bank, flood plain, wetland, riparian vegetation
Resource Functions:	Microclimate and shade; stream flow moderation and water storage; bank function and sediment, nutrient and pollution control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; and wildlife habitat and movement corridor
Special Habitat Area:	<p>Willamette River: (S) – provides habitat for at-risk wildlife species; (C) – wildlife connectivity corridor; (M) – migratory stopover habitat</p> <p>Ross Island Complex: (I) – Island; (B) – bottomland hardwood forest; (C) – wildlife connectivity corridor; (M) – migratory stopover habitat</p> <p>Oaks Bottom Complex: (O) – Oregon white oak; (B) – bottomland hardwood forest; (C) – wildlife connectivity corridor; (S) – provides habitat for at-risk wildlife species; (M) – migratory stopover habitat</p>
Special Status Species:	<p>Fish: Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead trout, LCR coastal cutthroat trout, Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout, Pacific lamprey, Western brook lamprey, white sturgeon.</p> <p>Amphibians: Northern red-legged frog</p> <p>Birds: American kestrel, bald eagle, band-tailed pigeon, black-throated gray warbler, brown creeper, bufflehead, bushtit, common yellowthroat, downy woodpecker, great blue heron, green heron, Hammond's flycatcher, hooded merganser, Hutton's vireo, merlin, Nashville warbler, olive-sided flycatcher, orange-crowned warbler, Pacific-slope flycatcher, peregrine falcon, pileated woodpecker, purple finch, purple martin, rufous hummingbird, Swainson's thrush, Thayer's gull, varied thrush, Vaux's swift, Western sandpiper, Western wood-pewee, white-breasted nuthatch (slender-billed), willow flycatcher (little), Wilson's warbler, Pacific wren, wood duck and yellow warbler.</p> <p>Mammals: American beaver, hoary bat, Northern river otter</p>
Natural Hazards:	Flood area, landslide, earthquake, liquefaction
Contamination:	Yes

Site Description

This 1,031 acre site is located between the Ross Island Bridge and the Sellwood Bridge and from the Willamette River thalweg east to include the Oaks Bottom Wildlife Refuge (see Map 12). The primary uses in the inventory site are parks, recreation and natural areas. There is also a floating home community. A railroad track extends the length of the reach from north to south directly east of the Springwater Corridor Trail. Ross Island Sand and Gravel is located here.



The site contains approximately 123 acres (12 percent) of impervious surfaces. Of the vegetated areas over ½ acre in size, there are approximately 209 acres of forest, 41 acres of woodland vegetation, 44 acres of shrubland and 41 acres of herbaceous vegetation. There are 835 acres of flood area, including 542 acres of open water, 227 acres of vegetation and 65 acres of developed area (see Table 9).

Table 9: Summary of Natural Resource Features in WR19 – Ross Island/Oaks Bottom	
	Study Area (miles/acres)
River (miles/acres)	3/496
Stream/Drainageway (miles)	0
Wetlands (acres)	93
Flood Area (acres)*	
Vegetated (acres)	227
Non-vegetated (acres)	65
Open Water** (acres)	542
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	209
Woodland (acres)	41
Shrubland (acres)	44
Herbaceous (acres)	41
Impervious Surfaces (acres)	123
* 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.	

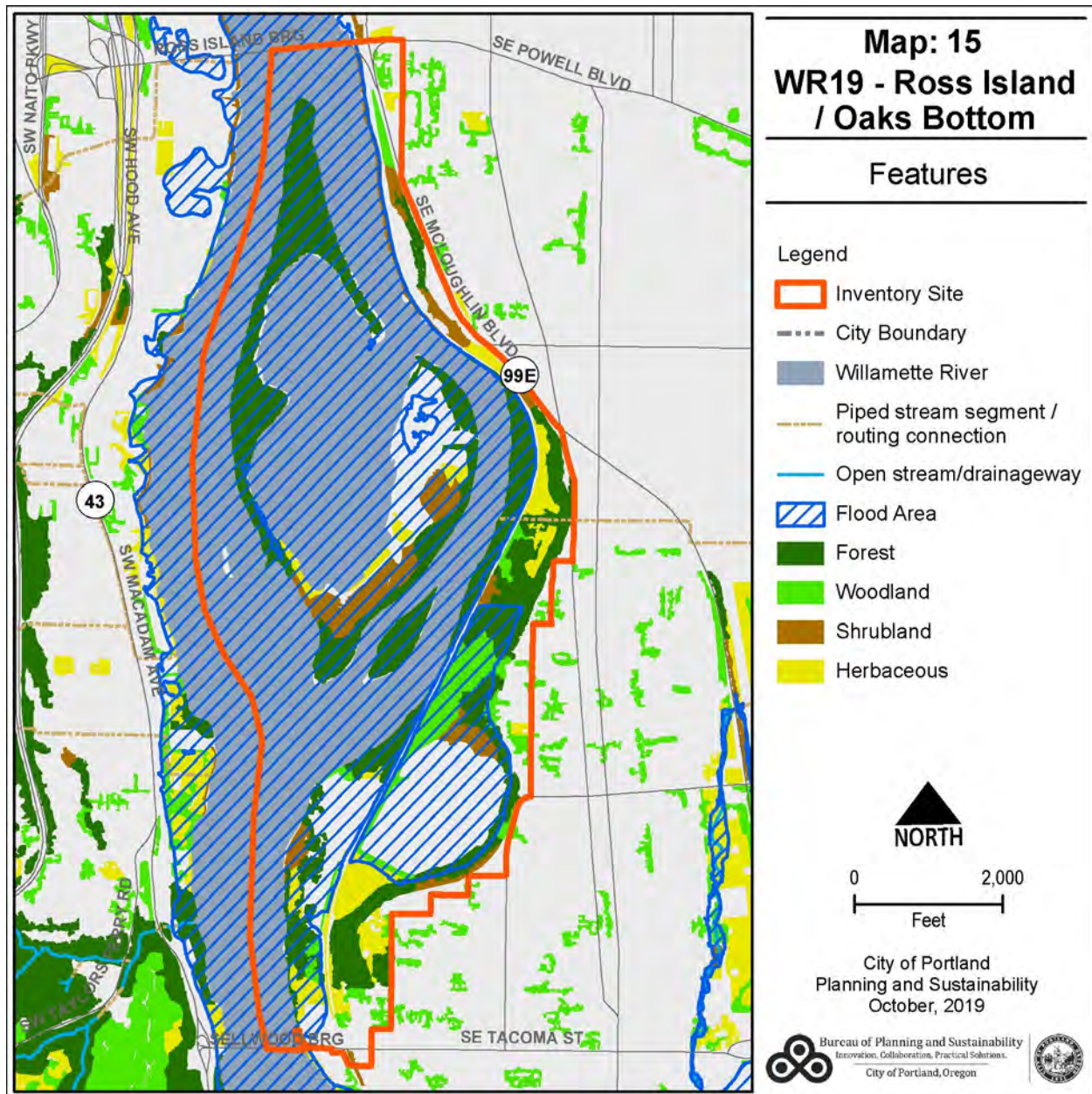
Natural Resource Description

Historically, the Portland-area portion of the Willamette River watershed was comprised of an active channel, open slack waters, emergent wetlands, riparian forests, adjacent upland forests and exposed coarse and fine sediments (also known as "gravel bars"). 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. Woodlands of Oregon white oak, Pacific madrone, red alder and bigleaf maple were found on the Willamette escarpment on the east side of the river.

Today, the land within the South Reach inventory area is comprised largely of parks, natural areas, open spaces and commercial and residential development. Parks and natural areas in this inventory site include Ross Island Natural Area, Toe Island, Oaks Bottom Wildlife Refuge, Springwater on the Willamette Corridor, Oaks Crossing Natural Area, Sellwood Park, and Sellwood Riverfront Park. Land along the Springwater Corridor Trail is also managed as a natural area. Oaks Amusement Park is located along the riverfront just north of Oaks Crossing Natural Area. There are also some commercial uses along the major transportation corridors: SW Macadam Ave. and SE Tacoma St.

Significant natural resource areas in this inventory site include:

- Willamette River, including Holgate Channel (open water and river banks)
- Ross Island, including the lagoon
- Oaks Bottom Complex, including Oaks Crossing Natural Area and land along the Springwater Corridor managed as natural areas.



Willamette River

Below is a summary of Lower Willamette River natural resources documented in inventory site WR19. Additional information about the water quality, hydrology, and fish and wildlife use of the entire Willamette River South Reach is provided earlier in this chapter. Information on the Willamette River as a whole and the Lower Willamette River, more specifically, can be found in Chapter I.

Inventory site WR19 includes 542 acres of the Lower Willamette River. The river is the primary habitat link providing connectivity between upstream and downstream aquatic habitats. This connection is critical for fish, resident and migrating birds and other species.

The Willamette River is an important reach of the primary migration corridor for ESA-listed Chinook and coho salmon, as well as steelhead, and coastal cutthroat trout. These fish enter the Lower Willamette River system to explore and spawn in reaches throughout the Willamette River watershed. Shallow water areas, which are found along shoreline margins in this inventory site, are especially important for juvenile fish because they provide opportunities to escape the swift current of the main channel to rest and feed (see Map 14). Seasonal migrants use habitat within the inventory site during multiple life stages and are usually present during predictable seasonal peaks:

- Juvenile salmon and trout out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead and coho out-migration peaks between May and June.

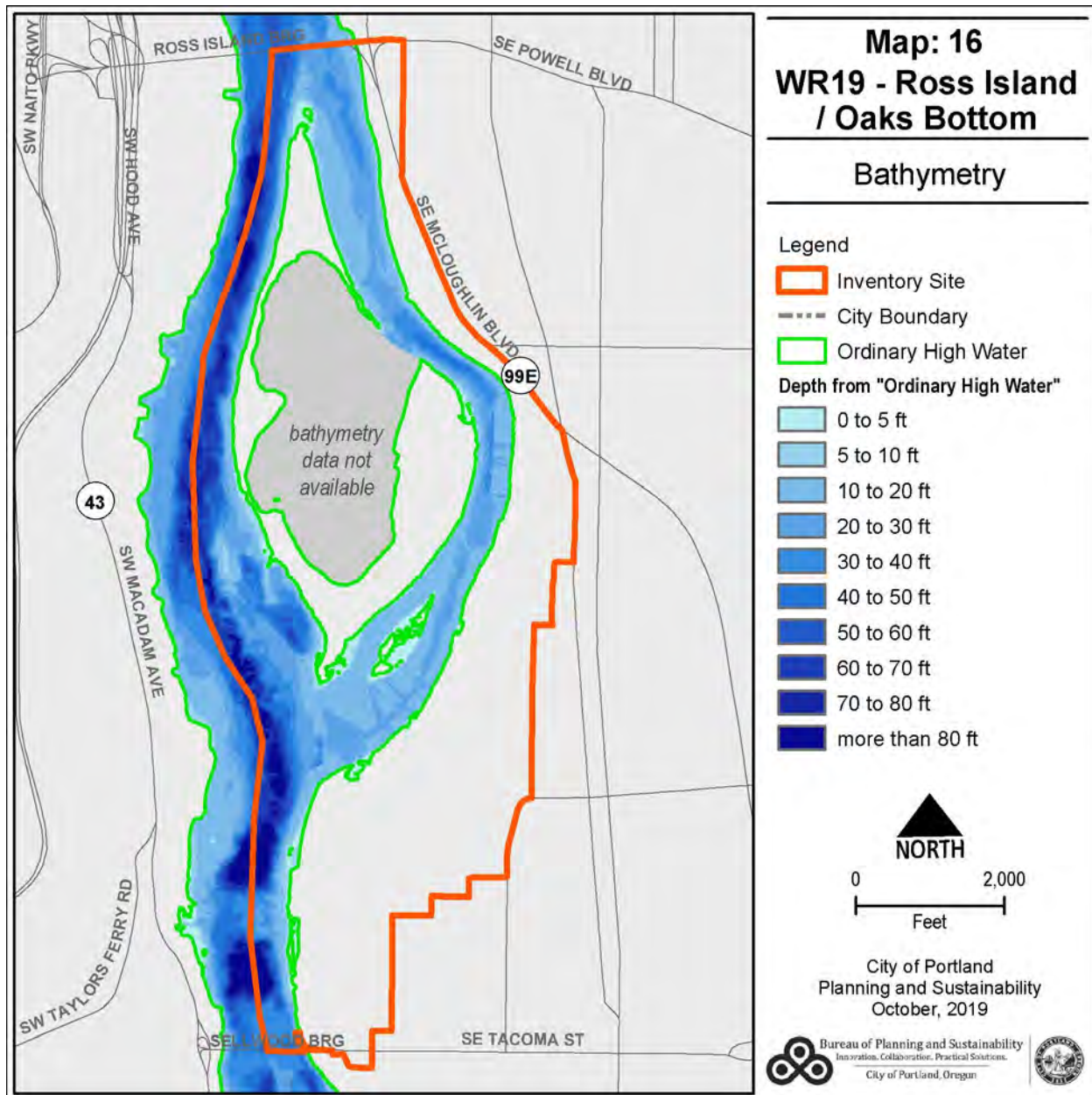
Pacific eulachon (*Thaleichthys pacificus*) pass through the lower Columbia and Willamette rivers as opportunistic migrants as well. Adults return from the Pacific Ocean to spawn in their natal river every winter; however, the timing of the outmigration of juveniles back to the ocean is not well documented.

White sturgeon (*Acipenser transmontanus*) generally move throughout the Columbia River estuary and Lower Willamette River throughout the year. As adults, sturgeon can migrate freely between fresh, brackish and saline water; juveniles and young-of-year cannot, so their rearing range is limited. Recent white sturgeon stock assessment data collected in the Willamette River between Willamette Falls and the Columbia River confluence describe a compromised population of white sturgeon represented by several young age classes.

The historic run of adult Pacific lamprey (*Entosphenus tridentatus*) from the Pacific Ocean up the Willamette River numbered in the hundreds of thousands. Today, that run is significantly smaller; however, tribal harvest of these fish for subsistence and ceremonial uses still brings many families to Willamette Falls every year. Documentation of Pacific lamprey rearing and outmigration patterns in the Lower Willamette River is limited; however, juveniles are often observed in soft substrate samples collected throughout the lower river. The rearing life stage of Pacific lamprey is known to last between 4-7 years in freshwater habitat before individuals migrate to the ocean for their maturation life stages.

Resident fish assemblages within this reach include native species such as largescale sucker, sculpin (prickly and reticulate), reidside shiner and northern pikeminnow. Exotic species include large and smallmouth bass, Asian carp and several yellow perch. Asian carp is considered a highly invasive species by the Oregon Department of Fish and Wildlife and among their top species of concern for the state.

The Willamette River plays an important part of the Pacific Flyway migratory route. Over 200 resident and migratory bird species, including iconic species such as great blue heron, osprey, Peregrine falcon and bald eagle use the riverine habitat. Species use the open water habitat for foraging and as a migratory corridor. Avian species also use natural features and human-made structures for nesting, resting and foraging. Shallow water areas and exposed sand and mud in some areas are used by shorebirds and waterfowl.



The lower Willamette River does not meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 10). Total Maximum Daily Loads (TMDL) for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water

Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

As a result of the repeated occurrence of harmful algal blooms (HAB) in Ross Island Lagoon, the area was recently added to the DEQ listing of the state's imperiled waters. This area (Mile Marker 14-15) falls in the center of WR19. The Oregon Health Authority has issued a warning for the area in four out of the last five years (2014-18). HABs are a result of increased temperatures combined with stagnant, nutrient-rich water and can cause illness in humans and animals if ingested.

Table 10: Water Quality (303(d)) Listings in WR19 – Ross Island and Oaks Bottom				
Pollutant	Season	Year River was Listed for this Pollutant	River Miles¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Aquatic Weeds				
Harmful algal blooms (HAB)	Year-round	2012	14 to 15	Fish and other aquatic life Water contact recreation
Bacteria (Fecal Coliform)	Fall/Winter/ Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at:

<https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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 such overflows over the past decade and completed a 1.4 billion dollar sewer pipe retrofit and upgrade project in 2011 that now captures 94 percent of sewer overflows and transports it to treatment facilities. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

The flood area in this inventory site includes Ross Island and extends into the Oaks Bottom Wildlife Refuge, Oaks Crossing Natural Area and Sellwood Riverfront Park. Oaks Bottom Wildlife Refuge is a substantial part of the 100-year floodplain for this portion of the river and provides substantial flood capacity. The recent replacement of a small culvert with a 16-foot wide arched culvert provides easier access for high flows to enter Oaks Bottom Wildlife Refuge, reducing the impacts of future flood events in Downtown Portland and the Willamette River North Reach (see below for more information on this culvert replacement).

The Willamette River and shallow water habitat are designated Special Habitat Areas because they meet the following criteria:

- (S) – An at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (C) – Wildlife connectivity corridor
- (M) – Migratory stopover habitat

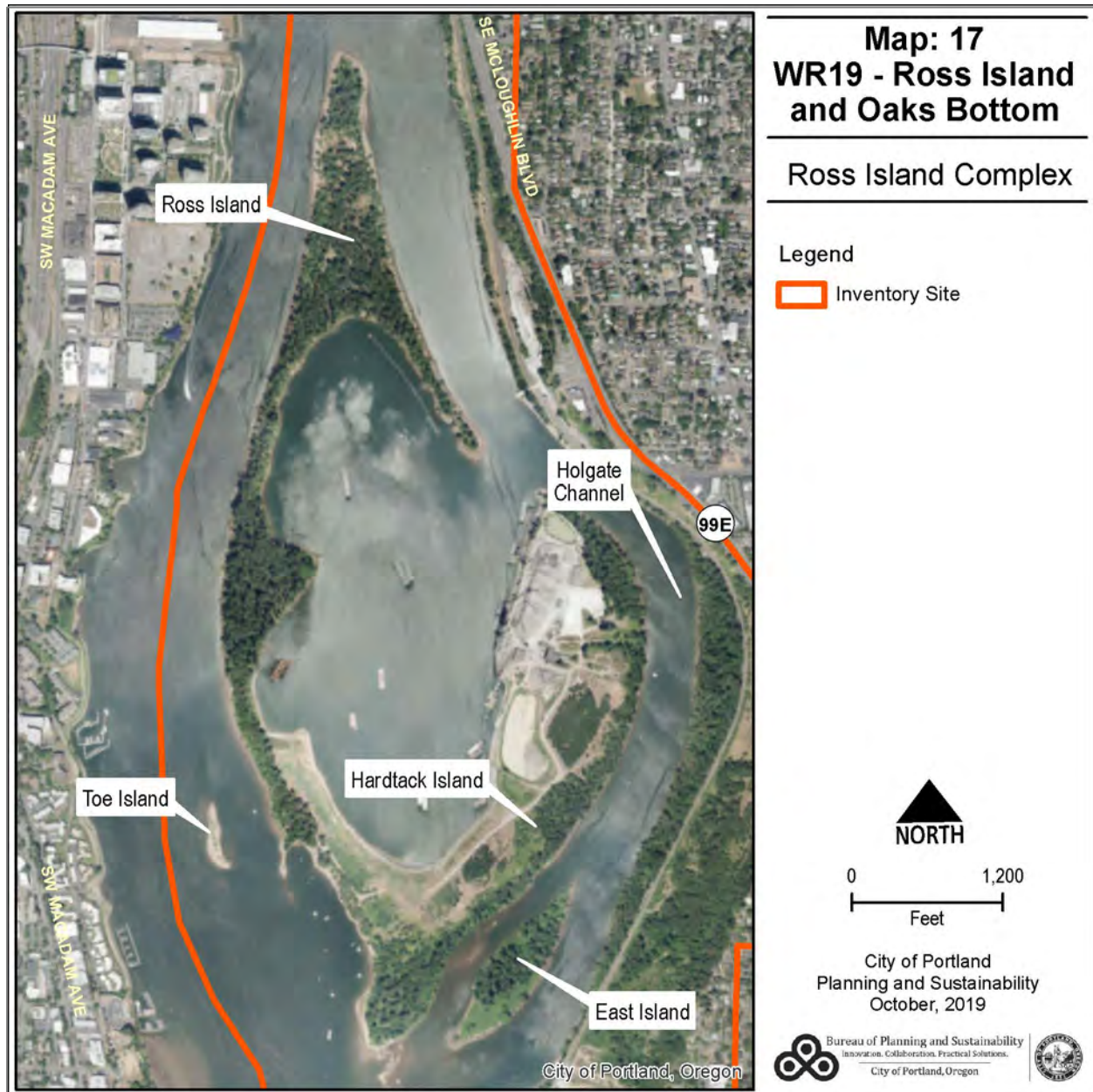
Ross Island Complex

Inventory site WR19 includes Ross Island and the connected Hardtack Island, which were artificially joined with fill in the 1920's. It also includes the smaller Toe Island, located on the southwest side of Ross Island, and the larger East Island, located to the southeast side of Ross Island (see Map 15). These islands are composed of fluvial gravel and sand. The main channel of the Willamette River flows west of Ross Island and the shallower Holgate Channel secondarily flows along the east corridor.

The Ross Island Complex is a diverse establishment of habitat features that includes riparian forest, forested wetland, scrub/shrub wetland, shallow water, beach, and a deep water lagoon. This island habitat mosaic is a unique feature in Portland; the only other areas providing this degree of habitat diversity are West Hayden Island, located in the Columbia River just upstream of the Willamette River confluence, and Sauvie Island, located at the confluence of the Willamette and Columbia rivers.

The Ross Island area includes more than two miles of sand and gravel beach on Ross, Hardtack, and East islands. Much of these lower banks are densely vegetated with an early successional willow community of Pacific, Columbia River and Piper's willows, as well as black cottonwood saplings. This dense vegetation with open sand beach helps control erosion during seasonal flooding events and traps large amounts of driftwood and large wood, which add cover habitat for birds and small mammals and organic biomass to the islands' food web.

Erosion has been observed on the main channel side (west side) of Ross Island and the island's internal banks of the lagoon.



A bottomland forest containing the black cottonwood/red-osier dogwood association dominates the majority of Ross, Hardtack, and East Islands. The interiors of Ross and Hardtack Islands also contain Oregon ash, Pacific willow, Suksdorf's hawthorn, black hawthorn and red alder. The canopy closure is approximately 80 percent, with abundant dead and downed wood as well as snags at a density of 10 to 15 per acre. The diameter of the largest snag exceeds 36 inches and several snags are over 100 feet tall. These are dense bottomland forests in a mid- successional stage (60 to 100 years), with forested wetland areas occurring near the perimeter of the woods and extending toward the beach on East Island. Regeneration of black cottonwood and Oregon ash is

persistent, with many seedlings and saplings evident in the shrub stratum. The shrub canopy cover is approximately 75 percent and is dominated throughout by trailing blackberry, Himalayan blackberry, red elderberry, snowberry and dogwood. The herbaceous cover is approximately 85 percent and is dominated by a mix of native and non-native herbaceous plants. Shiny leaf geranium, garlic mustard, reed canarygrass, blue wildrye and English and Irish ivies are dominant species in the understory, but many other species are present in varying amounts. The understory contains a healthy volume of decaying, dead and downed wood which provides excellent habitat for many species and increases seedling survival by providing organic substrate and nutrients.

Numerous meadows and areas with sparse or young stands of woody vegetation (< 10' tall) exist to the south and west of the lagoon. These areas generally consist of fill or disturbed soils and are vegetated with a broad array of mostly non-native herbaceous and shrub species that provide a huge array of floral and nectar resources that support insects and birds that require open, unforested habitats. Pasture grasses, butterfly bush, tansy, oxeye daisy, teasel, and numerous non-native legume species dominate these habitats.

The entire site is within the Willamette River's 100-year floodplain. Seasonally-inundated wetlands are found in the lower elevations of the area, such as the forest and shrub habitats on East Island and at the south end of Hardtack Island.

The islands support high diversity of wildlife, indicative of a productive food web with many trophic levels and habitat niches. An active heron rookery exists on East Island, adjacent to the slough between Hardtack and East Islands. Up to 30 active nests have been documented (approximately 60 adults). In addition, another (older) rookery with over 20 nests is located on the central portion of Ross Island but appears to have low nest occupation or activity. Another rookery of approximately 15 nests is located at the northern tip of the island.

Bald eagles nest on the west side of Ross Island. Nest fidelity is strong for these birds and some maintain seasonal territories that contain two nests. In addition, red-tailed hawks and osprey are also known to nest on the island. The high occupancy of interspecific raptor nests indicates that sufficient cover, forage, and protected nest sites are available for each within this densely vegetated island area. Passerine species present during surveys included Northern flickers, downy woodpeckers, varied thrushes, and California scrub jays. The islands also provide a feeding ground for thousands of birds that live in the adjacent Oaks Bottom Wildlife Refuge.

Tracks from deer, coyote, river otter, nutria, and possibly red fox, have been observed in the area. Signs of active beaver and moles are also common. Due to the abundance of large snags with old nests or woodpecker holes on Ross and East Islands, it is highly likely that several common owl species including great horned occur here, as well as several species of bats including long-eared and long-legged myotis. It appears that the prey base in or near this area (including small mammals, amphibians, reptiles, fish, and insects) is sufficient to support the site's predator species at the top of the food chain.

Current Ross Island Sand and Gravel (RISG) operations on the site involve transporting raw sand and gravel material via barge to the facility on Hardtack Island. This material is then sorted and graded for delivery to construction sites and other locations around the region. RISG gravel mining in the lagoon began in 1926 and ceased in the early 2000's with the listing of Chinook salmon and steelhead trout as threatened under the ESA. Parts of the lagoon have been excavated to a depth of up to 120 feet. Past mining activities have had a

significant impact on aquatic habitat and noise generated by current activities likely impacts the surrounding wildlife.

The Ross Island Lagoon and southern section of Holgate Channel are designated a “Slow-No Wake” zone, which is defined by the Oregon State Marine Board as “operating a boat at the slowest speed necessary to maintain steerage and that reduces or eliminates waves that appear as white water behind the boat.” However, recreational boaters in Holgate Channel and Ross Island Lagoon often are unaware or ignore the Slow-No Wake requirements. These activities create noise and vibration that can disturb fish and wildlife, including Bald Eagle and Great Blue Heron nests on Ross Island, and can cause erosion in some areas.

The Ross Island Complex is designated a Special Habitat Area for the following:

- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species
- (S) – an at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat

Oaks Bottom Complex

This area extends the entire length of the reach along the east bank of the Willamette River from the Ross Island Bridge south to Sellwood Riverfront Park (see Map 16). The north end of the site is a narrow corridor following a steep bluff between Holgate Channel and McLoughlin Boulevard and includes the Springwater Corridor trail and parallel rail line along the Willamette River. South of the McLoughlin and Holgate Street intersection the site widens to include the Oaks Bottom Wildlife Refuge. Three additional city parks, Oaks Crossing Natural Area, Sellwood Park and Sellwood Riverfront Park, are located at the south end of the area. Oaks Amusement Park is centrally located within the site.

Since the late 1800s, railroad construction and fill have altered Oaks Bottom habitat and its connection to the river. The railroad embankment disconnected an important part of the floodplain from the river. In 1905, the Oregon Water Power and Navigation Company built the 44-acre Oaks Amusement Park, filling part of the bottomlands west of the railroad and clearing much of the understory vegetation (oak trees were preserved and/or planted at the time). In 1909, the City of Portland acquired the 16-acre Sellwood Park located on the bluff above the bottomlands and developed it for active recreational use. The City acquired Oaks Pioneer Park in the late 1950s, which comprised 115 acres of bottomlands and bluff north of Sellwood Park. Soon thereafter, two large wetland areas were filled. The south end of the park was filled as a garbage dump and plans were crafted to build a parking lot at this location. Just north of the park, 50 acres of wetland were filled with debris from the Stadium Freeway project in anticipation of future development. In 1969, after a change in the City’s political and social climate, the City purchased the northern property and crafted an initial plan for a wildlife and plant preserve, known today as Oaks Bottom Wildlife Refuge. Also, in 1969 the City acquired the 9-acre Sellwood Riverfront Park, which was developed for boating and passive recreational uses.

The City’s Bureau of Environmental Services and Portland Parks and Recreation recently partnered with the U.S. Army Corps of Engineers to complete a habitat enhancement project within the refuge. Completed in the fall of

2018, the project included the replacement of an existing narrow culvert with a larger natural-bottom arched culvert, the excavation of tidal slough channels and placement of native vegetation in areas disturbed by construction. The project will improve habitat conditions and enhance fish passage between the river and the refuge.



The Oaks Bottom Complex provides a diverse mix of fish and wildlife habitat. The natural resource functions here are closely linked to the adjacent Ross Island Complex described above, providing important aquatic, riparian and upland habitat in Portland. There are numerous seeps and springs that feed Oaks Bottom Wildlife Refuge.

The Oaks Bottom Complex contains a mosaic of bottomland forest, foothill savanna/oak woodland, conifer forest, shrub, grassland, and wetland habitats that remain linked, despite prior disturbances, to nearby river, slough, and island habitats. A dense, bottomland forest community dominated by black cottonwood covers large portions of this area, including forested wetlands and a high bluff fringe around the refuge. Pacific willow and red-osier dogwood are typical co-dominants with cottonwood. The cottonwood/dogwood association is common throughout the area, while the Oregon ash/willow association is most notable north of the large emergent wetland area and along the shoreline upstream of Ross Island. Other components of the forest include Oregon ash, red alder, and various willow species. The structural diversity of the forest is relatively high. Trees vary in age from approximately 40 to 80 years. Snags and large woody material provide habitat complexity, particularly along the riverbank and within the wildlife refuge. In addition to dogwood and willow, the shrub layer includes snowberry, blue and red elderberry, Douglas spirea, and Himalayan blackberry. The forest ground layer is dominated by trailing blackberry and Irish and English ivies, though sword fern remains common on the forested bluff. Large areas of reed canarygrass are also present in parts of the forest, particularly in the seasonal wetlands and in higher elevations along the Willamette River beach.

Considerable vegetation management efforts have been undertaken by the City in the Oaks Bottom resource area. Both the Bureau of Environmental Services (BES) and Portland Parks and Recreation (PP&R) have committed significant resources in controlling invasive plant species and maintaining native cover. These efforts include treatments to control non-native trees, shrubs, and vines throughout the complex, installation of tens of thousands of willow and dogwood seedlings, cutting in and around the Oaks Bottom reservoir, seeding and planting of native understory shrubs and herbaceous plants on the bluffs, and early detection and rapid response (EDRR)-level control efforts targeting plants such as garlic mustard, false brome, and lesser celandine.. New plantings of Oregon white oak, cottonwood, alder, western red cedar, elderberry, hazel, and snowberry dominate recent endeavors.

The vegetation found along the bluffs at Oaks Bottom Wildlife Refuge has notable differences from that found at the Waud Bluff and Mock's Crest bluff sites in the North Reach. At Oaks Bottom Wildlife Refuge, Oregon white oak is dominant along portions of the bluff, occasionally with madrone as a co-dominant, but species such as cottonwood, Douglas fir, and big-leaf maple are much more prevalent than in north or central reaches. The understory layer is comprised of snowberry, poison oak, blackberry species, English ivy, Irish ivy and clematis. Oregon white oak also occurs on the slightly elevated river terrace at Oaks Amusement Park. Some of the oaks at this site are well over 100 years in age.

Upland shrub habitat typically occurs in disturbed areas of the site such as the north fill, along the northern bluff and adjacent to the railroad track. As in other parts of the study area, the shrub association is dominated by Himalayan blackberry, which often forms a dense, impenetrable thicket. Other occasional shrub species in this association include dogwood Filbert, *Corylus avellana* and willows. A "hedgerow" of native and non-native shrubs and small trees exists immediately east of the railroad berm and runs the length of the wildlife refuge, effectively buffering to some extent the refuge from the rail and trail.

Managed turf and grass species are frequently found areas of prior fill and disturbance. These areas include the managed lawns at Oaks Amusement Park and Sellwood Riverfront Park, which are chiefly comprised of mowed grassland and lawn.

A variety of forested, scrub-shrub, emergent and open water wetland habitats occur at this site. A large and regionally-significant wooded wetland dominated by Pacific willow, Oregon Ash and reed canarygrass occupies about 20 acres in the middle of the refuge. Additional smaller emergent and forested wetlands (some artificially created) occur on the north fill area and are dominated by non-native herbaceous vegetation, Oregon Ash and black cottonwood. Scrub-shrub wetlands are located at the edges of emergent wetlands at the Wildlife Refuge and in the northeast portion of Sellwood Riverfront Park. Forested wetlands typically are willow- or Oregon ash-dominated areas within the bottomland forest containing hydric soils and dominated by hydrophytes.

With one or two minor exceptions, this site contains natural or semi-natural banks along the entire length of the Willamette River and Holgate Channel, although sections are fairly steep and eroded. Bordering the upstream segment of river south of Holgate Channel is one of the longest and most diverse beach habitats within the study area. In a pattern similar to the Stephens Creek/Willamette confluence across the river and Kelley Point Park at the Willamette-Columbia River confluence, Pacific willow of varying ages and reed canarygrass commonly occur along the high water fringe of the beach. As noted above, an emergent wetland (bordered by willows) is located on the beach below Oaks Park. During high water events, this wetland is connected to the Willamette River and functions as a backwater area. The beach and backwater area, combined with the shoreline willow growth, recruit substantial quantities of large wood. These large logs and root wads provide long-term cover, resting, and feeding areas for reptiles (most importantly, turtles), birds and small mammals.

Holgate Channel is the only true side-channel habitat in the study area. The slough links Oaks Bottom Wildlife Refuge to the Ross Island habitat areas and shorelines are preserved in a natural or semi-natural condition, with overhanging vegetation, undeveloped banks, and large wood. In recent years, the banks of the slough have experienced significant erosion and there have been many landslides in the past decade. Still, this area provides excellent refuge for wildlife.

WR19, Ross Island and Oaks Bottom, attracts the greatest abundance of wildlife within the study area. The mosaic of aquatic and terrestrial habitat types and the connection to Willamette River, Holgate Channel, and the islands creates forage, nesting, and resting opportunities for birds, reptiles, amphibians, and mammals. Over 180 bird species have been reported in this inventory site, including birds nesting on Ross and East Islands such as bald eagle, great blue heron, red tail hawk, and osprey. Several active osprey nests were also noted at Oaks Bottom Wildlife Refuge (see Table 11). Other raptors at this site include kestrels, harriers, hawks, and owls. Anna's hummingbirds commonly nest at the refuge. River birds include green heron, Northern shoveler, pintails, mallards, wood ducks, coots, wigeons, gulls, cormorants, and owls. Passerines include warblers, red-winged blackbird, common yellowthroats, chickadees, bushtits, flycatchers, wrens, robins, sparrows, jays, crows, juncos, thrushes, finches, towhees, nuthatches, and kinglets. Other birds identified at Oaks Bottom Wildlife Refuge include hummingbirds, quail, woodpeckers, flickers, and kingfishers and band-tailed pigeons. A full list of birds observed at Oaks Bottom Wildlife Refuge can be found in Appendix E.

Table 11: Avian Special Status Species Observed at Oaks Bottom Wildlife Refuge

Common Name	Scientific Name	SHA At Risk Species	Notes
American Kestrel	<i>Falco sparverius</i>		Occasional, only a few records per year
Bald Eagle	<i>Haliaeetus leucocephalus</i>	X	
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	X	Occasional, only a few records per year
Black-throated Gray Warbler	<i>Setophaga nigrescens</i>		Fairly common in spring
Brown Creeper	<i>Certhia americana</i>		Known or likely breeding species
Bufflehead	<i>Bucephala albeola</i>	X	
Bushtit	<i>Psaltiriparus minimus</i>		Known or likely breeding species
Common Yellowthroat	<i>Geothlypis trichas</i>		Known or likely breeding species
Downy Woodpecker	<i>Picoides pubescens</i>		Known or likely breeding species
Great Blue Heron	<i>Ardea herodias</i>		
Green Heron	<i>Butorides virescens</i>		
Hammond's Flycatcher	<i>Empidonax hammondi</i>		Uncommon spring and fall migrant
Hooded Merganser	<i>Lophodytes cucullatus</i>		
Hutton's Vireo	<i>Vireo huttoni</i>		Known or likely breeding species
Merlin	<i>Falco columbarius</i>	X	Occasional, only a few records per year
Nashville Warbler	<i>Oreothlypis ruficapilla</i>		Occasional spring migrant
Olive-sided Flycatcher	<i>Contopus cooperi</i>	X	Occasional, only a few records per year
Orange-crowned Warbler	<i>Oreothlypis celata</i>		
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>		Uncommon to occasional spring and fall migration
Peregrine Falcon	<i>Falco peregrinus</i>	X	
Pileated Woodpecker	<i>Dryocopus pileatus</i>	X	Occasional, only a few records per year
Purple Finch	<i>Haemorhous purpureus</i>		Occasional, only a few records per year
Purple Martin	<i>Progne subis</i>	X	Known or likely breeding species
Rufous Hummingbird	<i>Selasphorus rufus</i>		Known or likely breeding species
Swainson's Thrush	<i>Catharus ustulatus</i>		Uncommon
Thayer's Gull	<i>Larus thayeri</i>		Uncommon
Varied Thrush	<i>Ixoreus naevius</i>		Uncommon
Vaux's Swift	<i>Chaetura vauxi</i>		
Western Sandpiper	<i>Calidris mauri</i>		Uncommon to occasional spring and fall migration
Western Wood-Pewee	<i>Contopus sordidulus</i>		Known or likely breeding species
White-breasted Nuthatch (Slender-billed)	<i>Sitta carolinensis aculeata</i>	X	
Willow Flycatcher (Little)	<i>Empidonax traillii brewsteri</i>	X	Known or likely breeding species
Wilson's Warbler	<i>Cardellina pusilla</i>		Uncommon spring and fall migrant
Pacific wren	<i>Troglodytes pacificus</i>		
Wood Duck	<i>Aix sponsa</i>		Known or likely breeding species
Yellow Warbler	<i>Setophaga petechia</i>		Uncommon spring and fall migrant

A two-year amphibian study was completed in 2009 by Portland Parks and Recreation. Oregon salamander, Western red-back salamander, Pacific chorus frog, Northern red-legged frog and long-toed salamander were found in the Oaks Bottom Wildlife Refuge. Northern red-legged frogs are an at-risk species. Rough-skinned newts have also been observed.

The Holgate Channel and Oaks Bottom channel banks contain burrows at or above the high water mark. River otter, mink, beaver, muskrat and nutria are all known to use the refuge and Holgate Channel. Other mammals utilizing this site include blacktail deer, beaver, and small rodents.



Oaks Bottom Wildlife Refuge is designated a Special Habitat Area for the following (see Map 17):

- (S) – an at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (O) – Oak
- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat



Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 13). The relative ranks are produced using GIS models and information on Special Habitat Areas.

The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter II: Methodology Overview of this report and Appendix B: *Natural Resources Inventory: Riparian Corridors and Wildlife Habitat Project Report*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning projects and programs, including regulations, design of development or redevelopment projects, and mitigation and restoration activities.

