Hayden Island Natural Resources Inventory

February 2012

APPENDIX K: Natural Resources Inventory Project Report

NATURAL RESOURCE INVENTORY UPDATE

RIPARIAN CORRIDORS AND WILDLIFE HABITAT | CITY OF PORTLAND, OREGON

PROJECT REPORT
RECOMMENDED DRAFT, JUNE 2012

Bureau of Planning and Sustainability
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7. APPENDICES

MAPS

TABLES

1. INTRODUCTION

The City of Portland Bureau of Planning has recently produced extensive updated inventory information for riparian areas and wildlife habitat resources in the city.

The Natural Resource Inventory Update supports Portland's long-standing investment in conserving natural resources to enhance neighborhood livability, protect public health and safety, and sustain fish and wildlife habitat. This inventory update also helps implement the City's River Renaissance Strategy and the Portland Watershed Management Plan by informing the following activities:

- Development of citywide and area- or topic-specific plans (e.g., the River Plan, Terrestrial Ecology Enhancement Strategy)
- Updates to existing regulatory programs (e.g., Willamette Greenway Program and environmental overlay zones)
- Preparation of strategies to comply with regional, state and federal regulatory requirements (e.g., riparian area and wildlife habitat protections required by Title 13 of Metro's Urban Growth Management Functional Plan)
- Prioritization of restoration and willing-seller land acquisition actions
- Public education and outreach

INVENTORY PRODUCTS INCLUDE

1. Updated natural resource feature information, GIS data and maps
2. Updated special-status animal and plant species
3. Lists and maps of Special Habitat Areas (SHAs)
4. Criteria and models to evaluate the relative function and quality of the resources using Geographic Information Systems (GIS) technology
5. Relative ranking maps for riparian areas, wildlife habitat, and combined resources
6. Documentation of the project approach

Metro's 2005 inventory of regionally significant riparian corridors and wildlife habitat provided the technical basis and starting point for Portland's inventory update project. By starting with Metro's inventory, the Bureau of Planning has been able to incorporate and build on the extensive research, technical analysis, and public review that shaped the regional inventory.

Working with the Bureau of Environmental Services, the Bureau of Parks and Recreation, and Metro, the Bureau of Planning has also refined the regional inventory to increase the level of detail and accuracy, incorporate new information, and better reflect Portland-specific conditions. The refinements were also reviewed by a group of technical experts to ensure that any changes would be scientifically acceptable and generally consistent with the regional approach.

This report documents the approach and methodologies used to develop the new riparian corridor and wildlife habitat inventory for Portland. It provides the context for the inventory update, followed by a detailed description of the project methodology. Summary statistics and maps are presented for the city as a whole, and by watershed and inventory planning area.

The following points are important to remember:

- The inventory is designed to support many activities identified in the City's adopted River Renaissance Strategy and Portland Watershed Management Plan.
- The inventory is "information only" and does not propose programs or regulations.
- The City inventory was not produced "from scratch." It incorporates and builds on the well-vetted science and approach Metro developed to produce a comprehensive riparian corridor and wildlife habitat inventory for the region.
- The City inventory reflects the realities of the urban landscape, and includes:
  - Both "natural" and "constructed" features
  - Resources that range in condition from relatively good to highly degraded.
- The inventory information does not automatically update existing inventories. Although the new information is already being put to good use, implementation of the City's environmental and Willamette Greenway overlay zoning programs will continue to use 6 to 20 year old inventories until they are updated via a legislative project such as the River Plan.
- The inventory must evolve to reflect new information, changing conditions, and emerging technologies. New mapping tools provide not only higher quality products, but the ability to update over time.

2. PROJECT CONTEXT

2A. PORTLAND'S NATURAL RESOURCES

> ***"... The happy citizen of this place will be the one with access to the wild in the city — in the marshes, the stream margins, the forests, and the self ...." Kim Stafford (Cody, M.J., 2002)***

Portland would not be here today were it not for an historic abundance of natural resources. Long before Portland was established in 1851, native peoples lived for thousands of years on salmon and game that were abundant in the Willamette Valley and lower Columbia River basin. When immigrants came to the United States from Europe and Asia, many traveled westward via the Oregon Trail and settled in the Willamette Valley. Surrounded by waterways, forests, woodlands and prairies, fish and fur-bearing animals, and fertile soils, these settlers could build their homes, feed their children, and establish businesses and transport their wares.

Today, approximately 562,700 people reside within the 130 square mile area that is the City of Portland. The Portland metropolitan region is home to roughly 2.12 million people (Population Research Center, PSU, 2007). Portland metropolitan regional population is expected to grow by another estimated 832,200 people by the year 2025 (Metro 2000-2030 Regional Forecast, Metro 2002). This growth can be attributed in part to Portland's reputation as a beautiful, livable, and "green city," with easy access to nature and many outdoor recreational opportunities. Although many parts of the city are developed, a wealth of streams, wetlands, forests and other types of natural open spaces remain and support a wide variety of fish and wildlife species. Important natural resources are interwoven throughout major parts of the city, including public parks and natural areas, many residential neighborhoods, golf courses, cemeteries and college campuses, and industrial areas along the Willamette River and in the Columbia Corridor.

These resources provide important ecosystem services that can protect public health, safety and property, and reduce local infrastructure costs. For example, although the city has developed an elaborate stormwater pipe system, local rivers, streams, wetlands and floodplains still provide critical water storage and conveyance capacity throughout Portland's watersheds. Trees, shrubs and groundcover help reduce the impacts of stormwater runoff by intercepting precipitation and filtering out pollutants. Vegetation also helps prevent erosion and landslides by stabilizing streambanks and steep slopes. Trees and vegetation help maintain healthful air quality and reduce energy demand and discharge of greenhouse gases, particularly carbon dioxide which contributes to global warming.

Tree canopy over impervious surfaces reduces ground level air temperatures and associated ozone formation that exacerbates respiratory problems such as asthma. Trees can keep buildings cooler in summer and warmer in winter which reduces demand for heating and air conditioning. Tree shading helps keep the water in local streams cool enough to support native fish.

Portland's watersheds support numerous native fish and wildlife species. The city is part of the regional ecologies of the Lower Willamette River Basin and Columbia River Estuary. Portland's river and streams are used by native salmonids such as steelhead trout, fall and spring Chinook and Lower Columbia River Coho, which are listed as "threatened" under the federal Endangered Species Act (ESA). Resident cutthroat trout, lamprey and other native fish species also live in many Portland streams.

Portland is also home to many native amphibian, reptile, mammal and bird species, some of which have been deemed at risk status by state and federal agencies, and/or other organizations such as the Oregon Natural Heritage Information Center or Partners in Flight. Portland is also located along the Pacific Flyway, and is one of seven U.S. cities that are part of a collaborative treaty with the U.S. Fish and Wildlife Service under the Urban Migratory Bird Conservation Act. Thirty-one additional community partners have signed on since Portland entered into the treaty in 2003.

The City watersheds also contain many non-native plant and animal species. Portland residents and business owners landscape their yards and business sites with various native and non-native ornamental plant species. While not all non-native plants are problematic, some exotic plants are invasive and crowd out native plants. This results in loss of biodiversity and habitat quality. Plants such as Himalayan blackberry, English ivy and clematis are already out of control in many of Portland's most valuable remaining natural areas. Other plant species such as purple loosestrife and Japanese knotweed are not yet as wide-spread but pose significant risks. Non-native animal species can also have negative impacts on watershed conditions in the city. Domestic (outdoor) and feral cats are responsible for 40% of the wildlife intakes at Audubon Society of Portland's Wildlife Care Center, the number one cause of injury by a wide margin. Dogs can harass wildlife if allowed to run free in natural areas. Dog waste left on the ground contributes to pollution of local waterways via runoff from rain or landscape watering. Non-native wildlife species such as nutria and European starlings compete with native species for food, habitat, and nesting areas.

2B. MANAGING PORTLAND'S NATURAL RESOURCES: A HISTORICAL PERSPECTIVE

The City of Portland has a long history of protecting, conserving and restoring natural resources through land acquisition, proactive stewardship activities, and land use regulations.

2B1. Land Acquisition

In the early 1900s the city began acquiring land to create a diverse system of parks and natural areas. The city's natural areas total more than 7,000 acres. Forest Park is the jewel of the system. This 5,000-acre Douglas fir forest creates a habitat corridor spanning five miles along the west hills from the north-western edge of the city southward. Forest Park is also part of a major regional east-west habitat corridor extending from Willamette River to forests of the Coast Range. Portland's southwest hills contain Marquam Park, Tryon Creek State Park, and a number of smaller publicly-owned natural areas. Major public natural areas located east of the Willamette River include Smith and Bybee Wetlands Wildlife Refuge and Kelley Point Park to the north, Oaks Bottom Wildlife Refuge to the south, and the Powell Butte natural area park in outer southeast Portland.

In October 2006, the City Council endorsed a new long-term natural area land acquisition strategy for Portland. The Bureau of Parks and Recreation designed the acquisition strategy to enhance existing natural areas, acquire new high-value natural areas, and create and improve linkages and corridors between natural areas. The land will be purchased using capital dollars and Portland's "local share" of funds from a regional greenspaces bond measure that was approved by voters in November 2006.

In addition to purchasing natural area parks and recreation areas, the City has established a program to improve floodplain and watershed function. For example, in 1997 the City established the Johnson Creek Willing Seller Land Acquisition Program to purchase flood-prone properties in four target areas. The primary

goals of the program are to reduce risk to public health, safety and property while improving natural conditions on the land to increase flood storage and improve water quality and habitat. Since the program began, the City has used both local and federal funds to purchase more than 160 acres of property and has completed several large projects to reconfigure and restore stream channels, floodplains and riparian areas.

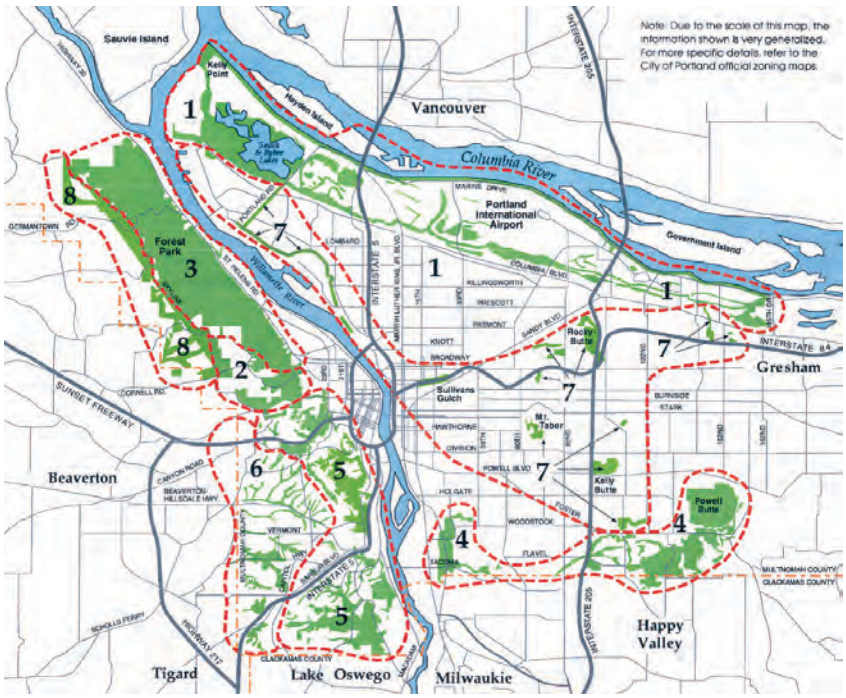
2B2. Stewardship Activities

The City actively partners with local organizations such as Friends of Trees and the Columbia Slough, Johnson Creek, and Tryon Creek watershed councils, and private property owners, to help improve the condition of Portland's watersheds. For example, the Bureau of Environmental Service's Watershed Revegetation Program partners with local agencies and private property owners to remove invasive plants and install native trees and plants on public and privately owned land. The city also sponsors public education and grant programs to encourage citizen participation in "naturescaping," stormwater retrofit projects, and other stewardship efforts.

2B3. Land Use Planning and Zoning

The City land use and zoning program is an important tool in Portland's natural resource management "toolbox." In 1982 the City adopted new stream setback provisions in the Portland Zoning Code and a map of local streams. The new regulations were intended to preserve a buffer between development and local waterways. In 1990 the City adopted its first regulations to protect upland forests, Chapter 33.221 "Temporary prohibition on the disturbance of forests."

During the mid- to late-1980s the Bureau of Planning began producing a series of reports and maps that describe Portland's important natural resources and their functions. Since then, the City has adopted natural nine separate natural resource inventories and protection plans for different parts of the city. The first inventory was developed for the Willamette River Greenway in 1986. The most recent inventory was produced for urbanizing pockets of Multnomah County in 2001.

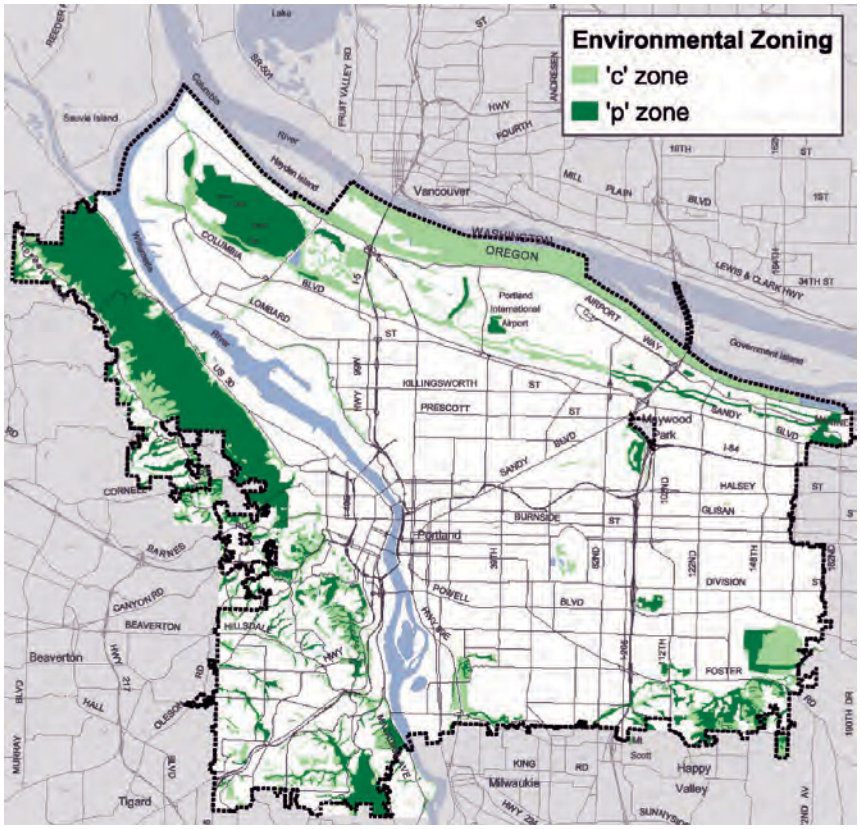


NATURAL RESOURCE INVENTORY AREAS*

1. Columbia Corridor (1989)
2. Balch Creek (1991)
3. Northwest Hills (1991)
4. Johnson Creek Basin (1991); Boring Lava Domes Supplement (1997)
5. Southwest Hills (1992)
6. Fanno Creek and Tributaries (1993)
7. East Buttes, Terraces and Wetlands (1993)
8. Skyline West (1994)

* Willamette River and Multnomah County inventories not shown.

In adopting the inventories and associated protection plans, the City established overlay zones to protect and conserve significant natural resource identified in the inventories. The environmental and greenway overlay zones are Portland's primary tools to comply with State Land Use Planning Goals 5 and 15. Land Use Planning Goal 5 requires cities and counties to take steps to inventory and establish programs to protect significant natural resources. Goal 15 provides general local planning guidelines for the Willamette River Greenway. Environmental and greenway overlay zones also help the City comply with Goal 6 Air, Water and Land Resources, and Goal 7 Areas Subject to Natural Hazards, and are listed Best Management Practices (BMPs) in the City Stormwater Management Plan and Municipal Stormwater (NPDES) Permit as required by the Clean Water Act.



CITY OF PORTLAND ENVIRONMENTAL ZONING

Today, environmental and greenway overlay zones apply to more than 18,200 acres of land, local streams and wetlands in Portland and urbanizing Multnomah County. The overlay zones also apply to portions of the Willamette and Columbia rivers. Environmental overlay zone regulations are contained in Chapter 33.430 of the Portland Zoning Code, and in several plan districts and Natural Resource Management Plans (Bureau of Planning, 2007). The regulations are triggered when new development and redevelopment is proposed to be located within the environmental overlay zone. The City has established two types of environmental overlay zones. In the environmental protection zone ("p" zone), most types of development are generally prohibited. In the environmental conservation zone ("c" zone), development is allowed if it meets specific standards or approval criteria. The environmental zone regulations also require mitigation of unavoidable adverse impacts on natural resources.

The Willamette Greenway overlay zoning regulations were established as part of the Willamette Greenway Plan (1987) and are found in Chapter 33.440 of the Portland Zoning Code. These regulations address a broad range of issues including industrial and river dependent development, recreation, trails and public access, and natural resources. Natural resources in the greenway are addressed through design guidelines that all development in the greenway must meet. These guidelines include requirements for planting the banks of

the Willamette to help restore natural resource function. The guidelines also require development to avoid adversely impacting high value resources that are identified in the 1986 inventory. Two of the five existing greenway overlay zones (Greenway Natural, or n-zone; Water Quality or q-zone) address natural resources and water quality.

In 1998 NOAA Fisheries/National Marine Fisheries Service listed steelhead trout as a threatened species under the federal Endangered Species Act (ESA). Steelhead trout inhabit Portland rivers and streams, as do spring and fall Chinook salmon. These species are currently listed as "threatened" under the ESA. To better understand the implications of the listings, the City evaluated existing activities that could harm the listed species and their habitats. One of the recommendations was to update the existing environmental zoning program to better protect aquatic and riparian ecosystems.

In 1999, the Bureau of Planning initiated the "E-zone Update" project. The project, later renamed "Healthy Portland Streams," was intended to update the city's environmental policies, environmental codes and environmental zone boundaries. The initial Healthy Portland Streams proposal was released in late 2001. It included expanding the environmental zones by about 20 percent to improve protections for aquatic ecosystems and riparian areas. The proposal generated significant public comment and controversy. Many people expressed concerns about the complexity of the proposal and the potential for additional regulation of private property. Some questioned the methods used to produce the riparian resource inventory and draft zoning maps.

Several other related planning efforts were also underway during the same time period:

- The Bureau of Planning was leading a multi-bureau effort to develop a strategy to realize the River Renaissance Vision which was adopted by the City Council in 2001.
- Portland's Bureau of Environmental Services had begun an effort to produce an integrated scientific framework for restoring watersheds and the first citywide watershed management plan.
- Metro had started developing a new program to protect and restore fish and wildlife habitat throughout the tri-county region.
- The Oregon Department of Environmental Quality had initiated new Clean Water Act requirements for managing pollutant loads to streams that do not meet existing water quality standards (i.e., Total Maximum Daily Loads, or TMDLs).

Taking into consideration: 1) that both the City and Metro were in the middle of two major watershed/ natural resource planning projects; and, 2) public concern over the Healthy Portland Streams proposal, the Bureau of Planning decided to suspend the Healthy Portland Streams proposal and propose a new workplan.

The first phase of the workplan would focus on two elements: updating City natural resource inventories and improving existing environmental regulations. The Bureau would also continue working closely with Metro and BES during development of the regional habitat protection program and citywide watershed plan.

The new phased workplan was designed so that future program updates would be guided by the goals, policies and requirements of the City's first watershed plan and Metro's regional habitat protection program. Future work would also benefit from improved City regulations and natural resource information. In November 2002, the Planning Commission endorsed the workplan and directed Planning staff to proceed.

As of today:

Metro Title 13: Nature in Neighborhoods

- The Metro Council adopted the "Nature in Neighborhoods" program in September of 2005. The program establishes new requirements to protect, conserve and restore riparian corridors and wildlife habitat in the tri-county region. The adopted program includes an inventory of regionally significant riparian corridors and wildlife habitat, a new Title 13 of Metro's regional Urban Growth Management Functional Plan, and a series of maps. The program establishes regulatory requirements, incentives and technical assistance to protect, conserve and restore regionally significant riparian corridors and wildlife habitat.

  The Oregon Department of Land Conservation and Development adopted an order in January 2007 finding the Nature in Neighborhoods program in compliance with state land use planning goals. The Nature in Neighborhoods program now implements the state Goal 5 rule pertaining to riparian areas and wildlife habitat within Metro's jurisdiction. The Nature in Neighborhoods program also supplements the region's program to protect water quality under statewide Land Use Planning Goal 6, and is intended to assist local jurisdictions in meeting applicable requirements of the Clean Water Act (e.g., TMDLs).

  The provisions of Metro's Title 13 apply to high-value riparian corridors called Habitat Conservation Areas. The provisions generally require that impact on Habitat Conservation Areas be avoided or mitigated. Portland and other Metro area cities and counties have until January 2009 to demonstrate that their local programs comply with Title 13 requirements. Local jurisdictions may adopt Metro's model ordinance, or ask Metro Council to approve existing or proposed programs under a substantial compliance option. Compliance programs may include both regulatory and non-regulatory components.

Portland Watershed Management Plan

- The Portland City Council adopted the *Portland Watershed Management Plan (Watershed Plan)* in March 2006 (Bureau of Environmental Services, 2005). The *Watershed Plan* characterizes the conditions of Portland's watersheds, establishes citywide goals and objectives relating to hydrology, water quality, physical habitat, and biological communities. The plan recommends strategies and actions to protect and restore watershed health. Included in the Council adoption action were the *Framework for Integrated Management of Watershed Health* and the *2005-2006 Annual Watershed Action Plan.* The *Framework* synthesizes a wealth of scientific information and establishes ecological principles and guidelines for watershed planning and restoration in Portland. The *Framework* and the *Watershed Plan* emphasize the importance of protecting high-value natural resources to sustain and restore watershed health. The *2005 – 2006 Annual Watershed Action Plan* calls for completion of the Natural Resource Inventory Update project.

Environmental Code Improvement

- The Bureau of Planning's Environmental Code Improvement (ECI) project was adopted by the City Council in August 2005 (new codes went into effect in September 2005). A general purpose of the project was to clarify and simplify existing City environmental regulations while continuing to protect and conserve significant natural resources. The project addressed problems that had been identified by people who have used or are affected by the regulations, such as the process for resolving violations of the environmental zoning code. The environmental regulations are now clearer, simpler, and more equitable, efficient, and enforceable. Modified review procedures are quicker and cost less. New standards encourage enhancement of natural resources and site conditions as well. The Environmental

Code Improvement project was completed using a collaborative problem-solving process that engendered strong support from community stakeholders and other City bureaus.

Natural Resource Inventory Update

- The Bureau of Planning has produced new inventory information for riparian corridors and wildlife habitat in Portland. Project staff briefed the Portland Planning Commission on the inventory update in October of 2006. Staff plans to return to the Planning Commission in 2008/2009 for endorsement of the draft citywide inventory methodology and a recommended workplan for the Bureau's Environmental Planning program. The workplan will lay out the steps in which the updated inventory information will be adopted in conjunction with citywide or area-specific legislative projects (e.g., River Plan). The updated inventory is the subject of the remainder of this report.

3. PROJECT APPROACH

This chapter describes the approach used to develop the City's new inventory of riparian corridors and wildlife habitat. The information is presented in the following sections:

3A. Project Success Criteria
3B. Scientific Foundation
3C. Inventory Methodology

The Inventory Methodology section includes a summary of Metro's approach to developing the regional inventory of riparian corridors and wildlife habitat. Following is a step-by-step description of the City's project approach and methodology, including efforts to refine the regional inventory.

3A. PROJECT SUCCESS CRITERIA

Developing new natural resource inventory information for Portland is an ambitious undertaking, involving large, diverse landscapes, complex data and model development, and collaboration with technical experts and key stakeholders. In order for the project to be successful, it would need to meet the following criteria:

- The project methodology would need to reflect current, generally-accepted scientific principles and information.
- The project should build on existing information and avoid duplication of effort.
- The project approach and products must be clear, consistent, and understandable.
- The inventory products must be designed to inform a broad array of resource management and watershed activities citywide.
- Inventory tools and products must be readily accessible to potential users of the information.
- The inventory must be easy to maintain and update over time.
- The inventory must help the City achieve compliance with existing and emerging regional, state and federal requirements to protect public health and safety, water quality, and fish and wildlife habitat.

To meet the above criteria most efficiently, the Bureau of Planning elected to build on work already done. The Bureau chose to use Metro's regional inventory of riparian corridors and wildlife habitat as the methodological basis for the citywide inventory update project.

Metro developed the regional inventory over a period of years, by completing the following steps:

1. Established a committee of local experts and agency staff to work with project staff during development of the inventory.

2. Conducted an extensive review of scientific literature relating to riparian corridors and wildlife habitat. From this literature Metro identified a set of key riparian functions and wildlife habitat attributes that would form the basis of the inventory.

3. Generated GIS data and maps of rivers and streams, wetlands, flood areas, vegetation and other landcover types – features that contribute significantly to specific functions and overall health of riparian areas and wildlife habitat.

4. Developed GIS models comprised of criteria to evaluate, rank and map the relative functional value of natural resources. Criteria addressed key riparian functions and wildlife habitat attributes.

5. Produced regional fish and wildlife species lists and identified habitats of concern.

6. Generated preliminary inventory reports and maps.

7. Conducted field work to assess the habitat model's performance and adjusted the model based on the results.

8. Provided the draft inventory methodology and preliminary products to the Independent Multidisciplinary Science Team (comprised of leading experts in the Pacific Northwest) and other local experts and stakeholders for review and comment.

9. Submitted the draft inventory to the Metro technical and policy advisory committees for endorsement.

10. Notified stakeholders, including affected property owners, about opportunities to comment.

11. Held public workshops in different parts of the region and a public hearing before the Metro Council.

12. Endorsed the inventory and directed the development of a regional program to protect, conserve, and restore regionally significant riparian corridors and wildlife habitat (2001). Adopted the inventory as part of the Nature in Neighborhoods program (2005).

By using Metro's inventory as the starting point for Portland's inventory update, Bureau of Planning has addressed the success criteria listed above in an efficient, cost-effective manner. The approach builds on work already done and avoids duplicating efforts. The approach relies on generally-accepted, current scientific information, applies consistent policies and methods, and produces high quality, understandable, accessible products. The updated inventory maps and reports will inform a broad array of resource management activities, and help the City achieve compliance with existing and emerging regional, state and federal requirements. New mapping tools will allow the City's inventory information to be kept current over time.

3B. SCIENTIFIC FOUNDATION

Before presenting the methodology used to produce the updated natural resource inventory, it is important to become familiar with the underlying science. The scientific basis for the inventory is found in two key documents:

- *Portland Framework for Integrated Management of Watershed Health (2005*); and
- *Metro's Technical Report for Fish and Wildlife Habitat (2005)*

3B1. FRAMEWORK FOR INTEGRATED MANAGEMENT OF WATERSHED HEALTH

The *Framework for Integrated Management of Watershed Health (Framework)* presents a science-based approach to restore urban watershed systems. The *Framework* establishes the technical basis and process used to develop the *Portland Watershed Management Plan* (adopted by City Council in March 2006). The Bureau of Environmental Services developed the *Framework* in consultation with a team of independent scientists, the City's Watershed Science Advisory Group (WSAG), and staff from other City bureaus.

The *Framework* provides a comprehensive reference document for City bureaus to use in implementing their respective programs. The *Framework* emphasizes the need for a "scientific foundation" as a basis for making decisions. The term "scientific foundation" is described as a "set of scientific principles and assumptions that can give direction to management activities…," noting that, "reestablishing healthy watersheds will require restoration of *ecological functions and conditions."* (Italics added). The *Framework* points out that, "… scientific information is rarely static …," and that "… this scientific foundation will be refined over time…"

The ecological principles and guidelines presented in the *Framework* provide valuable context and support for the natural resource inventory update work. The principles focus on watersheds as complex, dynamic systems of interdependent spatial and temporal factors. The principles emphasize that rivers are not separate from the wetland and upland areas they drain, and that watershed health should be assessed in terms of physical, chemical and biological integrity.

The guidelines call for the characterization of existing conditions to inform restoration planning. This emphasizes the importance of protecting and restoring fish and wildlife functions, populations and habitats, and building outward from existing populations, functions and rare and high quality habitats.

In addition, the *Framework* provides a wealth of information about Portland's natural environment, including existing watershed conditions, biological communities and habitats in the city, priority habitats and wildlife species. This information will be supplemented by current projects such as the Natural Resource Inventory update and the development of a Terrestrial Ecology Enhancement Strategy.

The inventory update project is consistent with the principles and guidelines set forth in the *Framework*. The inventory reflects the best available information pertaining to Portland's streams, wetlands, vegetation and other natural features. It helps to characterize Portland's natural resources and their respective functions and attributes, and identifies key species and habitats. The inventory evaluates the relative quality of Portland's natural resources based on physical, chemical and biological criteria. The inventory will allow resource managers to examine connections and gaps in resource and habitat systems, and set priorities to protect, conserve and restore natural resources to improve watershed conditions over time.

3B2. METRO'S TECHNICAL REPORT FOR FISH AND WILDLIFE HABITAT

The *Framework* described above has provided a sound foundation and guidance for the City's inventory update effort. The specific scientific basis is found in Metro's *Technical Report for Fish and Wildlife Habitat (Technical Report)* (April 2005).

The first step Metro took toward developing a regional inventory of riparian corridors and wildlife habitat was to conduct a comprehensive review of the relevant scientific literature. Metro's *Technical Report* summarizes the literature review, highlighting the interconnectedness of watershed systems and functions, and interrelationships between streams, riparian corridors and upland areas. Watershed ecosystems are characterized by a network of natural resources including tributaries, streams and rivers, floodplains, groundwater, and upland and riparian vegetation. Urban features are also part of the watershed ecosystem, including buildings and streets and other paved areas, and landscaped areas. Watershed ecosystems also consist of the plants and animals that live there, including people. Combined, these features drive a complex mix of physical, chemical and biological processes that together represent the overall health of a watershed.

Metro found that although many of the scientific studies had been conducted in rural forested areas, the information from these works is applicable and relevant to urban and urbanizing watersheds. Whether in an urban or rural area, a watershed is an area of land from which water, sediment and organic and dissolved materials drain to a common point such as a stream, river, pond, lake or ocean. The ecological health of a watershed and its value for fish and wildlife depends on preserving the connectivity of natural resource components over time and space (Naiman et al. 1992).

Key information from Metro's technical report is summarized below under the topic headings:

- Riparian Corridors
- Terrestrial and Upland Wildlife Habitat

Literature citations in the next section include sources identified by Metro and additional sources by the City as part of Portland's inventory update effort.

3B2.1 Riparian Corridors

Riparian corridors are generally thought of as areas bordering rivers, streams, lakes and wetlands. Riparian corridors include the transition between the aquatic and upland areas, where vegetation continues to provide streams with structure, shade, microclimate, nutrients, and other organic materials, and habitat for fish and wildlife. For the purpose of the regional and city inventories, "riparian corridor" includes river and stream channels, adjacent riparian vegetation, and off-channel areas including wetlands, side channels, and the floodplain. Riparian corridors also encompass subsurface areas beneath stream channels where streamflow and groundwater interact physically, chemically and biologically (hyporheic zones).

Intact riparian corridors in the region are generally characterized by multi-story vegetation assemblages consisting of trees or woody vegetation (live and downed wood), shrubs and herbaceous plants. The character of a riparian corridor reflects the influence of multiple factors such as climate, light and water availability, topography, soil properties, surface and groundwater flows, and natural disturbances (flood, fire, etc.). Riparian plant communities vary from headwaters to the mouth of a stream, reflecting differences in watershed hydrology, hydraulic gradient, geomorphology, and disturbance regimes (Harr 1976; Kauffman et al. 2001).

The spatial extent or width of a riparian area is not fixed. The scientific literature suggests that riparian corridor widths should be viewed in the context of specific functions and relationships between terrestrial and aquatic features and systems (Naiman and Decamps, 1997; Gregory et al. 1991).

Riparian Functions

Riparian corridors provide important ecological functions including:

- ***Microclimate and shade***
- ***Bank function and control of sediments, nutrients and pollutants***
- ***Streamflow moderation and flood storage***
- ***Organic inputs and food web***
- ***Large wood and channel dynamics***
- ***Wildlife habitat/corridors***

- ***Microclimate and shade***
  The presence of vegetation and water affects air temperature, humidity, and soil moisture in riparian corridors. The shade provided by riparian vegetation also affects the temperature of water in streams and wetlands (Thomas et al. 1979; Swanson et al. 1982; Naiman et al. 1992; Pollock and Kennard 1998; Kauffman et al. 2001; Pollock and Kennard 1998). Riparian microclimate effects directly influence ecological processes and metabolic activity (Chen et al. 1999; Swanson et al. 1982). Water temperature is a critical factor for aquatic ecosystems. In general, salmon require cold water ranging between 4 and 17 degrees C (39 to 63 degrees F). The effectiveness of riparian corridors in producing shade depends on vegetation composition, height, and density; channel width, and channel orientation relative to solar angle. Riparian tree canopy has the greatest shade impact on narrower streams channels. Riparian canopy cannot fully shade larger rivers, but can create cool microhabitats for fish and aquatic organisms.

- ***Bank function, and control of sediments, nutrients and pollution***
  Although some erosion and sedimentation is natural in a stream system, increased erosion and sedimentation from urbanization and disturbance can negatively impact stream functions and aquatic ecosystems (Beauchamp et al. 1983). Streams of all sizes, and especially headwater streams, benefit from the regulating influence that riparian vegetation has on the amount of sediment entering aquatic habitats (Knutson and Naef 1997). The dense root networks of species such as willow, alder and dogwood are effective in protecting streambanks from erosion (Bureau of Land Management, 1999). The physical structure of standing riparian vegetation and large wood in the stream channel slows water, mechanically filters and stores fine silt and sediment, holds materials in place, and reduces stream channel scouring which is especially important during periods of high streamflow (Swanson et al. 1982; Gregory et al. 1991; Knutson and Naef 1997; Naiman and Decamps 1997). Riparian vegetation can trap excess nutrients, such as nitrogen and phosphorus found in fertilizers, and pollutants such as herbicides and industrial chemicals carried in surface water. Riparian microbial processes can also help immobilize nutrients and degrade organic pollutants found in overland flows (Palone and Todd 1997). In urban areas such as Portland, engineered alternatives have been used to stabilize river and stream banks (e.g. pilings). These structures generally prevent erosion and slumping but also immobilize the banks and isolate the river bank or stream bank from the water and natural fluvial processes. Non-vegetated hardened banks are also limited in their ability to filter or capture sediments, nutrients and pollutants.

- ***Streamflow moderation and flood storage***
  Variability in streamflow volume, rate, and velocity influences the structure, dynamics, and habitats of rivers and streams. In urbanized landscapes, increases in impervious surfaces prevent infiltration, resulting in more runoff, increased storm flows and flood flows, and decreased dry season flows (Booth 1991; Schueler 1994; Booth and Jackson 1997; May et al. 1997; Morgan and Burton 1998; Karr et al. 2000; Booth et al. 2001). Riparian and upland vegetation helps moderate streamflows by intercepting, absorbing and storing rainfall. Plant roots increase soil porosity and help promote infiltration. These areas can also help provide cool groundwater to streams during the dry season. Floodplains and riparian wetlands provide important storage capacity for flood flows. In urban areas such as Portland, floodplains have often been developed with structures and impervious surfaces. Although highly degraded, these areas still contribute on a cummulative basis to the storage of flood water, which can delay or reduce flood damage downstream.

- ***Organic inputs and food web***
  Forest ecosystems adjacent to stream corridors provide over 99 percent of the energy and carbon sources in aquatic food webs (Budd et al. 1987). Riparian plant communities affect the quantity, quality, and timing of nutrients delivered to the stream channel that are then used by aquatic species (Swanson et al. 1982; Gregory et al. 1991; Naiman and Decamps 1997). Deciduous and coniferous forests contribute important organic matter to Pacific Northwest stream systems. Leaves, wood, fruit, cones, insects and other types of organic matter can fall directly into the stream channel from the riparian area. Organic matter can also be deposited into streams via wind or erosion (Gregory et al. 1991; Naiman et al. 1992). Organic matter may enter the stream as dissolved materials in water, flowing subsurface from the hyporheic zone. Organic matter is also produced within the streams themselves. Many fish, amphibians, reptiles, birds and mammals rely on freshwater macroinvertebrates and fish eggs, fry, live adults and carcasses for food. Although the aquatic food web in large rivers is primarily driven by phytoplankton production, riparian vegetation provides localized sources of organic matter and nutrients, especially in shallow-water areas.

- ***Large wood and channel dynamics***
  Stream channels move and change naturally over time. However, in urban environments, channel migration is often constrained by channel straightening, streambank armoring and land development. These factors, combined with increases in impervious surfaces throughout urban drainages, generate higher rates of runoff, resulting in stream channel down-cutting and scouring.

  Riparian areas can contribute branches, logs, uprooted trees, and rootwads that help to form channel features and provide instream cover for fish. Large in-channel wood also controls the routing of water and sediment, dissipates stream energy, protects stream banks, stabilizes streambeds, helps retain organic matter, and acts as a surface for biological activity (Swanson et al. 1982; Harman et al. 1986; Bisson et al. 1997; Sidell et al. 1988; Bilby and Ward 1989; Gregory et al. 1991). In headwater streams large wood typically stays where it falls and spans the stream. Large wood helps form the channel in headwater streams and mid-section stream reaches. Channel formation in larger river is influenced by regional events (e.g., floods and geomorphic preprocesses. Large wood can also provide important localized functions, such as sediment capture and cover for fish, in large, low-gradient rivers.

Active floodplains and riparian wetlands also contribute to stream channel formation by providing areas for high streamflows to spread out and form new channels. These areas allow high flows to slow down and deposit sediment, which affects channel form over time. In urban watersheds, channel movement is often constrained, and floodplains and riparian wetlands are often developed or disconnected from river and stream channels. Still, even degraded channels, floodplains and wetlands contribute to the overall dynamics of river and stream systems.

- ***Riparian wildlife habitat/corridors***
  In the Metro region, 93 percent of terrestrial vertebrate wildlife species regularly use water-associated habitats. The three main water-associated habitat types in the Metro region are open water (rivers, lakes, and streams), herbaceous wetlands (also known as emergent wetlands), and riparian wetlands (includes conifer/hardwood corridors and forested and shrub-scrub wetlands). Each of these habitat types supports a broad array of plant and wildlife species, including a number of species at risk. Riparian vegetation surrounding these features creates a unique microclimate and provides abundant food, cover, and a link to drinking water. In addition, riparian areas provide important movement corridors for wildlife. Water bodies and associated riparian corridors allow wildlife to move along and between habitat areas (Thomas et al. 1979). Riparian corridors provide edge habitat which can promote species diversity, while also having a negative effect on species that rely on interior habitat characteristics or species vulnerable to predators moving along edge habitat.

The key riparian features and functions described above are summarized in the following table.

TABLE 1: RIPARIAN CORRIDOR RESOURCE FEATURES AND FUNCTIONS

	Streamflow Moderation and Flood Storage	Bank Function, Control of Sediments, Nutrients, Pollutants	Large wood and Channel Dynamics	Organic Inputs and Food Web	Microclimate and Shade	Wildlife Movement Corridor
Open water (rivers, streams, drainages, sloughs, ponds, lakes)	Open water features store and convey water and interact with groundwater. Headwater streams are particularly important to the hydrology and chemistry of watersheds.	Water volumes, levels and flows correlate directly with water temperature, dissolved oxygen and pollutant levels in rivers, streams, lakes and ponds. Interaction between the water body and bank influence ground water, microclimate and microbial activity.	Channel dynamics cannot occur without the presence of waterway channels and flows; wood is carried from upstream and is deposited along banks and in shallow-water areas.	Distinct food web functions occur within open water bodies. Processing of organic matter reflects portion of the drainage, flow rates, nutrients, plants, insects, and light availability.	Where open water and vegetation coexist, they produce humidity and moderate soil and air temperatures.	Open water features are essential to the life cycles and survival of most fish and wildlife species. Rivers, streams, lakes and ponds provide water, food, cover and movement corridors.
Wetlands	Riparian and upland wetlands intercept and store surface runoff and groundwater throughout watersheds, and can contain floodwaters in riparian areas.	By moderating stream flows, wetlands can reduce bank erosion. Wetlands also store and filter sediments, cycle nutrients, decompose organic waste and prevent heavy metals from entering streams	Wetlands can reduce channel degradation by moderating streamflows. Forested wetlands contribute large wood to nearby streams. Floodplain and riparian wetlands contribute to overall complexity and resilience.	Wetland productivity contributes to the food chain. In floodplains, wetlands nutrient cycling is enhanced by flooding and fluctuating groundwater levels.	Evaporation from wetlands contributes to localized humidity levels and air and soil temperature moderation.	Wetlands provide food, water, refuge from summer heat, shelter from winter cold, and cover for a broad variety of wildlife species. Wetlands are a type of off-channel habitat and provide key habitat for young salmon.
Floodplain	Floodplains reduce or delay peak streamflows during storms by providing storage and/or infiltration capacity. These functions occur even if the floodplain is developed. Intact floodplains connect streams to groundwater (hyporheic zone), helping maintain year-round stream flow.	Floodplains slow flows down, allowing sediments to drop out before entering the stream. Vegetated floodplains also reduce nutrient loads, help process chemical and organic wastes, and help create fertile soils and riparian areas	Vegetated floodplains reduce flow velocities, redirect flows, settle sediment, and promote side channel formation. They also contribute large wood to nearby streams.	Flooding interchanges organic material, nutrients, and organisms between aquatic and terrestrial environments. Flooding can establish vegetation and control biotic communities. Floodplain vegetation contributes organic material to streams and wetlands.	Floodplains contribute to microclimate by influencing vegetation, increasing humidity and moderating soil moisture and water temperatures. Floodplains connect to hyporheic zones which help maintain year-round streamflow.	Floodplains provide periodic habitat for fish, macroinvertebrates, amphibians, and many bird species. They can also provide refugia and cover during flood events. Floodplain plants are valuable food sources for fish and wildlife.

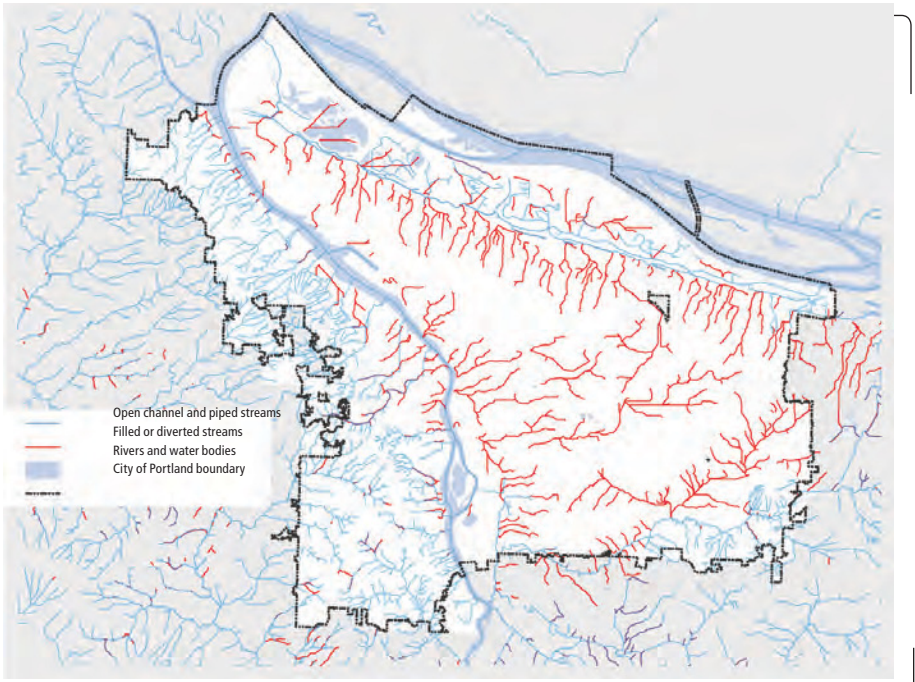
TABLE 1: (CONTINUED) RIPARIAN CORRIDOR RESOURCE FEATURES AND FUNCTIONS

	Streamflow Moderation and Flood Storage	Bank Function, Control of Sediments, Nutrients, Pollutants	Large wood and Channel Dynamics	Organic Inputs and Food Web	Microclimate and Shade	Wildlife Movement Corridor
Vegetation and soil	Vegetation affects watershed hydrology by intercepting and storing precipitation, and returning water to the atmosphere through transpiration. These functions vary depending on the extent, age, density and composition of vegetation. Soil porosity affects the rate of water infiltration and runoff. Vegetation reduces runoff by contributing organic matter, which soaks up water, and protecting soils from compaction.	Plants, roots, wood and soils reduce erosive power of stream flows and hold soil in place. Riparian vegetation is especially important to reduce cumulative sedimentation impacts. Vegetation absorbs nutrients and other dissolved materials as they are transported through uplands and riparian zones, thereby reducing or preventing water pollution. Riparian vegetation filters and traps soil particles and organic matter, and can intercept undesirable dissolved compounds (pesticides, herbicides, heavy metals)	Riparian vegetation provides large wood, stabilizes banks and side channels, and retains and filters sediment. Large wood promotes formation of channels, side channels, islands and bars. Vegetation can also promote stream bank development. In large, low gradient rivers, wood deposits from upstream and adjacent riparian areas have a localized effect on channel structure. Relationships between soil, landforms, geomorphic processes and vegetation substantially influence how channels are formed and change over time.	Forested riparian areas provide more than 99% of the energy and carbon in aquatic food webs. Riparian trees, shrubs and herbaceous vegetation (leaves, needles, cones and wood) provide nutrition to stream channels. Fluctuating water levels and periodic flushing can affect soil characteristics in riparian corridors, resulting in increased plant (and therefore animal) diversity. Wetter soils can also promote decomposition of organic matter.	Vegetation influences microclimate in riparian areas by altering soil moisture, wind speed, relative humidity and the temperature of soil, air and water. Vegetation affects soil, and soil affects vegetation. Riparian vegetation provides shading critical to keep water cool in open water bodies and wetlands. By affecting vegetation characteristics, riparian soils can have a profound effect on microclimate and shade.	Riparian vegetation provides wildlife movement corridors and migration routes, food and forage, nesting and breeding sites, resting areas, and cover. Large wood and organic matter in streams provides substrate and food for invertebrates and cover for fish. Large wood provides critical habitat for amphibians and small mammals. Riparian soils support many bacteria, fungi, and insect species. Soil animals (for example, macroinvertebrates) are generally more abundant and diverse in riparian than upland soils.
Steep slopes	Steep slopes reduce infiltration while increasing overland flow of stormwater runoff. Steep slopes with little or no vegetation can increase streamflow rates, fluctuation ("flashiness") and flooding.	Non-vegetated steep slopes can increase erosion and landslides, causing stream sedimentation and turbidity and altering hydrology. Altered hydrology can reduce streambank stability and riparian vegetation cover. Steep slopes can also increase nutrient and pollutant loads to streams.	Steep slopes with vegetation contribute large wood to streams. Vegetation on these slopes protects hydrology, thereby increasing streambank stability.	Steep slopes can influence the organic inputs to streams by affecting the types and position of overhanging vegetation relative to channel, wind and runoff rates. Gravity carries more organic material down steep slopes than across flatter areas.	Steep ravines and stream canyons can contribute to riparian microclimate effects by limiting solar radiation and creating local inversions (cold air trapped at the canyon floor).	Wildlife species can take refuge on undeveloped hillsides if their preferred habitat is degraded by development. Certain plant and wildlife species utilize steeply sloped landscapes (e.g. Oregon white oak, winter wrens). Riparian vegetation can often be found on steep slopes because groundwater emerges from such areas.

Effects of Urbanization on Riparian Corridors

Riparian corridors in Portland and the Metro region have been significantly altered by the cumulative impacts of urbanization. Hundreds of miles of streams have been channeled or placed underground in pipes. Many streams do not meet current water quality standards for temperature, bacteria, nutrients, toxics and other pollutants.

Riparian corridors in Portland are fragmented by streamside development, loss of native vegetation, and proliferation of invasive plant species. This fragmentation reduces the supply of large wood and organic inputs to aquatic and terrestrial ecosystems, and interrupts riparian wildlife movement corridors. In many places, riparian areas now consist of riverfront development, levees, hardened banks, and other man-made structures. Development has often severed the connections between streams and their floodplains.



PORTLAND'S CURRENT AND HISTORIC STREAMS

Science-based Planning Guidelines for Riparian Corridors

Metro noted the following points when preparing to map and assess the functions of riparian corridors in the region.

- Continuous riparian vegetated corridors protect functions more effectively than fragmented corridors (Fisher et al. 2000).
- The functionality of upstream riparian corridors has an effect downstream, e.g., contribution and accumulation of large wood (Pollack and Kennard 1998).
- Protecting riparian corridors is especially important along small headwater streams (Osborne and Kovacic 1993; Hubbard and Lowrance 1994; Lowrance et. al. 1997; May et al. 1997a; Fisher et al. 2000).
- Key factors that should be taken into consideration when determining size of riparian buffers are the presence of floodplains, steep slopes, riparian wetlands, site potential tree height, and aquatic and terrestrial habitat.
- Large buffers are even more important in areas of high intensity use than low intensity use (Johnson and Ryba 1992).

Metro used information from the following table to develop riparian corridor mapping criteria described later in the report.

TABLE 2: RANGE OF FUNCTIONAL RIPARIAN AREA WIDTHS FOR FISH AND WILDLIFE HABITAT

Aquatic Habitat			
	Function	**Reference**	**Functional width (each side of stream)**
Temperature regulation and shade	Shade	FEMAT 1993	100 ft
	Shade	Castelle et al. 1994	50-100 ft
	Shade	Spence et al. 1996	98 ft
	Shade	May 2000	98 ft
	Shade	Osborne and Kovacic 1993	33-98 ft
	Shade/reduce solar radiation	Brosofske et al. 1997	250 ft
	Control temperature by shading	Johnson and Ryba 1992	39-141 ft
Bank stabilization and sediment control	Bank stabilization	Spence et al. 1996	170 ft
	Sediment removal/erosion control	May 2000	98 ft
	Ephemeral streams	Clinnick et al. 1985	66 ft
	Bank stabilization	FEMAT 1993	½ SPTH
	Sediment control	Erman et al. 1977	100 ft
	Sediment control	Moring 1982	98 ft
	Sediment removal	Johnson and Ryba 1992	10 ft (sand) – 400 ft (clay)
	High mass wasting area	Cederholm 1994	125 ft
Pollutant removal	Nitrogen	Wenger 1999	50-100 ft
	General pollutant removal	May 2000	98 ft
	Filter metals and nutrients	Castelle et al. 1994	100 ft
	Pesticides	Wenger 1999	>49 ft
	Nutrient removal	Johnson and Ryba 1992	33 – 141 ft
Large woody debris and organic litter	Large woody debris	Spence et al. 1996	1 SPTH
	Large woody debris	Wenger 1999	1 SPTH
	Large woody debris	May 2000	262 ft
	Large woody debris	McDade et al. 1990	150 ft
	Small woody debris	Pollock and Kennard 1998	100 ft
	Organic litterfall	FEMAT 1993	½ SPTH
	Organic litterfall	Erman et al. 1977	100 ft
	Organic litterfall	Spence et al. 1996	170 ft
Aquatic wildlife	Cutthroat trout	Hickman and Raleigh 1982	98 ft
	Brook trout	Raleigh 1982	98 ft
	Chinook salmon	Raleigh et al. 1986	98 ft
	Rainbow trout	Raleigh et al. 1984	98 ft
	Cutthroat trout, rainbow trout and steelhead	Knutson and Naef 1997	50 – 200 ft
	Maintenance of benthic communities (aquatic insects)	Erman et al. 1977	100 ft
	Shannon index of macroinvertebrate diversity.	Gregory et al. 1987	100 ft
	Trout and salmon influence zone (Western Washington)	Castelle et al. 1992	200 ft
	Willow flycatcher nesting	Knutson and Naef 1997	123 ft
	Frogs and salamanders	NRCS 1995	100 ft
	Full complement of herpetofauna	Rudolph and Dickson 1990	>100 ft
	Belted Kingfisher roosts	USFWS HEP Model	100 – 200 ft
	Deer	NRCS 1995	200 ft
	Smaller mammals	Allen 1983	214 – 297 ft
	Birds	Jones et al. 1988	246 – 656 ft
	Beaver	NRCS 1995	300 ft
	Minimum distance needed to support area-sensitive Neotropical migratory birds	Hodges and Krementz 1996	328 ft
	Western pond turtle nests	Knutson and Naef 1997	330 ft
	Pileated woodpecker	Castelle et al. 1992	450 ft

TABLE 2: (CONTINUED) RANGE OF FUNCTIONAL RIPARIAN AREA WIDTHS FOR FISH AND WILDLIFE HABITAT

Terrestrial Habitat			
	Function	**Reference**	**Functional width (each side of stream)**
Aquatic wildlife (continued	Bald eagle nest, roost, perch	Castelle et al. 1992	600 ft
	Nesting ducks, heron rookery and sandhill cranes		
	Pileated woodpecker nesting	Small 1982	328 ft
	Mule deer fawning	Knutson and Naef 1997	600 ft
	Rufous-sided towhee breeding populations	Knutson and Naef 1997	656 ft
	General wildlife habitat	FEMAT 1993	100-600 ft
	General wildlife habitat	Todd 2000	100-325 ft
	General wildlife habitat	May 2000	328 ft
Edge effect	Interior bird species	Tassone 1981	164 ft
	Neotropical migrants	Keller et al. 1993	328 ft
	Effect of increased predation	Wilcove et al. 1986	2,000 ft
	Noise reduction of a mature evergreen buffer	Harris 1985	20 ft
	Reduce commercial noise	Groffman et al. 1990	100 ft
LWD and structural complexity	Snags and downed wood	FEMAT 1993	1 SPTH outside the buffer
Species movement	Travel corridor for red fox and marten	Small 1982	328 ft
	Minimum to allow for interior habitat	Environment Canada 1998	328 ft
Microclimate	Maintain microclimate	May 2000	328 ft
	Prevent wind damage	Pollock and Kennard 1998	75 ft
	Approximate natural conditions	Brosofske et al. 1997	250 ft
	Maintain microclimate	Knutson and Naef 1997	200-525 ft
	Maintain humidity and soil temperature	Chen et al. 1995	98 – 787 ft

Acronyms:
SPTH: site potential tree height NMFS: National Marine Fisheries Service NRCS: National Resource Conservation Service USFWS: U.S. Fish and Wildlife Service FEMAT: Forest Ecosystem Management Assessment Team
Source: *Attachment 2 to Exhibit F of Ordinance No. 05-1077C; Metro's Technical Report for Fish and Wildlife Habitat, April 2005 Table 7, Page 82*

3B2.2 Terrestrial and Upland Wildlife Habitat

As noted, most wildlife species in Portland and the metropolitan region rely on riparian areas, wetlands, and open water bodies to survive. Many species also depend on upland areas for breeding, food and shelter. Upland habitat types include grassland or meadow, mixed conifer and deciduous forest, woodland and shrubland vegetation, rocky slopes and other topographic features. Some wildlife species may reside in the area year round, while others migrate through or use an area for breeding (e.g., Neotropical songbirds) or as a wintering ground, (e.g., waterfowl and wintering raptors).

To inform the regional wildlife habitat inventory, Metro reviewed correlated landcover data for the region with a widely accepted terrestrial habitat classification system (Johnson and O'Neil 1995). Metro reviewed the basic upland habitat types and species that use them, and found that 89 percent of the 292 native amphibians, reptiles, birds and mammal species in the Metro region use upland habitats types.

