

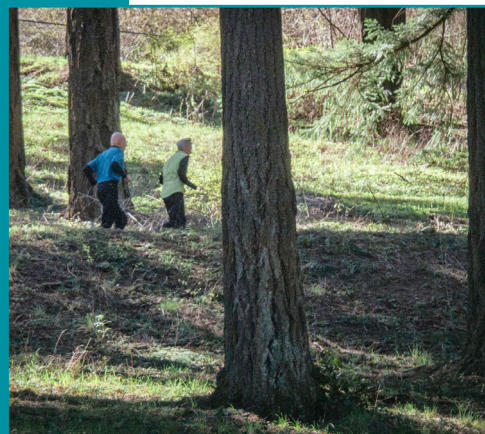
ENVIRONMENTAL OVERLAY ZONE MAP CORRECTION PROJECT

VOLUME 3:

Natural Resources
Inventory Summary

**PROPOSED DRAFT,
AS AMENDED**

July 2021



THE BUREAU OF
**PLANNING &
SUSTAINABILITY**

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Planning and Sustainability Commission
Ezone Map Correction Project Testimony
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Portland, OR 97201

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This plan is the culmination of three years of work across the City of Portland. Many thanks to the thousands of stakeholders, property owners, renters, business owners and interested people who attended dozens of neighborhood and community meetings and invited staff to their homes and businesses to perform site visits.

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A. INTRODUCTION

Portland's Natural Resources Inventory, adopted in 2012, follows the Oregon Goal 5 rules as well as the Metro Title 13 methodology to document the location, quantity and quality of natural resources and evaluate the resources for significance. As part of this Ezone Map Correction Project plan, the Natural Resources Inventory follows the same rules and uses the same methodology as was adopted in 2012, but utilized up-to-date information and technology, as well as on-site verification, to map the location of rivers, streams, wetlands, flood areas, vegetation (forest, woodland, shrubland, herbaceous), steep slopes and unique habitat areas.

The results of the updated Natural Resources Inventory updates are presented in Volume 2.

B. NATURAL RESOURCE DEFINITIONS

Below are the definitions of natural resource features documented in the Natural Resources Inventory.

B.1 Waterbodies

Stream: A stream is a channel that has a defined bed and bank and carries water continuously for a week or more during at least the wet season (October through April). Streams may be naturally occurring or may be a relocated, altered or created channel. Streams may contribute water into another waterbody or the water may flow into a pipe or culvert. Streams may flow for some distance underground. Streams are also referred to as *drainageways*, *ditches*, or *drainages* in other City of Portland reports, codes and rules or by other agencies including but not limited to Oregon Department of State Land or US Army Corps of Engineers. Streams include:

- the water itself, including any vegetation, aquatic life or habitat;
- the channel, bed and banks located between the top-of-bank; the channel may contain water, whether or not water is actually present;
- intermittent streams, which flow continuously for weeks or months during the wet season and normally cease flowing for weeks or months during dry season;
- sloughs, which are slow-moving, canal-like channels that are primarily formed by tidal influences, backwater from a larger river system, or groundwater;
- oxbows and side channels connected by surface flow to the stream during a portion of the year; and
- drainage from wetlands, ponds, lakes, seeps or springs, which may or may not form a defined bed and bank.

Drainage: A drainage is an area on the land that conveys flowing water for only hours or days following a rainfall. If a drainage drains water from a wetland, pond, lake, seep, or spring even if it does not have a defined bed and bank, then it is classified as a stream.

Roadside Ditch: A roadside ditch is a constructed channel typically parallel and directly adjacent to a public or private road. A roadside ditch is designed to capture and convey stormwater runoff from the road and is routinely cleaned (i.e., mechanically scoured or scraped of vegetation and debris) to maintain water conveyance capacity. Naturally occurring streams and drainages that have been relocated due to the construction of a road are not considered a *roadside ditch*.

Wetlands: Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions; although due to landscaping, seeding, mowing or grazing wet-adopted vegetation (hydrophytes) may not be present.

Flood area: The combination of the FEMA 100-year floodplain, the Special Flood Hazard Area (those areas with a 1% or greater chance of flooding in any given year), as well as areas that were inundated with water during the February 1996 floods.

Floodway: The floodway consists of the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood (100-year flood) without cumulatively increasing the water surface elevation more than one foot.

Riparian Corridors: Rivers, streams, wetlands and flood areas plus the areas bordering the waterbodies; the width of the riparian corridor varies by waterbody size, as well as the vegetation and slopes surrounding the waterbody.

B.2. Vegetation

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.

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.

B.3 Terrestrial Features

Land: The ground itself and any features associated with or located on the ground including but not limited to flood area, vegetation, rip rap, paved areas, structures, buildings, trails, etc.

Steep slopes: Land with a 25% or greater slope.

Wildlife Habitat: Land, vegetation and other features, including waterbodies and flood areas, that support fish and wildlife during one or more life cycle phase; manmade features may provide wildlife habitat.

Special Habitat Areas: Habitats designated by the City of Portland in accordance with Metro's Urban Growth Management Functional Plan Title 13, Nature in Neighborhoods, criteria for Habitat of Concern. These are areas that contain or support special status species, sensitive/unique plant populations, or other unique natural or manmade habitat features.

C. RELATIONSHIP TO TITLE 13 INVENTORY

The Bureau of Planning and Sustainability (BPS) used Metro's Urban Growth Management Functional Plan Title 13, Nature in Neighborhoods, inventory of regionally significant riparian corridors and wildlife habitat as a starting point for citywide natural resource inventory development. The citywide inventory incorporates and builds on the extensive research, analysis, technical review and public scrutiny that went into the development of Metro's regional inventory. Metro's inventory was reviewed by the Independent Multidisciplinary Science Team and other local experts.