Riparian Areas

The site contains the Willamette River and river bank, flood area, wetlands and riparian vegetation. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are assigned to the Willamette River itself, wetlands and forest vegetation in the floodplain or in proximity to the water bodies. Medium relative functional ranks are assigned to less dense and lower structure vegetation in the floodplain and up to 300 feet from water bodies. Low relative ranks are generally assigned to non-vegetated flood areas.

Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas 2 acres in size or greater, including adjacent woodland vegetation (note: Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). The model assigns relative ranks to qualifying habitat patches based on their size, interior area, proximity to other patches and proximity to water. Medium relative functional ranks are assigned to wetland and forest patches in this inventory site.

Special Habitat Areas (SHA) consist of rare and declining habitat types and unique features that provide critical habitat for at-risk plant and animal species as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat, and include:

The Willamette River, including shallow water habitat areas, is designated a SHA because it meets the following criteria:

- (S) – An at-risk species uses the habitat area or feature on more than an incidental basis to complete one or more life history phases
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor

The Ross Island Complex is designated a SHA because it meets the following criteria:

- (I) – Islands or the portions of riverine islands that provide habitat for river/island-associated resident and/or migrating wildlife species

- (S) – an at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat

Oaks Bottom Wildlife Refuge is designated a SHA because it meets the following criteria:

- (S) – an at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat

Rare Plant Species

A number of rare native plant species have been documented in WR19 and are listed in Table 12.

Table 12: Rare Native Plant Species in WR19 – Ross Island/Oaks Bottom		
Common Name	Scientific Name	NatureServe State Rank ¹
Indianhemp	<i>Apocynum cannabinum</i>	
Tall beggarticks	<i>Bidens vulgate</i>	
Fox Sedge	<i>Carex vulpinoidea</i>	

1. The NatureServe system is an international system for ranking rare, threatened and endangered species throughout the world. The ranking is a 1-5 scale, with 1 being critically imperiled and 5 being secure. The state ranks specifically evaluate the rarity of a species within each state's boundary.

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank.

Table 13: Summary of Ranked Resources in WR19 – Ross Island/Oaks Bottom				
Total Inventory Site = 1,031 acres				
	High	Medium	Low	Total
Riparian Resources*				
acres	766	60	87	913
percent total inventory site area	74	6	8	89
Wildlife Habitat				
Wildlife Habitat*				
acres	0	295	7	304
percent total inventory site area	0	29	<1	29
Special Habitat Areas**				
acres	830			
percent total inventory site area	80			
Wildlife Habitat - adjusted by Special Habitat Areas***				
acres	830	18	2	850
percent total inventory site area	80	2	<1	82
Combined Total***				
acres	846	34	53	933
percent total inventory site area	82	3	5	90
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat include the Willamette River. ** Special Habitat Areas rank high for wildlife habitat. *** Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				

Natural Resource Protection Recommendation

The Willamette River and associated floodplain and riparian areas in resource site WR19 represent a diverse complex of unique, high-quality natural resources not found elsewhere in Portland. Parks and natural areas make up the large majority of this inventory site. The inventory site provides valuable habitat for fish and wildlife, including providing shallow water habitat along the shorelines of Ross Island and the Holgate Channel as well as wetland and upland habitat for birds and mammals within the Oaks Bottom complex. A number of important fish species migrate through this inventory site on their way up and down the Willamette River. Natural resources within this inventory site are generally contiguous, allowing for relatively easy movement throughout the area for wildlife species.

WR19 is also home to the large majority of industrial activities within the South Reach. Ross Island Sand and Gravel continues to process aggregate on Hardtack Island and maintains its headquarters on the top of the bluff at the northern end of this inventory site. Oaks Amusement Park, also located in this inventory site, is an historic recreation destination that serves the region and provides substantial seasonal employment during the spring, summer and fall months. Protection recommendations should recognize these unique land uses in WR19.

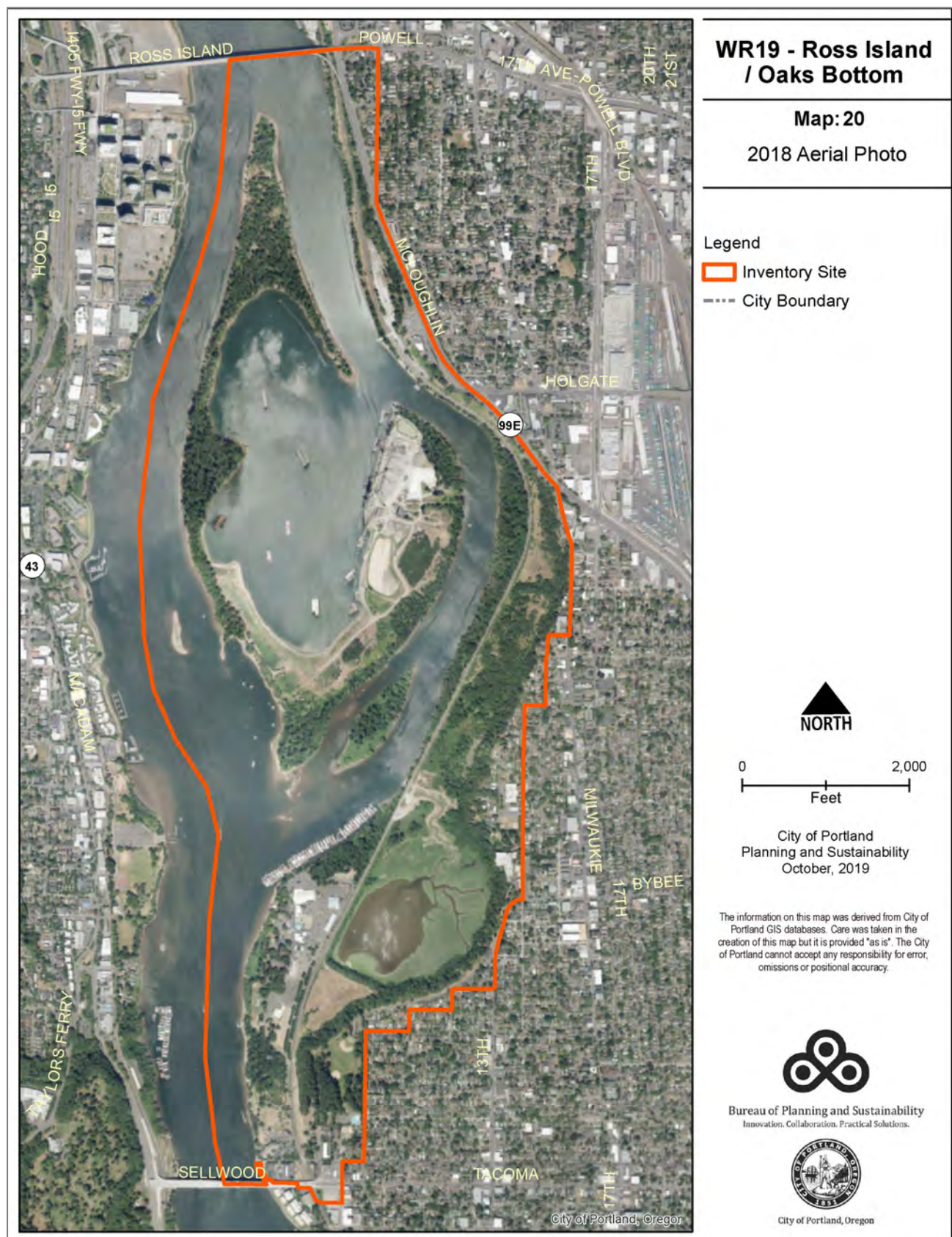
The general recommendation, shown on Map 24, aims to balance the environmental, economic and social consequences of protecting natural resources in WR19. Due to the substantial amount of high and medium ranked resources in this inventory site, the map shows development within sizable portions of the inventory site to be strictly limited. In these areas, conflicting uses should be limited to the extent possible. Additional flexibility should be provided for development on parcels containing medium-ranked resources. Developed areas within the 100-year or 1996 Flood Inundation Area (ranked as low-value resources) should be provided moderate protections to ensure no loss of flood storage and floodplain habitat as a result of development in these areas.

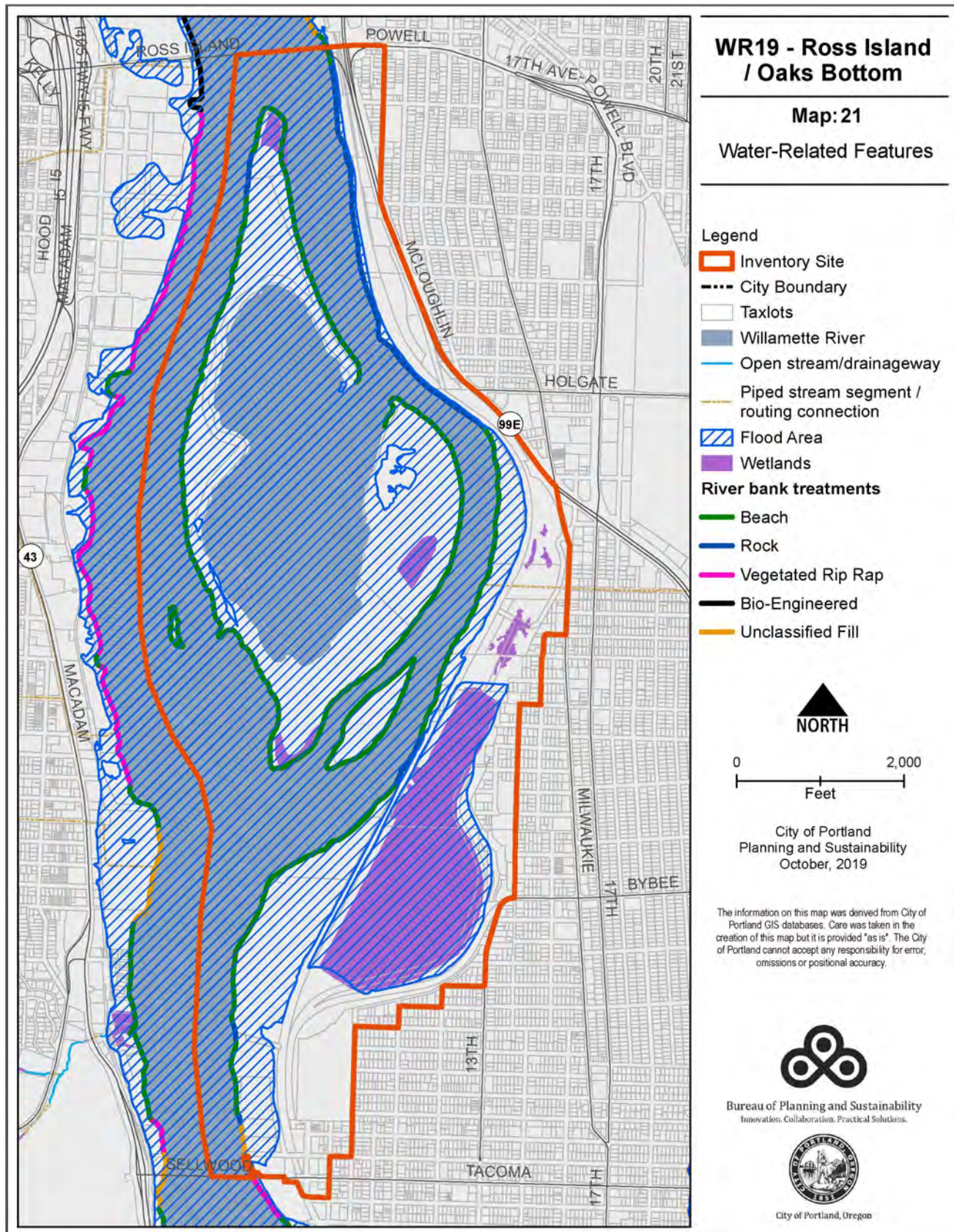
The recommendation for riparian areas is to:

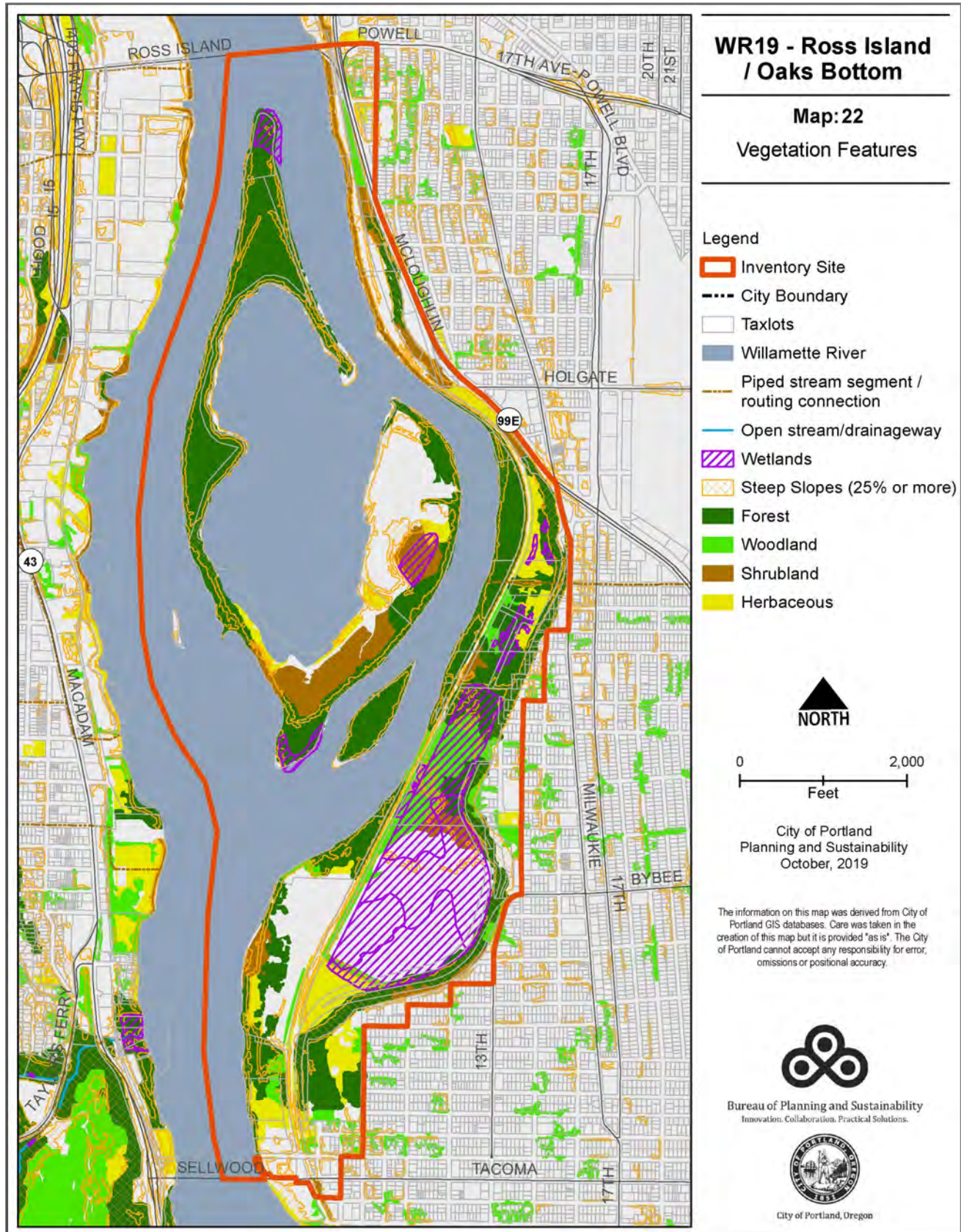
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land located landward of and waters below the top of bank of the Willamette River, tributaries of the river and land within the undeveloped 100-year floodplain and 1996 Flood Inundation Area.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked riparian areas and developed floodplain (classified as low ranked resource).

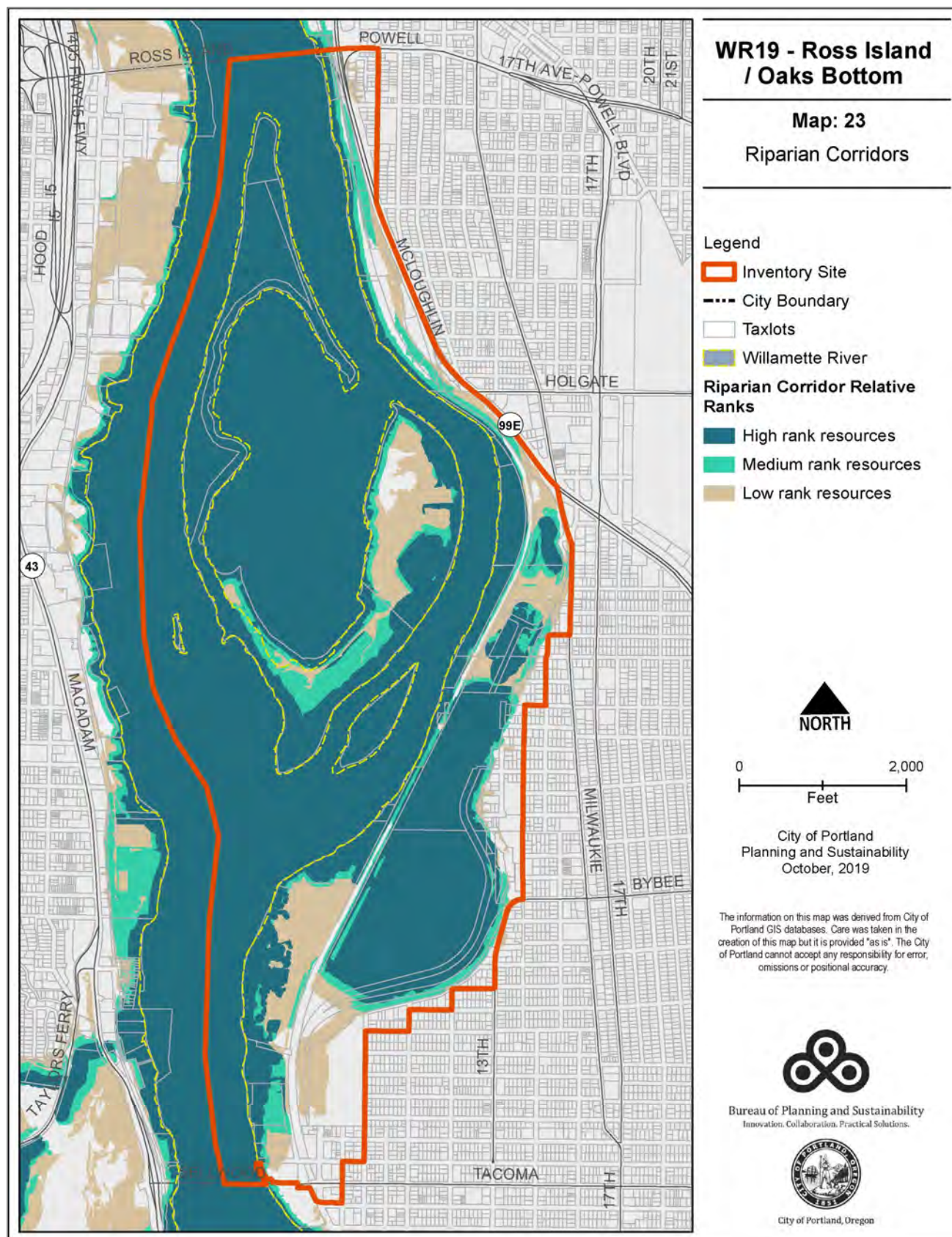
The recommendation for wildlife habitat areas outside of riparian areas is to:

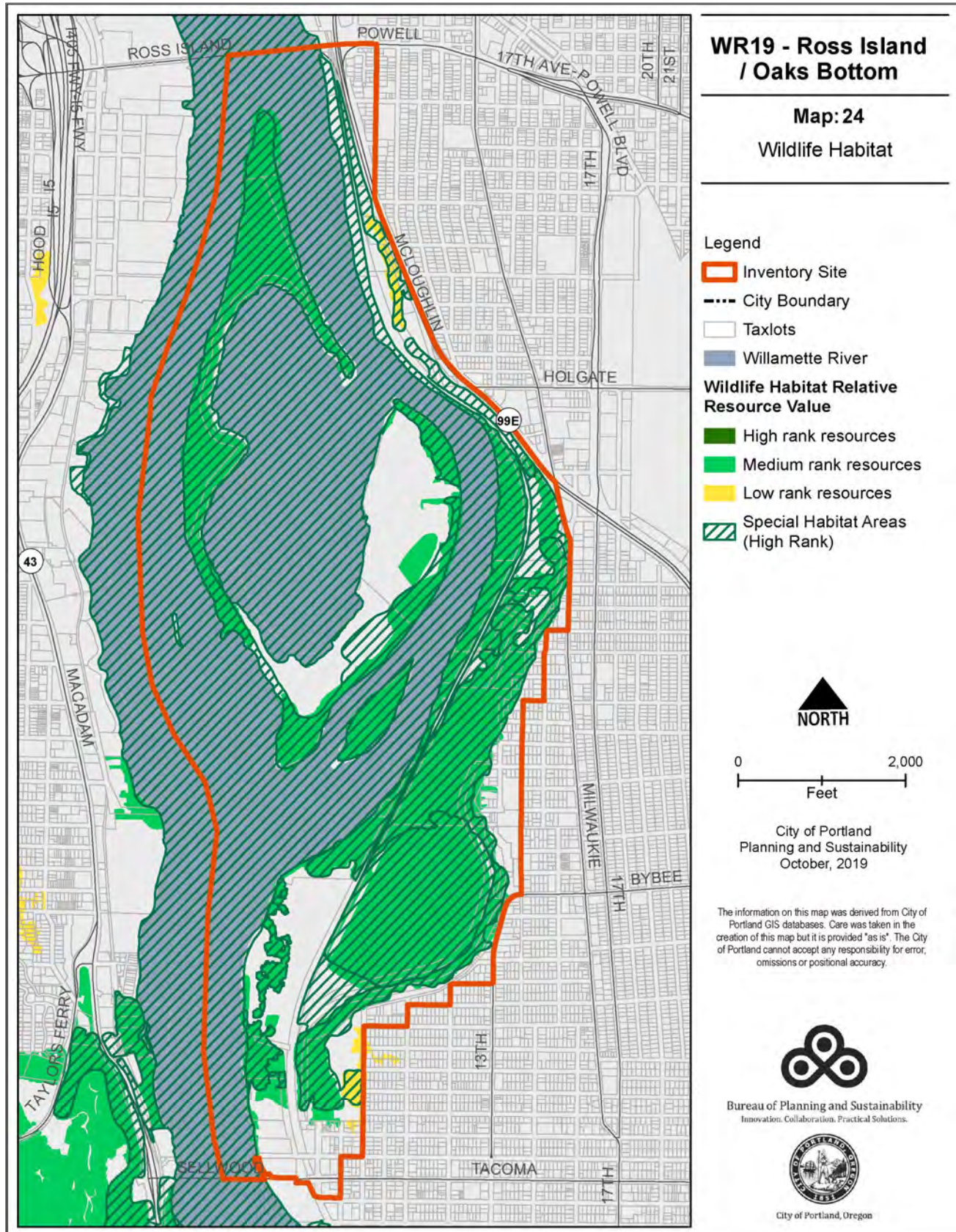
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked resources.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked resources.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

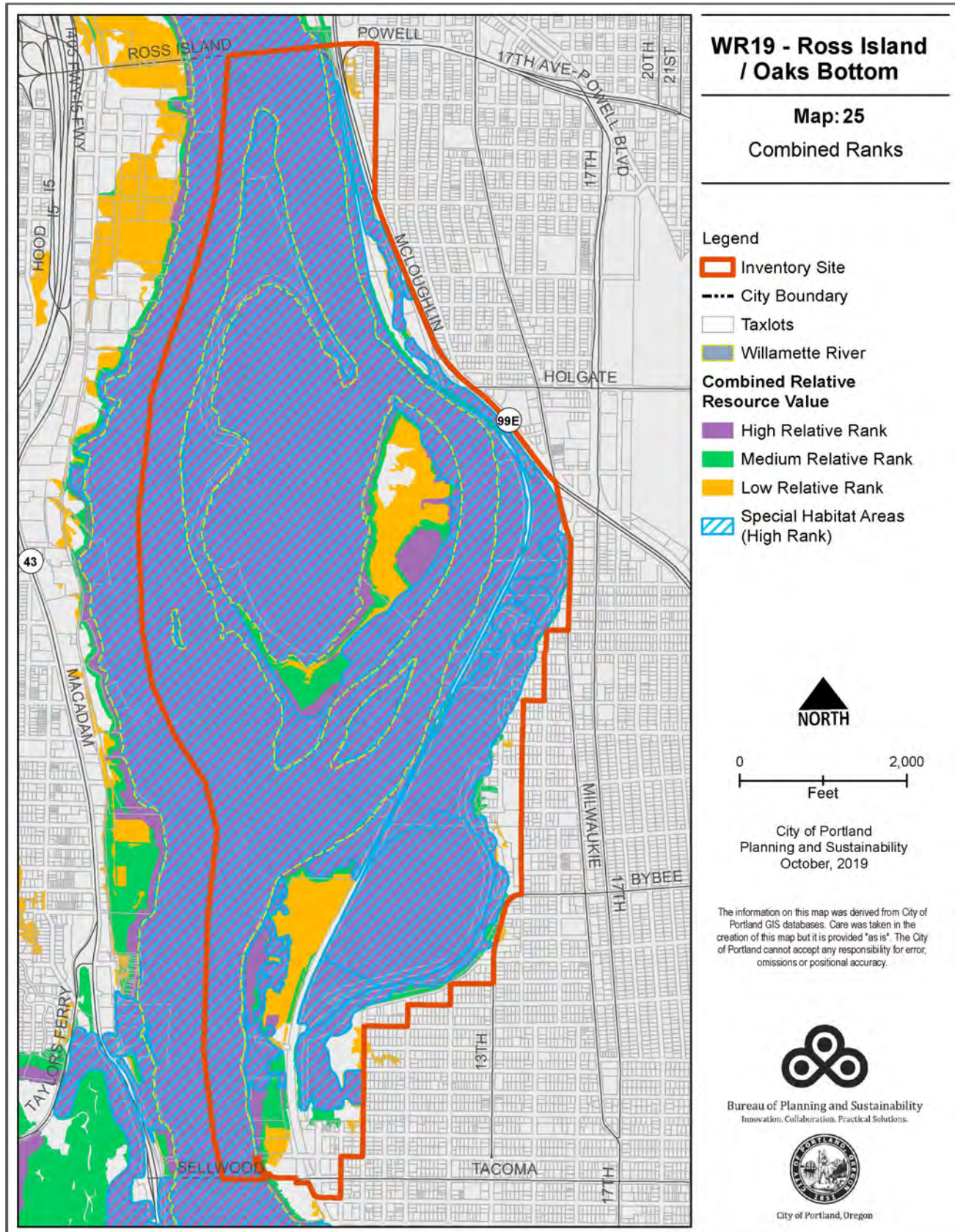


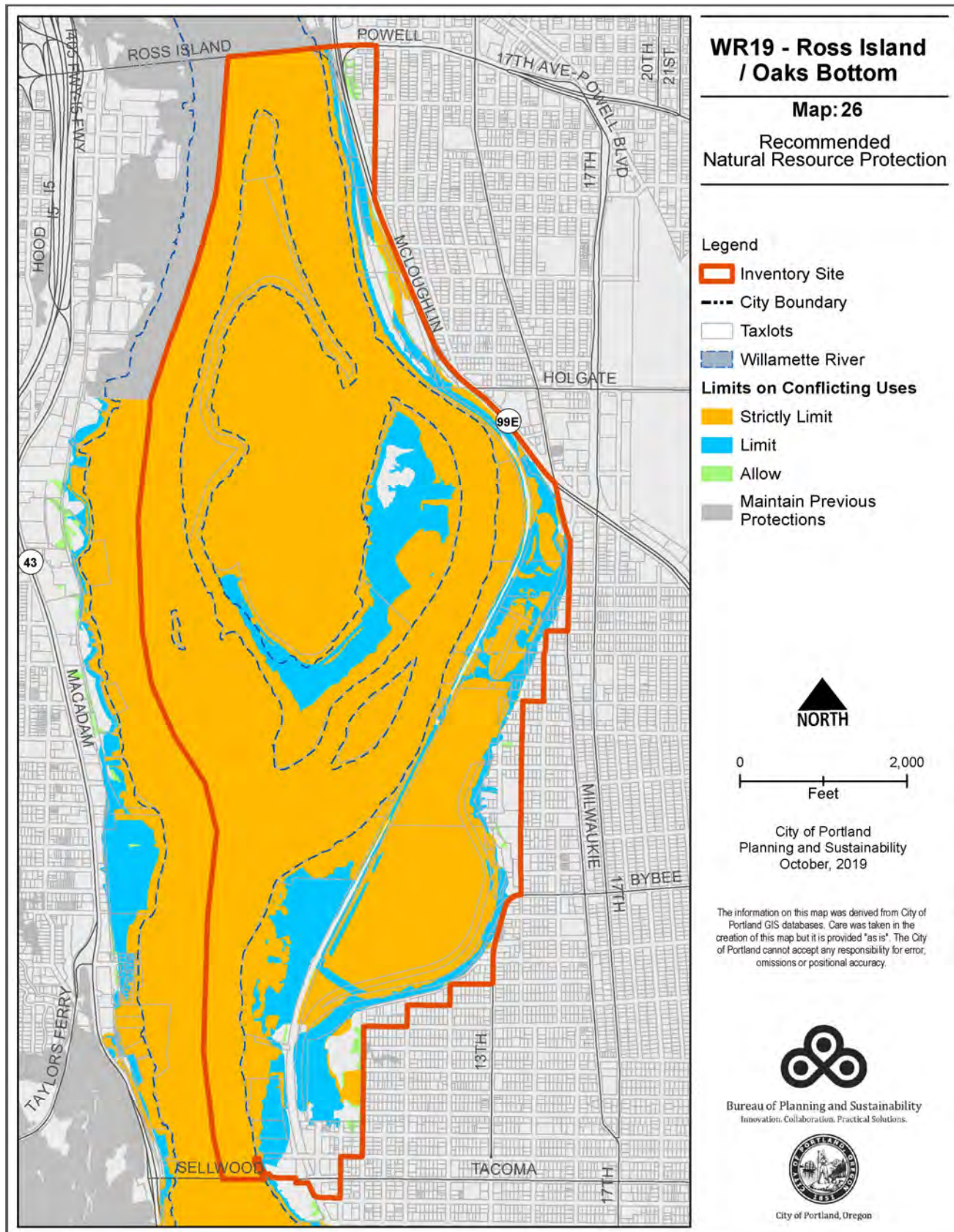








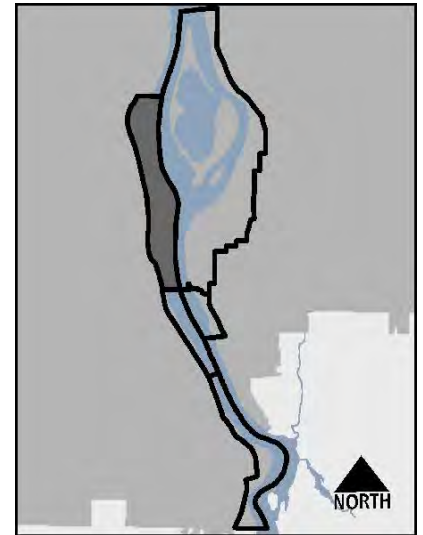




4.ii: INVENTORY SITE WR20 SW RIVERFRONT PARKS

Summary Information

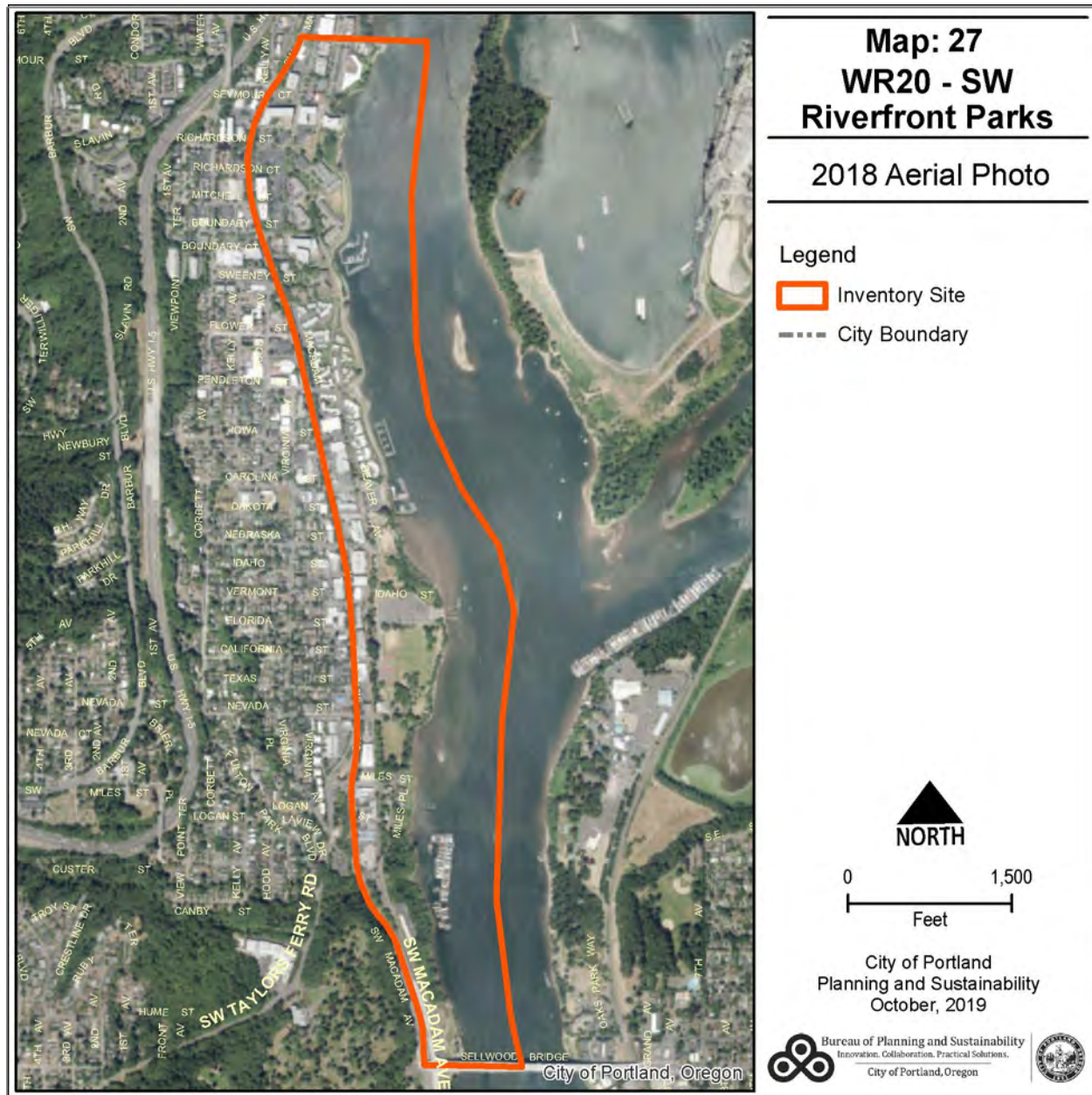
Watershed:	Willamette River Watershed
Neighborhood:	South Portland
USGS Quadrangle and Quarter Section Maps:	1S1E15A, 1S1E15B, 1S1E15C, 1S1E15D, 1S1E 22A, 1S1E22B, 1S1E22C, 1S1E22D
River Mile:	14.7 – 16.5
Site Size:	269 acres (land and water)
Previous Inventory:	Southwest Hills Resource Protection Plan, 1992; Lower Willamette River Wildlife Habitat Inventory, March 1986
Zoning:	Commercial Employment (CE) Commercial/Mixed Use 2 (CM2) Residential 1,000 (R1) Residential 2,000 (R2) Residential 5,000 (R5) Open Space (OS) Design Overlay Zone (d) Scenic Overlay zone (s) Willamette Greenway River General Overlay (g) Willamette Greenway River Natural Overlay (n) Willamette Greenway River Recreational Overlay (r)
Existing Land Use:	Commercial, residential, parks and open space, railroad, highway
General Description:	The northern portion of the site is characterized by residential and commercial uses. The southern portion of the site also has commercial uses along Macadam Avenue, but the riverward land is occupied by Willamette Park and Willamette Moorage, which includes the restored confluence to Stephen's Creek. Macadam Ave. runs the entire length of the site.
Resource Features:	Open water, shallow water habitat, river bank, flood plain, wetland, riparian vegetation
Resource Functions:	Microclimate and shade; stream flow moderation and water storage; bank function and sediment, nutrient and pollution control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; and wildlife habitat and movement corridor



Special Habitat Area:	<p>Willamette River: (S) – provides habitat for at-risk wildlife species; (C) – wildlife connectivity corridor</p> <p>Cottonwood Bay: (B) – bottomland hardwood forest; (M) – migratory stopover habitat; (C) – wildlife connectivity corridor habitat; (U) – unique feature</p> <p>Willamette Moorage: (S) – provides habitat for at-risk wildlife species; (B) – bottomland hardwood forests; (W) – wetland; (M) – migratory stopover habitat; (C) – wildlife connectivity corridor habitat</p>
Special Status Species:	<p>Fish: Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead trout, LCR coastal cutthroat trout, Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout, Pacific lamprey, Western brook lamprey, white sturgeon.</p> <p>Amphibians: None</p> <p>Birds: American kestrel, bald eagle, band-tailed pigeon, black-throated gray warbler, brown creeper, bushtit, downy woodpecker, Dunlin, great blue heron, merlin, olive-sided flycatcher, orange-crowned warbler, Pacific-slope flycatcher, purple martin, rufous hummingbird, Swainson's thrush, tree swallow, Vaux's swift, Western grebe, Western sandpiper, white-breasted nuthatch (slender-billed), Western wood-pewee, willow flycatcher (little), Wilson's warbler, wood duck and yellow warbler.</p> <p>Mammals: American beaver, hoary bat, Northern river otter</p>
Natural Hazards:	Flood area, wildfire, landslide, earthquake and liquefaction
Contamination:	Yes

Site Description

This 269-acre site is located between Hamilton Ct. and the Sellwood Bridge, east of SW Macadam Ave (Hwy 43) (see Map 25). The northern portion of the site is characterized by residential and commercial uses. The southern portion of the site also has commercial uses along Macadam Ave, but the riverward land is occupied by Willamette Park and Willamette Moorage. Macadam Avenue is the western border for the entire length of the site.



The site contains 63 acres (23 percent) of impervious surfaces. Of the vegetated areas over ½ acre in size, there are approximately 12 acres of forest, 16 woodland vegetation, three acres of shrubland and 17 acres of herbaceous vegetation. There are 193 acres of flood area on this site, most of which is open water.