To identify and map wildlife habitat patches in the region, Metro focused on forest vegetation and wetlands. This was due in part to limitations on available vegetation data. However that said, forested areas and tree canopy provide critical functions for native wildlife in the Willamette Valley, including breeding, foraging, dispersal, and wintering habitat for wildlife species. Recent benthic macroinvertebrate studies in the region show positive correlations between forested land in watersheds and along stream corridors, and healthy stream communities (Frady et al. 2003). Wetlands also provide important habitat for birds, mammals, amphibians and reptiles. Many breeding bird populations feed, nest, and raise their young in wetlands. For some animals and plants, such as wood ducks and cattails, inland wetlands are the only place they can live. Metro also acknowledged the importance of upland meadows and grasslands as wildlife habitat, and addressed these areas through the designation of regional Habitats of Concern.

Wildlife Attributes

From the scientific literature, Metro identified key wildlife habitat attributes to serve as indicators of habitat function and the impacts of habitat fragmentation due to urbanization. These attributes are:

- ***Habitat patch size***
- ***Edge effect***
- ***Connectivity (including distance and age effect)***

- ***Habitat patch size***

  Studies indicate that larger habitat patches are better for the survival of native species than smaller patches (Wilcove 1985; Bolger et al. 1997a; Burke and Nol 1998). Some species need a certain amount of territory for foraging and breeding. Larger animals typically require more land areas to support their body mass (Soule 1991a). Smaller patches generally contain more edge habitat than larger patches. Edge effect can benefit some species, but can also foster proliferation of invasive species, next parasitism, and predation (see next section for more detail on edge effect).

  Small patches that are well-connected to other patches can provide important functions for species that are not dependent on interior habitat. Small patches provide "habitat islands" in developed urban areas. Some species may compose a home range made up of multiple habitat fragments. Proximity of small patches to rivers, streams and wetlands elevates their importance for wildlife.

- ***Edge effect***

  Edge habitat occurs where one habitat type, such as a forest, meets a stream, grassland, road, yard or landscaped area, or other natural or artificial habitat type (Forman and Godron 1986; Lidicker and Koenig 1996). Urbanization typically increases habitat fragmentation, resulting in more edge habitat and less interior habitat (Lidicker and Koenig 1996).

  Both the size and shape of a patch influence the amount of edge habitat in a patch. For instance, a large square or round patch has less edge habitat and more interior habitat than a long narrow patch. Circular or square patches often contain more species diversity, allow for increased foraging efficiency, and contain fewer barriers than rectangular or oblong patches (Forman and Godron 1986).

  Increased fragmentation favors species that thrive on habitat edges, while the reproduction and survival of interior species declines (Soule, 1991a; Nilon et al. 1994). Predators such as foxes and coyotes are better able to hunt along edge habitats where prey such as birds and small mammals are easier to find. Species such as the House Finch, Anna's Hummingbird, deer and raccoons are also able to use resources in human-altered landscapes (Bolger et al. 1997b).

  However, many species rely on relatively undisturbed interior habitat, such as Swainson's thrush and winter wren. Friesen et al (1995) found that the edge effect of residential development affected the diversity and abundance of songbirds in forest habitat patches regardless of patch size. In addition, edge habitats are associated with higher frequency and increased severity of fire, increased intensity of predation and invasion of exotic plants.

- ***Connectivity***

  Connection between habitat patches and between terrestrial habitat and water (rivers, streams and wetlands) is important to the survival of many wildlife species. Wildlife populations that are connected to each other are more likely to survive catastrophic events by moving from one patch to another to escape or to repopulate or revive an area (Hess 1994). Dispersal of animals between patches helps to preserve populations by protecting against catastrophes and preventing genetic decline due to inbreeding (Soule 1991a; Lidicker and Koenig 1996). Connections between habitats allow seasonal migrations (Lidicker and Koenig 1996; Duerkson et al. 1997) and interbreeding between populations. This increases the vigor and survival of overall populations (Duerkson et al. 1997).

  Animal movement decreases in direct relation to distance between habitat patches. However, if the landscape contains barriers, animal movement can be inhibited even where the distance between habitat fragments is not great (Bolger et al. 1997a). The impact of distance (distance effect) between patches is influenced by the amount of time that has passed since fragmentation took place (age effect). Several studies show that the species diversity is negatively correlated with the length of time a habitat patch has been fragmented from a large habitat area (Bolger et al. 1997a; Sole et al. 1988).

  Well-designed corridors can have a key role in maintaining ecosystem vitality (Adams and Dove 1989; Soule 1991 a, b; Beier and Noss 1998). However, the potential benefits and disadvantages of habitat corridors have been debated though not quantified in our region. Potential risks include invasion by exotic plant and animal species, transmission of disease, and predation (Simberloff and Cox 1987; Simberloff et al. 1992; Adams and Dove 1989; Duerdson et al. 1997). However, the literature indicates that the benefits of a connected landscape typically outweigh the potential negative effects of corridors, especially in urban environments (Soule at al. 1988; Beier and Noss 1998).

Effects of Urbanization on Wildlife Habitat

Urbanization has adverse impacts on each of the key attributes listed above, including:

- ***Loss of total wildlife habitat area***
- ***Loss of larger habitat patches and interior area***
- ***Fragmentation and loss of habitat connectivity and corridors***
- ***Reduction in habitat quality (e.g., through loss of canopy or understory, habitat disturbance, contamination and wildlife harassment), and***
- ***Alteration or conversion of one habitat type to another.***

Metro identified several main impacts of urbanization on wildlife habitat:

- ***Influx of non-native species***
  In natural ecosystems there are a number of biological, physical and environmental barriers that help prevent influx of non-native species such as land barriers and the presence of food that is unsuitable for introduced species (Parendes and Jones 2000; University of Washington, 1998). However, human disturbance can create conditions that allow non-native species to overcome such barriers (Witmer and Lewis 2001). Invasive species tend to respond positively to disturbance and often lack natural predators. The Portland metropolitan area already experiences significant impacts from non-native plant and animal species that are crowding, overtaking, and out-competing native species for food and habitat availability. Impacts from non-native insects are suspected but are relatively unstudied.

- ***Increased predation and competition***
  E.g., increases in small mammals that eat bird eggs and cat predation of birds and amphibians. Increases in edge habitat associated with urban development and habitat fragmentation provide additional opportunities for nest predation and parasitism by crows, jays, Brown-headed cowbirds, and European Starlings.

- ***Road impacts***
  E.g., loss of trees and vegetation, dispersal of exotic species, sediment and pollutants to streams, fragmentation of habitat, direct mortality impacts, and barriers to fish and wildlife movement. Wildlife species most at risk are those that avoid edge environments, occur in low densities, are unwilling or unable to successfully cross roads (e.g., amphibians), or that seek roads for heat (snakes) or food (owls) (Fleury and Brown 1997). Local data suggests that long-distance migratory bird species such as Black-headed Grosbeak and Common Yellowthroat are especially susceptible to road or other urban impacts (Hennings 2001).

- ***Recreational impacts***
  Protected open spaces can provide important opportunities for people to recreate and to connect with nature. However, recreation can also have negative impacts on wildlife and habitat such as vegetation trampling and disturbance from trails and roads, and harassment by domestic dogs. Some species are more or less sensitive to human disturbance. A number of bird species are particularly vulnerable during breeding season (Hennings 2001). Bats are sensitive to human disturbance during breeding and hibernation (Montana Chapter, The Wildlife Society 1999).

Science-based planning guidelines for wildlife habitat

Based on information from the literature, Metro produced the planning guidelines for upland wildlife habitat provided in the table below.

TABLE 3: METRO PLANNING GUIDELINES FOR UPLAND WILDLIFE HABITAT

Aquatic Habitat		
Guideline	**Explanation**	**Supporting literature**
Large patches are better than small patches, *and they should be round or square to reduce the amount of edge effect*	• Research shows that the edge effect ranges from 200-500 meters • Larger patches provide more interior habitat • Can support a larger number of individuals and a greater diversity of species • Can support a wildlife population for a longer time period • Provides greater opportunity for foraging and dispersal	Wilcove 1985; Forman and Godron 1986; Soulé 1991a; Bolger et al. 1997a; Duerkson et al. 1997; Fleury and Brown 1997; Germaine et al. 1998; Burke and Nol 1998; Environment Canada 1998
Small patches of unique habitat are worth saving	• Can retain unique vegetation communities • May provide "stepping stones" of habitat if in relatively close proximity, or in combination with habitat corridors • Can provide habitat for generalist and edge species • Especially important if near water resources	Soulé 1991a Dunning et al. 1992; Noss and Csuti 1997; Bolger et al. 1997a; Environment Canada 1998; Hennings 2001
Connectivity to other patches is important, *corridors should be as wide as possible, and it is cheaper to retain corridors than to create them after the fact*	• Can play a key role in maintaining ecosystem vitality and the survival of may species • Connected populations are more likely to survive over the long term • Allows populations to interbreed, maintaining genetic variability • Provides movement corridors for seasonal migration, finding better habitat, finding a mate, dispersal of post-breeding young, and escape routes	Adams and Dove 1989; Soulé 1991a Linehan et al. 1995; Lidicker and Koenig 1996; Bolger et al. 1997a; Clergeau and Burel 1997; Fleury and Brown 1997; Environment Canada 1998
Connectivity and/or proximity to water resources is valuable	• Habitat patches near water resources have increased diversity of wildlife • Most wildlife species use riparian areas for some aspect of their life history • Over 60 percent of mammals in the Northwest use riparian areas for breeding or feeding • Riparian corridors frequently serve as travel routes, especially in urban areas	Forman and Godron 1986; Environment Canada 1998; Hennings 2001; Kauffman et al. 2001
Buffers can help protect wildlife from human disturbance	• Surrounding land uses have an impact on the effectiveness of a habitat patch in providing functions and values to wildlife • People like to use natural areas and open space for recreation • A buffer zone allows for human use of a selected part of a habitat patch, while protecting wildlife from excessive disturbance	Adams and Dove 1989; Adams 1994; Nilon et al. 1994; Friesen et al. 1995; Linehan et al. 1995; Lidicker and Koenig 1996

3C. INVENTORY METHODOLOGY

The previous section summarizes the scientific literature review from which Metro's and the City's inventory methodologies are derived. The following section describes the actual inventory methodology, models and other tools that were developed to produce the inventories.

3C1. METRO'S INVENTORY METHODOLOGY

Based on the scientific literature, Metro developed GIS natural resource data and maps, and created GIS models to rank the relative value of the natural resource features as riparian corridors and wildlife habitat. Metro conducted fieldwork, and consulted with local, state and federal agencies, academic institutions and other organizations to identify key fish and wildlife species and habitats of concern.

3C1.1 Mapping and Ranking Riparian Corridors

Metro began mapping riparian corridors and wildlife habitat in early 2001. The first step was to collect and produce GIS data and maps of natural resource features such flood areas, lakes, wetlands, streams, forest canopy, steep slopes, woody vegetation, culverts, etc.

Metro found that neither the science nor the regulatory agencies provide guidelines for how to map and evaluate the value of riparian corridors. For example, the state's rule for compliance with Goal 5 defines a riparian corridor generally as a "…resource that includes the water areas, fish habitat, adjacent riparian areas, and wetlands within the riparian area boundary." The rule defines the riparian area boundary as an "imaginary line that is a certain distance upland from the top of bank" (OAR 660-23-090(1)).

Given this flexibility, Metro developed an innovative scoring system to map and evaluate the significance of riparian corridors based on the functions they provide. Specific GIS mapping and scoring criteria were developed for the following functions:

- Microclimate and shade
- Streamflow moderation and water storage
- Bank Stabilization, and control of sediment, nutrients and pollutants
- Large wood and channel dynamics
- Organic inputs

Metro developed a GIS model that assigned relative scores for riparian function based on specific criteria. Relative scores were based on the types of natural resource features present; the proximity to and/or distance from a river, stream, or wetland. "Primary" scores were applied to landscape features that provide the most direct and substantial contribution to a particular riparian function. Generally, the features that received primary scores included vegetated flood areas, wetlands located within ¼ mile of a stream, and forest or woody vegetation located adjacent to or near a stream (typically within 100 to 200 feet, although floodplains are often more extensive). Metro also assigned primary scores to low-structure vegetation for the water quality functions it provides within 100 from a stream (or 200 feet if in a steeply sloped area).

"Secondary" scores were assigned to features that provide lesser, but still important riparian functions based on Metro's review of the scientific literature. Secondary functional scores were typically assigned to vegetation that is contiguous to the primary functional area and extends to distances ranging from 170 feet to 780 feet from a river or stream. Maximum functional distances reflect factors such as vegetation type,

presence of steep slopes and the particular function being evaluated. Once the primary and secondary scores had been assigned, Metro ranked the region's riparian corridors by summing the individual functional scores. The highest possible score was 30 points (6 points for each of the five riparian functions).

In spring 2001, Metro tested this methodology in three parts of the region to ensure that the model results correlated with actual conditions. Satisfied with the results, Metro Council directed staff to produce riparian corridor maps for the entire region. After Metro's technical and policy committees reviewed the mapping approach and draft maps, Metro Council held a public hearing and approved the riparian corridor mapping criteria with proposed amendments. The most notable amendment was the Council's decision to downgrade the functional score assigned to developed floodplains from primary to secondary. Metro Council also deemed that all the riparian corridors receiving primary and/or secondary scores are regionally significant according to the provisions of the Goal 5 rule (described further below). (Metro Resolution No. 01-3141C).

After this initial endorsement, Metro revised the riparian corridor inventory several times before it was adopted as part of the Nature in Neighborhoods program in 2006. Revisions included correcting the maps and extending the inventory to include areas within one mile of Metro's jurisdictional boundary and potential urban growth boundary expansion areas.

3C1.2 Mapping and Ranking Wildlife Habitat

Metro designed a separate inventory methodology to map and rank the relative quality of wildlife habitat areas in the region. The regional wildlife habitat inventory design is based on the following assumptions:

- Large habitat patches are more valuable than small patches
- Interior habitat is more important to at-risk wildlife species than edge habitat
- Connectivity and proximity to other habitat patches is important
- Connectivity and proximity to water is important
- Unique or at-risk habitats deserve special consideration

Metro's produced a second GIS model to assess the relative value of wildlife habitat "patches" in the region. Habitat patches were not based on documented use by wildlife, but rather, were based on vegetation features that would be expected to support wildlife on a non-incidental basis. Metro defined two types of patches for the modeling exercise. "Type 1" habitat patches had to be at least two acres in size, and comprised of contiguous forest vegetation, wetlands, or a combination of forested area and wetlands. "Type 2" patches included shrubs and other low structure vegetation within 300 feet of streams and wetlands. Type 2 patches were meant to account for habitat connectivity riparian corridors, but were not valued as highly as the mapped forest or wetland areas.

Consistent with the science, Metro decided to evaluate relative habitat quality based on each of the following attributes:

- Habitat patch size
- Interior habitat area
- Connectivity between patches
- Connectivity of patches to water

Metro developed scoring criteria for each of these attributes, and combined the individual attribute scores to generate a 1 to 10-point overall wildlife habitat rank for each patch. In fall 2001, Metro tested the wildlife habitat model by conducting field assessments at randomly selected sites throughout the region. The model results were compared with the field results, confirming that the model provided a reasonable means to evaluate relative value of the patches.

Ultimately, Metro simplified the wildlife habitat rankings from the 10-point scoring system to an A, B, and C class ranking system. Metro also adjusted the model-generated inventory rankings as needed to incorporate Habitats of Concern (described in the next section).

3C1.3 Identifying Wildlife Species and Habitats of Concern

State of Oregon rules for compliance with Land Use Planning Goal 5 require local wildlife habitat inventories to contain information about threatened, endangered, and sensitive wildlife species and their habitats, sensitive bird sites, and any species or habitats of concern that are identified and mapped by the Oregon Department of Fish and Wildlife (ODFW) (OAR 660-023-0110 (3). Metro worked with local, state and federal wildlife habitat experts to develop vertebrate species lists and identify and map Habitats of Concern (HOCs) for the region. Metro created a comprehensive list of vertebrate species that typically occur in the region on a yearly basis. The species list reflected input from local wildlife experts, including the species-habitat associations developed by Johnson and O'Neil (2001). In addition, the list indicated the status of a species as threatened, endangered, or sensitive, and the relative importance of different habitat types for the different species.

The species list illustrated the region's biodiversity, identifying more than 290 known native vertebrate species occurring here. Ninety-three percent of the species listed use riparian areas, and eighty-nine percent of the terrestrial species in the region also use upland habitats.

Metro compiled species and habitat information, gathering data on sensitive species sighting locations, sensitive bird sites, and wildlife species and habitats of concern. Habitats of Concern, contain unique features or are of critical importance for particular wildlife species or functions. The HOCs include some important habitat areas that were not captured by the GIS Wildlife Model (e.g., open grassland areas on butte tops; key wildlife connectors).

Metro worked with agencies and wildlife experts to identify and map areas meeting one or more of the following criteria:

1. Vegetation patches identified as Priority Conservation Habitats by ODFW, USFWS, or other agencies or local wildlife experts. Priority Conservation Habitats include Oregon white oak savannas and woodlands, native prairie grasslands, wetlands and bottomland hardwood forests. Less than one percent of historic Willamette Valley native oak and grassland habitats still exists (World Wildlife Fund, 2001). Over 70 percent of the bottomland hardwood forests have been lost. In the Willamette Valley, between 40 and 70 percent of documented wetlands have been lost, with continuing losses of more than 500 wetland acres per year. *(Metro Habitat Inventory Report* Appendix 5: Riparian corridors and wildlife habitat GIS model criteria matrices, 2005)

2. Land cover identified by ODFW, USFWS or other agencies or local wildlife experts as a riverine island or delta important to wildlife. Riverine islands and deltas provide unique habitat for shorebirds, waterfowl, nesting terns and gulls, and other wildlife through enriched food resources,

sand and mudflats, and protection from predators and disturbance. Bald Eagles winter, breed and forage on islands in the Willamette and Columbia rivers. Channel complexity and large wood, which are linked to island formation, have been substantially reduced from historic levels.

3. Habitat areas that meet life-history requirements of sensitive, threatened or endangered wildlife species; habitat that supports at-risk plants; or habitats that support important wildlife functions, such as Great Blue Heron rookeries, elk migratory corridors and migratory bird stopover areas.

4. Grassy hilltops, inter-patch connectors, biologically or geologically unique areas (rocky outcrops or talus slopes) provide vital habitat for sensitive wildlife species and support at-risk plant species.

Metro mapped HOCs using existing GIS data, aerial photos and other information submitted by local agencies and wildlife experts. Preliminary HOC designations and maps were reviewed by Metro's Goal 5 Technical Advisory Committee and during public hearings process for the regional inventory. The Habitats of Concern were integrated with the wildlife habitat model results to produce a regional Wildlife Habitat map. Integrating the HOCs with the model results caused a minor expansion in inventoried wildlife habitat area and some changes in the wildlife habitat rankings. HOCs were assigned a Class A wildlife habitat or Class I riparian corridor/wildlife habitat designation which superseded lower rankings assigned by the model.

3C1.4 Resource Site Analysis

To comply with the state's rules for compliance with Goal 5, local jurisdictions must produce natural resource inventory information for individual resource sites. A "resource site" or "site" is defined as "…a particular area where resources are located. A site may consist of a parcel or lot or portion thereof or may include an area consisting of two or more contiguous lots or parcels." (OAR 666-23-010 (10)

Metro identified 27 resource sites based on groupings of watersheds and subwatersheds located wholly or partially within Metro's jurisdictional boundary. For each site, Metro identified:

- Named streams
- Communities (jurisdictions) within the site
- Total acreage within Metro's boundary
- Total acreage within riparian corridors (and by jurisdiction)
- Riparian resources (descriptions and relative value/ecological scores)
- Wildlife habitat resources (descriptions and patch scores; patch breakdowns by landcover type and known wetlands; habitat availability based on habitat types and species habitat associations per Johnson and O'Neil (2001))
- Species of concern
- Habitats of concern

Eleven of the regional resource sites are located at least partially within Portland, including:

Rock Creek/Tualatin River area
Site #7: Middle Rock Creek – Tualatin River subwatershed
Site #8: Beaverton Creek subwatershed

Lower Tualatin River
Site #12 Upper and Middle Fanno Creek subwatershed
Site #14 Lower Fanno Creek subwatershed

Johnson Creek
Site #18 Johnson Creek – Sunshine Creek subwatershed
Site #19 Kelley Creek subwatershed
Site #20 Middle Johnson Creek subwatershed
Site #22 Lake Oswego subwatershed
Site: #23 Tryon Creek subwatershed
Site #24 Johnson Creek – Crystal Springs Creek subwatershed
Site: #25 Mt. Scott Creek subwatershed

Scappoose Creek
Site #26 Lower Willamette River subwatershed
Site #27 Columbia Slough subwatershed

Although the scale of Metro's resource sites is considerably larger than the scale of Portland's existing resource sites, the regional information provides a useful reference for the City inventory update.

3C1.5 Determining Regional Significance

Metro concluded the regional inventory process by:

- Confirming that the regional inventory process meets state Goal 5 requirements for adequacy of the information; and
- Determining which of the inventoried resources are regionally significant.

Adequacy of the Information

According to the Goal 5 rules, the information contained in local natural resource inventories must address location, quantity and quality in order to be deemed "adequate." (OAR 660-023-0030) Metro addressed these factors as follows:

- **Location**
  To meet the location requirement, a local inventory must include a description or map for each resource site, sufficient to determine whether a resource exists. Precise locations need not be determined at this stage of the inventory process. Metro's regional inventory provides resource information at the tax lot level. Maps were reviewed and corrected based on input from property owners and other stakeholders.

- **Quantity**
  To address the quantity requirement, an inventory must estimate the relative abundance or scarcity of the resource for each resource site. Metro's regional inventory quantified natural resource features by site, including streams (miles), riparian corridors (acres) and wildlife habitats (acres).

- **Quality**
  To meet the quality requirement, an inventory must indicate resource value, by resource site, relative to other known examples of the same resource. Relative value may or may not reflect the actual condition of a natural resource feature. In other words, a resource could somewhat degraded but still receive a high relative value rating if it is in better condition than other local examples of the same resource. Metro's inventory mapping and ranking methodology (described in the previous section) produced a meaningful assessment of the relative ecological function and quality of the region's riparian corridors and wildlife habitat.

Resource Significance

If a local inventory meets the "adequacy" requirements, the Goal 5 rule requires local jurisdictions to determine if a resource site is "significant" based on location, quantity and quality of the resource (described above), and additional criteria pertaining to specific resource types (in this case riparian corridors and wildlife habitat). The city or county may consider any other criteria adopted by the local jurisdiction as long as they do not conflict with criteria in the rule. Resources that have been deemed significant must then be evaluated to determine if and how those resources should be protected by the local jurisdiction.

Metro first confirmed the ecological significance of inventoried riparian corridors and wildlife habitat based on the science. Metro then determined which of the ecologically significant riparian corridor and wildlife habitat areas are regionally significant.

Riparian corridors

For riparian corridors, Metro determined that all resources that received scores for riparian functional value should be considered ecologically significant. Metro points to the scientific literature in explaining this decision:

- To the maximum extent possible, all perennial, intermittent, and ephemeral streams should be protected from surrounding land use activities by a buffer (May 2000).

- Continuous buffers are more effective at moderating stream temperatures, reducing non-point source pollution, and providing better habitat and movement corridors for wildlife (Fischer et al. 2000).

- The temperature in streams is influenced by the condition of adjacent forest and also by upland conditions (Pollack and Kennard 1998).

- Riparian corridors are especially important along the small headwater streams that typically make up the majority of stream miles in any basin (Osborne and Kovacic 1993; Binford and Bucheneau 1993; Hubbard and Lowrance 1994; Lowrance et al. 1997; May et al. 1997A; Fischer et al. 2000).

Next, Metro staff and technical committees evaluated several approaches for determining which inventoried riparian corridors should be deemed significant. Ultimately, Metro determined that any ecologically significant riparian corridor is also regionally significant. Metro notes that this approach:

- Is consistent with the scientific literature
- Addresses resources at the watershed scale
- Fosters protection of hydrologic function
- Promotes connectivity between tributaries and larger rivers, groundwater and surface water, wetlands and floodplains, and fish and wildlife habitats and movement corridor
- Fosters protection of biological diversity
- Promotes restoration by recognizing riparian corridors that are currently degraded but are important to ecological functions
- Meets Goal 5 requirements and likely addresses Endangered Species Act requirements for listed salmonids

Wildlife habitat

Similarly, Metro deemed all wildlife habitat areas receiving a score greater than zero to be biologically significant based on the following rationale:

- The regional wildlife habitat mapping approach established minimum guidelines for inclusion in the inventory, including size and composition requirements (2-acre minimum and forest/wetland, respectively), and/or designation as a Habitat of Concern.
- An inclusive approach reflects the proven importance of connectivity across the landscape as a basic component of functioning wildlife habitat.
- The mix of factors used to construct the wildlife habitat inventory (patch size, interior area, and connectivity), provide a regional "backbone" of habitats that could potentially support healthy, productive and diverse wildlife populations.

Before deciding which of the inventoried wildlife habitat areas should be deemed significant, Metro staff and technical committees evaluated the options to ensure that the determination would:

- Meet Goal 5 requirements
- Meet the goals in the Metro's Vision Statement for the fish and wildlife habitat planning effort
- Support the goals in the Oregon Department of Fish and Wildlife, Wildlife Diversity Plan
- Be consistent with the scientific literature
- Apply an ecosystem approach
- Promote sensitive species/habitat conservation
- Promote maintenance of existing connectivity
- Maximize restoration potential

After evaluating several options, Metro Council determined that all but the lowest-ranked wildlife habitats are regionally significant. The lowest-ranked habitats consisted primarily of small, isolated and/or linear patches in developed areas (e.g., street trees in areas like Portland's Ladd's Addition and Eastmoreland neighborhoods). Metro Council noted that these types of areas could provide locally significant habitat, and recommended that cities and counties consider these areas when developing local protection programs.

3C1.6 Creating A Combined Regional Inventory Map

After determining the significance of riparian corridors and wildlife habitat, Metro produced a single inventory map by combining both inventories.

The final combined regional significance rank categories included:

Class I Riparian/Wildlife Habitat Resources
Class II Riparian/Wildlife Habitat Resources
Class III Riparian/Wildlife Habitat Resources
Class A Wildlife Habitat Resources
Class B Wildlife Habitat Resources
Class C Wildlife Habitat Resources

Where the Class I, II, and III ranked areas overlapped with the Class A, B, and C ranked areas, AND where the two ranks differed, Metro used the higher of the two for the combined rank.

Metro identified "impact areas" adjacent to significant riparian corridors and wildlife habitat. They are intended to represent areas where land uses and development could have an adverse impact on the significant resources. Metro did not assign the impact areas relative ranks or regional significance.

3C1.7 Adopting The Regional Inventory

Metro's inventory includes 89,682 acres of regionally significant riparian corridors and 56,979 acres of wildlife habitat in the region. Combined, the total acreage in the regional inventory is approximately 146,661. Of the total resource area included in the regional inventory, 23,899 acres are located within Portland. The inventory was used as a basis for identifying and evaluating potential programmatic approaches to protect, conserve and restore the riparian corridors and wildlife habitat identified in the regional inventory.

In September 2005, the Metro Council adopted the regional inventory as part of the new "Nature in the Neighborhoods" program. Program requirements were established through the adoption Title 13 of the Urban Growth Management Functional Plan (September 29, 2005, Metro Ordinance 05-1077C). Title 13 establishes a regional baseline level of protection for identified resource areas. Prior to adoption, Metro evaluated different program options using the Economic, Social, Environmental and Energy (ESEE) Analysis process required for compliance with State Land Use Planning Goal 5. After completing the ESEE Analysis, the Metro Council decided to apply the regional program requirements only to inventoried Class I and II riparian corridors/wildlife habitat areas. Metro also applied regional requirements to Class A and B wildlife habitats that will be brought into the Urban Growth Boundary after the program goes into effect. Metro calls the areas to which the Title 13 provisions apply "Habitat Conservation Areas."

In making these decisions, Metro established regional program requirements for Class III Riparian Areas or Class A, B, or C Wildlife Habitat resources within the UGB that existed at the time of program adoption. Metro also exempted four marine terminal sites along the Willamette River in Portland from the Title 13 requirements, determining that from a regional perspective the economic value of the terminals outweighs the benefits of protecting natural resources on these sites.

The Metro Council agreed to establish incentives to promote voluntary resource protections for natural resources not addressed by Title 13. For example, Metro promised to pursue a regional bond measure to purchase important natural resources. This commitment was realized with the passage of Ballot Measure 26-80 in November 2006. In addition, Metro established a grants program and is providing "habitat friendly development" technical assistance to residential, commercial and industrial developers.

In October 2006, the Oregon Land Conservation and Development Commission found that Metro's program meets the state requirements of Goal 5, and augments the region's existing requirements to meet Goal 6 Air, Water and Land Resource Quality (found in Title 3 of the Urban Growth Management Functional Plan). The program was officially acknowledged through a final order signed on January 5, 2007 (Oregon LCDC Order 06-ACK-001713)

Cities and counties within Metro's jurisdiction must, by January 2009, demonstrate that their local programs meet Title 13 requirements. Local programs to protect Habitat Conservation Areas may include regulatory and/or non-regulatory components, and may include more stringent provisions than required by Title 13. Title 13 recognizes that some localities, including the City of Portland, have already established programs to protect significant natural resources. Title 13 restricts local jurisdictions from taking actions that would weaken existing state-approved Goal 5 programs.

3C2. PORTLAND'S INVENTORY METHODOLOGY

The previous section outlines the approach Metro took to produce the regional inventory on which the new City inventory is based. The following section describes the methodology the Bureau of Planning has implemented to develop the new citywide inventory of riparian corridors and wildlife habitat.

Relying on the science and Metro's general methodology, the Bureau of Planning completed the following steps to produce the new inventory information for Portland:

1. Assembling GIS data for key natural resource features
2. Developing GIS models to rank and map the relative quality of Portland's riparian corridors and wildlife habitat areas
3. Updating regional species lists and designating Special Habitat Areas
4. Assigning "relative ranks" to riparian corridors and wildlife habitat areas
5. Technical Review Process
6. Quality Control – Quarter-Section Assessments
7. Determining Resource Significance

As these steps were completed the Bureau made a number of updates and refinements to the regional inventory, including:

- Upgrading the landscape feature data
- Honing the regional mapping criteria
- Localizing the regional species lists
- Updating regional Habitats of Concern and designating local special habitat areas (or SHAs)

The refinements are intended to:

- Increase the level of detail of the inventory maps;
- Improve clarity and transparency of the inventory process;
- Enhance mapping accuracy and consistency;
- Integrate new Portland-specific conditions and functions; and
- Enable the city to update the inventory regularly and cost-effectively over time.

3C2.1 Step 1: Assembling GIS Data For Key Natural Resource Features.

The City inventory methodology is integrally tied to the role of key natural resource features on the ground. Thus, the quality of the City inventory will be a direct reflection of the quality of the GIS data for streams, wetlands, floodplains, vegetation and topography in Portland. To improve the level of detail and accuracy of the regional data, the Bureau of Planning invested considerable effort to produce new data for streams, vegetation and flood areas in the city. See Appendix 6: Mapping Protocols for a description of updating feature data.

Streams – The Bureau conducted an extensive stream remapping effort between 2002 and 2004. The Bureau worked closely with other City bureaus to ensure that the new stream data could be used by the City as a whole. The remapping process involved reviewing the most recent aerial photos and other data sources, and conducting more than 160 site visits to confirm the existence and location of points along streams (using GPS units where feasible to locate points along the drainages).

The updated stream data include more than 180 miles of remapped stream centerlines and about 86 miles of newly mapped streams or stream segments in the city. Products also included improved mapping of stream/stormwater pipe connections. Many of the newly mapped streams are located in the headwater areas of Portland's watersheds. These headwater areas, including intermittent streams, provide critical watershed functions relating to system hydrology, water quality and temperature, and aquatic and terrestrial ecosystems (Meyer, J.L. et al 2003). The stream remapping project report can be accessed on-line at http://www.portlandonline.com/planning. The Bureau submitted the updated stream data to Metro in 2003 for inclusion in the regional inventory.

Vegetation – Vegetation mapping was carried out between 2004 and 2006. The Bureau of Planning produced new GIS vegetation data and maps for Portland using current aerial photographs and targeted site visits. The Bureau selected a minimum vegetation mapping unit of ½ acre to provide more detail than the vegetation data (which used a one acre minimum mapping unit). Like Metro, city-mapped vegetated areas may contain mixes of native, non-native and invasive plant species. In addition, because the region is so large, Metro was able to

classify the different vegetation types (other than forest) only within 300 feet of streams. The Bureau of Planning updated the classification of different vegetation types (forest, woodland, shrubland and herbaceous) and extended the classification to a distance of ¼ mile from mapped streams, environmental zones and regionally significant resource areas. The Bureau used the National Vegetation Classification System (NVCS) which allowed this data to be merged with existing vegetation information produced by the Bureau of Parks and Recreation for the City-managed natural areas.

Flood Area – The Bureau of Planning has continued to update the City flood area data for use in the inventory. The Bureau has incorporated the 2004 FEMA 100-year floodplain and information from the Port of Portland and others regarding alterations to the floodplain.

The GIS layers used to develop the updated inventory information is presented in the following table.

TABLE 4: NATURAL RESEOURCE INVENTORY GIS IMODEL DATA INPUTS

Natural Resource Feature(s)	Description	Lineage	Online Reference
Rivers and major streams (Willamette River, Columbia River, Johnson Creek, Columbia Slough)	Regional streams, rivers, lakes, ponds and other surface water features. Only features large enough to be visible on aerial photographs were mapped (more detailed stream information is available as centerlines).	Updated from original Metro dataset by City of Portland, Bureau of Planning, to refine geometry, remove erroneously mapped water bodies, and add missing water bodies.	GIS data metadata: http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52070&Db_type=sde&City_Only=False
Streams and drainageways	Regional stream centerlines.	Updated from original Metro dataset by City of Portland, Bureau of Planning, to refine stream centerline geometry, remove erroneously mapped streams, add missing stream centerlines, and route the stream dataset through the City of Portland sewer and stormwater network.	Stream mapping project description: http://www.portlandonline.com/shared/cfm/image.cfm?id=106049 GIS data metadata: http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52071&Db_type=sde&City_Only=False
Wetland	National Wetland Inventory (NWI) with revisions made by local governments in the tri-county region.	Portland wetlands are updated from the original Metro dataset by City of Portland, Bureau of Planning to refine geometry, remove erroneously mapped wetlands, and add missing wetlands.	GIS data metadata: http://www.portlandonline.com/ cgis/metadata/viewer/display.cfm? Meta_layer_id=52608&Db_type=sde &City_Only=False
Flood area	The combination of the modified FEMA 100-year floodplain and the 1996 flood inundation area.	The 100-year floodplain was originally delineated by the Federal Emergency Management Association (FEMA).Digitized by the Portland Office of the Army Corps of Engineers using by registering the flood plain maps to USGS 7.5 minute quadrangle maps. The floodplain has been modified based on local input by the City of Portland and Metro to remove areas that meet FEMA standards for removal from the floodplain. The 1996 flood inundation area was digitized by the Army Corps of Engineers using aerial photos taken during the February 1996 flood. The flood area is not registered to taxlot base maps.	100-year floodplain GIS data metadata: http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52128&Db_type=sde&City_Only=False 1996 flood GIS data metadata: http://geode.metro-region.org/metadata/display.cfm?Meta_layer_id= 2056&Db_type=rlislite
Vegetation	Vegetation patches larger than 1/2 acre. Vegetation patches area classified as forest, woodland, shrubland, or herbaceous. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland.	Created and maintained by the City of Portland, Bureau of Planning. Based on information from reference data sources including aerial photos, City of Portland Parks and Recreation "natural area assessments," and vegetation surveys along the banks of the Willamette and Columbia rivers.	Vegetation mapping project description: http://www.portlandonline.com/shared/cfm/image.cfm?id=106047 GIS data metadata: http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52135&Db_type=sde&City_Only=False
Steep slopes	Areas with a slope equal to or greater than 25 percent (12 degrees)	Slope was mathematically derived by Metro from USGS 10' contours using GIS software. The resulting dataset was "smoothed" to remove the "sawtooth" edges.	GIS data metadata: http://geode.metro-region.org/metadata/display.cfm?Meta_layer_id= 358&Db_type=rlislite

3C2.2 Step 2: Developing GIS Models To Rank And Map The Relative Quality Of Portland's Riparian Corridors And Wildlife Habitat Areas.

Like Metro, the City has developed GIS modeling tools to evaluate the relative quality of the riparian corridor and wildlife habitat in Portland. The City inventory models are comprised of the same general modeling approach that Metro developed for the regional inventory.

Riparian Corridor Model

The City riparian corridor model assigns scores to natural resources for each of the riparian functions:

- **Microclimate and shade –** Open water bodies, wetlands, and surrounding trees and woody vegetation are associated with localized air cooling and increased humidity.
- **Bank function and control 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.
- **Stream flow moderation and flood storage –** Waterways and floodplains provide for conveyance and storage of streamflows and floodwaters, while trees and vegetation intercept precipitation and promote infiltration which tempers streamflow fluctuations or "flashiness" that often occurs in urban watersheds.
- **Large wood and channel dynamics –** Streams, riparian wetlands, floodplains and large trees and woody vegetation contribute to the natural changes in location and configuration of stream channels over time.
- **Organic inputs, food web and nutrient cycling –** Water bodies, wetlands and nearby vegetation provide food for aquatic species (e.g., plants, leaves, twigs, and insects) and are part of an ongoing chemical, physical and biological nutrient cycling system.
- **Wildlife habitat/corridors –** Vegetated corridors along waterways, and between waterways and uplands, allow wildlife to migrate and disperse among different habitat areas, and provide access to water.

As noted in the Scientific Foundation Section above, riparian functions occur within certain distances of streams and wetlands depending on the type and extent of the features present. The riparian corridor model assigns primary and secondary scores to landscape features depending on how close the feature is to a river, stream, drainageway 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, riparian functions. Consistent with Metro, the City assigns riparian functional scores to land within 50 feet of a river, stream or wetland regardless of land cover. The predominance of riparian functions occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body. However, some functions can occur up to several hundred feet from a water body. Locations where at least one primary-scoring feature exists receive a primary score for that function. Table 5 summarizes the criteria the City is using to score and map riparian corridor functions in Portland.

Within the City, natural resources generally reflect the impacts of urbanization; however, the resources still provide important riparian and wildlife habitat 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 varied wildlife food source and effective slope stabilization. However, non-native plants still provide critical watershed functions such as water storage and nutrient cycling. Other examples of the affects 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 experience some degradation but still provides provide important functions such as water conveyance and storage, and fish and wildlife habitat.

Refining Metro's Riparian Corridor Model

The criteria summarized in Table 5 reflect some refinements to the criteria Metro used to map riparian corridors across the region. The City riparian corridor model uses the same criteria framework Metro developed for the regional inventory. However, some of the regional criteria specifications have been revised to:

- **Recognize the riparian functions provided by rivers, streams, and wetlands.** The City assigns riparian functions directly to these features explicitly, while Metro incorporated the features by assigning function to the land, vegetation, and flood areas around them. To better reflect existing conditions in the North and Central reaches of the Willamette River, secondary scores are assigned for river bank function and control of sediments, nutrients, and pollutants.

- **Recognize beaches as part of the Willamette River channel.** Beaches are dynamic features in the Lower Willamette River, inundated daily and seasonally; and because of this direct relationship with the river, it is appropriate to consider beaches as part of the river channel itself.

- **Narrow the functional scoring and broaden the secondary scoring functions attributed to riparian wetlands and vegetation adjacent to or near wetlands.** The City inventory reduces the distance from a stream within which a wetland must be located in order to receive a primary score for certain functions. The City inventory broadens the array of secondary functions attributed to vegetation near wetlands.

Technical reviewer comments:

" Wetlands, even away from a stream channel, affect nutrient processing, microbial production, etc. The hydrologic connection between streams and wetlands is not always apparent from the surface topography." Nancy Munn, NOAA/National Marine Fisheries Service, June 21, 2006

" Adjacent riparian areas may even be more important to the adequate functioning of a wetland than they are for streams…I question whether 150' is adequate, but certainly I would think this is at least minimally needed for a wetland." Dr. Alan Yeakley, PSU, July 16, 2006

" I still have concerns specifically with wetlands that are not hydrologically connected to streams or rivers even during overbank flows in the stream…If the wetlands are not hydrologically connected to the stream, then there is no pathway for large wood to recruit to the stream." Paul Fishman, SWCA, June 12, 2006

- **Reflect more variability in the riparian functions provided by different types of vegetation.** The City refined the vegetation mapping to classify vegetation patches as natural/semi-natural or cultivated as part of the Willamette River Natural Resource Inventory update. Cultivated vegetation is narrowly defined as landscaped, highly manicured, intensely managed (e.g. mowed) vegetation and generally includes lawn and common areas, golf courses, parks and rights-of-way. This refinement recognizes that cultivated vegetation does not provide the same level of resource functions as more natural vegetation types. In some cases cultivated vegetation can have a negative impact on natural resource functions, such as when fertilizers and pesticides are applied and run off into local waterways. The City's inventory applies a lower score to cultivated woodland and shrubland vegetation for riparian functions associated with bank function, and sediment, pollution and nutrient control; and organic inputs, food web and nutrient cycling, Such

refinements may be undertaken for parts of the City other than the Willamette Corridor if the data and science support additional differentiation. The City inventory distinguishes more closely between the functions provided by different vegetation types than was done for the regional inventory. In Portland, relatively little natural or unmanaged grassland areas remain. Much of the herbaceous vegetation consists of lawn, cultivated turf grass, or landscape groundcover in developed areas with compacted soils. (City of Tacoma, 2003) It is assumed that throughout the Metro region there are more areas comprised of meadow, grassland, and agricultural fields, as well as urban landcover types. While lawns can help slow and filter runoff, stabilize banks, and provide wildlife corridors, they function at a lower level than healthy stands of trees, woody/shrubby vegetation, and more natural or complex grasses or groundcovers. Further, lawns located near streams contribute more runoff than wooded areas and the runoff can be laden with pollutants such as fertilizer nutrients and pesticides. (USGS, 2003) The City inventory reflects these functional differences by assigning lower relative ranks to riparian herbaceous vegetation than the ranks assigned by the regional model. Depicting more variation in riparian corridor functions will better inform future management decisions relating resource protection, land acquisition, restoration and public education.

Technical reviewer comments:

" I support ascribing a lower functional value to lawns … given their potential negative contributions (e.g., pesticides, nutrients, bacteria)." Karen Font Williams, Oregon Dept. of Environmental Quality, June 13, 2006

" While … there may be concern over the proposal to assign a secondary score to herbaceous vegetation for bank stabilization, sediment, pollution, and nutrient control, I agree that it is appropriate for the City of Portland. Quality low structure vegetation outside of forest and shrub areas in the City is pretty rare and does mostly consist of lawn or graveled and weedy areas." Tom McGuire, Adolfson and Associates, June 12, 2006

" … I agree, particularly in relation to lawns, while also recognizing that non-lawn herbaceous veg (sic) can provide effective functions in some situations …" Paul Fishman, SWCA, June 12, 2006

" … concur that herbaceous vegetation provides lesser value than riparian forest for water quality and hydrologic function … these areas are important for restoration and enhancement, and should be recognized as such even though current conditions are degraded and highly modified …" Susan Barnes/ Patty Snow, Oregon Department of Fish and Wildlife, June 21, 2006

" My concern is whether by taking this approach the restoration potential of a site is lost." Mike Houck, Urban Greenspaces Institute, July 12, 2006

" … lawns and unmanaged herbaceous areas have very different hydrological and water quality signals. I believe they should be separated into distinct classes." Dr. Alan Yeakley, PSU, July 16, 2006

- **Recognize how the management activities of drainage districts affect riparian function.** The City inventory includes additional riparian corridor mapping criteria that apply only to areas managed by local drainage districts. The Multnomah County Drainage District (MCDD) manages an extensive system of pumps and levees to control the rates and the elevations of water in the upper and middle Columbia Slough and associated waterways. Without pumping, the area would be flooded causing extensive damage to local industries, businesses and residents. The drainage district also routinely removes large wood to maintain channel conveyance capacity. While riparian corridors within drainage districts continue to provide important water quality and fish and wildlife habitat functions, these management activities eliminate floodplain functions and restrict natural channel dynamics. The City inventory reflects these impacts by assigning lower relative ranks to riparian corridors within a drainage district for functions relating to flood storage and channel dynamics. The proposed mapping criteria refinements more accurately reflect MCDD's management of flow levels to prevent flooding and also of the channels themselves to maintain conveyance, including the regular removal of large wood to maintain adequate flow conveyance capacity. MCDD agrees with the City's proposal to modify criteria relating to hydrology and channel dynamics without modifying criteria relating to other riparian functions (e.g., pollution and sediment control, microclimate and shade, wildlife habitat). By reflecting these local differences, the City inventory can educate citizens and stakeholders about the important and unusual role of drainage districts, and to help tailor local planning and restoration efforts for the Columbia Corridor.

- **Reflect the extent of bank hardening and vegetation removal in the North and Central Reaches of the Willamette River.** The land within 50 feet of the Willamette River in the North and Central Reach has been significantly altered by bank hardening and other development. The riparian model was refined to assign a secondary score to hardened, non-vegetated land within 50 feet of the Willamette River North and Central Reach for river bank functions, sediment, pollution and nutrient control; and large wood and channel dynamics.

- **Large wood recruitment from forest vegetation located on steep slopes.** Forest vegetation that is located further from a stream or river has the potential to contribute large wood to the waterway when it is located on steep slopes. The City refined the riparian model by limiting the assignment the secondary score for Large Wood and Channel Dynamics only to forest vegetation located on slopes greater than 25% (applies to vegetation 150 – 260 feet from a river or stream).

- **Use more comprehensive topography data to address the water quality benefits provided by vegetation on steep slopes** The City inventory uses local data for steep slopes instead of Metro's regional "break-in-slope" data to map the water quality functions of vegetation on steep slopes. This approach helps address significant gaps in the regional data for areas surrounding recently mapped streams.

TABLE 5: CITY OF PORTLAND RIPARIAN CORRIDOR MODEL CRITERIA

Microclimate and Shade

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
Forest or dense trees 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 or dense trees contiguous to and within 100 feet of a river, stream or wetland	1, 2	Forest or dense trees contiguous to primary forest vegetation and within 780 feet of a river, stream or wetland	1, 2
----		Woodland vegetation contiguous to and within 100 feet of a river, stream or wetland	1, 2
----		Shrubland vegetation contiguous to and within 50 feet of a stream or wetland	1, 2

Stream Flow Moderation and Water Storage

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
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
----		Forest or dense trees, woodland or shrubland vegetation within 300 feet of a river, stream or wetland	1, 2
----		Forest or dense trees contiguous to flood area or starts within 300 feet of a river, stream or wetland, and extends up to 780 feet of a river, stream or wetland	1, 2
----		Herbaceous vegetation within 100 feet of a river, stream or wetland	1, 2

Bank Function, and Sediment, Pollution and Nutrient Control

	Primary Feature:	Footnotes		Secondary Feature:	Footnotes
1	River, stream/drainageway or wetland (except Willamette River North and Central Reach)	2, 5	1	Willamette River North and Central Reach	5
2	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	2	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
7	Forest, woodland or shrubland vegetation within the flood area (except within a drainage district)	3, 4	6	Herbaceous vegetation within the flood area (except within a drainage district)	3, 4
5	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
3	Forest, woodland or shrubland vegetation outside a flood area, between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2	4	Herbaceous vegetation outside the flood area, and between 50 feet and 100 feet of a stream/drainageway or wetland	1, 2
6	Where the slope is at least 25%: Forest and natural/semi-natural woodland or shrubland vegetation that is outside the flood area, and is between 100 feet and 200 feet of a river	1, 6, 8		----	
4	Where the slope is at least 25%: Forest, woodland or shrubland vegetation that is outside the flood area, and is between 100 feet and 200 feet of a stream/drainageway or wetland	1, 2	3	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
	----		5	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

TABLE 5 (CONTINUED): CITY OF PORTLAND RIPARIAN CORRIDOR MODEL CRITERIA

Large Wood and Channel Dynamics

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
1 River (including Willamette and Columbia River beaches) or stream/drainageway	2, 5	----	
2 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	----	
4 Forest vegetation within 50 feet of a river in the Willamette River North Reach and Columbia River surrounding Hayden Island		1 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	
7 Forest vegetation within the flood area (except within a drainage district)	3, 4	5 Woodland, shrubland or herbaceous vegetation within a flood area (except within a drainage district)	3, 4
5 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	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
----		2 Within a drainage district, forest vegetation that is contiguous to and within 150 feet of stream/drainageway	1, 4
6 Forest that is contiguous to and within 150 feet of a wetland that is located completely or partially within the flood area or 150' of a river or stream (except within a drainage district)	1, 2, 3, 4	3 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
3 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	----	

Organic Inputs, Food Web and Nutrient Cycling

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
Flood area with forest or dense trees and natural/semi-natural woodland or shrubland vegetation (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 or dense trees and natural/semi-natural woodland or shrubland vegetation within 100 feet of a river	1, 2, 6	Forest or dense trees and natural/semi-natural woodland or shrubland vegetation that is contiguous to primary vegetation and is within 170 feet of a river	1, 2, 6
----		Cultivated woodland or shrubland vegetation within 100 feet of a river	1, 2, 6, 8
Forest or dense trees, woodland or shrubland vegetation within 100 feet of a stream or wetland	1, 2	Forest or dense trees, woodland or shrubland vegetation that is contiguous to primary vegetation and within 170 feet of a stream or wetland	1, 2

Riparian Wildlife Movement Corridor

Primary Feature:	Footnotes	Secondary Feature:	Footnotes
River, stream/drainageway or wetland	2, 5	----	
Vegetation that is contiguous to and within 100 feet of a river, stream or wetland	1, 2	Vegetation that is contiguous to primary vegetation and within 300 feet of a river, stream or wetland	1, 2

Footnotes:

1 All search distances are measured from either a) the edge of the mapped water body, or b) the stream/drainageway centerline.

2 "Wetland" refers to all mapped regional wetlands fully or partially within 1/4 mile of a river or stream/drainageway, unless otherwises specified.

3 "Flood area" is comprised of the combined FEMA 100-year floodplain (2004), the adjusted 1996 flood inundation area, and additional adjustments to reflect more recent permitted activities affecting site elevation.

4 Portland-area drainge districts: Peninsula Drainage District #1, Peninsula Drainage District #2, and Multnomah County Drainage District #1.

5 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.

6 Data classifications that differentiation between natural/semi-natural and cultivated vegetation has been assigned for the Willamette River Corridor only.

7 Hardened 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.

8 Criteria relating to natural, semi-natural and cultivated vegetation are currently applied only to the Willamette River corridor and to flood area. Criteria made be modified, if warranted, in the future during area-specific planning efforts.

Wildlife Habitat Model

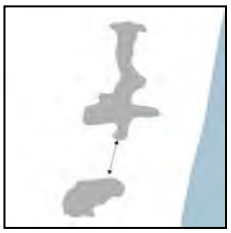
The City wildlife habitat model assigns scores of high, medium, or low to mapped habitat patches. Patches are defined as areas of forest vegetation and/or wetlands, at least two acres in sizes, plus adjacent woodland vegetation. Scores area assigned for each of the following attributes:

- **Habitat patch size –** Low: 2 to 30 acres in size; Medium: 30 to 585 acres; High: at least 585 acres in size.
- **Habitat interior area** (area net 200 ft. internal buffer) **–** Low: 2 to 15 acres; Medium: 15 to 500 acres; High: at least 500 acres.
- **Connectivity between habitat patches –** Low: index value less than 30; Medium: index value between 30 and 100; High: index value at least 100 (based on Fragstats 3.3. "Proximity index" measures relative size and distance between patches).
- **Connectivity/proximity to water –** Habitat patches located close to water are valuable to wildlife survival. Scoring criteria: Low: less than 25% of patch is w/in 300 feet; Medium: between 25% and 75% of patch is w/in 300 feet; High: at least 75% of patch is w/in 300 feet of a river, stream, or wetland.

Scores for each of the four habitat patch attributes are combined to produce an overall relative rank of High, Medium or Low for each wildlife habitat patch. For example, a small patch could receive low ranks for size and interior area, but could receive higher rank if located close to other patches or water.

HABITAT PATCH SIZE

PATCH SHAPE/INTERIOR AREA



CONNECTIVITY BETWEEN PATCHES

PROXIMITY TO WATER

Like within the riparian corridors, habitat patches generally reflect the impacts of urbanization. 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 source. However, non-native plants still provide important watershed functions including cover and nesting opportunities. Other examples of the affects 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 experience some degradation but still provides provide important functions such as fish and wildlife habitat.

Refining Metro's Wildlife Habitat Model

These wildlife habitat scoring criteria also reflect refinements to the Metro's regional habitat scoring criteria. The City's refinements to the wildlife habitat model include:

- Includes woodland vegetation in habitat patches. Wildlife habitat patches addressed by the regional inventory were comprised of forest vegetation and wetlands only. Given the availability of more detailed vegetation for Portland, the Bureau of Planning consulted with wildlife experts and determined it would be appropriate to also include woodland vegetation that is adjacent to the core forest/wetland patches.

- Correlates more directly to Portland habitat attributes and reflects recent local research. The thresholds that Metro used to assign scores for habitat patch size, interior habitat area, and connectivity were based on the characteristics of habitat patches throughout the region. Given the urbanized character of Portland's watersheds, the Bureau of Planning revised the scoring thresholds to correlate more closely with the characteristics of habitat patches in the City. The Bureau relied on additional scientific literature, including local research, to develop the scaled scoring thresholds (Murphy, M. T. (Principal Investigator), Bailey, D.C.; Lichti, N., and Roberts, L.A., 2005). Some habitat patch ranks will change as a result of changes in the criteria. For example, the Oaks Bottom Wildlife Refuge and Ross Island were assigned low ranks for habitat patch size in the regional inventory. Applying the City's criteria these sites received a medium rank for patch size. Similarly, the Bureau revised the regional connectivity criteria to correlate to the location and configuration of wildlife habitat patches located in the City.

Technical Reviewer comments:

"Good rationale. Great to see PSU's research being applied to real on-the-ground issues." Jennifer Thompson, US Fish and Wildlife Service, June 8, 2006

"Overall this change appears very sound … My one concern is with the 2-acre minimum at the low end… some species of native flora and fauna may yet thrive in smaller patches …" Dr. Alan Yeakley, PSU, July 16, 2006

The City's riparian corridor and wildlife habitat scoring criteria are presented verbatim in Tables 6 and 7. A comparison with the original Metro criteria is provided in Appendix 1.

TABLE 6: CITY OF PORTLAND WILDLIFE HABITAT MODEL CRITERIA

Habitat Patch Size[1]		
High Value (3 points) 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.	**Medium Value (2 points)** 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.	**Low Value (1 point)** 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 Area[2]		
High Value (3 points) 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.	**Medium Value (2 points)** 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.	**Low Value (1 point)** 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.
Connectivity to Other Patches[3]		
High Value (3 points) Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area comprised of forest vegetation and/or wetland is at least 2 acres, and the patch proximity index value is 100 or more.	**Medium Value (2 points)** Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area comprised of forest vegetation and/or wetland is at least 2 acres, and the patch proximity index value is at least 30 and less than 100.	**Low Value (1 point)** 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.
Connectivity to Water[4]		
High Value (3 points) 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.	**Medium Value (2 points)** 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.	**Low Value (1 point)** Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area comprised of forest vegetation and/or wetland 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 woodland vegetation adjacent and contiguous to the core forest/woodland patch 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' from the edge of that portion of the patch.

3 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 spec

4 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 co

3C2.3 Step 3: Species Lists and Special Habitat Areas

Updating Regional Species Lists

To support the City natural resource inventory update effort and watershed planning activities, the Bureau of Environmental Services (BES) worked with local and regional wildlife experts to update the regional fish and wildlife (vertebrate) "special status" fish and wildlife species lists for Portland. The City lists have been culled to remove species that would not be expected to occur in Portland. The lists also indicate the status of species as designated by the U.S. Fish and Wildlife Service, the Oregon Department of Fish and Wildlife, the Oregon Natural Heritage Information Center, the Oregon Watershed Enhancement Board, and Partners in Flight. The updated Portland species lists are summarized in Table 8. For the complete list of special status fish and wildlife species, refer to Appendix 2.