The Metro Council adopted the inventory as part of the Title 13, Nature in Neighborhoods, program in September 2005. In 2007, The Oregon Department of Land Conservation and Development acknowledged Title 13 as in compliance with Oregon State Land Use Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces, and Goal 6: Air, Water and Land Resources Quality. The development of Metro's inventory is documented in the Technical Report for Fish and Wildlife (Metro, 2005), Riparian Corridor and Wildlife Habitat Inventories (Metro, 2005) and Addendum and Update to Metro's Riparian Corridor and Wildlife Habitat Inventories (Metro, 2005).

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

C.1. Riparian corridors

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

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

1. Microclimate and shade – Open water bodies, wetlands, flood areas, and surrounding trees and woody vegetation are associated with localized air cooling, soil moisture and increased humidity.
2. Bank function and control of sediments, nutrients and pollutants – River, stream, drainageway channels and flood areas have a direct relationship to bank functions and the conveyance of sediments, nutrients and pollutants. Trees, vegetation, roots and leaf litter

intercept precipitation; hold soils, banks and steep slopes in place; slow surface water runoff; take up nutrients; and filter sediments and pollutants found in surface water. Structures, such as pilings, can also help stabilize banks and contain contaminants.

3. Stream flow moderation and flood storage – Waterways and floodplains provide for conveyance and storage of stream flows and floodwaters in channel and above and below the ground surface; trees and vegetation intercept precipitation and promote infiltration which tempers stream flow fluctuations or “flashiness” that often occurs in urban waterways.
4. Organic inputs, nutrient cycling and food web – Water bodies, wetlands, flood areas and nearby vegetation provide food (e.g., plants, leaves, twigs, insects) for aquatic and terrestrial species and are part of an ongoing chemical, physical and biological nutrient cycling system.
5. Large wood and channel dynamics – Rivers, streams, drainageways, riparian wetlands, flood areas and large trees and woody vegetation contribute to natural changes in location and configuration of the waterway channel over time.
6. Wildlife movement corridors – Rivers, streams, drainageways, wetlands, floodplains and vegetated corridors along waterways allow wildlife to migrate and disperse among different habitat areas and provide access to water.

C.2. Wildlife Habitat

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

1. Habitat patch size – Larger habitat patches generally provide more food, cover, dispersal and nesting/denning opportunities for multiple wildlife species.
2. Interior habitat area – Larger, rounder-shaped habitat patches experience less “edge effect” (disturbance from urban land uses such as noise/light/vibration, predation and invasive species) and provide more interior habitat area, a requirement for some sensitive wildlife species, than narrow patches.
3. Connectivity between habitat patches (including distance and edge effect) – Patches located closer together allow for species dispersal and migration, and provide additional access to food, cover, nesting sites and reproduction opportunities.
4. Connectivity/proximity to water – Access to water is vital to wildlife survival.

C.3. Habitats of Concern/Special Habitat Areas

The regional inventory recognizes specific habitat types or features that provide important functions for wildlife, including habitats and species at risk, rare or declining habitat types such as native oak assemblages, critical habitat for threatened or endangered species, and urban structures such as bridges that are utilized by Peregrine Falcons for nesting. Metro called these “Habitats of Concern” while Portland calls them “Special Habitat Areas”; however, the criteria to designate habitat area is the same and are found in Table 1.

Table 1: Special Habitat Area Criteria

Code	Criteria
P	Area contains sensitive or unique plant populations
W	Wetlands and associated seeps, springs and streams that are part of the wetland complex
O	Native oak
B	Bottomland hardwood forest
I	Riverine island
D	River delta
M	Migratory stopover habitat
C	Corridor between patches or habitats
S	An 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 grassland 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)

D. NATURAL RESOURCES INVENTORY METHODOLOGY

The following steps were taken to produce the citywide Natural Resources Inventory. These steps are based on the Metro Title 13 rules found in 3.07.1340.

1. Verify habitat areas by compiling GIS data and mapping key natural resource features, including rivers, streams, wetlands, flood areas, vegetation and topography.
2. Designated Special Habitat Areas based on the regional Habitats of Concern criteria.
3. Developed GIS models to rank and map the relative functional values of existing natural resources.
4. Produced Habitat Classification Maps.

Each step is described below.

D.1. Verifying Habitat Areas

In 2005, Metro provided the Title 13 natural resource feature GIS data to Portland and Portland assumed the responsibility of maintaining the data. The natural resource feature data are the primary inputs to Portland's GIS inventory models for riparian corridors and wildlife habitat. BPS improved the regional natural resource feature GIS data by:

- a. Remapping more than 160 miles of stream/drainageway centerlines and adding 100 stream/drainageway miles to the maps.
- b. Mapping smaller vegetation units (1/2 acre minimum), and classifying forest, woodland, shrubland and herbaceous vegetation over a wider area (using the National Vegetation Classification System as shown below). Vegetation mapping does not include land that is sparsely vegetated.¹
- c. Verifying the location and extent of wetlands using state and city permits, USGS soils data, LiDAR derived topography, current aerial photography, and on-site or off-site wetland determinations following the US Army Corps of Engineers wetland degermination methodology.
- d. Updating the City's flood area data for use in the inventory, including incorporation of the FEMA 100-year floodplain and 1996 flood inundation area.
- e. Using Light Detection and Ranging (LiDAR), a method for precisely measuring the elevation of the Earth's surface, and objects on the surface (trees, buildings, etc.).

Mapping protocols for streams, wetlands and vegetation are presented below.

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

D.1.a. Stream Mapping Protocol

A stream is a channel that has a defined bed and banks and carries water continuously for a week or more during the wet season (October through April). Streams may be naturally occurring or may be a relocated, altered or created channel. Streams may contribute water into another waterbody or the water may flow into a pipe or culvert or may flow for some distance underground. Streams may be referred to as *drainageways* or *ditches* in City reports, codes and rules and by other agencies including Oregon Department of State Lands or US Army Corps of Engineers.