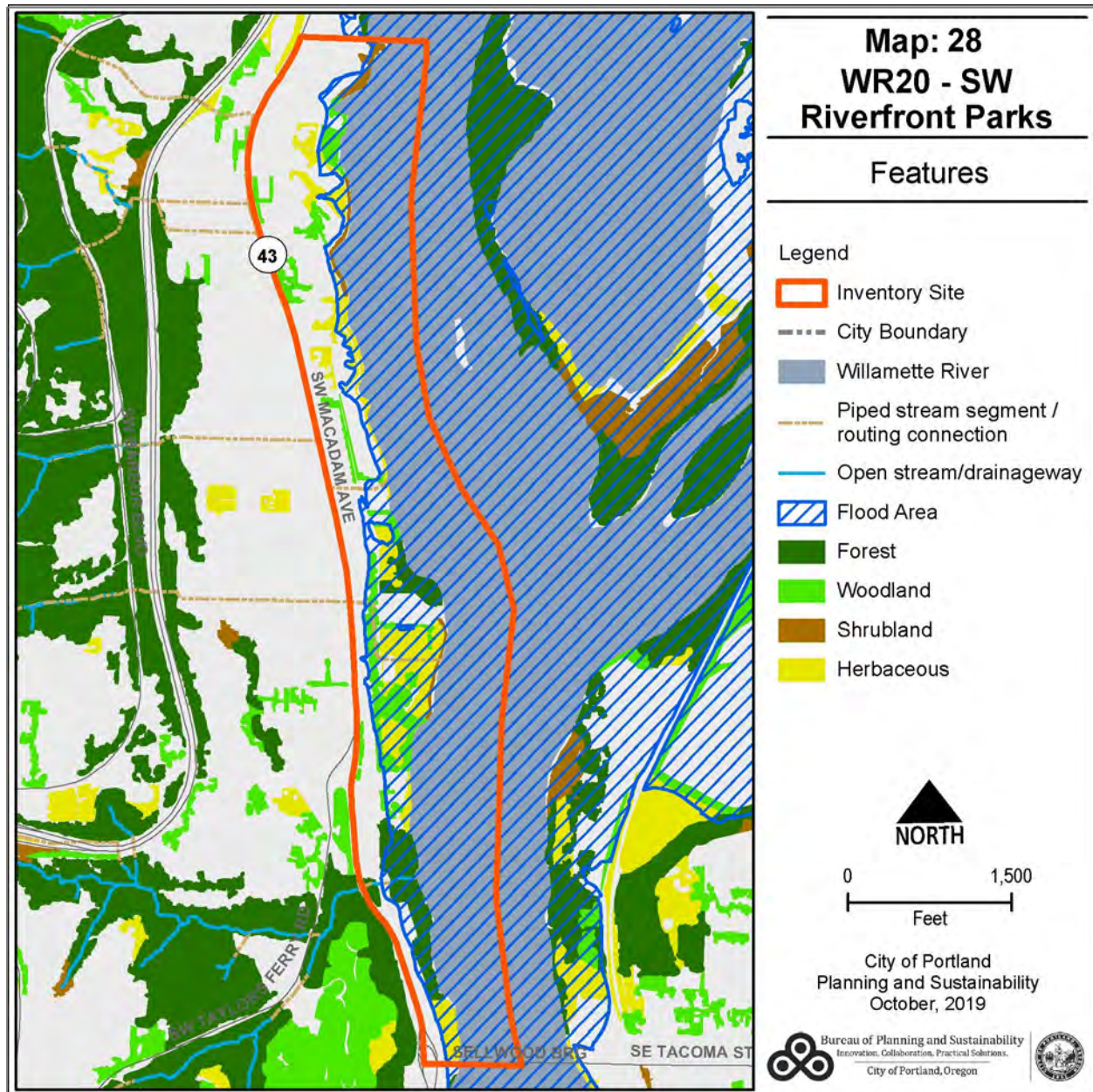
Table 14: Summary of Natural Resource Features in WR20 – SW Riverfront Parks

	Study Area (miles/acres)
River (miles/acres)	2/138
Stream/Drainageway (miles)	<1
Wetlands (acres)	2
Flood Area (acres)*	
Vegetated (acres)	36
Non-vegetated (acres)	19
Open Water** (acres)	138
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	12
Woodland (acres)	16
Shrubland (acres)	3
Herbaceous (acres)	17
Impervious Surfaces (acres)	63
* 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.	

Natural Resource Description

Historically, the portion of the Willamette River watershed within the City of Portland 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 residential development, parks and natural areas. There are also a variety of commercial uses along SW Macadam Avenue (Hwy 43). Parks in this inventory site include the southern portion of Cottonwood Bay, Willamette Park, Willamette Moorage, Miles Beach and the northern portion of Powers Marine Park. All of these parks, as well as the Willamette River open water and river banks are significant natural resource areas.



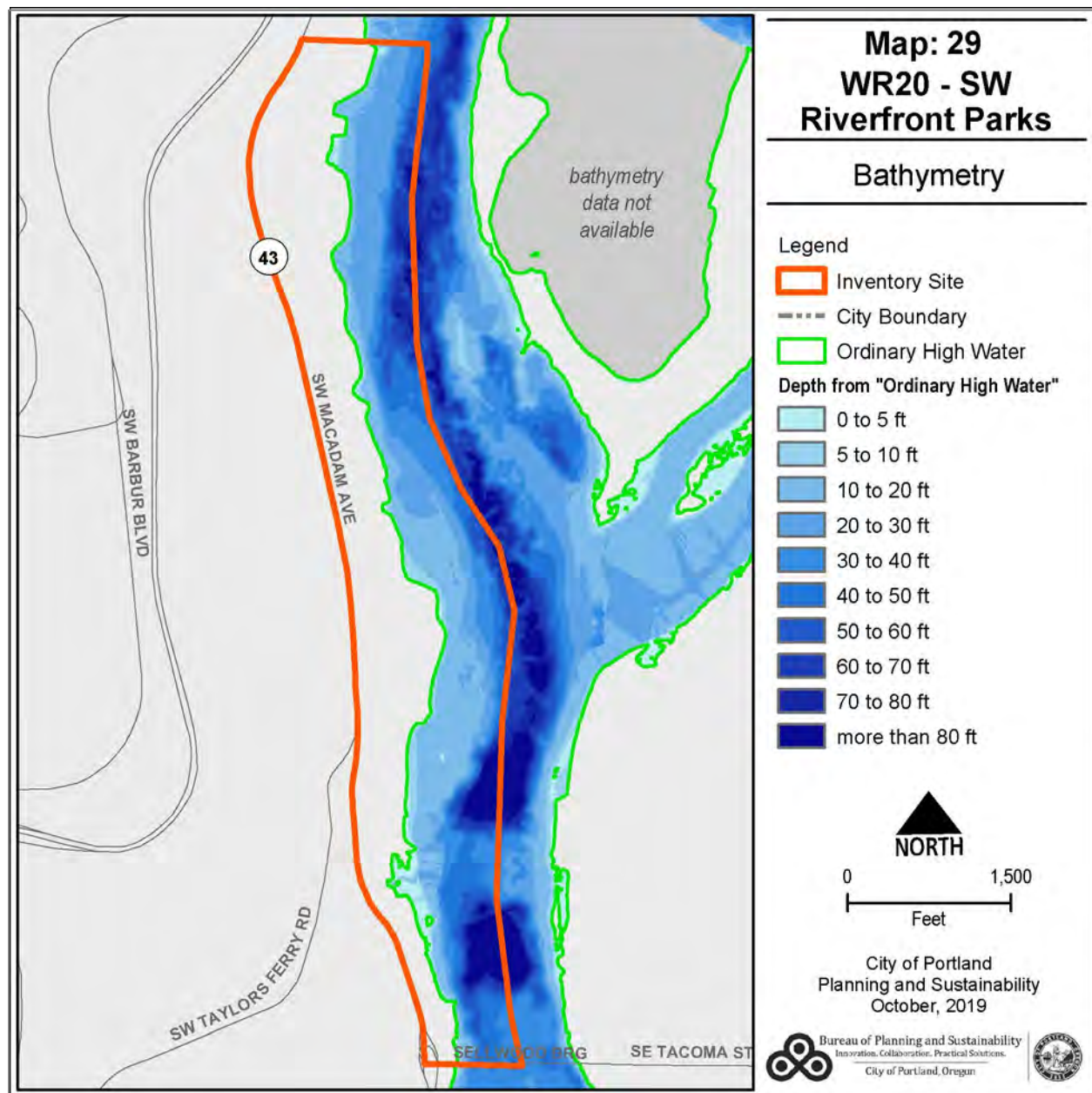
Willamette River

Below is a summary of Lower Willamette River natural resources documented in inventory site WR20. Additional information about the water quality, hydrology, and fish and wildlife use of the entire Willamette River South Reach is provided earlier in this chapter. Information on the Willamette River as a whole and the Lower Willamette River, more specifically, can be found in Chapter I.

Inventory site WR20 includes 138 acres of the Lower Willamette River. The river is the primary habitat link providing connectivity between upstream and downstream aquatic habitats. This connection is critical for fish, resident and migrating birds and other species.

The Willamette River is the primary migration corridor for ESA-listed Chinook and coho salmon, as well as steelhead and coastal cutthroat trout. These fish enter the Lower Willamette River system to explore and spawn in reaches throughout the Willamette River watershed. Shallow water areas, which are found along shoreline margins in this inventory site, are especially important for juvenile fish because they provide opportunities to escape the swift current of the main channel to rest and feed (see Map 27). Seasonal migrants use habitat within the inventory site during multiple life stages, and are usually present during predictable seasonal peaks:

- Juvenile salmon and trout out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead and coho out-migration peaks between May and June.



The Columbia eulachon pass through the lower Columbia and Willamette rivers as opportunistic migrants as well. Adults return to their natal river every winter; however, their out-migration timing is not as well documented.

White sturgeon generally move throughout the Columbia River estuary and Lower Willamette River throughout the year. As adults, sturgeon can migrate freely between fresh, brackish and saline water; juveniles and young-of-year cannot, so their rearing range is limited. Recent white sturgeon stock assessment data collected in the Willamette River between Willamette Falls and the Columbia River confluence describe a compromised population of white sturgeon represented by several young age classes.

The historic run of adult Pacific lamprey up and over Willamette Falls numbered in the hundreds of thousands. Today, that run is significantly smaller; however, tribal harvest of these fish for subsistence and ceremonial uses still brings many families to the Willamette Falls every year. Documentation of Pacific lamprey rearing and outmigration patterns in the Lower Willamette River is limited; however, juveniles are often observed in soft substrate samples collected throughout the lower river. The rearing life stage of Pacific lamprey is known to last between 4-7 years in freshwater habitat, before individuals migrate to the ocean for their maturation life stages.

Resident fish assemblages within this reach include native species such as largescale sucker, sculpin (prickly and reticulate), reidside shiner and northern pikeminnow. Nuisance species include large and smallmouth bass, Asian carp and yellow perch.

The Willamette River plays an important part of the Pacific Flyway migratory route. Over 200 resident and migratory bird species, including iconic species such as great blue heron, osprey, Peregrine falcon and bald eagle use the riverine habitat. Species use the open water habitat for foraging and as a migratory corridor. Avian species also use natural features and human-made structures for nesting, resting and foraging. Shallow water areas and exposed sand and mud in some areas are used by shorebirds and waterfowl.

The Willamette River in the inventory site does not meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 15). TMDLs for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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.

Table 15: Water Quality (303(d)) Listings in the WR20 – SW Riverfront Parks

Pollutant	Season	Year River was Listed for this Pollutant	River Miles ¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Bacteria (Fecal Coliform)	Fall/Winter/ Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at:

<https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

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 such 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. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

In this inventory site, the 100-year floodplain is generally confined to the Willamette River itself, though it does extent beyond the riverbanks in Willamette Park, in the Miles Place neighborhood just south of Willamette Park, and on a few properties at the north end of the inventory site. The 1996 Flood Inundation Area extended landward of the 100-year floodplain in a number of locations, including areas of John's Landing, the Willamette Sailing Club, and Willamette Park.

The Willamette River and shallow water habitat are designated Special Habitat Areas because they meet the following criteria:

- (S) – An at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (C) – Wildlife connectivity corridor
- (M) – Migratory stopover habitat

Cottonwood Bay/Heron Pointe Wetlands

Cottonwood Bay spans from the Willamette River Central Reach into South Reach. The larger northern embayment is approximately 1.2 acres in size and the southern embayment is approximately 0.6 acres. These coves maintain small beach areas with ample cottonwoods and willows; however, river bank function is impaired by extensive riprap, fill and steepening (see Map 28).

Cottonwood Bay contains small stands of black cottonwood along the upper riverbanks and within the three embayments. Red alder, Pacific willow, red-osier dogwood, Douglas spirea and scattered ornamental trees also occur along the banks. Interspersed along the banks in the cottonwood stands is a blackberry-dominated shrub association. Irish and English ivies cover most of the ground layer at this site.

A constructed forested wetland is established adjacent to the Heron Pointe Condominium development and is dominated by large Pacific willows is located within the southernmost cove. Reed canarygrass and common rush are also common in the wetland. Native vegetation includes salal, Oregon grape, wild rose, red-osier dogwood, and black cottonwood. The Heron Pointe wetland is a rare contiguous wetland in this northwestern portion of the South Reach planning area.

Bird species detected on this extent of the river includes double-crested cormorant, common merganser, great blue heron, Western grebe, bald eagle, white-crowned sparrow, dark-eyed junco, belted kingfisher, violet-green swallow, house finch, and American crow. The site's proximity to the Ross Island complex makes it an occasional stopover and forage site for herons, osprey, woodpeckers, hawks, waterfowl and other avian species that are frequently observed across the river.

Cottonwood Bay is designated a Special Habitat Area for the following:

- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat
- (U) – Unique feature



Willamette Park, Miles Beach and Willamette Moorage

Miles Beach and Willamette Moorage Park are located on the west bank of the Willamette River between the north end of Willamette Park and Powers Marine Park north of the Sellwood Bridge (see Map 29). The site is approximately one mile long and includes the mouth of Stephens Creek where it joins the Willamette River. Stephens Creek flows through a forested ravine at River View Cemetery and is piped under SW Macadam Avenue before discharging to an open channel at this site near the Willamette Trolley line.



This area contains one of only two westside forested wetlands directly linked to the Willamette River in Portland. Like its counterpart at Harborton, located at the confluence of the Willamette River and Multnomah Channel in the North Reach, this area provides a primary link to upland forest habitats. There is a new culvert underneath the Willamette Trolley, Regional Trail and Macadam Bay driveway that better connects Stephens Creek to the Willamette River. The culvert is 30 feet wide and 15 feet tall from streambed to top of culvert. It provides wildlife movement from the river to Macadam Avenue; however, the culvert under the road does not allow for fish passage. All of SW Macadam Avenue is a barrier for all fish passage.

The dominant bottomland forest association in this area is black cottonwood/Pacific willow. In the low-lying areas near the outfall of Stephens Creek, this community transitions from a riparian forest into a forested

wetland. The wetland plant association consists of red-osier dogwood, Douglas spirea, and scattered Suksdorf's and black hawthorns in the understory shrub layer, with stinging nettle, reed canarygrass, and small-fruited bulrush on the ground layer. The non-wetland forest is similar in composition, but contains no bulrush, little reed canarygrass, and fewer willows. The riparian forest also includes sword fern, red alder, and Oregon white oak. Along the shoreline of Willamette Park, the dominant forest association is cottonwood; shrub species include red-osier dogwood, Columbia River willow, alder, and Douglas spirea. Stephens Creek and its adjacent forest provide an important link between this site and the upland forest habitats to the west. Most of the trees in this vicinity vary in age between 30 and 80 years old.

Three other valuable habitats are notable. Offshore from Willamette Park is a rock outcrop island which is widely used by river birds as a sheltered resting site along the west shore. Though small in size, this is one of few islands within the Willamette River in Portland. Also of note is the small opening in the forest at the northern end of Willamette Moorage Park. This area contains a young bottomland hardwood forest. Avian fauna move freely between the river and wetland habitats and the upland forest. As noted, however, SW Macadam Avenue poses a substantial hazard to terrestrial wildlife movement between the forest and the river. Wildlife that is able to negotiate the concrete barriers and the multiple lanes of traffic typically do so at night. A final key habitat is the mudflats located just north of the Willamette Park boat launch. This mudflat is exposed during low water periods and serves as a rich feeding area for shorebirds and other species.

The Stephens Creek basin above this area includes large areas of mixed conifer forest land, and over the years the vegetation community was significantly compromised by the rapid spread of English ivy and Irish ivy. A major portion of the Stephens Creek canyon area has undergone a significant revegetation enhancement through the efforts of the Burlingame Sanitary Trunk Sewer Pipe Protection Project that was completed in 2008. The English Ivy that was once dominant in the canyon area has been cut down from the large trees and significantly reduced. Control efforts will need to continue to avoid a reoccurrence of the problem. Other invasive plant species control efforts continue in the canyon, including early detection and rapid response control efforts for *Impatiens bicolor*, which is currently confined to this sub-watershed.

Table 16: Avian Special Status Species Observed at Willamette Park

Common Name	Scientific Name	SHA At Risk Species
American Kestrel	<i>Falco sparverius</i>	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	X
Band-tailed pigeon	<i>Patagioenas fasciata</i>	X
Black-throated gray warbler	<i>Setophaga nigrescens</i>	
Brown creeper	<i>Certhia americana</i>	
Bushtit	<i>Psaltiriparus minimus</i>	
Downy woodpecker	<i>Picoides pubescens</i>	
Dunlin	<i>Calidris alpina</i>	
Great blue heron	<i>Ardea herodias</i>	
Merlin	<i>Falco columbarius</i>	
Olive-sided flycatcher	<i>Contopus cooperi</i>	X
Purple martin	<i>Progne subis</i>	X

Table 16: Avian Special Status Species Observed at Willamette Park

Common Name	Scientific Name	SHA At Risk Species
Rufous hummingbird	<i>Selasphorus rufus</i>	
Tree swallow	<i>Tachycineta bicolor</i>	
Vaux's swift	<i>Chaetura vauxi</i>	
Western grebe	<i>Aechmophorus occidentalis</i>	X
Western sandpiper	<i>Calidris mauri</i>	
White-breasted nuthatch (slender-billed)	<i>Sitta carolinensis aculeata</i>	X
Willow flycatcher	<i>Empidonax traillii brewsteri</i>	X
Wood duck	<i>Aix sponsa</i>	
Yellow warbler	<i>Setophaga petechia</i>	

Table 17: Avian Special Status Species Observed at Stephens Creek Confluence/Willamette Moorage

Common Name	Scientific Name	SHA At Risk Species
Bald Eagle	<i>Haliaeetus leucocephalus</i>	X
Band-tailed Pigeon	<i>Patagioenas fasciata</i>	X
Brown Creeper	<i>Certhia americana</i>	
Bushtit	<i>Psaltiriparus minimus</i>	
Downy Woodpecker	<i>Picoides pubescens</i>	
Great Blue Heron	<i>Ardea herodias</i>	
Orange-crowned Warbler	<i>Oreothlypis celata</i>	
Pacific-slope Flycatcher	<i>Empidonax difficilis</i>	
Swainson's Thrush	<i>Catharus ustulatus</i>	
Western Wood-Pewee	<i>Contopus sordidulus</i>	
Willow Flycatcher (Little)	<i>Empidonax traillii brewsteri</i>	X
Wilson's Warbler	<i>Cardellina pusilla</i>	
Wood Duck	<i>Aix sponsa</i>	

Riverbanks along the south are predominantly natural or semi-natural. In the northern half of inventory site, the banks are composed of riprap and large blocks of concrete. Along Willamette Park the beach consists primarily of small gravels and mud flats, however the bank is all riprap. The beach habitat is most diverse in the southern portion of the area in the vicinity of the mouth of Stephens Creek and areas to the south. Willow communities have established on the beach as the river's hydrology allows. Some large wood is lodged in the sand and willows along the beach. As a part of the Sellwood Bridge Replacement project, a range of restoration activities were conducted in Willamette Moorage Park and the former Staff Jennings site (currently owned by Multnomah

County, just north of the Sellwood bridge). Extensive vegetation removal and planting of native grasses, shrubs and trees was completed. Some of the plantings were incorporated into a new green wall constructed on the western portion of the Multnomah County property.

The banks north of the boat ramp have been the focus of an intensive City revegetation effort. Willows have been established along the banks to help stabilize the banks. Native shrubs and grasses have been planted to provide a diverse understory to the otherwise ornamental and manicured character of Willamette Park. A stormwater swale mimicking a wetland meadow helps filter runoff from the adjacent parking lot and provides additional habitat complexity.

An oak restoration and stormwater management project was also recently completed as a part of the implementation of the *Willamette Park Redevelopment and Phasing Plan* (2012). Stormwater from the parking lot is now managed in a stormwater facility in the area. Stands of native oaks are designated as Special Habitat Areas due to their role in providing habitat for a variety of key species.

Willamette Park and Willamette Moorage's proximity to nearby habitat areas at River View Natural Area, Riverview Cemetery, Ross Island and Oaks Bottom Complexes makes the area a frequent stopover and forage site for many wildlife species. Numerous large and small holes at or above the ordinary high water mark in this inventory site indicate the presence of river otter, nutria, beaver and/or kingfishers. Barn swallows and violet-green swallows feed and collect nesting materials at the site. Kingfishers were observed foraging at this site during the field survey. Other river bird species detected include cormorant, widgeon, bufflehead, Canada goose, and numerous pairs of mallards. Passerine and other bird species observed include golden crowned kinglet, song sparrow, Pacific wren, American goldfinch, bushtit, black-capped chickadee, and American crow. Purple martins are seasonal visitors to the site. In total, 113 bird species have been observed at Willamette Park.

Willamette Park and the Willamette Moorage Complex (includes Stephen's Creek and Miles Beach) are designated a Special Habitat Area for the following:

- (S) – An at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (B) – Bottomland hardwood forests
- (W) – Wetland
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat
- (U) – Unique feature

Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 19). The relative ranks are produced using GIS models and information on Special Habitat Areas.

The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter II: Methodology Overview of this report and Appendix B: *Natural Resources Inventory: Riparian Corridors and Wildlife Habitat Project Report*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning projects and programs, including regulations, design of development or redevelopment projects, and mitigation and restoration activities.

Riparian Areas

The site contains the Willamette River and river bank, flood area, wetlands and riparian vegetation. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are assigned to the Willamette River itself, wetlands and forest vegetation in the floodplain or in proximity to the water bodies. Medium relative functional ranks are assigned to less dense and lower structure vegetation in the floodplain and up to 300 feet from water bodies. Low relative ranks are generally assigned to non-vegetated flood areas.

Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas two acres in size or greater, including adjacent woodland vegetation (note: Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). The model assigns relative ranks to qualifying habitat patches based on their size, interior area, proximity to other patches and proximity to water. Medium relative functional ranks are assigned to wetland and forest patches in this inventory site.

Special Habitat Areas (SHA) consist of rare and declining habitat types and unique features that provide critical habitat for at-risk plant and animal species as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat, and include:

Willamette River, including shallow water habitat areas, are designated SHA because they meet the following criteria:

- (S) – An at-risk species uses the habitat area or feature on more than an incidental basis to complete one or more life history phases
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor

Cottonwood Bay is designated a Special Habitat Area for the following:

- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat
- (U) – Unique feature

Willamette Moorage Complex is designated a Special Habitat Area for the following:

- (S) – An at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (B) – Bottomland hardwood forests
- (W) – Wetland
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat
- (U) – Unique feature

Rare Plant Species

A number of rare native plant species have been documented in WR20 and are listed in Table 18.

Table 18: Rare Native Plant Species in WR20 – SW Riverfront Parks		
Common Name	Scientific Name	NatureServe State Rank¹
California False Hellebore	<i>Veratrum californicum</i> var. <i>caudatum</i>	

1. The NatureServe system is an international system for ranking rare, threatened and endangered species throughout the world. The ranking is a 1-5 scale, with 1 being critically imperiled and 5 being secure. The state ranks specifically evaluate the rarity of a species within each state's boundary.

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank.

Table 19: Summary of Ranked Resources in WR20 – SW Riverfront Parks				
Total Inventory Site = 269 acres				
	High	Medium	Low	Total
Riparian Resources*				
acres	157	23	18	199
percent total inventory site area	58	9	7	74
Wildlife Habitat				
Wildlife Habitat*				
acres	0	13	0	13
percent total inventory site area	0	5	0	5
Special Habitat Areas**				
acres	152			
percent total inventory site area	57			
Wildlife Habitat - adjusted by Special Habitat Areas***				
acres	152	5	0	157
percent total inventory site area	57	2	0	58
Combined Total***				
acres	161	22	17	199
percent total inventory site area	60	8	6	74
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat include the Willamette River. ** Special Habitat Areas rank high for wildlife habitat. *** Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				

Natural Resource Protection Recommendation

The Willamette River and associated floodplain and riparian areas in resource site WR20 have been significantly reduced in extent, simplified and degraded over time. This inventory site is generally characterized by existing development with isolated natural resource areas along the shoreline at its north end and a complex of natural areas (including Willamette Moorage Park and the Multnomah County parcel formerly known as Staff Jennings) to the south. Remaining natural resource areas are fragmented and impacted by adjacent development. Landward of the river setback is characterized office and multi-dwelling developments north of Willamette Park. Vegetation in this area is dominated by ornamental species and turf grass. Existing natural resource areas still provide the remaining habitat for fish and wildlife that reside in and migrate through this disturbed, urbanized environment. Given the extent of existing development within this inventory site, it is important to protect existing natural resource areas, reduce the impacts of adjacent development whenever possible and expand vegetation and stormwater infiltration, especially in the developed floodplain.

WR20 includes the commercial and industrial uses along SW Macadam Avenue (Hwy 43). SW Macadam Avenue is a Civic Corridor that provides important services to the adjacent neighborhood and those that travel through the district. These activities will not be affected by the protections recommended below.

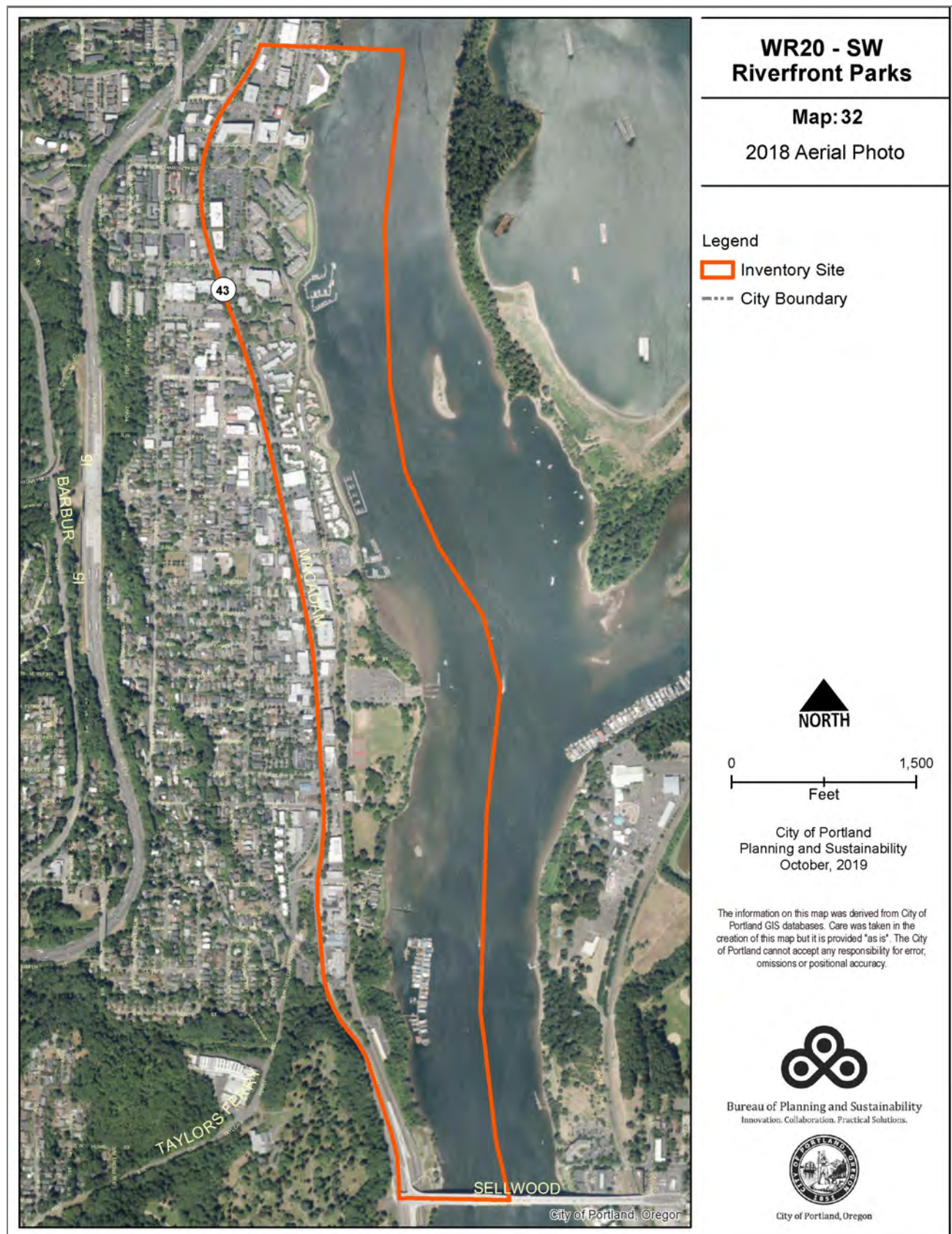
The general recommendation, shown on Map 36, aims to balance the environmental, economic and social consequences of protecting natural resources in WR20. As described above, high ranked resources include the river and riverbank areas with existing vegetation, as well as the natural areas to the south. Development is recommended to be strictly limited in these areas. To the extent possible, conflicting uses should be limited in high-ranked resource areas. Additional flexibility should be provided for development on parcels containing medium-ranked resources. Developed areas within the 100-year or 1996 Flood Inundation Area (ranked as low-value resources) should be provided moderate protections to ensure no loss of flood storage and floodplain habitat as a result of development in these areas.

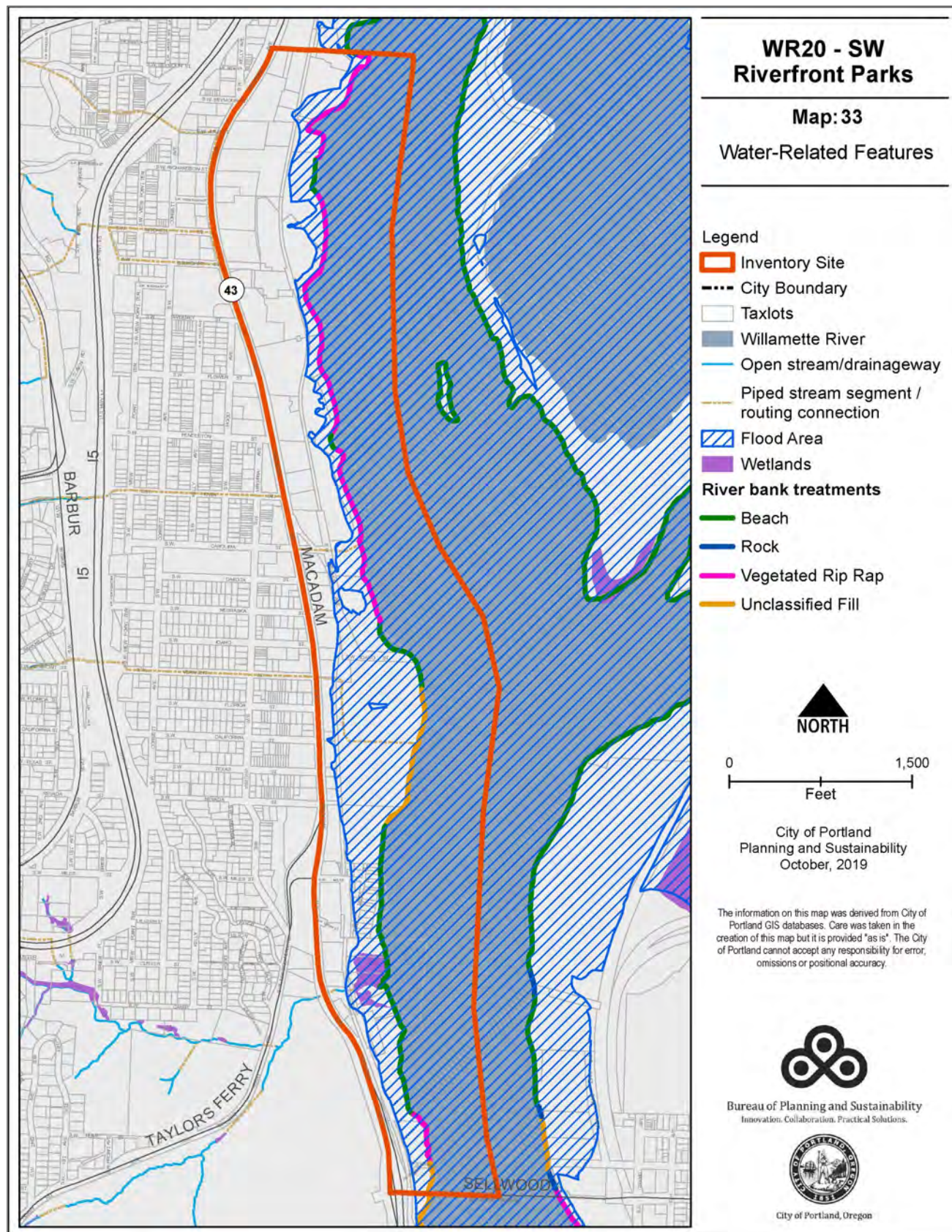
The recommendation for riparian areas is to:

1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land located landward of and waters below the top of bank of the Willamette River, tributaries of the river and land within the undeveloped 100-year floodplain and 1996 Flood Inundation Area.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked riparian areas and developed floodplain (classified as low ranked resource).