TABLE 7: SPECIAL STATUS FISH AND WILDLIFE SPECIES IN PORTLAND

Birds		Fish	Amphibians	Reptiles	Mammals
Wood Duck	Common Yellowthroat	River Lamprey	Clouded Salamander	Western Painted Turtle	White-footed Vole
Great Blue Heron	Bald Eagle	Pacific Lamprey	Northern Red-legged Frog	Northwestern Pond Turtle	Red Tree Vole
Short-eared Owl	Yellow-breasted Chat	Oregon Chub			American Beaver
American Bittern	Bullock's Oriole	Chum Salmon			Townsend's Big-eared Bat
Bufflehead	Varied Thrush	Coho Salmon			Silver-haired Bat
Swainson's Hawk	Loggerhead Shrike	Steelhead			Hoary Bat
Green Heron	Thayer's Gull	Sockeye Salmon			Northern River Otter
Dunlin	Hooded Merganser	Chinook Salmon			California Myotis
Western Sandpiper	Red Crossbill				Long-eared Myotis
Purple Finch	Long-billed Curlew				Fringed Myotis
Swainson's Thrush	American White Pelican				Long-legged Myotis
Brown Creeper	Downy Woodpecker				Yuma Myotis
Vaux's Swift	Red-necked Grebe				Western Gray Squirrel
Common Nighthawk	Vesper Sparrow				Camas Pocket Gopher
Northern Harrier	Sora				
Band-tailed Pigeon	Purple Martin				
Olive-sided Flycatcher	Bushtit				
Western Wood-Pewee	Rufous Hummingbird				
Black-throated Gray Warbler	White-breasted Nuthatch (Slender-billed)				
Hermit Warbler					
Yellow Warbler	Chipping Sparrow				
Pileated Woodpecker	Western Meadowlark				
White-tailed Kite	House Wren				
Pacific-slope Flycatcher	Winter Wren				
Hammond's Flycatcher	Orange-crowned Warbler				
Willow Flycatcher (Little)	Nashville Warbler				
Streaked Horned Lark	Hutton's Vireo				
Merlin	Red-eyed Vireo				
Peregrine Falcon	Wilson's Warbler				
American Kestrel					

The City has also developed a list of special status plant species that are found in Portland. The list includes plant species that have been assigned a special status designation by U.S. Fish and Wildlife Services, Oregon Department of Fish and Wildlife, Oregon Natural Heritage Information Center, or City of Portland Bureau of Parks and Recreation. The City's plant species (common name) list includes:

Howell's bentgrass	Tall bugbane	Salt heliotrope	Toothcup
Grand redstem (loosestrife family)	Mountain lady's-slipper	Holy grass	Pale bulrush
Northern wormwood	White rock larkspur	Howellia	Sierra mock-stonecrop
Texas bergia	Nuttall's larkspur	Howell's montia	White-topped aster
Oregon bolandra	Peacock larkspur	Loose-flowered bluegrass	Meadow checker-mallow
Bristly sedge	Nuttall's waterweed	Weak bluegrass	Oregon sullivantia
Retrorse sedge	Western wahoo	Dotted smartweed	Columbia water-meal
Golden paintbrush	Indian rice / black lilly	Columbia cress	Golden alexanders

For the complete list of special status plant species, refer to Appendix 3.

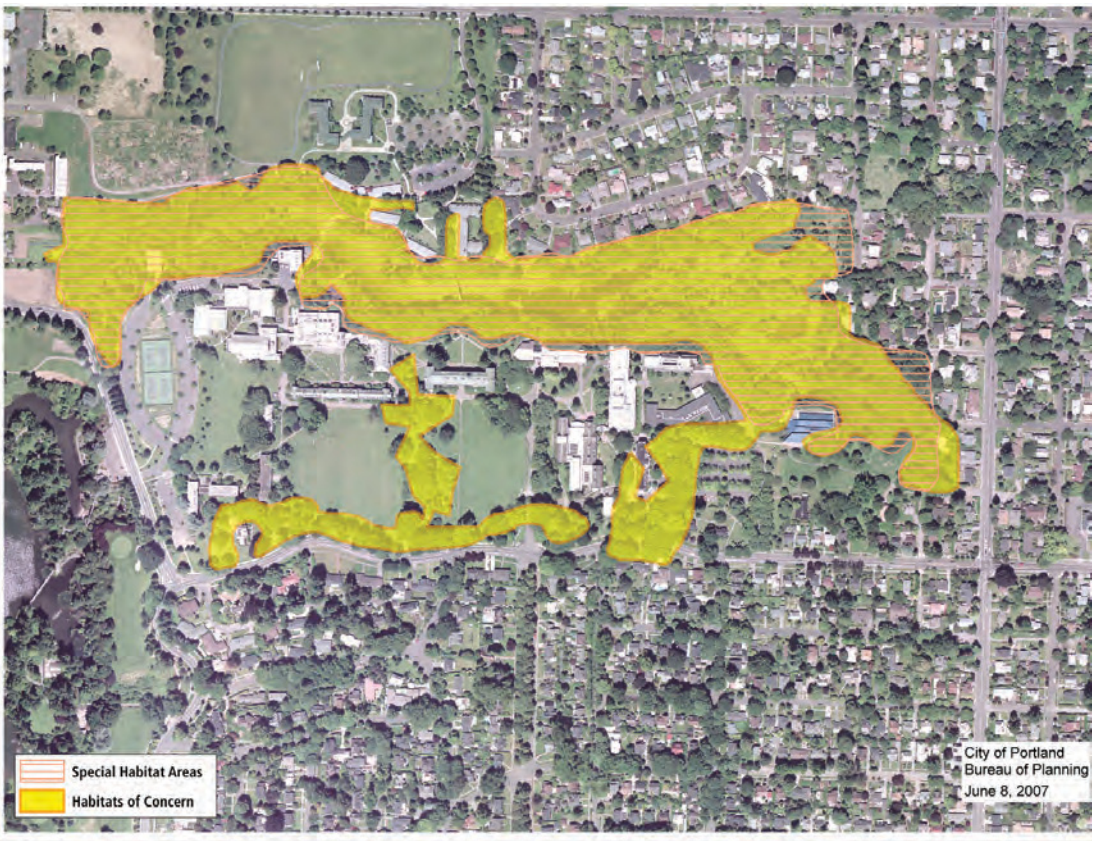
Designating Special Habitat Areas

Special Habitat Areas are an important part of the City inventory of riparian corridors and wildlife habitat. Special Habitat Areas are the updated equivalents of the Portland-area Habitats of Concern that Metro designated for the regional inventory. Special Habitat Areas contain or support special status fish or wildlife species, sensitive/unique plant populations, wetlands, native ok, bottomland hardwood forests, riverine islands, river delta, migratory stopover habitat, connectivity corridors, grasslands, and other unique natural features. The name "Special Habitat Area" was chosen in order to focus on the unique or unusual habitat features and functions, and to avoid implying that all these areas have been officially deemed at-risk by state or federal regulatory agencies.

Special Habitat Area mapping

The Bureau of Planning worked closely with the Bureau of Environmental Services and Portland Parks and Recreation to update and hone the descriptions and boundaries for the Special Habitat Areas. The Special Habitat Areas (SHA) boundaries generally follow the adopted regional Habitat of Concern (HOC) boundaries. However, the boundaries have been updated to:

1. Reflect more detailed analysis of resource location
2. Incorporate new stream or vegetation information
3. Consider information from more recent studies
4. Improve mapping consistency (e.g., removing peripheral buildings, streets and other structures; eliminating small holes in areas where they suggest a greater level of mapping precision than is warranted).



COMPARISON OF METRO HABITAT OF CONCERN AND PORTLAND SPECIAL HABITAT AREA: REED LAKE/CRYSTAL SPRINGS CREEK

Special Habitat Areas (like Metro's regional Habitats of Concern) differ from the GIS natural resource feature and model-based ranking maps in some important ways. First, while the natural resource feature and ranking maps were developed using citywide data sets, the Special Habitat Areas are based on information developed by different agencies and organizations for specific areas or sites. As such, the SHA information may vary from one area to another. In addition, some special habitats may be left out of the inventory due to lack of available information. Nevertheless, the SHA information enriches the inventory by providing more current and detailed information about important habitat areas throughout the city.

Second, the model-based rankings maps correspond directly with specific landscape feature data, while many Special Habitat Area boundaries were mapped more generally to capture areas that contain specific features, provide special functions, and/or support special-status fish and wildlife species within their boundaries. For example, the Forest Park has been designated as an SHA in its entirety because it provides habitat for special-status species such as Pileated Woodpecker as well as an elk migratory corridor. Within the West Wye/T-5 Powerline Wetlands SHA are wetlands that provide critical habitat for the Western Painted Turtle. Appendix 7 includes a map and a list of Special Habitat Areas in Portland.

Portland's Special Habitat Areas are bounded by the city limits. Where a Special Habitat Area corresponds with a regional Habitat of Concern that crosses jurisdictional boundaries, the City's inventory maps will show SHA boundary and the HOC boundary. This will help inform resource management decisions and inter-jurisdictional coordination.

Special Habitat Area eligibility criteria

Table 8 lists the eligibility criteria used to designate Special Habitat Areas for the City inventory. These criteria are generally consistent with the criteria Metro used to designate Habitats of Concern; however the City has updated, clarified, and further defined the eligibility criteria. Some criteria have also been broadened to address habitat features and other agency habitat designations found specifically in Portland. For example, the City inventory includes certain urban structures that provide important habitat for special-status species, e.g., bridges that provide nesting habitat for Peregrine falcons.

The City's SHA eligibility criteria and specifications are outlined below.

TABLE 8: SPECIAL HABITAT AREA ELIGIBILITY 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 at risk 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 Oregon Endangered Species Act; OR
2. Species that receive an Oregon Natural Heritage rank 1, 2 or 3
   a) 1 = Critically imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
   b) 2 = Imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
   c) 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-topes/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:
   a. LE Listed Endangered
   b. LT Listed Threatened
   c. PE Proposed Endangered
   d. PT Proposed Threatened
   e. SoC Species of Concern
   f. C Candidate
   g. Includes areas designated as Critical Habitats by NOAA Fisheries
2. Species Listed by Oregon Department of Agriculture (ODA) or ODFW as:
   a. LE Listed Endangered
   b. LT Listed Threatened
   c. SC Critical
   d. SV Vulnerable
3. Species that received an Oregon Natural Heritage rank or list 1, 2 or 3.
   a. 1 = Critically imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
   b. 2 = Imperiled because of extreme rarity or especially vulnerable to extinction or extirpation
   c. 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
- feeding, foraging, hunting
- resting, basking, perching
- cover/protection from predators or disturbances (e.g. noise, light)
- 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.

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.

As noted above, 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. For instance, areas of bottomland forest along the Willamette River has been designated as Special Habitat Areas, in part because there are so few such areas left along the Willamette in the city. Bottomland forest is more common along the Columbia Slough and may not be designated as Special Habitat Area in that watershed.

3C2.4 Step 4: Technical Review Process

The previous sections describe criteria for assigning functional scores to riparian corridors and wildlife habitat. As noted, these criteria reflect refinements to Metro's regional inventory criteria. It is important to recognize that the refinements result in differences between Metro's and the City's inventory maps. By incorporating new resource data, the City can produce more detailed natural resource maps than the regional resource maps. The City's inventory maps also differ somewhat from the Metro maps in terms of the area, shape, and boundaries of the inventoried resource areas. Using new resource data can also result in higher or lower relative resource rankings. For example, riparian corridors within a drainage district or which are comprised of lawn and no trees will rank lower for some riparian functions than the regional inventory. In addition, wildlife habitat patches may rank higher in the City inventory than in the regional inventory due to the scaling of size and connectivity ranking criteria. These differences are an expected result of the intentional efforts to customize the regional inventory to better fit localized conditions in Portland.

The Bureau of Planning worked closely with Metro and the Bureau of Environmental Services to ensure that the refinements would be consistent with the scientific and methodological basis of Metro's work and would support the City's watershed health goals.

MAY 2006 TECHNICAL REVIEW

In May 2006, the Bureau of Planning convened a group of technical experts to review proposed refinements to Metro's regional inventory methodology. Reviewers were selected based on their expertise in regional watershed systems, aquatic and terrestrial ecology, and local watershed conditions. In addition, many of the reviewers had participated in, or had at least some familiarity with the development of Metro's regional inventory. The technical reviewers included representatives from U.S. Fish and Wildlife Services, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Metro, Multnomah County Drainage District, Audubon Society of Portland, Port of Portland, Portland State University, and consulting companies in science and planning related fields.

Given the extensive scientific and public review of the regional inventory prior to adoption by Metro Council in 2005, the Bureau asked that technical reviewers focus solely on proposed changes to the Metro's regional inventory data and methodology. Reviewers were asked whether the proposed refinements:

- Are generally consistent with the intent, scientific basis, and approach used to develop the regional inventory,
- Are scientifically acceptable, and
- Will enhance the inventory for use in Portland.

The technical reviewers provided valuable critique, information, insights, and suggestions. They concurred with many parts of the inventory update proposal, commending the City for incorporating more recent data and locally-based research. They also raised concerns and provided valuable suggestions to improve several parts of the proposal. For example, while most reviewers agreed with the proposal to downgrade rankings assigned to riparian corridors dominated by herbaceous vegetation (i.e., without trees or woody vegetation), a number of reviewers had concerns because even low-functioning riparian corridors still provide important functions for water quality and wildlife movement and may also have high restoration potential.

Some reviewers raised concerns about aspects of the regional inventory that the City has not changed. One concern relates to continued the inclusion of the developed floodplain as a low-ranked riparian resource. Another concern relates to the use of certain scientific literature sources as the basis for mapping specific functions. Staff considered these concerns however elected not to deviate from the regional approach.

The reviewers' input helped to hone and clarify some of the proposed refinements, resulting in several changes to the City's mapping and Special Habitat Area eligibility criteria. The refinements are summarized in the table below. More detailed information about the City refinements to the regional inventory and the technical review process are documented in the *Technical Review Synthesis Report and Staff Recommendations*, October 24, 2006 (Appendix 4).

JANUARY 2008 TECHNICAL REVIEW - WILLAMETTE INVENTORY

In August 2007, the Bureau of Planning produced a discussion draft Willamette Natural Resources Inventory (WNRI). The WNRI was produced to support the River Plan, among other efforts. The River Plan is a multifaceted plan for the Willamette River corridor in Portland, and includes an update of the City's 20-plus year-old Willamette Greenway Plan. The WNRI report is the first to utilize the natural resource inventory update for a specific area of the City. Comments on the discussion draft were received through October 2007. Stakeholders providing comments included the Audubon Society of Portland, the Port of Portland, Schnitzer Steel and other property owners or their representatives, US Fish and Wildlife Services, Portland Bureau of Environmental Services, and others. The comments were categorized as editorial, site specific, methodological or programmatic. Editorial, site-specific, and methodology-related comments were addressed individually, while programmatic comments were channeled to the River Plan project.

Staff convened a group of technical experts in January 2008 to discuss key comments pertaining to WNRI methodology. The group included some of the commenters and other technical experts. Following this discussion, staff conducted additional analysis and drafted recommendations to address the issues discussed. As a result some of the riparian corridor GIS model criteria were refined. Most of the refinements are specific to the Willamette River North Reach, while some of the refinements apply citywide. The refinements are summarized in the table below.

TABLE 9: CITY OF PORTLAND REFINEMENTS TO METRO RIPARIAN CORRIDOR AND WILDLIFE HABITAT INVENTORY DATA, MAPPING/SCORING CRITERIA AND SPECIAL HABITAT ELIGIBILITY CRITERIA

Refinement	Description and comparison to Metro approach	Explanation
Data/Model Inputs		
Improved vegetation data	Metro mapped vegetation using 2000 aerial photos. Metro mapped forest canopy >1 acre throughout the region, and classified forest, woody, shrub and low structure/undeveloped soils landcover only w/in 300' of a stream. Beyond 300' of a stream, Metro mapped forest vegetation only Portland used 2004 aerial photos and targeted field visits to produce GIS data for vegetated areas > ½ acre in size, and located within ¼ mile of any river, stream, environmental zone or regionally significant habitat area. The City classified these vegetated areas as forest, woodland, shrubland, or herbaceous per the National Vegetation Classification System (NVCS).	Portland's vegetation data is more detailed and current than the regional vegetation data. Small mapping units allow for more detailed identification and assessment of riparian corridors and wildlife habitat. Classification of vegetation types outside stream corridors makes more detailed upland mapping possible. Classifying vegetation in accordance with NVCS protocol provides compatibility with other data sources and allows "seamless" linkage with Portland Bureau of Parks and Recreation Natural Areas Vegetation Assessments.
Clarified landcover types	Metro included low structure vegetation/undeveloped soils as one of its landcover categories. City landcover types include forest, woodland, shrubland, and herbaceous vegetation, but do not include undeveloped soils. The City also classified vegetation patches as natural/semi-natural or cultivated.	In an urban area like Portland, most areas that are not vegetated, paved and/or covered by structures \ are highly compacted features such as gravel roads, parking lots, ball fields, construction sites. These features do not contribute significantly to most riparian and wildlife habitat functions unless located in the floodplain or river/stream bank areas. In an urban area like Portland, much of the vegetation is cultivated – landscaped, manicured, intensely managed (e.g. mowed). Cultivated vegetation includes common areas, golf courses, parks and rights-of-way, and yards.
Local topography data	***Applies to Bank Function, Sediment, Pollution and Nutrient Control*** Metro assigned secondary functional scores to vegetation located on slopes >25% that began w/in 175' of a surface stream, and extending to "the first effective break in slope." The City is using local topography data instead of regional break-in-slope data to apply this mapping criterion.	Regional break-in-slope data were not developed for areas with recently mapped streams. The City's topography data are more comprehensive and can be used to meet the intent of the regional approach.
Riparian Mapping Criteria		
Recognizing functions of rivers, streams and wetlands	***Applies to all riparian functions*** Metro's did not attribute riparian functions to rivers and stream explicitly, although these features were captured indirectly by ranking adjacent vegetation and land within 50 feet of a waterway. The City assigns rivers, streams and wetlands primary scores for riparian functions. The City assigns the Willamette River North and Central Reach a secondary, instead of primary, score to the river for riparian functions associated with bank function and sediment, pollution and nutrient control.	Rivers and streams and drainage ways contribute significantly to riparian functions (streamflow conveyance, flood storage, microclimate, organic inputs/nutrient cycling, etc.). Including waterways in the riparian mapping criteria makes this explicit although doing so does not change the ultimate mapping or ranking of such features. Assigning a lower score to the Willamette River North and Central Reach reflects the extent of bank hardening, vegetation removal, and existing contamination
Narrowing primary functions assigned to wetlands	***Applies to the Large Wood and Channel Dynamics*** Metro assigned primary functional value to forest vegetation adjacent to wetlands that are located within ¼ mile of a stream. The City assigns primary scores to wetlands and adjacent forest vegetation only if the wetland is within a flood area or within 150' of a river or stream. (150' is the functional distance in which forest vegetation receives a primary score for Large Wood and Channel Dynamics.)	Wetlands can affect watershed hydrology, sediment patterns and flooding, and can large wood in riparian corridors. Within a flood area or near a river or stream these functions would be expected to affect channel dynamics. Beyond these areas it is not clear that wetlands and associated vegetation would have a primary effect on channel dynamics.

TABLE 9: CONTINUED

Refinement	Description and comparison to Metro approach	Explanation
Broadening secondary functions assigned to wetlands.	***Applies to all riparian functions*** Both Metro and the City assign primary scores to vegetation within 150 of a wetland. Metro's applies secondary functional value to vegetation extending beyond 150' of a wetland only for the Microclimate and Shade function. The City assigns a secondary functional value to vegetation that extends beyond 150' from a wetland for all riparian functions.	Vegetated buffers help to sustain a multiple wetland functions (e.g., sediment and nutrient control, fecal coliform removal, temperature moderation, water level fluctuation, and wildlife habitat. Buffer widths of 100, 200, 300 feet and greater are noted in the literature. Larger buffers are especially important on steep slopes, where land uses have potentially more damaging effects such as in urban areas. (Castelle et al, 1992, Castelle et al, 1994, Washington Department of Ecology and Department of Fish and Wildlife, 2005, Desbonnet et al., 1994, in Kitsap County Summary of Best Available Science, 2004). It is appropriate to assign secondary functional value for the broad array of riparian functions.
Recognizing the effect of drainage districts on riparian corridor functions.	***Applies to Large Wood and Channel Dynamics, and Streamflow Moderation and Water Storage*** Metro's regional inventory did not recognize how riparian functions are affected along waterways within a drainage district. The City has modified certain mapping criteria to account for the effect of drainage district management activities on flows, flooding and channel dynamics.	Several drainage districts operate within the Columbia Slough watershed in Portland. The districts are managed by the Multnomah County Drainage District (MCDD). MCDD maintains an extensive levee system, controls water levels and flows in drainage ways, and routinely removes large wood that can impede conveyance. These management activities affect hydrology and channel dynamics, and virtually eliminate the active floodplain. Recognizing how riparian corridors function differently within the drainage district increases the accuracy and usefulness of the inventory.
Downgrading functional scores for herbaceous vegetation	***Applies to Bank Function and Sediment, Pollution and Nutrient Control*** Metro assigned primary scores to low structure vegetation w/in 100' of a stream or wetland, or w/in 100-200' where slopes are >25%. The City downgrades the score to secondary for herbaceous vegetation meeting the same distance criteria. Metro assigned secondary functional scores to all vegetation on slopes greater than 25% that starts within 175 feet and extends to the first effective break in slope. The City assigns secondary scores only to forest, woodland and shrubland vegetation on slopes greater than 25% that starts within 200 feet and extends to the end of the 25% slope area.	It is appropriate to downgrade the value assigned to herbaceous vegetation in Portland. Within the City's urban watersheds, much of the herbaceous vegetation is managed lawn. Although grass can filter and slow stormwater runoff, the scientific literature generally ascribes a lesser functional value to lawn than to the more diverse riparian vegetation assemblages. Shallow-rooted lawn species have a limited soil and bank-holding capacity, which can increase risk of bank erosion lawn species. Also, lawn is associated with increased runoff, where runoff is laden with phosphorus and other nutrients into water bodies (USGS, 2003) Infiltration and evaporation are much higher for forested land as compared with lawn (Kennebec County SWCD, 2001)
Downgrading riparian functional scores for cultivated vegetation associated with rivers and flood area.	***Applies to Bank Function and Sediment, Pollution and Nutrient Control; and Organic Inputs, Food Web and Nutrient Cycling*** Metro did not differentiate between cultivated and semi-natural/natural vegetation. The City downgraded the scores applied to cultivated river and flood area associated woodland and shrubland vegetation for certain riparian functions. This type of refinement may be considered for tributary streams through one or more separate inventory update projects.	Cultivated vegetation is landscaped, highly manicured, intensely managed (e.g. mowed) vegetation and generally includes lawn and common areas, golf courses, parks and rights-of-way. This refinement recognizes that cultivated vegetation provides lesser resource functions than more natural vegetation assemblages. Cultivated vegetation can also have a negative impact on natural resource functions fertilizers and pesticides are applied and runoff into nearby waterways.

TABLE 9: CONTINUED

Refinement	Description and comparison to Metro approach	Explanation
	Applies to Streamflow Moderation and Water Storage Metro assigns secondary scores to low structure vegetation w/in 300' of a stream. The City assigns a secondary score to herbaceous vegetation only if located within 100' of a stream and 200' where slopes exceed 25% (same for Bank Stabilization, etc.)	The City applies a more stringent criterion than Metro for assigning value to herbaceous vegetation. Often the herbaceous vegetation in an urban environment has also been highly compacted which reduces opportunity for infiltration (City of Tacoma/WA Hydrology Model, 2003).
Downgrading scores assigned to hardened, non-vegetated river banks and associated land within 50 feet of the Willamette River North and Central Reach	***Applies to Bank Function and Sediment, Pollution and Nutrient Control; and Large Wood and Channel Dynamics Functions*** Metro assigned a primary score to all land with 50 feet of the Willamette River. The City assigns a secondary score to hardened, non-vegetated land within 50 feet of the Willamette River North Reach and Central Reach.	The land within 50 feet of the Willamette River in the North and Central Reach has been significantly altered by extensive bank hardening, vegetation removal and development. These alterations significantly reduce the overall bank function and channel dynamics.
Linking recruitment of large wood from riparian corridors to topography	***Applies to Large Wood and Channel Dynamics*** Metro assigned a secondary score to forest vegetation located 150-260 feet from a waterway. The City refined this criterion to assign a secondary score to forest vegetation located 150-260 feet from a waterway only when it is located on slopes 25% or steeper.	Forest vegetation that is located further from a stream or river has a greater potential to contribute large wood to banks and the waterway when it is located on steep slopes.
Establishing a maximum riparian corridor mapping width for modeling purposes	***Applies to Streamflow Moderation and Flood Storage and Microclimate and Shade*** Metro did not establish a maximum secondary functional distance for forested land contiguous to and extending beyond 300 feet from a stream. The City inventory limits riparian corridor mapping to a maximum distance of 780' from a river, stream or wetland for this function.	The scientific literature does not identify specific distances from rivers and streams within which vegetation helps moderate streamflows and store water as a riparian function. This is in part because the streamflow and watershed hydrology are affected by vegetation, particularly forest, located throughout a watershed. The City is using a 780' limit for mapping this function to establish the area within which predominantly riparian functions are occurring. 780' was chosen because it is the greatest functional distance ascribed to any of the riparian functions (secondary functional distance for Microclimate and Shade).
Wildlife Habitat Mapping Criteria		
Broadening secondary function of shrubland vegetation	***Applies to Microclimate and Shade*** Metro and the City assign primary function to forest or woody vegetation within 100 feet of a stream, wetland or flood area and secondary function to forest or woody vegetation extending out from 100 feet, to a maximum of 780 feet within the City inventory. The City also assigns secondary function to shrubland located within 50 feet of a stream, drainageway or wetland.	

TABLE 9: CONTINUED

Refinement	Description and comparison to Metro approach	Explanation
Developing a Riparian Wildlife Movement Corridor	***Applies to Riparian Wildlife Movement Corridor*** Metro addressed riparian wildlife corridors by assigning connectivity value to different vegetation types (Type 1 and Type 2 patches) within 300 feet of a stream. Type 1 patches contain forest vegetation and Type 2 patches contain other types of vegetation and were ranked lower than Type 1 patches The City assigns primary scores are to mapped vegetation contiguous to and within 100 feet of a river, stream or wetland. Secondary scores are assigned to vegetation that is contiguous to the primary vegetation and is between 100 and 300 feet.	Riparian wildlife corridors are valued similarly in the Metro and City inventories. However, the City inventory places a higher value on 1) more types of vegetation, 2) vegetation contiguous to the water feature and 3) to vegetation located closer to the water feature (i.e., within 100 feet). The City also applies the riparian wildlife corridor criterion to wetlands which is well-supported by the literature (Castelle, 1992; Duncan, 2003; Kennedy, 2003).
Simplifying assessment of habitat connectivity in riparian corridors	***Definition of Wildlife Habitat Patches*** Metro established two types of patches to include in the regional wildlife habitat model. Type 1 patches are comprised of forest landcover and/or wetlands at least 2 acres in size. Type 2 patches are comprised of shrubland/scrubland or grassland/open soils landcover at least 2 acres in size and within 300' of a surface stream. With this information Metro was able to model wildlife habitat connectivity and other functions provided by medium and low structure vegetation within riparian corridors. The City inventory includes only one type of wildlife habitat patch, which is equivalent to Metro's Type 1 patch, and including adjacent woodland vegetation (described in the next row of the table). The City inventory replicates the function of the Type 2 patches through the application of the Riparian Wildlife Corridor criterion described above.	Using more detailed vegetation data and the riparian movement corridor criterion, the City inventory provides an equivalent valuation of riparian wildlife corridors using a simpler approach.
Including woodland vegetation in wildlife habitat patches.	***Definition of Wildlife Habitat Patches*** Metro did not include woodland vegetation in regional wildlife habitat patches due to limited vegetation information at the regional scale. The City is including woodland vegetation in wildlife habitat patches where the woodland vegetation is adjacent to core forest/wetland patches at least 2 acres in size.	Woodland vegetation extends and improves the diversity of forest and wetland habitat patches, and can buffer interior habitat area. Woodland vegetation can also provide corridors or links to other habitat patches or water. Including woodland is consistent with views that cultural savannahs and woodland should be included within patch boundaries if doing so can help minimize negative effects of surrounding land uses, strengthen internal linkages, and connect patches to watercourses or each other. (Forman, R.T., 1983.) It is intended that woodland vegetation augments but would not comprise the majority of the delineated patch area. Most of the refined patches in the City contain more than 80 percent forest or wetland.

TABLE 9: CONTINUED

Refinement	Description and comparison to Metro approach	Explanation
Scaling habitat patch size and interior area scoring thresholds.	***Applies to Habitat Patch Size and Interior Habitat scoring*** Metro determined Habitat Patch Size and Interior Habitat scoring thresholds based on natural breaks in the distribution of patch sizes for the region as a whole. The City has scaled the regional patch size and interior area thresholds to reflect local research, additional guidance from the scientific literature, and the scale of Portland habitat patches.	Metro's scored patch size and interior area based on natural breaks in the distribution of patch sizes and interior area across the region. Given that many parts of the region are still suburban or rural in character, habitat patches are relatively large. Metro's "high" and "medium" scoring thresholds for size are 2,470 acres and 585 acres, respectively. Applying the regional criteria, only Forest Park ranks high for patch size, while the 160-acre Oaks Bottom Wildlife Refuge receives a low ranking for size. Based on additional information and analysis, the City has scaled the regional patch size and interior habitat area criteria. Patches at least 30-acres in size receive a "medium" score for patch size. This is consistent with local research indicating that species richness for multiple species types increased significantly where greenspaces are at least 10 hectares (~25 acres), (Murphy et al, 2003). The 30-acre threshold is also consistent with Metro's field assessments of habitat patches in Portland and mirrors the targets adopted in Title 13. The City also revised the regional "high" patch size criterion after additional literature review. ~75 – 100 acres have been identified as an "optimal" patch size in an urban area (Washington Department of Fish and Wildlife, 1997). Habitat areas of at least >42 hectares (~105 acre)s have also been recognized as patch size to strive for (Marzluff and Donnely 2002, cited by King County 2004). Some assign high value to smaller habitat patches, e.g., >4 hectares (City of London, Ontario, 2002), while others call for larger areas e.g., greater than 250 to 12,000 acres. (Barnes, 1999) The City inventory now scores patches "high" for size if they are at least 585 acres. This is consistent with literature suggesting that urban areas should maintain habitat area at least 250 hectares (or about 500 acres). (Canadian Wildlife Service, 2005). The proposed Interior Habitat Area scoring thresholds represent the refined Habitat Patch Size scoring thresholds, minus the 200-foot internal "edge" buffer used in the Metro model. Linking the Habitat Patch Size and Interior Habitat Area scoring thresholds links the City's adjusted scores for total patch area and the shape of habitat patches, appropriate for the spatial scale and habitat conditions found there. Thus, as with Metro's regional model, the same patch that receives a medium or high score for Patch Size could potentially receive a low ranking for Interior Habitat Area if the patch is long and narrow.
Using a more flexible model to assess habitat patch connectivity; ranking based on Portland patches	***Connectivity Between Patches*** Metro developed a model to evaluate patch proximity/connectivity and established connectivity ranking thresholds based on natural breaks in the proximity data for the region as a whole. The City is using Fragstats 3.3 to model connectivity/proximity between habitat patches. The City and Metro are both using a ¼ mile "search area" to evaluate patch connectivity. The City has adjusted the ranking thresholds to reflect natural breaks in the distribution of habitat patches within Portland.	Fragstats is a widely accepted, user-supported modeling platform used to evaluate proximity, connectivity and fragmentation between wildlife habitat patches based on a dimensionless proximity index. Metro attempted to use this model for the regional inventory but the size of the regional data sets made use of Fragstats infeasible. Fragstats is generally equivalent to the approach Metro developed to evaluate connectivity between habitat patches in the region, but is more effective in identifying connectivity between smaller habitat patches. Fragstats also has the advantage of regular use by the broader scientific community. Basing the connectivity ranking thresholds on natural breaks determined for habitat patches in Portland provides a more relevant analysis of relative habitat value in the City than using distribution of patches throughout the Metro region.

TABLE 9: CONTINUED

Refinement	Description and comparison to Metro approach	Explanation
Using Portland patches to assess connectivity to water; including wetlands; adding riparian wildlife movement corridor criterion	***Connectivity to Water*** Metro scored patches for Connectivity to Water based on the percentage of a patch within 300 feet of a stream. The scoring thresholds were derived based on natural breaks in the distribution for all patches in the region. Metro applies this criterion only to rivers and streams. The City has adjusted the scoring thresholds to correspond to natural breaks in the distribution of patches in Portland. The City is also applying Connectivity to Water criterion to wetlands as well as rivers, and streams. The City further recognizes the importance of proximity to water by adding the riparian wildlife movement corridor criterion described above.	Basing the patch percentage thresholds on natural breaks for habitat patches in Portland provides a more refined analysis of relative habitat value in the City than using distribution of patches throughout the Metro region. As noted above, the scientific literature supports maintenance of a vegetated buffer to maintain wildlife habitat movement and other habitat functions out to at least 300' from wetlands.
Habitats of Concern (HOC) / Special Habitat Areas (SHA)		
Including seeps, springs in wetlands Special Habitat Areas	Metro designated all locally significant wetlands as regional HOCs but did not specify seeps and springs. The city is including known seeps, springs and streams that are associated with a "wetland complex" in locally-designated SHAs.	Wetlands are often functionally part of a larger hydrologic complex that includes seeps, springs and streams. Seeps and springs also provide biologically unique habitats for invertebrates and the animals that feed on them
Developing a plant list.	Metro did not include a plant species list in its HOC criteria. The City has developed a list of sensitive plants species that are known or expected to occur within the City. This list include species: 1. 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 Oregon Endangered Species Act; OR 2. That receive an Oregon Natural Heritage rank 1, 2 and 3.	A plant species list was added to be clear plants would currently quality an area for SHA status in the City inventory. The list can be found in Appendix C.
Revising the fish and wildlife species list	Metro included a fish and wildlife list for the region in its technical report. The City has updated the list to reflect species known or expected to occur within the city.	It is consistent and appropriate to include only those fish and wildlife species know or expected to exist within the city.
Including federally designated Critical Habitats.	Metro did not explicitly include areas designated as Critical Habitats for ESA-listed salmonids. The City has designated these areas as SHAs.	It is consistent and appropriate to include federally-designated habitats as Special Habitat Areas per the "Species" criterion.
Including urban structures that provide habitat for sensitive species.	The City inventory has broadened the "U" category Metro used to identify unique Habitats of Concern to include urban structures that provide habitat to sensitive species.	Peregrine falcons are using several bridges for nesting and Vaux's swifts are chimneys for roosting. These structures provide a unique and important habitat function in urban Portland.

3C2.5 Step 5: Assigning "Relative Ranks" To Riparian Corridors And Wildlife Habitat Areas

Using the GIS inventory modeling results and information on Special Habitat Areas, the Bureau of Planning assigned relative quality ranks to identified riparian corridors and wildlife habitat areas. The Bureau used ranking formulae that are similar to the formulae Metro used for the regional inventory. The riparian corridor and wildlife habitat GIS models assign relative ranks of "high," "medium," "low" or no rank to natural resource features. The ranks are produced using a consistent and replicable method and represent a simple ordinal scale depicting the relative number and distribution of functions provided by natural resource features in the city. The ranks are not tied to a reference or baseline condition, but allow comparison of the existing relative condition of natural resources within the region or city.

Riparian Corridor Ranking

As noted above, the GIS model assigns mapped natural resources a primary or secondary score to natural resource features for each of the six riparian functions:

- Microclimate and shade
- Bank function and control of sediments, nutrients and pollutants
- Stream flow moderation and flood storage
- Large wood and channel dynamics
- Organic inputs, food web and nutrient cycling
- Wildlife habitat/corridors

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 those Metro used for the regional inventory and also reflects the distribution of primary scores assigned to features in the city. 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. Table 2 shows the formula used to establish the aggregate relative ranks.

Riparian Corridor Aggregated Relative Ranking Formula

	Primary Functions	*Secondary Functions*
High	4-6	0-6
Medium	1-3	0-6
Low	0	1-6

Wildlife Habitat Ranking

Using the GIS model, each wildlife habitat patch receives a score for:

- Patch size
- Interior habitat area
- Connectivity between patches
- Connectivity/proximity water.

For each attribute, patches receive 3 points for a high value, 2 points for a medium value, and 1 point for a low value. The overall wildlife habitat patch ranking is assigned as shown below. As with the riparian corridor model, the formula used to generate the aggregate wildlife habitat ranks is similar to that used by Metro.

Wildlife Habitat Patch Ranking Formula

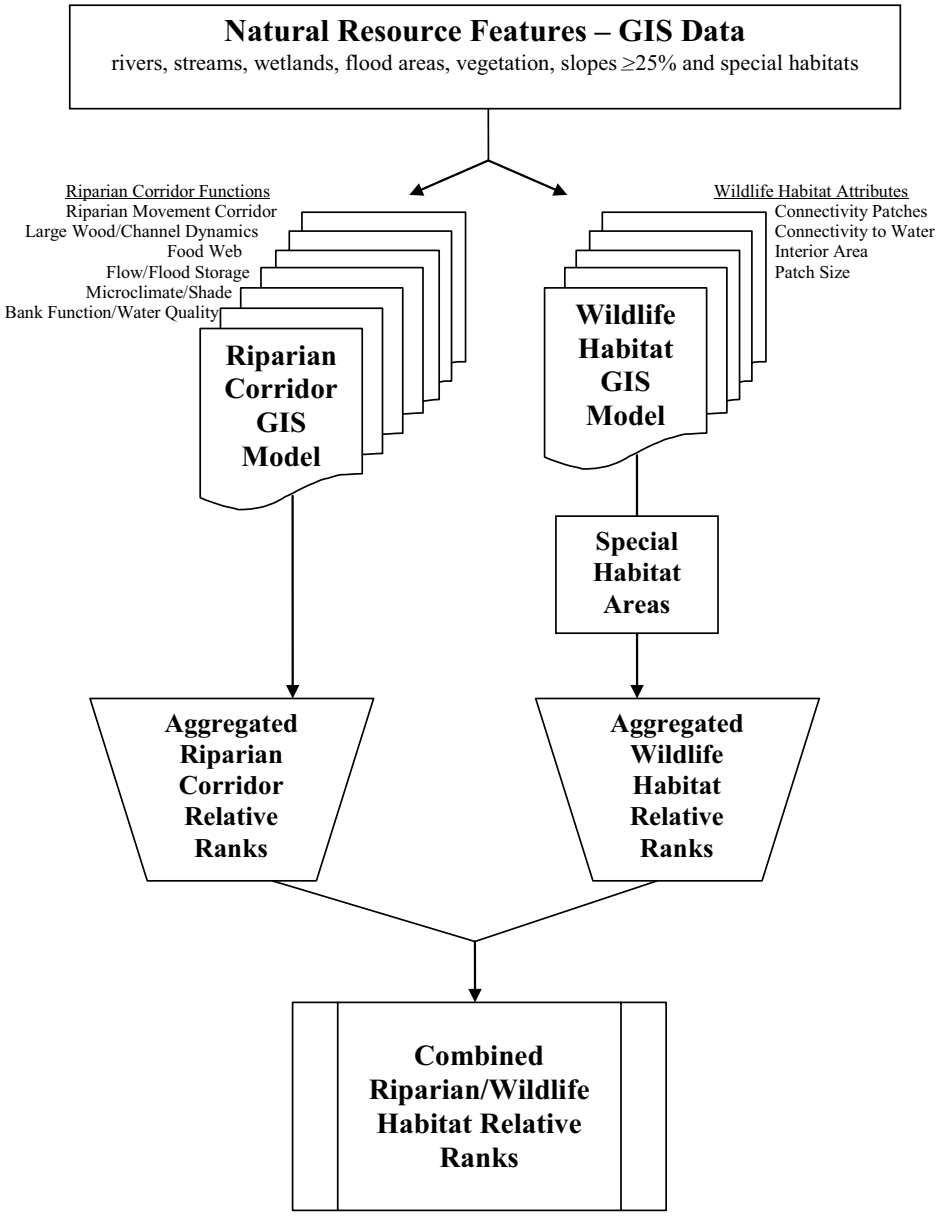
Relative Ranks	
High	9 or more points
Medium	4 to 8 points
Low	1 to 3

Consistent with Metro's approach, all Special Habitat Areas receive a high relative rank for wildlife habitat, which would supersede any lower ranks assigned by the GIS model.

Combined Riparian Corridor/Wildlife Habitat Ranking

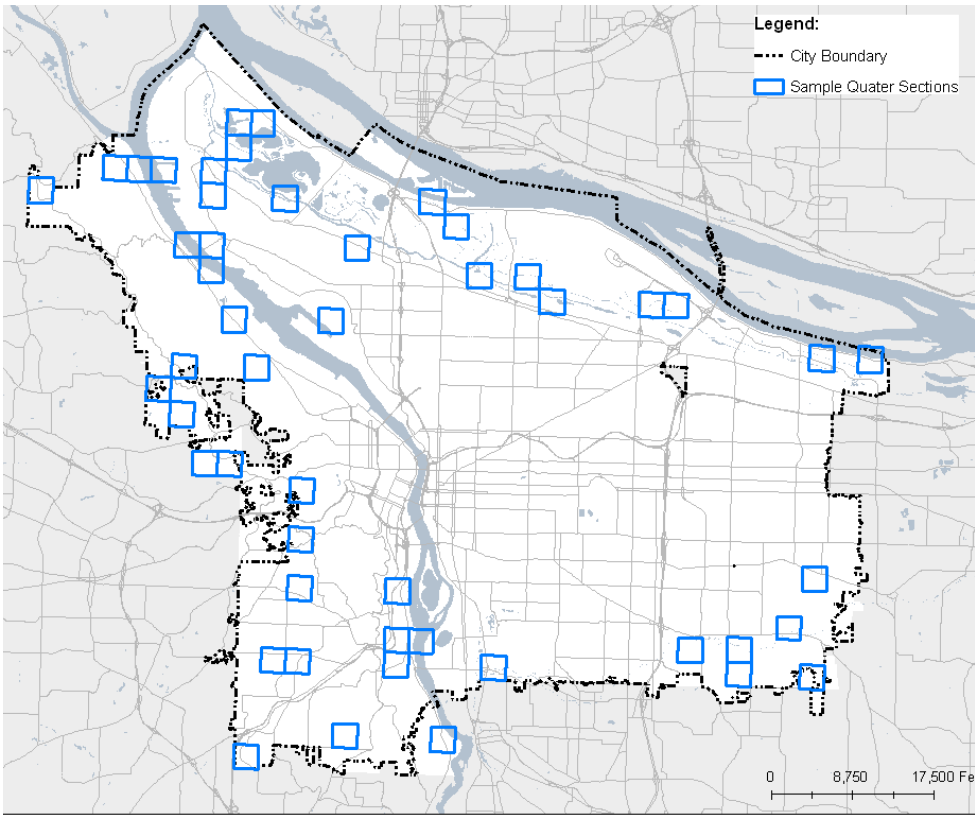
The final step in the ranking process involves combining the riparian corridor and wildlife habitat rankings to produce a single map showing the combined relative ranks. Where riparian corridors and wildlife habitat areas overlap, the higher of the two relative rankings is presented on the combined inventory map. This follows the approach Metro used to assign a single overall relative rank to inventoried resources. This approach reflects the substantial overlap between riparian and wildlife habitat resources and the inter-dependencies between the functions they provide (e.g., water quality and microclimate contribute to wildlife habitat character and quality).

The following figure is a flow diagram of the GIS models and steps used to produce the relative ranks of natural resource functions.



3C2.6 Step 6: Quality Control – Quarter-Section Assessments

To help ensure the quality of the updated Natural Resource Inventory, project staff designed an exercise to examine the landscape feature data (inputs) and the inventory model results (outputs) for quarter sections in the city. The primary purpose of the exercise was to identify any fundamental or systemic problems with the GIS landscape feature data (e.g., streams, wetlands, vegetation) and/or the model outputs. The exercise also involved comparing the updated natural resource inventory information with Metro's regional inventory and City environmental overlay zones.



QUALITY CONTROL - QUARTER-SECTION ASSESSMENT

Because the area being inventoried is large, staff generated a random sample of 49 (out of 518) quarter-sections in the city. The sample included quarter-sections where 20 percent of the total area was comprised of ranked natural resources. The sample was also stratified to cont
from each of Portland's five major watersheds, and adjusted to rep
of the Willamette or Columbia rivers.

To complete the quarter-section assessment, staff:

1. Reviewed 2005 aerial photographs to become familiar with the quarter section landscape (also 2000 to 2004 aerial photographs, including "leaf on" and "leaf off" images).

2. Reviewed landscape features data including streams and drainageways, wetlands, floodplain, and vegetation, and identified obvious inconsistencies in resource location/boundaries or vegetation classification.

3. Reviewed inventory model results (relative functional rankings) and identified questions or anomalies, such as high rankings for small or highly fragmented patches of vegetation.

4. Compared inventory model results with Metro inventory to identify any major inconsistencies (e.g., area Metro ranked high are ranking low or are not included in the City inventory). Staff attempted to discern reasons for such differences including the use of new vegetation data and revised mapping/ranking criteria.

5. Compared inventory model results with existing environmental zones. Staff attempted to identify the causes of significant or common discrepancies. For example, the existing environmental zones often do not comport with the City's new stream maps. In addition, the mapping convention used to establish the environmental overlay zoning was, in many areas, fairly general and did not necessarily follow feature lines.

6. Entered comments and questions into a database and made corrections as needed.

The quarter-section assessment yielded the following information:

- **"Mega" vegetation patches –** Staff discovered several vegetation patches that extended over very large areas. These patches contained diverse vegetation types and characteristics ranging from large forested areas of Tryon Creek State Park to very narrow fragmented street tree canopy that extended from larger forested areas into and throughout low and medium density residential neighborhoods. Because these patches were so large, the wildlife habitat inventory model had assigned high relative functional rankings areas with very different characteristics.

  To address this problem, staff developed a process re-delineate the mega-patches and reduce the model bias. For patches that are larger than 100 acres, breaks in the patch were created manually so that each patch represents a cohesive unit. "Patch breaks" were implemented by modifying the vegetation data. The location of patch breaks were determined based on one or more of the following criteria:

  1) Patch "width" – Where the vegetation narrows to a strip that is one or two trees wide (often confined by buildings or roads).
  2) Character/fragmentation – Where large areas of closed canopy with few buildings and minimal impervious surfaces shift to narrow vegetated areas interspersed with buildings, roads, driveways, and yards.
  3) Streets – Where a street creates a clear break between vegetated areas, or where there is a significant difference in vegetation character on each side of the street.

Breaking up the mega-patches resulted in lower habitat rankings for patches that are relatively small, narrow, or highly fragmented. Further, patches smaller than 2 acres in size were dropped from the inventory unless they were also mapped and ranked for riparian function, or are designated Special Habitat Areas.

- **Inconsistent vegetation classifications –** In reviewing the quarter-sections, staff observed some inconsistencies in vegetation classifications, both within and across quarter sections. Inconsistencies were most prevalent in the classification of woodland and shrubland vegetation, and in assigning "natural" and "cultural" sub-classifications.

  Staff has and will continue to refine the vegetation data over time. The acquisition of LiDAR data should help in distinguishing between woodland and shrubland vegetation types. In the future, staff will revisit the "natural" and "cultural" sub-classifications to determine if it is feasible to apply the designations more consistently to Portland's urbanized landscape. However, for the time being, the "natural" and "cultural" sub-classifications are not used to assign relative resource rankings.

- **Differences between City and Metro inventory results –** The City's and Metro's inventory results were observed to be generally consistent in terms of areas mapped and ranked, especially the highest and lowest-ranked resource areas. City and Metro resource area boundaries varied across the quarter-sections, largely due to the use of different vegetation data sets. Also, because the City used more detailed vegetation data and mapping criteria, the City's resource rankings tend to be more variable than the rankings Metro produced for the regional inventory.

- **Differences between City inventory results and existing environmental overlay zones –** Staff observed both considerable overlap and discrepancies between the updated inventory information and the existing environmental zones. Consistency was greatest where inventory results assign high relative rankings to riparian areas near streams that are currently within the environmental protection zone. Areas within environmental conservation zones included resources of varying relative quality (i.e., ranked high, medium or low by inventory models). Discrepancies were prevalent where environmental zone boundaries do not follow actual resource locations or specific distances from water features. Staff also observed many newly mapped streams and associated riparian areas, and upland habitat patches that are not within existing environmental overlay zones.

Overall, the quarter-section assessment exercise provided several benefits. First, the process required staff to become more familiar with the inventory inputs, criteria and outputs as well as its strengths and limitations. Second, the exercise allowed staff to spot key problems that required immediate attention (e.g., corrections to vegetation data). Third, the exercise provided greater understanding of how the City's inventory compares to Metro's regional inventory of riparian corridors and wildlife habitat. This will be helpful in working with Metro and other agencies, and in developing strategies to comply with the requirements of Title 13 of the Metro Urban Growth Management Functional Plan. And finally, comparing the updated inventory information with City environmental zones will help inform future program directions.

3C2.7 Step 7: Determining Resource Significance

Subsequent steps in the inventory process will include:

- Determining the adequacy of the information;
- Determining the significance of resource sites; and,
- Adopting a list of significant resource sites. (OAR 660-023-0300)

The adopted significant resource sites are then subject to the remainder of the Goal 5 process, including completion of an Economic, Social, Environmental, and Energy analysis and development of a program to protect natural resources.

Before adopting an inventory, local jurisdiction must determine 1) if the inventory information meets Goal 5 requirements for "adequacy," and 2) which of the inventoried resources are "significant." These determined actions can only be made once the inventory information is produced for individual resource sites.

At this point, the updated natural resource information (GIS data and models, Special Habitat Area information, and relative resource quality ranks) has been produced for the city as a whole and for each of the major watersheds in the city. Information for individual resource sites will be produced when the City initiates legislative projects to update the adopted natural resource inventories. At such time, updated inventory information and maps will be produced for resource sites located within the project area. It is anticipated the information will meet "adequacy" requirements of Goal 5, and that all mapped riparian corridors and wildlife habitats receiving a relative rank should be deemed ecologically and regionally and/or locally significant. This result is expected for several reasons:

1. **Consistency with historical City policy**. The updated natural resource inventory information addresses primarily the same types of resources, values and functions that the City has included and deemed significant in earlier adopted inventories. In addition, the resource areas identified in the updated inventory coincide substantially with areas that the City has already deemed significant through the adoption of nine prior inventories. The updated inventory information builds on and improves the quality and accessibility of information about key natural resource features and functions they provide.

2. **Consistency with Metro determination of adequacy and significance.** The City inventory is based on the approach Metro used to develop their adopted inventory of riparian corridors and wildlife habitat. Metro determined that the information produced for the inventory met Goal 5 adequacy requirements. Metro also determined that all inventoried riparian corridors, and all but the lowest-ranked wildlife habitat areas, are both ecologically and regionally significant. The Oregon Department of Land Conservation and Development acknowledged the regional inventory and associated "Nature in Neighborhoods" program with regard to compliance with the Goal 5 rule in January 2007. It is appropriate to assume that areas deemed regionally significant would also be deemed locally significant as well.

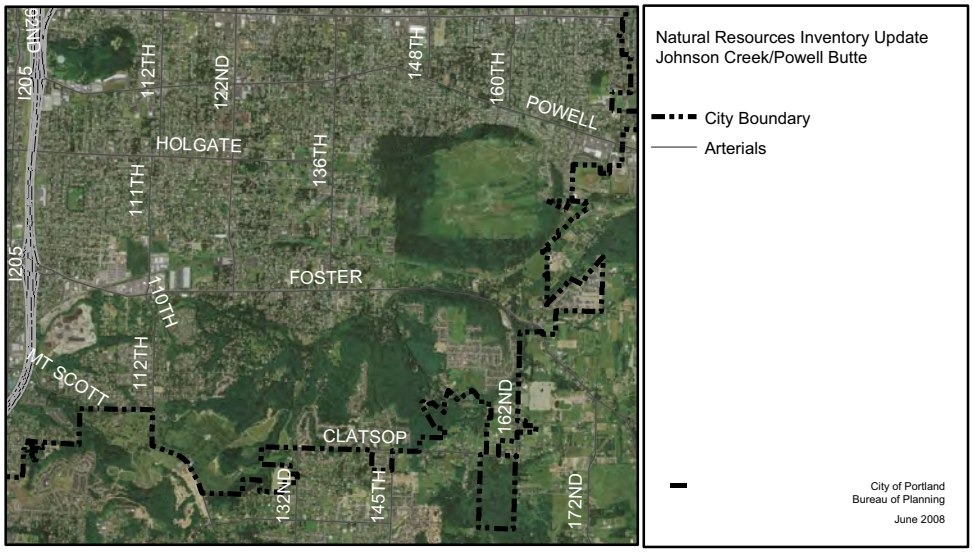
3. **City refinements to the regional inventory further support a determination of significance for inventoried resources.** The City inventory reflects updates and refinements to the regional resource data, modeling criteria and information on special habitats. These improvements have increased the accuracy and level of detail of the City inventory information. The City inventory also relates more closely to existing relative quality and functions of Portland's natural resources than was depicted by the regional inventory. These refinements are expected to support and bolster future determinations of significance.

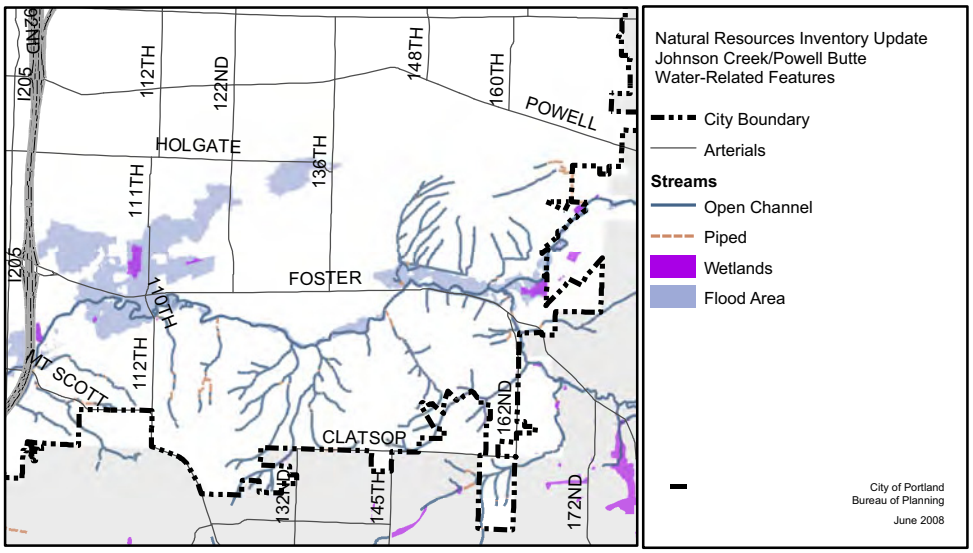
3D. SAMPLE MAPS

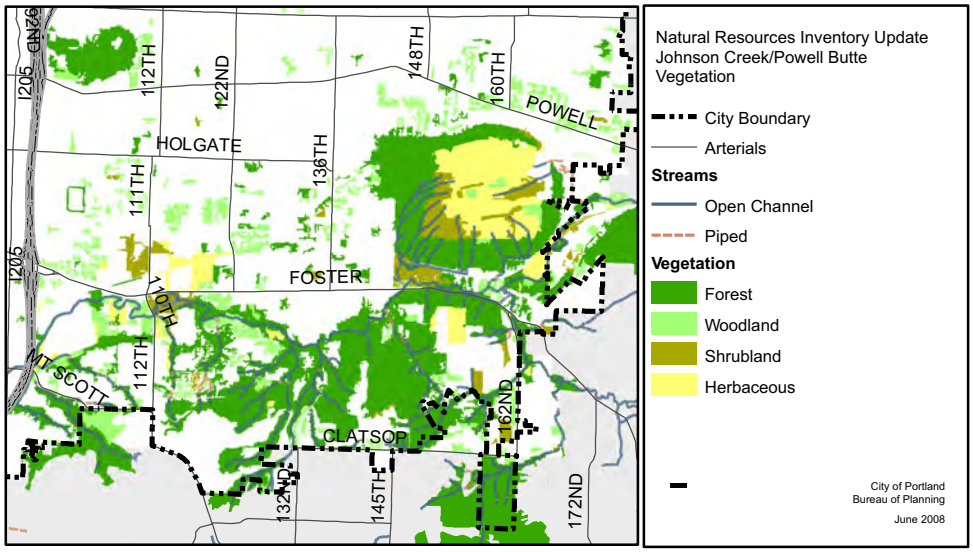
The two map series presented on the next pages show the City's inventory "building blocks" for different areas of the city: 1) Southwest Hills and Willamette River, including Ross Island, and 2) Johnson Creek, Kelley Creek and Powell Butte. The maps are presented in the following order to demonstrate how natural resource features provide the basis mapping and ranking riparian corridor and wildlife habitat functions and values.