Streams include:

- the water itself, including any vegetation, aquatic life or habitat;
- the channel, bed and banks located between the top-of-bank; the channel may contain water, whether or not water is actually present;
- intermittent streams, which flow continuously for weeks or months during the wet season and normally cease flowing for weeks or months during dry season;
- sloughs, which are slow-moving, canal-like channels that are primarily formed by tidal influences, backwater from a larger river system, or groundwater;
- oxbows and side channels connected by surface flow to the stream during a portion of the year; and
- drainage from wetlands, ponds, lakes, seeps or springs, which may or may not form a defined bed and bank.

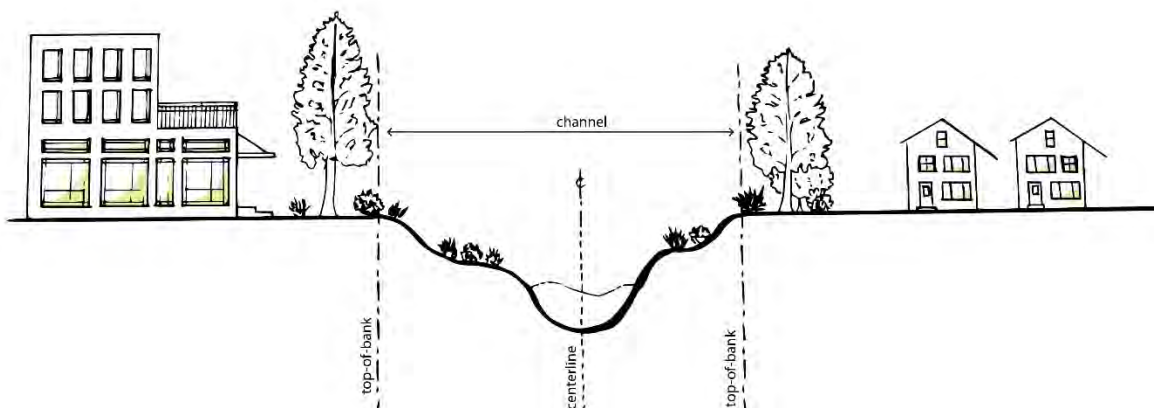


Figure 1: Stream Channel Cross Section

Ephemeral streams are called *drainages* for the purposes of Natural Resources Inventory. A drainage is an area on the land that conveys flowing water for only hours or days following a rainfall. If a drainage drains water from a wetland, pond or lake, even if it does not have a defined bed and bank, then it is classified as a stream.

A roadside ditch is a constructed channel typically parallel to and in close proximity (approx. 15 feet) to a public road and is routinely cleaned (i.e., mechanically scoured or scraped of

vegetation and debris) to maintain water conveyance capacity. Naturally occurring streams that have been relocated due to the construction of a road are not considered a roadside ditch.

For the purposes of the Natural Resources Inventory streams and drainageways are the same and are mapped in the inventory. A drainage is not included in the inventory nor are roadside ditches.

Figure 2: Examples of Streams and a Roadside Ditch



Fanno Creek



Columbia Slough



Tryon Creek



Roadside Ditch (not a stream)

The starting point for the stream mapping project in Portland was the 2003 regional stream centerlines developed by Metro for Title 13. More accurate stream centerline maps available for select areas around the City were also used as reference – including Columbia Slough centerlines created by BES and Powell Butte centerlines mapped by the Bureau of Parks and Recreation. All editing of stream data was done in ESRI's ArcGIS GIS software.

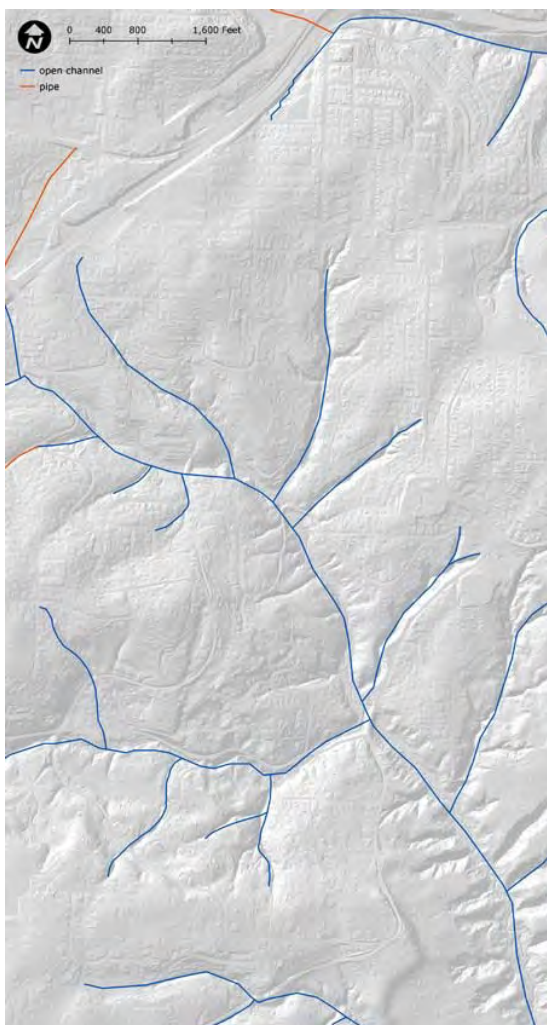
The BES collection line GIS data, LiDAR-derived elevation models, photogrammetric data (2' contours), and aerial photos were among the data sources referenced by the BPS when mapping the stream centerlines.