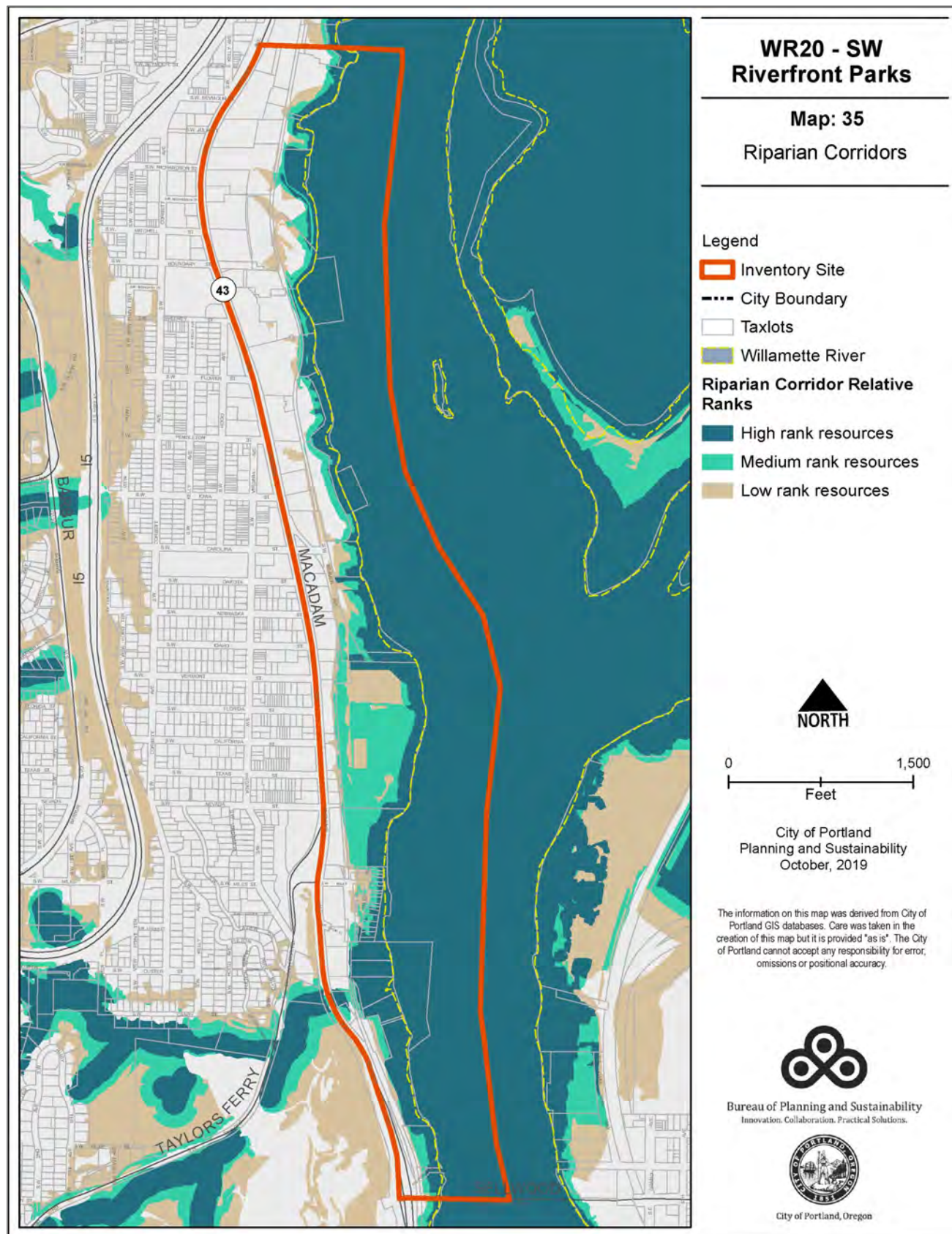
The recommendation for wildlife habitat areas outside of riparian areas is to:

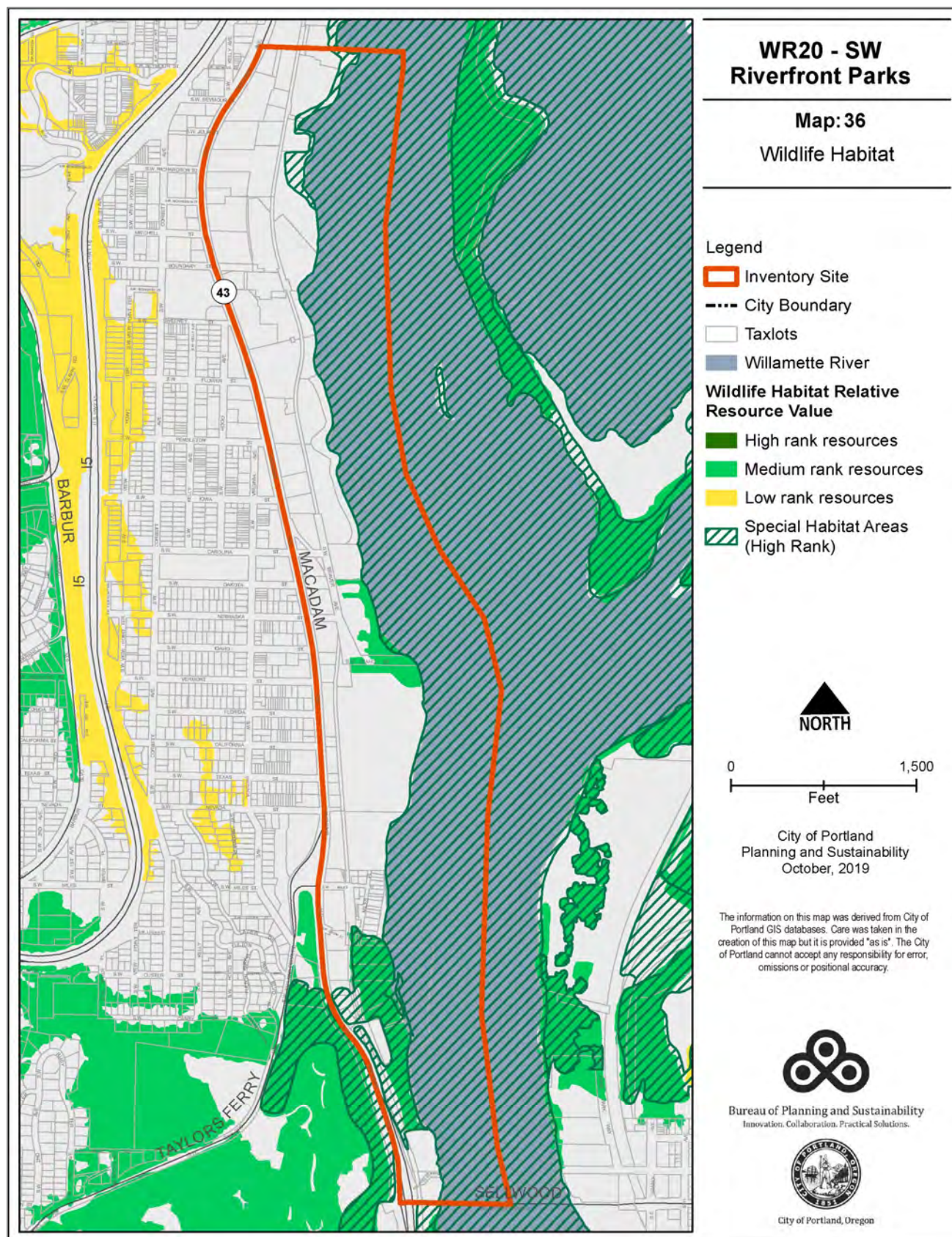
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked resources.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked resources.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

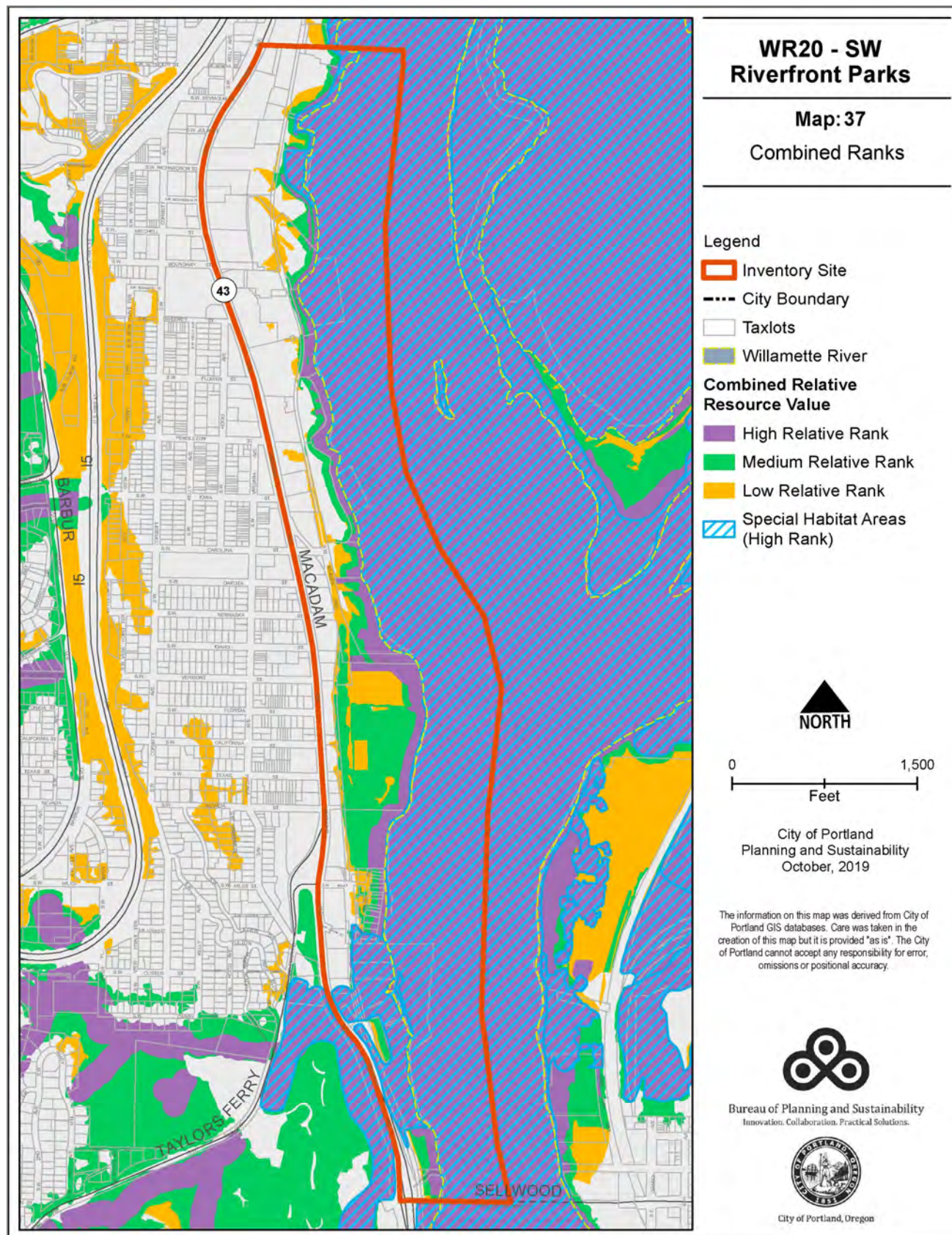


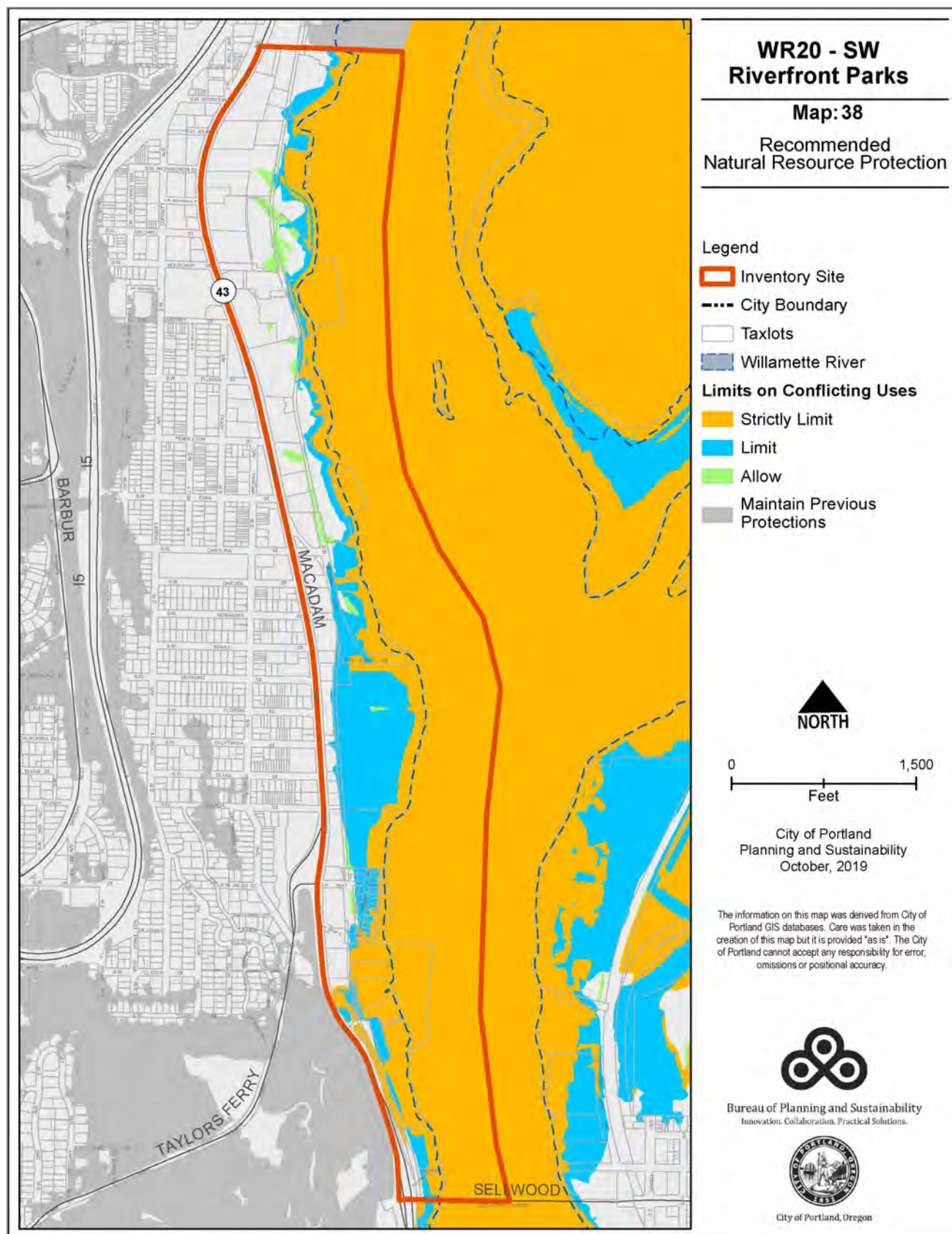












4.iii: INVENTORY SITE WR21 ROWING CLUB

Summary Information

Watershed:	Willamette River Watershed
Neighborhood:	Sellwood-Moreland Improvement League
USGS Quadrangle and Quarter Section Maps:	1S1E22D, 1S1E23c, 1S1E26B, 1S1E27A
River Mile:	16.5 – 17.0
Site Size:	62 acres (land and water)
Previous Inventory:	Lower Willamette River Wildlife Habitat Inventory, March 1986
Zoning:	Commercial/Mixed Use 1(CM1) Commercial/Mixed Use 2(CM2) High Density Residential (RH) Residential 5,000 (R5) Design Overlay Zone (d) Willamette Greenway River General Overlay (g) Willamette Greenway River Water Quality Overlay (q)
Existing Land Use:	Commercial, residential, railroad, highway
General Description:	This inventory site is largely developed. Uses include the Portland Rowing Club, condos, and mooring of personal watercrafts. The river banks are hardened with rip rap and have low structure vegetation with only a few scattered trees. There is a stand of Oregon white oaks located behind the Portland Rowing Club and condos located immediately south of the club.
Resource Features:	Open water, shallow water habitat, river bank, flood plain, riparian vegetation
Resource Functions:	Microclimate and shade; stream flow moderation and water storage; bank function and sediment, nutrient and pollution control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; and wildlife habitat and movement corridor
Special Habitat Area:	Willamette River: (S) – provides habitat for at-risk wildlife species; (C) – wildlife connectivity corridor; (M) – migratory stopover habitat Rowing Club Oaks: (O) – Oregon white oak;



Special Status Species:	<p>Fish: Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead trout, LCR coastal cutthroat trout, Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout, Pacific lamprey, Western brook lamprey, white sturgeon.</p> <p>Amphibians: None</p> <p>Mammals: American beaver, hoary bat, Northern river otter.</p>
Natural Hazards:	Flood area, landslide, earthquake and liquefaction
Contamination:	Yes

Site Description

This 62-acre site is located on the east side of the Willamette River, between the Sellwood Bridge and Portland city boundary (see Map 37). This inventory site is largely developed. Uses include the Portland Rowing Club, condos, and mooring of personal watercrafts. The river banks are hardened with rip rap and have low structure vegetation with only a few scattered trees. There is a small stand of Oregon white oaks located behind the Portland Rowing Club and between the Rowing Club and the Waverly Condominiums immediately to the south.



The site contains 13 acres (21 percent) of impervious surfaces. Of the vegetated areas over ½ acre in size, there are approximately 5 acres of forest and woodland vegetation, 2 acres of shrubland and 2 acres of herbaceous vegetation. There are 41 acres of flood area on this site, most of which is open water.

Table 20: Summary of Natural Resource Features in WR21 – Rowing Club

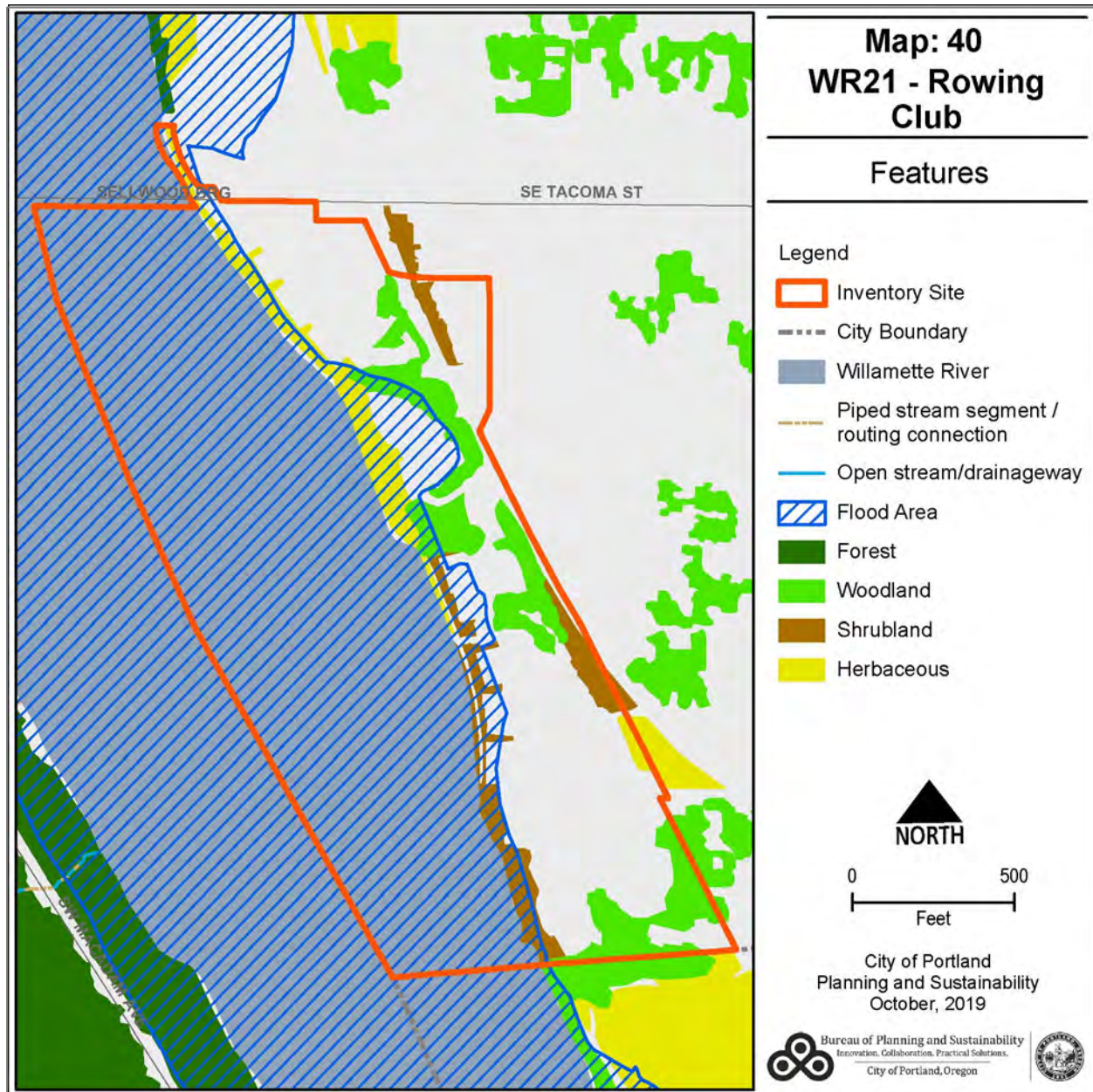
	Study Area (miles/acres)
River (miles/acres)	0.5/35
Stream/Drainageway (miles)	0
Wetlands (acres)	0
Flood Area (acres)*	
Vegetated (acres)	4
Non-vegetated (acres)	3
Open Water** (acres)	35
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	0
Woodland (acres)	5
Shrubland (acres)	2
Herbaceous (acres)	2
Impervious Surfaces (acres)	13
* 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.	

Natural Resources Description

Historically, the Portland-area portion of the Willamette River watershed 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 parks, natural areas and open spaces and residential development. Significant natural resource areas in this inventory site include:

- Willamette River (open water and river banks)
- Oaks and Mature Tree Canopy



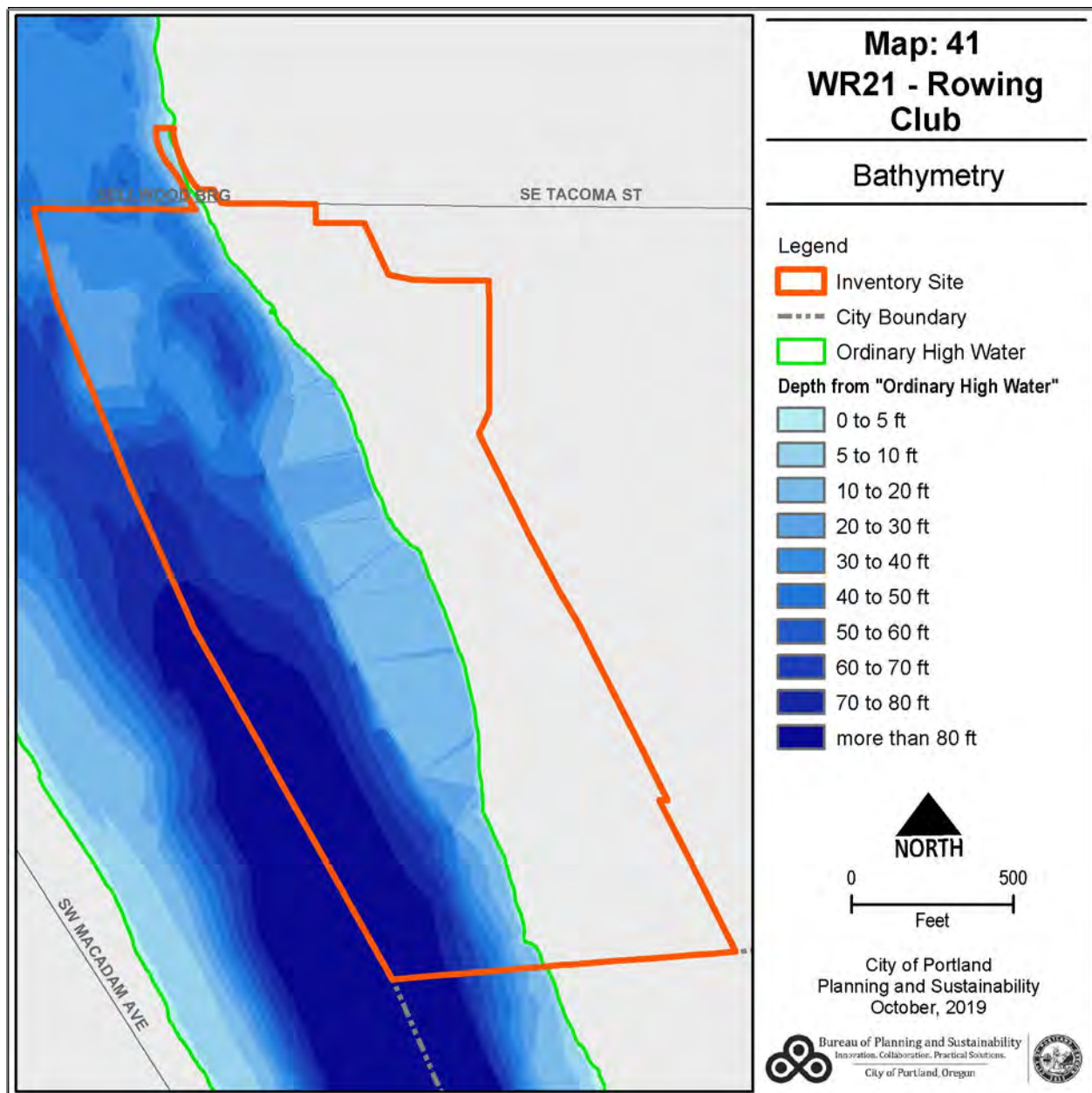
Willamette River

Below is a summary of Lower Willamette River natural resources documented in inventory site WR21. Additional information about the water quality, hydrology, and fish and wildlife use of the entire Willamette River South Reach is provided earlier in this chapter. Information on the Willamette River as a whole and the Lower Willamette River, more specifically, can be found in Chapter I.

Inventory site WR21 includes 35 acres of the Lower Willamette River. The river is the primary habitat link providing connectivity between upstream and downstream aquatic habitats. This connection is critical for fish, resident and migrating birds, and other species.

The Willamette River is the primary migration corridor for ESA-listed Chinook and coho salmon, as well as steelhead, and coastal cutthroat trout. These fish enter the Lower Willamette River system to explore and spawn in reaches throughout the Willamette River watershed. Shallow water areas, which are found along shoreline margins in this inventory site, are especially important for juvenile fish because they provide opportunities to escape the swift current of the main channel to rest and feed (see Map 39). Seasonal migrants use habitat within the inventory site during multiple life stages, and are usually present during predictable seasonal peaks:

- Juvenile salmon and trout out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead and coho out-migration peaks between May and June.



Pacific eulachon pass through the lower Columbia and Willamette rivers as opportunistic migrants as well. Adults return to their natal river every winter; however, their out-migration timing is not as well documented.

White sturgeon generally move throughout the Columbia River estuary and Lower Willamette River throughout the year. As adults, sturgeon can migrate freely between fresh, brackish and saline water; juveniles and young-of-year cannot, so their rearing range is limited. Recent white sturgeon stock assessment data collected in the Willamette River between Willamette Falls and the Columbia River confluence describe a compromised population of white sturgeon represented by several young age classes.

The historic run of adult Pacific lamprey up and over Willamette Falls numbered in the hundreds of thousands. Today, that run is significantly smaller; however, tribal harvest of these fish for subsistence and ceremonial uses still brings many families to the Willamette Falls every year. Documentation of Pacific lamprey rearing and outmigration patterns in the Lower Willamette River is limited; however, juveniles are often observed in soft substrate samples collected throughout the lower river. The rearing life stage of Pacific lamprey is known to last between 4-7 years in freshwater habitat, before individuals migrate to the ocean for their maturation life stages.

Resident fish assemblages within this reach include native species such as largescale sucker, sculpin (prickly and reticulate), reidside shiner and northern pikeminnow. Nuisance species include large and smallmouth bass, Asian carp and yellow perch.

The Willamette River plays an important part of the Pacific Flyway migratory route. Over 200 resident and migratory bird species, including iconic species such as great blue heron, osprey, Peregrine falcon and bald eagle use the riverine habitat. Species use the open water habitat for foraging and as a migratory corridor. Avian species also use natural features and human-made structures for nesting, resting and foraging.

The Willamette River in the inventory site does not meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 21). TMDLs for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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.

Table 21: Water Quality (303(d)) Listings in WR21 – Rowing Club

Pollutant	Season	Year River was Listed for this Pollutant	River Miles¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Bacteria (Fecal Coliform)	Fall/Winter/ Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at:

<https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

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 such 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. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

In the inventory site, the flood area is generally confined to the Willamette River itself and the adjacent riverbanks. In a few cases, the flood area extends deep into the adjacent property, including the Portland Rowing Club and Waverly Condominiums. The Portland Rowing Club property contains few structures in the flood area. A number of existing structures are in the flood area on the Waverley Condominiums property.

The Willamette River and shallow water habitat are designated Special Habitat Areas because they meet the following criteria:

(S) – An at-risk species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

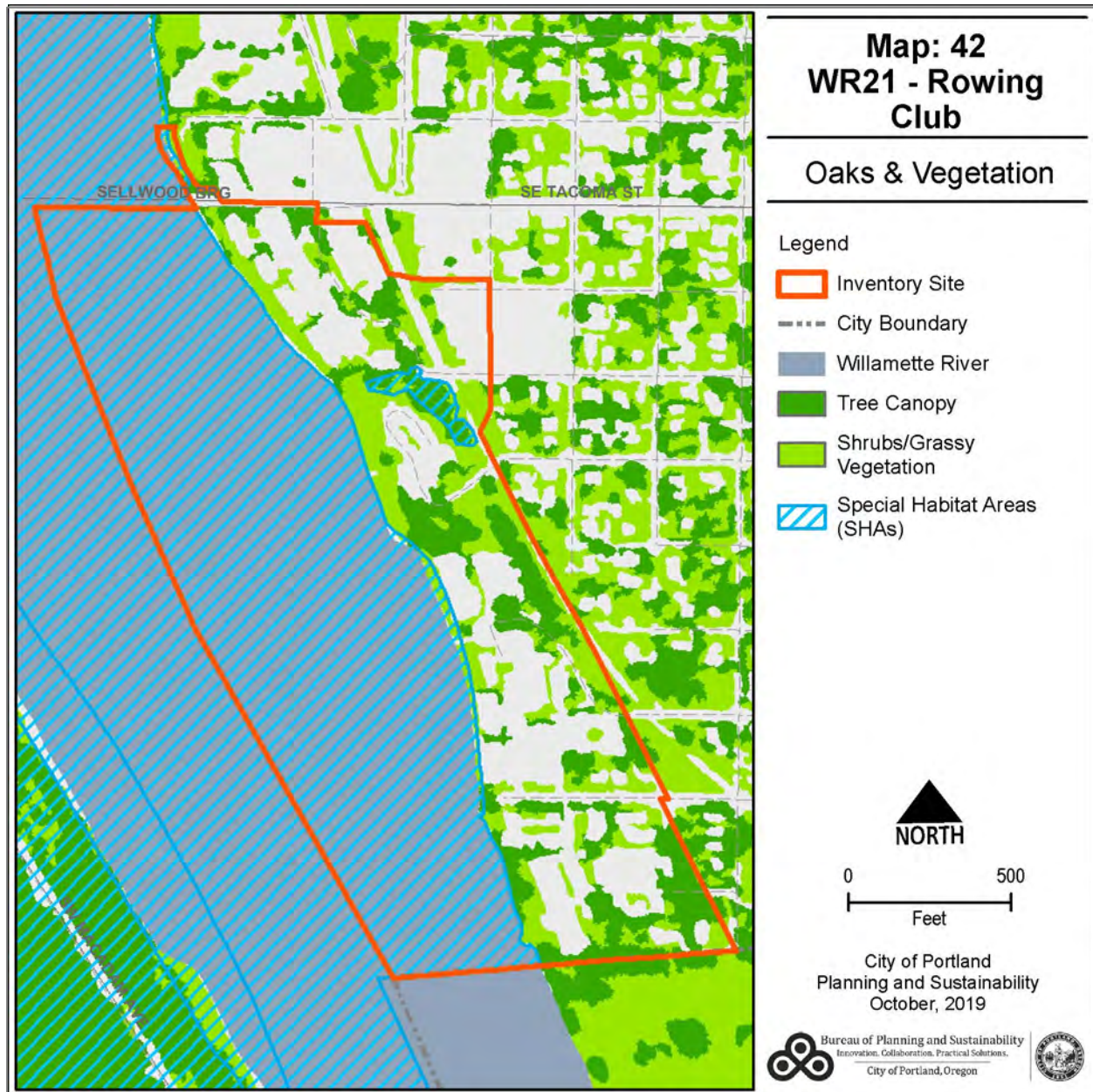
(C) – Wildlife connectivity corridor

(M) – Migratory stopover habitat

Oaks and Mature Tree Canopy

For purposes of the Natural Resources Inventory mapping and modeling, vegetation patches at least ½ acre in size are captured. The model ranks forest/wetland patches at least two acres in size for wildlife habitat; there are no forest/wetland patches in this inventory site. However, there are stands of mature tree canopy that provide functions, including cleaning and cooling the air and water, capturing greenhouse gases, capturing and uptaking stormwater, reducing energy demand and providing wildlife habitat (see Map 40).

Located along the rail line behind the Portland Rowing Club and Waverly Condominiums is a stand of Oregon white oak, which is characteristic of the foothill savanna/oak woodland community type. Other trees species include pines and maples. Although small, the oak stand is one of the only sources of local cover for bird and small mammal species that use this inventory site. Acorns and insects found on trees are food sources and tree cavities provide nesting habitat for birds, such as swallows, wrens, and great horned owls.



Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 22). The relative ranks are produced using GIS models and information on Special Habitat Areas.

The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter II: Methodology Overview of this report and Appendix B: *Natural Resources Inventory: Riparian Corridors and Wildlife Habitat Project Report*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning projects and programs, including regulations, design of development or redevelopment projects, and mitigation and restoration activities.

Riparian Areas

The site contains the Willamette River and river bank, flood area, wetlands and riparian vegetation. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are assigned to the Willamette River itself, wetlands and forest vegetation in the floodplain or in proximity to the water bodies. Medium relative functional ranks are assigned to less dense and lower structure vegetation in the floodplain and up to 300 feet from water bodies. Low relative ranks are generally assigned to non-vegetated flood areas.

Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas 2 acres in size or greater, including adjacent woodland vegetation (note: Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). The model assigns relative ranks to qualifying habitat patches based on their size, interior area, proximity to other patches, and proximity to water.

Site WR21 contains no forests and/or wetland areas 2 acres or larger in size.

Special Habitat Areas (SHA) consist of rare and declining habitat types and unique features that provide critical habitat for at-risk plant and animal species as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model. Therefore, all SHAs within the site rank high for wildlife habitat, and include:

- (S) – An at-risk species uses the habitat area or feature on more than an incidental basis to complete one or more life history phases
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor

Rare Plant Species

No rare native plant species have been documented in WR21.

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank.

Table 22: Summary of Ranked Resources in WR21 – Rowing Club				
Total Inventory Site = 62 acres				
	High	Medium	Low	Total
Riparian Resources*				
acres	38	2	4	44
percent total inventory site area	61	3	6	71
Wildlife Habitat				
Wildlife Habitat*				
acres	0	0	0	0
percent total inventory site area	0	0	0	0
Special Habitat Areas**				
acres	36			
percent total inventory site area	58			
Wildlife Habitat - adjusted by Special Habitat Areas***				
acres	36	0	0	36
percent total inventory site area	58	0	0	58
Combined Total***				
acres	38	2	4	44
percent total inventory site area	61	3	6	71
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat include the Willamette River. ** Special Habitat Areas rank high for wildlife habitat. *** Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				

Natural Resource Protection Recommendation

The Willamette River and associated floodplain and riparian areas in resource site WR21 have been significantly reduced in extent, simplified and degraded over time. This inventory site is generally characterized by existing development along the entire extent of the river. Remaining natural resource areas are fragmented and impacted by adjacent development. However, two existing oak stands are located landward of the river setback. These oak stands and the river and its associated riverbank are the only high rank natural resources in the inventory site. Much of the upland vegetation is turf grass with ornamental species associated with existing development. Given the extent of existing development within this inventory site, it is important to protect existing natural resource areas, reduce the impacts of adjacent development whenever possible and expand vegetation and stormwater infiltration, especially in the developed floodplain.

The general recommendation, shown on Map 47, aims to balance the environmental, economic and social consequences of protecting natural resources in WR21. As described above, high ranked resources include the river and riverbank areas and upland oak stands. Development is recommended to be strictly limited in these areas. To the extent possible, conflicting uses should be limited in high-ranked resource areas. Additional flexibility should be provided for development on parcels containing medium-ranked resources. Developed areas within the 100-year or 1996 Flood Inundation Area (ranked as low-value resources) should be provided moderate protections to ensure no loss of flood storage and floodplain habitat as a result of development in these areas.

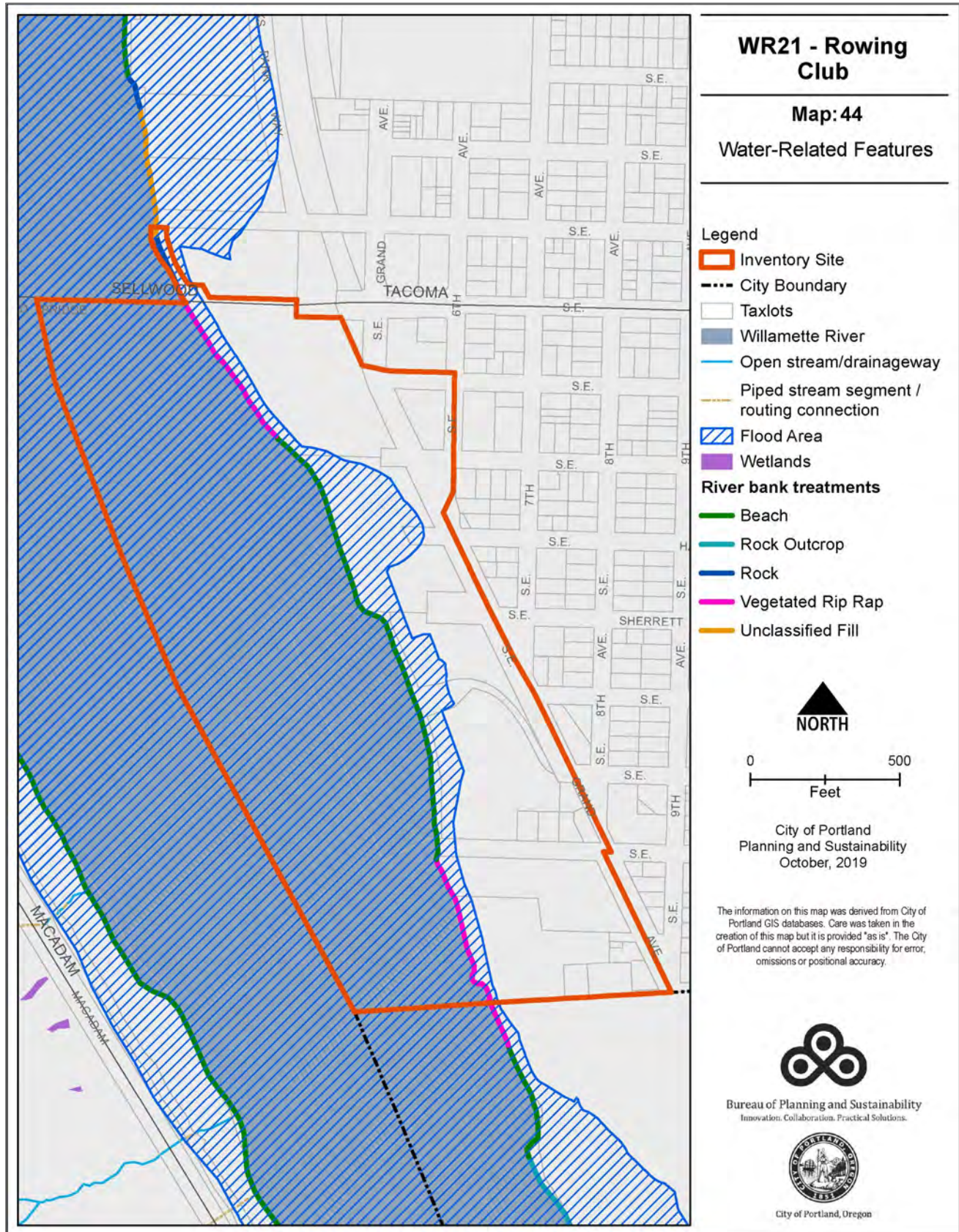
The recommendation for riparian areas is to:

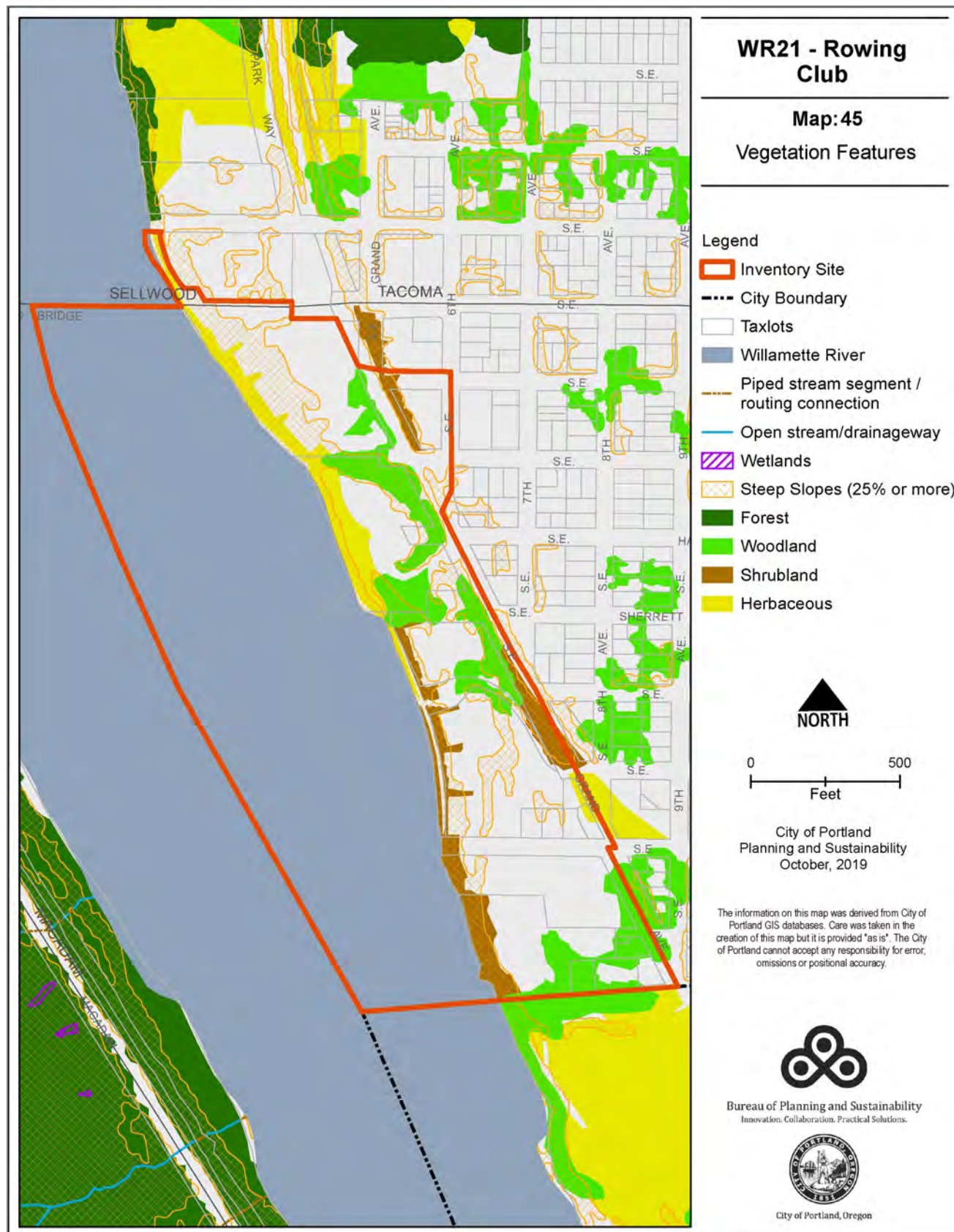
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land located landward of and waters below the top of bank of the Willamette River, tributaries of the river and land within the undeveloped 100-year floodplain and 1996 Flood Inundation Area.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked riparian areas and developed floodplain (classified as low ranked resource).