1. **Aerial photo** – 2005 aerial of the area and main arterial streets, which are labeled
2. **Riparian Resources** – water bodies, stream channels both open and piped, wetlands and flood areas
3. **Vegetation** – forest, woodland, shrubland and herbaceous cover
4. **Riparian corridor relative ranks**
5. **Wildlife habitat relative ranks** – including Special Habitat Areas Special Habitat Areas receive a high rank, which supersedes lower ranked wildlife habitat
6. **Combined relative riparian and wildlife habitat ranks**

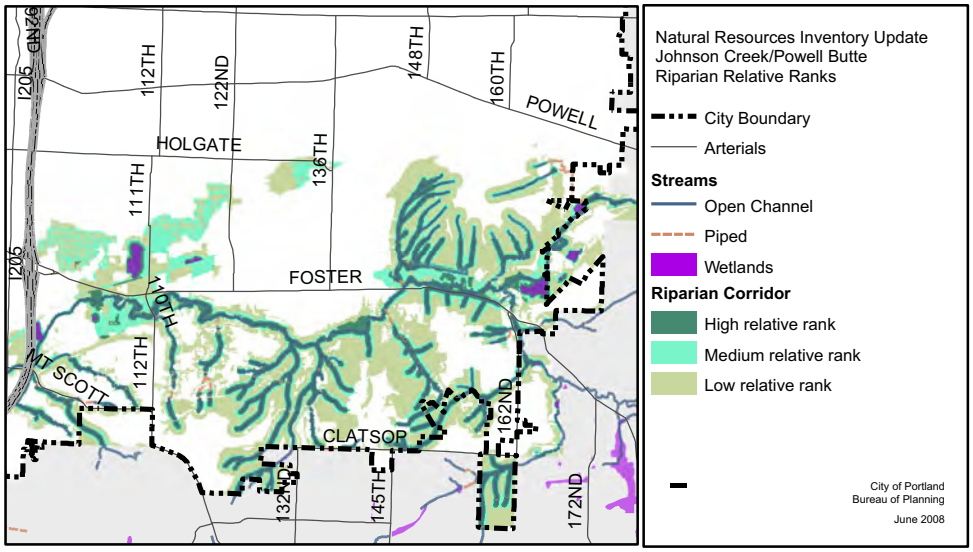
JOHNSON CREEK AND POWELL BUTTE NATURAL RESOURCE INVENTORY MAP SERIES

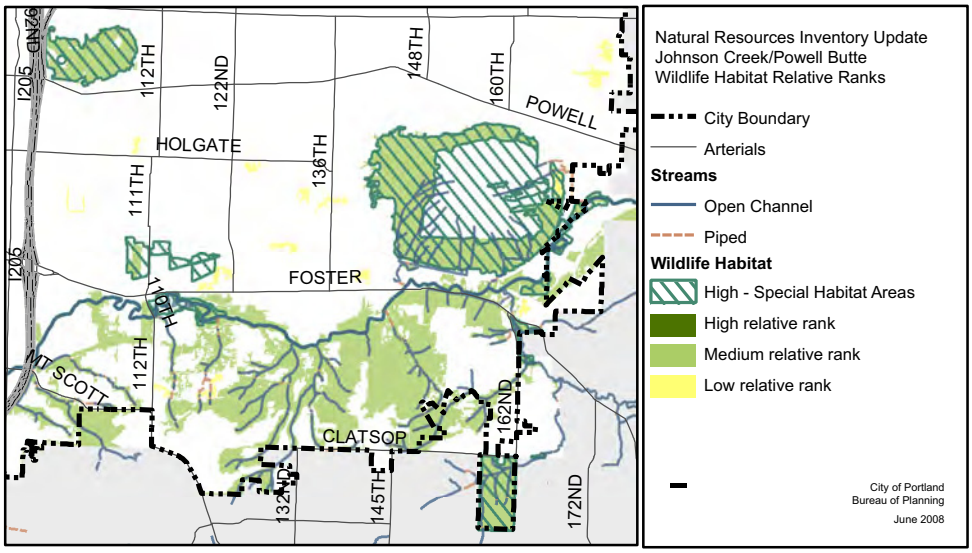


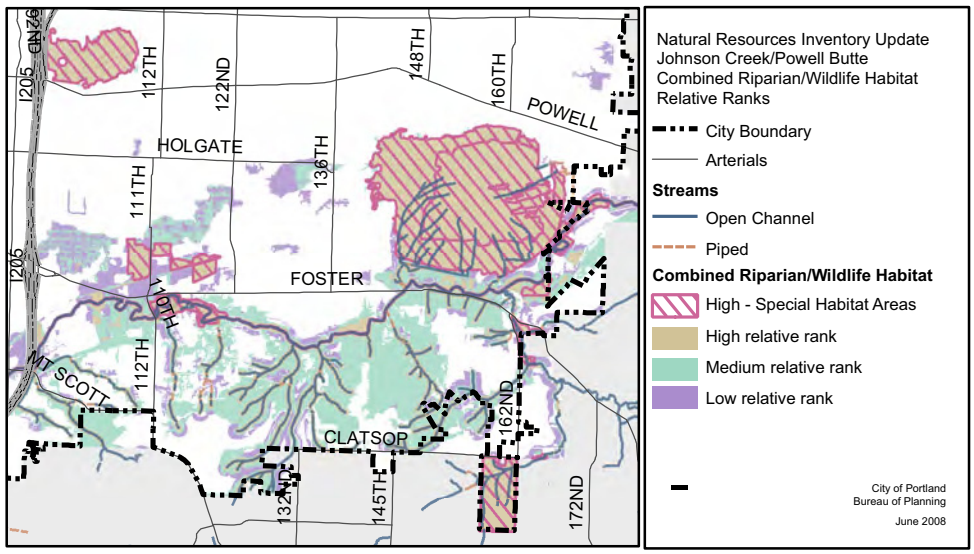




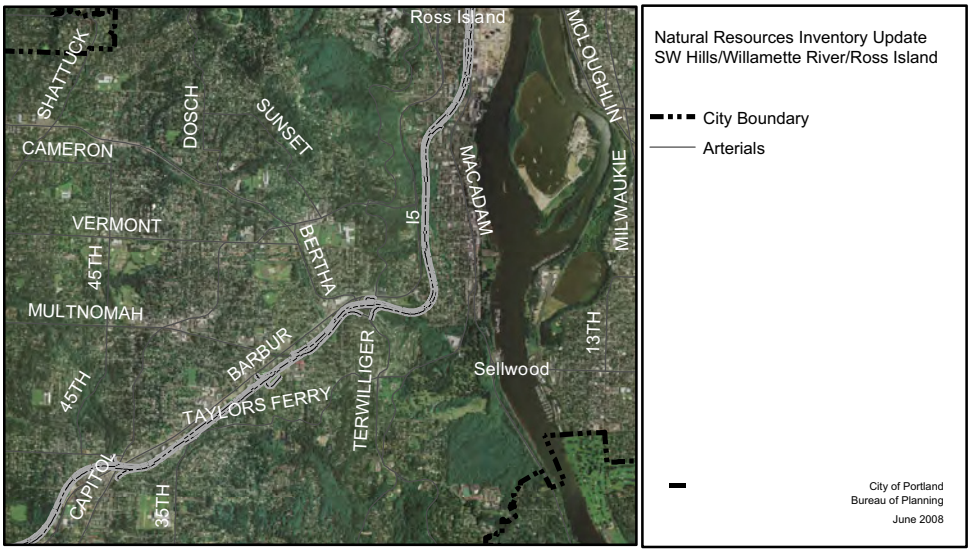
JOHNSON CREEK AND POWELL BUTTE NATURAL RESOURCE INVENTORY MAP SERIES

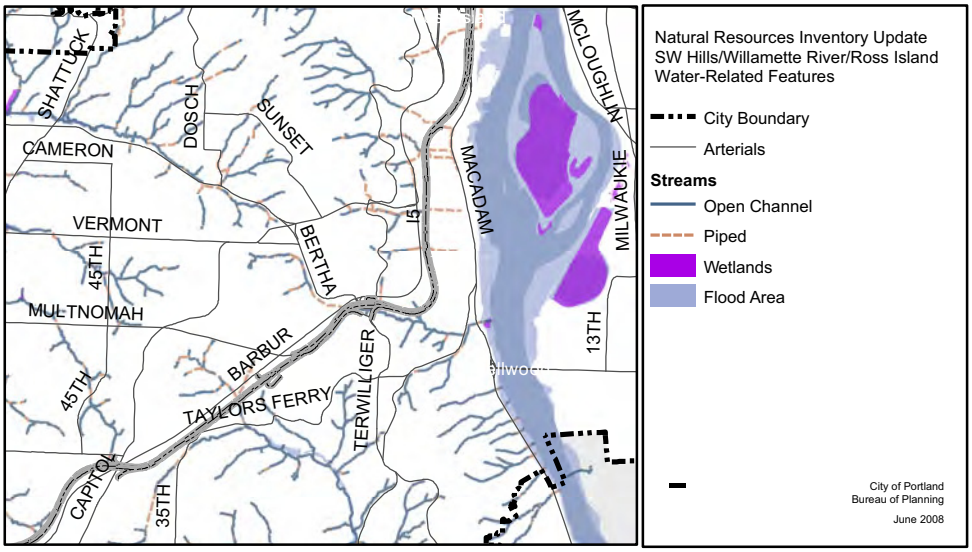


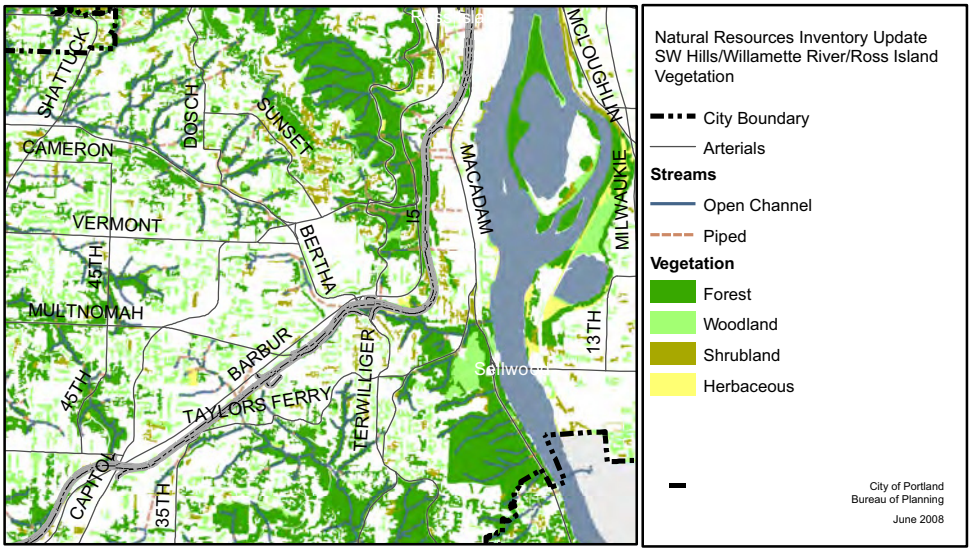




SOUTHWEST HILLS, WILLAMETTE RIVER AND ROSS ISLAND NATURAL RESOURCE INVENTORY MAP SERIES







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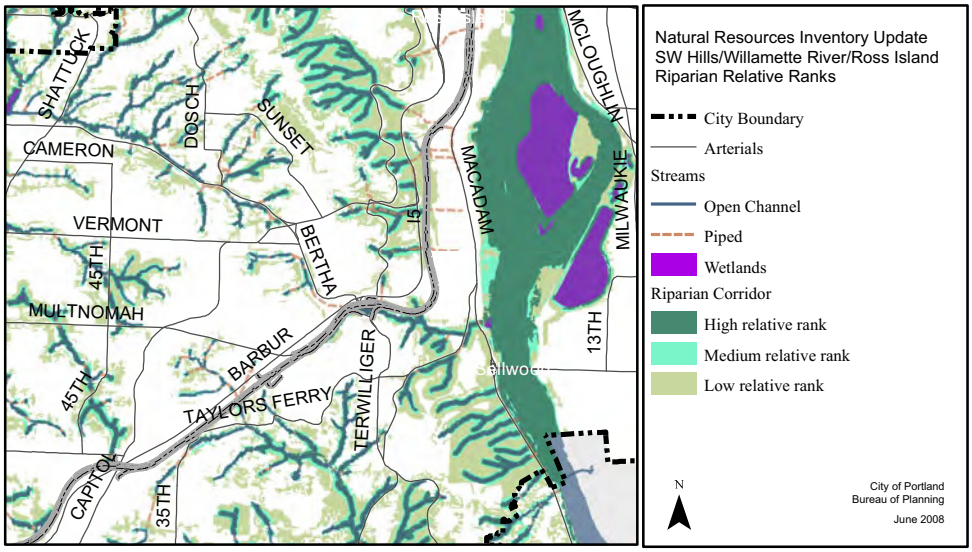
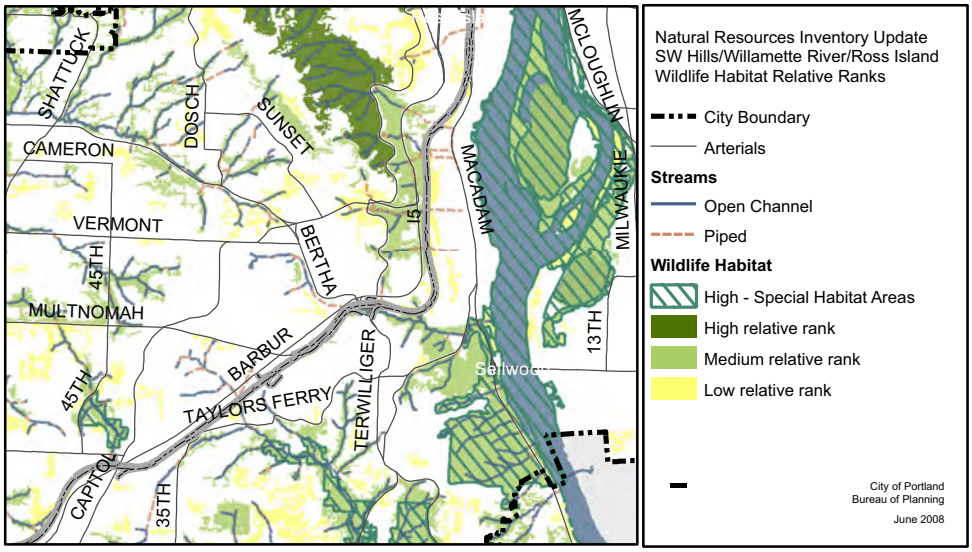
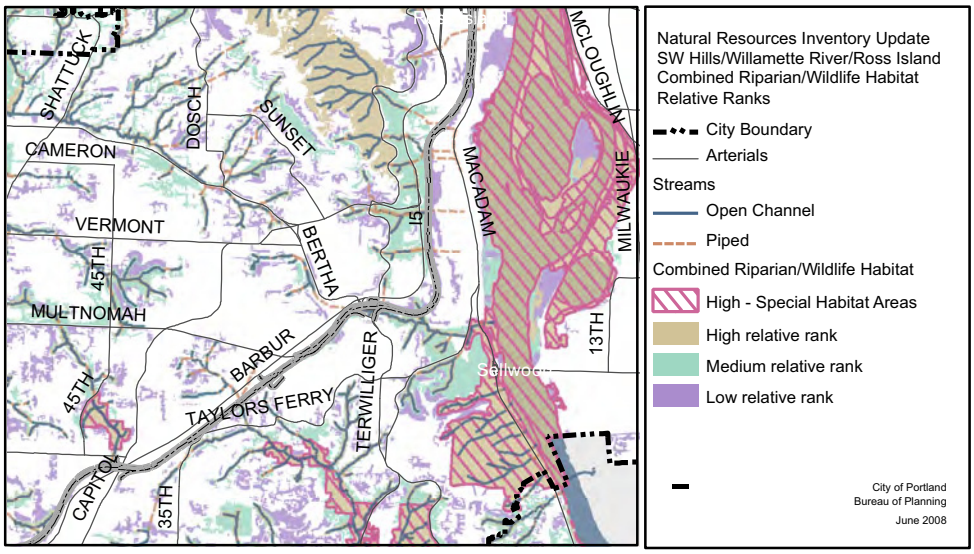






4. INVENTORY PRODUCTS AND USES

Products

City staff, other agencies and organizations, and citizens now have access to updated information about Portland's natural resources. Maps of local streams, wetlands, flood areas and vegetation are available online, by logging onto PortlandMaps.com. Maps can be viewed for individual properties and nearby areas.

As data regarding the location and extent of natural resources is refined, the online maps can be updated.

New GIS modeling tools have been developed to map Portland's riparian corridors and wildlife habitat, and to assess their relative functional value. Resource rankings have also been produced in draft map form. Maintaining the GIS data and modeling tools will allow the City to update the inventory information data to reflect changing conditions in Portland's watershed. Species lists and special habitat information for Portland are also available.

Updates to City inventories for the Willamette River areas around the Portland International Airport and Hayden Island are currently underway.

WEST HAYDEN ISLAND

Uses

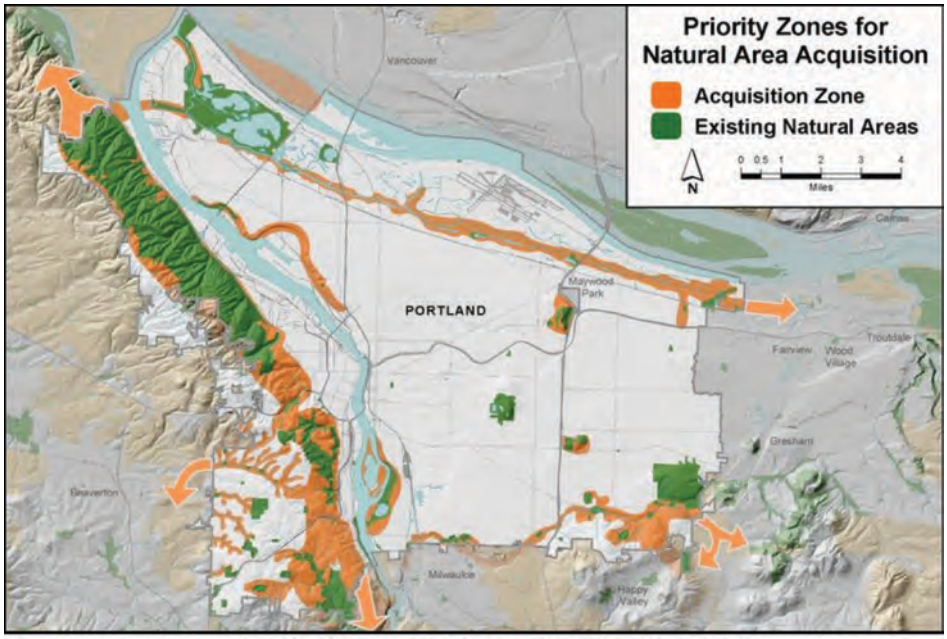
The inventory maps and reports will inform an array of City and community activities, including setting priorities for land acquisition and restoration, updating local regulatory programs, and developing strategies to comply with various regional, state, and federal regulations.

Draft inventory products are already being put to good use. Metro incorporated the City's updated stream data to revise the regional inventory of riparian corridors and wildlife habitat. The City used the draft inventory maps to inform development of the *Portland Watershed Management Plan*. Draft inventory maps are also informing the development of a new City Terrestrial Ecology Enhancement Strategy. The City and Metro have used draft inventory information to help identify local and regional land acquisition priorities. The updated inventory information will inform upcoming updates to the City's existing Willamette Greenway program and the environmental zoning program. The inventory will also support City efforts to comply with regional, state and federal regulatory requirements, including Metro's Title 3 and 13, Clean Water Act, and the Endangered Species Act.

Finally, the inventory provides a useful tool for reaching out to citizens and community organizations. Inventory maps can be used to prioritize public education and outreach activities, and to identify potential partnership opportunities.

IN CLOSING, the following points are important to remember when considering the products and uses of the updated natural resource inventory information:

- **The inventory is "information only"** and will inform a broad array of activities and does not propose any specific programs or regulations.
- **The new inventory information can be put to a number of uses, but will not automatically replace Portland's adopted inventories**. Inventories used to inform land use decisions will be updated through area-specific or citywide legislative projects, such as the River Plan.
- **The inventory addresses multiple watershed functions (not just a habitat inventory), and reflects Portland's urban landscape:**
  - **The inventory includes "natural" and "constructed" features** that contribute to the functional values of riparian corridor and wildlife habitats in the city.
  - **The conditions of inventories resources range from relatively good to highly degraded.** Most resource areas in the city are affected to some extent by human disturbance, invasive species, and other factors. Degraded areas still contribute to important watershed functions in the city and the region. Knowing which areas are high and low functions will help set priorities for protection and restoration.
- **The inventory maps reflect current information and technologies, both of which will evolve over time.** State-of-the-art mapping tools will allow the Bureau to incorporate new citywide or site-specific information as it becomes available.



CITY OF PORTLAND NATURAL AREA ACQUISITION STRATEGY, 2006

5. Next Steps

Next steps in the inventory process:

The Bureau of Planning will make the draft updated inventory maps and project report available to key stakeholders including City bureaus and Metro, local, state and federal agencies (e.g., Port of Portland, ODFW, DEQ, NOAA Fisheries), organizations (e.g., neighborhood associations, watershed councils, business and environmental interests), and interested citizens. Stakeholders will be invited to review and provide feedback on the reports, including more current information about natural resources on the ground. The Bureau will use this information to continue improving the inventory.

JOHNSON CREEK

As directed by the Planning Commission in October 2006, the Bureau of Planning will develop a workplan to update, maintain and improve the City's Environmental Program. The workplan will identify key steps and timelines to update the existing City inventories and to maintain the inventory information over time. The workplan will also include potential strategies to meet the City's watershed goals and to comply with Metro Title 13 and the Clean Water Act pollutant load restrictions. Such steps likely include citywide or area-specific updates to the City's zoning programs and other regulations, as well as an array of non-regulatory approaches. The Bureau will consult with other bureaus, agencies and key stakeholders in developing the work program. The Bureau will ask Planning Commission to endorse the proposed workplan, including the updated inventory methodology in 2008/2009.

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APPENDIX 1

COMPARISON OF PORTLAND AND METRO INVENTORY MODEL CRITERIA

Microclimate and Shade

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, stream or wetland	2, 5	----			----
forest within the flood area (except within a drainage district)	3, 4	A forest or woody vegetation landcover type within 100 feet of: a surface stream; a hydrologically connected wetland; or an area subject to flooding	woodland within the flood area (except within a drainage district)	3, 4	
forest that is contiguous to and within 100' of a river, stream or wetland	1, 2		forest that is contiguous to primary forest vegetation and within 780' of a river, stream or wetland	1, 2	A forest or woody vegetation landcover that is (contiguous to the primary area?) beyond 100 feet but within 780 feet
			woodland that is contiguous to and within 100' of a river, stream or wetland	1, 2	
		A forest or woody vegetation landcover type within 100 feet of: a surface stream; a hydrologically connected wetland; or an area subject to flooding	shrubland that is contiguous to and within 50' of a stream or wetland	1, 2	A forest or woody vegetation landcover that is (contiguous to the primary area?) beyond 100 feet but within 780 feet

Stream Flow Moderation and Water Storage

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, stream or wetland	2, 5	An area subject to flooding except developed floodplains			Developed floodplain
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	
			woodland or shrubland within 300' of a river, stream or wetland	1, 2	A forest, woody vegetation or low structure/undeveloped soils land cover type within 300 feet of a surface stream; or forest vegetation that is contiguous to the riparian corridor (starts within 300 feet) but extends beyond
		----	forest that is contiguous to primary forest vegetation or starts within 300' of a river, stream or wetland, and is within 780' of a river, stream or wetland	1, 2	A forest, woody vegetation or low structure/undeveloped soils land cover type within 300 feet of a surface stream; or forest vegetation that is contiguous to the riparian corridor (starts within 300 feet) but extends beyond
			herbaceous vegetation within 100' of a river, stream or wetland	1, 2	
			where the slope is 25 percent or more, herbaceous vegetation that starts within 100' of a river, stream or wetland, and is within 200' of a river, stream or wetland	1, 2	

Bank Function, and Sediment, Pollution and Nutrient Control

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, stream or wetland (except Willamette River North and Central Reach)	2, 5	(Land?) that is within 50 feet of a surface stream and is not a forest, woody vegetation, or low structure vegetation/undeveloped soils landcover type	Willamette River North and Central Reach	5	----
land within 50' of a river, stream or wetland (except hardened river banks in the Willamette River North and Central Reach)	1, 2, 7		land within 50' of a hardened, non-vegetated river bank in the Willamette River North and Central Reach	7	
forest, woodland or shrubland within the flood area (except within a drainage district)	3, 4	A forest, woody vegetation, or low structure vegetation/undeveloped soils landcover type within 100 feet of a surface stream; a hydrologically connected wetland; or within an area subject to flooding	vegetation within the flood area (except within a drainage district)	3, 4	A forest, woody vegetation, or low structure/undeveloped soils landcover type located on a slope greater than 25%, that starts within 175 feet of a surface stream reach and runs to the first effective break in slope
forest and natural/semi-natural woodland or shrubland within 100' of a river	1, 6, 8			1, 6, 8	
forest, woodland and shrubland within 100' of a stream or wetland	1, 2		vegetation within 100' of a river, stream or wetland	1, 2	
where the slope is 25 percent or more, forest and natural/semi-natural woodland or shrubland within 200' of a river	1, 6, 8	A forest, woody vegetation, or low structure vegetation/undeveloped soils landcover type within 100-200 feet of a surface stream if the slope is greater than 25%			A forest, woody vegetation, or low structure/undeveloped soils landcover type located on a slope greater than 25%, that starts within 175 feet of a surface stream reach and runs to the first effective break in slope
where the slope is 25 percent or more, forest, woodland or shrubland within 200' of a stream or wetland	1, 2		where the slope is 25 percent or more, forest, woodland and shrubland that is contiguous to primary vegetation (limited to the area of 25 percent slope)	1, 2	
			where the slope is 25% or more, herbaceous vegetation that is contiguous to primary vegetation and is within 200' of a river, stream or wetland	1, 2	

Large Wood and Channel Dynamics

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, beach or stream	2, 5	50 feet from a stream where there is no flood area - low and medium gradient rivers and streams only			----
land within 50' of a river or stream (except land within 50' of a river in the Willamette River North and Central Reach)	1, 4	50 feet from a stream where there is no flood area - low and medium gradient rivers and streams only			----
forest within 50' of a river in the Willamette River North and Central Reach			non-forest land within 50' of a river within the Willamette River North and Central Reach		
forest within the flood area (except within a drainage district)	3, 4	A forest landcover type within 150 feet of a surface stream or hydrologically connected wetland, or within an area subject to flooding	vegetation within the flood area (except within a drainage district)	3, 4	----
forest that is contiguous to and within 150' of a river or stream (except within a drainage district)	1, 3, 4	----	within a drainage district, forest that is contiguous to and within 150' of a stream	1, 3, 4	

Large Wood and Channel Dynamics

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
		----	where the slope is 25 percent or more, forest that is contiguous to primary forest vegetation and is within 260' of a river or stream (except within a drainage district)	1, 4	----
forest that is contiguous to and within 150' of a wetland located completely or partially within the flood area or 150' of a river or stream (except within a drainage district)	1, 2, 3, 4	A forest landcover type within 150 feet of a surface stream or hydrologically connected wetland, or within an area subject to flooding	where the slope is 25 pecent or more, forest that is contiguous to primary forest vegetation and within 260' of a wetland located completely or partially within the flood area or 150' of a river or stream (except within a drainage district)	1, 2, 3, 4	A forest landcover within 150 to 262 feet from a surface stream
wetland located completely or partially within the flood area or 150' of a river or stream (except within a drainage district)	1, 2, 3, 4	----			----

Organic Inputs, Food Web and Nutrient Cycling

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, stream or wetland	2, 5	A forest or woody vegetation landcover type within 100 feet of a surface stream, hydrologically connected wetland or within an area subject to flooding			A forest or woody vegetation landcover type within 100 to 170 feet of a surface stream.
forest and natural/semi-natural woodland or shrubland within the flood area (except within a drainage district)	3, 4, 8		cultivated woodland or shrubland within a flood area (except within a drainage district)	3, 6, 8	----
forest and natural/semi-natural woodland or shrubland within 100' of a river	1, 2, 6		forest and natural/semi-natural woodland or shrubland that is ontiguous to primary vegetation and is within 170' of a river	1, 2, 6	A forest or woody vegetation landcover type within 100 to 170 feet of a surface stream.
			cultivated woodland or shrubland within 100' of a river	1, 2, 6, 8	
forest, woodland or shrubland within 100' of a stream or wetland	1, 2		forest, woodland or shrubland that is contiguous to primary vegetation and within 170' of a stream or wetland	1, 2	

Riparian Wildlife Movement Corridor

Portland Primary Criteria	Footnotes	Metro Primary Criteria	Portland Secondary Criteria	Footnotes	Metro Secondary Criteria
river, stream or wetland	2, 5	----			----
vegetation that is contiguous to and within 100' of a river, stream or wetland	1, 2		vegetation that is contiguous to primary vegetation and is within 300' of a river, stream or wetland	1, 2	

Comparison of Portland and Metro Wildlife Habitat Model Criteria (1)

Wildlife habitat attribute	Portland - High Relative Functional Value	Metro - High Relative Functional Value	Portland - Medium Relative Functional Value	Metro - Medium Relative Functional Value	Portland - Low Relative Functional Value	Metro - Low Relative Functional Value
Habitat Patch* Size	Patch >= 585 acres	Patch > 2,467 acres (2)	Patch >=30 acres and <585 acres	Patch > 585 acres and <=2,467 acres (2)	Patch >=2 acres and <30 acres	Patch < 2 acres and <=585 acres (2)
Interior Habitat Area**	Interior Area >500 acres	Interior Area >1,118 acres (2)	Interior Area >=15 acres and <30 acres	Interior Area >386 acres and <=1,118 acres (2)	Interior Area >=2 acres and <15 acres	Interior Area >2 acres and <=386 acres (2)
Connectivity/Proximity to other Habitat Patches***	Core forest/wetland portion of the patch is >= 2 acres and receives a patch proximity index value >=100.	2,254 10'x10' cells in patch are within ¼ mile of each patch	Core forest/wetland portion of the patch >=2 acres and receives a patch proximity index value >= 30 and <100.	>1,207 and <=2,254 10'x10' cells in patch are within ¼ mile of each patch	Core forest/wetland portion of the patch is >= 2 acres and receives a patch proximity index value <30.	<= 1,207 10'x10' cells in patch are within ¼ mile of each patch
Proximity of Habitat Patch to Water****	>= 75% of patch is within 300' of a river, stream or wetland.	>73% of patch is within 328' of a stream	>=25% and <75% of patch is within 300' of a river, stream or wetland.	>31% and <=73% of patch is within 328' of a stream	<=25% of patch is within 300 feet of a river, stream or wetland.	<=31% of patch is within 328' of a stream

Footnotes:
1 Criteria are paraphrased for readability
2 Rounded to nearest acre

The following footnotes apply to Portland criteria:

* 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.

** "Interior area" is defined as the area within the forest and/or wetland portion of a habitat patch that is situated at least 200' from the edge of that portion of the patch.

*** 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.

**** 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.

APPENDIX 2

SPECIAL STATUS FISH AND WILDLIFE SPECIES

Appendix 2: Special Status Fish and Wildlife Species in Portland

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
A	Northern Red-legged Frog	Rana aurora aurora	Species of Concern	SV	G4T4/S3	2	X		X		☑
A	Clouded Salamander	Aneides ferreus		SV	G3/S3	3					☑
B	Purple Martin	Progne subis	Species of Concern	SC	G5/S3B	2	X	X	X		☑
B	Loggerhead Shrike	Lanius ludovicianus		SV	G4/S3B, S2N	4					☑
B	Long-billed Curlew	Numenius americanus		SV	G5/S3B	4				Yellow List	☑
B	Merlin	Falco columbarius			G5/S1B	2					☑
B	Nashville Warbler	Vermivora ruficapilla						X			☐
B	Northern Harrier	Circus cyaneus					X	X			☐
B	Olive-sided Flycatcher	Contopus cooperi	Species of Concern	SV	G5/S4	4	X	X	X	Yellow List	☑
B	Orange-crowned Warbler	Vermivora celata						X			☐
B	Pacific-slope Flycatcher	Empidonax dificilus						X	X		☐
B	Peregrine Falcon	Falco peregrinus	American & Arctic Delisted	SV	G4/T3/S1B	2					☑
B	Swainson's Thrush	Catharus ustulatus						X			☐
B	Purple Finch	Carpodacus purpureus							X		☐
B	Hooded Merganser	Lophodytes cucullatus							X		☐
B	Red Crossbill	Loxia curvirostra						X			☐
B	Red-eyed Vireo	Vireo olivaceus					X	X			☐
B	Red-necked Grebe	Podiceps grisegena		SC	G5/S1B,S4N	2					☑
B	Rufous Hummingbird	Selasphorus rufus						X			☐

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
B	Short-eared Owl	Asio flammeus						X	X	Yellow List	☐
B	Sora	Porzana carolina					X				☐
B	Streaked Horned Lark	Eremophila alpestris strigata	Candidate	SC	G5/T2/S2B	1	X	X	X		☑
B	Pileated Woodpecker	Dryocopus pileatus		SV	G5/S4	4	X	X			☑
B	Chipping Sparrow	Spizella passerina					X	X			☐
B	American Bittern	Botaurus lentiginosus							X		☐
B	American Kestrel	Falco sparverius					X	X	X		☐
B	American White Pelican	Pelecanus erythrorhynchos		SV	G3/S2B	2					☑
B	Bald Eagle	Haliaeetus leucocephalus	Delisted	LT	G4/S3B, S4N	2	X				☑
B	Band-tailed Pigeon	Columba fasciata	Species of Concern		G5/S4	4		X	X		☑
B	Black-throated Gray Warbler	Dendroica nigrescens						X			☐
B	Brown Creeper	Certhia americana						X			☐
B	Bufflehead	Bucephala albeola			G5/S2B,S5N	4					☑
B	Hutton's Vireo	Vireo huttoni						X			☐
B	Bushtit	Psaltriparus minimus						X			☐
B	House Wren	Troglodytes aedon						X			☐
B	Common Nighthawk	Chordeiles minor		SC	G5/S5	4					☑
B	Common Yellowthroat	Geothlypis trichas					X				☐
B	Downy Woodpecker	Picoides pubescens						X			☐
B	Dunlin	Calidris alpina					X		X		☐
B	Great Blue Heron	Ardea herodias							X		☐

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
B	Green Heron	Butorides virescens					X				☐
B	Hammond's Flycatcher	Empidonax hammondii						X			☐
B	Hermit Warbler	Dendroica occidentalis						X		Yellow List	☐
B	Thayer's Gull	Larus thayeri								Yellow List	☐
B	Bullock's Oriole	Icterus bullockii						X	X		☐
B	Wilson's Warbler	Wilsonia pusilla						X			☐
B	Swainson's Hawk	Buteo swainsoni		SV	G5/S3B	4				Yellow List	☑
B	Yellow-breasted Chat	Icteria virens	Species of Concern	SC WV	G5/S4?	4		X			☑
B	Yellow Warbler	Dendroica petechia					X	X	X		☐
B	Winter Wren	Troglodytes troglodytes						X			☐
B	Willow Flycatcher (Little)	Empidonax traillii brewsteri		SV	G5TU/S1B	4	X	X	X	Yellow List	☑
B	White-tailed Kite	Elanus leucurus			G5/S1B, S3N	2					☑
B	Vaux's Swift	Chaetura vauxi					X	X			☐
B	Western Wood-Pewee	Contopus sordidulus					X	X			☐
B	Western Sandpiper	Calidris mauri								Yellow List	☐
B	Varied Thrush	Ixoreus naevius						X		Yellow List	☐
B	Western Meadowlark	Sturnella neglecta		SC WV	G5/S5	4	X	X	X		☑
B	Vesper Sparrow	Pooecetes gramineus	Species of Concern	SC	G5/T3/S2B, S2N	2	X	X	X		☑
B	White-breasted Nuthatch (Slender-billed)	Sitta carolinensis aculeata		SV			X	X	X		☑
B	Wood Duck	Aix sponsa					X				☐

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
F	Steelhead, Lower Columbia River ESU	Oncorhynchus mykiss	LT	SC	G5T2Q/S2	1					☑
F	Coho Salmon, Lower Columbia R./Southwest Washington ESU	Oncorhynchus kisutch	C	LE	G4T2Q/S2	1					☑
F	Chum Salmon, Columbia River ESU	Oncorhynchus keta	LT	SC	G5T2Q/S2	1					☑
F	River Lamprey	Lampetra ayresi	SoC		G4/S4	4					☑
F	Coastal Cutthroat Trout, SW WA/Col. R. ESU	Oncorhynchus clarki clarki	PT	SC	G4T2Q/S2	2					☑
F	Steelhead, Upper Willamette River ESU, winter run	Oncorhynchus mykiss	LT	SC	G5T2Q/S2	1					☐
F	Chinook Salmon, Snake River Spr/Sum.run	Oncorhynchus tshawytscha	LT	LT	G5T1Q/S1	1					☐
F	Pacific Lamprey	Lampetra tridentata	SoC	SV	G5/S3	2					☑
F	Chinook Salmon, Upper Col. R. Spring-run	Oncorhynchus tshawytscha	LE		G5T1Q/SU						☐
F	Steelhead, Middle Columbia River ESU	Oncorhynchus mykiss	LT	SC/SV	G5T2Q/S2	1					☐
F	Steelhead, Snake River Basin ESU	Oncorhynchus mykiss	LT	SV	G5T2T3Q/S2S3	1					☐
F	Steelhead, Upper Columbia River ESU	Oncorhynchus mykiss	LE		G5T2Q/SU						☐
F	Sockeye Salmon, Snake River ESU	Oncorhynchus nerka	LE		G5T1Q/SX	1 - ex					☐
F	Chinook Salmon, Lower Columbia R. ESU	Oncorhynchus tshawytscha	LT	SC	G5T2Q/S2	1					☑

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
F	Coastal Cutthroat Trout, Upper Will. R. ESU	Oncorhynchus clarki clarki	SoC		G4T?Q/S3?	4					☐
F	Chinook Salmon, Snake River Fall-run ESU	Oncorhynchus tshawytscha	LT	LT	G5T1Q/S1	1					☐
F	Chinook Salmon, Upper Will. R spring run	Oncorhynchus tshawytscha	LT		G5T2Q/S2	1					☐
M	Red Tree Vole	Arborimus = Phenacomys longicaudus	Species of Concern	SV	G3G4/S3S4	3	X				☑
M	Yuma Myotis	Myotis yumanensis	Species of Concern		G5/S3	4					☑
M	White-footed Vole	Arborimus = Phenacomys albipes	Species of Concern		G3G4/S3	4					☑
M	Western Gray Squirrel	Sciurus griseus		SV	G5/S4	3	X				☑
M	Silver-haired Bat	Lasionycteris noctivagans	Species of Concern	SV	G5/S3S4	4					☑
M	Northern River Otter	Lontra canadensis					X				☐
M	Long-legged Myotis	Myotis volans	Species of Concern	SV	G5/S3	4					☑
M	Long-eared Myotis	Myotis evotis	Species of Concern		G5/S3	4					☑
M	Hoary Bat	Lasiuris cinereus		SV	G5/S3	4					☑
M	Fringed Myotis	Myotis thysanodes	Species of Concern	SV	G4G5/S2	2					☑
M	Camas Pocket Gopher	Thomomys bulbivorus	Species of Concern		G3G4/S3S4	3					☑
M	California Myotis	Myotis californicus		SV	G5/S3	4					☑
M	American Beaver	Castor canadensis					X				☐
M	Townsend's Big-eared Bat	Corynorhinus townsendii townsendii	Species of Concern	SC	G4/T3T4/S2	2	X				☑
R	Western Painted Turtle	Chrysemys picta bellii		SC	G5/S2	2			X		☑
R	Northwestern Pond Turtle	Actinemys marmorata	Species of Concern	SC	G3T3/S2	1	X		X		☑

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
Code	B	bird								
	F	fish								
	A	amphibian								
	R	reptile								
	M	mammal								
Federal Status	LE	Listed Endangered	Species listed by the by the USFWS or NMFS as Endangered							
	LT	Listed Threatened	Species listed by the USFWS or NMFS 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							
ODFW Status	LE	Listed Endangered		Species listed by ODFW or ODA as Endangered						
	LT	Listed Threatened		listed by ODFW or ODA as Threatened						
	SC	Critical		Species for which listing 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 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.						
	SP	Peripheral or Naturally Rare		Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those which had low population numbers historically in Oregon because of naturally limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum requirement. Disjunct populations of several species that occur in Oregon should not be confused with peripheral.						
ODFW StratSp		Strategy Species		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.						
ORNHP Rank	1	Critically imperiled			Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.					
	2	Imperiled			Imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences.					
	3	Rare			Rare, uncommon or threatened, but not immediately imperiled, typically with 21-100 occurrences.					
	4	Long-term Concern			Not rare and apparently secure, but with cause for long-term concern, usually more than 100 occurrences.					
	5	Secure			Demonstrably widespread, abundant, and secure					
	H	Historical			Historical Occurrence, formerly part of the native biota with the implied expectation that it may be rediscovered.					
	T	Trinomial			The taxon has a trinomial (a subspecies, variety or recognized race)					

Code	Species Name	Scienticif Name	USFWS	ODFW	ORNHIC Rank	List	NWPCC	PIF Focal Species	OWEB	ABC	City of Portland Sensitive Species
	U	Unknown	Unknown rank.								
	NR	Not Ranked	Not yet ranked								
	G	Global Rank	The 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.								
	S	State Rank	The 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.								
	Q	Taxonomic Questions	Indicates the taxon has taxonomic questions								
	?	Uncertain	Assigned rank is uncertain.								
	X	Extirpated	Presumed extirpated or extinct.								
ORNHP List	1	Threatened or extinct	List 1 contains species that are threatened with extinction or presumed to be extinct throughout their entire range.								
	2	Threatened or extirpated	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. ORNHP regards extreme rarity as a significant threat and has included species that are very rare in Oregon on this list.								
	3	Imperiled, more information needed	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.								
	4	Conservation concern	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 3

SPECIAL STATUS PLANT SPECIES

Appendix 3: Special Status Plant Species in Portland

November 2009

Latin Name	Common Name	USFWS Status	ODFW Status	ORNHIC Status
Carex comosa	Bristly sedge			2
Rorippa columbiae	Columbia cress		C	1
Wolffia columbiana	Columbia water-meal			2
Polygonum punctatum	Dotted smartweed			3
Zizia aptera	Golden alexanders			3
Castilleja levisecta	Golden paintbrush	LT	LE	1-extirpated
Ammannia robusta	Grand redstem (loosestrife family)			3
Hierochloe odorata	Holy grass			3
Howellia aquatilis	Howellia	LT		1
Agrostis howellii	Howell's bentgrass			1
Montia howellii	Howell's montia			4
Fritillaria camschatcensis	Indian rice / black lilly			2
Poa laxiflora	Loose-flowered bluegrass			4
Sidalcea campestris	Meadow checker-mallow			4
Cypripedium montanum	Mountain lady's-slipper			4
Artemisia campestris var. wormskioldii	Northern wormwood			1-extirpated
Delphinium nuttallii	Nuttall's larkspur			2
Elodea nuttallii	Nuttall's waterweed			3
Bolandra oregana	Oregon bolandra			4
Sullivantia oregana	Oregon sullivantia	SOC	C	1
Scirpus pallidus	Pale bulrush			3
Delphinium pavonaceum	Peacock larkspur			1
Carex retrorsa	Retrorse sedge			2
Heliotropium curassavicum	Salt heliotrope			2
Sedella pumila	Sierra mock-stonecrop			2-extirpated
Cimicifuga elata var. elata	Tall bugbane		C	1
Bergia texana	Texas bergia			4
Rotala ramosior	Toothcup			2
Poa marcida	Weak bluegrass			4
Euonymus occidentalis	Western wahoo			4
Delphinium leucophaeum	White rock larkspur			1
Sericocarpus rigidus (syn Aster curtus)	White-topped aster			1

LE - Listed Endangered LT - Listed Threatened C - Candidate SOC - Species of Concern

APPENDIX 4

PORTLAND NATURAL RESOURCE INVENTORY UPDATED PROJECT: TECHNICAL REVIEW SYNTHESIS REPORT AND STAFF RECOMMENDATIONS (OCTOBER 2006)

Portland Natural Resources Inventory Update Project

TECHNICAL REVIEW SYNTHESIS REPORT AND STAFF RECOMMENDATIONS

****

REPORT PURPOSE

The purpose of this report is to summarize and document the Portland *Natural Resource Inventory Update* Technical Review process, including input received from technical reviewers, staff responses and decisions to date. Staff will create an addendum to this report to document how the City's inventory results change as a result of the decisions presented in this report. The addendum will summarize the updated inventory model results including acres mapped, relative functional rankings, and comparisons to Metro's regional inventory. If additional refinements to data or model criteria are considered to address unforeseen problems with the models or new information, these will be addressed in the addendum as well.

BACKGROUND

The City of Portland Bureau of Planning is currently leading an effort to update and refine its natural resource inventories that range from 10 to 20 years old. The update project applies to areas within the city and urbanizing portions of Multnomah County. This effort continues the City's long-term investment in conserving natural resource values and functions that are critical for neighborhood livability, public health and safety, and fish and wildlife habitat. Portland's "Natural Resource Inventory Update" (NRIU) project also helps to implement the City's *River Renaissance Strategy (2004)* and the *Portland Watershed Management Plan (2005)*.

The NRIU project will improve the quality and accessibility of information on riparian resources and wildlife habitat in the City. New GIS data management, modeling, and mapping tools will allow the inventory to be updated regularly over time.

The products of the NRIU project will supplement the natural resource inventories that the City has produced over the last two decades. New data, maps and reports will inform a broad array of City and community activities such as:

- Developing citywide or area plans and strategies to improve watershed health and meet other goals (e.g., River Plan project, Terrestrial Enhancement Strategy)
- Identifying priority locations for restoration and willing-seller land acquisition
- Updating and improving existing regulatory programs, including the Willamette Greenway Plan and the City's environmental and greenway overlay zones
- Preparing strategies to comply with current and emerging regulatory requirements, including Metro's recently adopted Nature in Neighborhoods Program (Title 13 of the Urban Growth Management Functional Plan)
- Designing development and resource enhancement projects
- Targeting public education and outreach to specific areas

The Portland NRIU project incorporates and builds on the fundamental science and methodology that Metro developed and employed to produce the *Regionally Significant Riparian Corridors and Wildlife Habitat Inventory* which provides the technical basis for Title 13: Nature in Neighborhoods of the Urban Growth Management Functional Plan. The Metro Council first endorsed the regional inventory in 2001 after extensive technical review and input from local, state and federal agencies (including the City of Portland) and completion of a public hearings process. The Metro Council adopted the regional inventory in September 2005 and amended the inventory again in December of 2005.

The City is not proposing to reopen the fundamental science, assumptions and approach that provide the basis for Metro's regional inventory. However, the City is proposing to refine the regional inventory by:

- Incorporating more recent landscape feature data (i.e., vegetation);
- Updating plant and wildlife species lists and Habitats of Concern;
- Refining some of the regional inventory modeling/mapping criteria to reflect local conditions and research and analysis of more recent scientific literature; and
- Using a different but accepted model for evaluating connectivity between wildlife habitat patches.

As a result, the refinements should:

- Increase the level of detail of the inventory maps;
- Improve clarity and transparency in the inventory methodology;
- Enhance mapping accuracy;
- Integrate Portland-specific watershed conditions and functions; and
- Enable regular inventory updates for Portland.

Central to the City's inventory update and refinement effort is the production of new GIS data for streams and vegetation. The methodologies used to develop this data are documented and can be found in on-line at http://www.portlandonline.com/planning/index.cfm?c=40437**.** The Bureau of Planning has also developed a number of refinements to Metro's inventory modeling criteria. Proposed refinements are intended to reflect specific local watershed conditions and functions, information from recent local empirical research, and review of scientific literature published since the regional inventory was developed. Staffs from the Portland bureaus of Planning, Environmental Services and Parks and Recreation have also been collaborating in an effort to update the criteria Metro used to designate regional Habitats of Concern for Portland, as well as the boundaries of these areas.

The products of this effort will include maps showing landscape features that individually and collectively comprise the City's riparian corridors and wildlife habitat areas. Products will also include maps depicting the relative functional value of these resource areas. Various reports will be developed to describe and document the City's inventory update methodology and process, as well as updated inventory reports for different areas in the City.

Initial products of the City's effort have already been put to use. Metro incorporated Portland's new stream information when updating the regional inventory in 2003 and 2005. Initial draft maps were also used to inform the recently adopted *Portland Watershed Management Plan* and to inform the identification of Portland's local target areas for Metro's 2006 Natural Area Bond Measure. Currently, draft inventory maps are being used to support several activities of the River Plan/North Reach Project. The Bureau of Planning intends that this inventory update be provided in time to support the completion of the River Plan/North Reach project and the initiation of subsequent River Plan phases. Further, the products of the NRIU will be used to inform a future multi-objective planning effort for the Columbia Corridor area.

TECHNICAL REVIEW PROCESS

In early 2006, the Bureau of Planning initiated a technical review process to ensure that the proposed refinements to Metro's regional inventory:

- Are reasonable, appropriate, and scientifically acceptable.
- Are generally consistent with the intent of Metro's inventory, *and* will complement and enhance the applicability of the inventory for use in Portland.
- Would not invalidate or affect the credibility of the regional inventory in other cities or counties with different characteristics or data availability.

After the technical review process has been completed, the Bureau of Planning will finish drafting the Natural Resource Inventory Update methodology report and produce new working draft resource and inventory maps for broader review and use. Staff will seek stakeholder review and comment on the maps by planning area (e.g., the River Plan/North Reach, Columbia Corridor, and/or by watershed).

The inventory methodology and products will be submitted to the Planning Commission and City Council for endorsement, and to Metro as part of the City's Nature in Neighborhoods compliance package. The City will be crafting its compliance strategy over the next year or so, however the strategy may take several years to implement fully.

The first major step in the technical review process was for City and Metro staffs to review, discuss, and modify the initial inventory refinement proposal. These discussions were critical to ensuring that the proposed refinements would meet the criteria above.

Once City and Metro staffs reached general agreement on most of the proposed refinements, the City invited a broader set of experts and stakeholders to review all or parts of the refinement proposal. Technical experts were selected based on their expertise in watershed systems, riparian functions, and/or fish and habitat ecology. In addition, some of the reviewers represented key environmental regulatory agencies and some reviewers also have particular knowledge about specific local watershed conditions and functions, such as the workings of the managed floodplain within local drainage districts.

Most of the selected reviewers were familiar with Metro's inventory methodology. Some of the reviewers served on Metro technical committees during the inventory process. Others provided extensive comments on the regional inventory as it was being developed.

Given that the regional inventory was subject to extensive technical and public review before Metro Council adoption, technical reviewers were asked to focus on proposed refinements to the regional inventory methodology rather than critiquing aspects of Metro's methodology for which no changes were being proposed.

Technical Reviewers:
Susan Barnes/Patty Snow, Oregon Department of Fish and Wildlife
Jim Labbe/Bob Sallinger, Audubon Society of Portland
Tom Bouillion/Paul Fishman, Port of Portland
Nancy Munn, NOAA Fisheries
Karen Font Williams, Oregon Department of Environmental Quality
Mike Houck, Urban Greenspaces Institute
Paul Ketcham, Metro
Lori Hennings, Metro
Jennifer Thompson, U.S. Fish and Wildlife Service
Tom McGuire, Adolfson Associates
Alan Yeakley, Environmental Science, Portland State University
Bob Eaton/Dave Hendricks, Multnomah County Drainage District

City Bureau Reviewers
Bureau of Environmental Services
Portland Parks and Recreation

To orient the technical reviewers to the refinement proposal, project staff prepared the *Natural Resource Inventory Update Project Technical Review Briefing Paper*, Bureau of Planning *Draft* – May 31, 2006. The briefing paper provided background information, project context, an overview and general comparison of Metro and Portland inventory methodologies (including models, mapping criteria, ranking and scoring), a summary of the City's proposed refinements to the regional approach, and a table presenting specific refinements and associated rationale. The briefing paper concluded with a section describing how the results of the City's proposed refinements compared to the regional inventory. This section compared total acres mapped in the City's and Metro's inventories and the relative functional rankings for riparian corridors and wildlife habitat areas. The briefing paper included a number of attachments including maps, species lists, and mapping criteria comparison matrices. The body of the briefing paper is provided in Appendix 1. Attachments are available on request.

Project staff sent the briefing paper to technical reviewers in preparation for a half-day meeting that was held on June 13, 2006. The PowerPoint presentation used to inform and guide this discussion is available on request. Additional meetings were held with staff from the Bureau of Environmental Services and Portland Parks and Recreation (July 12, 2006), Bureau of Environmental Services (July 19, 2006), the Port of Portland (July 25, 2006) and the Multnomah County Drainage District (August 10, 2006). Meeting summaries are available on request.

The technical reviewers provided extensive, informative, and extremely constructive feedback on the City's proposal. Overall, the reviewers generally appreciated the intent of the City's efforts as well as the process used to develop the proposed refinements. Many of the refinements received general approval from most of the technical reviewers. However, individual views ranged from strong concurrence on some topics, to strong concerns about a few topics.

Comments from the technical reviewers are summarized in the next two report sections. Here, staff attempts to relate the reviewers' views by excerpting and paraphrasing, without linking specific comments to individual reviewers. Verbatim comments from individual reviewers are provided in Appendix 3. Revised versions of the inventory mapping criteria and Special Habitat Area criteria descriptions are presented in Appendices 4 and 5.

General/overarching comments

Some of the technical reviewers' comments were not tied to specific proposed inventory refinements. These comments seemed to relate to three general or overarching themes as presented below.