Streams that were previously-mapped by Metro 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 were re-mapped to correspond with the new and more detailed reference data. Any new streams apparent in the reference data were added to the map as they were encountered during the revision process (Figure 3).

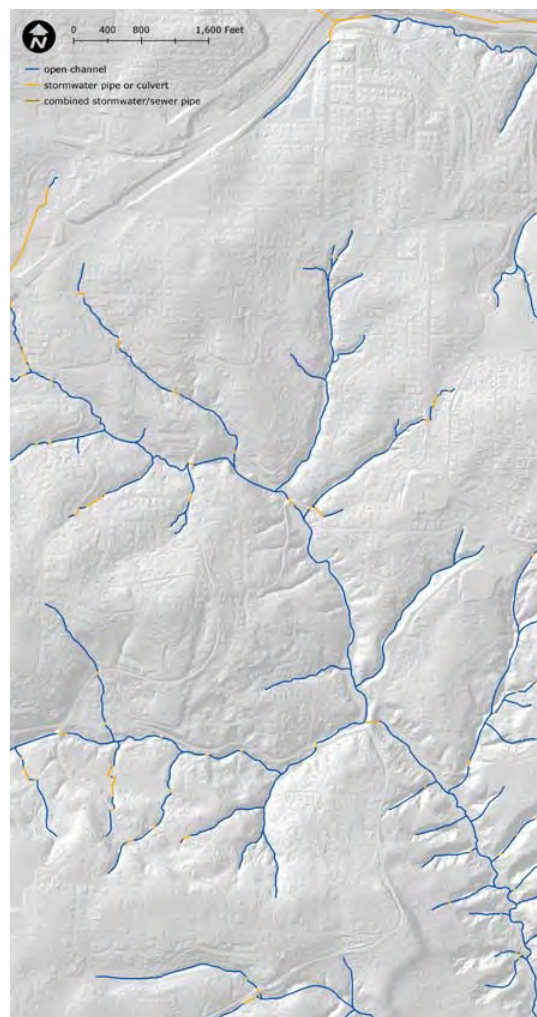
New streams were required to satisfy the following criteria in order to be added to the map:

1. 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.
2. 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.

Figure 3: Comparison of Metro GIS Stream Data and Portland Remapped Stream GIS Data



Original Metro Centerlines



Remapped Centerlines

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

1. If two or more reference sources affirmed the existence of a stream channel (e.g., topography indicates a channel and BES has mapped the channel), project staff deemed the stream “substantiated” and required no further verification. The stream was mapped based on the reference data.
2. If a stream channel was supported by only one reference source (e.g., topography suggests a channel), project staff “flagged” the channel for field verification.

BPS 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 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 centerlines were transferred to the new stream centerlines. Additional information about the new and revised streams was also captured, including the channel type, source of the geometry, and the date of the modification.

Project staff visited both publicly- 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 segments flowing through properties where a larger percentage of property owners had given staff permission to enter and survey the stream. Staff also focused on visiting streams 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 segment was made, a field crew visited the site and verified the presence and location of the stream 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 segment.

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

1. water flowing through the channel or evidence of periodic inundation, for example scouring that has removed vegetation and created a channel in the soil;
2. riparian-associated plants, including both native and non-native species;
3. presence of amphibians, aquatic reptiles (e.g. turtles) or fish, including both native and non-native species; or
4. 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, etc., and a map with 6-inch-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 were also taken in most cases. All digital documentation and photos are available from BPS.

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. 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 channel. GPS points at each location on the stream were differentially-corrected, averaged, and exported to GIS shapefile format. Stream centerline segments were then digitized by manually “connecting” the field collected points in ArcInfo workstation. Digitized lines were “smoothed” to more realistically portray stream 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. 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 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 than the point feature collection method. In addition, it was only practical when the stream channel was open enough to allow relatively long – 50’ or more – sections to be walked without obstruction.

Points were differentially-corrected using the base station located at the U.S. Forest Service/Bureau of Land Management building in downtown Portland. 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 remapping project are available in ESRI Shapefile format from the City of Portland, Bureau of Planning.

Streams 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. Streams located in this manner were assigned a “field date” in the stream centerline GIS database. Not all streams flagged for field verification were visited by project staff. Approximately 40% of flagged stream had been visited. Any flagged stream not visited were identified at the time in the GIS database.

In 2007, BPS GIS staff used the newly-release LiDAR data to refine the stream centerline data. LiDAR is remote-sensing satellite data that maps the surface of the earth. It has a high degree of accuracy.

In 2012, the Natural Resources Inventory was adopted by City Council and Metro approved the Natural Resources Inventory as being in substantial compliance with Urban Growth Management Functional Plan Title 13, Nature in Neighborhoods (see Volume 4 for additional explanation).

In the spring of 2018, following adoption of the 2035 Comprehensive Plan, BPS staff launched a project to correct the location of the environmental overlay zone (ezone) boundaries to better match existing natural resource features including streams. The project began by using the adopted 2012 Natural Resources Inventory, which includes the results of the 2003 stream remapping project and the 2007 LiDAR refinements. It was assumed that all stream data had a high level of confidence.

All property owners, public and private, with existing ezones or where ezones boundaries were proposed to change on the property where sent a postcard notifying them of the project and providing a link to an online interactive map. The online map allowed property owners to look up their address and see the mapped natural resource features, including streams, existing ezones and draft corrected ezones. Through the online map, property owners could request a site visit to verify the location of natural resources on their site. Any property owner that requested a site visit had one completed. Over 600 site visits were performed between 2018 and 2021.

Staff also attend neighborhood association meetings and held drop-in hours at local libraries to inform the community about the project and encourage property owners to request a site visit.

During the site visits staff assessed the location of the natural resource features, except wetlands (see Wetland Mapping Protocol). Staff used detailed maps of topography (LiDAR-based), vegetation, streams and wetlands, aerial photography and field notes to verify the location of features.