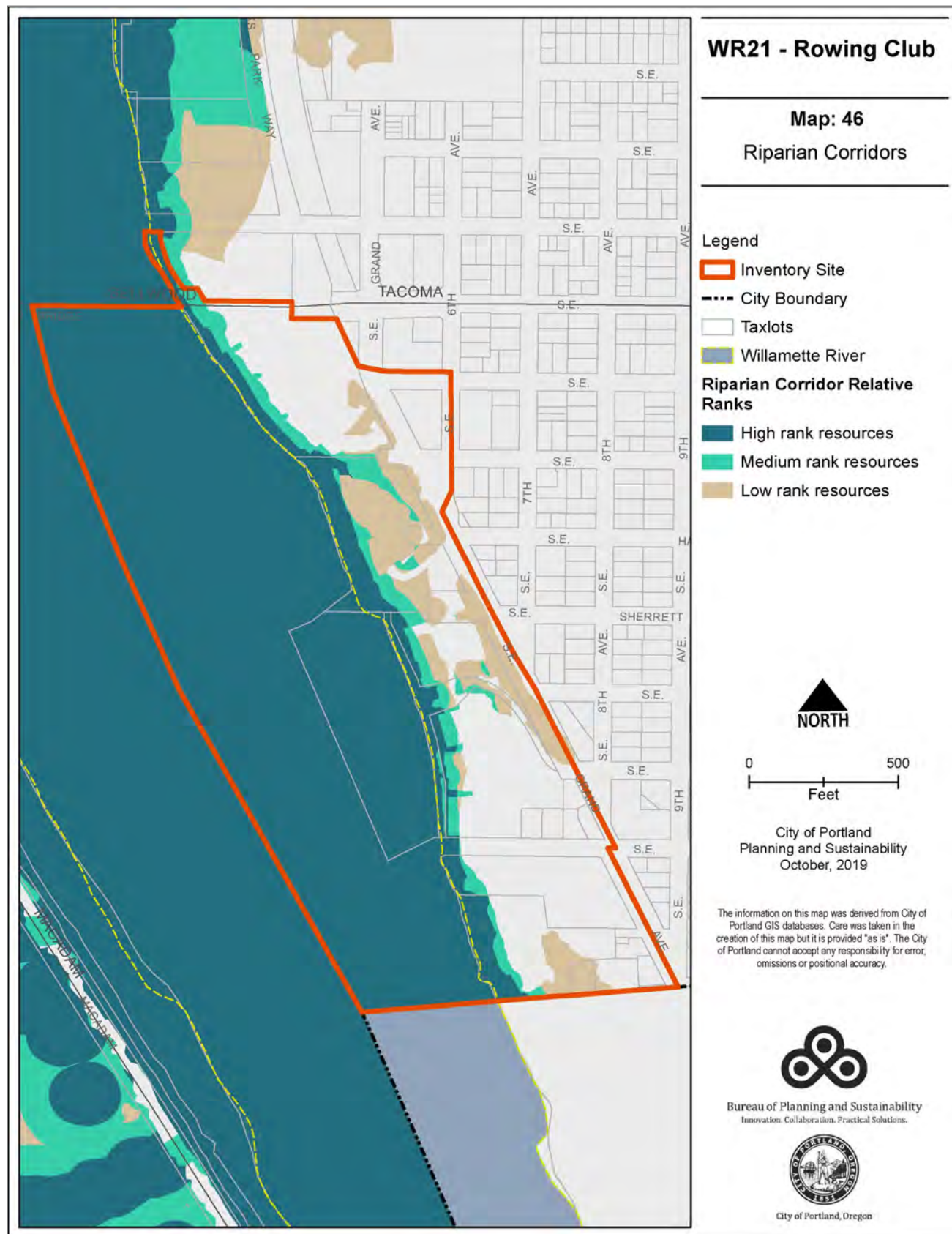
The recommendation for wildlife habitat areas outside of riparian areas is to:

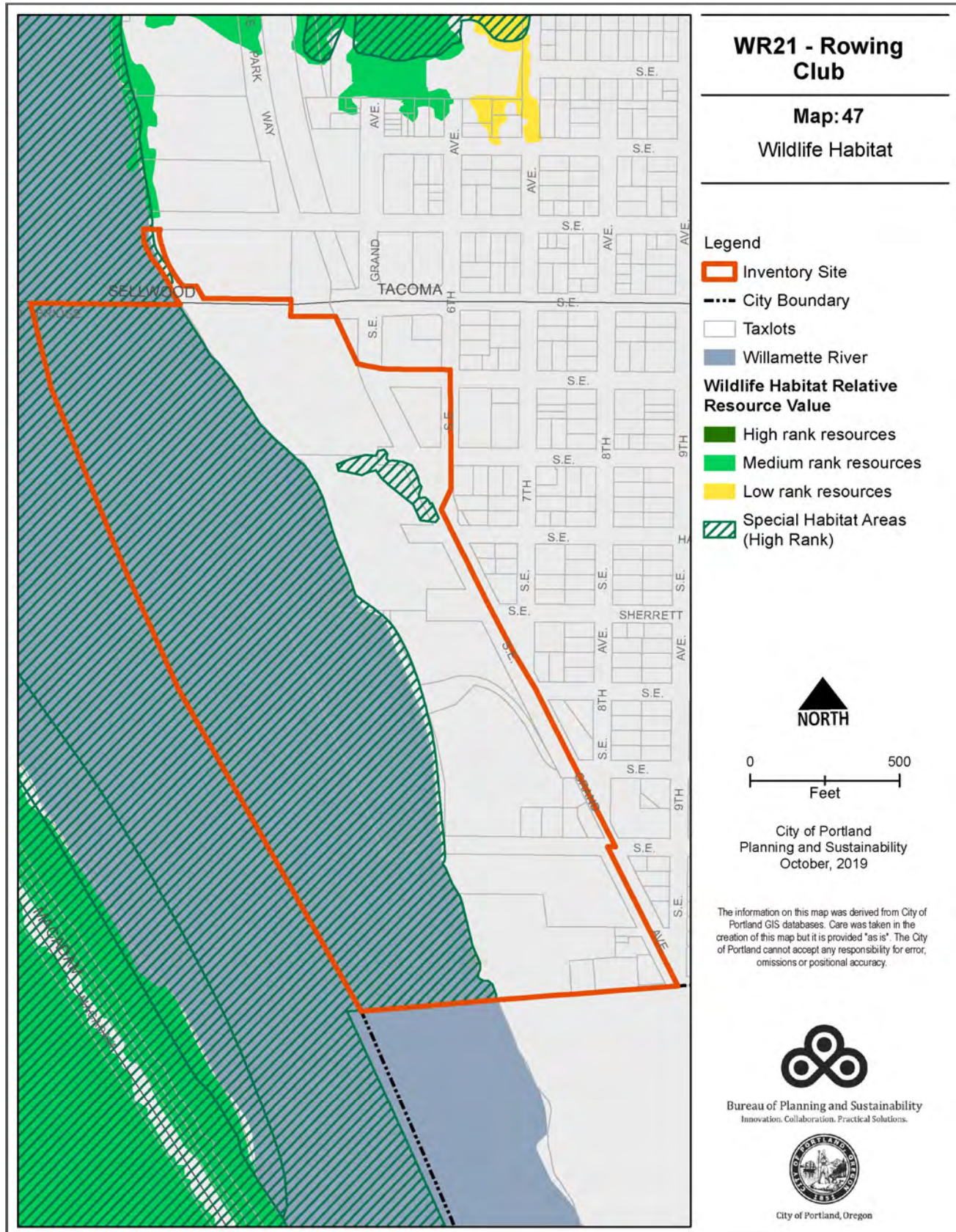
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked resources.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked resources.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

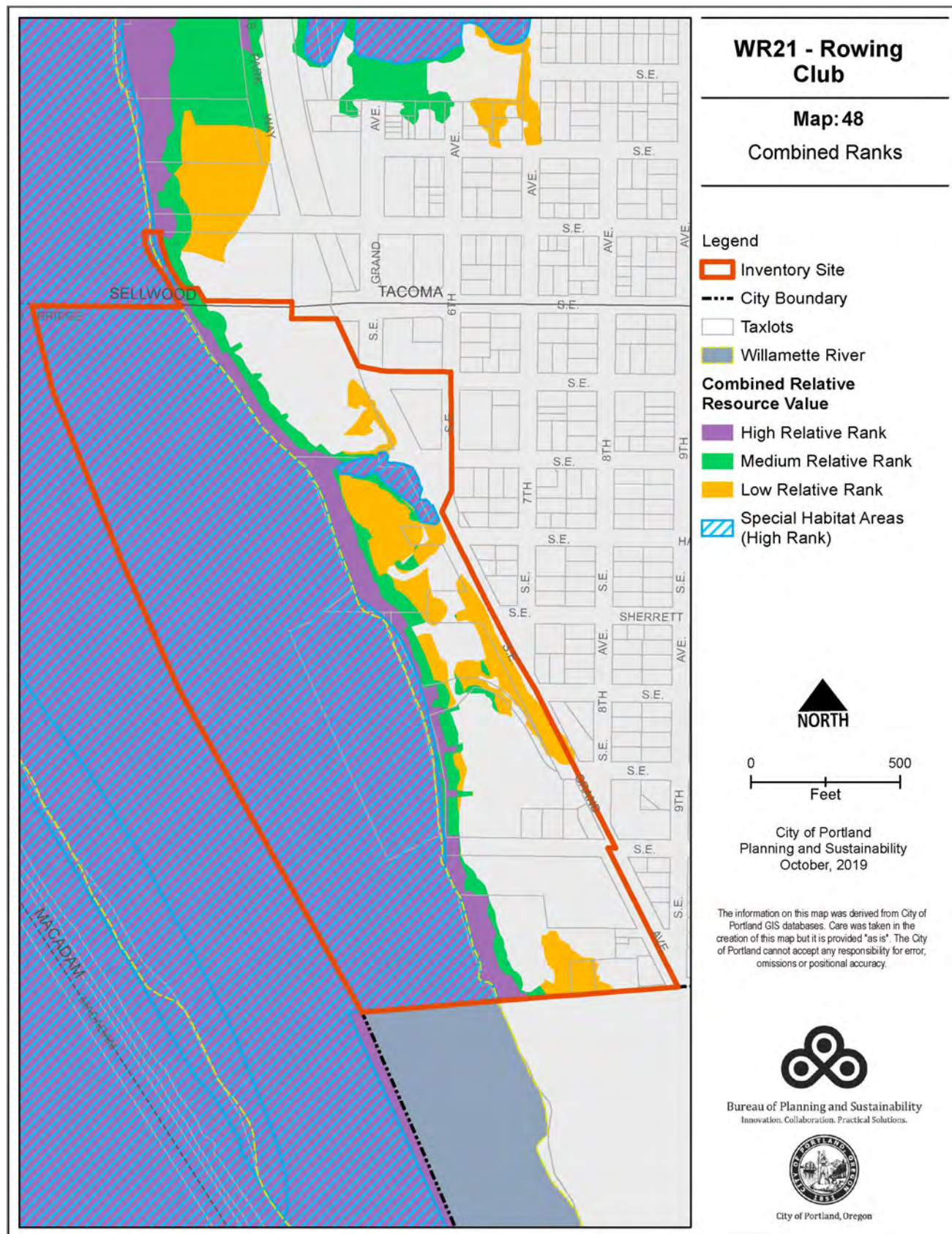


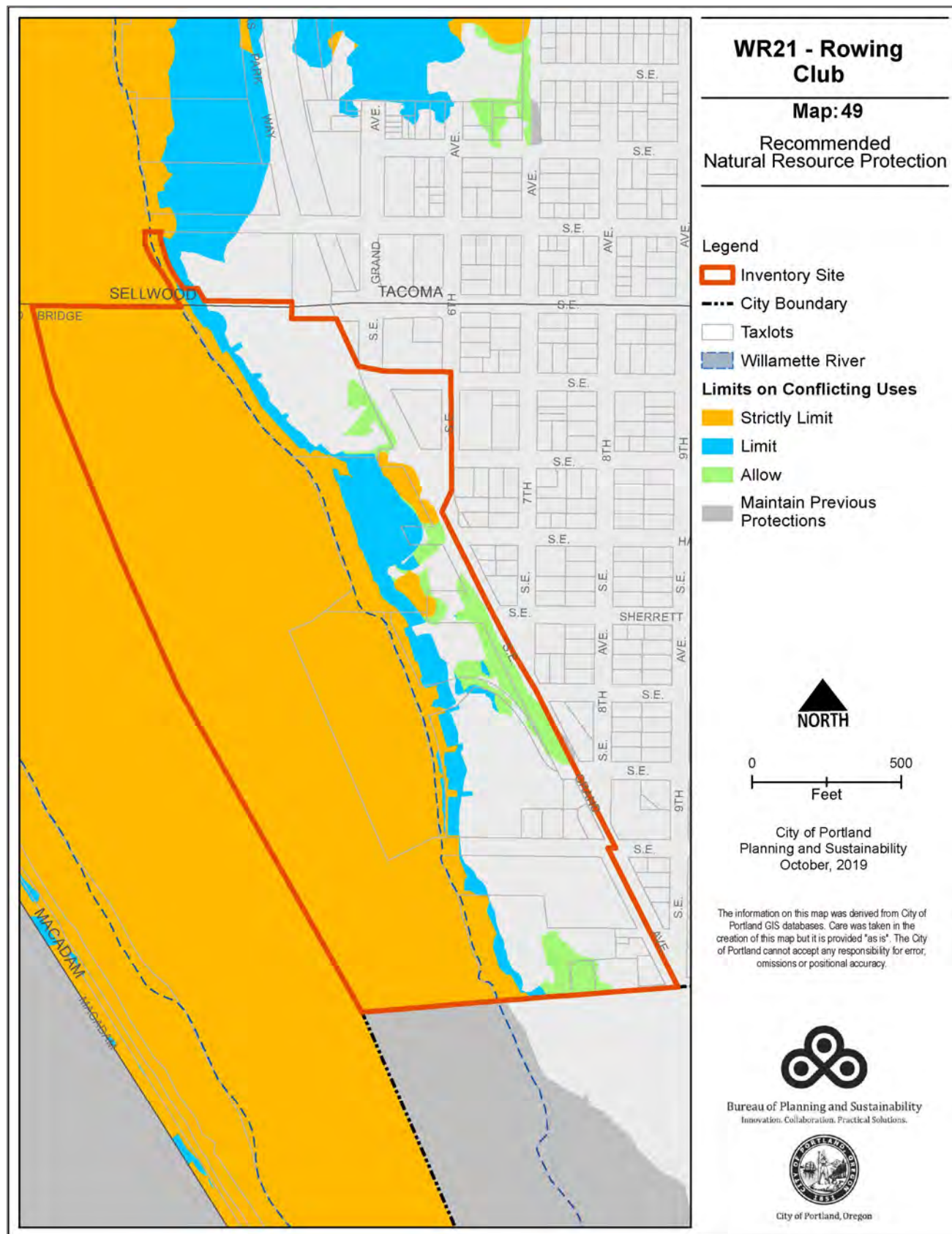












4.iv: INVENTORY SITE WR22 POWERS MARINE

Summary Information

Watershed:	Willamette River Watershed
Neighborhood:	Multnomah County Unclaimed #11
USGS Quadrangle and Quarter Section Maps:	1S1E22D, 1S1E26B, 1S1E26C, 1S1E27A, 1S1E27D
River Mile:	16.7 – 17.3
Site Size:	82 acres (land and water)
Previous Inventory:	Southwest Hills Resource Protection Plan, 1992; Lower Willamette River Wildlife Habitat Inventory, March 1986
Zoning:	Residential 10,000 (R10) Residential 20,000 (R20) Open Space (OS) Willamette Greenway River General Overlay (g) Willamette Greenway River Recreational Overlay (r) Willamette Greenway River Water Quality Overlay (q)
Existing Land Use:	Parks and natural areas, Lewis and Clark College, railroad, highway
General Description:	This inventory site is primarily Powers Marine Park and the Willamette River. It contains a significant bottomland hardwood forest, rock outcrops, mud flats and shallow water habitat. Seven unnamed streams cross the site.
Resource Features:	Open water, shallow water habitat, river bank, flood plain, wetland, riparian vegetation
Resource Functions:	Microclimate and shade; stream flow moderation and water storage; bank function and sediment, nutrient and pollution control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; and wildlife habitat and movement corridor
Special Habitat Area:	Willamette River: (S) – provides habitat for at-risk wildlife species; (C) – wildlife connectivity corridor; (M) – migratory stopover habitat Powers Marine Park: (B) – bottomland hardwood forest; (M) – mudflat; (C) wildlife connectivity corridor; (M) – migratory stopover habitat
Special Status Species:	Fish: Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead trout, LCR coastal cutthroat trout, Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout, Pacific lamprey, Western brook lamprey, white sturgeon. Amphibians: Northern red-legged frog Mammals: American beaver, hoary bat, Northern river otter.
Natural Hazards:	Flood area, wildfire, landslide, earthquake, liquefaction
Contamination:	No



Site Description

This 82-acre site is located on the west side of the Willamette River, south of the Sellwood Bridge with Macadam Avenue (Highway 43) to the west (see Map 48). Almost the entire inventory site is occupied by Powers Marine Park, managed as a natural area. The inventory site contains a significant bottomland hardwood riparian forest corridor that runs along the entire western shoreline, rock outcrops, mudflats and shallow water habitat. Powers Marine is adjacent to River View Natural Area, which contains a complex of forest, wetland and stream habitats. Wildlife move between River View Natural Area, Powers Marine Park and the Willamette River.



The site contains 4 acres (5 percent) of impervious surfaces. Of the vegetated areas over ½ acre in size, there are approximately 18 acres of forest and woodland vegetation, 0 acres of shrubland and 0 acres of herbaceous vegetation (see Table 23). There are 71 acres of flood area on this site, 13 acres of which are vegetated and 57 acres are open water.

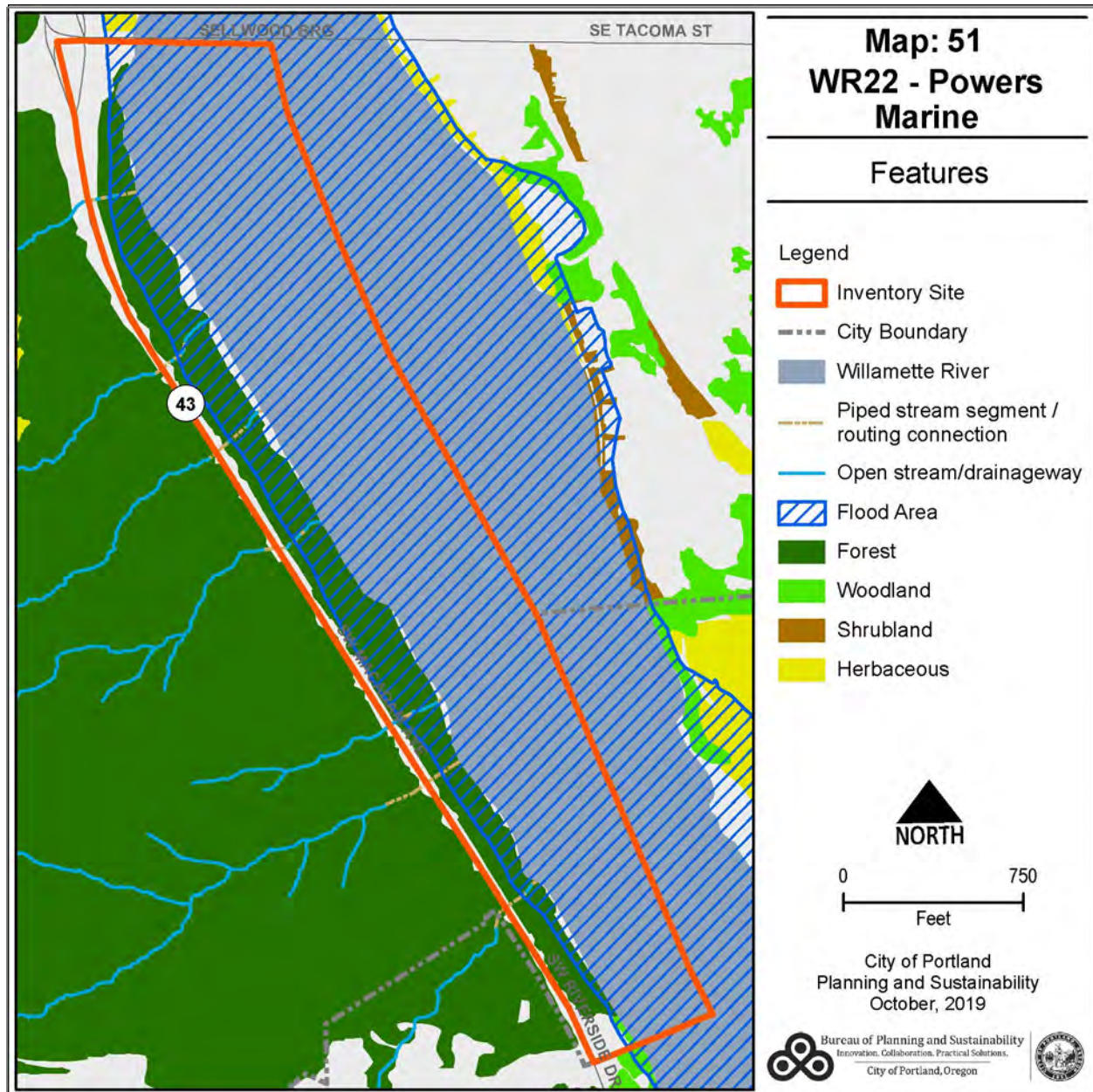
Table 23: Summary of Natural Resource Features in WR22 – Powers Marine	
	Study Area (miles/acres)
River (miles/acres)	1/57
Stream/Drainageway (miles)	<1
Wetlands (acres)	0
Flood Area (acres)*	
Vegetated (acres)	13
Non-vegetated (acres)	2
Open Water** (acres)	57
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	18
Woodland (acres)	<1
Shrubland (acres)	0
Herbaceous (acres)	0
Impervious Surfaces (acres)	4
* 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.	

Natural Resources Description

Historically, the Portland-area portion of the Willamette River watershed 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 Pacific 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 SRNRPP study area is comprised largely of parks, natural areas and open spaces and residential development. Significant natural resource areas in this inventory site include:

- Willamette River (open water and river banks)
- Powers Marine Park



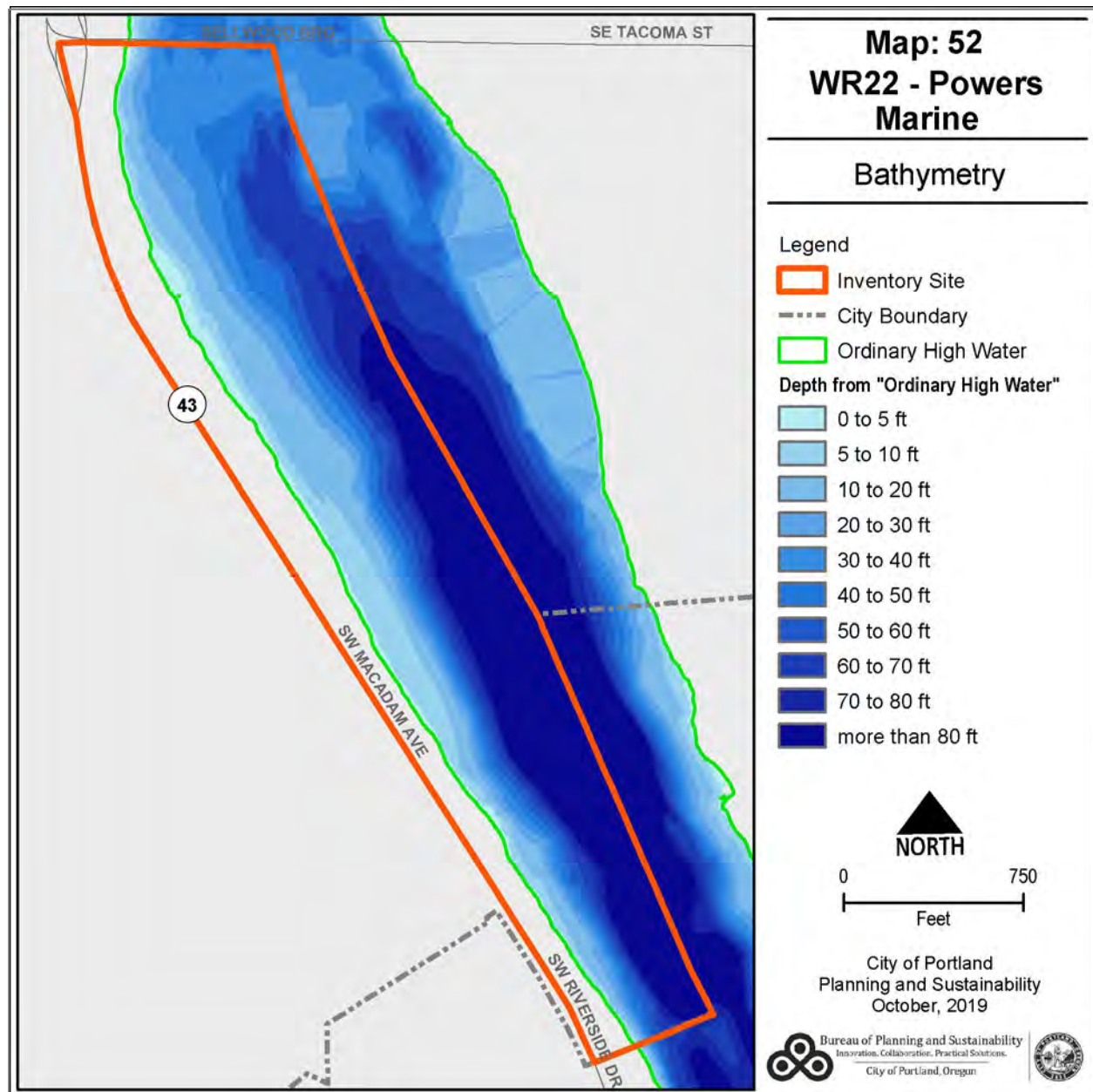
Willamette River

Below is a summary of Lower Willamette River natural resources documented in inventory site WR22. Additional information about the water quality, hydrology, and fish and wildlife use of the entire Willamette River South Reach is provided earlier in this chapter. Information on the Willamette River as a whole and the Lower Willamette River, more specifically, can be found in Chapter I.

Inventory site WR22 includes 57 acres of the Lower Willamette River. The river is the primary habitat link providing connectivity between upstream and downstream aquatic habitats. This connection is critical for fish, resident and migrating birds, and other species.

The Willamette River is the primary migration corridor for ESA-listed Chinook and coho salmon, as well as steelhead, and coastal cutthroat trout. These fish use the Lower Willamette River system to explore and spawn in reaches throughout the Willamette River watershed. Shallow water areas, which are found along shoreline margins in this inventory site, are especially important for juvenile fish because they provide opportunities to escape the swift current of the main channel to rest and feed (see Map 50). Seasonal migrants use habitat within the inventory site during multiple life stages and are usually present during predictable seasonal peaks:

- Juvenile salmon and trout out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead and coho out-migration peaks between May and June.



Columbia eulachon pass through the lower Columbia and Willamette rivers as opportunistic migrants as well. Adults return to their natal river every winter; however, their out-migration timing is not as well documented.

White sturgeon generally move throughout the Columbia River estuary and Lower Willamette River throughout the year. As adults, sturgeon can migrate freely between fresh, brackish and saline water; juveniles and young-of-year cannot, so their rearing range is limited. Recent white sturgeon stock assessment data collected in the Willamette River between Willamette Falls and the Columbia River confluence describe a compromised population of white sturgeon represented by several young age classes.

The historic run of adult Pacific lamprey up and over Willamette Falls numbered in the hundreds of thousands. Today, that run is significantly smaller; however, tribal harvest of these fish for subsistence and ceremonial uses still brings many families to the Willamette Falls every year. Documentation of Pacific lamprey rearing and outmigration patterns in the Lower Willamette River is limited; however, juveniles are often observed in soft substrate samples collected throughout the lower river. The rearing life stage of Pacific lamprey is known to last between 4-7 years in freshwater habitat, before individuals migrate to the ocean for their maturation life stages.

Resident fish assemblages within this reach include native species such as largescale sucker, sculpin (prickly and reticulate), reddsideshiner and northern pikeminnow. Nuisance species include large and smallmouth bass, Asian carp and several yellow perch.

The Willamette River plays an important part of the Pacific Flyway migratory route. Over 200 resident and migratory bird species, including iconic species such as great blue heron, osprey, Peregrine falcon and bald eagle use the riverine habitat. Species use the open water habitat for foraging and as a migratory corridor. Avian species also use natural features and human-made structures for nesting, resting and foraging. Shallow water areas and exposed sand and mud in some areas are used by shorebirds and waterfowl.

The lower Willamette River does not meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 24). TMDLs for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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.

Table 24: Water Quality (303(d)) Listings in WR22 – Powers Marine

Pollutant	Season	Year River was Listed for this Pollutant	River Miles ¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Bacteria (Fecal Coliform)	Fall/Winter/ Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at:

<https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

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 such 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. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

In the inventory site, the flood area is generally confined to the Willamette River itself and associated riverbank in developed areas and extends almost all the way to SW Macadam Avenue (Hwy 43) in most of Powers Marine Park.

The Willamette River and shallow water habitat are designated Special Habitat Areas because they meet the following criteria:

- (S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases
- (C) – Wildlife connectivity corridor
- (M) – Migratory stopover habitat

Powers Marine Park

The inventory site is almost entirely within the boundaries of Powers Marine Park, located between the Willamette River and SW Macadam Avenue from the Sellwood Bridge to a Lewis and Clark College property to the south (see Map 51). This area became a City of Portland public park in 1926 when it was donated by Ira Powers, owner of the Powers Furniture Company.

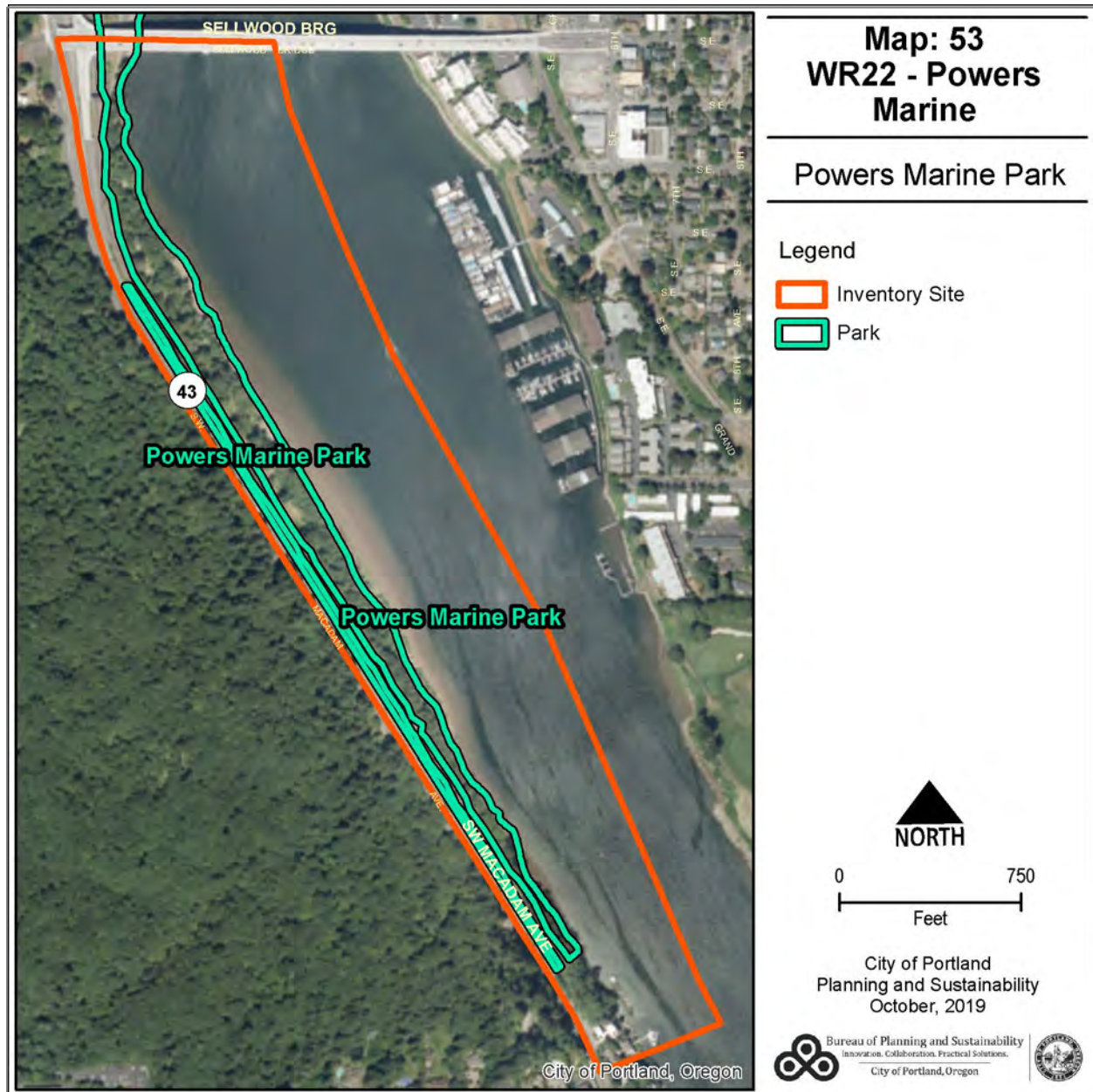
The landscape within the SRNRPP here is narrow. It is dominated to the west by the forested Tualatin Mountain which rises to heights of 500 feet within one half mile of the river. In addition, several rock outcroppings and a natural sand and gravel beach are found along the river's shoreline. The geomorphology of this inventory site remains largely unchanged, due to strong river currents and a narrow rocky channel that have prevented substantial channel modifications.



Historic photo of Powers Marine Park, 1935

A nearly continuous forest canopy extends to the water's edge, bisected by SW Macadam Avenue (Highway 43), the main transportation corridor between Lake Oswego and Portland. Seven unnamed streams provide a partial connection between the uplands at River View Natural Area and the Willamette River; several of which contribute cool perennial flows to the mainstem below. As part of the construction of the new Sellwood Bridge (completed in 2017), two of these streams were restored from the railroad tracks to the river. An additional linkage exists, at least for avian species, between the Tualatin Mountain, the Willamette River and the Waverly Country Club, which is south of the city limits across from Powers Marine Park.

The vegetation community in Powers Marine Park consists of areas of bottomland forest, conifer forest, herbaceous cover and turf. The majority of the vegetation is in an early to mid-successional stage (40 to 70 years) with some older conifers and black cottonwoods that are remnants of more mature historic communities. The bottomland forest contains a narrow strip of the black cottonwood/Pacific willow association, with red alder, and bitter cherry. Conifer forest species are found primarily near SW Macadam Avenue, but some Douglas fir and western red cedar are located throughout the floodplain area. Several large snags in the river's floodplain provide habitat diversity. The canopy closure in some areas of this forest is only 45 percent, allowing for herbaceous cover and shrub communities in the lower strata. These two forest communities are generally separated by the railroad tracks that traverse the site, with the bottomland forest community located on the river side of the tracks.



The shrub community is dominated by snowberry and includes some Indian plum and red elderberry. Cover in the shrub stratum is less than 10 percent, with an invasive herbaceous understory. The understory cover exceeds 90 percent and is primarily Irish and English ivies and annual and perennial grasses planted as lawn. Other species include western sword fern, reed canarygrass and various rushes. Several areas of herbaceous cover are located near the railroad. Some of the lower gradient riverbank areas are vegetated with dense stands of riparian shrubs such as spirea, willow, and dogwood, which are frequently inundated at moderate or higher river stages.

On the hillside above the site, the City owns the 146-acre River View Natural Area. Seven unnamed streams originate in the River View Natural Area and flow from the uplands to the Willamette River through culverts that

pass underneath Macadam Avenue (Highway 43) and the railroad track. Many large and moderately mature Douglas fir, western red cedar, and Pacific dogwood trees are located throughout the natural area; most are remnants of the dense upland forest that used to dominate the western slopes of the Willamette River in the Portland area. The forested slopes and ravines of River View Natural Area continue to provide important food and forage, nesting and breeding, rest and cover, and movement corridors for wildlife. This upland area continues for a brief distance downslope from SW Macadam Avenue, where it blends with the bottomland forest and grassland habitats in Powers Marine Park. Terrestrial wildlife must cross the four lane Macadam Avenue (Highway 43) to get to Powers Marine Park and the Willamette River.

Riverview Cemetery, established in 1882 and rising several hundred feet west of the Willamette River, is located just north of River View Natural Area. The cemetery includes sizeable contiguous forested areas west of SW Macadam Avenue (Hwy 43) and along two creeks that feed Stephens Creek at its western boundary. Many of these trees are over 100 years of age. Between these forested areas, the interior of the property is largely characterized by turf grass with large trees scattered throughout. Though the forest canopy is somewhat fragmented here, the cemetery property provides important food and forage, nesting and breeding, rest and cover and migration corridors for wildlife adjacent to and accessing the river.

The shoreline includes areas of natural sand and gravel beach with scattered boulders, driftwood, and large wood as well as two small rock outcrops (basalt) that extend to the river edge. Mudflats along the shoreline were enhanced as a part of the Sellwood Bridge project (though no work was completed below ordinary high water).

Bird species observed in Powers Marine Park include osprey, bald eagle, peregrine falcon, dark eyed junco, fox and white crowned sparrow, golden-crowned kinglet, European starling, and American robin, among many others. The area maintains habitat for many migratory passerines and the long stretch of shoreline is likely utilized by many of the common river birds and mammals found throughout the study area and within the cemetery.

Powers Marine is designated a Special Habitat Area for the following:

- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat

Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 26). The relative ranks are produced using GIS models and information on Special Habitat Areas.

The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter I: Methodology Overview of this report, and Appendix B: *Natural Resources Inventory: Riparian Corridors and Wildlife Habitat Project Report*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning projects and programs, including regulations, design of development or redevelopment projects, and mitigation and restoration activities.