- **Relationship to Metro inventory** – Some reviewers commented about how the proposed refinements for the Portland inventory update relate to the Metro's regional inventory. It was noted that the City did a good job of building upon and maximizing consistency with Metro's approach. The proposal makes good use of more detailed data that are available for Portland, and tailors the regional methodology to reflect local conditions. The approach also makes good use of all the hard work and thinking Metro put into their inventory (scientific information, public review, etc.) and helps promote regional consistency in natural resource management. ***Staff appreciates this feedback.***

- **Restoration Potential** – There has been extensive discussion during the technical review process regarding the policy implications of ranking sites low in terms of current relative function if these

same sites also have very high restoration potential. Some reviewers suggested that the City begin correlating low rankings with high restoration potential and high rankings as high protection potential. It was also suggested that areas ranked relatively low in terms of current watershed function should not be viewed as unimportant. Reviewers wanted to make it clear that these areas may still need protection from development so as not to preclude future restoration and enhancement of watershed conditions over time. There seems to be general agreement among reviewers that this topic should be addressed in discussions with the public and decision-makers. ***Staff agrees and is committed to bringing this issue forward as the project proceeds.***

- **Criteria/Modeling Limitations for Watershed-Scale Processes** - Reviewers have pointed out that watershed hydrology and sediment, pollution, and nutrient production and control are determined by the landscape from ridgetop to ridgetop, including groundwater. The inventory modeling evaluates these functions and processes only in the context of riparian corridors. This approach does not recognize the relationship between forest cover throughout a watershed and stream health. This relationship should be made explicit in the inventory reports. ***Staff agrees. This is a limitation in both the Metro and City inventories and should be pointed out as such in the NRIU methodology report. In addition, it should be made clear that the upland vegetated areas mapped in the inventory as wildlife habitat also provide important functions and benefits relating to watershed hydrology and water quality.***

Comments on specific inventory refinements and staff decisions

This report section is comprised of discrete sub-sections pertaining to each of the proposed refinements presented to the technical reviewers. Each sub-section contains a brief description of the proposed refinement. (For more detailed explanations and rationale for the proposed refinements refer to the Technical Review Briefing Paper in Appendix 1.) Following this description is a synthesis of the technical reviewers' comments on that specific refinement. The sub-sections conclude with an explanation of staff's decision having considered all comments provided by the technical reviewers.

Consistent with the *Technical Review Briefing Paper* contained in Appendix 1, these discussions are presented under the following category headings:

- Data and Model Inputs
- Riparian Inventory Model
- Wildlife Habitat Model
- Species Lists and Habitats of Concern
-

This section concludes with some additional comments from the technical reviewers and brief staff responses listed under the heading "Other Topics."

Data and Model Inputs

1. **Proposed Refinement:** ***Using new vegetation data to improve model inputs and refine Habitats of Concern for Portland.***

Within 300 feet of the region's streams Metro mapped vegetated areas greater than 1 acre and classified landcover as forest vegetation, woody vegetation, or low structure vegetation/undeveloped soils. Beyond 300 feet from a stream, Metro mapped only forest vegetation patches 2 acres or larger.

To update the regional vegetation data, the City used 2004 aerial photos and selective field visits to produce GIS maps for vegetated areas that are greater than ½ acre and located within ¼ mile (1320 feet) of a river, stream/drainageway, existing environmental zones, and regionally significant habitat areas. (One-quarter mile was selected for data management purposes.) Establishing the ½ acre minimum mapping unit and ¼ mile distance would allow the City to produce more detailed vegetation maps for Portland while also maintaining the ability to manage the data. For these areas the City has classified vegetation as forest, woodland, shrubland, or herbaceous per the National Vegetation Classification System (NVCS).

Synthesized comments: Technical reviewers expressed general concurrence and support for this proposed refinement. Some reviewers asked for more information on the NVCS definitions (which was provided). One reviewer noted that while mapping vegetated areas down to ½ acre is an improvement over the regional level of resolution significant habitats for native plants and fauna can exist in smaller units. Questions about how the City's inventory addresses the shape of a vegetated patch are addressed in the discussion of *Interior Habitat Area* below.

Staff response/decisions:
While vegetated areas smaller than ½ acre can provide important habitat (e.g., individual trees), it is infeasible to map smaller units for purposes of the citywide inventory. Staff proposes to continue using the revised vegetation data as proposed. In addition, the City should continue updating the data to reflect new information (e.g., 2005 aerial photographs), and to improve the quality of the vegetation data over time (e.g., improve precision and consistency in classification, etc.).

2. **Proposed Refinement:** ***Not specifying an "undeveloped soils" landcover type in City inventory.***

As noted above, Metro combined low structure vegetation and undeveloped soils into one of the regional landcover types used in the regional modeling. Metro scanned the aerial photographs for the region in efforts to eliminate areas where non-vegetated soils would be highly compacted. The City has not included a specific "undeveloped soils" component in the herbaceous vegetation. In a highly urbanized environment, areas that are not vegetated or covered with pavement or structures are likely highly compacted (e.g., gravel parking lots, dirt or gravel roads, exterior storage areas, construction sites, etc.).

Data and Model Inputs

1. **Proposed Refinement:** ***Using new vegetation data to improve model inputs and refine Habitats of Concern for Portland.***

Within 300 feet of the region's streams Metro mapped vegetated areas greater than 1 acre and classified landcover as forest vegetation, woody vegetation, or low structure vegetation/undeveloped soils. Beyond 300 feet from a stream, Metro mapped only forest vegetation patches 2 acres or larger.

To update the regional vegetation data, the City used 2004 aerial photos and selective field visits to produce GIS maps for vegetated areas that are greater than ½ acre and located within ¼ mile (1320 feet) of a river, stream/drainageway, existing environmental zones, and regionally significant habitat areas. (One-quarter mile was selected for data management purposes.) Establishing the ½ acre minimum mapping unit and ¼ mile distance would allow the City to produce more detailed vegetation maps for Portland while also maintaining the ability to manage the data. For these areas the City has classified vegetation as forest, woodland, shrubland, or herbaceous per the National Vegetation Classification System (NVCS).

Synthesized comments: Technical reviewers expressed general concurrence and support for this proposed refinement. Some reviewers asked for more information on the NVCS definitions (which was provided). One reviewer noted that while mapping vegetated areas down to ½ acre is an improvement over the regional level of resolution significant habitats for native plants and fauna can exist in smaller units. Questions about how the City's inventory addresses the shape of a vegetated patch are addressed in the discussion of *Interior Habitat Area* below.

Staff response/decisions:
While vegetated areas smaller than ½ acre can provide important habitat (e.g., individual trees), it is infeasible to map smaller units for purposes of the citywide inventory. Staff proposes to continue using the revised vegetation data as proposed. In addition, the City should continue updating the data to reflect new information (e.g., 2005 aerial photographs), and to improve the quality of the vegetation data over time (e.g., improve precision and consistency in classification, etc.).

2. **Proposed Refinement:** ***Not specifying an "undeveloped soils" landcover type in City inventory.***

As noted above, Metro combined low structure vegetation and undeveloped soils into one of the regional landcover types used in the regional modeling. Metro scanned the aerial photographs for the region in efforts to eliminate areas where non-vegetated soils would be highly compacted. The City has not included a specific "undeveloped soils" component in the herbaceous vegetation. In a highly urbanized environment, areas that are not vegetated or covered with pavement or structures are likely highly compacted (e.g., gravel parking lots, dirt or gravel roads, exterior storage areas, construction sites, etc.).

Synthesized comments: Most reviewers expressed concerns that the City has not included "undeveloped soils" in the inventory. Many expressed concerns about potentially missing opportunities for restoration by not identifying these areas on the map. Some suggest that undeveloped areas, particularly near streams, do provide function. One reviewer suggested that undeveloped lots function differently than paved areas and that soil quality is extremely variable (e.g., compacted or pervious). A couple of reviewers pointed out that even compacted soil near a stream could serve functions related to flood water movement, channel migration and water storage. One reviewer concurred with the City's proposal and expressed disagreement with Metro's original use of an "undeveloped soils" landcover layer.

Staff response/decisions: Staff appreciates the reviewers' concerns and agrees that soil types are variable, and that undeveloped soil can, depending on the circumstances, provide more riparian function than impervious area. Highly compacted soil or graveled areas would not provide significant functions other than storage of water during flooding. At this point, staff believes that it would not be appropriate or productive to invest additional public resources in establishing a separate "undeveloped soils" landcover type at this time. However, it is important to note that the City inventory model assigns *all areas* within 50 feet of a stream or wetland, or within a flood area, some level of riparian function. Staff hopes that this clarification addresses the reviewers' concerns to some extent.

Riparian Inventory Model

3. **Proposed Refinement:** ***Recognizing the contribution of rivers and streams to riparian function and developing a new "surrogate stream channel" mapping criteria.***

Metro's mapping criteria did not explicitly attribute riparian functions to rivers and streams themselves (though functional values were assigned indirectly through other criteria pertaining to riparian vegetation and 50-foot buffers to protect basic waterway functions). The City proposal included attributing riparian functions directly to rivers, streams and hydrologically connected wetlands, and creating a protocol for mapping stream channels where only stream centerline data are available (i.e., 10' on each side of stream centerline to create a surrogate stream channel).

Synthesized comments: Most reviewers concurred with the proposal to recognize the role of streams and rivers in providing riparian function. One reviewer suggested that stream channel functions and riparian functions are different and that clarification was warranted. Regarding the proposed mapping criteria, technical reviewers expressed qualified concurrence in most written comments. However, reviewers urged care in explaining the role of the "surrogate channel." During the June 13 meeting, reviewers expressed concern that the mapped channel area would often be either smaller or larger than the actual channel width, triggering questions about the accuracy of the model. Reviewers noted that mapping "surrogate stream channels" would cause confusion and controversy without really providing additional information with which to differentiate between the functional values of different streams.

Staff response/decisions: Staff understands that although the technical reviewers agree that rivers and streams provide important watershed functions, there are many valid concerns

raised regarding the surrogate stream channel mapping approach. In order to prevent public concern and confusion, staff proposes to abandon the "10-foot from centerline" surrogate channel mapping protocol and eliminate specific reference to rivers and streams in mapping criteria. Alternatively, staff proposes that rivers and streams be assigned a high level of resource significance without modifying the maps, either descriptively in the report and/or by designating them as Special Habitat Areas.

4. **Proposed Refinement:** ***Broadening the assignment of secondary riparian functional values to vegetation within specified proximities of a wetland.***
Both Metro and the City assign primary riparian functional value to vegetation located within 150 feet of a wetland. Metro assigned secondary functional value to wetland-associated vegetation only for the *Microclimate and Shade function* (to a maximum distance 780 feet from a wetland). The City is proposing to assign secondary functional value to vegetation proximate to wetlands for each of the riparian functions evaluated by the model, not just microclimate. This would not change the maximum riparian functional distance (the maximum distance would remain 780 feet) but would increase the total ranked area by approximately 180 acres (most of which rank low for riparian function). This approach could also increase the relative ranking of wetland-associated vegetation.

Synthesized comments: Most of the technical reviewers concurred with the concept of assigning secondary value to wetland-associated vegetation for a broader array of riparian functions. A couple of reviewers agreed that wetland vegetation functions extend to and beyond 150 feet. One reviewer noted that adjacent riparian areas may be more important to the adequate functioning of a wetland than for streams, given that the riparian areas often represent the primary source of water to a wetland. Another reviewer disagreed with retaining the maximum functional distance of 780 feet, pointing out that progressively larger buffers are needed to achieve progressively smaller increases in effectiveness. It was also noted that the impacts from intense surrounding land uses (e.g., heat island effect) may warrant including even more vegetation to buffer the wetland. One reviewer asked if mitigation/constructed wetlands and natural wetlands are treated the same for this criterion, and what the breakpoint is between a natural and mitigation/constructed wetland. It was suggested that developing a Local Wetlands Inventory or some equivalent for Portland would provide more detail about the types and significance of local wetlands.

Staff response/decisions: Reviewers raised a number of salient points pertaining to this proposed refinement. Currently, the inventory methodology does not distinguish between the functions provided by constructed wetlands and natural wetlands if the constructed wetlands do in fact function like wetlands. Staff also agrees that developing more detailed wetland information (e.g., a local wetland inventory) would help refine the inventory further in the future. However at this point in time, staff proposes to retain this refinement as proposed which reflects the general concurrence of most technical reviewers.

Proposed Refinement: ***Assigning primary value to wetlands for Large Wood and Channel Dynamics functions and narrowing the area in which wetlands and associated vegetation contribute to Large Wood and Channel Dynamics functions.***
Metro assigned primary functional value for *Large Wood and Channel Dynamics* to forest vegetation existing within 150 feet of "hydrologically connected wetlands" (defined for this purpose as wetlands located within ¼ mile of a stream). The City proposes to broaden this approach by assigning primary functional value for *Large Wood and Channel Dynamics* both to wetlands *and* to associated forest vegetation. The City also proposes to narrow the approach by including only those wetlands that are located partially or fully within a flood area or within 150 feet of a river or stream. This proposed refinement focuses on the critical role of floodplain wetlands in shaping channels. The proposed refinements also reflect an assumption that within 150 feet of a stream are somewhat more to likely have a subsurface connection with the stream than wetlands located ¼ mile from a stream, and that within 150 feet wetlands could collect large wood and sediment which would have a direct effect on channel dynamics. (Note: All but two of the wetlands mapped within the City are within 150 feet of a stream.)

Synthesized comments: Most of the technical reviewers generally concurred with this proposed refinement. However, several concerns were raised as well. One reviewer noted that wetlands located further than 150 from a stream could still affect the baseflow hydrology of the stream via subsurface flows. However, this reviewer thought it unlikely that such flows would significantly affect channel dynamics except possibly over the long term. Another reviewer noted that while wetlands beyond 150 feet may provide functions linking to streams, it would be difficult to make a link to large wood and channel dynamics. One reviewer questioned the rationale for 150 feet, and another emphasized that unless a wetland is actually hydrologically connected to a stream, there would be no pathway for large wood to reach the stream, even during overbank flows. Another reviewer noted that the hydrologic connection between streams and wetlands is not always apparent from surface topography. It was suggested that subsurface contributions of wetlands within 250 feet of a stream be evaluated if alterations to the wetland are planned.

Staff response/decisions: Given general concurrence from technical reviewers and the lack of information on the actual hydrologic connection between wetlands and streams, staff believes that this proposed refinement hones and enhances the regional inventory and proposes that it be retained.

Proposed Refinement: ***Recognizing limitations on certain riparian functions for managed floodplain areas within drainage districts.***
The City proposed to modify several of the regional mapping criteria relating to *Streamflow Moderation, Water Storage and Watershed Hydrology* and *Large Wood and Channel Dynamics* functions. The proposed modifications are intended to recognize that hydrologic and floodplain functions are different within drainage districts than in other parts of the City. Drainage districts manage flows and channel movement intensively and regularly remove large wood to maintain channel conveyance. Flows and hydrology within drainage districts are managed rigorously through a system of levees and pumps. Flooding and channel movement are highly restricted. There is virtually no active floodplain within the drainage

districts, although there are many wetlands and active surface water/groundwater interaction. Modifying the mapping criteria is intended to reflect local hydrologic and channel dynamics functions more accurately.

The initial refinement proposal did not include changing mapping criteria for riparian functions relating to water quality, microclimate and shade, organic inputs or wildlife habitat.

Modifying the criteria as proposed would lower the relative functional rankings for some riparian areas within drainage districts. Some flood areas without woody vegetation (e.g., paved or grass) would be dropped from the inventory as well.

Synthesized comments: Technical reviewers provided extensive feedback on this issue during each of the three meetings and in written comments. Most reviewers expressed qualified concurrence with the proposal. Many reviewers expressed concern that lower relative rankings could result in lesser protections or missed opportunities for restoration. One reviewer recommended that the model results be reviewed closely to ensure that known, important riparian habitat areas are not dropping out of the inventory completely. This reviewer also asked that changes in the modeling results be described in the discussion document. Some reviewers noted that streamflow, floodplain, and channel dynamics functions are also degraded through many other parts of the City. One reviewer concurred with the proposal so long as it is clear that the inventory reflects current, not future conditions. Many reviewers emphasized that there is considerable potential to improve many riparian functions within the Columbia Slough channel (e.g., 10 miles of restored habitat funded by Clean Water Act Section 1135 grants).

Some reviewers requested staff to emphasize the important role of these areas for other functions such as habitat for wildlife and aquatic species, filtration, shade, food web, etc. One reviewer recommended that the same criteria refinements proposed for areas in drainage districts be applied to the Willamette River, suggesting that river flows and the channel are also intensively managed.

After the June 13 Technical Review meeting, project staff conducted additional sensitivity analysis to compare inventory model results with and without modifying certain functional criteria for areas within a drainage district. Applying the modified criteria resulted in relatively minor changes in relative rankings for riparian areas within the Multnomah County Drainage District's (MCDD) jurisdiction. Approximately 200 acres of flood area located more than 100 feet from a drainageway and without woody vegetation (in other words, covered with herbaceous vegetation, bare soil or impervious surfaces) would be dropped from the inventory because the management prevents these areas from flooding. Meetings with staff of the Bureau of Environmental Services (BES) Columbia Slough Watershed staff (July 19, 2006) and MCDD staff (August 10, 2006) focused on these criteria specifically. MCDD staff concurred that the proposed criteria refinements accurately reflect their activities in the managed floodplain and associated impacts on flooding and channel dynamics. MCDD also emphasized the importance of continued restoration (as evidenced by projects to create wetland benches and targeted placement of large wood). BES staff also concurred that certain riparian functions are affected by management activities within the drainage district, but cautioned that these areas remain critical for water quality, habitat and overall watershed health.

Staff response/decisions: Taking into consideration extensive feedback from technical reviewers and additional input with MCDD and BES staff, project staff propose to retain the mapping criteria refinements for areas within a drainage district for the time being. Several additional riparian mapping criteria will be modified to exclude areas within a drainage district where the function of the landscape feature (e.g., vegetation) is being ascribed solely due to location within a flood area. These additional changes are needed to achieve consistent treatment of the floodplain in the inventory methodology. However, the additional changes will *not* affect the riparian rankings for landscape features that meet other mapping criteria (e.g., resources within x distance from a stream or wetland).

Note: Staff is working with MCDD and other stakeholders to update the flood area maps for Portland. At such time the City's flood area maps are updated to more accurately reflect actually flooding activity, the flood-area specific criteria refinements would no longer be necessary and would be dropped.

Staff does not recommend applying these refined criteria to the Willamette River in Portland. Although Willamette River flows have been altered through the operation of dams in tributary sub-basins, the effects are regional rather than local. In addition, large wood is allowed to collect along the banks of the Willamette and there remain some areas of active floodplain along the Willamette in Portland. The Columbia Slough is the only water body within the City that has this system of levees and pumps. Secondary drainageways are also highly managed. Flooding is virtually non-existent. Trees may not be planted on the levees and large wood is regularly removed from waterways within the drainage districts to maintain flood storage capacity.

7. **Proposed refinement:** ***Applying secondary functional value to vegetation up to 300 feet from river, stream or wetland in lieu of using Metro's "break-in-slope" (where slopes >25%) as the functional distance limit for Bank Stabilization, and Sediment, Nutrient, and Pollution Control.***

Metro assigned secondary functional value to vegetation located on slopes >25% that began w/in 175' of a surface stream, and extending to "the first effective break-in-slope." Metro developed he regional break-in-slope information by drawing generalized boundaries based on regional topographic information. The City's initial refinement proposal included establishing a 300' maximum secondary functional distance instead of using Metro's "break-in-slope" data. The 300 foot distance limit was proposed because the regional break in slope data is very general and does not include information for miles of newly mapped stream segments. Also, the additional specificity of the City's contour data actually makes it more difficult to establish and map break-in-slope as conceptualized by Metro. Applying the 300-foot distance limit would have captured most of the area Metro mapped for this criterion. This approach would also have included some areas that are not steeply sloped but where vegetation may be contributing to sediment and pollutant removal.

Synthesized comments: Technical reviewers generally concurred with this proposed refinement, although several expressed concern about losing the relationship between slope and water quality related riparian function. Some reviewers suggested using the 300 foot

maximum distance or break-in-slope, whichever offers the greater area of protection. One reviewer noted that soil quality (e.g., compaction, texture, organic matter) is as important as slope in terms of how riparian areas reduce nonpoint source runoff and associated toxics and nutrients. Another reviewer asserted that the inventories are attributing too much to riparian areas and emphasized that upland processes and conditions have a critical impact on riparian resources and streams (e.g., mass wasting and landslides). Reviewers suggested that the inventory be linked to landslide hazards maps and public health and safety issues.

Staff response/decisions: Staff agrees that it is important to recognize the importance of slope conditions for functions relating to bank and slope stability, and control of sediments, nutrients and pollution. In order to do so, staff proposes to modify the original proposal. If GIS model test runs are successful, this functional criterion will be tied to the City's 25% slope data instead of the 300-foot functional distance presented in the initial refinement proposal. Mapping secondary functions using the City's >25% slope data should produce results that are generally consistent with Metro's break-in-slope approach, and will also ensure that steep areas surrounding newly mapped steams are included. The City will also continue to collaborate with Metro and others to improve the accuracy and consistency of local and regional topography maps as LiDAR data is produced for the region as a whole (expected sometime in 2007).

8. Proposed Refinement: ***Downgrading the riparian functional value of herbaceous vegetation relative to the value of more complex riparian vegetation assemblages.***
All vegetation types, including herbaceous or low-structure vegetation, can contribute significantly to how riparian corridors function. Metro recognized this by assigning primary functional value to all vegetation types for *Bank Stabilization and Sediment, Nutrient and Pollution Control.* More specifically, Metro assigned primary functional scores to low structure vegetation, which includes herbaceous vegetation, within 100 feet of a stream or wetland, or within 200 feet of a stream in areas where slopes exceed 25% for this function. Where slopes exceed 25%, Metro assigned secondary value to all contiguous vegetation, including low structure, starting within the primary functional area and extending to break-in-slope.

For *Streamflow Moderation and Water Storage* functions, Metro assigned secondary functional value to non-floodplain low structure vegetation. Metro applies the secondary value to low structure vegetation extending to 300 feet from a stream.

In Portland, much of the herbaceous vegetation consists of lawn and other areas that are often highly compacted, frequently mowed, and managed through application of fertilizers and pesticides. The City proposes to refine the regional mapping criteria to reflect differences in the functions provided by herbaceous vegetation and more complex riparian vegetation assemblages. These refinements are intended to hone the City's inventory and increase its credibility. The resulting maps will provide more detailed information that better inform priority setting for restoration, protection, land acquisition, etc.

Toward this objective, the City has proposed to downgrade the functional value assigned to herbaceous vegetation from primary to secondary for *Bank Stabilization and Sediment, Nutrient and Pollution Control* functions. For *Streamflow Moderation and Water Storage*

functions, the City's refinement proposal would assign secondary value to herbaceous vegetation (as Metro did), but would apply the same functional distances as used to model the *Bank Stabilization and Sediment, Nutrient and Pollution Control* functions (i.e., within 100 feet of a river, stream or wetland, and extending to 200 feet where slopes exceed 25%).

Synthesized comments: Technical reviewers expressed strong and varied opinions on this proposed refinement. Metro staff and others pointed out the important contribution of herbaceous vegetation to riparian functions. Some asserted that grass provides considerably more riparian function than pavement. However, most of the reviewers agreed that grass functions differently than more complex riparian vegetation. For example, one reviewer supported the proposal, asserting that low structure vegetation outside of forest and shrub areas in Portland is fairly rare and consists mostly of lawn or graveled and weedy areas.

A number of the reviewers agreed with assigning secondary functional value but questioned limiting the hydrology-related functional distances for herbaceous vegetation. And many reviewers expressed concern that lowering the relative ranking for these areas could result in reduced levels of protection and lost restoration opportunities. Several suggested that such areas may not currently function as well but are still important for stream health.

One reviewer supported reducing the value assigned to lawns, noting that lawn care and managed vegetation leads to an increase in nutrients and pesticide pollution. However, this reviewer does not support reducing the functional value assigned to unmanaged herbaceous vegetation and suggests placing managed and unmanaged herbaceous vegetation in different categories. Another reviewer suggested that the City assign secondary value to herbaceous vegetation within 300 feet of a slope exceeding 25%.

Staff response/decisions: Of all the proposed refinements, this is the most difficult to resolve given the strong opinions and concerns expressed by technical reviewers. Most of the technical reviewers confirmed the rationale to distinguish between Portland's herbaceous vegetation and other riparian vegetation types. Several reviewers could not support the modification because they are concerned that a lower inventory ranking could result in policy decisions not to not protect or restore these areas. Staff acknowledges this concern and is committed to bring this issue forward into future policy and resource management discussions and decision-making processes.

In addition, while staff is interested in the future potential to distinguish between functions provided by "unmanaged" and "managed" vegetation, the current vegetation data are not precise enough to do so at this time. In addition, it is very difficult to determine if and how herbaceous vegetation is or is not managed using aerial photos (e.g. pesticide application is not visible on an aerial photograph). In a highly urbanized area like Portland, most herbaceous landcover is managed to some degree and it is often unclear where to draw a line between levels of function.

After considering all the feedback, and recognizing the diverse perspectives and concerns, staff has concluded that the proposed shift in ranking for herbaceous vegetation continues to make overall sense from a bank stabilization and sediment, nutrient and pollution control perspective, and therefore proposes to retain the mapping criteria as initially presented. Staff also proposes to retain the proposed criterion for evaluating the relative function of Portland's

herbaceous vegetation for *Streamflow Moderation and Storage*. The soil compaction often associated with herbaceous vegetation in an urbanized environment reduces its ability to provide the level of interception and infiltration compared to the function provided by more complex vegetation assemblages. It seems appropriate in this circumstance to establish consistent criteria for assigning secondary hydrologic and water quality related functional value to herbaceous vegetation.

9. **Proposed Refinement:** ***Establishing a maximum riparian corridor functional width for modeling purposes.*** The City recognizes that riparian areas are not defined by specific widths, but rather by how they function as ecological units. However, the City proposes to refine the regional mapping criteria by establishing a maximum riparian functional distance "search area," primarily for modeling purposes. Without establishing a spatial limit, riparian functions could conceivably be mapped thousands of feet from a water body. To address this issue, the City proposed to establish a riparian corridor mapping boundary using the largest functional distance ascribed by the riparian model, specifically the 780-foot secondary functional distance that both Metro and the City is using to map *Microclimate and Shade* functions.

Synthesized comments: Technical reviewers generally concurred with a few qualifiers. One reviewer noted that this approach does not recognize the relationship between forest cover throughout a watershed and stream health, noting that while the Wildlife Habitat Model may capture some of these upland areas, the relationship of these areas to stream health needs to be made explicit in inventory reports. Another reviewer pointed out that if riparian areas represent ecological units (vs. a buffer or setback), a standard width is not appropriate. This reviewer also questioned the applicability of the literature source on which Metro and the City base the 780 foot functional distance for *Microclimate and Shade*. One reviewer suggested that 780 feet seems overly large and wondered if there are any riparian areas that are this wide in Portland. Another reviewer recommended that the City address impact areas, and suggested that primary impact areas should consist of all forest canopy that drains directly to streams and secondary impact areas would include all other areas within a watershed.

Staff response/decisions: Staff appreciates the questions and comments from technical reviewers on this somewhat confusing topic. In terms of questions about the 780-foot functional distance used to map *Microclimate and Shade* functions, staff reiterates that this number underwent extensive technical and public review, and has been adopted by Metro Council as part of the regional inventory. Barring the introduction of a scientifically-based functional distance that is more appropriate for Portland, the City will continue to use this assumption.

Staff also appreciates reviewer comments regarding the influence of vegetation throughout a watershed on stream health and will discuss this in the methodology report. Staff will make sure to explain and distinguish between riparian functional distances in the modeling criteria, the role of actual riparian areas, and buffer area concepts.

After considering technical reviewer feedback on this topic, staff proposes to proceed in establishing the proposed maximum riparian corridor width for modeling purposes.

10. **New Refinement:** ***Assigning secondary(instead of primary) functional value shrubland vegetation within 50 feet of a river, stream/drainageway or wetland***

Staff is also proposing a new refinement to the riparian inventory model; one that was not provided to technical reviewers. Metro's inventory assigned primary functional value for microclimate and shade to forest and woody vegetation within 100 feet of a stream. Metro did not assign value to low structure vegetation for these functions. The initial criteria provided by the City to the technical reviewers would have assigned a primary microclimate and shade value to forest, woodland, and shrubland vegetation within 100 feet of a river, stream/drainageway, or wetland.

City staff is now proposing to assign a secondary value to shrubland vegetation within 50 feet of a river, stream/drainageway or wetland. Portland varies extensively in terms containing woody vegetation. Some shrubland vegetation is comprised of riparian understory vegetation with some trees, including patches of Himalayan blackberry. These areas would generally qualify as woody vegetation that can contribute significantly to microclimate and shade functions. However, Portland's shrubland vegetation also includes shrub orchards and extensive landscaped areas comprised primarily of smaller plants, groundcover and grass. These types of areas may not contain much woody vegetation. Typically, riparian microclimate and shade functions are associated primarily with multi-story vegetation assemblages that include tree canopy. Still, shrubland vegetation on or near stream banks can provide shade that helps to moderate stream temperature. Staff believes that the proposal to assign secondary value to shrubland adjacent or very near a waterway or wetland is appropriate to capture this function.

Wildlife Habitat Model

11. **Proposed Refinement:** ***Relying on new vegetation data in lieu of creating two patch types.***

Metro established two types of patches as inputs to the regional wildlife habitat model. Type 1 patches are comprised of forest landcover and/or wetlands at least 2 acres in size. Type 2 patches are comprised of shrubland/scrubland or grassland/open soils landcover at least 2 acres in size and w/in 300' of a surface stream. With this information Metro was able to model wildlife habitat connectivity and other functions provided by medium and low structure vegetation within riparian corridors. The City proposes to rely on more detailed vegetation data instead of establishing 2 patch types. Details about the City's vegetation data are provided in item #1 and on the web at http://www.portlandonline.com/planning/index.cfm?c=40440.

Synthesized comments: Technical reviewers concurred with this proposed refinement. One reviewer noted that the new vegetation data recognizes the value of smaller patches in Portland not picked up in the regional inventory. Another noted that while mapping vegetated areas as small as ½ acre is an improvement over the regional inventory, significant habitat for native plants and small fauna can yet exist in small units.

Staff response/decisions: Proceed as initially proposed.

12. Proposed Refinement: ***Including woodland/shrubland vegetation in wildlife habitat patches.***

The City has proposed to include in wildlife habitat patches woodland/shrubland vegetation that is adjacent to forest/wetland patches at least two acres in size. Metro identified 2-acre minimum forest/wetland habitat patches but did not include other types of vegetation in habitat patches due to limitations in the regional vegetation data.

Synthesized comments: Technical reviewers concurred with this proposal and the underlying rationale. One issue that came up is whether this refinement meant that the inventory would include large patches of Himalayan blackberry or other invasive monocultures. Some technical reviewers noted that blackberry attract nuisance species and that including this type of invasive plant could be a public point of contention. Other reviewers commented that blackberry can serve as a buffer to protect natural areas and provide some value for specific wildlife habitat species. Blackberry can also effectively expand the habitat patch size and provide connectivity. Another concern is the potential for large areas of shrubland comprised of residential, commercial, or industrial landscaping to be included in wildlife habitat patches. It was also noted that any woodland/shrubland vegetation is potential habitat, and that even strips of single trees can provide green corridors down the center of residential blocks for birds and mammals.

Technical reviewers asked how the inventory addresses grasslands and meadows since the habitat patches being modeled do not include herbaceous vegetation.

Staff response/decisions: Staff appreciates the thoughtful discussion and comments from technical reviewers on this topic. Staff recognizes continuing concern about including Himalayan blackberry and other non-native or invasive species in the City's natural resource inventory. However, many of the most significant riparian corridors and wildlife habitat areas in the City contain non-native plant and animal species. City staff share the technical reviewers concern Recognizing that technical reviewers had different opinions on the topic, staff proposes to include woodland vegetation in wildlife patches if adjacent to areas that are 2 acres or larger and are comprised of forest vegetation and/or wetland. Staff proposes not to include shrubland vegetation in the wildlife patches. This is in part to address concerns expressed above. This is also because Portland's shrubland vegetation is, in many instances, by development or part of an area of cultivated landscaping. Where shrubland vegetation is part of an identified critical habitat corridor or connector, it can be mapped in the inventory through designation as a Special Habitat Area (like grassland areas).

13. Proposed Refinement: ***Scaling the regional relative habitat rankings criteria for Habitat Patch Size and Interior Habitat Area.***

In producing the regional inventory, Metro established relative ranking thresholds for Habitat *Patch Size* and *Interior Habitat Area* attributes by identifying natural breaks in the distribution of patch sizes for the region as a whole. Because much of the region is far less urban than Portland, the ranking thresholds were fairly high. For example, using Metro's thresholds, the Oaks Bottom Wildlife Refuge would receive a low ranking for *Habitat Patch*

Size. The City is proposed to scale these ranking thresholds to reflect Portland's urbanized landscape as well as recent research findings. The City's proposed rankings thresholds are shown below with the regional ranking thresholds.

City High:	>585 acres	(Metro High:	> 2,467 acres)
City Medium:	30 to 585 acres	(Metro Medium:	585 to 2,467 acres)
City Low:	2 to 30 acres	(Metro Low:	2 to 585 acres)

Similarly, the City's proposal involves linking the ***Interior Habitat Area*** and ***Habitat Patch Size*** rankings to provide a sound measure of the shape of a patch (relative to the size), while also continuing to scale the evaluation to Portland's urban environment. The City would continue to measure *Interior Habitat Area* using Metro's method (patch area minus a 200-foot interior buffer inward from the edge of the patch), and then linking the interior area ranking thresholds to the patch size thresholds above. The City's proposed ranking thresholds are shown below with the regional thresholds.

City High:	>500 acres of interior habitat	(Metro High:	> 1,118 acres)
City Medium:	15 to 500 acres of interior habitat	(Metro Medium:	386 to 1,118 acres)
City Low:	2 to 15 acres of interior habitat	(Metro Low:	2 to 386 acres)

Synthesized comments: Technical reviewers concurred with these two proposed refinements. Several reviewers commended the City for incorporating recent local research into the project. Another reviewer noted that the refinements help account for the fact that in urban areas there are smaller patches to work with and build upon. A couple of reviewers suggested that the two-acre minimum patch size Metro and Portland are using may be too large and asked if the City had considered using smaller patch sizes.

Staff response/decisions: In response to questions regarding the 2 acre minimum patch size, staff has encountered literature citing the important role of smaller vegetated areas, such as backyard trees, as habitat. However literature discussing habitat patches primarily addresses areas of 2 acres or larger. For the riparian wildlife movement corridor the City's model will map and evaluate vegetated areas down to ½ acre.

Consistent with general concurrence by technical reviewers, staff intends to proceed with refinements as proposed.

14. **Proposed Refinement:** ***Using FRAGSTATS to model Connectivity between Habitat Patches and adjusting ranking thresholds to reflect the distribution of patches in Portland.***

Metro developed a model to evaluate patch proximity/connectivity and established connectivity ranking thresholds based on natural breaks in the proximity data for the region as a whole. The City proposes to adjust the ranking thresholds to reflect natural breaks in the distribution of habitat patches within Portland. The City also proposes to use FRAGSTATS 3.3 to model connectivity/proximity between habitat patches. FRAGSTATS is an accepted, user-supported modeling platform used to evaluate proximity, connectivity and fragmentation between wildlife habitat patches based on a "dimensionless proximity index." The proximity

index of a habitat patch is the sum of the area of each patch divided by the squared nearest edge-to-edge distance between each patch and the habitat patch for which the index is being calculated. The proximity index increases as a specified "search area" around each patch is increasingly occupied by other habitat patches and as those patches become closer, larger, and more contiguous (or less fragmented) in their distribution. For more information on FRAGSTATS, please refer to http://www.umass.edu/landeco/research/fragstats/fragstats.html.

Metro attempted to use this model for the regional inventory but the size of the regional data sets made use of FRAGSTATS infeasible. FRAGSTATS is generally equivalent to the approach Metro developed to evaluate connectivity between habitat patches in the region, but is more effective in identifying connectivity between smaller habitat patches. FRAGSTATS also has the advantage of regular use by the broader scientific community and will be updated over time. Given that this factor is being evaluated generally (e.g., not for specific species), Metro and the City are using a ¼ mile "search area" for evaluating patch connectivity. The ¼ mile was selected based on data management and modeling considerations.

Synthesized comments: Most technical reviewers concurred generally with this refinement; however several were not very familiar with FRAGSTATS. One reviewer requested a more explicit explanation of the criteria used to evaluate connectivity. Another noted that FRAGSTATS simply quantifies the areal extent and spatial configuration of patches within a landscape; it is incumbent on the user to establish a sound basis for defining and scaling the landscape and how the patches are classified and delineated. This reviewer went on to note FRAGSTATS, like the Jenks optimization used by Metro, looks at numbers and finds groups within them, and asked if this meaningful in terms of wildlife ecology.

Staff response/decisions: Staff appreciates technical reviewer comments on this topic and agrees that the FRAGSTATS is in many ways similar to the approach Metro used to evaluate connectivity between patches. Staff also agrees that like the approach used to develop the regional inventory, FRAGSTATS is not species-specific and the index created evaluate relative connectivity is based solely on the geographic distribution of habitat patches in the Portland area.

Staff intends to proceed as proposed, and will continue to work with Metro and others to monitor advancements in evaluating habitat patch connectivity, particularly in urban areas.

15. **Proposed Refinement:** ***Applying the "Connectivity to Water" factor to wetlands (as well as rivers and streams), basing connectivity rankings on Portland habitat patches, and adding a riparian wildlife movement corridor function.***

In developing the regional inventory, Metro ranked habitat patches based in part on an attribute called *Connectivity to Water.* Metro established the ranking thresholds for this attribute based on the percentage of a patch that is located within 300 feet of a stream. Metro established ranking thresholds by identifying natural breaks in the distribution of percent area within 300 feet of a stream for all the habitat patches in the region. The City proposes to adjust the ranking thresholds to reflect percent area within 300 feet of a stream for habitat patches in Portland.

The City also proposed to apply the *Connectivity to Water* criterion to wetlands, while Metro applies this criterion only to streams.

The City's refinement proposal also included evaluation of riparian wildlife habitat as movement corridors by assigning primary value to forest, woodland, and shrubland vegetation within 300' feet of a river, stream, drainageway or wetland, and to apply a secondary functional value to herbaceous vegetation w/in 100' of these features. Metro addressed riparian wildlife movement corridor functions by assigning function to multiple vegetation types (type 2 patches) within 300 feet of a stream.

Synthesized comments: Technical reviewers expressed mixed views on these proposed refinements. There was general concurrence regarding the application of the *Connectivity to Water* factor to wetlands, although one reviewer expressed concern that for small wetlands a functional distance of 300 feet could be much larger than the resource. A couple of reviewers also had concerns about limiting the movement corridor functional distance for herbaceous vegetation. One reviewer noted that herbaceous vegetation may provide some of the best and most significant opportunities for wildlife movement in some locations. Another stated that the proposal does not reflect the importance of meadow habitat and provides a disincentive for planting trees or shrubs in areas that are currently grass. One reviewer suggested distinguishing between functions provided by managed and unmanaged herbaceous vegetation.

Staff response/decisions: Staff proposes to retain the proposed riparian movement corridor function which supports movement of wildlife to and along or around a stream or wetland. Staff proposes to modify the initial refinements to assign primary value to *all* vegetation types located within 100 feet of a stream or wetland and that is contiguous to the river, stream or wetland. (Where only stream centerline data are available, vegetation up to 10 feet from the centerline will be mapped as contiguous to the waterway.) Further, staff proposes to assign secondary value to vegetation (all types) that is contiguous vegetation receiving a primary score for this function (i.e., within 100 feet of a stream or wetland) and extending to a maximum distance of 300 feet from a river, stream or wetland. It may in the future be possible to distinguish between functions provided by natural/semi-natural herbaceous vegetation and managed herbaceous vegetation if/when the data could support this distinction. Herbaceous areas that are cultivated as lawn or landscaping are often highly fragmented by development, fences, roads and other barriers to wildlife movement some of which might present significant wildlife hazards.

Species and Special Habitat Areas

16. Proposed Refinement: ***Broaden the regional wetlands criteria used to designate Habitats of Concern to include known seeps and springs that are associated with a wetland complex.***

Metro included all locally significant wetlands in the regional Habitats of Concern but did include wetland-associated seeps and springs in the wetland criterion. The city has proposed to broaden this criterion to include seeps, springs and streams that are associated with the wetland, thus creating a "wetland complex."

Synthesized comments: Technical reviewers concurred with this refinement. One reviewer noted that the modification would better capture wetland hydrological and water quality functions. Another reviewer noted that it may be unrealistic to capture all seeps and springs.

Staff response/decisions: Staff agrees that it will not be feasible to identify all seeps and springs associated with wetlands. However the purpose of this criterion is to provide a mechanism recognize the importance of these seeps and springs and document their occurrence where know. Staff proposes to retain the refinement as proposed.

17. **Proposed Refinement:** ***Adding a new criterion for identifying Special Habitat Areas in Portland: Willamette Beach.***

The City proposed that this new criterion would be applied to documented natural and semi-natural beaches at least 1700 feet long (1700 feet is the mean Willamette beach length in Portland) and located along the Willamette River. This proposal is based on the importance of beach habitat to many species of shorebirds and significant correlations between Willamette Beaches and listed fish species as documented in *Biology, Behavior, and Resources of Resident Anadromous Fish in the Lower Willamette River* report, completed by the Oregon Department of Fish and Wildlife (ODFW 2005).

Synthesized comments: Most reviewers concurred with this proposal. Several noted that adding this habitat type was a good improvement. One reviewer asked what was meant by natural and semi-natural and said they saw flaws in the ODFW study. Another reviewer noted that the OFDW study provides strong support for inclusion of Willamette beaches. One reviewer asked how beaches would be distinguished from riparian areas. Some reviewers questioned the proposed 1700-foot minimum beach length limitation. One reviewer recommended that this criterion be broadened to include beaches along the Columbia River and Hayden Island, or that the Riverine Island or River Delta criterion be modified to include Columbia River and Hayden Island Beaches.

Staff response/decisions: To address questions raised by reviewers, staff conducted additional analysis regarding beach length. Bank treatment types were first inventoried by Greenworks et al in 2000, and were then modified by the Oregon Department of Fish and Wildlife for use in the *Biology, Behavior and Resources of Resident and Anadromous Fish in the Lower Willamette River*, 2005. This data layer contains 43 beach segments within the City of Portland. ODFW conducted statistical analyses for a subset of these, ranging in length from 200 feet to more than 3000 feet. At each transect ODFW found statistically

significant correlations between Willamette beaches and occurrence of listed salmonids; no distinction was made between longer and shorter beaches). Thus, staff proposes to change the initial 1700-foot minimum to a 200-foot minimum beach length for this criterion.

The establishment of Special Habitat Areas is intended to reflect documented information about specific areas. Therefore, staff does not propose to apply this criterion to other beaches along the Columbia River or other streams unless area-specific documentation is provided.

18. **Proposed Refinement:** ***Developing a plant list for Special Habitat Areas.***

Metro did not include a plant species list to accompany the Habitats of Concern "Plants" criterion. The City proposes to create a list of plants to clarify what is meant by the "Plants" criterion being used to designate Special Habitat Areas in the City's inventory. The list would include species that are known or expected to occur within Portland. Preliminary eligibility criteria include:

1. Plant species 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 Oregon Endangered Species Act; OR
2. Plant species receiving an Oregon Natural Heritage rank 1, 2 and 3; OR
3. Selected species from the City of Portland Bureau of Parks and Recreation (PPR) Species of Interest List.

Synthesized comments: Reviewers concurred with the proposal to develop a plant list. One reviewer suggesteed reviewing more recent species lists and consideration of additional species. Another noted that the list is not a complete list of native species for Portland and suggested incorporating all the relevant species. This reviewer also asked if the inventory would address invertebrate species, noting that various mollusk and insect species native to this area use vegetated patches that are generally smaller than sizes needed for vertebrates.

Staff recommendation: Staff proposes to work with Bureau of Environmental Services and Parks and Recreation staff to convene a group of plant experts to review these criteria and the initial draft list, and develop recommendations to revise the list before finalizing. Staff proposes to not include the Species of Interest List because that was not developed to meet the intent of Special Habitat Areas (the Bureau of Parks and Recreation staff concurs with removing these plant species.)

Other Topics

19. Regarding the developed floodplain: During the technical review process, some reviewers questioned why the City is assigning any riparian functional value to developed floodplains. Reviewers pointed out that the developed floodplain can be essentially impervious, with few natural resources remaining to provide beneficial wildlife habitat or other riparian functions. It was also pointed out that these areas can pose risks to water quality during flooding events. *Staff agrees that riparian functions in the developed floodplain are highly degraded and that these areas can pose risks during flooding events (for example, if stored contaminants were mobilized under flood conditions). These issues were also raised and discussed extensively during the development of Metro's inventory of regionally significant riparian corridors and wildlife habitat. The Metro Council directed that developed floodplains be assigned a secondary*

value for functions relating to streamflow moderation, water storage, and channel dynamics. This decision resulted in the developed floodplain receiving a low significance ranking in the regional inventory. The City's inventory approach is consistent with the Metro decision and no changes are currently proposed.

20. **Regarding the "U" Unique Special Habitat Area designation criterion – Comment:** It is important the city capture urban structural habitats within its inventory. Five percent of the known falcon nests in the state occur on bridges. The largest known swift roost in the world is at Chapman Elementary School. These sites can have significant ecological importance.
    Staff agrees.

21. **Regarding the Special Habitat Area mapping protocol - Comment:** The City's proposal to narrow HOC/SHA boundaries to exclude street trees (e.g., at Reed College) could have implications. In general the delineation of SHAs should err on the side of being inclusive rather than narrow. Consider areas that are used by wildlife that are adjacent to the significant habitat areas (street trees, parks, etc.) – the periphery is important. SHA could be applied to smaller areas and to neighborhood habitat.
    Staff appreciates this comment; however, it is important that the SHA boundaries are mapped consistently and can be justified based on existing documentation.

22. **Regarding elevation of Special Habitat Area rankings:** The City's inventory models assign "High" relative functional rankings to most areas proposed as SHAs. However a few SHAs and some portions of SHAs receive "Medium or "Low" relative rankings. The City's initial refinement proposal involved using the model rankings as significance rankings for SHAs, rather than elevating SHAs to a high significance ranking as Metro did. Some reviewers found this approach to be somewhat counter-intuitive and confusing in that the resources comprising or located within SHAs are by definition "highly significant." Questions were also raised as to how this information would play out in future discussions of management tools including protections and restoration.
    To address these issues, staff now proposes to present the model results as one element of the NRI, to be followed by the assignment of "significance levels." SHAs will be assigned a "high" level of significance even if their model-based rankings are low or medium.

23. **Regarding Impact Areas:** As noted above, one technical reviewer suggested that the City include impact areas in its Natural Resource Inventory as Metro did. Metro identified impact areas within certain distances of inventoried riparian and wildlife habitat resource areas. This reviewer also suggested the City use a more inclusive approach to identifying the impact areas (i.e., including all forested areas draining directly to streams as primary impact area, and including entire watersheds as secondary impact areas).
    Although Metro elected to identify impact areas as part of the regional inventory, the City is choosing to defer identifying an impact area. The Oregon Administrative Rule for compliance with Goal 5 defines impact area as "a geographic area within which conflicting uses could adversely affect a significant Goal 5 resource." The rule requires determination of an impact area as part of the evaluation of tradeoffs conducted through an Economic, Social, Environmental, and Energy (ESEE) analysis. Cities and counties are expected to rely on Metro's ESEE analysis when updating local Goal 5 program to meet Title 13 requirements. Therefore, it may not be appropriate for local jurisdictions to update the regional impact area specifications unless the city or county intends to conduct additional ESEE analyses.

Conclusions and Next Steps

The technical review process described in this report constitutes a critical step in the City's Natural Resource Inventory Update (NRIU) project. Throughout the process, technical reviewers provided invaluable critique, information, insights, and suggestions that have led, in many instances, to important improvements in the City's inventory methodology. Key improvements include multiple modifications to the inventory modeling/mapping criteria and Special Habitat Area (SHA) designation criteria. As a result the City's NRIU methodology better meets the criteria stated at the outset of this report, specifically, to build and improve on Metro's inventory of significant riparian corridors and wildlife habitat, while also maintaining overall consistency with the intent, approach and scientific underpinnings of the regional inventory.

Suggestions from technical reviewers will also be incorporated into the text of the City's inventory methodology report to ensure the City's approach and rationale is presented clearly and comprehensively. Where suggestions from technical reviewers have not been incorporated into the inventory, staff has attempted to provide clear responses explaining the decisions.

Staff will be creating an addendum to this report will be created after the City's inventory models have been revised and run to create new maps and statistics that can be compared to Metro's inventory and the original refinement proposal. The full set of SHA criteria will be presented in the addendum along with updated plant and animal species lists.

In addition, the technical review process and products will be noted in a project briefing before the Portland Planning Commission on October 10, 2006. This briefing will update the Planning Commission on the status of the NRIU work and how it fits into recent and upcoming Bureau of Planning and other City activities.

Natural Resource Inventory Update Project

Technical Review Briefing Paper

City of Portland Bureau of Planning
Draft – May 31, 2006

BACKGROUND

The City of Portland Bureau of Planning is currently leading an effort to update and refine existing natural resource inventories for areas within the city and urbanizing portions of Multnomah County. Portland's "Natural Resource Inventory Update" (NRIU) project is an implementation element of the *River Renaissance Strategy* and the *Portland Watershed Management Plan*. The project also supports the City's long-standing investments in conserving natural resource values and functions that are critical for neighborhood livability, public health and safety, and fish and wildlife habitat.

The NRIU project will improve the quality and accessibility of information on riparian resources and wildlife habitat in the City. New GIS data management, modeling, and mapping tools will allow the inventory to be updated regularly over time.

The products of the NRIU project will supplement the natural resource inventories that the City has produced over the last two decades. New data, maps and reports will inform a broad array of City and community activities such as:

- Developing citywide or area plans and strategies to improve watershed health and meet other goals (e.g., River Plan project, Terrestrial Enhancement Strategy)
- Identifying priority locations for restoration and willing-seller land acquisition
- Updating and improving existing regulatory programs, including the Willamette Greenway Plan and the City's environmental and greenway overlay zones
- Preparing strategies to comply with current and emerging regulatory requirements, including Metro's recently adopted Nature in Neighborhoods Program (Title 13 of the Urban Growth Management Functional Plan)
- Targeting public education and outreach to specific areas.

The Portland NRIU project incorporates and builds on the fundamental science and methodology that Metro developed and employed in producing an inventory of riparian corridors and wildlife habitat for the tri-county metropolitan region. The Metro Council endorsed an earlier draft of the inventory in 2001 after extensive technical review and input from local, state and federal agencies (including the City of Portland) and completion of a public hearings process. The Metro Council adopted an updated edition of the inventory in December of 2005.

Through the NRIU project, the City will refine Metro's inventory for Portland. Proposed refinements include:

- incorporating more recent landscape feature data;
- updating species lists and Habitats of Concern;
- refining several mapping criteria to address local conditions and data availability; and
- using a different, but widely-accepted model for evaluating connectivity between wildlife habitat patches.

These refinements are needed to:

- increase level of resolution;
- increase clarity and transparency;
- improve mapping accuracy;
- address data limitations;
- integrate Portland-specific watershed conditions and functions; and
- enable regular inventory updates for Portland.

The Bureau of Planning is submitting the proposed refinements to a group of technical experts for review. The purpose of the review is to ensure that:

1. The refinements are reasonable, appropriate, and scientifically acceptable.

2. The refinements are generally consistent with the intent of Metro's inventory, *and* will complement and enhance Metro's inventory for use in Portland.

3. The refinements make sense for Portland, and, at the same time do not invalidate the regional inventory in other cities or counties with different characteristics or date availability.

The technical review group will be asked to focus on aspects of the City's NRIU approach that differ from Metro's inventory methodology rather than critiquing portions of the NRIU that are virtually identical with Metro's adopted approach.

The remainder of this report:

- Provides additional context for the NRIU project

- Presents a general overview and comparison of Metro and Portland inventory methodologies

- Describes the rationale and scientific basis for City-proposed refinements to Metro's inventory for Portland, and

- Explains how the refinements will change the inventory results.

PROJECT CONTEXT

Portland's Natural Resource Inventory Update (NRIU) project is part of the City's long-term investment in producing natural resource inventories and establishing mechanisms to protect, conserve and restore important resources. The following is a chronology of events leading up to and guiding the NRIU project.

In 1982, the City adopted a map of local streams and water features. Setback standards were added to the Zoning Code to prevent development from coming too close to the waterways. In 1986, the City began producing more comprehensive natural resource inventories for specific areas in Portland. Starting with the Willamette and Columbia Corridors, the City produced ten natural resource inventories and protection plans over a 15 year period. The most recent inventory and protection plan was completed in 2001 for urbanizing pockets of Multnomah County.

The Portland City Council adopted these inventories and protection plans and established the resource overlay zones to: protect important resources and habitats; reduce landslides, flooding, pollution and other threats to public health and safety; and help the City comply with the federal Clean Water Act requirements and Title 3 of Metro's Urban Growth Management Functional Plan. To date, the City Council has established some type of resource overlay zoning for approximately 18,200 acres of land in Portland and urbanizing Multnomah County.

In 1997 NOAA Fisheries (formerly the National Marine Fisheries Service) listed steelhead trout as a threatened species under the federal Endangered Species Act (ESA). Steelhead trout inhabit Portland's rivers and streams, as do several other fish species that have since been listed. In response to the fish listings the City conducted a review of activities that could affect listed species and their habitats. Emerging from this review was a recommendation to update the existing environmental zoning program to reflect more recent scientific information and enhance protection for aquatic habitats.

The City initiated the "E-zone Update Project," later called the "Healthy Portland Streams" project. This effort included some initial work to update the City's inventory of streams, wetlands, water bodies and riparian resources. City staff also drafted proposed amendments to Portland's environmental policies environmental zoning regulations, and environmental zoning maps.

The initial Healthy Portland Streams proposal, released in November 2001, would have expanded the environmental overlay zone by approximately 5,000 acres to improve protection of streams and riparian areas. This proposal generated considerable public comment, and controversy. Many people expressed support for the intent of the proposal. However, the City received numerous comments opposing new regulations and, in some instances, questioning the underlying information and methodology used to generate new inventory and zoning maps.

During this same period, Metro began to develop a fish and wildlife habitat protection program for the tri-county region. The first step was to develop an inventory of regionally significant riparian corridors and upland wildlife habitat resources. Endorsed by Metro Council in December 2001, Metro's inventory includes approximately 87,000 acres in Clackamas, Washington and Multnomah Counties. About 28,000 acres are within the City of Portland and urbanizing Multnomah County. The next step was to develop a regional habitat protection program.

Given public concerns over the Healthy Portland Streams proposal, the fact that Metro was developing a new regional habitat protection program, and the then upcoming citywide watershed planning effort, the Bureau of Planning developed a modified workplan. The first phase of the work plan was to include:

- Clarifying and simplifying existing environmental zoning regulations to make them easier to understand, administer, and enforce.

- Revisiting and improving the City's inventory of riparian resources and upland wildlife habitats.

Further discussion of amending the environmental zoning maps would be deferred until the City's inventory update and Metro's program were completed. The Planning Commission concurred with the revised work plan in November 2002, and directed the staff to proceed accordingly.

The Environmental Code Improvement (ECI) project was completed in summer of 2005. The goal of the ECI project was to clarify, simplify and streamline existing environmental regulations, continue to protect important natural resources, and encourage enhancement of site conditions as part of development. The ECI project expanded opportunities for applicants to select simpler, less costly review process for projects that meet environmental development standards or projects that include site enhancement components. The project also established a new, more efficient and equitable process for responding to environmental violations. The ECI project received strong support from community stakeholders and other city bureaus. The City Council adopted the proposal in August of 2005. The code amendments took effect September 27, 2005.