D.1.b. Wetland Mapping Protocol

A wetland is an area where shallow water is present long enough to create hydric soils and could support hydrophilic vegetation, although due to landscaping, seeding or mowing hydrophilic vegetation may not be present.

The starting point for the wetland inventory data was information from the 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 two-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 state and local site development or building permits.

In 2010, the Bureau of Planning and Sustainability began the wetland data refinement project. 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

NWI 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:

1. 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.
2. New Wetlands – New wetlands were added to the City inventory data based on the following mapping information:
 - a. A survey or delineation from a qualified source clearly showed the boundaries of the wetland; or
 - b. 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).
3. Modified Wetland Boundaries – Wetland boundaries of existing City inventory data were modified based on the following information:
 - a. A survey or delineation from a qualified source clearly showed that the boundaries of the wetland differ from the existing data; or

² The mapping protocol is available at <https://usace.contentdm.oclc.org/utis/getfile/collection/p266001coll1/id/7646>

- b. 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.
4. Deleted Wetlands – Wetlands were deleted from the City inventory data based on the following information:
 - a. A removal/fill permit from the Department of State Lands and verification with aerial photography; or
 - b. Any other map from a qualified source showed that the wetland did not exist or had been removed, and aerial photography verified this.
5. Probable Wetlands – Sometimes wetlands were referenced in a report or permit but could not be mapped or modified for the following reasons:
 - a. The map was not from a qualified source;
 - b. 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
 - c. 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 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.

In 2018, the Bureau of Environmental Services began the Wetland Inventory Project to update maps of wetlands throughout the city. The following steps were taken to refine existing wetland boundaries and identify previously unmapped wetlands; for more details please refer to Appendix E: Wetland Mapping Protocol.

1. Supplement the City of Portland wetland inventory with the most current National Wetland Inventory (NWI). NWI data was updated in 2016 by US Fish and Wildlife Service. When the City’s wetland data has a high level of accuracy, such as when a determination or delineation was performed, the City’s data is retained. NWI data is typically used to identify previously unmapped wetlands and confirm removal of wetlands due to permitted activities.

2. Refine wetland boundaries based on existing wetland data. Existing wetland data comes from Oregon Department of State Lands, US Army Corps of Engineers or City of Portland Land Use permits or wetland determinations or delineations performed by a certified environmental consultant.
3. Identify previously unmapped wetland and refine existing wetland boundaries using LiDAR, hydric soil data, and aerial photography. LiDAR (Light Detection and Ranging) is a remote sensing system used to collect topographic data. LiDAR maps show land depressions that are common in wetland areas. This is also referred to as geomorphic position in wetland determination. LiDAR data was updated in 2014. Hydric soils are one indicator of wetland presence. Hydric soil data was updated by the State of Oregon in 2018. Aerial photography is used to check for standing water or wetland vegetation; photography from 2005 to 2017 was consulted. The combination of these data provides sufficient information to refine wetland boundaries and identify previously unmapped wetlands.
4. All property owners with mapped wetlands were notified via mail and invited to review the draft wetland inventory and request a site visit for an on-site wetland determination to be performed. Notification was sent by watershed: Johnson Creek in summer 2018 and Columbia Slough in winter 2018/2019 with verifications in spring 2019; and Northwest Hills in summer 2019 and Southwest Hills in spring 2020 with verifications in spring 2020. When a site visit was requested, a consultant hired by the Bureau of Environmental Services performed a wetland determination following the US Army Corps of Engineers protocol³. For properties where no site visit was requested, consultants made over-the-fence field observations (if possible) to confirm presence of standing water and/or wetland vegetation. Field verifications were performed March through May of 2019 and 2020 when wetland hydrology is visible. *Note* – Field verification is not required to refine wetland boundaries or add previously unmapped wetlands. However, field verification provides an opportunity to more accurately map the wetland boundaries.

D.1.c. Vegetation Mapping Protocol

A vegetation patch is 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 4).



Figure 4: Vegetation Patch

Vegetation patches are classified based on 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):