Riparian Areas

The site contains the Willamette River and river bank, flood area, wetlands and riparian vegetation. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are assigned to the Willamette River itself, wetlands and forest vegetation in the floodplain or in proximity to the water bodies. Medium relative functional ranks are assigned to less dense and lower structure vegetation in the floodplain and up to 300 feet from water bodies. Low relative ranks are generally assigned to non-vegetated flood areas.

Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as a forest and/or wetland area two acres in size or greater, including adjacent woodland vegetation (note: Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). The model assigns relative ranks to qualifying habitat patches based on their size, interior area, proximity to other patches and proximity to water. Medium relative functional ranks are assigned to wetland and forest patches in this inventory site.

Special Habitat Areas (SHAs) consist of rare and declining habitat types and unique features that provide critical habitat for at-risk plant and animal species as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model.

The Willamette River, including shallow water habitat areas, are designated as SHAs because they meet the following criteria:

- (S) – An *at-risk* species uses the habitat area or feature on more than an incidental basis to complete one or more life history phases
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor

Powers Marine is designated a Special Habitat Area for the following:

- (B) – Bottomland hardwood forests
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor habitat

Rare Plant Species

A number of rare native plant species have been documented in WR22 and are listed in Table 25.

Table 25: Rare Native Plant Species in WR22 – Powers Marine		
Common Name	Scientific Name	NatureServe State Rank ¹
Bittercress	<i>Cardamine pensylvanica</i>	
Clammy hedgehyssop	<i>Gratiola neglecta</i>	
Cotton batting cudweed	<i>Pseudognaphalium stramineum</i>	

¹. The NatureServe system is an international system for ranking rare, threatened and endangered species throughout the world. The ranking is a 1-5 scale, with 1 being critically imperiled and 5 being secure. The state ranks specifically evaluate the rarity of a species within each state's boundary.

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank.

Table 26: Summary of Ranked Resources in WR22 – Powers Marine				
Total Inventory Site = 82 acres				
	High	Medium	Low	Total
Riparian Resources*				
acres	73	4	1	78
percent total inventory site area	89	5	>1	95
Wildlife Habitat				
Wildlife Habitat*				
acres	0	20	0	20
percent total inventory site area	0	24	0	24
Special Habitat Areas**				
acres	79			
percent total inventory site area	96			
Wildlife Habitat - adjusted by Special Habitat Areas***				
acres	79			79
percent total inventory site area	96	1	0	96
Combined Total***				
acres	79	<1	<1	80
percent total inventory site area	96	<1	<1	98
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat include the Willamette River. ** Special Habitat Areas rank high for wildlife habitat. *** Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				

Natural Resource Protection Recommendation

The Willamette River and associated floodplain and riparian areas in resource site WR22 represent a diverse complex of unique, high-quality natural resources. Powers Marine Park makes up the large majority of this inventory site. The inventory site provides valuable habitat for fish and wildlife, including shallow water habitat and riparian habitat along the shorelines of Powers Marine Park and parcels to the south, as well as upland wildlife habitat for birds and mammals as a result of the adjacent forest canopy of River View Natural Area and Riverview Cemetery. The extensive shallow water habitat in Powers Marine Park is an important resource for fish that migrate through this inventory site on their way up and down the Willamette River.

WR22 is almost entirely made up of high ranked natural resources. These high ranking resources are generally contiguous, allowing for relatively easy movement throughout the area for wildlife species. However, SW Macadam Avenue (Hwy 43) represents a significant barrier for wildlife movement between Powers Marine Park and River View Natural Area and the Riverview Cemetery.

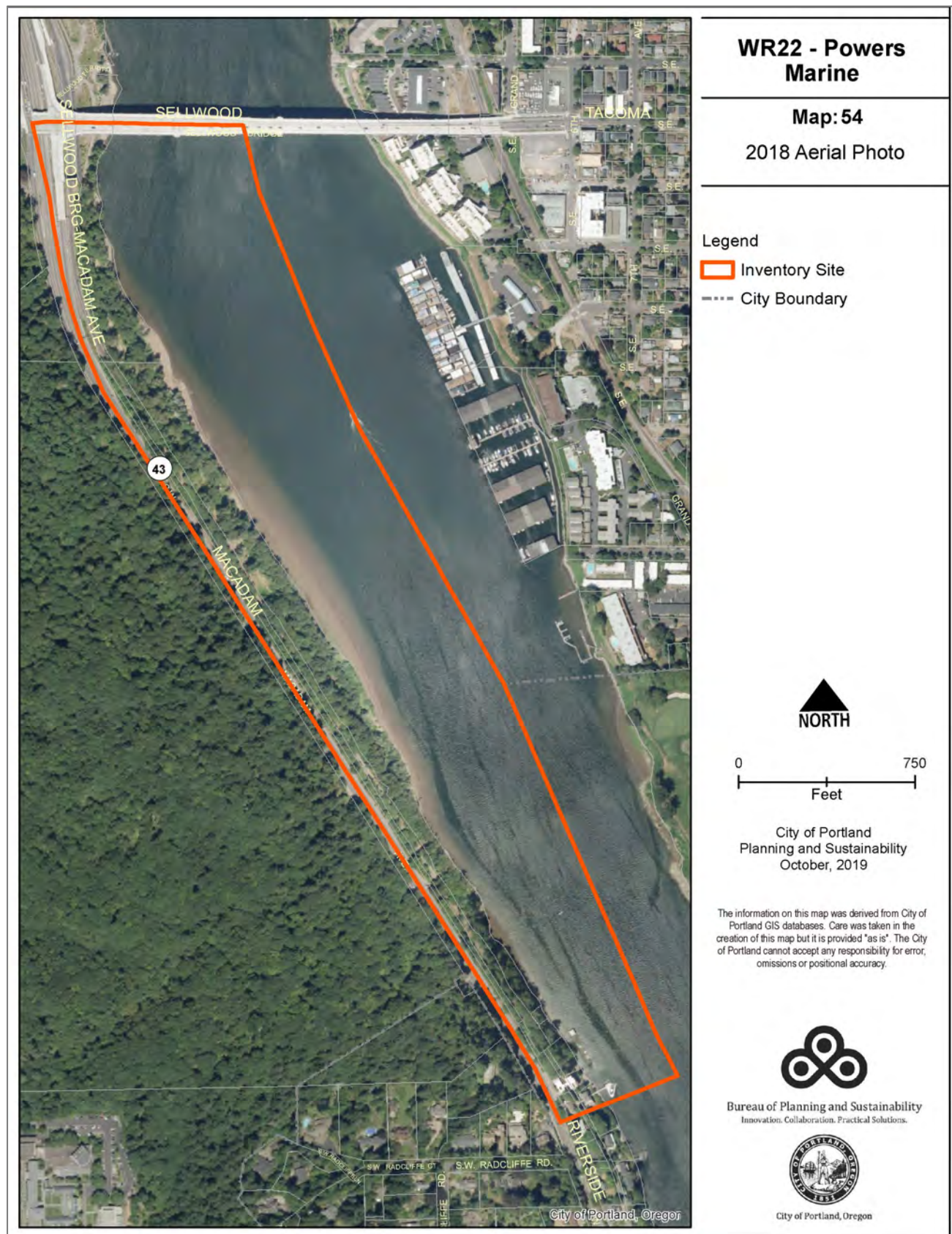
The general recommendation, shown on Map 58, aims to balance the environmental, economic and social consequences of protecting natural resources in WR22. High ranked resources dominate this inventory site; therefore the map shows development within almost all of the inventory site to be strictly limited. In these areas, conflicting uses should be limited in high-ranked resource areas. Additional flexibility should be provided for development on parcels containing medium-ranked resources.

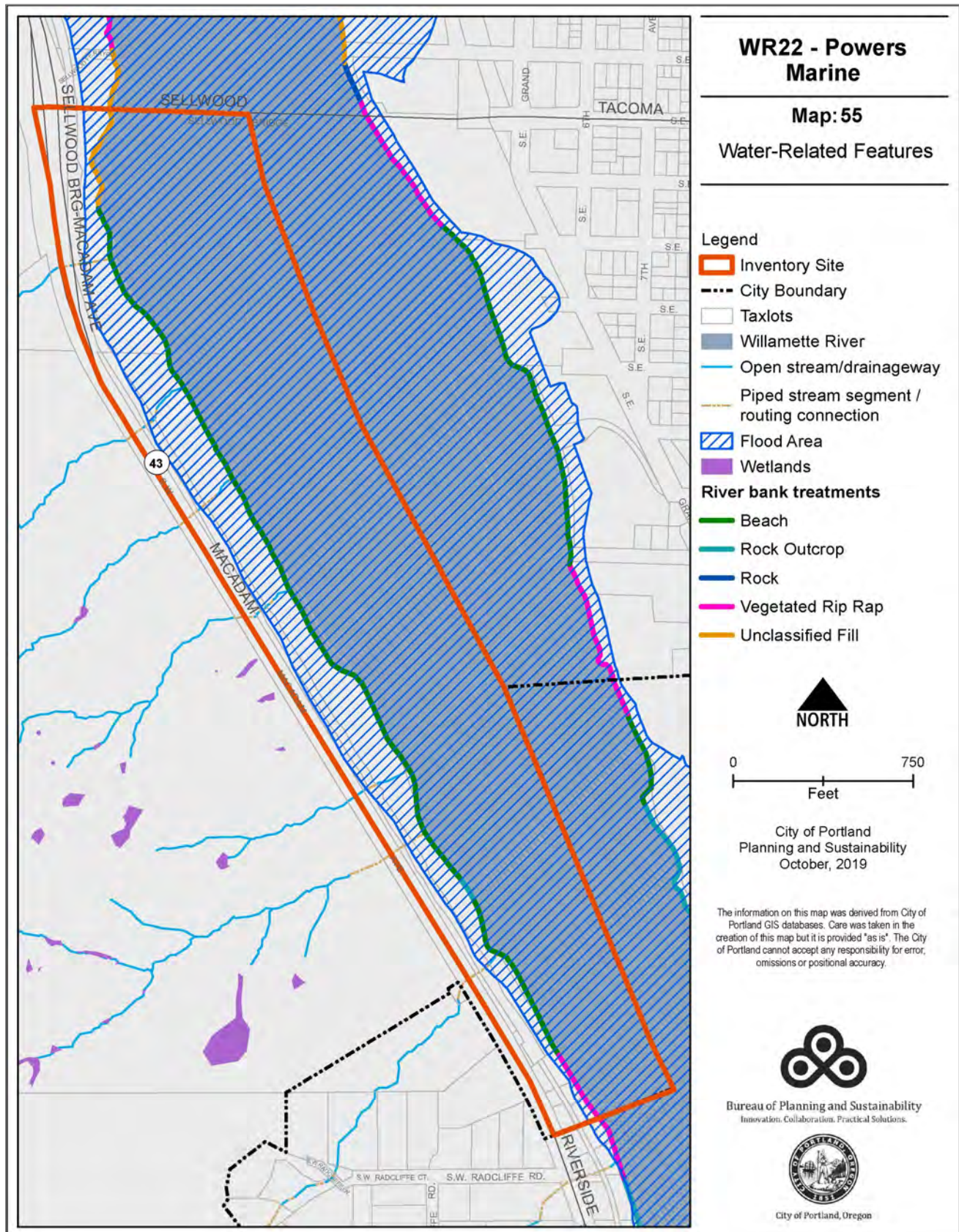
The recommendation for riparian areas is to:

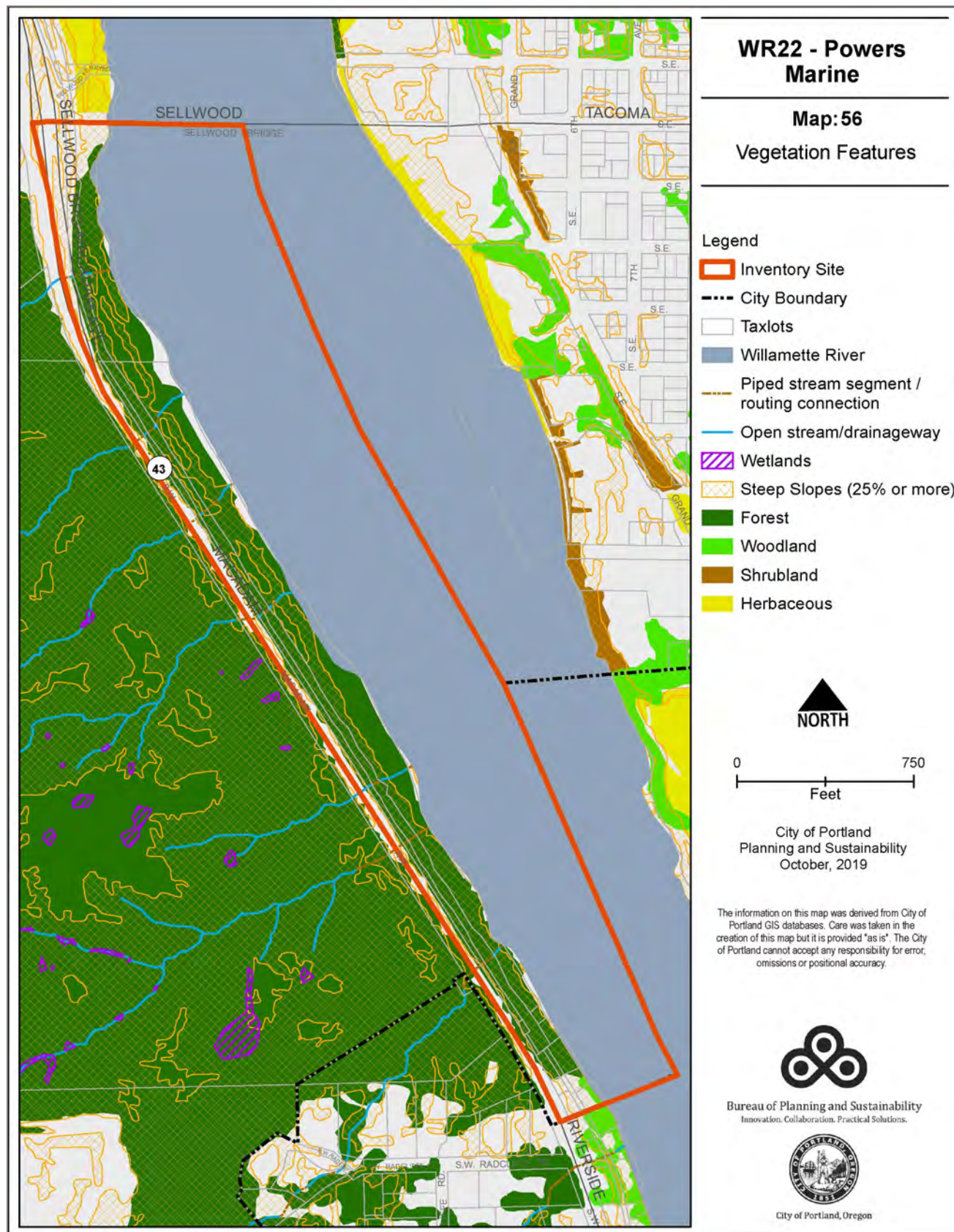
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land located landward of and waters below the top of bank of the Willamette River, tributaries of the river and land within the undeveloped 100-year floodplain and 1996 Flood Inundation Area.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked riparian areas and developed floodplain (classified as low ranked resource).

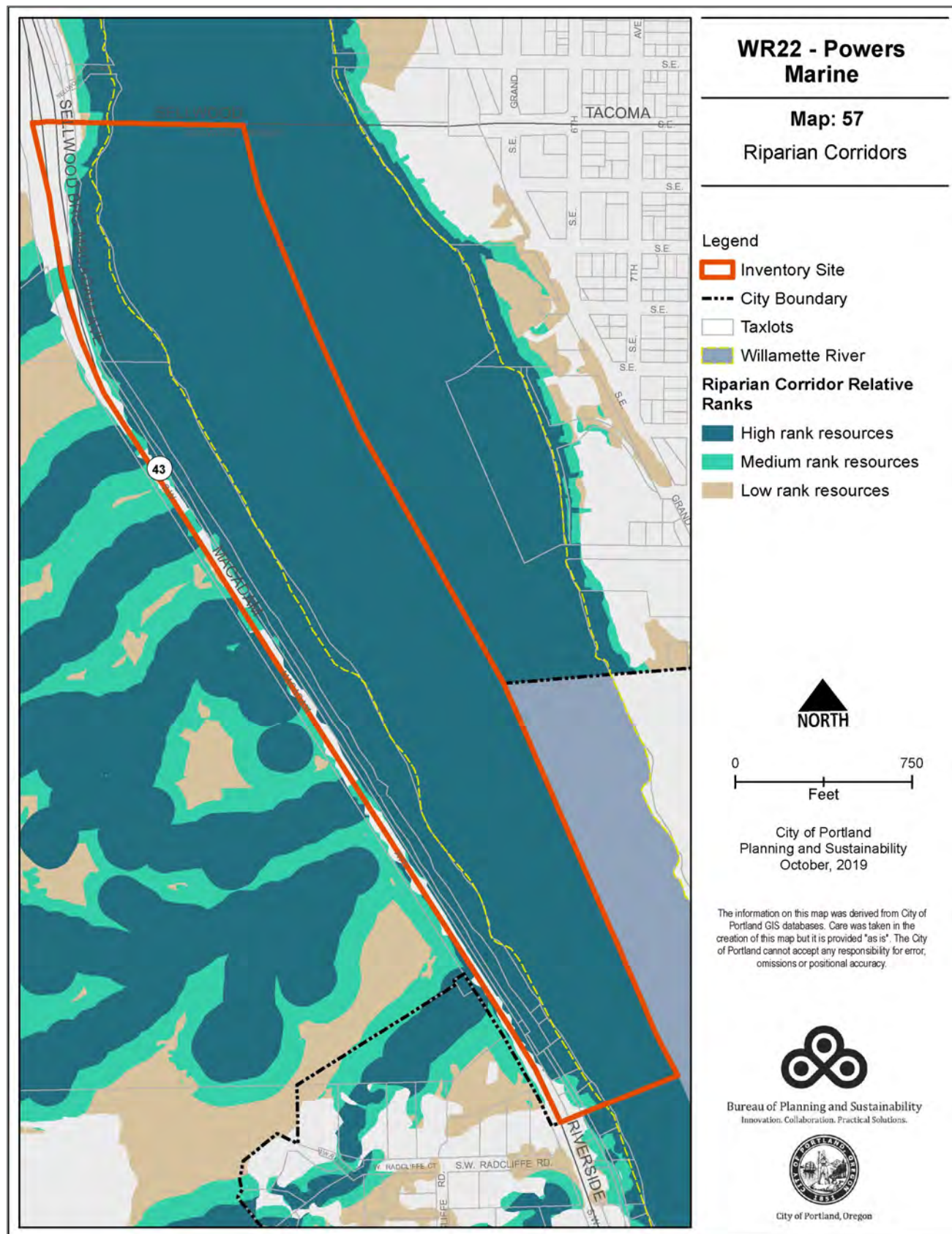
The recommendation for wildlife habitat areas outside of riparian areas is to:

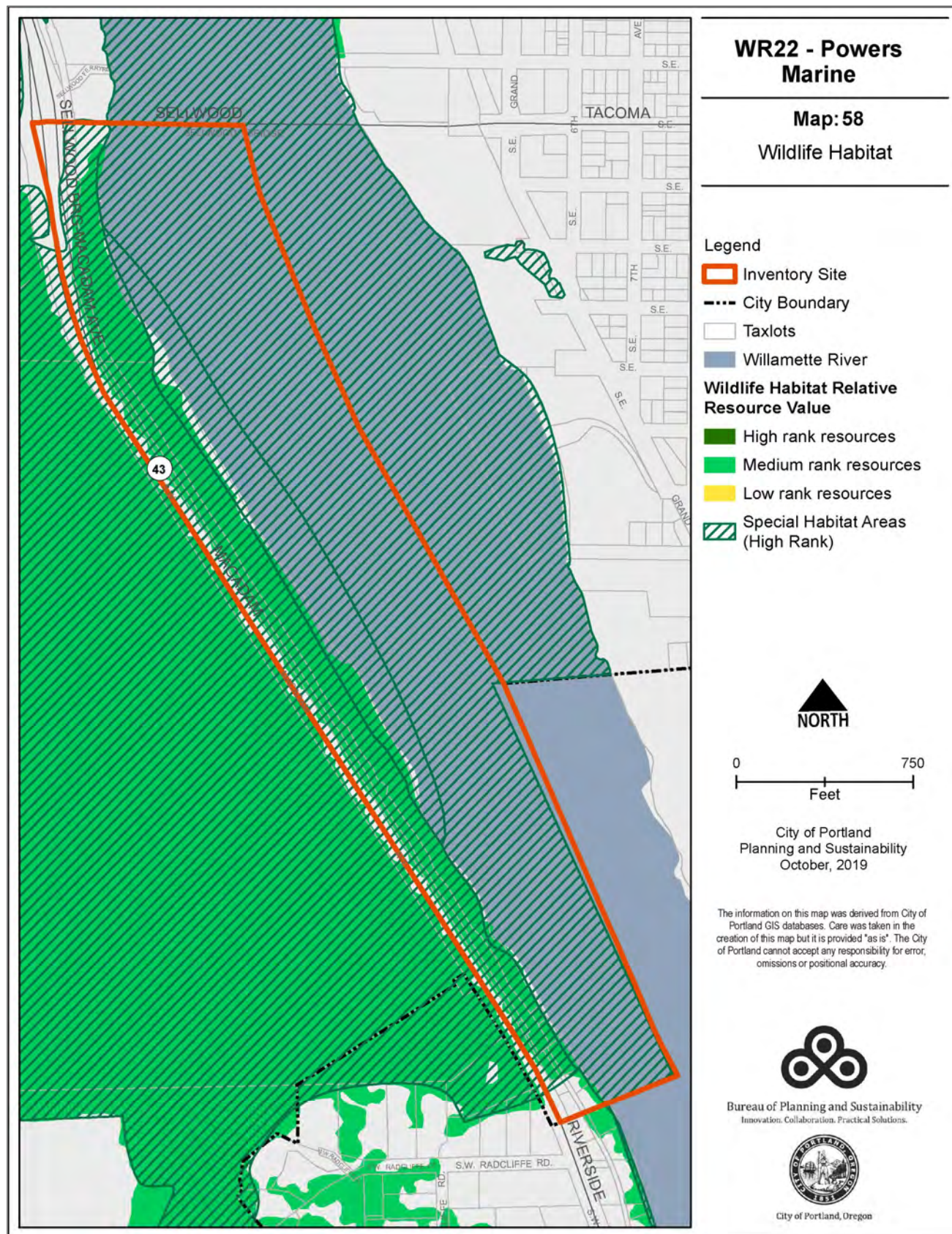
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked resources.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked resources.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

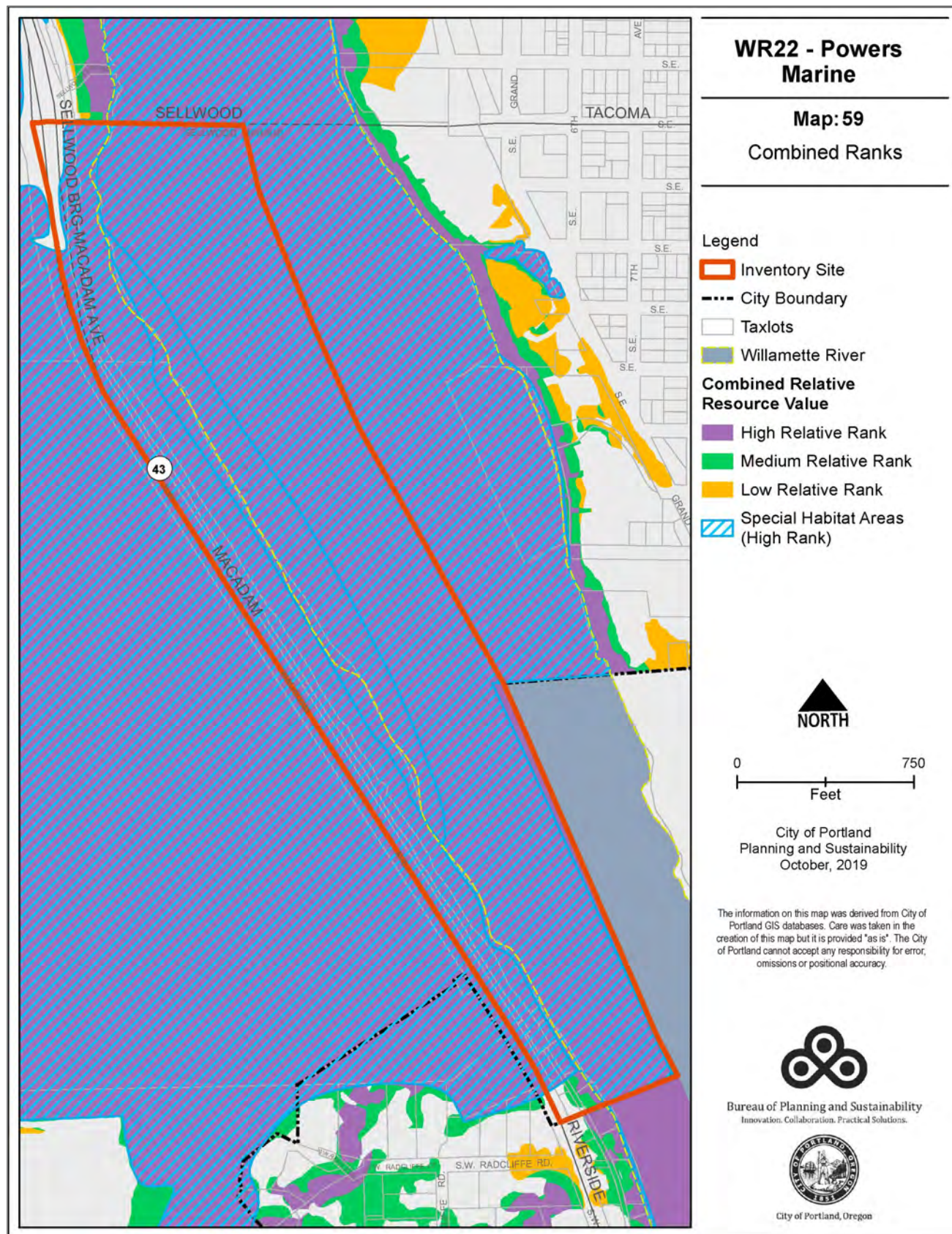


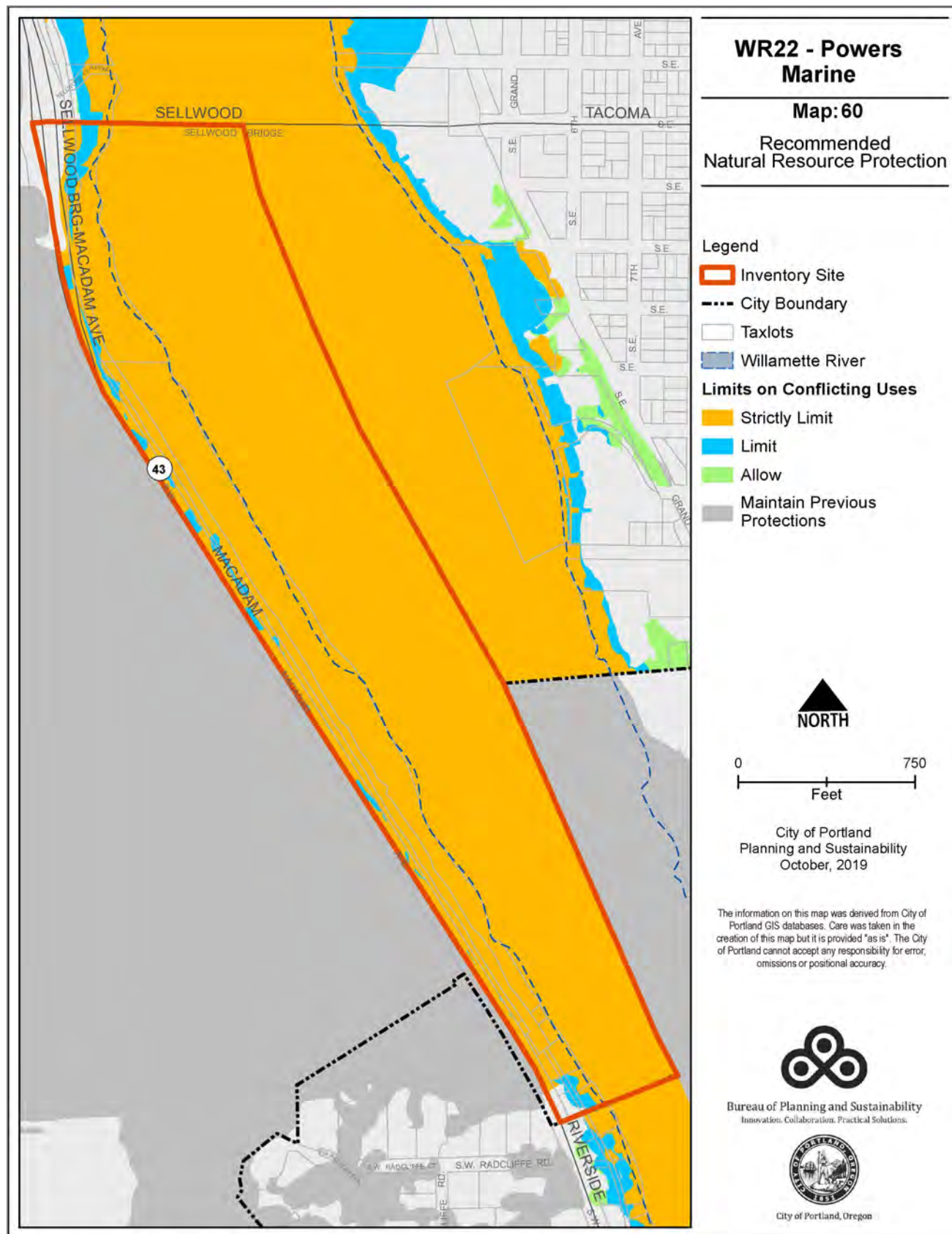












4.v: INVENTORY SITE WR23 DUNTHORPE

Summary Information

Watershed:	Willamette River Watershed
Neighborhood:	N/A
USGS Quadrangle and Quarter Section Maps:	1S1E26C, 1S1E26D, 1S1E35A, 1S1E35B, 1S1E35C, 1S1E35D
River Mile:	17.4 – 19.1
Site Size:	170 acres (land and water)
Previous Inventory:	Lower Willamette River Wildlife Habitat Inventory, March 1986
Zoning:	Residential 20,000 (R20) Open Space (OS) Environmental Conservation Overlay Zone (c) Environmental Protection Overlay Zone (p) Willamette Greenway River General Overlay (g)
Existing Land Use:	Residential, railroad
General Description:	The majority of this site is developed with single family residential uses. There are steep slopes and major tree canopy, including Oregon white oak and Pacific madrone. Three streams cross the site.
Resource Features:	Open water, shallow water habitat, river bank, flood plain, wetland, riparian vegetation
Resource Functions:	Microclimate and shade; stream flow moderation and water storage; bank function and sediment, nutrient and pollution control; large wood and channel dynamics; organic inputs, food web and nutrient cycling; and wildlife habitat and movement corridor
Special Habitat Area:	Willamette River: (S) – provides habitat for at-risk wildlife species; (C) – wildlife connectivity corridor Dunthorpe Oak Escarpment: (O) – Oregon White Oak; (C) – wildlife connectivity corridor; (U) – unique feature
Special Status Species:	Fish: Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead trout, LCR coastal cutthroat trout, Upper Willamette River (UWR) Chinook salmon, UWR steelhead trout, Pacific lamprey, Western brook lamprey, white sturgeon. Amphibians: None Birds: Bald eagle, brown creeper, bushtit, common yellowthroat, downy woodpecker, great blue heron, house wren, orange-crowned warbler, Pacific-slope flycatcher, peregrine falcon, Swainson's thrush, Western wood-pewee, white-breasted nuthatch (slender-billed) Mammals: American beaver, hoary bat, Northern river otter.



Natural Hazards: Flood area, landslide, earth quake

Contamination: No

Site Description

This 170 acre site is located on the west side of the Willamette River between Powers Marine Park and the southern end of the Dunthorpe neighborhood in unincorporated Multnomah County (See Map 59). Much of the inventory site is characterized by steep slopes with a mix of vegetation including residential landscaping. Three streams cross the inventory site from the hills to the Willamette River; two of which are in an open channel through parts of the site. Douglas fir is the dominant tree species; however, there is a significant oak/madrone escarpment and cliffs extending from the Garden at Elk Rock to the City of Portland property (also known as the Peter Kerr property) to the south. Other tree species include bigleaf maple, western red cedar, red alder and western hemlock.



The site contains 13 acres (7 percent) of impervious surfaces. Of the vegetated areas over ½ acre in size, there are approximately 31 acres of forest, 16 acres of woodland, 0 acres of shrubland and 1 acre of herbaceous vegetation. There are 113 acres of flood area on this site, of which 12 acres are vegetated and 93 acres are open water.

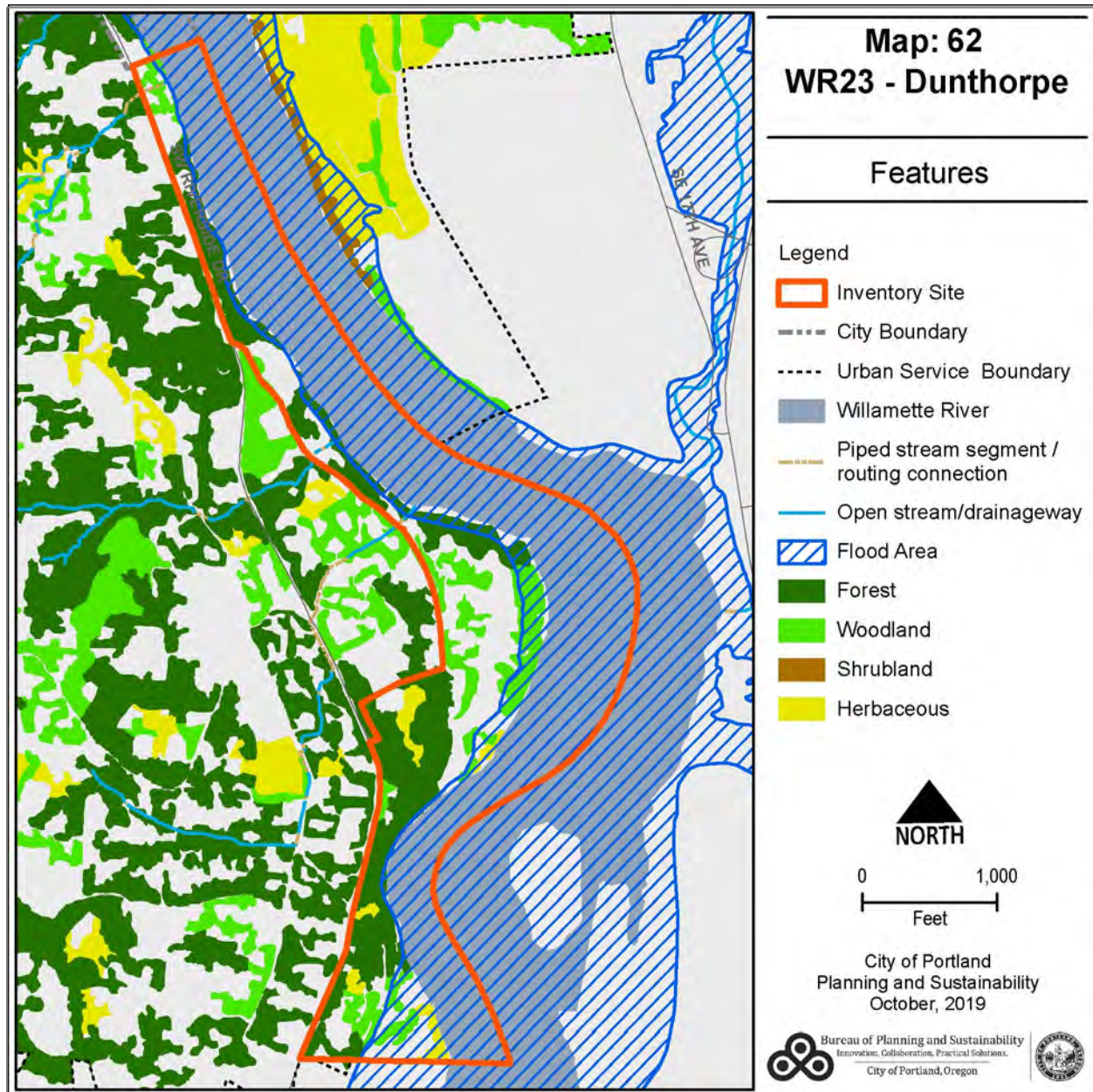
Table 27: Summary of Natural Resource Features in WR23 – Dunthorpe	
	Study Area (miles/acres)
River (miles/acres)	2/94
Stream/Drainageway (miles)	<1
Wetlands (acres)	0
Flood Area (acres)*	
Vegetated (acres)	12
Non-vegetated (acres)	8
Open Water** (acres)	93
Vegetated Areas >= ½ acre (acres)*	
Forest (acres)	31
Woodland (acres)	16
Shrubland (acres)	0
Herbaceous (acres)	1
Impervious Surfaces (acres)	13
* 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.	