As the first step in continuing to update the natural resource inventories, the Bureau of Planning developed more current and accurate stream and vegetation data for the City. During 2003 and 2004 Bureau of Planning staff, with assistance from the Bureau of Environmental Services, staff remapped approximately 160 miles of stream centerlines and added approximately 75 new stream miles to the maps. (Attachment 1) The Bureau of Planning provided Portland's updated stream data to for incorporation into the regional resource inventory. A detailed account of the stream remapping project can be found on http://www.portlandonline.com/planning/index.cfm?c=40440

The next step was to create new GIS data and maps for vegetation located within ¼ mile of either a stream, existing City resource overlay zone, and/or areas included in Metro's inventory of regionally significant riparian corridors and wildlife habitat. The project

involved using 2004 aerial photographs to map vegetated areas at least ½ acre in size and classifying the vegetation as forest, woodland, shrubland and herbaceous, in accordance with the National Vegetation Classification System (NVCS). The City also attempted to classify vegetation as "natural" or "cultural," as outlined in the NVCS guidelines, however, this information is less reliable than the basic vegetation type classifications. City staff conducted targeted field visits to check the vegetation information where needed. (Attachment 2) More information on the Vegetation Mapping Project can be found http://www.portlandonline.com/planning/index.cfm?c=40440

The Bureau of Planning has also been conducting additional research and analysis, developing proposed refinements to Metro's inventory modeling assumptions, and updating the regional Habitats of Concern criteria and maps for the City of Portland. These refinements and updates are presented in detail later in this report.

In September 2005 the Metro Council adopted Title 13 of the Urban Growth Management Functional Plan, thereby establishing the new Nature in Neighborhoods (NIN) program. The purpose of the program is to protect, conserve, and restore significant riparian corridors and certain wildlife habitat areas in the region. Title 13 establishes provisions intended to prevent impacts or ensure mitigation of unavoidable impacts on habitat conservation areas (HCAs) within the region. HCAs are comprised of the highest value riparian resources identified in the Metro's regional inventory of riparian corridors and wildlife habitat.

The Metro Council adopted the regional resource inventory as the scientific basis for the NIN program. The Metro Council also expressed an intent and expectation that local jurisdictions would continue to update and enhance the regional inventory based on new and improved information over time. .

In May 2006, Metro submitted the NiN program to the Oregon Department of Land Conservation and Development (DLCD) for acknowledgement with respect to the riparian and wildlife provisions of the OAR 660, Division 23 *Procedures and Requirements for Complying with Goal 5.* Except for the Tualatin Basin jurisdictions, cities and counties within Metro's jurisdiction will be required to demonstrate that their programs comply with Title 13 requirements within 2 years of acknowledgement by DLCD. The Tualatin Basin Partners for Natural Places (local cities and unincorporated counties within Metro's jurisdiction) worked together to submit a single package for acknowledgement by the Metro Council as part of Title 13. Tualatin Basin jurisdictions must demonstrate compliance under Title 13 in early 2007).

Two other important documents provide guidance for the NRIU: the *Framework for Integrated Watershed Management* and the *Portland Watershed Management Plan*. Both were endorsed by City Council in December of 2005. These documents establish key ecological principles, restoration priorities, citywide watershed goals and objectives, and recommended strategies and actions to protect and restore watershed health.

METRO AND PORTLAND INVENTORY METHODOLOGIES – OVERVIEW AND GENERAL COMPARISON

Overview

As noted above, Portland's NRIU project relies heavily on the science, methodology, and review processes Metro used to produce the recently adopted inventory of regionally significant riparian corridors and wildlife habitat.

The scientific basis for Metro's inventory is presented in the report entitled *Revised Draft – Metro's Technical Report for Goal 5 – July 2002*, which synthesizes information from numerous scientific reports and studies on the following topics:

- Watershed systems and processes
- Ecological functions and wildlife uses of riparian corridors and of upland habitats
- Impacts of urbanization on watershed features, systems and functions
- Relevance of applying scientific research conducted for non-urban ecosystems in an urban setting

Metro's inventory methodology and review processes are documented in the report entitled *Metro's Riparian Corridor and Wildlife Habitat Inventories – April 2005*. The report describes:

- Role of Metro advisory committees and public participation process
- Collection of information about riparian and wildlife habitat resource sites, (i.e., landscape feature data sources, fieldwork, and consultations with agencies and organizations including but not limited to those required by the Goal 5 rule)
- Methodology for mapping riparian corridors and wildlife habitats
- Species and Habitats of Concern, and Sensitive Species Descriptions
- Fieldwork to assess mapping criteria
- Explanation of how the inventory provides location, quality, and quantity information for identified resource sites as required by the Goal 5 rule
- Basis for determining regionally significant riparian resources and wildlife habitat

Metro's inventory work was subject to extensive review by the Independent Multidisciplinary Science Team which is comprised of leading experts in Pacific Northwest watershed and ecological systems. The Metro Council first endorsed the draft regional inventory in 2001, after a public review process. Since then, Metro

staff revised the data, maps and documentation reports several times to incorporate input from local jurisdictions (including the City of Portland), agencies, organizations, and property owners. The most recent versions of the regional inventory were adopted as part of the Nature in Neighborhoods program in September 2005, and again as amended in December 2005.

Metro Regional Inventory Models

To produce the regional resource inventory, Metro developed GIS models to generate consistent, well-documented maps of riparian corridors and wildlife habitat areas. Mapping was based on an assessment of key riparian and wildlife habitat functions as gleaned from relevant scientific literature.

Riparian functions

- Microclimate and shade
- Streamflow moderation and water storage
- Bank Stabilization, Sediment and Pollution Control
- Channel Dynamics and Large Wood
- Organic Material Sources

Wildlife Habitat Functions:

Wildlife habitat functions include breeding and rearing, food and foraging, cover, and connectivity and dispersal. Recognizing these critical functions, Metro used the following attributes as the basis for mapping and assigning relative wildlife habitat value:

- Habitat patch size
- Interior habitat area
- Connectivity between patches
- Connectivity to water

Regional Model Inputs – Key Landscape Features

Metro compiled the most current data available to map landscape features that the scientific literature associates directly with the riparian and wildlife habitat functions listed above. These features include:

- Flood areas (included only in riparian inventory)
- Forest Canopy, woody vegetation and low structure/undeveloped soils (w/in 300 feet of streams) – generally larger than 1 acre in size
- Steep slopes >25% (included only in riparian inventory)

- Wetlands (riparian inventory used "hydrologically connected wetlands," or those located within ¼ mile of a stream; wildlife habitat inventory used complete wetland layer)
- Open Water
- Streams (centerlines)
- Culverts
- Satellite land cover
- Riparian and Wildlife Values layers
- Habitats of Concern Layer (only included in wildlife habitat inventory)
- Species of Concern layer (informational and was not used to influence resource values)

Regional Mapping Criteria

For Metro's riparian inventory model, key landscape features are assigned a primary or secondary functional score depending on the type of landscape feature and/or its proximity to a stream or river. Metro performed an extensive review of the scientific literature to determine which features and proximities provide primary or secondary functions. Metro typically assigned primary scores to undeveloped floodplains, hydrologically connected wetlands, steep slope areas, and forest or other vegetation located adjacent to or near a stream. Secondary values were assigned to landscape features adjacent to but extending beyond the primary functional area out to a specified maximum distance from a stream. Secondary values were also assigned to the developed floodplain for certain functions.

For Metro's Wildlife Habitat model the mapping is based on specific assumptions for habitat patches (comprised of forest and wetland areas at least 2 acres in size). Assumptions were identified for how patch size, interior habitat area, connectivity between patches and connectivity to water contribute to the value of wildlife habitat. The Wildlife Habitat Model does not involve assignment of primary and secondary functional values. Rather, a single relative habitat value is assigned to each patch. Metro tested the viability of the wildlife habitat assumptions and mapping criteria by conducting field assessments at randomly selected sites throughout the region and comparing the results of the field visits with the model results. The model was adjusted to reflect the results of the field studies.

A table describing key functions and presenting Metro's final mapping criteria is provided in Attachment 3.

Regional Species and Habitats of Concern

Metro produced lists of the region's fish and wildlife species and species of concern. Metro also worked with agencies, organizations, wildlife experts and local jurisdictions to identify "Habitats of Concern" (HOCs). HOC categories include:

- regionally at-risk or priority conservation habitats (including wetlands);
- riverine islands and deltas,;
- habitat patches providing known unique or critical wildlife functions such as major wildlife crossings or corridors, migratory bird stopover areas, and biologically or geologically unique areas such as rocky outcrops; and
- important habitats that were not picked up by the Metro's models (e.g., uplands known to be important to migratory songbirds).

Metro evaluated potential HOCs against a set of criteria to determine their eligibility. HOCs were mapped as a separate GIS layer to overlay the model-based inventory maps Most but not all of the HOCs are contained within the areas mapped by Metro's riparian and/or wildlife habitat models.

Impact Areas

Metro identified impact areas as part of the inventory of regionally significant riparian corridors and wildlife habitat. These impact areas were not assigned relative function rankings for regional significance. However, the Impact Areas represent areas adjacent and proximate to significant riparian corridors and wildlife habitat areas where land uses and development could have an adverse impact on the significant resources.

Regional Riparian and Wildlife Habitat Ranking/Scoring

Metro devised a scoring system to rate the significance of the landscape features according to their contribution to riparian or wildlife habitat function.

For the riparian inventory, Metro assigned primary and secondary functional value scores to landscape features based on their proximity to a river, stream or hydrologically connected wetland (wetlands located within ¼ mile of a stream). Scores were additive for any landscape feature and were intended to reflect ecological function at any given point on the map. For example, a location on the landscape that contributes significantly to each of the five riparian functions could have received a score of 30 points (five primary functions time six points possible per function). Alternatively, an area could have received a few primary scores and a few secondary scores, or secondary scores only.

For the wildlife habitat inventory, Metro established significance scoring ranges for each of the four criteria (patch size, interior habitat area, connectivity to other patches, and connectivity to water). The scoring ranges were determined by using the Jenks method

to identify “natural breaks” in the regional data, which allowed Metro to create to establish different habitat classes.

Field data confirmed that the scoring ranges provide a reasonable means of differentiating the relative value of the patches from one another based on the specific model criteria.

Wildlife habitat scores were additive for a given habitat patch and reflect relative wildlife habitat value for each of the mapped patches. Habitat patches could have received a score of one to three points for each of the four model criteria, for a maximum of 12 points total.

Ultimately, Metro adjusted and simplified the riparian and wildlife inventory scoring significantly. Significant riparian resources were assigned a Class 1, Class 2 or Class 3 relative ranking. Significant wildlife habitat areas received a relative ranking of Class A, Class B or Class C. Metro gave Habitats of Concern a Class A wildlife habitat ranking, regardless of how the area was otherwise ranked by the model Attachment 4 provides an example of Metro’s inventory maps with rankings and showing a regional Habitat of Concern.

Technical and Public Review of Metro’s Mapping methodology

In developing the inventory methodologies, Metro consulted with multiple organizations, local, state and federal agencies, local experts, and the Independent Multidisciplinary Science Team. Metro also provided the methodology for review by Metro’s Goal 5 Technical Advisory Committee, Metro Technical Advisory Committee and Metro Policy Advisory Committee. After holding public workshops and a public hearing, the Metro Council adopted the methodology as part of Resolution 01-3087A and directed staff to apply the methodology to produce maps on a regional basis.

Portland Natural Resource Inventory Update (NRIU) Methodology – Overview and General Comparison to Metro’s Methodology

Overview

The City of Portland participated in the development of Metro’s inventory, both by providing data and information, and as active members of the Metro Goal 5 Technical Advisory Committee, Metro Technical Advisory Committee, and Metro Policy Advisory Committee. Given the strong scientific basis underlying Metro’s inventory and the extensive technical and public review Metro’s inventory underwent, the City is using this work as the basis for the NRIU project.

Following in Metro's footsteps, Portland has continued to work with the riparian and wildlife habitat GIS models to produce maps of key landscape features and functions. Portland is using the same riparian and wildlife habitat functions and mapping criteria categories used by Metro. Portland is also advancing and building on Metro's Habitats of Concern (HOCs) to complement and augment GIS model outputs. The City's scoring and ranking approach is consistent with Metro's, with a couple of exceptions as discussed below.

The City is proposing to update and refine Metro's inventory for Portland by:

- incorporating more recent landscape feature data;
- updating species lists and Habitats of Concern;
- refining several mapping criteria to address local conditions and data availability; and
- using a different, but widely-accepted model for evaluating connectivity between wildlife habitat patches.

These refinements are needed to:

- increase level of resolution;
- increase clarity and transparency;
- improve mapping accuracy;
- address data limitations;
- integrate Portland-specific watershed conditions to improve applicability of the inventory; and
- enable regular updates to the City's inventory to reflect new information and upgrades to modeling tools.

City staff and Metro staff met several times to discuss the proposed refinements to the regional inventory for Portland. It is the intent of City and Metro staff that the proposed refinements are scientifically acceptable, generally consistent with the intent and approach used to produce the regional inventory, and will complement and the regional inventory for applicability in Portland.

Based on these discussions, City staff further modified the proposal. Metro staff has expressed general acceptance and support for most of the proposed refinements, at least in concept. A couple of items were not discussed or not resolved and will be addressed during the upcoming technical review process. In addition Metro staff reserved judgment until they had a chance to review the revised model runs and compare the results with the regional inventory.

Summary of Proposed Refinements

As noted above, the City has proposed several types of refinements to the regional inventory for Portland. Refinements can be grouped into the following categories:

- Data and model inputs
- Riparian mapping criteria
- Wildlife habitat mapping criteria
- Species and special habitat areas

Data and Model Inputs

As described above, the City has produced new data for stream and vegetation as part of the NRIU update project. The City provided the updated stream data to Metro for inclusion in the region. However, given the increased level of detail in the City's vegetation data, it was not feasible for Metro to integrate the new vegetation data into the regional inventory. The City mapped areas greater than ½ acre. Metro's minimum vegetation mapping area was one acre. In the City has classified vegetation types across the mapping area (within ¼ mile of streams, environmental zones and regionally significant habitat areas). Metro was classified vegetation types other than forest landcover only within 300 feet of streams. This new vegetation data enables the City to generate more detailed inventory information, such as include woody vegetation in upland wildlife habitat patches where the woody vegetation is adjacent to the core forest/wetland patches greater than 2 acres in size (Attachment 2).

Riparian Mapping Criteria

The City is using the same set of riparian mapping criteria that Metro used to model the significant riparian corridors in the region. The City is, however, proposing to refine the specifics for a few of the riparian mapping criteria to:

- Produce more explicit and detailed mapping and evaluation of key landscape features;
- Address gaps in the data; and/or
- Address local conditions that Metro did not address in the regional inventory.

Wildlife Habitat Mapping Criteria

The City is using the same set of wildlife habitat mapping criteria that Metro used to model the significant wildlife habitat areas in the region. The City is, however, proposing to refine the specifics for a few of the riparian mapping criteria to:

- Scale habitat patch size and interior area thresholds to reflect empirical data for Portland, information from more recent scientific literature, and the extent to which Portland is urbanized relative to the rest of the region (i.e., at the far end of the regional "urbanization continuum").

- Enhance mapping of connectivity between habitat patches by using the Fragstats model and refining scoring thresholds to reflect further analysis of habitat patch distribution in Portland
- Update mapping of connectivity between wildlife patches and water to reflect habitat patch distribution in Portland

Species of Interest and Special Habitat Areas

As part of the NRIU project, the City in honing the regional lists of fish, wildlife and plant species contained in the supporting documents for the regional inventory. The proposed species lists have been revised to include species that are known or expected to occur in Portland. In addition, the updated lists include species of concern as identified by a broader group of organizations than was included in the regional inventory, including the Oregon Watershed Enhancement Board and Partners in Flight.

The City has also continued to update and refine Metro's Habitats of Concern (HOCs) for Portland. The Bureau of Planning met with staff from other bureaus and Metro, and other wildlife experts to review and update Metro's HOC designations based on additional information and documentation contained in the City's *Portland Watershed Management Plan* and other sources. In addition, the City has developed descriptions for each criterion to further clarify how the criteria would be applied on the landscape. The City has revised a number of the boundaries based on further analysis and is proposing to add a few new areas in the Columbia Slough, Johnson Creek and Fanno/Tryon watersheds.

The City is proposing to rename these areas "Special Habitat Areas (SHA)" rather than "Habitats of Concern. " This purpose of the renaming is to make it clear that these areas are more inclusive than the ODFW-mapped habitats of concern referred to in the state Goal 5 rule. The name "Special Habitat Area" is also intended to focus on positive aspects of these areas, opportunities for restoration, etc. Updated species lists, SHA criteria, SHA matrices, and an example of boundary refinements are provided in Attachments 5, 6, and 7, and 9 respectively.

Impact Areas

The City's inventory methodology does not, as yet, include the identification of Impact Areas. Impact areas could be added to the inventory if the City conducts an additional or supplemental Economic, Social, Environment, and Energy (ESEE Analysis) as specified in the Goal 5 rule.

Table 1. presents more detailed descriptions and explanations of the proposed refinements.

Table 1. Proposed Refinements to Metro Inventory of Regionally Significant Riparian Corridors and Wildlife Habitat for Applicability in Portland

City-Proposed Refinement "Snapshot"	Description of City-Proposed Refinement; comparison to Metro approach*	Rationale for City-Proposed Refinement	Metro staff opinion / technical review**
Data/Model Inputs			
The City is using new vegetation data in riparian and wildlife habitat inventory models, and for refinement of Habitats of Concern	Metro mapped vegetation within 300 feet of any river, stream or drainageway, and all forest canopy >1 acre in area. Metro classified vegetation as forest, woody, shrub and low structure/undeveloped soils only w/in 300' of a stream. To update the regional vegetation data, Portland used 2004 aerial photos and targeted field visits to produce GIS maps for vegetated areas > ½ acre, and w/in ¼ mile of any river, stream or drainage way, or within ¼ mile of existing environmental zones or regionally significant habitat areas. For these areas the City has also classified vegetation as forest, woodland, shrubland, or herbaceous per the National Vegetation Classification System (NVCS).	Portland's vegetation data is more detailed and accurate than the regional vegetation data. Classification of vegetation types outside stream corridors makes more detailed upland mapping possible. Classifying vegetation in accordance with NVCS protocol provides compatibility with other data sources and allows "seamless" linkage with Portland Bureau of Parks and Recreation Natural Areas Vegetation Assessments.	Metro staff concurs; additional discussion as needed.
The City is not including an "undeveloped soils" landcover type	Metro included low structure vegetation/undeveloped soils as one of its landcover categories. City landcover types include forest, woodland, shrubland, herbaceous and impervious surfaces. The City is not proposing to specify an "undeveloped soils" type.	The City's herbaceous vegetation layer captures some undeveloped soils in Portland. However, many unvegetated areas without structures or paving tend, in the City, to be comprised compacted features such as gravel roads, parking lots or otherwise compacted sites (e.g., ball fields, construction sites) that would not contribute significantly to most riparian and wildlife habitat functions. Where such areas are within a flood area the City's model will assign functional value for ***Channel Dynamics*** and ***Streamflow Moderation, Water Storage and Watershed Hydrology.***	To be discussed with Metro staff and technical reviewers as needed.
Riparian Mapping Criteria *			
Recognize waterway functions explicitly.	***Apply to all riparian functions*** Metro mapped stream centerlines, open water and locally significant wetlands. Metro's mapping criteria did not explicitly attribute riparian functions to rivers and streams themselves (though functional values were assigned indirectly through other criteria pertaining to riparian vegetation and 50-foot buffers to protect basic waterway functions). The City proposes to attribute riparian functions directly to rivers, streams and hydrologically connected wetlands in the riparian mapping criteria. The City mapped waterway channels based on water surface data where available, or 10' on each side of stream centerline (as a channel surrogate) where water and channel area are not available.	Rivers and streams and drainage ways contribute significantly to riparian functions (streamflow conveyance, flood storage, microclimate, organic inputs/nutrient cycling, etc.). Including waterways in the riparian mapping criteria makes this explicit.	Metro staff concurs; additional discussion as needed.
Broaden the attribution of secondary functional values to wetlands.	***Apply to all riparian functions*** Both Metro and the City assign primary value to vegetation within 150 of a wetland. Metro's applies secondary functional value to vegetation associated with wetlands only for the ***Microclimate*** function. The City's model currently assigns a secondary functional value to vegetation that extends beyond 150' from a wetland, using the same functional distances applied to vegetation along rivers, streams and drainage ways.	The scientific literature clearly confirms the importance vegetated buffers to support the broad array of wetland functions (e.g., sediment and nutrient control, fecal coliform removal, temperature moderation, water level fluctuation, and wildlife habitat. (Castelle, et al, 2002) Many sources confirm the functions of wetland buffers 100 to 200 feet or larger on steep slopes or where land uses have potentially more damaging effects (Castelle et al, 1994. Some cite the benefit of wetland buffers to 300' or further to protect wetland functions, particularly water quality and habitat functions. The City proposes to assign secondary functional values to contiguous wetland vegetation extends beyond primary area to recognize the additional functions associated with larger buffers (Desbonnet et al., 1994 as cited in Kitsap County Summary of Best Available Science, 2004).	To be discussed with Metro staff and technical reviewers

City-Proposed Refinement "Snapshot"	Description of City-Proposed Refinement; comparison to Metro approach*	Rationale for City-Proposed Refinement	Metro staff opinion / technical review**
Narrow the area in which wetlands contribute to channel dynamics.	***Large Wood and Channel Dynamics*** Metro assigned primary functional value to forest within 150' of hydrologically connected wetlands (i.e., located within ¼ mile of a stream). The City proposes to assign primary functional value to wetlands themselves, specifically those located w/in a flood area or located entirely and those located partially w/in 150' from a river or stream.	Channel dynamics are affected by riparian vegetation, sediment deposition, large wood, meander patterns, flow regime and flooding, vertical stability, etc. Wetlands affect sediment patterns and flooding. Wetlands can also attenuate large wood in riparian corridors. It is unclear whether wetlands outside flood areas or vegetated stream corridors would contribute significantly to channel dynamics.	Metro staff concurs; additional discussion as needed.
Recognize limited riparian functions w/in drainage districts.	***Large Wood and Channel Dynamics; Streamflow Moderation, Water Storage and Watershed Hydrology*** Metro's data limitations prevented recognition of the reduced hydrologic and floodplain function of drainage districts in the regional inventory model. The City proposes to modify certain mapping criteria to reflect limitations on hydrologic and floodplain function within drainage districts in Portland.	Several drainage districts operate within the City of Portland under the umbrella of the Multnomah County Drainage District. The drainage districts control water levels and flows in drainage ways which limits significantly the natural hydrologic and floodplain functions. Recognizing these differences improves the applicability of the riparian inventory model to Portland.	Metro staff concurs; additional discussion as needed.
Replace "break-in-slope" threshold w/ reasonable alternative for water quality related functions.	***Bank Stabilization, Sediment, Pollution and Nutrient Control*** Metro assigned secondary functional value to vegetation located on slopes >25% that began w/in 175' of a surface stream, and extending to "the first effective break in slope." The City proposes to use a 300' maximum distance threshold in lieu of Metro's "break-in-slope" threshold.	The City proposes an alternative approach for this criterion because: 1) Adequate break-in-slope information is not yet available for many parts of Portland where streams have been added to the maps. 2) Scientific literature indicates that that riparian forest and woody vegetation w/in 300 feet of streams can control sediment and pollutants on steep or shallow slopes. Using this approach the City is mapping the majority of the land captured in the regional inventory plus additional land along newly mapped streams.	Metro staff concurs; additional discussion as needed.
Reflect that herbaceous vegetation provides lesser value than riparian forest for water quality and hydrological functions	***Bank Stabilization, Sediment, Pollution and Nutrient Control*** Metro assigned primary scores to low structure vegetation w/in 100' of a stream or wetland, or w/in 100-200' of a stream where slopes are >25% (however regional vegetation data includes only forest beyond 300' from a stream) for this function. The City proposes to assign a secondary score to herbaceous vegetation (mostly grass/lawn) w/in 100', or w/in 200' where slopes >25%. ***Streamflow Moderation and Water Storage***, both Metro and the City assign a secondary functional value to herbaceous or low structure vegetation that is located outside of a flood area. The City proposes to apply the secondary function score to herbaceous vegetation within 100' of a stream and 200' where slopes exceed 25%. Metro applies the secondary score to low structure vegetation w/in 300' of a stream.	Mapped herbaceous vegetation in the City is primarily managed, (e.g., lawn). Although grasses can serve to filter and slow stormwater runoff, the scientific literature generally ascribes a lesser functional value to lawn than to the more diverse riparian vegetation assemblages. For example, there is increased risk of bank erosion due to limited soil and bank holding capacity of a number of shallow-rooted lawn species. Also, lawn is associated with increased discharge of phosphorus and other nutrients into water bodies (cit.). Infiltration and evaporation are much higher for forested land as compared with lawn (Kennebec County SWCD, 2001) Often the herbaceous vegetation in an urban environment has also been highly compacted which reduces opportunity for infiltration (City of Tacoma/W.WA Hydrology Model, 2003). Many literature sources call for replacement of lawn with riparian vegetation to improve water quality and other riparian functions.	Metro and City staff agree to raise this issue w/ technical reviewers
Establish maximum functional distance for riparian corridor.	***Streamflow Moderation and Flood Storage function.*** Metro did not establish a maximum distance for secondary functional value of forested land contiguous to and extending beyond 300 feet from a stream. The City proposes to establish a maximum distance of 780' from a river, stream or wetland.	The City's inventory model establishes a maximum distance from streams and wetlands within which ***riparian*** functions are expected to take place. (Outside this distance the functions are presumed to be associated with uplands.) Yet, the scientific literature does not recommend specific riparian corridor widths for vegetation to moderate streamflows and store water, outside the floodplain. Therefore the City proposes to use a distance of 780' for this function because this is the largest distance of all of the other riparian functions that are part of the model (secondary functional distance for ***Microclimate and Shade)***.	To be discussed with Metro staff and technical reviewers if needed.

City-Proposed Refinement "Snapshot"	Description of City-Proposed Refinement; comparison to Metro approach*	Rationale for City-Proposed Refinement	Metro staff opinion / technical review**
Wildlife Habitat Mapping Criteria *			
Rely on new vegetation data instead of defining 2 patch types.	***Definition of Wildlife Habitat Patches*** Metro established two types of patches to include in the regional wildlife habitat model. Type 1 patches are comprised of forest landcover and/or wetlands at least 2 acres in size. Type 2 patches are comprised of shrubland/scrubland or grassland/open soils landcover at least 2 acres in size and w/in 300' of a surface stream. With this information Metro was able to model wildlife habitat connectivity and other functions provided by medium and low structure vegetation within riparian corridors. The City proposes to rely on more detailed vegetation data instead of establishing 2 patch types.	The City has produced vegetation data for areas at least ½ acre in size within ¼ mile of rivers and streams in Portland. The City has classified the vegetation types in riparian corridors and uplands and therefore model habitat functions w/out establishing two types of patches.	Metro staff concurs; additional discussion as needed
Include woodland / shrubland vegetation in wildlife habitat patches.	***Definition of Wildlife Habitat Patches*** Consistent with Metro's Type 1 wildlife patches, City-mapped wildlife habitat patches must be of forest vegetation and/or wetland totaling 2 acres or larger in area. The City proposes to include woodland/shrubland vegetation wildlife habitat patches where it is adjacent to forest/wetland patches. Project staff will review patches containing >20% woodland shrubland to confirm functional value. Metro did not have woody vegetation data beyond 300' from streams.	The City is proposing to include woodland/shrubland vegetation in Portland's wildlife habitat patches because such areas can improve the diversity of habitat types and/or provide important buffers or connectors to other patches or water.	Metro staff concurs. To be discussed further w/ technical reviewers.
Scale ***Habitat Patch Size*** scoring thresholds for Portland	***Habitat Patch Size*** Metro determined ***Habitat Patch Size*** scoring thresholds based on natural breaks in the distribution of patch sizes for the region as a whole. The City proposes to scale the regional patch size thresholds to reflect empirical studies in Portland and guidance in the scientific literature. City High: >585 acres (Metro High: > 2,467 acres) City Medium: 30 to 585 acres (Metro Medium: 585 to 2,467 acres) City Low: 2 to 30 acres (Metro Low: 2 to 585 acres)	Metro's scoring thresholds are based on the distribution of habitat patch sizes across the region. In a highly urbanized landscape like Portland, it is appropriate to adjust habitat patch sizes based on local conditions. For example, using Metro's thresholds, the Oaks Bottom Wildlife Refuge would receive a low ranking for ***Habitat Patch Size.*** The City proposes a 30-acre "Medium" patch size threshold, which is consistent with the results of recent species research in Portland parks and greenspaces conducted by Dr. Michael Murphy et al at Portland State University. The 30-acre threshold is also consistent with Metro's field assessments of habitat patches in Portland and mirrors the targets adopted in Title 13. The proposed 585-acre "High" patch size threshold would link to Metro's "medium" ranking for the region. This is supported by some literature sources that suggest urban areas should strive to maintain habitat patches of at least 250 hectares (or about 500 acres). (Canadian Wildlife Service, 2005)	Metro staff concurs To be discussed further w/ technical reviewers
Modify ***Interior Habitat Area*** scoring thresholds	***Interior Habitat Area*** To determine scoring thresholds for this function Metro first subtracted the 200' internal buffer from all Type 1 patches and then identified natural breaks in the distribution of interior area for all patches in the region. The City proposes scoring thresholds that equal the proposed *Patch Size* scoring thresholds minus the 200-foot internal buffer that Metro used to define *Interior Habitat Area* (assumes the patch is round). City High: >500 acres (Metro High: > 1,118 acres) City Medium: 15 to 500 acres (Metro Medium: 386 to 1,118 acres) City Low: 2 to 15 acres (Metro Low: 2 to 386 acres)	The City-proposed ***Interior Habitat Area*** scoring thresholds represent the ***Habitat Patch Size*** scoring thresholds proposed above, minus the 200-foot internal "edge" buffer used in the Metro model. This approach links the scoring for patch area and the shape of habitat patches to the spatial scale and habitat conditions found in Portland. Thus, as with Metro's regional model, the same patch that receives a medium or high score for ***Habitat Patch Size*** could potentially receive a low ranking for ***Interior Habitat Area*** if the patch is long and narrow.	Metro staff concurs To be discussed further w/ technical reviewers

City-Proposed Refinement "Snapshot"	Description of City-Proposed Refinement; comparison to Metro approach*	Rationale for City-Proposed Refinement	Metro staff opinion / technical review**
Use Fragstats to model ***Connectivity Between Patches***. Adjust ranking thresholds to reflect distribution of patches in Portland.	***Connectivity Between Patches*** Metro developed a model to evaluate patch proximity/connectivity and established connectivity ranking thresholds based on natural breaks in the proximity data for the region as a whole. The City proposes to use Fragstats 3.3 to model connectivity/proximity between habitat patches. The City and Metro are both using a ¼ mile "search area" to evaluate patch connectivity. The City proposes to adjust the ranking thresholds to reflect natural breaks in the distribution of habitat patches within Portland.	Fragstats is a widely accepted, user-supported modeling platform used to evaluate proximity, connectivity and fragmentation between wildlife habitat patches based on a dimensionless proximity index. Metro attempted to use this model for the regional inventory but the size of the regional data sets made use of Fragstats infeasible. Fragstats is generally equivalent to the approach Metro developed to evaluate connectivity between habitat patches in the region, but is more effective in identifying connectivity between smaller habitat patches. Fragstats also has the advantage of regular use by the broader scientific. Basing the connectivity ranking thresholds on natural breaks determined for habitat patches in Portland provides a more refined analysis of relative habitat value in the City than using distribution of patches throughout the Metro region.	Metro staff concurs; additional discussion as needed.
Adjust ranking thresholds for distribution of patches in Portland. Apply criterion to wetlands. Add wildlife movement corridor component	***Connectivity to Water*** Metro established ranking thresholds for the percentage of a patch within 300 feet of a stream or based on natural breaks in the proximity data for the region as a whole. The City proposes to adjust the percentages to reflect natural breaks in the distribution of habitat patches within Portland. The City proposes to apply the ***Connectivity to Water*** criterion to hydrologically connected wetlands (along with rivers, streams and drainageways. Metro applies this criterion only to streams. The City proposes to use the riparian model to support the evaluation of riparian wildlife habitat by assigning primary value to forest, woodland, and shrubland vegetation within 300' feet of a river, stream, drainageway or wetland, and to apply a secondary functional value to herbaceous vegetation w/in 100' of these features.	Basing the patch percentage thresholds on natural breaks for habitat patches in Portland provides a more refined analysis of relative habitat value in the City than using distribution of patches throughout the Metro region. The scientific literature clearly supports maintenance of a vegetated buffer to maintain wildlife habitat movement and other habitat functions out to at least 300' from wetlands. While herbaceous vegetation in riparian areas can provide habitat and connectivity, much of the herbaceous vegetation in the City is managed as lawn which provides a lesser habitat value than more complex riparian vegetation assemblages.	Metro staff concurs with including the riparian wildlife corridor function, but questions limiting the functional value of herbaceous veg. to 100' from a stream or wetland. To be discussed with technical reviewers
Habitats of Concern / Special Habitat Areas			
Wetlands and associated seeps, springs and streams that are part of the wetland complex	Metro included all locally significant wetlands in the regional Habitats of Concern but did have sufficient regional data to specify seeps and springs. The city proposes to expand this criterion to include seeps, springs and streams that are associated with the wetland, thus creating a "wetland complex."	Wetlands are often functionally part of a larger complex that includes seeps, springs and streams. These features share the same hydrology. Seeps and springs also provide biologically unique habitats for invertebrates and the animals that feed on them.	To be discussed with Metro staff and technical reviewers if needed.
Willamette beach	The City proposes this new criterion that would be applied to documented natural and semi-natural beaches located along the Willamette River. The criterion may be applied to beaches that: 1. Are part of a larger resource area, such as a beach adjacent to a wetland complex; 2. Provides connectivity between other high value habitats; or 3. Extends a SHA to provide a habitat corridor. Metro did not identify beach habitat along the Willamette except as Habitats of Concern important to shorebirds.	The amount of each habitat along the Willamette has been reduced due to development and river use. Beaches also provide an important food source for shorebirds and waterfowl. They also are invertebrate-rich, similar to riverine islands, and provide unique and critical nesting habitat for certain shorebird species. The *Biology, Behavior, and Resources of Resident Anadromous Fish in the Lower Willamette River* report, completed by the Oregon Department of Fish and Wildlife (ODFW 2005), found significant correlations between beach habitats along the Willamette River and use by salmonids.	To be discussed with Metro staff and technical reviewers if needed.
Plants	Metro did not include a plant species list in its HOC criteria. The City proposes to add a list of sensitive plants species that are known or expected to occur within the City. This list include species: 4. 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 Oregon Endangered Species Act; OR 5. That receive an Oregon Natural Heritage rank 1 , 2 and 3; OR 6. Selected species from the City of Portland Bureau of Parks and Recreation (PPR) Species of Interest List. Note: The City also plans to review and consider modifying this list to address relevant plant species of concern in Oregon as identified in ODFW's new statewide wildlife strategy. .	A plant species list was added to be clear which areas of vegetation may have the plant criterion applied to them. The list can be found in Attachment 5.	To be discussed with Metro staff and technical reviewers if needed.

* (Attachments 10 and 11 provide an "at a glance" verbatim comparison of Metro and City-proposed mapping criteria.

Comparison of City and Metro Ranking/Scoring Approach

Both Metro and the City and Metro assign aggregate rankings to mapped areas based on a resource area's aggregated scores for individual riparian and wildlife habitat functions.

For the riparian corridors, both Metro and the City assign primary values for individual functions if at least one primary feature is present. To determine the aggregated riparian ranking (for all functions), the City assigns a high relative value if 3 or more primary functions are present; a medium relative value if 1 to 3 primary functions; and a low relative value if for areas where no primary functions are present but one or more secondary functions are present. This is consistent with Metro's approach in that it determines riparian resource classes based on the total number of points assigned for all functions.

For wildlife habitat areas, the City assigns a high value to patches that received at least 9 points of the 12 points available. Medium rankings are assigned to patches with 5 to 8 points and Low rankings are assigned to patches with 4 points or less. This is consistent with Metro's approach of assigning wildlife habitat classes based on the total number of points assigned for all habitat patch attributes.

Like Metro, the City is producing consolidated resource maps that incorporate significant riparian corridors and wildlife habitat areas. Where riparian corridors and wildlife habitat areas overlap, the City is applies the highest rank produced by either of the models (as did Metro).

One difference between the two ranking approaches is that while Metro elevated the rankings of Habitats of Concern to Class A Wildlife Habitat or Class I Riparian Habitat, regardless of the ranking assigned by the model, the City is proposing to retain the model ranking and continue showing the Special Habitat Areas on the maps. This will help inform viewers regarding whether the relative condition of habitat area vis-à-vis the model criteria, and will help inform the City and community stakeholders in setting restoration priorities. The City will need to keep in mind that where Metro elevated HOC rankings to Class I Riparian, these areas are subject to requirements of the Title 13 Nature in Neighborhoods program.

Attachment 8 provides an example of a City of Portland inventory map showing aggregate relative resource functional rankings and a Special Habitat Area.

Results and Implications: How does Portland's refined inventory compare to the regional inventory?

This section summarizes the how the City's inventory of riparian corridors and wildlife habitat areas compares to the regional inventory with the incorporation of all the proposed refinements described above.

Area of significant riparian corridors and wildlife habitat in Portland:

City inventory:	~25,351 acres (within the City of Portland)
Metro's regional inventory:	~23,898 acres
Difference:	+ ~1,453 acres (or ~6% more than the regional inventory)

Some key reasons for the additional net acreage in the City's refined inventory are:

- The City's new vegetation data allows inclusion of woodland/shrubland vegetation in wildlife habitat patches if the woodland/shrubland vegetation is contiguous to forest/wetland patches that are greater than two acres in size. While the vast majority of these patches contain less than 20% woodland/shrubland, this change adds inventoried area, primarily in uplands (areas extending beyond 300' from a river, stream or wetland)

- Metro did not produce new vegetation information for streams that were added to the maps after Portland's stream re-mapping project. Thus, the City's inventory includes more vegetation within 50' to 300' of the recently mapped streams.

Although the City's inventory includes additional net acreage, the City's inventory does not include approximately 2,047 acres to which Metro did assign functional rankings. More than 1/3 of this difference can be accounted for by the fact that Metro elevated all Habitats of Concern to Class 1 Riparian and Class A Upland Habitat. While the City's inventory likely includes these areas as Special Habitat Areas, the City would not have added or elevated model rankings for these areas. The remainder of the area not ranked by the City is likely attributed to the new vegetation data and other mapping criteria refinements.

Relative Functional Rankings

The City and Metro's overall relative functional significance rankings are generally consistent, and especially for the highest- and lowest-ranked areas, as shown in Table 2.

Metro rankings for regionally significant riparian corridors and wildlife habitat in Portland:

Class I Riparian/ Class A Upland Wildlife Habitat:	18, 243 acres	76%
Class II Riparian/Class B Upland Wildlife Habitat:	3,194 acres	14%
Class III Riparian/Class C Upland Wildlife Habitat:	2,462 acres	10%
Total:	23,899 acres	100%

City's rankings for significant riparian corridors and wildlife habitat in Portland:

High:	17,440 acres	69%
Medium:	4,399 acres	17%
Low:	3,513 acres	14%
Total	25,352 acres	100%

The distribution of City's and Metro's aggregate rankings differs slightly, in large part because most of the additional areas in the City's inventory are ranked Low or Medium. These areas are likely to be comprised of small to moderate size upland patches, or areas along recently mapped streams that have limited or low quality riparian vegetation. This relatively minor shift in ranking could also reflect the City's proposal to limit the functional value attributed herbaceous vegetation and to retain model rankings for Special Habitat Areas (or Habitats of Concern) that could have been ranked high in Metro's regional inventory.

Table 2. Comparison of Metro Inventory and City of Portland Refined Inventory Relative Resource Rankings

	Total Acreage								
	Acres of Regionally Significant Natural resources								
Portland Relative Resource Rankings	in Class I Riparian	in Class II Riparian	in Class III Riparian	in Class A Wildlife Habitat	in Class B Wildlife Habitat	in Class C Wildlife Habitat	in Regional Impact Area	Not in Regional Inventory	*TOTAL*
High Relative Value	9,028.39	552.58	87.97	6,334.23	218.80	93.64	446.04	678.72	17,440.38
Medium Relative Value	787.56	600.22	125.53	929.04	777.61	160.91	316.43	701.73	4,399.05
Low Relative Value	160.16	504.73	1,209.65	119.99	29.24	131.53	241.51	1,115.63	3,512.43
TOTAL ACREAGE	***9,976.11***	***1,657.53***	***1,423.15***	***7,383.27***	***1,025.64***	***386.07***	***1,003.99***	***2,496.09***	***25,351.85***
Not in City inventory	*176.24*	*273.22*	*155.47*	*707.01*	*237.95*	*496.97*	*3,169.17*		*5,216.03*
TOTAL RESOURCE CLASS ACREAGE	*10,152.35*	*1,930.75*	*1,578.62*	*8,090.28*	*1,263.59*	*883.05*	*4,173.15*		*28,071.80*

	Percentage of Metro Regional Resource Class within each City relative value class							
	in Class I	in Class II	in Class III	in Class A	in Class B	in Class C	in Impact Area	Not in Regional Inventory
High Relative Value	88.93%	28.62%	5.57%	78.29%	17.32%	10.60%	10.69%	27.19%
Medium Relative Value	7.76%	31.09%	7.95%	11.48%	61.54%	18.22%	7.58%	28.11%
Low Relative Value	1.58%	26.14%	76.63%	1.48%	2.31%	14.89%	5.79%	44.70%
Not in City inventory	*1.74%*	*14.15%*	*9.85%*	*8.74%*	18.83%	56.28%	75.94%	

	Percentage of City Relative Value Class within each Metro Regional Resource Class							
	in Class I	in Class II	in Class III	in Class A	in Class B	in Class C	in Impact	Not in Regional Inventory
High Relative Value	51.77%	3.17%	0.50%	36.32%	1.25%	0.54%	2.56%	3.89%
Medium Relative Value	17.90%	13.64%	2.85%	21.12%	17.68%	3.66%	7.19%	15.95%
Low Relative Value	4.56%	14.37%	34.44%	3.42%	0.83%	3.74%	6.88%	31.76%
Not in City inventory	*3.38%*	*5.24%*	*2.98%*	*13.55%*	4.56%	9.53%	60.76%	

In terms of the ***highest value resources***, Table 2 shows that Metro classified approximately 89% of the City's High-ranked areas as Class I Riparian or Class A Wildlife Habitat. Similarly, City models assign a High ranking to approximately 88% of Metro's Class I Riparian and 79% o the Class A Wildlife Habitat.

In terms of the ***lowest value areas,*** City models assign a Low rank to about 77% of the regiona Class III Riparian Areas and to about 14% of the regional Class C Wildlife Habitats. The City's inventory did not rank approximately 56% of Metro's Class C Wildlife Habitat. This is likely attributable to the City's refined vegetation data which was more precise about excluding non-vegetated areas. (Note: While 56% may sound like a large discrepancy, this area comprises than 500 acres, about 2% of the total area that Metro deemed regionally in Portland.)

There is more variation between City and Metro rankings for resources assigned Medium or Class II/B functional values. This is a result of the City's use of new vegetation data combined with refined modeling assumptions such as the valuation of herbaceous vegetation and scaling of wildlife patch sizes and interior habitat area scoring thresholds.

Overall Metro Habitats of Concern (HOCs) and City Special Habitat Areas (SHAs) are similar. City SHAs comprise approximately 12,180 acres. Metro HOCs comprise roughly 12,380. As noted above, the city has revised some of the boundaries, and is considering adding a few new areas in the Columbia Slough, Johnson Creek and Fanno/Tryon watersheds.

Conclusion

The City's proposed inventory approach refines and enhances Metro's regional inventory of riparian corridors and wildlife habitat within the City. The City's approach reflects newer, higher resolution data, and a honing of the regional mapping criteria for improved applicability at a smaller spatial scale and taking into account local knowledge in Portland. (Attachments 10 and 11 provide an "at a glance" verbatim comparison of Metro and City-proposed mapping criteria.) The City's refinements complement and are generally consistent with the intent and content of the regional inventory.

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APPENDIX 5

WILLAMETTE NATURAL RESOURCE INVENTORY TECHNICAL REVIEW - JANUARY 2008

The following paper addresses a number of key methodological issues raised in public comments on the draft Willamette Natural Resource Inventory for the North Reach. Most of these issues were discussed at a meeting of technical experts on January 10, 2008. Meeting participants included staff from the Port of Portland and SWCA Environmental Consultants, Ellis Ecological Services, Windward Environmental, Oregon Department of Fish and Wildlife, US Fish and Wildlife Service, Metro, NOAA Fisheries, Audubon Society of Portland, and the Portland Bureau of Environmental Services.

This paper provides a summary of the comments provided and staff responses which take into consideration input from the technical expert meeting and information gleaned from additional staff analysis.

Following the narrative discussion of the issues, comments, discussion and staff recommendations is a table summarizing this information and the anticipated changes in functional scores, aggregated riparian corridor and wildlife habitat ranks, and combined ranks.

Topic – Assigning riparian corridor functions and value to rivers and streams

Introduction to the Issue

Metro and Oregon Land Use Planning Goal 5 rules include rivers and streams as part of a riparian corridor. Metro's GIS inventory model did not assign scores directly to rivers and streams for the six riparian functions inventoried. According to Metro staff this was primarily due to mapping limitations (availability of stream centerline data only). The Bureau of Planning decided to explicitly recognize the important contribution of rivers and streams to each of the riparian functions addressed in the inventory. Rivers and streams store and convey flows and flood waters; contribute significantly to nutrient cycling and food web; provide hyporheic interactions and influence microclimate; contribute to channel dynamics; and are significant movement corridors for aquatic, terrestrial and avian species. As such, the GIS model assigns primary riparian functional scores directly to the rivers and streams in the draft WNRI.

Comments and Technical Discussion

Some commenters disagreed with the assignment of primary scores to Willamette River for the six riparian functions inventoried. They suggested that this approach obscures the variability of river conditions, including the considerable alteration and degradation of function in the lower river.

During the January 10th meeting, several of the technical experts attending supported the assignment of primary score to the Willamette River for the riparian corridor functions inventoried. It was noted that the river is the primary feature of the riparian corridor in the North Reach, and that it contributes significantly to all of the functions associated with the adjacent riparian zone. For example, the river provides the hydraulic forces that shape the channel and transports large wood from upstream that is then deposited onto North Reach beaches. Others disagreed, stating that that the riparian functions addressed in the inventory model are not the most appropriate metrics to use in assessing the quality or condition of the river.

There was general agreement that additional metrics should be incorporated into the inventory, whether or not the model is applied to the river. Recommended metrics include depth, width, geomorphology,

substrate, and water quality. Some of the meeting participants said that inventory needs to better reflect the degradation of the river conditions (e.g., water quality). Others said that despite the degradation, the inventory should reflect the unique and important ecological role and value of the lower river in the City, the region, and the basin as a whole.

All agreed that the inventory should address the variability in the North Reach character and conditions, such as shallow water areas. Participants encouraged staff to incorporate additional summary information from other reports, but cautioned staff not to duplicate the information provided in more detailed reports. They encouraged staff to cross-reference and provide links to other relevant studies.

Staff Recommendations and Results

Staff agrees the additional metrics should be incorporated into the draft WNRI to help characterize the condition of the river and contamination of sediment and riparian sites. The North Reach description will be revised to include more information on river geomorphology, water quality, and contamination. The revised inventory site descriptions will include more information (e.g. shallow water areas) to highlight variability in relative condition of the river where it exists.

Staff also proposes that the inventory continue to reflect the role of the river as a Special Habitat Area and the important contribution of the river to the riparian corridor functions addressed in the inventory.

Staff recommends that the river continue to receive primary scores for the following riparian corridor functions:

- Microclimate and shade
- Stream flow moderation and flood storage
- Organic inputs, food web and nutrient cycling
- Riparian wildlife movement corridor
- Large wood and channel dynamics (Note: Beaches will be incorporated into the Willamette River channel, and will also be assigned a primary score for channel dynamics)

To better reflect existing channel alterations, bank hardening, flow control, sediment contamination and water quality issues, staff recommends that the model be revised to assign a secondary score to the Willamette River in the North Reach for Bank Function, and Sediment, Pollution and Nutrient control. Changes to the model criteria will shift the scores assigned to the river for this function, however the aggregate relative rank assigned to the river for riparian functions will remain “high.”

Staff will refine the methodology section of the report to more clearly describe the relationships between the river and adjacent riparian areas.

Topic – Functional value of flood areas in the North Reach

Introduction to the Issue

The draft WNRI attributes riparian functional value to the flood areas within the Willamette River North Reach. Flood areas represent the combined FEMA 100-year floodplain and the areas inundated during the 1996 flood. The WNRI GIS riparian corridor model assigns primary scores to vegetated flood areas for five of the six riparian corridor functions. Developed flood areas are assigned a secondary score based solely on their contribution to flood storage. Therefore, the developed flood area receives a low relative rank for both aggregated riparian function and combined riparian/wildlife habitat function in the draft WNRI. This approach is consistent with the approach Metro used to evaluate riparian corridor function for the adopted regional Nature in Neighborhoods inventory.

Comments and Technical Discussion

Some commenters on the draft WNRI disputed the functional value attributed to the developed flood area along the Willamette in Portland. They suggested that:

1) The developed flood area does not provide significant ecological value;
2) More frequently flooded areas provide more value than the 100-year floodplains;
3) The storage capacity of the flood area in the Lower Willamette is insignificant relative to the flow volumes generated in such a large basin; and
4) The impact of flood storage is reduced given the management of flows by the Willamette Basin reservoir system.

A range of opinions on this topic were expressed during the January 10th meeting of technical experts. Some continued to dispute the value attributed to the 100-year floodplain, noting that it is primarily a tool developed by FEMA to insure property, rather than as an indicator of ecological value. They noted that this is a social, not an ecological function. Others asserted that the 100-year floodplain does provide significant ecological values (e.g. water storage, flow attenuation) and that the social values, such as property protection, are intertwined with the ecological values.

There was also disagreement as to whether the storage provided by flood area is important enough to be attributed value in the inventory. One participant pointed out that during a flood, the flood areas along the North Reach will fill with water within a very short period of time. It was also noted that some of the North Reach flood areas were inundated for several days during the 1996 flood. Others suggested that the role and value of these areas is cumulative and should be valued in the context of the basin as a whole. It was noted that no single site can "hold the river."

Everyone agreed that frequently flooded areas provide important ecological functions as well, and that developing data for these areas would enrich future inventories.

Staff Recommendations and Results

Staff agrees with the perspective that flood storage along the North Reach must be considered in the basin-wide context and valued from a cumulative perspective. Staff recommends that vegetated flood areas within the North Reach continue to be assigned primary score consistent with the adopted regional inventory, and developed (non-vegetated) flood areas continue to receive secondary score for flood storage. Staff also recommends that developed flood areas continue to receive a low relative rank for aggregated riparian functions and combined riparian/wildlife habitat function.

Topic – Functional Value of areas within 50 feet of the River

Introduction to the Issue

The draft WNRI attributes riparian corridor functional values to land within 50 feet of rivers, streams and wetlands for two of the six riparian corridor functions (*bank stabilization and control of sediments, nutrients and pollutants;* and *large wood and channel dynamics*). Primary scores are assigned to this area for these two functions regardless of bank condition. Therefore, the area within 50 feet of rivers and streams receive a high or medium relative rank for riparian corridor function and for combined riparian/wildlife habitat function.

This is consistent with the approach Metro used to develop the regional Nature in Neighborhoods inventory of riparian corridors and wildlife habitat. This approach was the subject of much discussion during the development of the regional inventory. Metro established these "default criteria" to recognize the critical role of river and stream banks and lands closest to the waterway in maintaining riparian functions. This approach was intended, in part, to reflect policies established to protect water quality through the adoption of Title 3 of the Urban Growth Management Functional Plan. Metro noted that these criteria should apply specifically to low and moderate gradient channel types (Metro, Table 4, Inventory report, August 2005).

Comments and Technical Discussion

Some commenters on the WRNI disputed this approach. They suggested that in the North Reach much of the riverbank and lands within 50 feet of the river is hardened or developed and do not provide functional values reflected by the relative ranks assigned in the inventory. They also suggest that the draft rankings do not draft reflect the variability of bank conditions and functions.

During the January 10th meeting of technical experts, most participants agreed that in the North Reach the extensive bank hardening and development within the first 50 feet of the river significantly affects the overall contribution of large wood and channel dynamics throughout the reach. Meeting participants seemed to agree with staff's proposal to assign non-vegetated banks and areas within 50 feet of the river a secondary instead of a primary score for *large wood/channel dynamics* functions.

Technical experts expressed more diverse opinions as to how the North Reach riverbank and first 50 feet should be valued in terms of *bank stabilization and sediments, pollution and nutrients control*.

Most agreed that vegetated banks, in a more natural condition, typically provide a superior range of functions compared to hardened banks. Several meeting participants pointed out that vegetation captures and filters sediments and contaminants and tempers erosion. However, there was also agreement that in areas like the North Reach, hardened banks provide important functions that should not be ignored or dismissed. For example, rip rap and seawalls are designed to stabilize banks and prevent erosion. In addition, it was noted that hardened banks can, in some instances, help prevent contaminants from entering the river.

A couple of experts suggested that the Willamette River banks are tied to the river and its ecological functions at all times and under all conditions. They noted that the banks provide important habitat and should be assigned a high relative rank regardless of condition. As the discussion progressed, experts pointed out that while structures like seawalls and pilings stabilize the riverbank, a truly functioning riverbank should not be static and isolated from the river. It was noted that stream and river channels

operate in state of dynamic equilibrium and that the function of hardened banks is significantly reduced compared to more natural banks.

After reflecting on the January 10th discussion, the Bureau of Environmental Services (BES) has recommended that the title for this function be changed. BES suggests that replacing the phrase "bank stability" with "bank function" or "bank dynamics" would more accurately reflect the functions the inventory is attempting to capture, and would help prevent the type of confusion and disparate views expressed during the meeting.

Staff Recommendations, and Results

Large wood and channel dynamics

Staff agrees with technical experts that the extensive bank hardening and development significantly reduces the overall channel dynamics functions along the North Reach. Almost seven miles of riverbank in the North Reach are mostly devoid of vegetation and are hardened, developed, and/or highly disturbed.

Staff conducted additional analysis of the available landcover data, and has determined that forest vegetation along the North Reach is generally associated with non-hardened banks. Other vegetation types are associated with a mix of bank types. As such, the forested , non-hardened river bank areas can provide a rare opportunity for localized channel dynamics and habitat structure in the North Reach by large wood and trapping sediments.

Based on the January 10th discussion and this additional analysis, staff recommends that only forested areas within 50 feet of the river continue to be assigned a primary score for its contribution to large wood and channel dynamic functions in the North Reach. Staff recommends that the score for non-forested areas, including non-vegetated banks, within 50 feet of the river shift from primary to secondary for these functions.

Bank stabilization, erosion and control of sediments, nutrients and pollutants

As pointed out at the January 10th technical expert meeting, seawalls, pilings and riprap help stabilize riverbanks and prevent sediments from entering the river. Nevertheless, staff believes that it is inappropriate to attribute a similar or greater functional value to structures that immobilize and isolate the river or stream bank from a water body, as is attributed to non-hardened or vegetated banks that can interact with the water body and change over time. Staff questions how effective riverbank structures are at containing contaminants (particularly water soluble pollutants) unless they are designed specifically to do so. Riparian vegetation also provides sediment, nutrient and pollution filtration and uptake benefits. .

Staff agrees with technical experts who have suggested that more complex natural or semi-natural vegetation assemblages provide these functions more effectively than highly manicured landscapes or lawn. Semi-natural landscapes generally provide more structural diversity and stronger root systems that help trap sediments, stabilize the soil and steep slopes, and help capture nutrients and pollutants. Cultivated landscapes in the North Reach generally contain a predominance of actively managed lawn, ornamental shrubs and trees. Further, the soils may be more compacted, and this type of landscape can contribute herbicides, fertilizers and pesticides to nearby water bodies.

Staff recommends that functional value continue to be attributed to the riverbank and first 50 feet for all conditions, however the inventory model criteria will be modified as follows to better reflect the variability in existing conditions and relative functionality:

- Vegetation with 50 feet of the river will continue to receive a primary score.