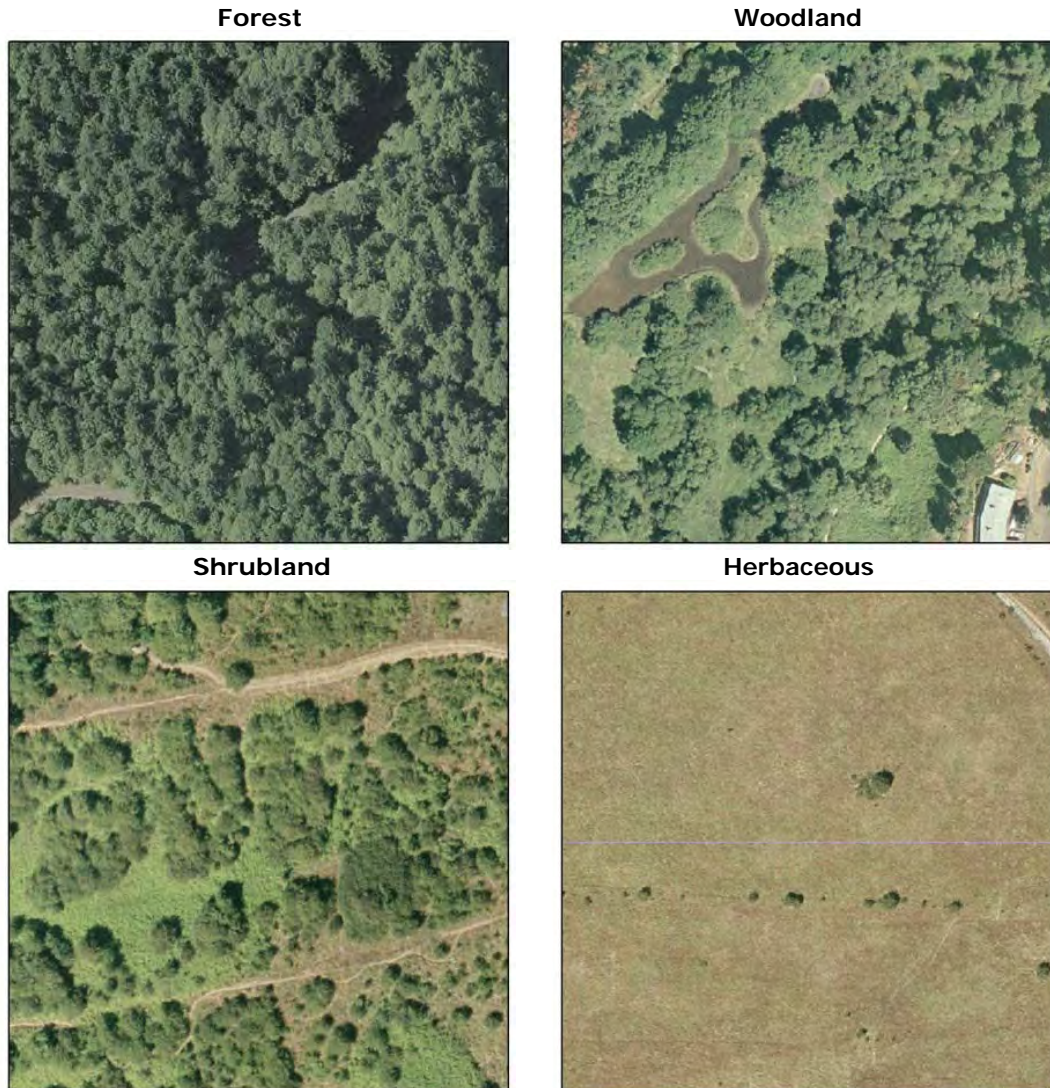
Forest: Trees with their crowns overlapping, generally forming 60-100% of cover.

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 5: Examples of Vegetation Classifications



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.

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 rainwater capture, nutrient uptake, organic inputs, wildlife cover, etc. In addition, the forest canopy itself may be occasionally pruned, but is not regularly maintained.

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 and Sustainability

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:
 - a. There are different patterns, distributions or character of vegetation included within the patch boundary;
 - b. Vegetation of the same character and patterns as adjacent vegetation is not included in the patch;
 - c. 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;
 - d. 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:
 - a. Vegetation that meets the forest or herbaceous NVCS classification is mapped. The guidelines to map forest vegetation patches are as follows:
 - i. 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;
 - ii. 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;
 - iii. 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.

- b. The guidelines to map herbaceous patches are:
 - i. 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;
 - ii. 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;
 - iii. 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.

- c. 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:
 - i. 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;
 - ii. The trees should be distributed across the patch;
 - iii. 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;
 - iv. Shrubbyland 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.

- d. The vegetation management classification of semi-natural/natural or cultivated, is determined as follows:
 - i. Forest is always classified as natural/semi-natural;
 - ii. 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);
 - iii. 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;
 - iv. 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;
- v. 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;
 - vi. Topography is used to help differentiate between areas that are cultivated and areas that are not. Very steep areas are not typically cultivated.
 - vii. 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.
- e. Visible, non-vegetated areas (e.g. buildings, bare soil) are excluded or removed from vegetation patches as necessary using the following guidelines:
- i. Visible buildings, driveways, parking areas are removed from vegetation patches;
 - ii. Vegetation that overhangs a non-vegetated area (e.g. a driveway) is included within the vegetation patch;
 - iii. Areas of bare soil, gravel, rocks are removed from a vegetation patch when the area is greater than $\frac{1}{4}$ acre in size;
 - iv. 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.

Between 2018 and 2021, staff conducted more than 600 site visits to confirm vegetation mapping. The primary goal was to more accurately map the edge of forest and woodland patches. Staff also used aerial photography, photography, topography, property boundaries and building footprints to refine mapping of the edge of the canopy.

D.2. Updating Habitat Classifications

Like Metro, the City produced GIS models to assess the relative functional value of riparian corridors and wildlife habitat (see Figure 6). The riparian corridor and wildlife habitat GIS models assign relative classifications of I, II or III for riparian corridors and A, B or C for wildlife habitat.⁴ The relative classifications are produced using a consistent and replicable scoring method based on the number and types of functions provided by specific natural resource features in the city. The classifications are not tied to a reference or baseline condition but allow comparison of the relative condition of natural resources within the region or city. In other words, a Class III/C resource is still providing important natural resource functions; however, it is providing less functions than a Class II/B or Class I/A resource.