Natural Resources Description

Historically, the Portland-area portion of the Willamette River watershed 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 Pacific 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 SRNRPP study area is comprised largely of parks, natural areas and open spaces and residential development. Significant natural resource areas in this inventory site include:

- Willamette River (open water and river banks)
- Dunthorpe Oak Escarpment
- Elk Rock Cliff
- Mature Tree Canopy



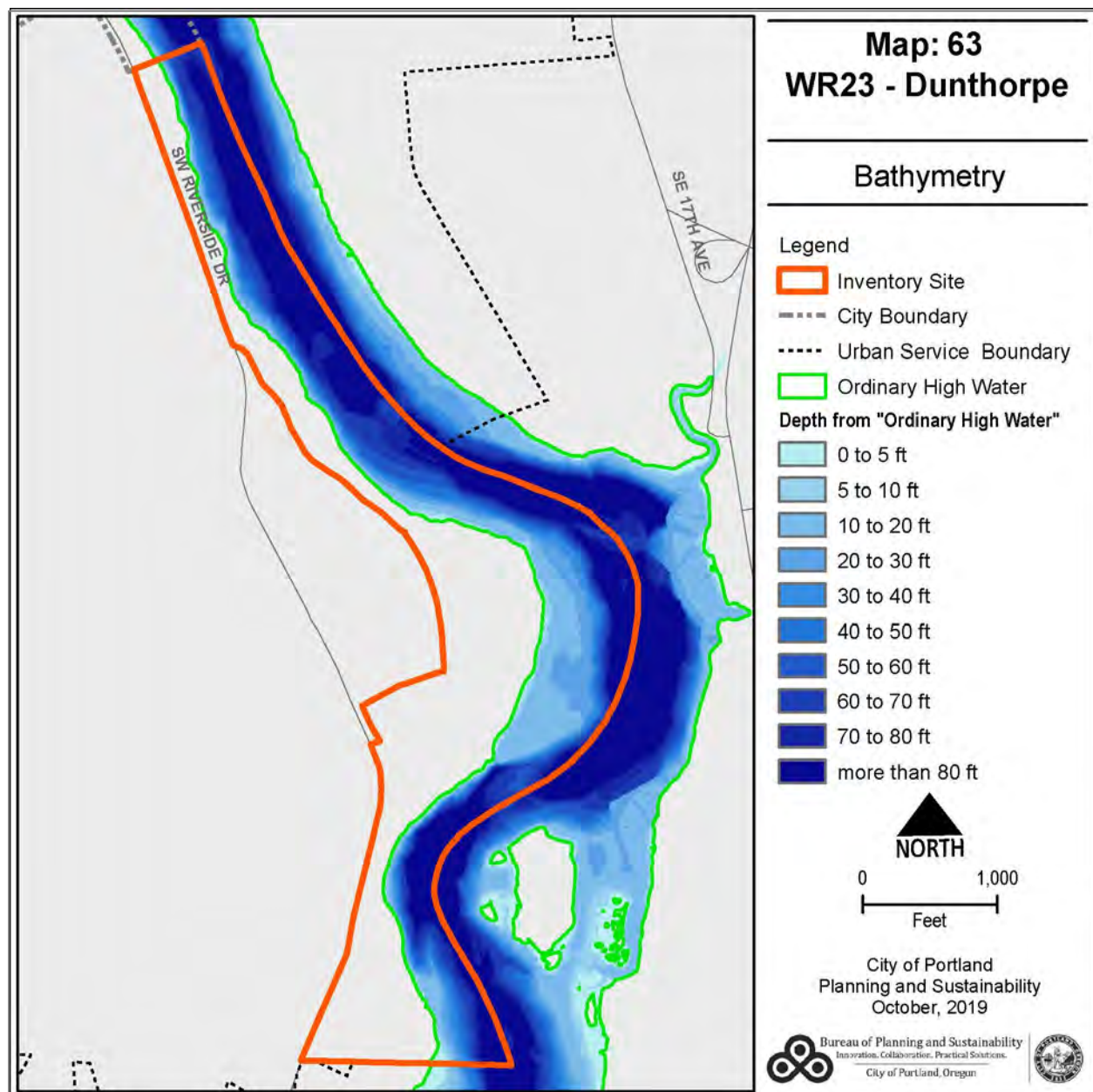
Willamette River

Below is a summary of Lower Willamette River natural resources documented in inventory site WR23. Additional information about the water quality, hydrology, and fish and wildlife use of the entire Willamette River South Reach is provided earlier in this chapter. Information on the Willamette River as a whole and the Lower Willamette River, more specifically, can be found in Chapter I.

Inventory site WR23 includes 94 acres of the Lower Willamette River. The river is the primary habitat link providing connectivity between upstream and downstream aquatic habitats. This connection is critical for fish, resident and migrating birds, and other species.

The Willamette River is the primary migration corridor for ESA-listed Chinook and coho salmon, as well as steelhead, and coastal cutthroat trout. These fish enter the Lower Willamette River system to explore and spawn in reaches throughout the Willamette River watershed. Shallow water areas, which are found along shoreline margins in this inventory site, are especially important for juvenile fish because they provide opportunities to escape the swift current of the main channel to rest and feed (see Map 61). Seasonal migrants use habitat within the inventory site during multiple life stages and are usually present during predictable seasonal peaks:

- Juvenile salmon and trout out-migration generally occurs between March and June.
- Spring Chinook out-migration peaks in April.
- Fall Chinook, steelhead and coho out-migration peaks between May and June.



Columbia eulachon pass through the lower Columbia and Willamette rivers as opportunistic migrants as well. Adults return to their natal river every winter; however, their out-migration timing is not as well documented.

White sturgeon generally move throughout the Columbia River estuary and Lower Willamette River throughout the year. As adults, sturgeon can migrate freely between fresh, brackish and saline water; juveniles and young-of-year cannot, so their rearing range is limited. Recent white sturgeon stock assessment data collected in the Willamette River between Willamette Falls and the Columbia River confluence describe a compromised population of white sturgeon represented by several young age classes.

The historic run of adult Pacific lamprey up and over Willamette Falls numbered in the hundreds of thousands. Today, that run is significantly smaller; however, tribal harvest of these fish for subsistence and ceremonial uses still brings many families to the Willamette Falls every year. Documentation of Pacific lamprey rearing and outmigration patterns in the Lower Willamette River is limited; however, juveniles are often observed in soft substrate samples collected throughout the lower river. The rearing life stage of Pacific lamprey is known to last between 4-7 years in freshwater habitat, before individuals migrate to the ocean for their maturation life stages.

Resident fish assemblages within this reach include native species such as largescale sucker, sculpin (prickly and reticulate), reidside shiner and northern pikeminnow. Nuisance species include large and smallmouth bass, Asian carp and yellow perch.

The Willamette River plays an important part of the Pacific Flyway migratory route. Over 200 resident and migratory bird species, including iconic species such as great blue heron, osprey, Peregrine falcon and bald eagle use the riverine habitat. Species use the open water habitat for foraging and as a migratory corridor. Avian species also use natural features and human-made structures for nesting, resting and foraging. Shallow water areas and exposed sand and mud in some areas are used by shorebirds and waterfowl.

The lower Willamette River does not meet state water quality standards for bacteria, mercury, DDT, temperature, and a variety of other pollutants (see Table 28). TMDLs for bacteria and temperature, as well as a phased TMDL for mercury, were established in 2006. Generally, the Oregon Water Quality Index values observed between 1998 to 2012 in the Willamette River have seen modest improvement and the trend is steady. In September of 2019, DEQ released its 2018/2020 Draft Integrated Report for public comment. Comments will be accepted through early December 2019.

High in-stream temperatures in the Lower Willamette River during the summer months negatively impact native fish productivity. Tributary streams can have a mitigating influence on the water temperature in the Willamette River by providing cool water refugia. However, many Willamette River tributaries do not meet standards for temperature and other pollutants, including bacteria, and toxic inputs into the river are also a concern.

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.

Table 28: Water Quality (303(d)) Listings in WR23 – Dunthorpe				
Pollutant	Season	Year River was Listed for this Pollutant	River Miles¹	Risk Factors
Pesticides and Toxics				
Aldrin, DDT, Dieldrin, PCBs, Polynuclear Aromatic Hydrocarbons (PAH)	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Copper, DDE 4,4	Year-round	2012	0 to 24.8	
Chloradanem, Hexachlorobenzene	Year-round	2010, 2012	0 to 24.8	
Cyanide, Pentachlorophenol	Year-round	2010	0 to 24.8	
Heavy Metals				
Iron	Year-round	2002, 2004/06, 2010, 2012	0 to 24.8	Fishing, drinking water, resident fish and aquatic life, anadromous fish passage
Lead	Year-round	2012	0 to 24.8	
Mercury	Year-round	1998, 2012	0 to 186.6	
Nutrients				
Chlorophyll a	Summer	2010, 2012	0 to 54.8	Fish and other aquatic life due excessive algal growth and a decrease in dissolved oxygen (DO)
Bacteria (Fecal Coliform)	Fall/Winter/ Spring	1998, 2004/06, 2012	0 to 24.8	Water contact recreation
Temperature	Summer	1998	0 to 24.8	Salmonid fish rearing, anadromous fish passage
Biological Criteria	N/A	1998, 2002, 2010, 2012	0 to 24.8	Resident fish and aquatic life

¹ South Reach project boundary extends from approximately mile marker 13.9 to 19.1

Data from the Oregon Department of Environmental Quality Integrated Report Databases (2019) – available at:

<https://www.oregon.gov/deq/wq/Pages/2012-Integrated-Report.aspx>

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 such 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. The result is that combined sewer overflows have been almost completely eliminated during the summer recreating season.

In the inventory site, the flood area is generally confined to the Willamette River itself though the eastern portion of a number of properties on SW Riverwood Rd fall within the flood area. Additionally, a number of properties at the southern end of the inventory site are completely within the flood area.

The Willamette River and shallow water habitat are designated Special Habitat Areas because they meet the following criteria:

(S) – An *at-risk* species uses the habitat area or feature on more than incidental basis to complete one or more life history phases

(C) – Wildlife connectivity corridor

(M) – Migratory stopover habitat

Elk Rock Cliff

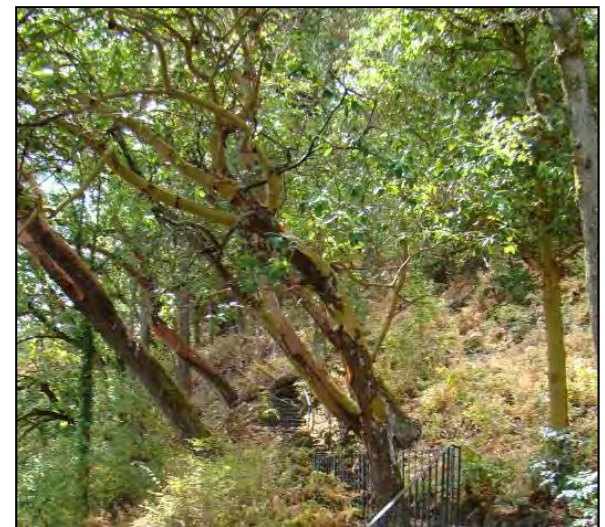
In addition to the Oak/Madrone forested areas, the escarpment south of the Gardens at Elk Rock (referred to as the Peter Kerr property) contains a unique (within Portland) habitat type consisting of both exposed shallow-soiled basalt outcrops and shaded vertical seeps over rock, both of which support populations of numerous plant species that are categorized as uncommon or rare. As shown in Table 29 in the Natural Resource Evaluation section below, a total of 25 rare species have been identified in this area. This compares to a maximum of three species in the other 4 inventory sites. Some of these species have received state designations due to their limited presence within the state as a whole. This cliff face, portions of the surrounding properties, and the vegetation that occurs there are functionally unique and evaluated by Bureau of Environmental Services staff as irreplaceable within the region.

Peregrine falcons nest at this site most years as well.

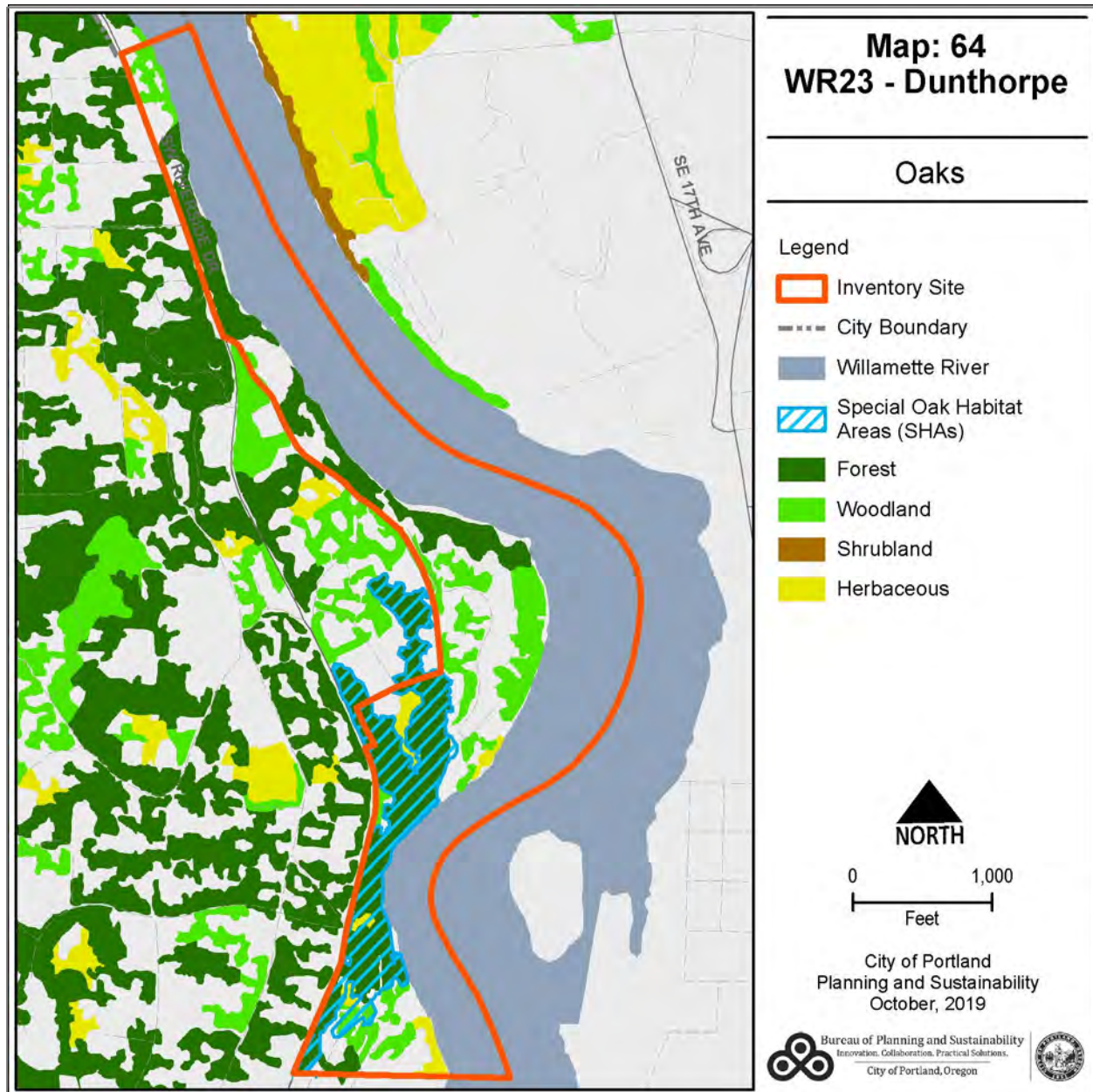
Dunthorpe Oak Escarpment and Mature Tree Canopy

Beginning at the Garden at Elk Rock and heading south along the ridge line is a remnant stand of Oregon white oak and Pacific madrone (see Map 62). This tree assemblage is rare and declining in the Metro area. On the Garden of Elk Rock property, the Oregon white oaks are between 200 and 300 years old and the Pacific madrones are some of the oldest in Portland. The grounds keepers are actively removing invasive species, particularly Irish and English ivies, from the slopes and supporting oak recruitment and native understory plants.

In addition to the Dunthorpe Oak Escarpment there are stands of mature tree canopy throughout the site. Douglas fir and bigleaf maple are the dominant species. The tree canopy is fragmented by large-lot residential development and most of the native understory has been removed. However, the large trees still provide numerous functions, including cleaning and cooling the air and water, capturing greenhouse gases, capturing and uptaking stormwater, reducing energy demand and providing wildlife habitat. Birds observed include black-capped chickadee, song sparrow, Oregon junco, Pacific wren, northern flicker, bald eagle and peregrine falcon (BES, 2010).



Photos of Oregon White Oak and Pacific Madrone at the Garden at Elk Rock



Natural Resource Evaluation

The natural resources located within this site have been evaluated for relative riparian and wildlife habitat quality. Relative quality is presented in the form of relative functional value ranks for riparian corridors, wildlife habitat, and riparian/wildlife habitat value combined (Table 30). The relative ranks are produced using GIS models and information on Special Habitat Areas.

The approach used to generate the relative ranks is summarized in the introduction to the inventory sites. Additional detail is provided in Chapter II: Methodology Overview of this report and Appendix B: *Natural Resources Inventory: Riparian Corridors and Wildlife Habitat Project Report*.

All of the ranked resource areas provide at least some important riparian and habitat value, recognizing that current condition and function levels may vary considerably. The relative ranks can inform planning projects and programs, including regulations, design of development or redevelopment projects, and mitigation and restoration activities.

Riparian Areas

The site contains the Willamette River and river bank, flood area, wetlands and riparian vegetation. These features contribute to the riparian functions as detailed in the natural resource descriptions, specifically:

- Microclimate and shade
- Stream flow moderation and water storage
- Bank functions, and sediment, pollution and nutrient control
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor

High relative functional ranks are assigned to the Willamette River itself, wetlands and forest vegetation in the floodplain or in proximity to the water bodies. Medium relative functional ranks are assigned to less dense and lower structure vegetation in the floodplain and up to 300 feet from water bodies. Low relative ranks are generally assigned to non-vegetated flood areas.

Wildlife Habitat

Within the context of this inventory model, a wildlife habitat patch is defined as forest and/or wetland areas 2 acres in size or greater, including adjacent woodland vegetation (note: Special Habitat Areas may be smaller and may contain different types of vegetation or other resource features). The model assigns relative ranks to qualifying habitat patches based on their size, interior area, proximity to other patches and proximity to water. Medium relative functional ranks are assigned to wetland and forest patches in this inventory site.

Special Habitat Areas (SHA) consist of rare and declining habitat types and unique features that provide critical habitat for at-risk plant and animal species as described in the Natural Resources Description section above. SHAs receive a high relative rank for wildlife habitat. The SHA ranking supersedes lower rankings generated by the GIS model.

The Willamette River, including shallow water habitat areas, are designated as SHAs because they meet the following criteria:

- (S) – An *at-risk* species uses the habitat area or feature on more than an incidental basis to complete one or more life history phases
- (M) – Migratory stopover habitat
- (C) – Wildlife connectivity corridor

Dunthorpe Oak Escarpment is designated a Special Habitat Area for the following:

- (O) – Oregon White Oak
- (C) – Wildlife connectivity corridor habitat
- (U) – Unique feature

Rare Plant Species

As stated in the previous section, a large number of native plant species have been documented in WR23 and are listed in Table 29. These are concentrated on Elk Rock Cliff and its surrounding area.

Table 29: Rare Native Plant Species in WR23 – Dunthorpe		
Common Name	Scientific Name	NatureServe State Rank ¹
Pacific hounds-tongue	<i>Adelinia grande</i>	
Oneflowered broomrape	<i>Aphyllon uniflorum</i>	
Streambank arnica	<i>Arnica amplexicaulis</i>	
Oregon bolandra	<i>Bolandra oregana</i>	S3
Primrose	<i>Clarkia amoena</i> ssp. <i>lindleyi</i>	
Large-Flowered Cryptantha	<i>Cryptantha intermedia</i>	
Brittle Bladderfern	<i>Cystopteris fragilis</i>	
White rock larkspur	<i>Delphinium leucophaeum</i>	S2
Coastal wood fern	<i>Dryopteris arguta</i>	
Heartleaf buckwheat	<i>Eriogonum compositum</i>	
Purple flowered Washington lily	<i>Lilium washingtonianum</i> ssp. <i>purpurascens</i>	
Fine-leaf desert parsley	<i>Lomatium utriculatum</i>	
Spur lupine	<i>Lupinus arbustus</i>	
Gorman's saxifrage	<i>Micranthes gormanii</i>	
Marshall's saxifrage	<i>Micranthes marshallii</i>	
Rusty hair saxifrage	<i>Micranthes rufidula</i>	
Howell's montia	<i>Montia howellii</i>	S3, S4
Broad-leaved penstemon	<i>Penstemon ovatus</i>	
Richardson's penstemon	<i>Penstemon richardsonii</i> var. <i>richardsonii</i>	
Goldback fern	<i>Pentagramma triangularis</i>	
Wheeler bluegrass	<i>Poa nervosa</i>	
Pine bluegrass	<i>Poa secunda</i> ssp. <i>secunda</i>	
Narrowleaf skullcap	<i>Scutellaria lateriflora</i>	
Broadleaf stonecrop	<i>Sedum spathulifolium</i>	
Oregon spikemoss	<i>Selaginella oregana</i>	
Oregon coolwort	<i>Sullivantia oregana</i>	S2

1. The NatureServe system is an international system for ranking rare, threatened and endangered species throughout the world. The ranking is a 1-5 scale, with 1 being critically imperiled and 5 being secure. The state ranks specifically evaluate the rarity of a species within each state's boundary.

Combined Relative Riparian/Wildlife Habitat Ranking

Where areas that are mapped as riparian corridors and wildlife habitat overlap, and their relative ranks differ, the combined relative rank will be the higher of the two ranks. For example, an area that ranks medium for riparian function and low for wildlife habitat will receive a medium combined relative rank.

Table 30: Summary of Ranked Resources in WR23 – Dunthorpe				
Total Inventory Site = 170 acres				
	High	Medium	Low	Total
Riparian Resources*				
acres	107	18	22	146
percent total inventory site area	63	11	13	86
Wildlife Habitat				
Wildlife Habitat*				
acres	0	46	0	46
percent total inventory site area	0	27	0	27
Special Habitat Areas**				
acres	15			
percent total inventory site area	9			
Wildlife Habitat - adjusted by Special Habitat Areas***				
acres	15	34	0	48
percent total inventory site area	9	20	0	28
Combined Total***				
acres	117	29	4	150
percent total inventory site area	69	17	2	88
* High-ranked riparian resources, Special Habitat Areas, and wildlife habitat include the Willamette River. ** Special Habitat Areas rank high for wildlife habitat. *** Because riparian resources, Special Habitat Areas, and wildlife habitat overlap, the results cannot be added together to determine the combined results.				

Natural Resource Protection Recommendation

The Willamette River and associated floodplain and riparian areas in resource site WR23 are largely developed with low-density residential developments on large lots. Most of these residential sites are characterized by tree canopy surrounding existing homes, driveways and associated development. The understory on these sites is frequently comprised of turf grass and other ornamental plants. Tree canopy on these sites creates habitat patches that connect the area with fragmented tree canopy that extends to southwest Portland, just to the west of the inventory site. The river and riverbank areas within WR23 are designated as high rank natural resources, while the tree canopy landward of the riverbanks is generally ranked as medium value resource.

Elk Rock Cliff and its surrounding area is a truly unique natural resource area within the City of Portland and the region. Elk Rock Cliff supports approximately 25 plant species not seen elsewhere in the region, with many of them rarely seen elsewhere in the state. This rare plant community has been determined to be irreplaceable within the region.

The general recommendation, shown on Map 69, aims to balance the environmental, economic and social consequences of protecting natural resources in WR23. High ranked resources include the river and riverbank areas with existing vegetation, as well as Elk Rock Cliff and the surrounding area (including portions of the Garden at Elk Rock property just to the north). Development is recommended to be strictly limited in these areas. To the extent possible, conflicting uses should be limited in high-ranked resource areas. Additional flexibility should be provided for development on parcels containing medium-ranked resources. Developed areas within the 100-year or 1996 Flood Inundation Area (ranked as low-value resources) should be provided moderate protections to ensure no loss of flood storage and floodplain habitat as a result of development in these areas.

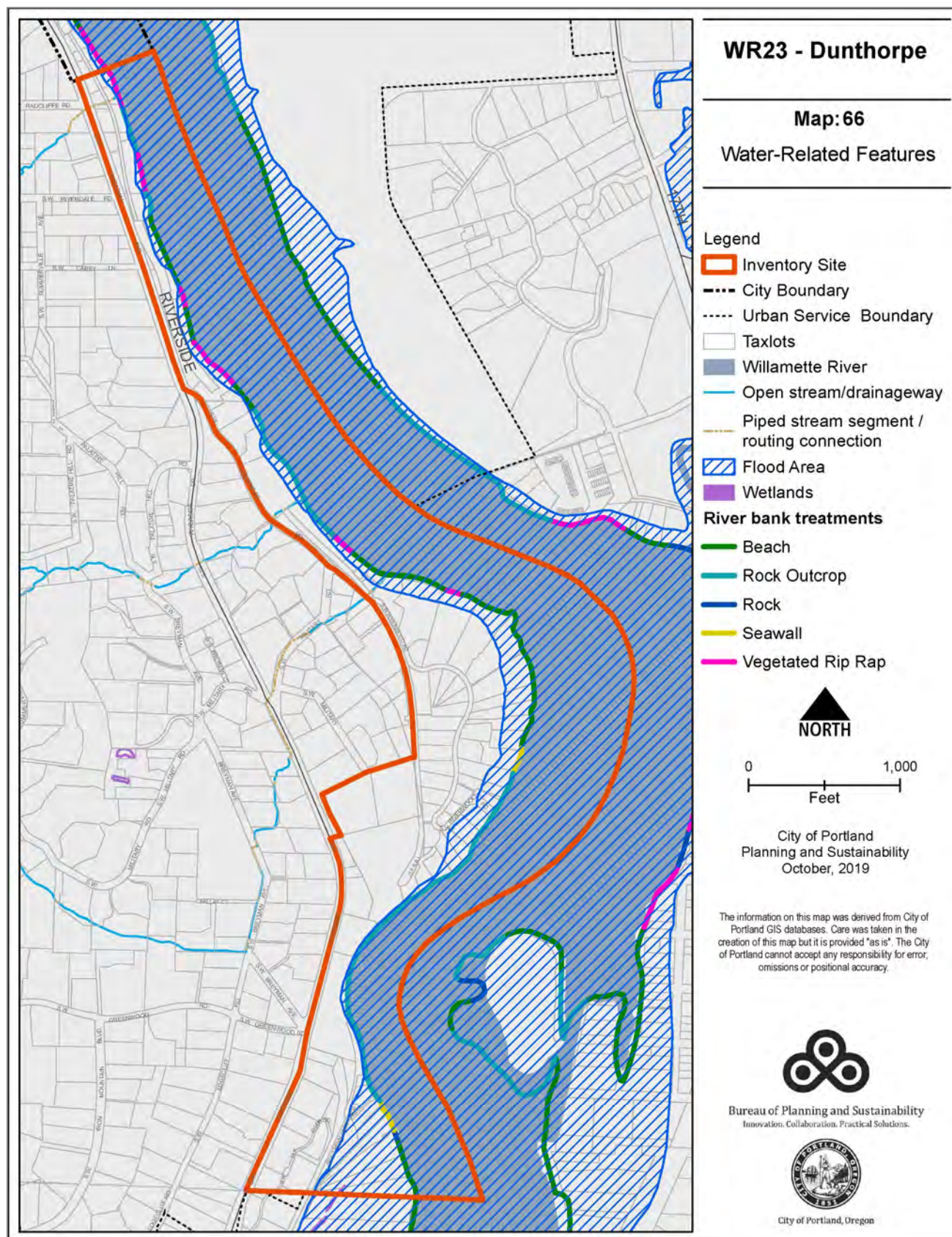
The recommendation for riparian areas is to:

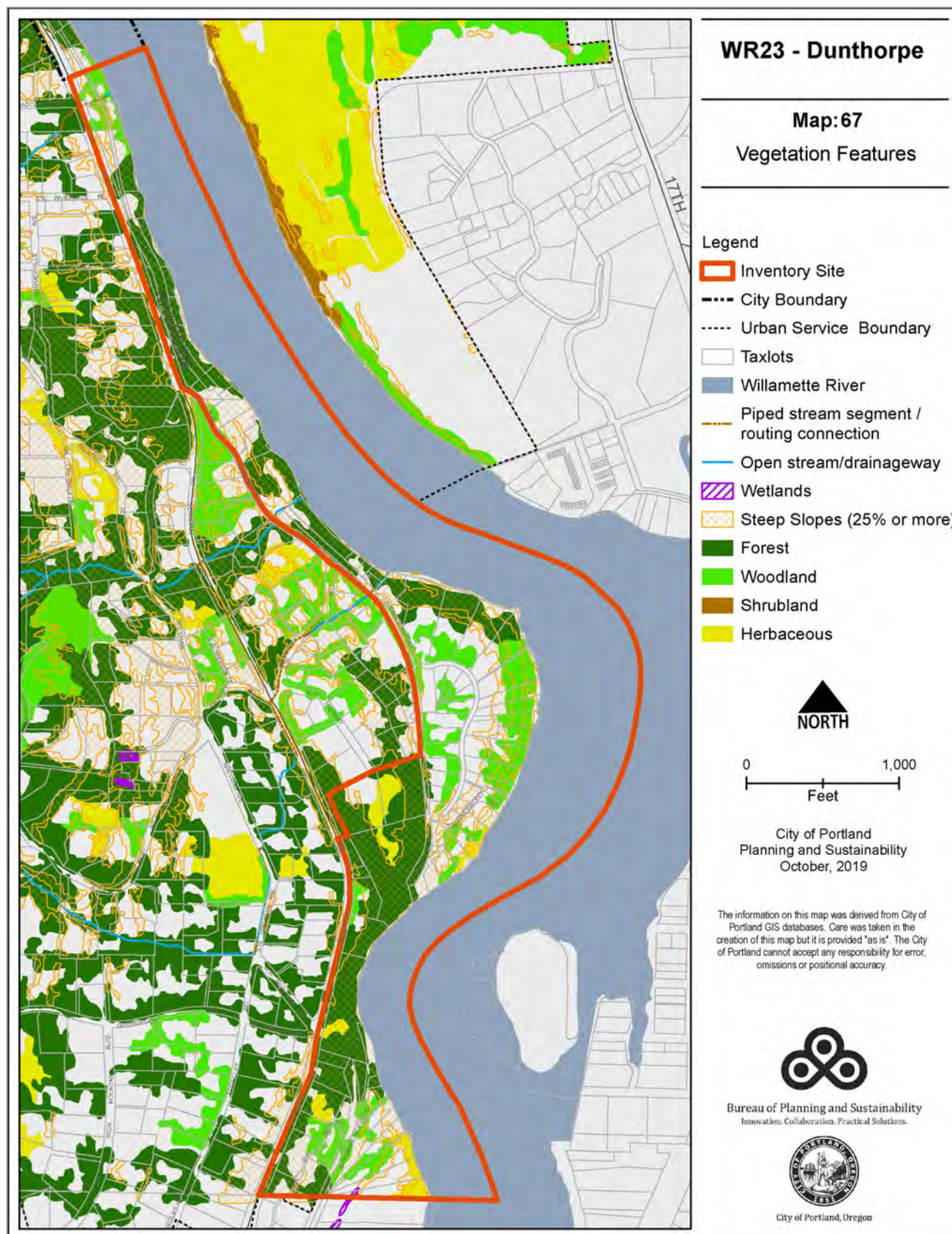
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked natural resources, including land located landward of and waters below the top of bank of the Willamette River, tributaries of the river and land within the undeveloped 100-year floodplain and 1996 Flood Inundation Area.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked riparian areas and developed floodplain (classified as low ranked resource).

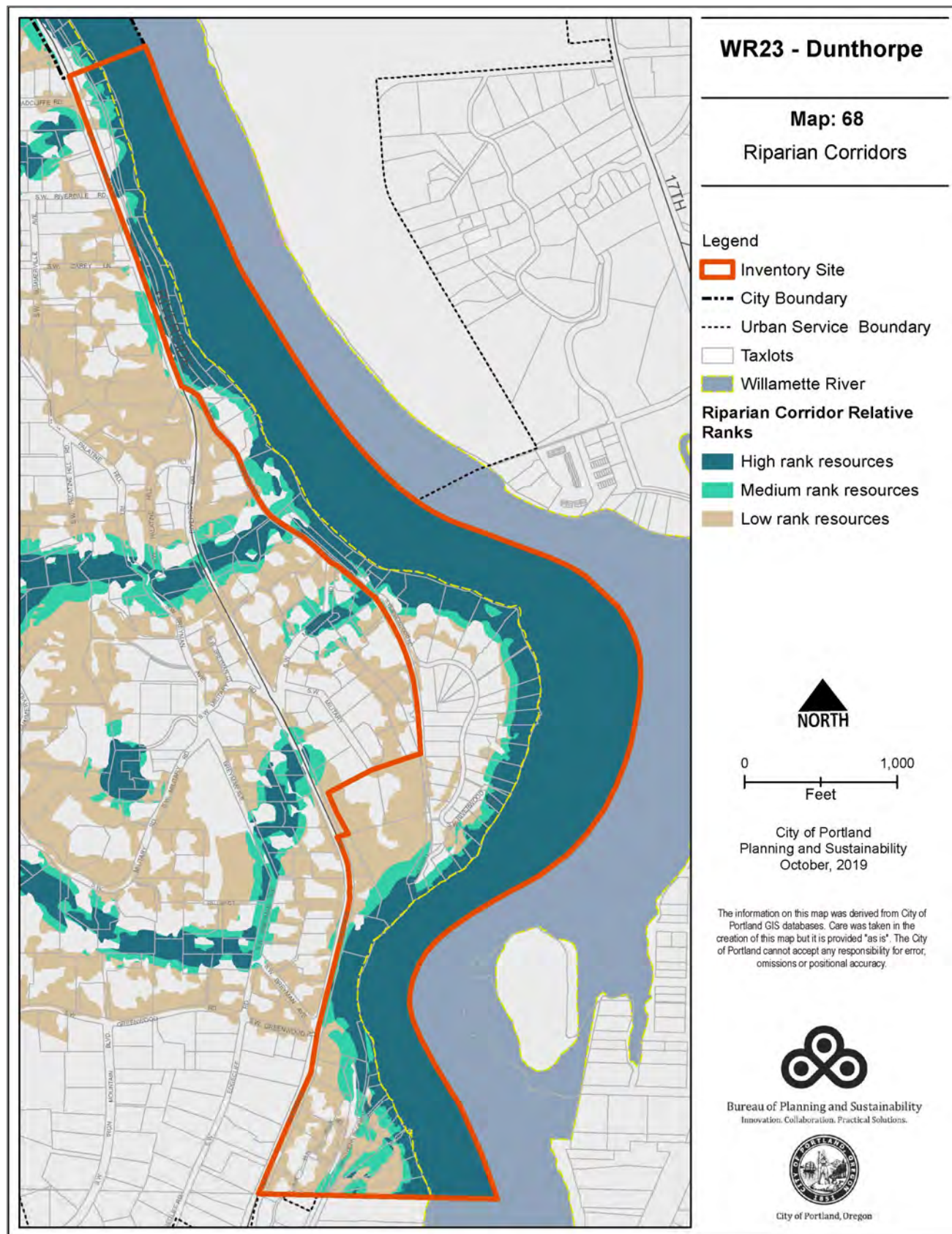
The recommendation for wildlife habitat areas outside of riparian areas is to:

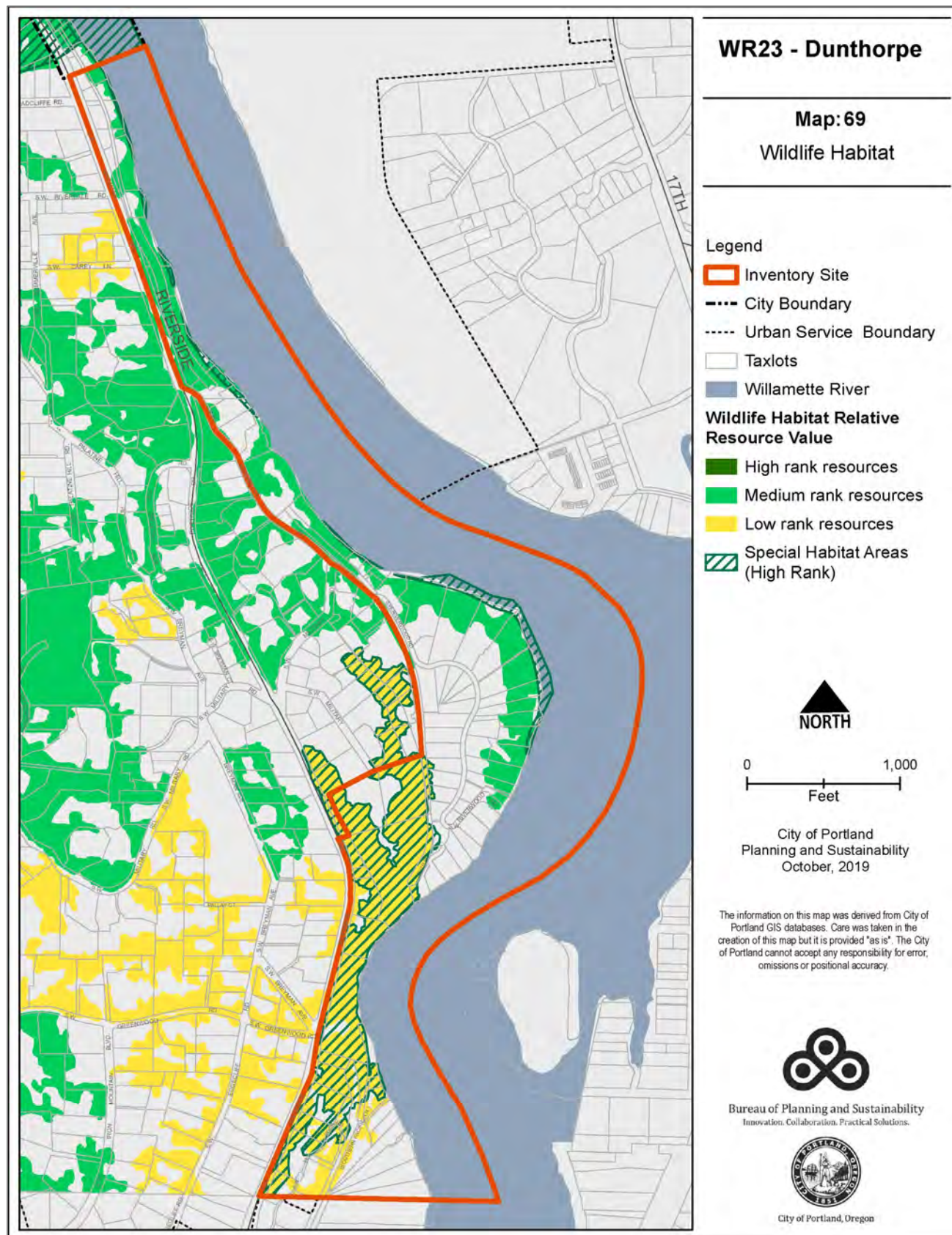
1. Provide the highest level of protection by strictly limiting conflicting uses within areas of high ranked resources.
2. Provide a moderate level of protection by limiting conflicting uses within medium ranked resources.
3. Allow conflicting uses within low ranked natural resource areas outside of the floodplain.