- Only forest or natural/semi-natural woodland and shrubland vegetation within the flood area or between 50 and 100 feet of the river will continue to receive a primary score for bank stabilization, erosion and control of sediments, nutrients and pollutants. Scores assigned to cultivated woodland and shrubland vegetation in these areas would shift from primary to secondary.

- The functional score assigned to seawalls, pilings and non-vegetated riprap, and adjacent land within 50 feet of the river, will shift from primary to secondary to reflect the diminished functions associated with hardened banks and areas largely devoid of vegetation.

Also, staff recommends that a portion of the title for this riparian function be changed from "bank stabilization" to "bank function" as recommended by the Bureau of Environmental Services.

As a result of the proposed changes to the WNRI GIS riparian corridor model:

- Cultivated woodland and shrubland vegetation within 100 feet of the river or within the flood area will shift to a medium or low relative rank for both aggregated riparian function and combined riparian/wildlife habitat function.

- The relative ranks assigned to seawalls, pilings and non-vegetated riprap, and land within 50 feet of the river will shift to low for aggregated riparian function and combined riparian/wildlife habitat function.

- Forested areas and natural/semi-natural woodland and shrubland vegetation within 100 feet of the river or within the flood area will continue to receive a medium or high relative rank for both aggregated riparian function and combined riparian/wildlife habitat function.

Staff believes that the resulting relative ranks more accurately reflect the variability in conditions along the river and will better inform future management decisions, including setting priorities for protection and restoration.

Topic – Contribution of large wood to channel dynamics along the North Reach

Introduction to the Issue

The draft WNRI attributes functional value to forest vegetation in the riparian corridor for its contribution to channel dynamics. Primary scores are assigned to forest vegetation within the flood area or 150 feet from river, stream or wetland. Secondary score is assigned to forest vegetation between 150 and 260 feet from the water body. These criteria are consistent with those Metro developed to assign scores for this function in the regional Nature in Neighborhoods inventory. The draft WNRI also assigns primary scores to wetlands within 150 feet of a stream or river for this function. Metro assigned scores for this function to any wetland within ¼ mile of a river or stream.

Comments and Technical Discussion

Some commenters on the draft WNRI disagree with the value attributed to riparian forest vegetation for its contribution to channel dynamics in the North Reach. They argue that 1) large wood is not an important factor in shaping the channel in the lower reaches of a large river system; and 2) alterations to the channel (dredging, straightening, and narrowing), filling and armoring of the river banks, further reduce the relative functional value of woody riparian vegetation along the North Reach. It was also suggested that the riparian forest vegetation will have a greater potential benefit where the vegetation on steep slopes that extend to the river. (Note: This situation occurs in the North Reach only where the east side bluffs are close to the river, below the University of Portland.)

At the January 10th meeting, technical experts agreed that the primary channel forming feature in the lower reaches of large rivers like the Lower Willamette, is the river itself. It was noted, however, that large wood does influence local channel conditions in the North Reach, helping to trap sediment and provide important habitat structure for salmonids and other species. Meeting participants agreed that large wood is conveyed from upstream areas to beaches and deposition areas in the North Reach. Trees along North Reach riparian corridor can contribute large wood to the system, particularly in more natural areas and where there are steep slopes. It was noted that the City is installing large wood as part of restoration projects along the Willamette River.

Staff Recommendations and Results

Taking into consideration the January 10th discussion, staff recommends that forest vegetation located within the flood area or within 150 feet of the river continue to receive a primary score for its locally significant contribution to channel conditions. Forest vegetation is associated with non-hardened riverbank conditions in the North Reach, which, along with the beach areas, may provide the only real opportunity for channel dynamism in this study area,

Staff also recommends that forest vegetation between 150 and 260 feet from a river or stream continue to be assigned a secondary score only where the vegetation is contiguous to primary vegetation and located on slopes greater than 25 percent. This modification to the riparian corridor criteria may lower the relative rank assigned to contiguous riparian forest vegetation located 150 – 260 feet from the river for both for aggregated riparian functions and combined riparian/wildlife habitat function.

Topic – Microclimate, shade and the role of riparian vegetation along the North Reach

Introduction to the Issue

The draft WNRI attributes functional value to trees and woody vegetation along rivers and streams, including the North Reach of the Willamette River. A primary score is assigned to trees and woody vegetation within a flood area or within 100 feet of a river, stream, or wetland. Secondary scores are assigned to contiguous trees and woody vegetation extending from 100 feet to a maximum of 780 feet from a river stream or wetland. These criteria are consistent with those Metro developed to assign scores for this function in the regional Nature in Neighborhoods inventory. The draft WNRI also assigns scores for these functions to shrubland vegetation within 50 feet from a river, stream or wetland.

Comments and Technical Discussion

Some commenters on the draft WNRI disputed the value attributed to woody riparian vegetation for microclimate and shade along the Lower Willamette River generally and the North Reach in particular. One assertion was that the shade provided by woody riparian vegetation cannot reduce the temperature of flows in the Willamette given the channel width and volume of flow. One commenter pointed out that the maximum functional distance prescribed in the secondary scoring criterion for microclimate (i.e., 780 feet) is based on scientific studies of how forest management practices affect microclimate, and that these studies should not be used as a basis for evaluating microclimate along the Willamette. Commenters have also questioned whether highly manicured landscapes provide equivalent microclimate value as more complex natural or semi-natural riparian vegetation.

At the January 10th meeting, the technical experts agreed that shade provided by riparian vegetation will not affect the overall temperature of flows in the river. However, several pointed out that shade provided by riparian vegetation can be important for aquatic species where the vegetation is adjacent to nearshore shallow water areas. It was noted that shading is also dependant on aspect, slope and river width.

In terms of microclimate, the discussion focused on the relationship between the river and the riparian area, and the influence the river and the hyporheic zone have on riparian microclimate. The concern regarding the 780-foot secondary functional distance was reiterated. It was noted that this number is based on research done to examine the effect of forest clear-cuts and has limited transferability to riparian vegetation on a large, low-gradient river. However, there seemed to be general agreement that the interaction between a large river like the Willamette, associated groundwater, hyporheic and soil conditions, and woody riparian vegetation would create a microclimate effect. No alternative functional distances or topographic criteria were suggested.

Staff Recommendations and Results

The January 10th discussion seemed to confirm that the shade from riparian vegetation along the North Reach is important primarily in conjunction with shallow water areas. Staff will provide additional descriptive information in the revised WNRI report linking the value of shade along the Willamette River to areas of shallow water.

Staff has also conducted additional research to determine whether the secondary functional distance of 780 feet should be modified. Staff did not find any studies suggesting alternate functional distances for microclimate effects within the riparian corridor of a large, low-gradient river. Looking specifically at the North Reach, there are only a few areas that receive a secondary score for microclimate; where woody vegetation is contiguous to the river and extends beyond 100 feet from the river. These areas include

forest and woodland vegetation at Kelley Point Park, T-5, Harborton Wetlands, Willamette Cove, Doane Lake, and the bluff below the University of Portland.

Considering the January 10th discussion and additional analysis, staff recommends the following modifications to the draft WNRI riparian corridor model criteria.

- Forest vegetation within a flood area or within 100 feet of the river will continue to receive a primary score for microclimate and shade functions, but only if the vegetation is contiguous to the river, stream or wetland.

- The score assigned to natural/semi-natural woodland vegetation within the flood area or 100 feet of the river should shift from primary to secondary, to reflect the open tree canopy associated with this vegetation type. Cultivated woodland vegetation will not be assigned values for this function.

- The criterion assigning shrubland vegetation a secondary score for microclimate should be eliminated. Shrubland vegetation may contribute significantly to microclimate along small streams, but it would not contribute significantly to microclimate along the Lower Willamette River.

Staff does not recommend changes to the 780 foot secondary functional distance for microclimate.

These criteria modifications will lower the scores assigned to some of the riparian vegetation for this function, particularly for some woodland vegetation, or forest vegetation that is within 100 feet but not contiguous to the river. The revisions may result in changes to the aggregate riparian ranks or combined ranks assigned to this vegetation depending on the values assigned by other criteria. Forest vegetation between 300 and 780 feet, outside of the flood area, would continue to receive a low rank.

Topic – Organic inputs/food web functions along the North Reach

Introduction to the Issue

The draft WNRI attributes functional value to riparian vegetation for its contribution of organic inputs along the North Reach of the Willamette River. Organics and nutrients enter the river through transport by stormwater runoff, wind and wildlife. A primary score is assigned to forest, woodland or shrubland vegetation in a flood area or within 100 feet of a river, stream or wetland. A secondary score is assigned to contiguous forest, woodland or shrubland vegetation extending from 100 feet to 170 feet from the water body. These criteria are consistent with those Metro developed to assign scores for this function in the regional Nature in Neighborhoods inventory.

Comments and Technical Discussion

Some commenters on the WNRI questioned the value attributed to vegetation located outside the flood area, noting that the organic inputs to the food web in Lower Willamette River are based primarily on inputs from upstream and in-stream phytoplankton production. Questions were also raised about the secondary functional distance of 170 feet from the water body, noting that vegetation that far from the river is not a likely source of organic inputs.

The technical experts attending the January 10th meeting seemed to agree that organic inputs, nutrient cycling and food web functions in the lower reaches of a large river are predominantly internal to the river itself. Much of the food web and productivity is associated with phytoplankton production in the river. However, it was also noted that the interactions and lateral exchanges between the banks and river provide locally important inputs of organic material and nutrients, especially where the water is relatively shallow. Some pointed out that riparian vegetation can provide important food sources for fish, and also for birds and other terrestrial species. Analysis of fish stomach contents indicate that some of their food comes from terrestrial sources along the Lower Willamette.

Staff Recommendations and Results

The January 10th discussion confirmed that riparian vegetation can be a locally important source of organic matter and nutrients to the river, especially where the river is shallow. This vegetation also contributes to terrestrial food webs in riparian corridors which are important to most wildlife species in the region.

Staff suggests that natural or semi-natural vegetation will be of greater value in terms of organic inputs aquatic and riparian ecosystem than cultivated landscaped areas comprised of lawn and ornamental shrubs or trees. Therefore, staff recommends modifying the WNRI GIS riparian corridor model criteria for this function to assign primary scores only to natural and semi-natural vegetation. Natural and semi-natural forest, woodland and shrubland vegetation within 100 feet of a river, stream or wetland, or with the flood area, will continue to receive a primary score. Scores assigned to cultivated woodland and shrubland within 100 feet of a river, stream or wetland should shift from primary to secondary.

Staff also recommends that only natural/semi-natural forest, woodland and shrubland vegetation continue to receive a secondary score for this function. Cultivated vegetated areas between 100 – 170 feet from a river, stream, or wetland will not be assigned values for this function.

These criteria modifications will change the scores shown on the resource maps for this function only. The modifications are not expected to result in changes to the relative ranks for aggregated riparian corridor function or combined riparian/wildlife habitat.

Topic – Willamette Beaches as Special Habitat Areas (SHA)

Introduction to the Issue

The draft WNRI identifies Special Habitat Areas (SHAs), which are resource features consisting of rare, unique or declining habitat types and/or features that would be expected to support special status species during portions of their life cycle. The designation of SHAs is largely consistent with areas that Metro designated as Habitats of Concern in the regional Nature in Neighborhoods inventory. Examples of Special Habitat Areas include oaks, bottomland hardwood forests, wetlands, connectivity corridors, mudflats, grasslands, etc. The Bureau of Planning designated beaches along the Willamette River as SHAs, recognizing the habitat they provide habitat for ESA-listed salmonids and for waterfowl and other species that use the river. The Bureau based this designation largely on the Oregon Department of Fish and Wildlife (ODFW) study *Biology, Behavior, and Resources of Resident and Anadromous Fish in the Lower Willamette River* (Friesen 2005), which found a correlation between observations of salmonids species and beaches along the river.

Comments and Technical Discussion

Some commenters on the WNRI expressed strong support for the designation of beaches as SHAs, noting that beaches provide important habitat for salmonids, and also for bald eagles, great blue herons, and shorebirds. Others disputed the designation, expressing concern that the ODFW study did not conclusively find that salmonids show a preference for beach habitats.

During the January 10th technical experts meeting, Tom Friesen, author of the ODFW study, clarified that the observations of salmonids were correlated primarily with water depth rather than substrate or bank type. Salmonids were found in shallow water areas generally. Coho observations were correlated with beach habitats. Macroinvertebrate communities along the Willamette were found to be more diverse at beaches, but greater numbers at riprap areas. Several technical experts noted that salmonids use a mix of bank types including rip rap. Some experts reiterated that beaches are rare and declining along the Lower Willamette, and should recognized as important for fish and other species such as shorebirds.

Staff Recommendations and Results

Taking the January 10th discussion into consideration, staff feels that the inventory should continue to recognize the Willamette beaches as providing important habitat function. However, staff has since decided that it would be simpler and more appropriate to incorporate and map the beaches as part of the river channel. Beaches are dynamic features in the Lower Willamette River. Depending on tidal influences and seasonal water flows, beaches are inundated daily and seasonally, which influences their shape and size. Because of this direct relationship with the river, it is appropriate to consider beaches as part of the river channel itself. Since the City does not have maps showing the top-of-bank, this change will provide an incremental improvement in the accuracy of the river channel maps.

The draft WNRI already designates the Willamette River as a SHA to reflect NOAA's designation of the river as Critical Habitat for listed salmonids, and the role of the river as a migratory corridor. So as part of the channel, the Willamette River beaches will become part of the Willamette River SHA. The revised inventory report will include information about the role of beaches and shallow water areas, and the inventory site descriptions will note where beaches and shallow water areas exist. New or modified feature maps depicting different bank conditions will be provided in the revised report.

This change will not result in changes to the relative ranks for riparian, wildlife habitat, or combined riparian/wildlife habitat function. However, mapping beaches as part of the Willamette River channel will result in minor changes to the riparian function and rank maps. This is because the riparian functions will be mapped from the landward edge of the beach instead of from mapped edge of the water surface.

Topic – Fragmentation of the riparian wildlife movement corridor along the North Reach

Introduction to the Issue

The draft WNRI attributes functional value to vegetation along the North Reach for riparian wildlife movement. A primary score is assigned to vegetation that is contiguous to and within 100 feet from the river. A secondary score is assigned to vegetation that is contiguous to, and between 100 – 300 feet of river, stream or wetland. This criterion was added to the riparian corridor model to recognize that vegetation patches smaller than 2 acres aide in wildlife movement along the river (2 acres is the minimum size for a patch to be scored by the GIS wildlife habitat model). The riparian wildlife movement criterion is not species-specific and is intended to recognize potential use by multiple species. This criterion does not consider fragmentation of vegetation along the river, although the GIS wildlife habitat model does evaluate connectivity and fragmentation between habitat patches.

Comments and Technical Discussion

Comments on the draft WNRI raised questions about the value of vegetation along the Willamette North Reach as a wildlife movement corridor. It was suggested that fragmentation and isolation of the habitat areas along the riparian corridor in the North Reach significantly reduces the value of these area as a wildlife movement corridor.

At the January 10th meeting it was again suggested that the relative value of riparian vegetation on the North Reach as a wildlife movement corridor was lower than if the vegetation were better connected. Some of the technical experts attending the January 10th meeting responded by pointing out that the Willamette River itself is a significant fish and wildlife movement corridor and that the river connects and elevates the value of vegetation patches along the riparian corridor. They noted that signs of river using wildlife such as beaver and river otter are often observed in these areas, and that the movement birds, deer and coyotes is less hindered by development than some other types of wildlife (e.g., amphibians).

Staff Recommendations and Results

Staff has determined that approximately 50% of the area within 100 feet of the river in the North Reach consists of vegetated areas at least ½ acre in size. Nearly 20% of the area within 100 feet of the river is impervious surface and the remaining area (30%) contains sparse vegetation, dirt/fill, rocks, etc. This information will be added to the revised WNRI report as well as the inventory site descriptions.

Taking the January 10th discussion into consideration, staff proposes that the value of habitat areas along the Willamette River be considered as part of the wildlife movement corridor formed by the river itself, and recommend no change to the WNRI GIS riparian corridor model for this function. Vegetation contiguous to and within 100 feet of the river will continue to receive a primary score for riparian wildlife movement. Contiguous vegetation that is between 100 and 300 feet of the river will continue to receive a secondary score for riparian wildlife movement.

Topic – Contamination

Introduction to the Issue

The Willamette River North Reach inventory area contains the 10.2-mile Portland Harbor Superfund site, and is associated with extensive areas of contaminated soil, groundwater, and in-river sediment. In September 2001 an agreement was established between the Oregon Department of Environmental Quality (DEQ) and a coalition of businesses and public agencies, including the City of Portland, to participate in investigation and cleanup of the sites. DEQ is working on the cleanup of approximately 70 sites along the banks of the Willamette River, most of which are in the North Reach.

The current draft WNRI provides descriptive information on contamination in the North Reach generally, and for individual inventory sites. The information comes from DEQ's Environmental Clean-up Site Information (ECSI) database.

Comments and Technical Discussion

Comments on the draft WNRI question how areas can rank relatively "high" for riparian corridor functions and wildlife habitat and also be heavily contaminated. Some have raised concerns that assigning contaminated areas a "high" relative rank may lead to restrictions on how remediation can be completed. (This topic was not discussed at the January 10th meeting.)

Staff Recommendations and Results

Staff agrees that the revised inventory should provide more information about contamination in the North reach. The inventory should make it clear that many of the scarce remaining natural resource features in the North Reach provide valuable riparian corridor and wildlife habitat functions and are also affected by at least some level of contamination. Having this information will better inform current planning efforts, and priority-setting for restoration and enhancement.

Staff is currently compiling additional information to include in the North Reach and inventory descriptions. The revised inventory report will include a summary of hazardous substances and waste types as well as environmental and health threats. A link to the DEQ ECSI database will be included. The revised inventory will also include maps showing the presence and status of contamination investigation and remediation on inventory site maps.

Topic –WNRI Resource Scoring and Ranking Systems

Introduction of the Issue

The draft WNRI includes an evaluation of the relative functional value of natural resources in the North Reach. Resource features are assigned scores for six riparian corridor functions and four wildlife habitat attributes. These scores are aggregated to generate riparian corridor and wildlife habitat ranks of "high," "medium" or "low." All Special Habitat Areas are assigned a high aggregated rank for wildlife habitat. The aggregated ranks for riparian corridors and wildlife habitat areas are then combined to produce a single riparian corridor/wildlife habitat relative rank of "high," "medium," or "low." Where inventoried riparian corridor and wildlife habitat areas overlap, and where their relative ranks differ, the higher of the two ranks becomes the combined relative rank for that resource feature.

This scoring and ranking approach is consistent with the approach Metro developed for the regional Nature in Neighborhoods Inventory. In addition, Oregon Laud Use Planning Goal 5 requires local natural resource inventories to assess the relative quality, quantity and significance of inventoried natural resources compared to similar features within the city or region.

Comments and Technical Discussion

Comments on the draft WNRI raised two general issues regarding the resource ranking approach. Some commenters suggested that relative ranking approach implies that some resources are "better" than others, which, in their view represents an application of policy that goes beyond the role of a scientifically based inventory. Concerns were raised that the ranking formulae are arbitrary and do not reflect science. Some also suggested that the aggregated and combined ranks mask the variability in existing conditions.

During the January 10th meeting, concerns were raised about the how the high, medium and low riparian corridor ranks are generated; specifically, that high and medium ranks are reflect only the number of primary functional scores assigned and not the number of secondary scores assigned to the resource feature. It was also suggested that combining the riparian corridor and wildlife habitat ranks and assigning the higher of the two ranks can be ambiguous and hard to interpret. For example features receiving a high riparian rank and low wildlife rank, receive a high combined rank, while features receiving a high riparian rank and medium wildlife rank also receive a high combined rank.

The technical experts discussed the utility of developing a more detailed ranking system for riparian corridors and combined ranks. Some suggested that more detailed ranks would be more informative than the current system. Others noted that Metro tried to provide more detailed rankings, but that the maps were too complex to be useful. Technical experts acknowledged the difficulty in producing maps that are sufficiently detailed without making them unduly complicated. One participant suggested that the revised inventory include tabular data showing the modeling results. Some felt that it might be most helpful for the revised inventory to include the individual function maps rather than creating a more complex ranking system.

Staff Recommendations and Results

First, staff believes that assessing the relative functional value or quality of existing natural resources is an appropriate component of an inventory, and is consistent historical and legal precedent pertaining to such inventories. The scoring criteria for individual riparian corridor function and wildlife habitat attributes are based on information gleaned from a comprehensive review of scientific literature. The scores are summed and broken down into aggregated ranks using an approach similar to the approach Metro developed for the regional inventory.

Willamette/North Reach Natural Resource Inventory – Methodological issues discussed by technical experts on January 10, 2008	**Staff Recommendations**	**Effect of Recommendations on Riparian Function Score**	**Effect of Recommendations on *Aggregated Riparian Relative Rank***	**Effect of Recommendations on *Combined Riparian/Wildlife Habitat Relative Rank***
Riparian Function of the Willamette River Should the Willamette River be assigned primary value for the 6 riparian functions addressed in the inventory?	▪ Continue to assign functional value to the Willamette for the 6 riparian functions. ▪ Shift from primary to secondary score to reflect extent of bank hardening and sediment pollution. ▪ Incorporate beaches into the river channel, map functional distances from landward edge of beach, and assign beaches a primary value for Large Wood/Channel Dynamics function. ▪ Include additional river-specific metrics in the revised inventory report.	**Changes:** The Willamette in the North Reach will shift from a primary to secondary score *Bank Dynamics and Control of Sediments, Nutrients and Pollutants* functions. Change the name of this function	**No change:** North Reach will continue to rank high given primary scores for 5 riparian corridor functions.	**No change:** North Reach will continue to receive a high relative combined rank.
Functional value of vegetation Should the inventory distinguish between functional of natural/semi-natural vegetation and highly cultivated landscapes?	Use refined woodland, shrubland, and herbaceous vegetation data to differentiate between the functional value of natural/semi-natural vegetation and highly cultivated landscapes in the North Reach. (Note: All forest vegetation is classified as natural/semi-natural.)	**Changes:** Cultivated woodland and shrubland vegetation scores shift from primary to secondary for: ▪ *Bank Stability/Control of Sediment, Nutrients and Pollutants* ▪ *Organic inputs/food web* Cultivated woodland shrubland vegetation no longer assigned value for *Microclimate/Shade* as relates to the Willamette river.	**Changes:** The Aggregated Riparian Rank for cultivated vegetation will likely shift from high to medium, or from medium to low.	**Changes:** The Combined Rank for cultivated vegetation will likely shift from high to medium, or medium to low.
Flood Areas Is the flood storage provided by the flood areas in the Lower Willamette/North Reach important given size of basin, flow volumes and flood levels? Should the inventory focus on more frequently flooded areas?	Recognize the importance of incremental flood storage by continuing to assign primary scores to vegetated flood areas along the North Reach. Continue assigning a secondary score to the developed flood area for flood storage only. Update the inventory to include information on frequently flooded areas if/when made available.	**No change**	**No change**: Vegetated flood areas will continue to receive a medium or high Aggregated Riparian Rank; developed flood area will continue to rank low.	**No change:** Vegetated flood areas will continue to receive a medium or high Combined Rank; developed flood area will continue to receive a low Combined Rank.
Land within 50 feet of the river Should the functional value assigned to land within 50 feet of the North Reach be downgraded where riverbanks areas within 50 feet are developed/hardened and primarily devoid of vegetation?	Continue to assigning primary value to vegetated land within 50 feet of the river. Shift functional scores assigned to non-vegetated land w/in 50 feet of the river (North Reach only) from primary to secondary for 2 functions.	**Changes:** Non-vegetated area w/in 50 feet of the river will receive secondary scores for *Large Wood / Channel Dynamics* and *Bank Stabilization and Control of Sediments, Nutrients and Pollutants*.	**Changes:** The Aggregated Riparian rank for non-vegetated area w/in 50 feet of the river will shift to low rank. The Aggregated Riparian Rank for herbaceous vegetation w/in 50 feet of the river will shift from high to medium	**Changes:** The Combined Rank for non-vegetated areas w/in 50 feet will shift to a low rank. The Aggregated Riparian Rank for herbaceous vegetation w/in 50 feet of the river will shift from high to medium

Willamette/North Reach Natural Resource Inventory – Methodological issues discussed by technical experts on January 10, 2008	**Staff Recommendations**	**Effect of Recommendations on Riparian Function Score**	**Effect of Recommendations on *Aggregated Riparian Relative Rank***	**Effect of Recommendations on *Combined Riparian/Wildlife Habitat Relative Rank***
Role of large wood in the Lower Willamette Does riparian forest vegetation contribute significantly to channel dynamics in the Lower Willamette River and North Reach? Does functional value of riparian forest vegetation for channel dynamics correlate with slopes? Should beaches be assigned functional value for channel dynamics?	Recognize localized effects of large wood contribution by assigning primary scores to contiguous forest vegetation within 150 feet of the river. Assign secondary scores to forest vegetation between 150 and 260 feet *only if* vegetation is located on slopes exceeding 25% Assign beaches a primary score for channel dynamics.	**Changes:** In the revised inventory forest vegetation between 150 and 260 feet from the river will receive a secondary value score only on slopes exceeding 25% Beaches will now be assigned primary value for this function.	**No change**	**No change**
Microclimate/shade Is the functional value of the shade provided by riparian forest vegetation significant in the Lower Willamette/North Reach? Is it appropriate to use functional distances (<=780') to assign secondary microclimate score to forest vegetation based on studies pertaining to forest practices in tributary drainages?	Primary scores should be assigned to forest vegetation within 100 feet of river, stream, and wetland *only if* vegetation is contiguous to the water. Do not continue to assign functional value to shrubland or cultivated woodland for this function (North Reach only) No change to secondary functional distances is recommended.	**Changes:** Some forest vegetation within 100 feet of a river, stream, and wetland may shift from a primary to secondary score if it is not contiguous to the water/wetland feature. Shrubland and cultivated woodland along the Willamette mainstem in the North Reach will no longer score for this function.	**Changes :** The Aggregated Riparian rank assigned to cultivated woodland vegetation along the Willamette mainstem in the North Reach will likely shift from high to medium or low.	**Changes:** The Aggregated Riparian rank assigned to cultivated woodland vegetation along the Willamette mainstem will likely shift from high to medium or low combined rank if not associated with a high ranking wildlife habitat patch or Special Habitat Area.
Organic Inputs/Food Web Does riparian vegetation along the Willamette mainstem in the North Reach provide a significant contribution of organic inputs to the aquatic ecosystem/food web? Terrestrial ecosystem/food web?	Continue to assign primary and secondary values to forest vegetation and natural/semi-natural woodland and shrubland vegetation within 100 feet of a river, stream or wetland to reflect important effect of localized inputs. Lower the score assigned to cultivated vegetation within 100 feet from primary to secondary. Do not assign value to cultivated vegetation further than 100 feet from a river, stream or wetland.	Cultivated woodland and shrubland vegetation will receive a secondary score for this function. Cultivated woodland and shrubland vegetation further than 100 feet from a river, stream or wetland will no longer be assigned value for this function.	Cultivated woodland and shrubland vegetation within 100 feet of a river, stream or wetland in the North Reach will shift from a high to a medium or low Aggregated Riparian Rank.	Cultivated woodland and vegetation within 100 feet of a river, stream or wetland in the North Reach will shift from a high or medium, to a medium or low Combined Rank if not associated with a high ranking wildlife habitat patch or Special Habitat Area.
Riparian Movement Corridor Does the vegetation along the Willamette River mainstem in the North Reach provide a significant wildlife movement corridor function given existing fragmentation due to development?	Continue to assign primary and secondary value to vegetation contiguous to and no further than 300 feet from the Willamette to reflect the use of these areas by wildlife traveling in and along the river.	**No change**	**No change**	**No change**
Willamette Beaches Is it appropriate to designate Willamette beaches as SHA based on the ODFW Willamette Fish Study?	Continue to highlight the role of beaches and also shallow water areas as special habitats for fish and wildlife. Show and describe in the context of the Willamette River SHA.	**No change**	**No change**	**No change**

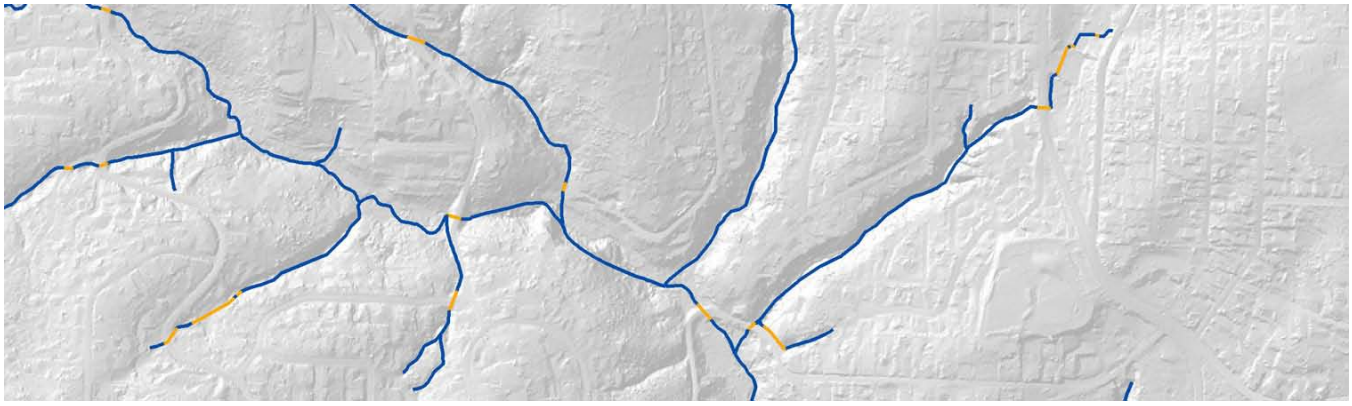
Willamette/North Reach Natural Resource Inventory – Methodological issues discussed by technical experts on January 10, 2008	**Staff Recommendations**	**Effect of Recommendations on Riparian Function Score**	**Effect of Recommendations on *Aggregated Riparian Relative Rank***	**Effect of Recommendations on *Combined Riparian/Wildlife Habitat Relative Rank***
Ranking system Should the WNRI ranking system be modified to provide more detailed information about the variability in relative resource condition and quality?	Retain current system for assigning "high," "medium," and "low" aggregate riparian corridor and wildlife habitat ranks, and combined riparian /wildlife habitat ranks. Include maps showing scores for individual riparian corridor and wildlife habitat functions with the revised inventory.			

APPENDIX 6

MAPPING PROTOCOLS

Natural Resource Inventory Update

stream and drainageway mapping project



City of Portland Bureau of

Planning and Sustainability

Sam Adams, Mayor | Susan Anderson, Director

Natural Resource Inventory Update

stream and drainageway mapping project

project description

The stream and drainageway mapping project originated in 2003 as the Bureau of Planning, (now called and referred to in this report as the Bureau of Planning and Sustainability) was developing a new automated GIS model to map and rank landscape features that contribute to riparian resource values and functions. This map is used to update Portland's significant natural resource inventories.

Initially the model was developed and tested using Metro's regional stream map layer. However, during the model testing phase it became apparent that the Metro map was not accurate enough to support Portland's inventory update and resource protection program. A more detailed, precise map of streams and drainageways was necessary for analysis at the local scale.

The key goals of the re-mapping project were defined as:

› to refine the location of streams and drainageways previously mapped by Metro;

› to verify the existence and location of a number of stream and drainageway segments that were not previously mapped by Metro or included in the City's significant natural resource inventories;

› to refine the maps to address the location of piped stream and drainageway segments and their connections to open channels, as there had never been a complete review of stream and drainageway location and surface water piping within the City.

For the purposes of this project streams and drainageways are defined as follows:

stream – An area where enough surface water flows to produce a channel, such as a river or creek, that carries flowing surface water during some portion of the year. Surface water flows may include stormwater runoff or groundwater discharge. Streams include:

- the water itself, including any vegetation, aquatic life or habitat;
- beds and banks below the ordinary high water level[1] which may contain water, whether or not water is actually present;
- the floodplain between the ordinary high water level of connected side channels;
- beaver ponds, oxbows, and side channels if they are connected by surface flow to the stream during a portion of the year;
- stream-associated wetlands;
- perennial stream (stream that flows throughout the year; permanent stream);

[1] *Ordinary high water* is the line on the bank established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

- intermittent stream (stream that flows only at certain times of the year, as when receiving water from springs or from surface sources; stream that does not flow continuously, as when water losses from evaporation or seepage exceed the available stream flow);
- ephemeral stream (stream or portion of stream that flows briefly in direct response to precipitation in the immediate vicinity, and with channels at all times above water table).

drainageway - An open linear depression, whether constructed or natural, which functions for the collection and drainage of surface water, subsurface flow or groundwater. It may be permanently or temporarily inundated. Drainageways may include sloughs[2]. Road-side ditches and similar facilities generally do not meet the definition of a drainageway unless the channel is a segment of an existing stream or redirected or relocated existing stream or stream segment.

The stream and drainageway mapping project focused on streams and drainageways flowing through the City of Portland, as well as those located within unincorporated parts of Multnomah County where land use permitting is administered by the City of Portland.

There are areas of the city where streams and drainageways have been relocated or reconfigured as part of or to accommodate development. In some situations, streams and drainageways have been created to supplement or even replace the natural hydrologic system. Relocated, reconfigured and some created streams and drainageways provide the critical watershed functions of the hydrologic system and were mapped as part of this project.

Beginning in April of 2003 the Bureau of Planning and Sustainability began revising stream and drainageway geometry based on information from reference data sources including 2' contours, aerial photos, and GPS surveys. New streams and drainageways were also added where previously unmapped surface flow was identified. All revised and newly mapped surface streams and drainageways were connected to the stormwater and combined sewer/stormwater pipes as mapped by the Bureau of Environmental Services.

In addition, the Bureau of Planning and Sustainability conducted an extensive field effort to confirm the existence and location of stream and drainageway channels and piped segments. Field crews employed global positioning system (GPS) technology to verify the presence and location of streams and drainageways where this information could not be derived from available sources of information. The field effort included streams and drainageways on public and privately-owned land (with permission from property owners).

[2] *Sloughs* are slow-moving, canal-like channels that are primarily formed by tidal influences, backwater from a larger river system, or groundwater. They may be permanently or temporarily inundated.

The stream and drainageway mapping project has been a collaborative effort involving Portland's Bureaus of Planning, Parks and Recreation, Environmental Services, and Corporate GIS. Metro and Clean Water Services also participated in the project. GIS staff from each of these agencies met at the beginning of the project to share the stream and drainageway centerline information used by each agency at that time. This information was combined into a single, regional stream and drainageway centerline dataset that served as a starting point for the mapping. The revised stream and drainageway centerlines are provided to all City bureaus for their use, and to Metro for regional distribution along with the Regional Land Information System (RLIS) "Natural Resource" GIS data.

The following report provides a brief description of the project status, the stream and drainageway mapping methodology, and the data sources used as reference for re-mapping and adding streams and drainageways. For a detailed description of the stream and drainageway centerline GIS data, please refer to the online metadata at:

http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52071&Db_type=sde&City_Only=False.

project status

The initial mapping and classification of all known stream and drainageway centerlines within the City of Portland is complete. The data is updated regularly as new information becomes available. The following chart is a summary of stream and drainageway miles mapped at the completion of the initial mapping exercise (January, 2006). Ongoing modifications to the map since that time are not reflected in these numbers.

Stream and Drainageway Mapping Project Summary
Miles of streams and drainageways currently mapped in Portland and the Multnomah County pockets (as of January, 2006)

Re-mapping progress to date:	miles	%
Total miles of stream and drainageways previously-mapped by Metro:	180	
Miles of previously-mapped stream and drainageways revised:	180	100.0%
Miles of stream and drainageways added:	131	
Total stream and drainageway miles revised or added:	*311*	
Total number of surface stream and drainageway miles revised or added:	*260*	83.6%
Total number of piped stream and drainageway miles revised or added:	*51*	16.4%
Stream and drainageway verification to date:		
Stream and drainageway miles verified using existing sources:	250	80.4%
Stream and drainageway miles verified in the field:	24	7.7%
Total stream and drainageway miles verified to date:	*274*	*88.1%*
Remaining stream and drainageway miles to verify:	*37*	*11.9%*
Field work summary to date:		
Total number of property owners contacted:	670	
Number of property owners granting access:	304	45.4%
Number of properties visited:	163	24.3%

methodology

The starting point for the mapping project was the 2003 regional stream and drainageway centerlines developed by Metro. More accurate stream and drainageway centerline maps available for select areas around the City were also used as reference – including Columbia Slough centerlines created by the Bureau of Environmental Services and Powell Butte centerlines mapped by the Bureau of Parks and Recreation. All editing of stream and drainageway data was done in ESRI's ArcGIS GIS software.

1) Stream and Drainageway Mapping Protocol

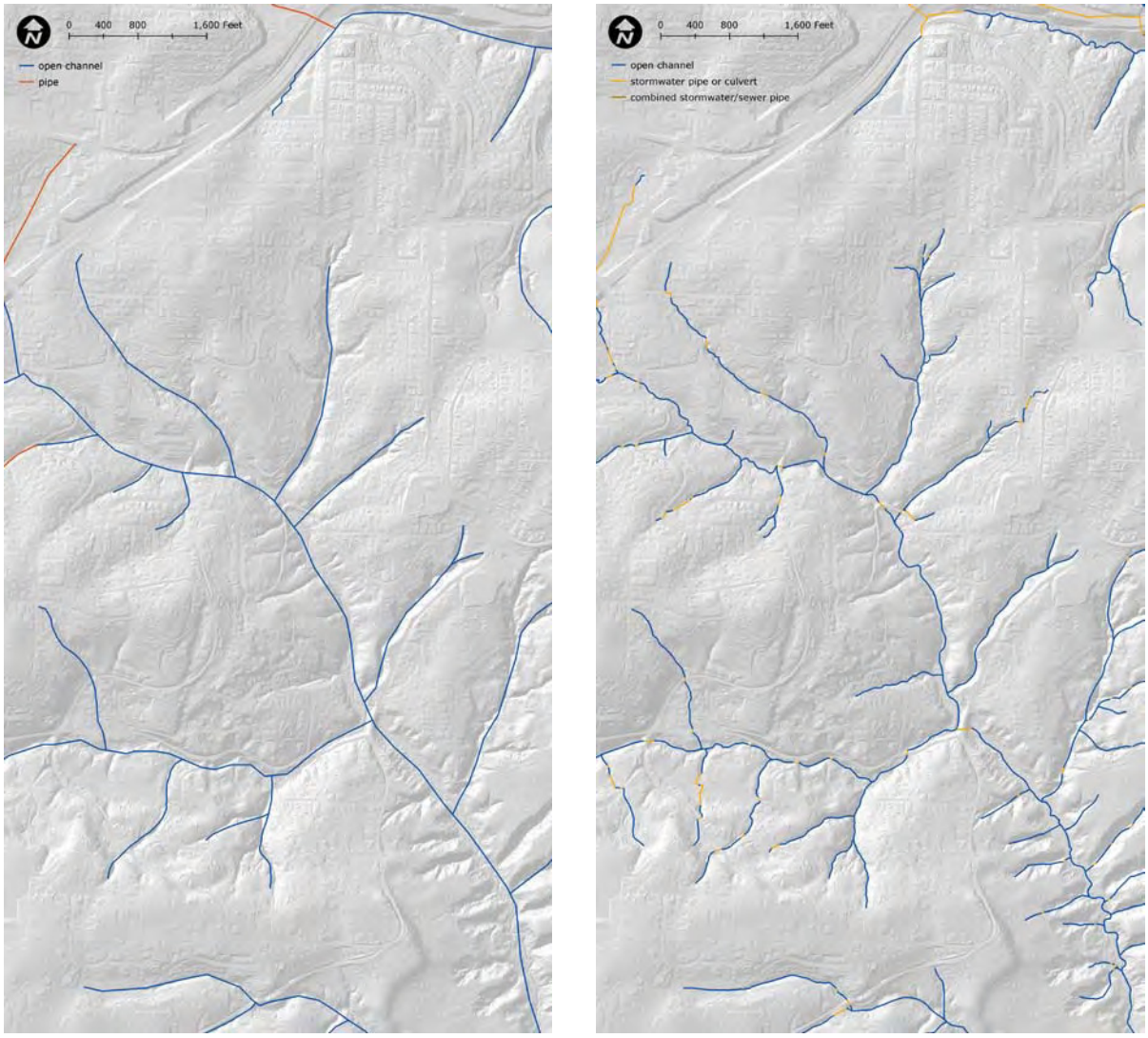
BES collection line GIS data, LiDAR-derived elevation models, photogrammetric data (2' contours), and aerial photos were among the data sources referenced by the Bureau of Planning and Sustainability when mapping the stream and drainageway centerlines.

Streams and drainageways that were previously-mapped by Metro[3] were checked against all reference sources and re-mapped starting at the lowest confluence and moving up to the headwaters. Virtually all of the previously-mapped streams and drainageways were re-mapped to correspond with the new and more detailed reference data. Any new tributaries apparent in the reference data were added to the map as they were encountered during the revision process (Figure 1).

New streams and drainageways were required to satisfy the following criteria in order to be added to the map:

- a channel exists and appears to be formed, at least in part, by water flowing through it - flow may be comprised of water from streams, surface flow, subsurface flow, groundwater, or stormwater discharge. Channels that emerge downstream of a pipe were mapped as beginning at the pipe outlet;
- the topographic information, aerial photo, BES collection line information or Multnomah County Drainage District information indicates that water on or upstream of the site drains to the channel;
- the length of the stream or drainageway was greater than 50' (stream, drainageways and springs under 50' in total length were not mapped.)

[3] Metro's 2003 stream and drainageway data was originally based upon 1:24000 USGS quad topography. Stream and drainageway centerlines and banks were adjusted or digitized at approximately 1:10000 using the 1998 Spencer Gross 2'-resolution aerial photography.



Original Metro Centerlines

Remapped Centerlines

Figure 1. Comparison of previously-mapped Metro streams and drainageways and remapped stream and drainageway centerlines .

Any stream or drainageway segments satisfying the mapping criteria above were further evaluated based on the following:

- If two or more reference sources affirmed the existence of a stream or drainageway channel (e.g., topography indicates a channel and BES has mapped the channel), project staff deemed the stream or drainageway "substantiated" and required no further verification. The stream or drainageway was mapped based on the reference data.

- If a stream or drainageway channel was supported by only one reference source (e.g., topography suggests a channel), project staff "flagged" the channel for field verification.

The Bureau of Planning and Sustainability compiled a list of all property owners whose tax lot contained a channel flagged for field verification. Property owners were sent a letter requesting permission for City staff to enter their property for on site stream/drainageway verification. The request included a self-addressed stamped return envelope for property owners to reply. Approximately 46% of property owners contacted granted access.

Database attributes from the old stream or drainageway centerlines were transferred to the new stream and drainageway centerlines. Additional information about the new and revised streams and drainageways was also captured, including the channel type, source of the geometry, and the date of the modification.

2) Field Verification Methodology

Project staff visited properties owned by the public and privately-owned properties where the owner had given written permission allowing access.

Because of time and staff constraints, staff was not able to visit every property that was accessible. Priority for visitation was given to stream or drainageway segments flowing through properties where a larger percentage of property owners had given staff permission to enter and survey the stream or drainageway. Staff also focused on visiting streams and drainageways that were relatively easy to access given topography (e.g., not steep vs. steep) and vegetation (e.g., penetrable vs. overgrown).

Once the decision to visit a particular stream or drainageway segment was made, a field crew visited the site and verified the presence and location of the stream or drainageway channel. Field crews used both visual assessment and, when GPS-satellite coverage was available, differentially-corrected GPS data collection. Field crews also took written notes on the location and description of the stream or drainageway segment.

Stream and drainageway characteristics used to verify whether the channel met the stream/drainageway criteria, include one or more of the following:

- water flowing through the channel or evidence of periodic inundation
- riparian-associated plants; including both native and non-native species
- presence of amphibians, aquatic reptiles (e.g. turtles) or fish; including both native and non-native species
- evidence of wildlife use (e.g. beaver chews)

Field crews carried copies of a standard field visit form for notes and sketches, a map showing local topography, stream, drainageways, etc., and a map with 6"-resolution aerial photographs of the property and surrounding area. All notes and maps for a particular field visit were scanned and stored in Acrobat PDF format. Digital photos of the stream or drainageway were also taken in most cases. All digital documentation and photos are available from the Bureau of Planning and Sustainability.

Two survey-grade GPS receivers were used during the project – a Trimble Pathfinder Pro backpack system and a Trimble GeoXT handheld receiver. Both systems collected points and lines with an average horizontal error after differential correction of between 1 and 3 feet.[4] Two types of GPS data were collected – point features and line features.

Point features represented a minimum of 10 GPS points collected at 1-second intervals at multiple locations along a stream or drainageway channel. GPS points at each location on the stream/drainageway were differentially-corrected, averaged, and exported to GIS shapefile format. Stream and drainageway centerline segments were then digitized by manually "connecting" the field collected points in ArcInfo workstation. Digitized lines were "smoothed" to more realistically portray stream and drainageway geometry. Most GPS data was collected as point features.

Line features were created by collecting a series of points at 1-second intervals while physically walking the centerline of a stream or drainageway. The collected points were each differentially-corrected and exported to GIS shapefile format as the vertices of a line feature. The advantage of this method was that it produced an actual centerline that could be directly incorporated into the stream/drainageway dataset, rather than a series of points that had to be manually connected. However, because the points were not averaged at a single location over time, this method was slightly less accurate then the point feature collection method. In addition, it was only practical when the stream and drainageway channel was open enough to allow relatively long – 50' or more – sections to be walked without obstruction.

[4] Differential correction is the process of correcting GPS data collected on a field unit with data collected simultaneously at a fixed base station. Because the base station it is at a known, surveyed location, any errors in data collected at the base station can be measured, and the necessary corrections applied to the field collected data.

A summary of the specific GPS data collection parameters follows:

- Collection interval: 1 second
- Minimum number of points[5]: 10
- Maximum PDOP[6]: 6
- Minimum number of satellites: 4
- Elevation mask: 15º above the horizon

Points were differentially-corrected using the base station located at the U.S. Forest Service/Bureau of Land Management building in downtown Portland[7]. All GPS data was exported into the U.S. Stateplane coordinate system, in international feet, based on the NAD HARN/HPGN datum.[8] All GPS point and line features collected for the stream and drainageway re-mapping project are available in ESRI Shapefile format from the City of Portland, Bureau of Planning.

Stream and drainageways flagged for further verification and visited in the field were remapped to correspond with the visual assessment and/or GPS information collected for that segment. Stream and drainageways located in this matter were assigned a "field date" in the stream and drainageway centerline GIS database. Not all stream and drainageways flagged for field verification were visited by project staff. To date, approximately 40% of flagged stream and drainageways have been visited. Any flagged stream and drainageways not visited are identified in the stream and drainageway centerline GIS database.

[5] Though a minimum of 10 GPS points were required, field crews attempted to collect a minimum of 60 points (1 minute of data collection) whenever possible.
[6] The Position Dilution of Precision (PDOP) is a numerical value representing the quality of the satellite geometry and its impact on data collection accuracy.
[7] refer to http://www.fs.fed.us/database/gps/portland.htm for more information about the U.S. Forest Service base station.
[8] High Accuracy Reference Network (HARN) datum, a.k.a. High Precision GPS Network (HPGN), is a statewide upgrade to the NAD83 datum using Global Positioning System (GPS) observations.

reference data sources

The following sources were used as reference for determining the presence and/or location of stream and drainageway centerlines:

Source:	**BES Collection Lines**
Created By:	City of Portland, Bureau of Environmental Services
Data Format:	GIS Shapefile
Date of Last Update:	11/26/2003
Description:	City of Portland regional sewer and drainage infrastructure. Includes sewer lines, stormwater pipes, combined sewer/stormwater pipes, culverts, and drainage ditches.
Notes:	Data is viewable for specific properties via www.portlandmaps.com
Metadata Reference:	http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52073&Db_type=sde&City_Only=False

Source:	**LiDAR Data**
Created By:	Puget Sound LiDAR Consortium for Metro
Data Format:	ERDAS Imagine-format elevation models
Date of Acquisition:	March/April 2007, March 2005, & March 2004
Description:	3-foot resolution digital elevation model (DEM) of all Portland area bare-earth LiDAR point returns collected and processed to date (2004 through 2007). The DEM was used to generate hillshades and 2'/5'/ 10' contours that were used to map stream and drainageways.
Notes:	Data is the property of the Portland LiDAR Consortium.
Metadata Reference:	http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52888&Db_type=sde&City_Only=False

Source:	**Photogrammetric Data (2' Contours)**
Created By:	City of Portland, Bureau of Environmental Services.
Data Format:	GIS Shapefile
Date of Acquisition:	1988 to 1994 (depending on location)
Description:	City of Portland 2' elevation contours. Contour lines derived from stereo analysis of aerial photos flown between 1987 and 1994. Created for the Bureau of Environmental Services.
Notes:	Data is viewable for specific properties via www.portlandmaps.com

Metadata Reference:	http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52452&Db_type=sde&City_Only=False

Source:	**2008 Aerial Photos**
Created By:	Sanborn Map Company for Metro
Data Format:	Geo-referenced GEOTIFF images
Date of Acquisition:	June 19-29, 2008
Description:	Natural color (RGB) and color infrared (CIR) ortho-rectified digital imagery. Images are at six-inch resolution.
Notes:	Data is viewable for specific properties via www.portlandmaps.com. Other image years (1996 through 2007) were also used as reference.
Metadata Reference:	http://rlismetadata.oregonmetro.gov/display.cfm?Meta_layer_id=2302&Db_type=rlis

Source:	**5' Elevation Contours**
Created By:	Metro
Data Format:	GIS shapefile
Date of Acquisition:	July 2001
Description:	Five-foot elevation contours for urban areas of Multnomah, Clackamas, and Washington counties. Covers Portland metropolitan area.
Notes:	Copyright 2001 by Metro.
Metadata Reference:	http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52453&Db_type=sde&City_Only=False

Source:	**BES Columbia Slough Centerlines**
Created By:	City of Portland, Bureau of Environmental Services
Data Format:	GIS Shapefile
Date of Last Update:	11/26/2003
Description:	Stream and drainageway centerlines mapped by the Bureau of Environmental Services Columbia Slough watershed team. Stream and drainageway locations not field verified.
Notes:	Shapefile data for the entire Columbia Slough watershed is available from BES.
Metadata Reference:	None currently available – contact Kevin Ramey in the City of Portland, Bureau of Environmental Services for more information.

project contacts

For more information about the City of Portland stream and drainageway mapping project, please contact the following Bureau of Planning & Sustainability staff:

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Natural Resource Inventory Update

vegetation mapping project

City of Portland Bureau of
Planning & Sustainability
Sam Adams, Mayor | Susan Anderson, Director

vegetation mapping project

project description

The vegetation mapping project originated in 2004 as the Bureau of Planning & Sustainability was developing a new automated GIS model to inventory landscape features that contribute to riparian and upland natural resource values and functions. The inventory will update Portland's existing significant natural resource inventories and their related programs (e.g., environmental overlay zoning, Willamette Greenway, etc.)

Initially the GIS model was developed and tested using the regional vegetation map layer digitized by Metro from 2000 aerial photos. During the model testing phase it became apparent that this regional data was not sufficient to support Portland's inventory. A more detailed, precise, and comprehensive map of vegetation was necessary for analysis at the local scale.

The key goals of the vegetation mapping project include:

- refine the location of vegetation "patches" — the patch *geometry* — of areas previously mapped by Metro;
- incorporate vegetation maps generated by other agencies — such as Portland Parks and Recreation and the Portland Bureau of Environmental Services — and refine and improve that information where necessary;
- map vegetation patches meeting Portland's criteria for inclusion in the natural resource inventory — a ½ acre minimum patch size versus the 1 to 2 acre patch size used by Metro for the regional dataset;
- map all vegetation within a ¼ mile of a surface stream, wetland, or regionally significant habitat resources included in Metro's inventory;[1]
- classify the vegetation into four NVCS[2] classes — forest, woodland, shrubland, and herbaceous;
- further classify vegetation as either "natural/semi-natural" or "cultivated";
- update, refine and improve vegetation map annually as new aerial images become available.

In June of 2004 the Bureau of Planning & Sustainability began mapping vegetation based on information from reference data sources including 2003 aerial photos and 2002 multi-spectral

[1] Significant regional resources mapped by Metro as part of their Goal 5 mapping process. Adopted by the Metro Council in September of 2001. Upland resources included resource classes A, B, and C. For more information, contact Metro's Long Range Planning Office.
[2] "National Vegetation Classification System" developed by the Nature Conservancy for classifying terrestrial vegetation (Grossman *et al.*, 1998).

imagery. The map has been updated in subsequent years, using new aerials, to incorporate changes in vegetation since the original mapping. The mapping area includes all land within the City of Portland and the unincorporated parts of Multnomah County that are administered by the City of Portland.

The Bureau of Planning & Sustainability is also conducting limited field surveys to confirm the existence, location, and correct classification of vegetation patches. Field crews employed global positioning system (GPS) technology and digital photography to document the presence and/or location of different classes of vegetation where this information could not be confidently derived from available GIS reference sources (such as aerial photos).

The vegetation mapping project has been a collaborative effort involving Portland's Bureaus of Planning, Parks and Recreation, Environmental Services, and Corporate GIS. Metro also participated in the project by supplying data and advice on mapping protocols. An effort was made at the beginning of the project to acquire all mapped vegetation information developed by each agency for internal use. This information was combined into a single, regional vegetation dataset that served as a starting point for the mapping project. The vegetation dataset has been made available to all City bureaus and to Metro for their use. We are hoping to regularly update the dataset and keep the vegetation information accurate and current.

The following report provides a brief description of the project status, the vegetation mapping methodology, and the data sources used as reference. For a detailed description of the vegetation GIS data, please refer to the online metadata at http://www.portlandonline.com/cgis/metadata/viewer/display.cfm?Meta_layer_id=52135&Db_type=sde&City_Only=False.

project status

The initial mapping and classification of vegetation patches has been completed. The data will be updated each year as new aerial photos are made available. The following chart shows how much vegetation has been mapped as of **January 21st, 2009**:

Bureau of Planning Vegetation Mapping Project
Acres of vegetation in Portland and the County pockets

	previously mapped[1]		***currently mapped[2]***		***change in acres***	
	natural	cultural	natural	cultural	natural	cultural
forest	16,573	0	15,137	0	(1,436)	0
woodland	375	0	1,230	2,666	855	2,666
shrubland	406	0	896	53	490	53
herbaceous	2,962	0	1,970	5,316	(993)	5,316
total by category	*20,317*	*0*	*19,233*	*8,036*	*(1,084)*	*8,036*
totals		*20,317*		*27,269*		*6,952*

Notes:
[1] *previously mapped* vegetation refers to Metro's regional vegetation map layer digitized from 2000 and 2002 aerial photos.
[2] *currently mapped* vegetation refers to the Bureau of Planning & Sustainability vegetation map as of the date above.

methodology

The starting point for the vegetation mapping project was the 2000 regional vegetation map developed by Metro. More accurate vegetation information available for select areas around the City was incorporated into the regional dataset, superseding Metro data for these locations. This information includes vegetation maps created by the Bureau of Parks and Recreation for all of the natural area parks and habitat maps created by the Bureau of Planning & Sustainability for areas along the Willamette River and Columbia Rivers. All editing is performed in ESRI's ArcGIS 9 using custom tools developed by the Bureau of Planning & Sustainability.

The following is a summary of the vegetation mapping and classification methodology.