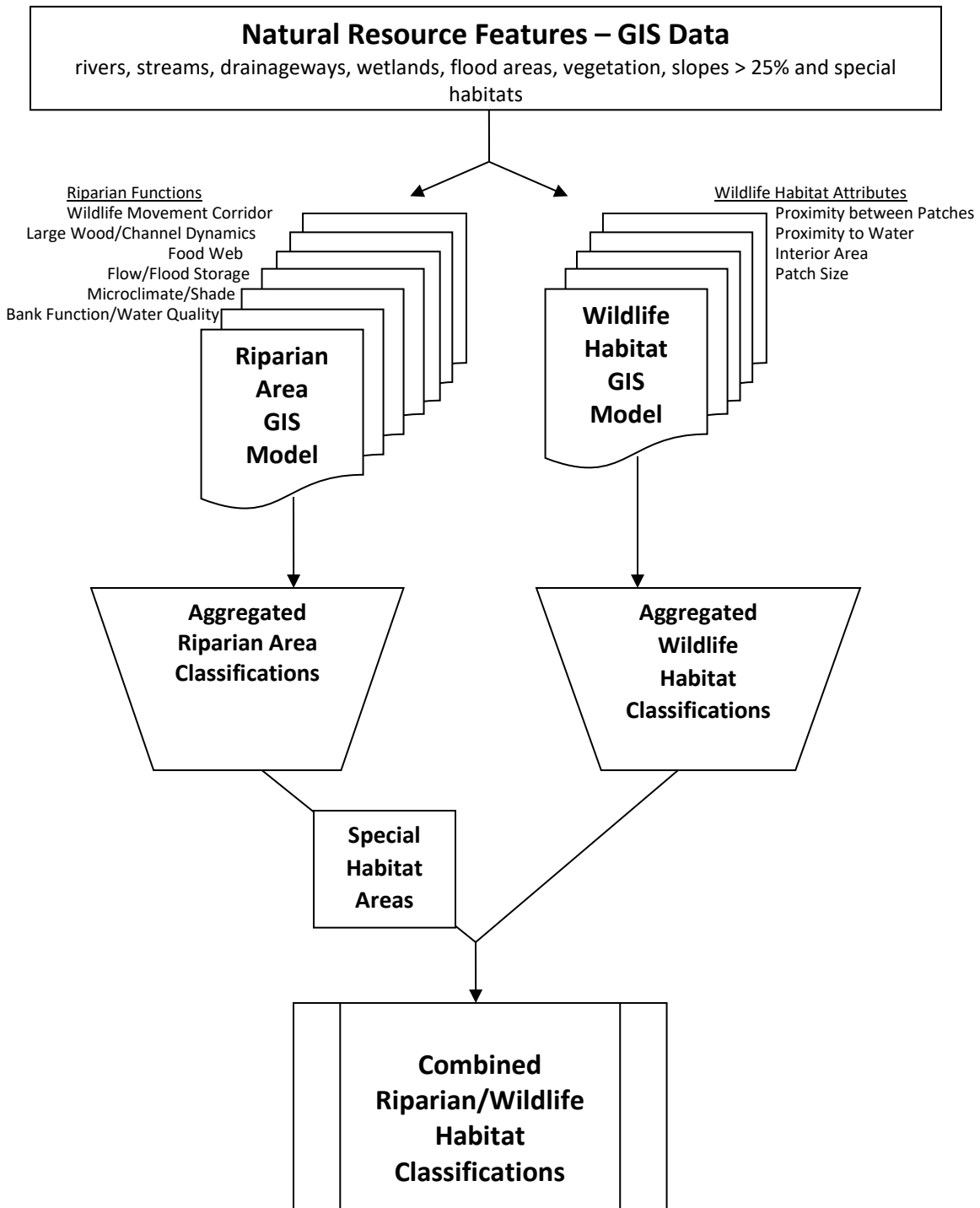
Science-based model criteria were developed to score, assign relative classifications and map the natural resources that provide the specific riparian functions and wildlife habitat attributes listed above. The City's model criteria focus on the presence, type and extent of specific natural resource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

The City's inventory models apply the same general sets of evaluation criteria that Metro developed for Title 13. However, BPS refined some of the regional criteria to reflect additional detail, more recent data and studies, and local conditions. For example, the City's wildlife habitat model was refined to assign a higher value to somewhat smaller habitat patches than Metro's model. Shifts in the patch size scoring thresholds were based on additional scientific studies and recent wildlife studies conducted in Portland's natural areas.

The City worked closely with Metro and technical experts to ensure that refinements to the regional inventory would be consistent with Metro's work and would support the City's watershed health goals. Metro determined that Portland's NRI, with refinements, was in substantial compliance with Title 13 in 2012.

⁴ Class I/A is high ranked, Class II/B is medium ranked and Class III/C is low ranked resources.

Figure 6: Natural Resources Inventory GIS Model Flow Diagram



D.2.a. Riparian Corridor Model

The City worked closely with Metro to clarify and in some cases refine the criteria to be appropriate for Portland's urbanized environment. In 2012, Metro found Portland's Natural Resources Inventory riparian area modelling criteria to be substantially consistent with Title 13.

The riparian area GIS model assigns primary and secondary scores to natural resources for six riparian functions. The scores reflect the types of landscape features present and the proximity of those features to a river, stream or wetland. Primary scores are applied to features that provide the most direct and substantial contribution to a particular riparian function. Secondary scores are assigned to features that provide lesser, but still important, contribution to riparian functions. The water features themselves – rivers, streams and wetlands – are assigned primary scores for all features. This is consistent with Title 13 which designated the rivers, streams and wetlands as Class I riparian area (see Title 13 Table 3.07-13d)

The scientific literature indicates that the preponderance of riparian functions, such as nutrient cycling, occurs within 30 to 100 meters (approximately 100 to 300 feet) of a water body. The microclimate effect associated with forest vegetation can occur up to several hundred feet from a water body. The model criteria are not sensitive to the species of vegetation present or whether vegetation is native or non-native. However, the model criteria do assign different riparian functional values to cultivated, heavily manicured and managed landscapes versus semi-natural and natural vegetation.

Table 2 presents the riparian area GIS model criteria. The criteria reflect some refinements to the criteria Metro used to map riparian corridors across the region. For example, Metro assigned a medium or high rank to all land within 50 feet of rivers and streams to recognize the direct and important impact of those areas on the river or stream. This methodology was reviewed by independent experts and adopted as part of Title 13, Nature in Neighborhoods. The City refined the regional inventory to further recognize the variability of riverbank conditions in Portland. The refinement resulted in a lesser level of function being assigned to hardened, non-vegetated banks along specific segments of the Willamette and Columbia rivers. This refinement was made to recognize the impact of extensive riverbank hardening associated with Portland Harbor marine terminal facilities. This recognizes the lower level of function but continues to highlight the importance of the riverbanks and adjacent land to overall riparian function.