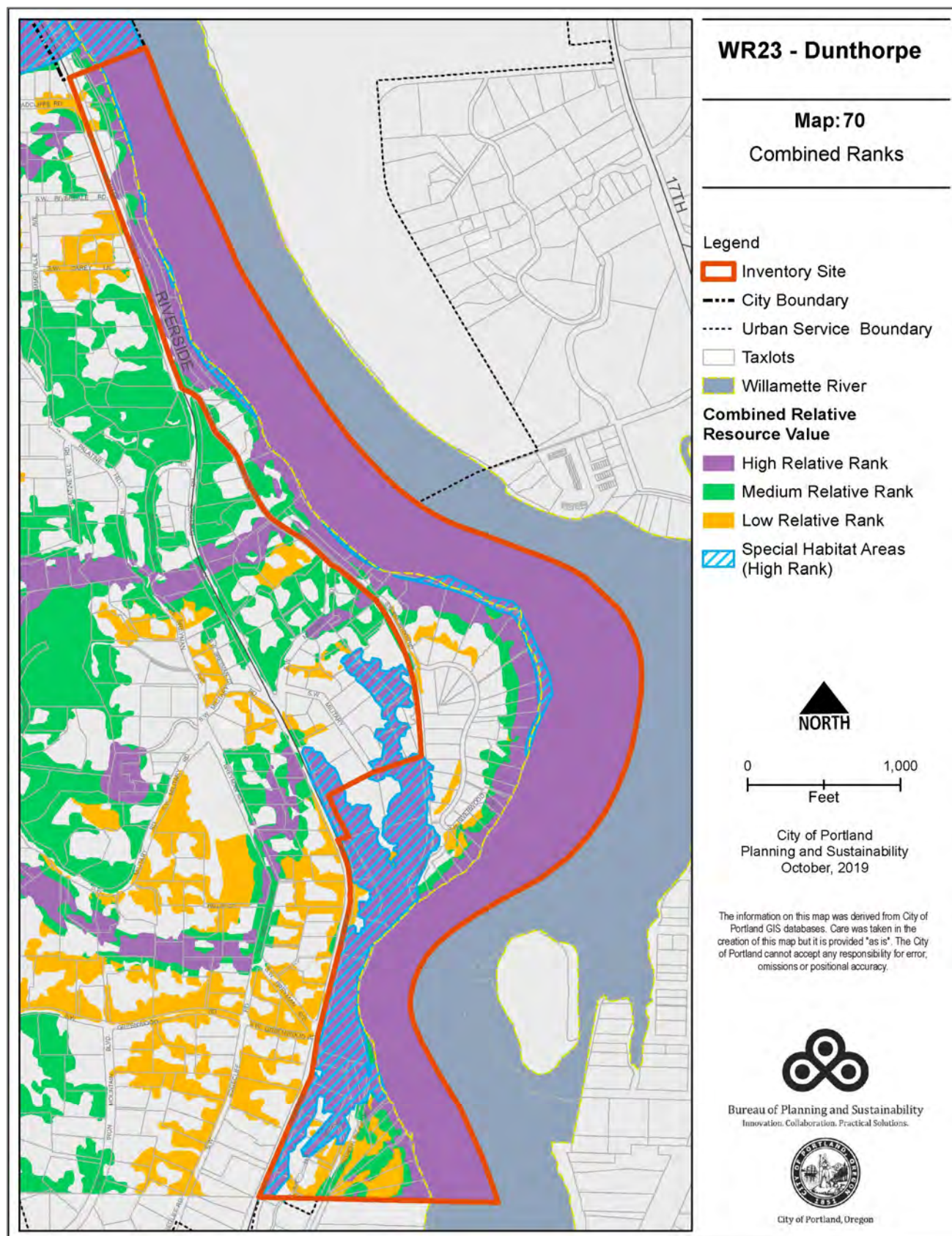


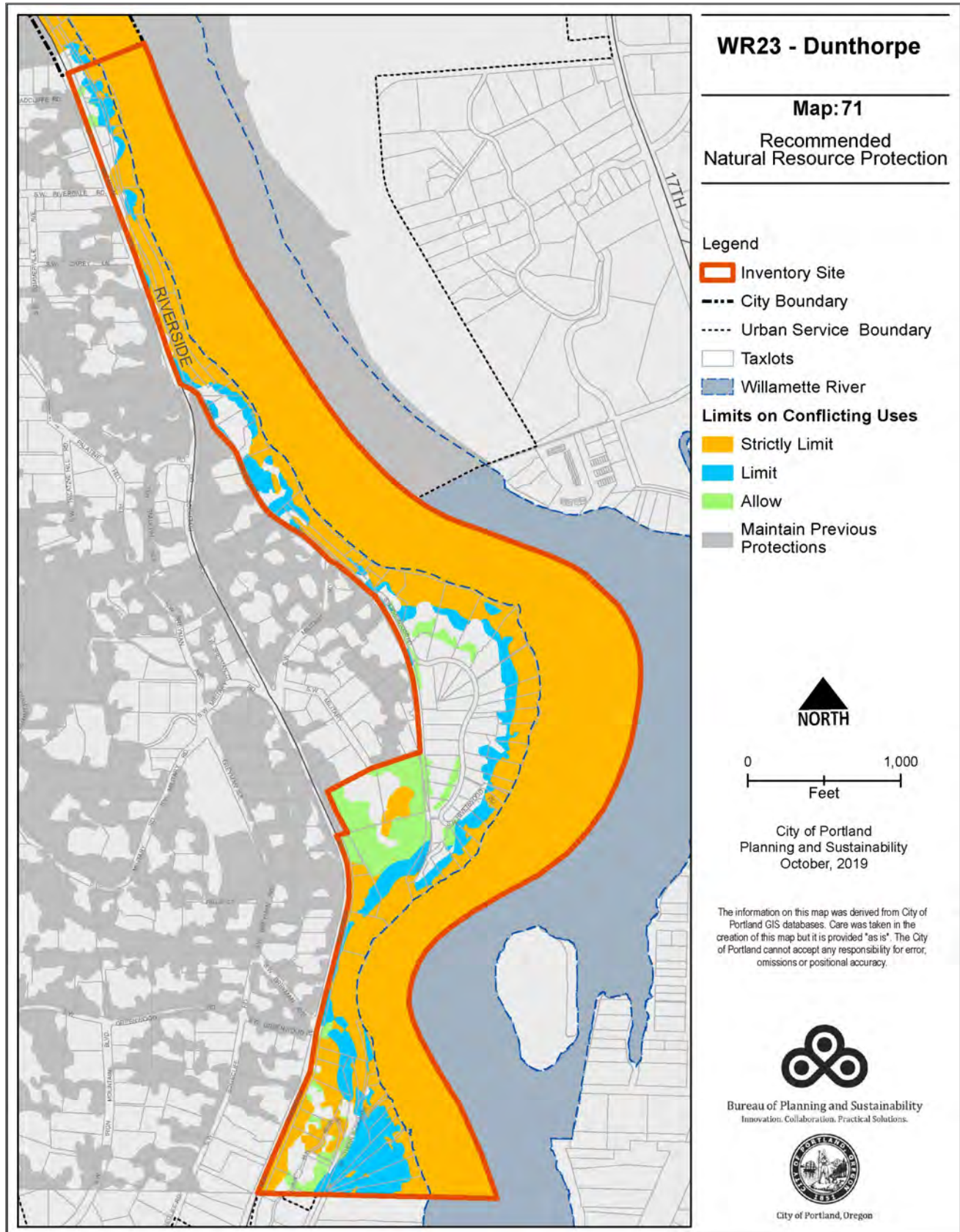












CHAPTER VI. IMPLEMENTATION TOOLS

The recommendations for each inventory site should be implemented through the updates to existing zoning code regulations and maps in the following ways:

1. Where there is a *strictly limit* or *limit* decision it is recommended that conflicting uses be restricted to a narrow set of environmentally appropriate development, such as natural resource enhancement, major public trails, and structures for river-dependent and river-related uses; as well as public utilities and infrastructure, such as bridges, and maintenance, repair and replacement of existing structures. The code should require negative impacts to natural resource features and functions be avoided and minimized to the maximum extent practicable; and unavoidable negative impacts should be fully mitigated. Mitigation for unavoidable impacts should result in no net loss of features or functions and account for:
 - location of the mitigation site in proximity to the impact site;
 - timing of the mitigation action(s) in relation to the timing of impacts;
 - lag-time to achieve desired future conditions and functions of the mitigation actions;
 - relationship between the mitigation site and adjacent habitats and land uses; and
 - monitoring needed to ensure the mitigation is successful.
2. The zoning code should provide exemptions or a non-discretionary review track for conflicting uses with minimal and definable impacts on natural resource feature and functions. For other conflicting uses with impacts that are not minimal and definable, a discretionary review track should be used. Under either a non-discretionary or discretionary review track, mitigation for unavoidable negative impacts to features and function should be required.

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APPENDICES

Appendix A. Portland Watershed Goals & Objectives

Appendix B. City of Portland *Natural Resource Inventory Update: Project Report*

Appendix C. SHA Criteria

Appendix D. Special Status Species List

Appendix E. Oaks Bottom Wildlife Refuge Bird List

APPENDIX A: Portland Watershed Management Plan, City-wide Goals and Objectives

(BUREAU OF ENVIRONMENTAL SERVICES, 2006)

Hydrology Goal: Move toward normative stream flow conditions to protect and improve watershed and stream health, channel functions, and public health and safety.

Objectives

Stream Flow and Hydrologic Complexity: Protect and increase rainfall interception areas, create infiltration and detention areas to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.

Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainageways, wetlands, riparian areas and floodplains to improve bank stability and natural hydrologic functions and reduce risk to development and human safety.

Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity.

Physical Habitat Goal: Protect, enhance, and restore aquatic and terrestrial habitat conditions and support key ecological functions and improved productivity, diversity, capacity, and distribution of native fish and wildlife populations and biological communities.

Objectives

Aquatic Habitat: Protect and improve aquatic, riparian, and floodplain habitat extent, quality, and connectivity that supports the persistence of native fish and wildlife communities.

Terrestrial Habitat: Protect and improve upland habitat extent, quality, and connectivity that support the persistence of native terrestrial communities and connectivity to aquatic and riparian habitat.

Water and Sediment Quality Goal: Protect and improve surface water and groundwater quality to protect public health and support native fish and wildlife populations and biological communities.

Objectives

Stream Temperature: Protect and improve stream temperatures, dissolved oxygen, and pH levels that protect ecological health and achieve applicable water quality standards.

Human Pathogens: Maintain and manage sewer infrastructure and stormwater inputs and runoff to limit sewage overflow and the delivery of pathogens to waterways and achieve applicable water quality and sewer design manual standards.

Urban Pollutants: Manage the sources and transport of urban stormwater and industrial pollutants and nutrients to limit surface water, groundwater, soil, and sediment contamination to levels that protect ecological and human health and achieve applicable water quality standards.

Biological Communities Goals: Protect, enhance, manage and restore native aquatic and terrestrial species and biological communities to improve and maintain biodiversity in Portland’s watersheds.

Objectives

Fish and Other Aquatic Organisms: Implement watershed actions to maximize the persistence of native Willamette and Columbia River fish and other aquatic organisms and assist with species recovery and potential population productivity by protecting and improving hydrology, habitat, and water quality.

Terrestrial Wildlife and Vegetation: Implement watershed actions to restore populations of terrestrial organisms to healthy, self-sustaining levels, protect and restore the composition and structure of native vegetation communities, and reduce populations of non-native plants and organisms to levels that do not compete with native species.

APPENDIX B: Natural Resources Inventory Project Report

The *Natural Resources Inventory Project Report* (June 2012) was adopted as factual basis for the Comprehensive Plan. The inventory presented in this document uses the methodology and data sets adopted in the report.

The *Natural Resources Inventory Project Report* is available

<http://www.portlandonline.com/portlandplan/?a=400492&>.

APPENDIX C: Special Habitat Area Criteria

CODE	CRITERIA
P	Area contains sensitive or unique plant populations
W	Wetlands and associated seeps, springs and streams that are part of the wetland complex
O	Native oak
B	Bottomland hardwood forest
I	Riverine island
D	River delta
M	Migratory stopover habitat
C	Corridor between patches or habitats
S	An <i>at risk</i> wildlife species uses the habitat area or feature on more than incidental basis to complete one or more life history stages
E	Elk migratory corridor
G	Upland habitat or landscape feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis
U	Resource or structure that provides critical or unique habitat function in natural or built environments (such as bridges or street trees)

P - Area contains sensitive or unique plant species

This criterion applies to areas containing the following plant species:

1. Those listed by USFWS or NOAA Fisheries as Endangered, Threatened, Proposed Endangered, or Proposed Threatened under the Endangered Species Act or by the ODA or ODFW under the
2. Oregon Endangered Species Act; OR
3. Species that receive an Oregon Natural Heritage rank 1, 2 or 3
 - 1 = Critically imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
 - 2 = Imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
 - 3 = Rare, uncommon or threatened, but not immediately imperiled

Not included are plant populations that are listed by USFWS/NOAA or ODA/ODFW as Candidate Taxa or Species of Concern, unless the plant population received an Oregon Natural Heritage rank of 1-3 or is a wetland indicator species. Also not included are those plant populations that received an Oregon Natural Heritage rank of 4 = not rare and apparently secure, but with cause for long-term concern, or 5 = demonstrably widespread and secure.

W – Wetlands and associated seeps, springs and streams that are part of a wetland complex

This criterion applies to selected wetlands, and associated seeps, springs and streams that provide critical watershed functions (i.e., water quality, hydrology, wildlife habitat, etc.) and are increasingly rare within Portland. SHAs include primarily those wetlands that:

1. Are connected to a stream or flood area;

2. Are part of a larger resource area, such as a wetland located within or adjacent to a forest; or
3. Provide connectivity between other high value habitats.

This criterion may incorporate constructed wetlands where the purpose of the wetland includes providing fish and wildlife habitat. Upland wetlands that are very small and are surrounded by development or intense land uses, such as golf courses, and certain water quality facilities are generally not designated as SHAs.

O – Native oak

The native oak criterion applies to areas that contain Oregon white oaks. Other tree species and vegetation, including invasive plants such as Himalayan blackberries, may be present.

B – Bottomland hardwood forest

This criterion applies to selected areas that contain remnant bottomland hardwood. Not all bottomland hardwood forests in the city are designated as a SHA. To be designated, an area must be considered unique, rare or declining within a particular watershed.

I – Riverine island

This criterion applies to islands or the portions of riverine islands that provide habitat for shorebirds, waterfowl, terns, gulls, Bald Eagles, river otter and other river/island-associated resident and/or migrating wildlife species. Beaches, mudflats, shoals and areas of large wood deposits are included along with other relevant resource features.

D – River delta

This criterion applies to river deltas that provide habitat for shorebirds, waterfowl, terns and gulls, Bald Eagles or other wildlife. The area shall contain beaches, mudflats and/or large wood deposits.

M – Migratory stopover habitat

This criterion is applied to vegetated areas and other landscape features (e.g., buttes) where use by migratory bird species has been documented, or is reasonably expected to occur, on more than an incidental basis. The criterion applies to areas that:

1. Provide nesting opportunities;
2. Provide food and resting opportunities;
3. Provide sufficient cover to reduce predation; and
4. Support a diverse assemblage or high concentration of migratory species

On more than an incidental basis means the identified species is documented to repeatedly or periodically use the habitat or feature.

Reasonably expected to occur generally applies to resource features that typically provide the functions listed above (e.g., buttes, ridge-topos/high elevation features, wetlands, mudflats, riparian areas or focal sites) and

where local or regional technical experts state such uses by migratory birds is expected based on existing information or observations.

C – Corridor between patches or habitats

This criterion applies to vegetated areas that:

1. Provide connectivity between high value habitats including other Special Habitat Areas;
2. Provide connectivity between water bodies, riparian areas and upland habitats; or
3. Extend outward from another SHA to provide a wildlife movement corridor.

S – An *at risk* wildlife species uses the habitat area or feature on more than incidental basis to complete one or more life history stages

This criterion applies to areas with documented use by the following wildlife species (see Appendix 2: Special Status Fish and Wildlife Species in Portland):

1. Species listed by USFWS or NOAA Fisheries as:

LE - Listed Endangered
 LT - Listed Threatened
 PE - Proposed Endangered
 PT - Proposed Threatened
 SoC - Species of Concern
 C - Candidate

Includes areas designated as Critical Habitats by NOAA Fisheries

2. Species Listed by Oregon Department of Agriculture (ODA) or ODFW as:

LE - Listed Endangered
 LT - Listed Threatened
 SC - Critical
 SV - Vulnerable

3. Species that received an Oregon Natural Heritage rank or list 1, 2 or 3.

1 = Critically imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
 2 = Imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
 3 = Rare, uncommon or threatened, but not immediately imperiled;

Life cycle phases include but are not limited to:

- courtship, nesting, breeding
- rearing young, juvenile development (e.g. noise, light)
- feeding, foraging, hunting
- resting, basking, perching
- cover/protection from predators or disturbances
- dispersal, migration, migratory stopover
- over-wintering

This criterion may apply to individuals that make up a local population, pairs, colonies or a regional population.

On more than an incidental basis means the identified species is documented to repeatedly or periodically use the habitat or feature.

E – Elk migratory corridor

This criterion is applied to areas that ODFW has designated as elk migratory corridors.

G – Upland habitat or landscape feature important to individual grassland-associated species or assemblages of grassland-associated species on more than an incidental basis

This criterion is applied to areas that contain vegetative structure, topography or soil substrates that provide functions similar to a native meadow, prairie or grassland and where use by grassland-associated wildlife species has been documented. This criterion is also applied to areas that:

1. Are part of a larger resource area, such as a grassy area located adjacent to a forest;
2. Provide connectivity between other high value habitats; or
3. Extend outward from an SHA to provide a wildlife movement corridor.

For the purposes of the G criterion, grassland-associated species include:

- | | |
|-------------------------|------------------------|
| • Deer Mouse | • White-tailed Kite |
| • Gray-tailed Vole | • Short-eared Owl |
| • Camas Pocket Gopher | • Streaked Horned Lark |
| • Red Fox | • Northern Harrier |
| • Oregon Vesper Sparrow | • American Kestrel |
| • Savannah Sparrow | • Common Nighthawk |
| • Western Meadowlark | • Chipping Sparrow |

On more than an incidental basis means the identified species is documented to repeatedly or periodically use the habitat or feature.

U – Resource or structure that provides critical or unique habitat function in natural or built environments

This criterion applies to resources or structures that are generally not accounted for by other criteria, and that provide a documented critical or unique habitat function. Examples include: bridges, chimneys, rock outcrops, groundwater upwelling areas, and street trees.

Note: Special Habitat Areas have been designated based on documented information about specific sites or areas. In addition, some of the SHAs reflect specific watershed conditions.

APPENDIX D: Special Status Fish and Wildlife Species

	Common Name	Scientific Name	Federal Status	ODFW Status	ODFW StratSp	ORNHIC Rank	ORNHIC List	NWPCC Subbasin	PIF FocalSp	OWEB Priority	ABC/Audubon Watchlist	SHA At Risk Species
Amphibian	Clouded Salamander	Aneides ferreus		SV		G3/S3	3					X
	Northern Red-legged Frog	Rana aurora aurora	SoC	SV	X	G4T4/S3	2	X		X		X
Reptiles	Northwestern Pond Turtle	Actinemys marmorata	SoC	SC	X	G3T3/S2	1	X		X		X
	Western Painted Turtle	Chrysemys picta bellii		SC	X	G5/S2	2			X		X
Birds	American Bittern	Botaurus lentiginosus								X		
	American Kestrel	Falco sparverius						X	X	X		
	American White Pelican	Pelecanus erythrorhynchos		SV	X	G3/S2B	2					X
	Bald Eagle	Haliaeetus leucocephalus	Delisted	LT		G4/S3B, S4N	2	X				X
	Band-tailed Pigeon	Columba fasciata	SoC			G5/S4	4		X	X		X
	Black-throated Gray Warbler	Dendroica nigrescens							X			
	Brown Creeper	Certhia americana							X			
	Bufflehead	Bucephala albeola				G5/S2B,S5N	4					X
	Bullock's Oriole	Icterus bullockii							X	X		
	Bushtit	Psaltiriparus minimus							X			
	Chipping Sparrow	Spizella passerina			X			X	X			
	Common Nighthawk	Chordeiles minor		SC	X	G5/S5	4					X
	Common Yellowthroat	Geothlypis trichas						X				
	Downy Woodpecker	Picoides pubescens							X			
	Dunlin	Calidris alpina						X		X		

	Common Name	Scientific Name	Federal Status	ODFW Status	ODFW StratSp	ORNHIC Rank	ORNHIC List	NWPCC Subbasin	PIF FocalSp	OWEB Priority	ABC/Audubon Watchlist	SHA At Risk Species
	Great Blue Heron	Ardea herodias								X		
	Green Heron	Butorides virescens						X				
	Hammond's Flycatcher	Empidonax hammondii							X			
	Hermit Warbler	Dendroica occidentalis							X		Yellow List	
	Hooded Merganser	Lophodytes cucullatus								X		
	House Wren	Troglodytes aedon							X			
	Hutton's Vireo	Vireo huttoni							X			
	Loggerhead Shrike	Lanius ludovicianus		SV	X	G4/S3B, S2N	4					X
	Long-billed Curlew	Numenius americanus		SV	X	G5/S3B	4				Yellow List	X
	Merlin	Falco columbarius				G5/S1B	2					X
	Nashville Warbler	Vermivora ruficapilla							X			
	Northern Harrier	Circus cyaneus						X	X			
	Olive-sided Flycatcher	Contopus cooperi	SoC	SV		G5/S4	4	X	X	X	Yellow List	X
	Orange-crowned Warbler	Vermivora celata							X			
	Pacific-slope Flycatcher	Empidonax difcilus							X	X		
	Peregrine Falcon	Falco peregrinus	Delisted	SV		G4/T3/S1B	2					X
	Pileated Woodpecker	Dryocopus pileatus		SV		G5/S4	4	X	X			X
	Purple Finch	Carpodacus purpureus								X		
	Purple Martin	Progne subis	SoC	SC	X	G5/S3B	2	X	X	X		X
	Red Crossbill	Loxia curvirostra							X			
	Red-eyed Vireo	Vireo olivaceus						X	X			
	Red-necked Grebe	Podiceps grisegena		SC	X	G5/S1B,S4N	2					X
	Rufous Hummingbird	Selasphorus rufus							X			
	Short-eared Owl	Asio flammeus			X				X	X	Yellow List	
	Sora	Porzana carolina						X				

	Common Name	Scientific Name	Federal Status	ODFW Status	ODFW StratSp	ORNHIC Rank	ORNHIC List	NWPCC Subbasin	PIF FocalSp	OWEB Priority	ABC/Audubon Watchlist	SHA At Risk Species
	Streaked Horned Lark	Eremophila alpestris strigata	C	SC	X	G5/T2/S2B	1	X	X	X		X
	Swainson's Hawk	Buteo swainsoni		SV	X	G5/S3B	4				Yellow List	X
	Swainson's Thrush	Catharus ustulatus							X			
	Thayer's Gull	Larus thayeri									Yellow List	
	Varied Thrush	Ixoreus naevius							X		Yellow List	
	Vaux's Swift	Chaetura vauxi						X	X			
	Vesper Sparrow (Oregon)	Poocetes gramineus	SoC	SC	X	G5/T3/S2B, S2N	2	X	X	X		X
	Western Meadowlark	Sturnella neglecta		SC WV	X	G5/S5	4	X	X	X		X
	Western Sandpiper	Calidris mauri									Yellow List	
	Western Wood-Pewee	Contopus sordidulus						X	X			
	White-breasted Nuthatch (Slender-billed)	Sitta carolinensis aculeata		SV	X			X	X	X		X
	White-tailed Kite	Elanus leucurus				G5/S1B, S3N	2					X
	Willow Flycatcher (Little)	Empidonax traillii brewsteri		SV	X	G5TU/S1B	4	X	X	X	Yellow List	X
	Wilson's Warbler	Wilsonia pusilla							X			
	Winter Wren	Troglodytes troglodytes							X			
	Wood Duck	Aix sponsa						X				
	Yellow Warbler	Dendroica petechia						X	X	X		
	Yellow-breasted Chat	Icteria virens	SoC	SC WV	X	G5/S4?	4		X			X
Mammals	American Beaver	Castor canadensis						X				
	California Myotis	Myotis californicus		SV		G5/S3	4					X
	Camas Pocket Gopher	Thomomys bulbivorus	SoC			G3G4/S3S4	3					X
	Fringed Myotis	Myotis thysanodes	SoC	SV		G4G5/S2	2					X

	Common Name	Scientific Name	Federal Status	ODFW Status	ODFW StratSp	ORNHIC Rank	ORNHIC List	NWPCC Subbasin	PIF FocalSp	OWEB Priority	ABC/Audubon Watchlist	SHA At Risk Species
	Hoary Bat	Lasiurus cinereus		SV		G5/S3	4					X
	Long-eared Myotis	Myotis evotis	SoC			G5/S3	4					X
	Long-legged Myotis	Myotis volans	SoC	SV		G5/S3	4					X
	Northern River Otter	Lontra canadensis						X				
	Red Tree Vole	Arborimus = Phenacomys longicaudus	SoC	SV		G3G4/S3S4	3	X				X
	Silver-haired Bat	Lasionycteris noctivagans	SoC	SV	X	G5/S3S4	4					X
	Townsend's Big-eared Bat	Corynorhinus townsendii townsendii	SoC	SC	X	G4/T3T4/S2	2	X				X
	Western Gray Squirrel	Sciurus griseus		SV	X	G5/S4	3	X				X
	White-footed Vole	Arborimus = Phenacomys albipes	SoC			G3G4/S3	4					X
	Yuma Myotis	Myotis yumanensis	SoC			G5/S3	4					X
Fish	Chinook Salmon	Oncorhynchus tshawytscha	LT, LE	LT		G5T2Q/S2	1			X		X
	Chum Salmon	Oncorhynchus keta	LT	SC		G5T2Q/S2	1			X		X
	Coho Salmon	Oncorhynchus kisutch	LT	LE		G4T2Q/S2	1			X		X
	Chum Salmon	Oncorhynchus keta	LT							X		
	Sockeye Salmon	Oncorhynchus nerka	LT, LE							X		
	Steelhead Trout	Oncorhynchus mykiss	LT	SC		G5T2Q/S2	1			X		X
	Coastal Cutthroat Trout	Oncorhynchus clarki clarki	PT	SC		G4T2Q/S2	2					X
	Columbia Eulachon	Thaleichthys pacificus	LT									
	Pacific Lamprey	Lampetra tridentata	SoC	SV		G5/S3	2			X		X
	River Lamprey	Lampetra ayresi	SoC			G4/S4	4			X		X
	Oregon Chub	Oregonichthys crameri	LT	SC						X		

Footnotes:

LE Listed Endangered

Species listed by the by the USFWS, NMFS, ODFW or ODA as Endangered

LT Listed Threatened

Species listed by the USFWS, NMFS, ODFW or ODA as Threatened

PE	Proposed Endangered	Species proposed by the USFWS or NMFS to be listed as Endangered under the ESA
PT	Proposed Threatened	Species proposed by the USFWS or NMFS to be listed as Threatened under the ESA
SoC	Species of Concern	Former C2 candidates which need additional information in order to propose as Threatened or Endangered under the ESA. These are species which USFWS is reviewing for consideration as Candidates for listing under the ESA.
C	Candidate	Species for which NMFS or USFWS have sufficient information to support a proposal to list under the ESA
SC	Critical	Species for which listing by ODFW or ODA as threatened or endangered is pending; or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species that are at risk throughout their range, and some disjunct populations.
SV	Vulnerable	Species for which listing by ODFW or ODA as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable, and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations over time.
ODFW StratSp		Identified as a 'Strategy Species' in the ODFW Comprehensive Wildlife Conservation Strategy for Oregon (2005) for the Willamette Valley Ecoregion. Strategy species are those closely associated with 'Strategy Habitats' or are declining for a variety of reasons.
ORNHIC Rank		1 Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.
ORNHIC Rank		2 Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.
ORNHIC Rank		3 Rare, uncommon or threatened, but not immediately imperiled, typically with 21-100 occurrences.
ORNHIC Rank		4 Long-term Concern Not rare and apparently secure, but with cause for long-term concern, usually more than 100 occurrences.
ORNHIC Rank		5 Secure Demonstrably widespread, abundant, and secure
ORNHIC Rank		H Historical Occurrence, formerly part of the native biota with the implied expectation that it may be rediscovered.
ORNHIC Rank		T The taxon has a trinomial (a subspecies, variety or recognized race)
ORNHIC Rank		U Unknown rank.
ORNHIC Rank		NR Not yet ranked
ORNHIC Rank		G Global rank system was developed by The Nature Conservancy and is maintained by The Association for Biodiversity Information (ABI) in cooperation with Heritage Programs or Conservation Data Centers (CDCs) in all 50 states, in 4 Canadian provinces, and in 13 Latin American countries.
ORNHIC Rank		S State rank system was developed by The Nature Conservancy and is maintained by The Association for Biodiversity Information (ABI) in cooperation with Heritage Programs or Conservation Data Centers (CDCs) in all 50 states, in 4 Canadian provinces, and in 13 Latin American countries.
ORNHIC Rank		Q Indicates the taxon has taxonomic questions
ORNHIC Rank		? Assigned rank is uncertain.
ORNHIC Rank		X Presumed extirpated or extinct.
ORNHIC List 1		Contains species that are threatened with extinction or presumed to be extinct throughout their entire range.
ORNHIC List 2		Contains species that are threatened with extirpation or presumed to be extirpated from the state of Oregon. These are often peripheral or disjunct species which are of concern when considering species diversity within Oregon's borders. They can be very significant when protecting the genetic diversity of a taxon. ORNHIC regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.
ORNHIC List 3		Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.



ORNHIC List 4

Contains species that are of conservation concern but are not currently threatened or endangered. This includes species which are very rare but are currently secure, as well as species which are declining in numbers or habitat but are still too common to be proposed as threatened or endangered. While these species currently may not need the same active management attention as threatened or endangered species, they do require continued monitoring.

APPENDIX E: Oaks Bottom Bird List

Species	s	S	F	W
<u>Flycatchers (continued)</u>				
*Willow Flycatcher	u	u	u	
Hammond's Flycatcher	u		o	
Dusky Flycatcher	x			
Pacific-slope Flycatcher	u		o	
Say's Phoebe	r			
Ash-throated Flycatcher			x	
Western Kingbird	x	x		
Eastern Kingbird		x		
<u>Shrikes to Vireos</u>				
Northern Shrike				x
Cassin's Vireo	o		r	
*Hutton's Vireo	u	u	u	u
Warbling Vireo	u	o	u	
<u>Corvids</u>				
*Steller's Jay	u	u	u	u
*Western Scrub-Jay	c	c	c	c
Common Raven		x		
*American Crow	c	c	c	c
<u>Swallows</u>				
*Purple Martin	f	f	f	
Tree Swallow	u	o	u	r
*Violet-green Swallow	c	f	c	
Northern Rough-winged Swallow	u	o	u	
Cliff Swallow	u	o	u	
*Barn Swallow	c	c	c	x
<u>Chickadees to Bushtits</u>				
*Black-capped Chickadee	c	c	c	c
Chestnut-backed Chickadee	u	u	u	u
*Bushtit	c	c	c	c
<u>Nuthatches to Creepers</u>				
Red-breasted Nuthatch	u	u	u	u
White-breasted Nuthatch	f	u	f	f
*Brown Creeper	f	f	f	f
<u>Wrens to Kinglets</u>				
*Bewick's Wren	c	c	c	c
House Wren	r		r	
Winter Wren	f		f	f
Marsh Wren	o	o	o	
Rock Wren	x			
Golden-crowned Kinglet	f		f	f
Ruby-crowned Kinglet	c		c	c
<u>Thrushes</u>				
Townsend's Solitaire	x			x
Swainson's Thrush	u	o	u	
Hermit Thrush	u		u	u
*American Robin	c	c	c	c
Varied Thrush	u		u	u
<u>Starling</u>				
*European Starling	c	c	c	c

Species	s	S	F	W
<u>Pipits to Waxwings</u>				
American Pipit	o		o	
*Cedar Waxwing	f	f	f	f
<u>Wood Warblers</u>				
Orange-crowned Warbler	f	o	f	x
Nashville Warbler	o		r	
Yellow Warbler	u	r	u	
Yellow-rumped Warbler	c	u	c	f
Black-throated Gray Warbler	f	o	u	x
Townsend's Warbler	u		u	u
Blackpoll Warbler	x			
MacGillivray's Warbler	r			
*Common Yellowthroat	f	f	f	r
Wilson's Warbler	u	o	u	x
Yellow-breasted Chat	x			
<u>Tanagers</u>				
Western Tanagers	u		u	
<u>Sparrows</u>				
*Spotted Towhee	c	c	c	f
Brewer's Sparrow		x		
Savannah Sparrow	r	r	r	
Fox Sparrow	f		f	f
*Song Sparrow	c	c	c	c
Lincoln's Sparrow	o		o	o
Swamp Sparrow	x			x
White-throated Sparrow	o		o	o
White-crowned Sparrow	u	o	u	o
Golden-crowned Sparrow	c		c	f
*Dark-eyed Junco	c	u	c	c
<u>Grosbeaks to Buntings</u>				
*Black-headed Grosbeak	f	u	u	
Blue Grosbeak	x			
Lazuli Bunting		x		
<u>Icterids</u>				
Western Meadowlark	x		x	x
Brown-headed Cowbird	o	o	o	
*Red-winged Blackbird	c	c	c	f
Brewer's Blackbird	o	o	o	o
Bullock's Oriole	r			
<u>Finches</u>				
Purple Finch	o	o		o
*House Finch	c	c	c	c
Red Crossbill	o	r	o	o
Common Redpoll	x		x	x
Pine Siskin	u	r	u	u
*Lesser Goldfinch	c	c	c	c
*American Goldfinch	c	c	c	c
Evening Grosbeak	u		o	o
<u>Old World Sparrows</u>				
House Sparrow	u	u	u	u

Oaks Bottom Bird List



Portland, OR

Illustrated and compiled by
Christopher Hinkle
January 2010

Key:**s=spring** – usually March through May**S=summer** – usually June to mid-August**F=fall** – usually mid-August to November**W=winter** – usually November through February**=**Nesting confirmed or very likely**c=common**; almost always present in proper habitat**f=fairly common**; often seen**u=uncommon**; sometimes seen**o=occasional**; only a handful of records each year**r=rare**; rarely occurs and usually not every year**x=extremely rare**; fewer than five records

Despite its urban surrounding in SE Portland, 160-acre Oaks Bottom is a true birding hotspot, with over 185 species recorded. This list covers Oaks Bottom Wildlife Refuge and the adjacent section of Willamette River, encompassing various habitats including a large shallow central lake, mixed maple and oak woodlands, riparian cottonwood, ash and willow forests, patches of shrubs, small fields and clearings, and open waters of the Willamette River. The Springwater Corridor multi-use trail passes through the refuge paralleling the river and offers views of the lake from its west shore. A one-mile trail loops around the east side of the lake. Short side trails lead up the bluff to Sellwood Park to the south, and the refuge parking lot to the north. The refuge is also accessible from Oaks Amusement Park.

Species	s	S	F	W
<u>Waterfowl</u>				
Greater White-fronted Goose	o		o	
*Canada Goose	c	c	c	c
Cackling Goose	u		o	u
Trumpeter Swan			x	
Tundra Swan	r		r	r
*Wood Duck	f	f	f	f
Eurasian Wigeon	o		o	o
American Wigeon	f		f	f
Gadwall	c		c	c
*Mallard	c	c	c	c
Blue-winged Teal	r	r	r	x
Cinnamon Teal	o	o	o	
Green-winged Teal	c		c	c
Northern Shoveler	c		c	c
Northern Pintail	c		c	c
Canvasback	o		o	o
Redhead	x		x	x
Ring-necked Duck	c		c	c
Greater Scaup	x		x	x
Lesser Scaup	f		f	f

Species	s	S	F	W
<u>Waterfowl (continued)</u>				
Surf Scoter			x	x
Bufflehead	c		c	c
Common Goldeneye	o		o	o
Hooded Merganser	u	u	u	u
Common Merganser	f	f	f	f
Ruddy Duck	o		o	o
<u>Pheasant & Quail</u>				
Ring-necked Pheasant	r	r	r	r
California Quail	r	r	r	r
<u>Grebes</u>				
*Pied-billed Grebe	f	f	f	f
Horned Grebe	r		r	r
Red-necked Grebe			x	x
Eared Grebe			x	
Western Grebe	r	x	r	r
<u>Pelicans to Cormorants</u>				
American White Pelican	x	x	x	
Brown Pelican				x
Double-crested Cormorant	c	f	c	c
<u>Egrets & Herons</u>				
Great Blue Heron	c	c	c	c
Great Egret	r		o	r
Snowy Egret			x	
Green Heron	u	u	u	o
Black-crowned Night-Heron		x		
<u>Vultures</u>				
Turkey Vulture	f	f	f	
<u>Osprey, Hawks & Falcons</u>				
*Osprey	c	c	c	
Bald Eagle	u	u	u	u
Northern Goshawk	x			
Sharp-shinned Hawk	u	u	u	u
*Cooper's Hawk	u	u	u	u
Red-shouldered Hawk	x		x	x
Red-tailed Hawk	f	f	f	f
Northern Harrier	x	x	x	x
American Kestrel	o	o	o	o
Merlin	o		o	o
Peregrine Falcon	u	u	u	u
<u>Rails to Cranes</u>				
Sora	x			
Virginia Rail	o		o	
American Coot	c	c	c	c
Sandhill Crane	r		r	
<u>Shorebirds</u>				
Semipalmated Plover			o	
*Killdeer	f	f	f	u
Greater Yellowlegs	o	r	u	
Lesser Yellowlegs			r	

Species	s	S	F	W
<u>Shorebirds (Continued)</u>				
Solitary Sandpiper	x			
*Spotted Sandpiper	u	u	u	u
Marbled Godwit			x	
Western Sandpiper	o	r	u	
Least Sandpiper	o	o	u	
Baird's Sandpiper			x	
Pectoral Sandpiper			x	
Dunlin	r		r	r
Short-billed Dowitcher			x	
Long-billed Dowitcher	o	r	u	
Wilson's Snipe	o		o	
Wilson's Phalarope			x	
Red-necked Phalarope			x	
<u>Gulls & Terns</u>				
Bonaparte's Gull			x	
Mew Gull	u		u	u
Ring-billed Gull	f	o	f	f
California Gull	c	u	c	c
Herring Gull	u		u	u
Thayer's Gull	u		u	u
Glaucous Gull			x	x
Glaucous-winged Gull	c	u	c	c
Western Gull	u		u	u
Caspian Tern			r	
Black Tern	x			
<u>Pigeons & Doves</u>				
Rock Pigeon	f	f	f	f
Band-tailed Pigeon	o	o	o	r
Eurasian Collared-Dove	x	x	x	
Mourning Dove	o	o	o	o
<u>Owls</u>				
*Western Screech-Owl	u	u	u	u
*Great Horned Owl	r	r	r	r
Barred Owl			x	
<u>Swifts to Hummingbirds</u>				
Vaux's Swift	c	c	c	
*Anna's Hummingbird	c	c	c	c
*Rufous Hummingbird	f	u	u	
<u>Kingfisher</u>				
*Belted Kingfisher	f	f	f	f
<u>Woodpeckers</u>				
*Red-breasted Sapsucker	u	u	u	u
*Downy Woodpecker	c	c	c	c
Hairy Woodpecker	o	o	o	o
Pileated Woodpecker	o	o	o	o
*Northern Flicker	c	c	c	c
<u>Flycatchers</u>				
Olive-sided Flycatcher	o		o	
*Western Wood-Pewee	u	u	u	