1) Mapping Area

All areas within a ¼ mile of a surface stream, wetland, or regionally significant habitat resource included in Metro's inventory were reviewed and remapped as necessary (Figure 1). The mapping effort is focused on areas that meet the following criteria:

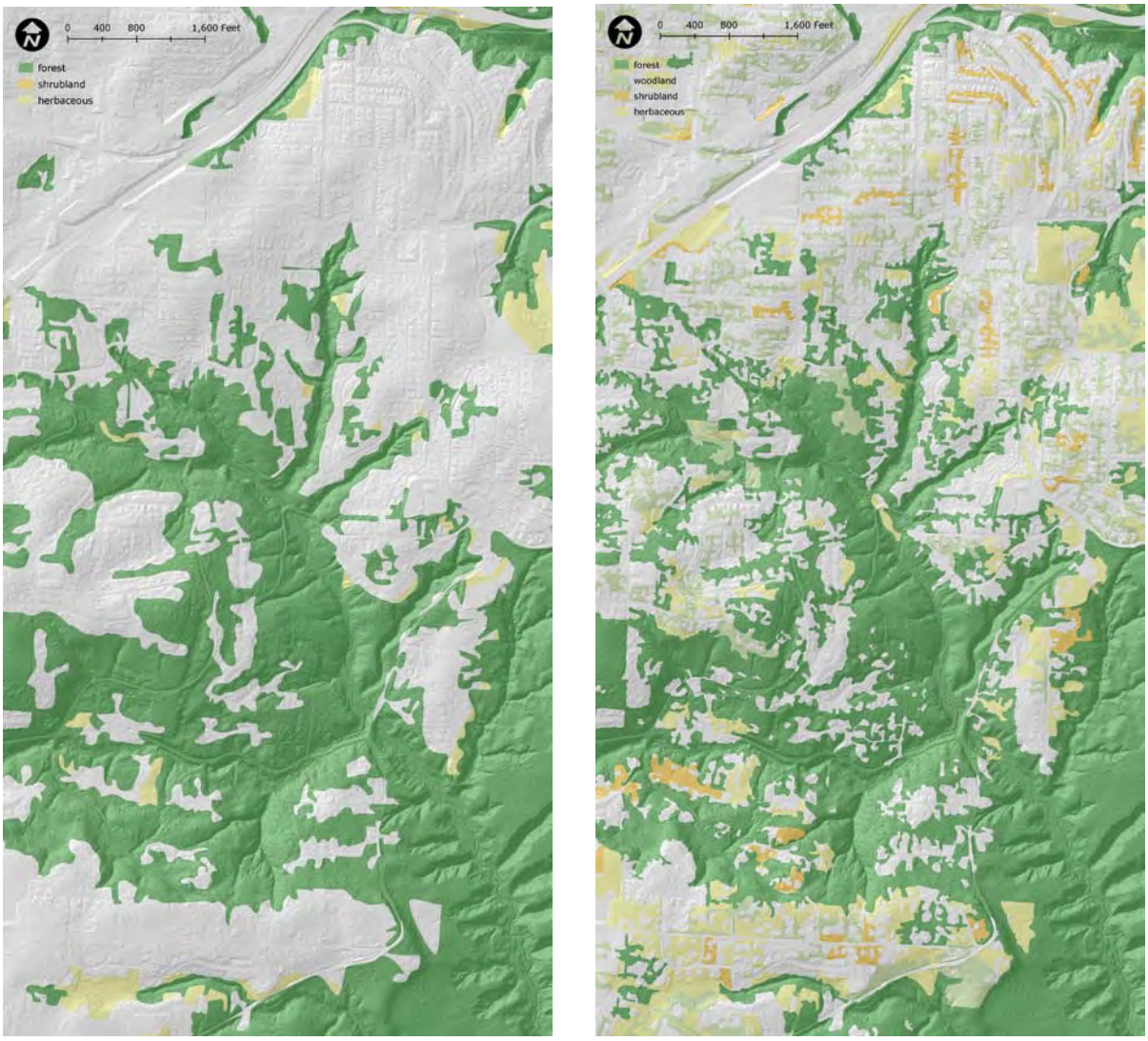
- Located with 300 feet of a river, stream/drainageway or wetland. Contiguous vegetation that begins within and extends beyond 300 feet from a river, stream/drainageway or wetland is mapped to its full extent;
- Comprised of forest vegetation and/or wetlands, at least 2 acres in size, plus any additional, adjacent woodland vegetation;
- Located within a current environmental overlay zone (e.g. c, p);
- Identified by Metro as regionally significant riparian corridor or wildlife habitat.

2) Vegetation Patches

City of Portland 6" resolution aerial photos are the primary reference sources for identifying vegetation patches. Other reference sources include Metro vegetation maps, LiDAR data, Portland Parks natural area assessments, and river habitat maps (refer to "Reference Data Sources" for more information).

For the purposes of this project, a vegetation patch is defined as:

> **Vegetation Patch**: *an area of contiguous vegetation greater than ½ acre in size containing a distinct pattern, distribution, and composition of vegetation relative to surrounding vegetated and non-vegetated areas (Figure 2).*



Original Vegetation Map

Revised Vegetation Map

Figure 1. Comparison of original and revised vegetation map.

Figure 2. Example of a vegetation patch.

2) Vegetation Patch Classification

a) Vegetation Class

The National Vegetation Classification System (NVCS) was derived by The Nature Conservancy (TNC) for the purpose of classifying properties for conservation purposes. The broadest level of the NVCS contains seven classifications: forest, woodland, shrubland, dwarf-shrubland, herbaceous, nonvascular and sparse vegetation.

For the purposes of this project, aerial photos were the primary reference for classifying vegetation patches into the following four NVCS classes (Grossman *et al.*, 1998) [3,4]:

Forest: *Trees with their crowns overlapping, generally forming 60-100% of cover.*

Woodland: *Open stands of trees with crowns not usually touching, generally forming 25-60% of cover. Tree cover may be less than 25% in cases where it exceeds shrubland and herbaceous vegetation.*

Shrubland: *Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching, generally forming more than 25% of cover with trees generally less than 25% of cover. Shrub cover may be less than 25% where it exceeds forest, woodland, and herbaceous vegetation. Vegetation dominated by woody vines (i.e., blackberry) is generally included in this class.*

Herbaceous: *Herbs (graminoids, forbs, ferns and shrubs less than 0.5m tall) dominant, generally forming at least 25% of cover. Herbaceous cover may be less than 25% where it exceeds forest, woodland and shrubland vegetation. This includes shrubs less than 0.5 m tall.*

Figure 3 shows examples of each class. For more examples, refer to "appendix 1 | image supplement" at the end of this document. Note that the 0.5 m height as a determination of class is difficult to apply consistently when using aerial photos as the primary reference source. Calculating the exact height of shrubs and low-structure vegetation in a patch is not possible without field verification, Vegetation heights were therefore estimated by comparing the shadows cast with those of nearby features such as trees and houses. This is not possible in all areas. Therefore, the shrubland class tends to be applied to areas with larger, woody shrubs more easily visible on the current aerial photos.

[3] For the purpose of this project, the dwarf-shrubland class described by the NVCS is classified as herbaceous given there is no accurate way to distinguish small shrubs from grass and other low-structure vegetation on the aerial photos.
[4] Nonvascular (e.g. moss and algae) and sparse vegetation were not mapped. The NVCS defines sparse vegetation as areas with a predominance of boulders, gravel, cobble, talus, consolidated rock and/or unconsolidated material.

b) Vegetation Subgroup

Each vegetation patch was further classified into either "natural/semi-natural" or "cultivated" NVCS subgroups based on the following definitions (adapted from Grossman *et al.*, 1998):

> **Natural/Semi-Natural Vegetation**: *Natural vegetation is that which appears to be unmodified by human activities, occurring spontaneously without regular management, maintenance or planting. Semi-natural vegetation has a composition or structure that has been sufficiently altered by anthropogenic disturbances such that it no longer has the characteristics of natural vegetation assemblages found in comparable conditions the watershed. However, semi-natural vegetation is self-maintaining without significant human maintenance or management. This type of vegetation may be dominated by either native or non-native species.*
>
> **Cultivated Vegetation**: *Vegetation that is consistent with traditional landscaping and is highly manicured and regularly (annually, semi-annually or more frequently) managed and maintained. Cultivated vegetation is often dominated by turf grasses and ornamental shrubs and trees. Cultivated vegetation typically has low species and structural diversity. It is assumed that cultivated areas are managed using a combination of mowing, pruning, fertilizers and pesticides. Residential yards, common areas, golf courses, parks and rights-of-way are included in this management class. In areas where agricultural land uses occur, cultivated fields and orchards are also included.*

Figure 4 shows examples of the two NVCS subgroups. For more examples, refer to "appendix 1 | image supplement" at the end of this document. Most vegetation, particularly within an urban setting, has been subjected to human disturbance. Even where these impacts are apparent, if the patch appears to be self-sufficient and displays patterns consistent with uninhibited and un-maintained growth, the patch is identified as natural/semi-natural.

It is important to note that though natural/semi-natural areas may be dominated by native species, they need not be. An example of this would be a patch of Himalayan blackberry. Though these plants are not naturally-occurring in the Portland area, they are not generally planted or maintained and they distribute naturally, so they are mapped as a natural/semi-natural vegetation patch. The subgroup distinction is based on the pattern of plant distribution within the patch and the patch's proximity to human features (such as houses and park infrastructure) rather than the type of vegetation present in the patch (which is often unknown).

Vegetation that has been planted as part of a restoration or enhancement project, includes a predominance of native vegetation, and is managed as a natural area, is classified as "natural/semi-natural." While this type of vegetation is often routinely managed for multiple years, it is managed to create a more naturalistic vegetation assemblage that supports an array of ecologic functions.

Also note that forest vegetation is always designated as semi-natural/natural. This is appropriate because forested areas are dominated by trees which provide significant ecologic functions, such as

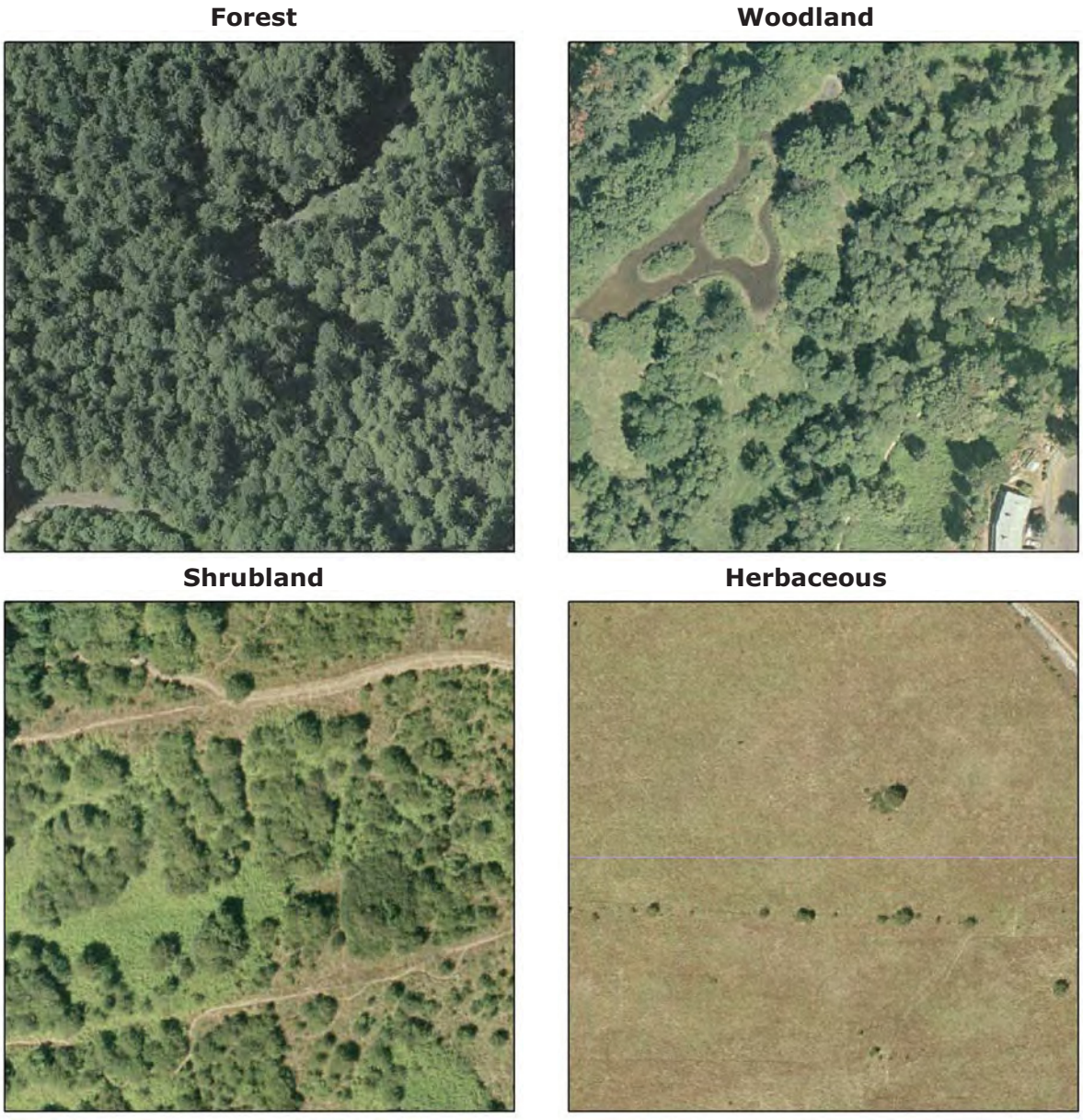


Figure 3. Examples of each of the four NVCS vegetation classes.

Figure 4. Examples of the two NVCS subgroups.

rainwater capture, nutrient uptake, organic inputs, wildlife cover, etc. In addition, the forest canopy itself is not regularly maintained.

Figure 5 summarizes the vegetation classification process.

4) General Mapping Protocol

Vegetation patches are mapped using the following protocol:

1. *Understand the landscape and general character of the vegetation*. At a scale of 1:8,000, which is approximately a quarter section, the general distribution and character of vegetation is observed. Other land use (e.g. residential, commercial) patterns are noted.

2. *Look at previously mapped vegetation patches*. Still at a scale of ~1:8,000, the previously mapped patches are reviewed to determine where refinements may be necessary. The patch should be refined if:

    - There are different patterns, distributions or character of vegetation included within the patch boundary;
    - Vegetation of the same character and patterns as adjacent vegetation is not included in the patch;
    - Patches that are not mapped to the smallest appropriate unit. For example, if a 4-acre area is mapped as woodland, but there are distinguishable ½-acre areas of herbaceous vegetation, then the herbaceous vegetation should be mapped as a separate patch;
    - In some cases, the boundary of a patch may be accurate but the vegetation type has changed. For example, a woodland patch may have developed into a forest patch.

3. *Refining and creating patches*. At a scale of approximately 1:3,000, distinct patches are mapped. This process includes both creating new patches and refined previously mapped patches.

    Below are the steps for refining and creating patches:

    i. First, vegetation that meets the forest or herbaceous NVCS classification is mapped. The guidelines to map forest vegetation patches are as follows:

        - A 4-lane road or highway splits a forest patch. Roads with less than 4 lanes split a patch where the road is clearly visible (i.e., no overhanging canopy). Where large vegetated areas located on two sides of a street are connected via a single tree overhanging the street, the two patches should be mapped separately;

- A narrow section of a forested area, which is one or two trees wide, can create a break between patches, provided that the two resulting vegetated areas are large enough to meet the ½ acre threshold;
- A significant change in character, even when the vegetation type and distribution is similar, can create a natural break between two forest patches. For example, a break between areas would likely occur where there is a significant shift from closed forest canopy with very few buildings or impervious area, to a primarily developed area with thin strips of trees between structures and yards. In this situation the closed forest canopy with few building/impervious would be a separate patch from the thin strip of trees that extends away from it.

The guidelines to map herbaceous patches are:

- When an area of predominantly herbaceous vegetation contains a narrow area of trees or shrubs located along its perimeter, and the trees do not meet the ½ acre criterion, the trees or shrubs should be included within the boundary of the herbaceous patch;
- When an area of predominantly forest, woodland or shrubland vegetation has a narrow area of herbaceous vegetation located along its perimeter, and the herbaceous vegetation does not meet the ½ acre criterion, the herbaceous vegetation should not be included within the boundary of the patch;
- Within developed areas, highly managed herbaceous vegetation that is fragmented or separated from larger vegetated areas by buildings, driveways, parking areas, etc. is generally excluded. The intent is to include larger structure vegetation when appropriate.

ii. Second, woodland and shrubland vegetation is mapped. There is a range of vegetation that meets woodland and shrubland vegetation classifications and often the differentiation is not clear. The following guidelines are used to differentiate between woodland and shrubland vegetation:

- Trees within a woodland patch generally make up about half the land cover but do not create significant closed canopy. The understory could be shrubs or herbs or sparsely vegetated; native or non-native;
- The trees should be distributed across the patch;
- When a vegetation contains relatively minimal canopy coverage (e.g. 25-30%) and the character of the vegetation doesn't appear to be woodland (e.g. intensely managed turf grass understory with very few, non-consolidated trees and shrubs), the patch should be classified as herbaceous vegetation;

- Shrubland vegetation should have a predominance of shrubs throughout the patch. Trees and grass may be present, but should occur throughout less than half the patch.

iii. Third, the vegetation management classification of semi-natural/natural or cultivated, is determined as follows:

- Forest is always classified as natural/semi-natural;
- Cultivated areas typically include yards, landscaped areas around buildings, golf-courses, ball parks and soccer fields, and rights-of-way. These areas are intensely managed and typically include turf grass and ornamental shrubs and trees. These areas generally lack structural diversity (e.g. sparse trees interspersed across lawn);
- Irrigated areas are usually, but not always, classified as cultivated. Other indicators, such as structural diversity, are used to determine if irrigated areas should be classified as semi-natural/natural;
- Semi-natural/natural vegetation is typically, but not always, found around rivers, streams and wetlands and in parks and natural areas. However, semi-natural/natural vegetation can be found in yards, around buildings, and adjacent to ball parks and soccer fields. These areas typically include a mix of trees, shrubs and grasses that do not appear to be mowed, pruned or otherwise treated. The vegetation may be dormant in the summer due to lack of irrigation;
- Areas maintained to restore a more natural vegetation pattern are considered semi-natural. These areas may be managed to remove invasive plant species and irrigation may occur;
- Topography is used to help differentiate between areas that are cultivated and areas that are not. Very steep areas are not typically cultivated.
- In cases where a patch meets one vegetation type, but two management types are present, the patch is split to differentiate between the management types.

iv. Finally, visible, non-vegetated areas (e.g. buildings, bare soil) are excluded or removed from vegetation patches as necessary using the following guidelines:

- Visible buildings, driveways, parking areas are removed from vegetation patches;
- Vegetation that overhangs a non-vegetated area (e.g. a driveway) is included within the vegetation patch;
- Areas of bare soil, gravel, rocks are removed from a vegetation patch when the area is greater than ¼ acre in size;
- Large trails (5’ wide or more) visible on the aerial photos are not included in the vegetation patch.

4. *Reassess the general pattern and distribution of vegetation*. Returning to a scale of 1:8,000, the general pattern, distribution and character of vegetation is assessed based on the refined vegetation patches.

4) Field Survey Methodology

Project staff visited properties owned by the public and privately-owned properties where vegetation patch was visible from public right-of-way. Field crews used visual assessment and, when GPS-satellite coverage was available, GPS data collection.

Field crews carried copies of a standard field visit form for notes and sketches, and a map with 6"-resolution aerial photographs of the vegetation patch and the surrounding area. All notes and maps for a particular field visit were scanned and stored in Acrobat PDF format. Digital photos of the patch were also taken in some cases. All digital documentation and photos are available from the Bureau of Planning & Sustainability.

reference data sources

The following sources were used as the main reference data for determining the presence and/or location of vegetation patches:

Source:	**City of Portland Aerial Photos**
Created By:	Varies; refer to metadata
Data Format:	Geo-referenced TIFF images
Date of Acquisition:	2007 aerials – July 12 - August 28, 2007 2006 aerials – June 23-27, 2006 2005 aerials – July 3 & 4, 2005 2004 aerials – July 21, 22, 24, 2004 2003 aerials – July 18 & 19, 2003 2002 aerials - August 2002
Description:	Natural color ortho-rectified digital imagery. All photography has been rectified to adjust for curvature of the earth. Photo resolution for all years is 6”.
Notes:	Data is viewable for specific properties via www.portlandmaps.com
Metadata Reference:	http://geode.metro-region.org/metadata/index.cfm?startpage=main.cfm?db_type=rlis (listed by aerial year)

Source:	**City of Portland LiDAR data**
Created By:	Varies; refer to metadata
Data Format:	Geo-referenced ERDAS Imagine images
Date of Acquisition:	West Hills/Columbia Slough – March, 2005 All other areas – March/April, 2007
Description:	A 3-foot rasterized digital elevation model (DEM) and digital surface model (DSM) of all Portland area LiDAR point returns collected and processed to date.
Notes:	Average vertical accuracy +/- 6”
Metadata Reference:	none currently available

Source:	**2002 Multispectral Image Classification**
Created By:	City of Portland Bureau of Environmental Services/Bureau of Planning & Sustainability
Data Format:	ERDAS Imagine 8.7 images
Date of Acquisition:	June 1st to June 20th, 2002

Description:	Classified 4-band 1.1-meter multispectral image data for the Portland metropolitan area. Classes are vegetation, bare soil, impervious surfaces, and water. Refer to the metadata link below for a complete description of the methodology.
Notes:	Overall classification accuracy – 89.3% (Kappa 0.8443).
Online Metadata:	\\cgisfile\data\Images\Multi-Spectral\June_2002\Classified_Images\June_2002_Classification_METADATA.htm (metadata available to City of Portland employees only. Can be made available to outside parties upon request.)

Source:	**Parks Vegetation Assessment**
Created By:	City of Portland Bureau of Parks and Recreation
Data Format:	ESRI Shapefile
Date of Acquisition:	May 2003 through October 2004
Description:	Vegetation patches as digitized by Parks natural area assessment team using 2002 and 2003 aerial photographs. Patches were visited in the field by Parks technicians, data about the patch was collected and recorded, and patch geometry and classes were changed as necessary based on the field data.
Notes:	Please contact the City of Portland, Bureau of Parks and Recreation for more information about the natural area assessment.
Online Metadata:	None available.

Source:	**River Habitat Maps**
Created By:	City of Portland Bureau of Planning & Sustainability (original mapping done on contract with Adolfson and Associates, Inc.)
Data Format:	ESRI Shapefile
Date of Acquisition:	November 1999 through April 2000
Description:	Wildlife habitat areas along the Willamette and Columbia rivers. Habitat areas were defined as plant species and plant communities that support avian, mammalian, reptilian and amphibian species that use the riparian area. The boundaries of the habitat area were mapped using 1998 and 1999 aerial photos and field visits.
Notes:	Modified by City of Portland, Bureau of Planning & Sustainability using 2000 and 2001 aerial photos to refine the habitat boundaries and incorporate vegetation changes since the original date of acquisition.
Online Metadata:	None available.

Source:	**Metro 2000/2002 Vegetation**

Created By:	Metro
Data Format:	ESRI Shapefile
Date of Acquisition:	July 2000
Description:	This is a simple vegetation land-cover layer collected via interpretation of Metro's 2000 digital orthophotographs. Polygons were digitized around forest, woody non-forest vegetation, open space, and developed gaps. Forest land-cover types were delineated for the entire area within the Metro Service District and all sections within one mile beyond the District boundary. Woody non-forest vegetation and open space was delineated only within 300 feet of a mapped stream within the Metro Service District and all sections within one mile beyond the District boundary. Updated with 2002 aerial photos.
Notes:	Minimum patch mapping size used by Metro was 1 acre.
Online Metadata:	http://geode.metro-region.org/metadata/display.cfm?Meta_layer_id=1997&Db_type=rlis

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references

Grossman, D.H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon, 1998. *The National Vegetation Classification System: Development, Status, and Applications*. The Nature Conservancy, Arlington, Virginia, 139 p. (available online at http://www.natureserve.org/library/vol1.pdf)

appendix 1 | image supplement

This image supplement features aerial photographs of correctly mapped patches of each of the NVCS classes and subgroups used in the vegetation mapping project. It is intended a visual reference to complement the textual description of the vegetation mapping methodology contained in this document.

The primary goals of this supplement are:

- to help foster consistency and accuracy in future additions or modifications to the vegetation GIS data;
- to better illustrate the range of different types of vegetation that fall within each NVCS class and subgroup.

Each map shows a vegetation patch (outlined in yellow) and any surface streams present in the patch (in blue). A brief description of each map describes what the patch represents (NVCS class and subgroup) and why.

Figure 1. Cultivated Herbaceous Vegetation Patches

A. These patches are marked cultivated herbaceous due to proximity to roads and human activity.
B. The herbaceous patches in this cemetery are divided by paved roads and paths.
C. A backyard patch of herbaceous vegetation follows the edge of bordering woodland patches.
D. Geometric planting patterns are an indication of a cultivated vegetation patch.

Figure 2. Semi-Natural/Natural Herbaceous Vegetation Patches

A. This herbaceous patch is semi-natural/natural because it is unmaintained and near the river.
B. An unused lot allowed to grow with vegetation is marked semi-natural/natural.
C. This cleared area in the middle of a forest patch is semi-natural/natural herbaceous.
D. This herbaceous patch near new development remains undisturbed and contains a small pond.

Figure 3. Cultivated Shrubland Vegetation Patches

A. Rose beds in Washington Park constitute a cultivated shrubland patch.
B. Small trees in this vegetation patch may eventually meet cultivated woodland status.
C. Connected backyards over ½ acre form a cultivated vegetation patch.
D. This cultivated shrubland patch consists of highly manicured low hedges.

Figure 4. Semi-Natural/Natural Shrubland Vegetation Patches

A. This semi-natural/natural shrubland contrasts with nearby forest and herbaceous patches.
B. These shrubland patches are distinct from the surrounding herbaceous in this wetland area.
C. A stream runs along the center of this semi-natural/natural shrubland patch in Kenton.
D. A patch of cultivated shrubland lies adjacent to the south of this semi-natural/natural patch.

Figure 5. Cultivated Woodland Vegetation Patches

A. These cultivated woodland patches are composed of tree canopy that overhangs the street.
B. Vegetation in this golf course shows the distance woodland patches should connect or break.
C. Two cultivated woodland patches split from a forest patch as they reach into a residential area.
D. Tree canopies overlap in this residential area to form a cultivated woodland patch.

Figure 6. Semi-Natural/Natural Woodland Vegetation Patches

A. Semi-natural and natural woodland patches often border cultivated vegetation.
B. Many woodland patches are found along the borders of denser natural forest patches.
C. This natural woodland area lies between natural shrubland and forest patches.
D. This woodland patch borders cultivated herbaceous, but its interior is not maintained.

Figure 7. Semi-Natural/Natural Forest Vegetation Patches

A. Forest patches can be extensive and border many land use and vegetation patterns.
B. Forest patches should be broken and not connect across areas of lower vegetation.
C. Highways split forest patches when the tree canopy does not touch over the roadway.
D. Forest patches can be large enough to encircle smaller areas that lack vegetation.

Natural Resource Inventory Update

wetland data refinement project | February 2010

City of Portland Bureau of

Planning and Sustainability

Sam Adams, Mayor | Susan Anderson, Director

Natural Resource Inventory Update
wetland data refinement project

project description

Overview

The Wetland Data Refinement Project is part of the City of Portland's Natural Resource Inventory Update Project. The Bureau of Planning (now Bureau of Planning and Sustainability) produced a number of natural resource inventories for different areas in the city between 1987 and 2002. The different inventories contain maps and descriptive information about resources including rivers, streams, wetlands, groundwater, forests and vegetation and wildlife. These inventories provided the technical basis for a series of resource protection plans and programs, including the Environmental and Greenway overlay zones. The inventories and associated overlay zones were developed to meet the requirements of Statewide Land Use Planning Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces. They also supported Statewide Planning Goal 6: Air and Water Quality, Goal 7: Areas Subject to Natural Hazards, and Goal 15: Willamette Greenway. In addition, they have helped the City meet the requirements of Titles 3 and 13 of Metro's Urban Growth Management Functional Plan, and the federal Clean Water Act.

Several years ago the City began the Natural Resource Inventory Update Project. The City modeled its approach on Metro's inventory of regionally significant riparian corridors and wildlife habitat. As part of this project, the Bureau of Planning and Sustainability (BPS) has updated the geographic information system (GIS) mapping data for streams, flood areas, vegetation and wildlife habitat in the City of Portland and in unincorporated parts of Multnomah County, where land use reviews and development permits are administered by the City.

The Wetland Data Refinement Project is a strategic update of the City's wetland inventory data. This update is required by the Oregon Department of Land Conservation and Development (DLCD) as part of the City's approved periodic review work plan (2009). Using available information from the Oregon Department of State Lands (DSL) and the City's land use review records, permits and other mapping data, the wetland GIS data have been refined to improve accuracy and better reflect current conditions. This updated wetland inventory information will support multiple City planning efforts including the Portland Plan and area-specific projects such as the Airport Futures Project and the River Plan. This information could also be used to support City and community restoration efforts and to educate the public about wetland functions.

Why are wetlands important?

The updated draft City of Portland natural resource inventory includes approximately 2,455 areas of wetlands located within the city limits and the urbanizing areas of unincorporated Multnomah County. Wetlands exist in all of Portland's watersheds, although a majority of these wetlands are found in the Columbia Slough Watershed.

Watershed	*Columbia Slough*	*Fanno Creek*	*Johnson Creek*	*Tryon Creek*	*Willamette River*	*Other Watersheds**
Approximate Acres of Wetlands	2011	8	71	1	298	66

**Other watersheds include: Columbia River, Multnomah Channel and Tualatin River*
(From Natural Resource Inventory Analysis: Watershed Statistics, City of Portland Bureau of Planning and Sustainability, 10/7/09)

Wetlands serve important functions including intercepting and storing surface runoff and groundwater and containing floodwaters. By moderating stream flows, wetlands can reduce bank erosion. They also store and filter sediments, cycle nutrients, decompose organic waste and prevent heavy metals from entering streams. Evaporation from wetlands contributes to localized humidity levels and air and soil temperature moderation. Forested wetlands contribute large wood to nearby streams offering habitat for wildlife. Wetlands can provide food, water, refuge from summer heat, shelter from winter cold, and cover for a variety of wildlife including mammals, amphibians, birds and aquatic species, such as rearing areas for juvenile salmon.

The City has established policies that recognize the importance of wetlands in its Comprehensive Plan and in the Portland Watershed Management Plan. The City has also applied overlay zones to protect wetlands. As a result, approximately 95% of the mapped wetlands in Portland are within environmental, greenway or other resource overlay zones. Metro has also recognized the role and functions of wetlands, and has established regional policies and requirements for cities and counties to protect and enhance wetlands through the adoption of Title 3: Water Quality, Flood Management and Fish and Wildlife Conservation and Title 13: Nature in Neighborhoods, of the Urban Growth Management Functional Plan

Project Purpose and Approach

The main goal of this project is to improve the accuracy of the City's wetland data in a relatively short period of time using readily available documentation and other resources.

On September 30, 2009, the DLCD approved a periodic review work plan for the City. The work plan includes a task to update the City's wetland inventory data using existing information sources. This project initiated the first steps of a Local Wetland Inventory process and was determined to be an efficient approach to update the data without delaying the periodic review work plan as a whole[1]. It is understood that the project scope is limited and additional steps will be needed to produce a comprehensive update.

The City of Portland's existing wetland inventory data is based primarily on information from the 1982 National Wetlands Inventory (NWI). The NWI was derived from high-altitude aerial photography flown at a scale of 1:24,000. The boundaries of those wetlands were sometimes inaccurate, and since the minimum mapping resolution was 2 acres, smaller wetlands were generally not included. Seasonal wetlands may also not have been mapped since photographs were taken primarily in the summer months[2]. In addition to the NWI, the City's existing GIS wetland data reflect ad hoc updates based on local City of Portland natural resource inventories and DSL permits. Before this project some DSL permit data and wetland-related documentation from City land use reviews, permits, and other surveys or delineations had not been incorporated into the inventory. This is primarily because the City had not yet established a systematic approach to regularly update its GIS wetland data with new information.

Key steps of this project included:

- Developing a wetland mapping protocol
- Reviewing existing DSL permit and City land use permit and other mapping information and conducting field visits
- Updating the City's GIS wetland data
- Producing recommendations for improving and maintaining the data

BPS staff collaborated with Portland's Bureaus of Development Services, Parks and Recreation, and Environmental Services to complete this project. The revised wetland data will be available to all City bureaus for their use and to Metro for regional distribution along with the Regional Land Information System (RLIS) "Natural Resource" GIS data.

The remainder of this report describes the mapping protocol used by staff, project results, and conclusions and recommendations to maintain and improve the BPS GIS wetland data over time.

[1] The City did not complete a full Local Wetlands Inventory as part of this project.

[2] *Just the Facts…About the National Wetlands Inventory*, Oregon Department of State Lands - Wetlands Program, Revised November 2004

wetland mapping protocol

The first step in this process was to determine which information sources would be appropriate to support the project and then develop protocol for updating the wetland data. It was important that the information be provided by credible "qualified" sources and be adequate to meet City and regional mapping criteria.

Ultimately, the project relied on data generated by the following sources:

- City of Portland land use and permit reviews and wetland delineations
- Department of State Lands permits
- U.S. Army Corps of Engineers permits
- Environmental consultants' maps

National Wetland Inventory GIS data, LiDAR (Light Detection and Ranging) data, and aerial photos were also referenced during the project. LiDAR is a remote sensing system used to collect topographic data. LiDAR maps show land depressions that are common in wetland areas. Aerial photography was used to check for standing water and/or vegetation typical to wetland areas and also to double check if wetlands were removed from a site in conjunction with a DSL removal/fill permit. Based on the clarity of the information, data was either used for immediate mapping updates or to identify the appropriate follow up action according to the following protocol:

Accurate Wetlands - The existing City GIS wetland inventory data was deemed to be accurate when maps from qualified sources were in substantial conformance with this data.

New Wetlands – New wetlands were added to the City inventory data based on the following mapping information:

- A survey or delineation from a qualified source clearly showed the boundaries of the wetland; or

- The wetland was indicated on a topographic map or other map from a qualified source, and was supported by LiDAR data and documented field observations (see additional information about field observations below).

Modified Wetland Boundaries – Wetland boundaries of existing City inventory data were modified based on the following information:

- A survey or delineation from a qualified source clearly showed that the boundaries of the wetland differ from the existing data; or

- The wetland boundaries were indicated on a topographic map or other map from a qualified source, and were supported by LiDAR data and documented field observations.

Deleted Wetlands – Wetlands were deleted from the City inventory data based on the following information:

- A removal/fill permit from the Department of State Lands and verification with aerial photography; or

- Any other map from a qualified source showed that the wetland did not exist or had been removed, and aerial photography verified this.

Probable Wetlands – Sometimes wetlands were referenced in a report or permit but could not be mapped or modified for the following reasons:

- The map was not from a qualified source;

- The referenced wetland was from a qualified source but did not include a survey or delineation and could not be confirmed because it was on private property; or

- The proposed new wetlands or modifications to existing wetlands were located on sites that were undergoing land use or permit review by the City of Portland.

These wetlands have been entered in a "probable wetland" database for follow up should the City proceed with further wetland inventory update projects.

Using the above criteria, staff compared maps and images from DSL and City permit records to existing City wetland inventory maps. Clear, well-documented information from qualified sources was used to update the data without further action. In some instances, these maps were either not clearly surveyed or were difficult to read. In these cases, BPS staff and experts from the Bureau of Parks and Recreation or the Bureau of Environmental Services visited the sites to confirm the presence and general location and configuration of wetlands. Field observations were conducted only on publicly owned property. Data sheets (see attached example) were used to record overall site conditions, vegetation, hydrology/drainage, soils and any indication of wildlife. No delineations were conducted. Soil pits were not dug, but National Resource Conservation Service mapping codes were noted on the data form. Sites with soils coded as "hydric" have a greater possibility of containing wetlands. Sites were also digitally photographed.

Original NWI mapping

New & modified wetland boundaries

Figure 1. Comparison of previously-mapped wetlands and remapped wetlands

accomplishments and results

To date, BPS has retrieved and reviewed more than 120 City land use review staff reports, project proposals and approved permits, and over 70 Department of State Lands permits for wetland site plans or other wetland data. Staff analyzed site plans, report text and project descriptions and compared this information with the GIS database, aerial photographs and property history information. This analysis, in conjunction with the above mapping protocol, allowed for modifications to the City's current wetland GIS database.

The project has updated the inventory information for 53 wetlands (as of 2/1/2010), totaling approximately 72 acres. Thirty-seven wetlands have been added to the data (48 acres) and the boundaries of sixteen wetlands have been modified substantially (24 acres). In addition, eleven wetlands were confirmed as accurate since more current documentation closely matched the existing data.

No wetlands were deleted from the database during this project. This may be because since 2000, the City has been updating maps based on information sent from DSL removal/fill permits. In addition, approximately 95% of most mapped wetlands in the City are in environmental resource overlay zones Resources within the overlay zones are subject to specific requirements to prevent impacts from new development.

Finally, 13 sites with "probable" wetland areas were targeted for follow up research. These sites are either on private property and could not be evaluated with a field visit or else are currently under permit or land use review, and so the wetland area could still be modified.

conclusions and recommended next steps

This project yielded an incremental update to the existing 2,455 acres of inventoried wetlands based on information readily available to City staff. It is important that the City now establish a process to continue using this type of information to regularly update the wetland database. Outlined below are recommendations for regularly incorporating new or revised wetland data from other information sources.

Department of State Lands permit information

The permit information provided to date from DSL has been instrumental in helping to keep the City's wetland records up to date. Staff should continue to use this information to add, modify or remove wetlands from the database.

City of Portland land use reviews and permits

When a City-required land use review or development permit addresses wetlands directly, or sites with wetlands, the project should be flagged for further research. Since all permits and land use reviews are assigned a permit tracking number in a program called TRACS, staff in the Bureau of Development Services should develop a consistent method to identify these projects. This may include either ensuring the project description field in TRACS contains the word "wetland," or creating a field in the "permit information" tab in TRACS to note if a wetland is located on the site. BPS staff could run regular reports to retrieve these permits for review. Maps would be reviewed using the mapping protocol described above. For example while some of the maps may be from a qualified source and allow updates to the database immediately, other wetlands may need further research. In many cases, the City of Portland does not require wetlands to be surveyed and/or delineated in order for the site to be developed, enhanced or otherwise modified. These sites could be placed in a follow-up database for future research, should funding become available for additional wetland inventory updates.

In addition, since natural resource information is included on the *Portlandmaps.com* website, current mapping data can be viewed by City staff and by the general public. This information is located in the "Maps" tab of *Portlandmaps.com* and includes a "Map Accuracy" section with a hyper-link to an online correction form. Anyone submitting corrections can describe the resource, its location, and the reason why they think the data is not accurate. This information can be submitted by property owners, surveyors, environmental consultants, or anyone familiar with the wetlands on a site. Mapping could be completed based on the mapping protocol described above. For instance, only data from a "qualified" source could be used to update City maps. Other sites could be placed in the follow-up database for future research. Permit and land use review staff may also be able to use this

link to alert GIS staff, who could then work with BPS staff to check records for additional mapping information.

Wetland delineations by other City of Portland bureaus

Other City bureaus such as Parks and Recreation and Environmental Services perform wetland delineations for various projects. As they are completed, these delineations should be forwarded to BPS for mapping. BPS GIS staff should work with staff in these bureaus to outline the necessary mapping data and a method for consistent retrieval of this information. These and others bureaus could also use the *Portlandmaps.com* tool described above to notify BPS GIS staff about corrections to the database.

Wetland data from current and future planning projects

The Airport Futures Project, the River Plan, the Portland Plan and other planning projects involve area-specific natural resource inventory updates. Any wetland mapping information generated through these types of projects should continue to be included in the GIS wetland database.

Other recommendations for identifying modified and new wetlands

Many wetlands in the City have not been subject to permit or land use review, so their boundaries have not been recently mapped, or may never have been mapped. Some wetlands may have been filled without a DSL permit. At this point, the City has not allocated resources to perform a full Local Wetland Inventory to identify and map or remap these sites. Staff may be able to identify additional probable wetlands by using soil information in conjunction with LiDAR data to search for land depressions that may contain wetlands. The City could also develop an outreach strategy to educate the public about the *Portlandmaps.com* correction tool described above, or provide a hotline to encourage residents to voluntarily submit information about potential new or modified wetlands on their property or in their neighborhood. With landowners' permission, staff could visit sites to determine if the site should be logged into the "probable wetlands" database.

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FIELD DATA FORM
WETLAND INDICATOR IDENTIFICATION

Site Address/location	N. PORTLAND RD between Marine + Columbia (N of Slough)	Date:	11/20/09
Property Owner:	METRO	Weather	Clouds/rain
Tax ID Number	1R314582	Date of recent measurable precipitation	11/20/09

Describe Overall Site Conditions:
PFO - Pulustrean Forested
Metro Mitigation site for fill in St Johns

Topography?
Sloped down

Investigators:
Susan van Staveren - BPS
Emily Roth - PARKS

VEGETATION

Remarks: Forest ✓ Woodland ✓ Shrubs ____ Herbaceous ____

(Structure, canopy, understory, contiguousness, fragmentation, wetland species, etc.)

Cottonwood (Populus), alder (alnus) rose understory, elderberry (spiraea douglasii), (sambucus) cattails (Typha latifolia) planting complement Smith Lake sedges + rushes (Cyperaceae)

HYDROLOGY/DRAINAGE

Remarks: (Standing/flowing water, open channels; pipes/culverts, bank erosion, ripple marks, water quality, etc.)

Central depressed area. Per Emily, this site ponds during rain events in the winter months.

SOILS

Remarks: (Color, texture, etc.) NRCS Mapping Code: 47A

Pits dug? Y (N)

Saturated

WILDLIFE

Remarks: (Wildlife presence, tracks, scat, calls, song, evidence of grazing, burrowing, nesting, browsing, wetland associations, etc.)

Noted nest in tree. Songbirds.

GENERAL NOTES AND OBSERVATIONS

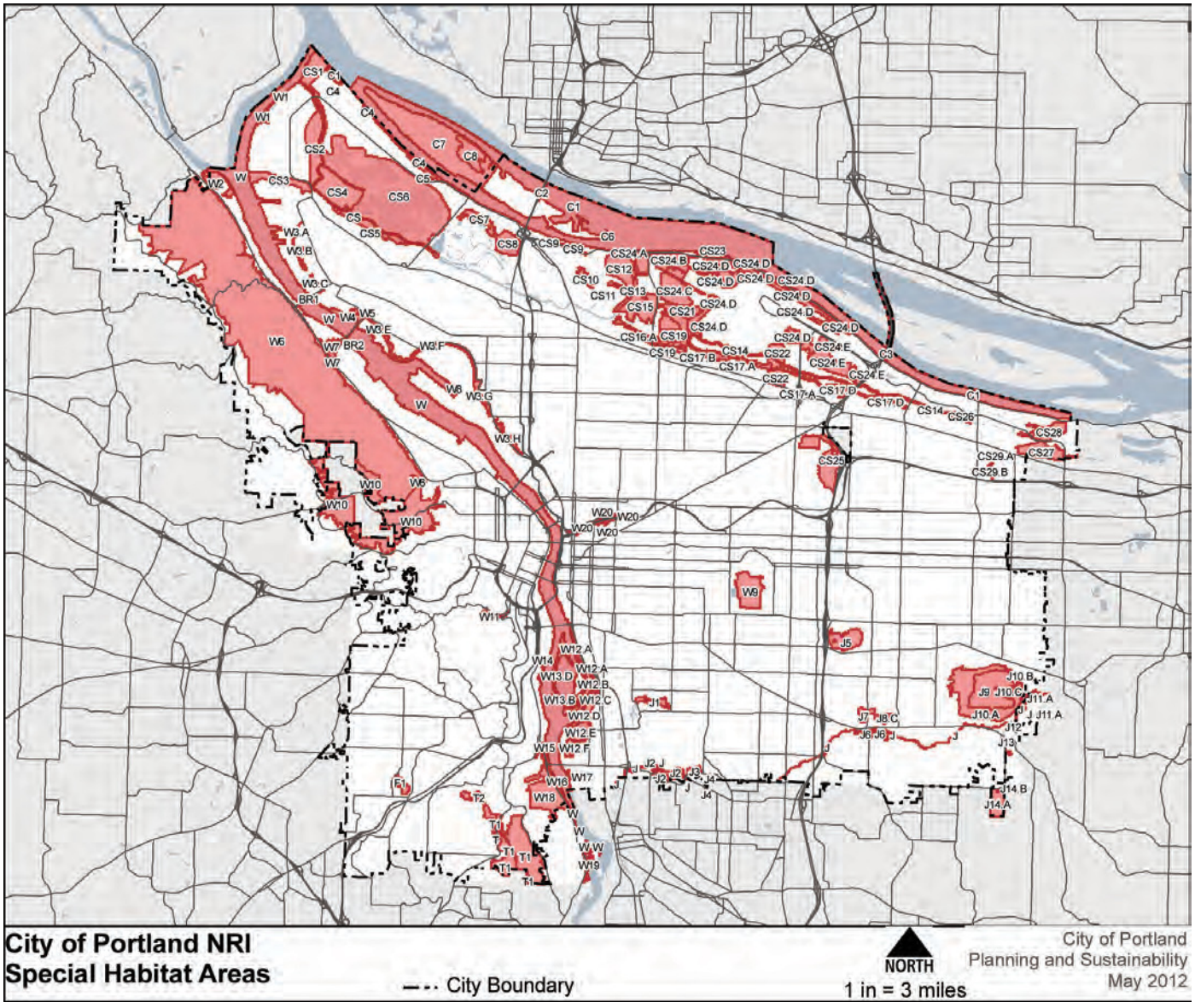
Remarks: (Summarize observations and conclusions relating to presence/absence and type(s) of wetlands), apparent size of wetlands, etc.)

Emily, who previously worked for Metro, knows that this site was a filled wetland that was re-excavated and replanted as a wetland.
Wetland area is centered in lower elevation on site.

BASED ON OBSERVATIONS, IS THERE PROBABLE WETLANDS ON SITE? Y ✓ N ____ UNCLEAR ____

APPENDIX 7

SPECIAL HABITAT AREAS



Special Habitat Areas

Updated May 30, 2012

			Attributes										
Watershed	***Site ID***	***Site Name***	***P***	***W***	***O***	***B***	***I***	***D***	***M***	***C***	***S***	***E***	***G***	***U***
Columbia River	C1	Columbia River Mainstem	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Columbia River	C2	Interstate Bridge (I-5)	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Columbia River	C3	Interstate 205 Bridge (I-205)	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Columbia River	C4	South Bank Oregon Slough	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Columbia River	C5	T6 Vacant Industrial Land	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☑	☐
Columbia River	C6	East Hayden Island	☐	☐	☐	☑	☑	☐	☑	☐	☐	☐	☐	☐
Columbia River	C7	West Hayden Island Mosaic	☐	☑	☐	☑	☑	☐	☑	☑	☑	☐	☐	☐
Columbia River	C8	Dredge Deposit Management Area	☐	☐	☐	☐	☑	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS	Lower Columbia Slough	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☑
Columbia Slough	CS1	Kelley Point Park	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Columbia Slough	CS10	Brandwein Wetlands	☐	☑	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Columbia Slough	CS11	Blue Heron Meadows Wetland	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Columbia Slough	CS12	Columbia Edgewater Golf Course	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Columbia Slough	CS13	Peninsula Drainage Canal	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS14	Middle Columbia Slough	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Columbia Slough	CS15	Riverside Golf Course	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Columbia Slough	CS16.A	South Arm Complex - Buffalo Slough West	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☑
Columbia Slough	CS16.B	South Arm Complex - Buffalo Slough East	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☑
Columbia Slough	CS17.A	South Arm Complex - Whitaker Slough	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☑
Columbia Slough	CS17.B	South Arm Complex - Whitaker Ponds	☐	☑	☐	☑	☐	☐	☑	☐	☑	☐	☐	☑
Columbia Slough	CS17.D	South Arm Complex - Johnson Lake	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☑
Columbia Slough	CS17.D	South Arm Complex - Little Four Corners / Prison Pond	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS18	Subaru Wetlands	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Columbia Slough	CS19	Broadmoor Golf Course	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Columbia Slough	CS2	Ramsey Wetland Complex	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS20	Buffalo Street Mitigation Site	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS20.A	Wilkes Creek Headwaters Property (North of NE Fremont St)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Columbia Slough	CS20.B	Wilkes Creek Headwaters Property (South of NE Fremont St)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Columbia Slough	CS21	Elrod Slough Complex	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐

			Attributes											
Watershed	**Site ID**	**Site Name**	**P**	**W**	**O**	**B**	**I**	**D**	**M**	**C**	**S**	**E**	**G**	**U**
Columbia Slough	CS22	Colwood Golf Course Forested Wetland	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS23	Broughton Beach	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS24.A	PDX Upland Grassland Complex - 33rd Field	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS24.B	PDX Upland Grassland Complex - Deicing/Fuel Farm Fields	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS24.C	PDX Upland Grassland Complex - SW Quad	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS24.D	PDX Upland Grassland Complex - Airfield	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS24.E	PDX Upland Grassland Complex - PIC/CS	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS25	Rocky Butte / Grotto	☐	☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Columbia Slough	CS26	Cross Levee Habitat Area	☐	☑	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Columbia Slough	CS27	Big Four Corners (south of NE Airport Way)	☐	☑	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Columbia Slough	CS28	Big Four Corners (north of NE Airport Way)	☐	☑	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐
Columbia Slough	CS3	West Wye/ I-5 Powerline Mitigation Site	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS4	St. Johns Landfill	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☑	☐
Columbia Slough	CS5	Wapato Wetlands	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐
Columbia Slough	CS6	Smith and Bybee Lakes Management Area	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Columbia Slough	CS7	Heron Lakes Golf Course Wetlands/ Force Lake and Wetlands	☐	☑	☐	☑	☐	☐	☑	☐	☑	☐	☐	☐
Columbia Slough	CS8	Vanport Wetlands	☐	☑	☐	☑	☐	☐	☑	☐	☑	☐	☐	☐
Columbia Slough	CS9	Bridgeton Slough	☐	☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐
Fanno Creek	F1	Woods Memorial Park	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Johnson Creek	J	Johnson Creek	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐
Johnson Creek	J1	Reed College Canyon	☐	☑	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J10.A	Powell Butte Nature Park	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J10.B	Powell Butte Nature Park	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J10.C	Powell Butte Nature Park	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J10.D	Powell Butte Nature Park	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J11.A	Circle Avenue Wetlands South	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐
Johnson Creek	J11.B	Circle Avenue Wetlands North	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐
Johnson Creek	J12	Alsop Wetland	☐	☑	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Johnson Creek	J13	Kelley Creek Refuge	☐	☐	☐	☑	☐	☐	☐	☑	☑	☐	☐	☐
Johnson Creek	J14.A	Scouter Mt. Uplands West	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐
Johnson Creek	J14.B	Scouter Mt.Uplands East	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐
Johnson Creek	J2	Tideman Johnson Park and Riparian Area	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐

Watershed	Site ID	Site Name	Attributes P	W	O	B	I	D	M	C	S	E	G	U
Johnson Creek	J3	Errol Heights Wetland	☐	☑	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐
Johnson Creek	J4	SE 55th and Harney Wetland	☐	☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J5	Kelly Butte	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐
Johnson Creek	J6	Brookside Wetlands	☐	☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J7	Springwater Wetlands Complex - Beggar's Tick Marsh Wildlife Refuge	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
Johnson Creek	J8.A	Springwater Wetlands Complex - North Wetland	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Johnson Creek	J8.B	Springwater Wetlands Complex - Central Wetland	☐	☑	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Johnson Creek	J8.C	Springwater Wetland Complex - Zenger Farm	☑	☑	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Johnson Creek	J9	Powell Butte Grassy Areas	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☑	☐
Tryon Creek	T	Tryon Creek	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
Tryon Creek	T1	Tryon Creek State Natural Area	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐	☐	☐
Tryon Creek	T2	Marshall Property, Jensen Property and Foley Balmer Property	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	BR1	St. Johns Bridge Nests	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Willamette River	BR2	Railroad Bridge Nests	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Willamette River	BR3	Fremont Bridge Nests	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Willamette River	BR4	Marquam Bridge Nests	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑
Willamette River	W	Willamette Mainstem ESA Critical Habitat	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐
Willamette River	W1	NW Willamette River Forested Wetland	☐	☑	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W10	Balch Creek Subwatershed	☐	☐	☑	☑	☐	☐	☑	☑	☐	☑	☐	☐
Willamette River	W11	Marquam Gulch Oak Stand	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Willamette River	W12.A	Oaks Bottom Complex - Oaks Bottom Bluff	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W12.B	Oaks Bottom Complex - Oaks Bottom River Riparian and Beaches	☐	☐	☑	☑	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W12.C	Oaks Bottom Complex - Oaks Bottom Savanna and Meadow North	☐	☐	☑	☑	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W12.D	Oaks Bottom Complex - Oaks Bottom Bottomland Forest and Wetlands	☐	☑	☑	☑	☐	☐	☐	☑	☑	☐	☐	☐
Willamette River	W12.E	Oaks Bottom Complex - Oaks Bottom Reservoir and Mudflats	☐	☑	☑	☐	☐	☐	☑	☑	☑	☐	☐	☐
Willamette River	W12.F	Oaks Bottom Complex - Oaks Bottom Savanna and Meadow South	☐	☐	☑	☑	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W13.A	Ross Island Complex - Toe Island	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐	☐	☐
Willamette River	W13.B	Ross Island Complex - East Island	☐	☐	☐	☑	☑	☐	☑	☑	☑	☐	☐	☐
Willamette River	W13.C	Ross Island Complex - Hardtack Island	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐	☐	☐

			Attributes										
Watershed	**Site ID**	**Site Name**	**P**	**W**	**O**	**B**	**I**	**D**	**M**	**C**	**S**	**E**	**G**	**U**
Willamette River	W13.D	Ross Island Complex - Ross Island	☐	☐	☐	☑	☑	☐	☑	☑	☑	☐	☐	☐
Willamette River	W14	Cottonwood Bay	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☑
Willamette River	W15	Stephens Creek Bottomland	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Willamette River	W16	Powers Marine Park Mudflats	☐	☐	☐	☑	☐	☐	☑	☑	☐	☐	☐	☐
Willamette River	W17	South Sellwood Bluff	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W18	Riverview Cemetery	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐
Willamette River	W19	Dunthorpe Oak	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
Willamette River	W2	Harborton Forest & Wetlands Complex	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Willamette River	W20	Sullivan's Gulch	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
Willamette River	W3.A	Willamette Bluff Complex - Roberts/ Railroad Bluff	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.B	Willamette Bluff Complex - Weyerhauser Ave Woodlands	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.C	Willamette Bluff Complex - Edison Street Woodlands	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.E	Willamette Bluff Complex - Willamette Bluff North	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.F	Willamette Bluff Complex - Willamette Bluff Central	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.G	Willamette Bluff Complex - Willamette Bluff South	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W3.H	Willamette Bluff Complex - Riverwood Woodland	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W4	Willamette Cove Bottomland	☐	☐	☑	☑	☐	☐	☐	☑	☐	☐	☑	☐
Willamette River	W5	Edgewater Street Forest and Ravine	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐
Willamette River	W6	Forest Park	☐	☐	☑	☑	☐	☐	☑	☑	☑	☑	☐	☐
Willamette River	W7	North Doane Lake, Doane Creek and Wildlife Habitat Area	☐	☑	☐	☑	☐	☐	☑	☑	☑	☐	☐	☐
Willamette River	W8	Swan Island Lagoon Beach and Wapato Wetland	☐	☑	☐	☐	☐	☐	☑	☐	☑	☐	☐	☑
Willamette River	W9	Mt. Tabor	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☑	☐

P - Area contains sensitive or rare 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 - Area critical to sensitive species life history, on more than an incidental basis; critical habitats as designated by NOAA
E - Elk migratory corridor
G - Upland meadow, prairie or grassy area important to migrants and grassland-associated species
U - Resource or structure that provides critical or unique habitat function in natural or built environments (such as bridges or street trees)