Table 2: Riparian Area GIS Model Criteria

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

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

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

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

Footnotes:

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

The primary and secondary scores for each function are combined to produce aggregated relative riparian area classifications of I, II or III (also referred to as high, medium or low). The formula is similar to those that Metro used for the regional inventory and also reflects the distribution of primary scores assigned to features in the city (Table 3).

Riparian Area Relative Classification	Ranking Formula	
	Primary Functions	Secondary Functions
Class I/High Rank	4-6	0-6
Class II/Medium Rank	1-3	0-6
Class III/Low Rank	0	1-6

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

Typically, the riparian area model assigns aggregated relative classifications to natural resource features as follows:

1. Class I – Rivers, streams and wetlands; forest or woodland vegetation within a flood area or in close proximity (0 to 100 feet) to a water feature.
2. Class II – Shrubland and herbaceous vegetation within a flood area or in close proximity (0 to 100 feet) to a water feature; and forest or woodland vegetation on steep slopes out to 200 feet from a water feature.
3. Class III – Vegetated areas outside the flood area and further from a water feature; developed, non-vegetated flood areas; forest or woodland vegetation on steep slopes further than 200 feet from a water feature; and hardened, non-vegetated banks of the Willamette River North Reach and Central Reach and Columbia River surrounding Hayden Island.

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

D.2.b. Wildlife Habitat Model

The wildlife habitat GIS model assigns scores to mapped habitat patches based on their size, shape and connectivity to other patches or water bodies as shown in Table 4 below. For purposes of the inventory model, habitat patches are defined as areas of forest vegetation and wetland that are at least 2 acres in size, plus adjacent woodland vegetation. The model does not assign scores to habitat areas smaller than 2 acres, or to shrubland or grassland habitats or woodland that is not associated with a 2 acre forest/wetland patch. However, these habitats may be designated Special Habitat Areas if the habitats meet specific criteria.

Table 4: Wildlife Habitat GIS Model Criteria		
High Value (3 points)	Medium Value (2 points)	Low Value (1 point)
Habitat Patch Size¹		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is 585 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 30 up to 585 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 up to 30 acres.
Interior Habitat Area²		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is 500 acres or larger.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 15 up to 500 acres.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the interior area of the forest vegetation and/or wetland patch area is at least 2 up to 15 acres.
Proximity to Other Patches³		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is 100 or more.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and the patch proximity index value is at least 30 up to 100.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres and the patch proximity index value is less than 30 acres.
Proximity to Water⁴		
Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and where at least 25% and less than 75% of the patch area is within 300 feet of a river, stream/drainageway or wetland.	Patches of forest vegetation and/or wetland, with adjoining woodland vegetation, where the area in forest vegetation and/or wetland area is at least 2 acres, and less than 25% of the patch area is within 300 feet of a river, stream/drainageway or wetland.

Footnotes:

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

Features that receive scores for one or more attributes provide significant wildlife habitat functions. Individual scores for each attribute are combined to produce an aggregated relative ranking of high, medium or low for each wildlife habitat patch. As with the riparian corridor model, the formula used to generate the aggregated wildlife habitat rank is similar to those Metro used for the regional inventory (see Table 5).

Wildlife Habitat Relative Rank	Ranking Formula
Class A/High Rank	9 or more points
Class B/Medium Rank	4-8 points
Class C/Low Rank	1-3 points

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

1. Class A – Large (>30 acres) forest and wetland areas such as Forest Park, Smith and Bybee Wetlands, and Tryon Creek State Natural Area.
2. Class B – Moderate-sized (2-30 acres) forest and wetland areas such as those at Rocky Butte Natural Area.
3. Class C – Numerous smaller (<2 acres) forest and wetland areas throughout the city.

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

D.2.c. Special Habitat Areas and Regional Species List

Portland uses the same criteria as Metro did for Habitats of Concern; however, Portland calls these Special Habitat Areas (SHA).

The BPS worked closely with the Metro 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:

- Reflect more detailed analysis of resource location.
- Incorporate new stream or vegetation information.
- Consider information from more recent studies.
- 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).

SHAs differ from the GIS natural resource feature and model-based riparian area and wildlife habitat ranking maps in some important ways. First, while the natural resource feature and ranking maps were developed using citywide data sets, the SHAs 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 SHA 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.

Portland's SHA are bounded by the urban services boundary. Where a SHA 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.

SHA eligibility criteria are outlined below. 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. In 2012, Metro deemed Portland refined SHA criteria to be in substantial compliance with Title 13.

Metro Table 3.07-13d stated that Habitats of Concern shall be treated as Class I riparian habitat areas in all cases. Table 3.07-13d went on to provide examples of Habitats of Concern that shall be treated as Class I riparian areas: Oregon white oak woodlands, bottomland hardwood forests, wetlands, grasslands, riverine islands and important wildlife migration corridors. Therefore, all SHA are designated as Class I riparian areas.

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

This criterion applies to 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:

4. Have a surface or groundwater connection to a stream or flood area;
5. Are part of a larger resource area, such as a wetland located within or adjacent to a forest;
6. Provide important stormwater management functions such as water storage that reduces in-stream erosion or flooding; or
7. 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 may not be designated as SHAs unless they provide important water storage functions for the surrounding area.

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-tops/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:

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

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 – Unique Habitat

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.

E. NATURAL RESOURCES INVENTORY RESULTS

Sections C and D of this report describe the methodology used to verify habitat areas and update habitat classifications for existing natural resource features. The results are reported in detail in Volume 2, Part A through G, for each resources site in the project area. The following Map 1 through 6 depict the citywide results on the Natural Resources Inventory:

Map 1 – Water Features

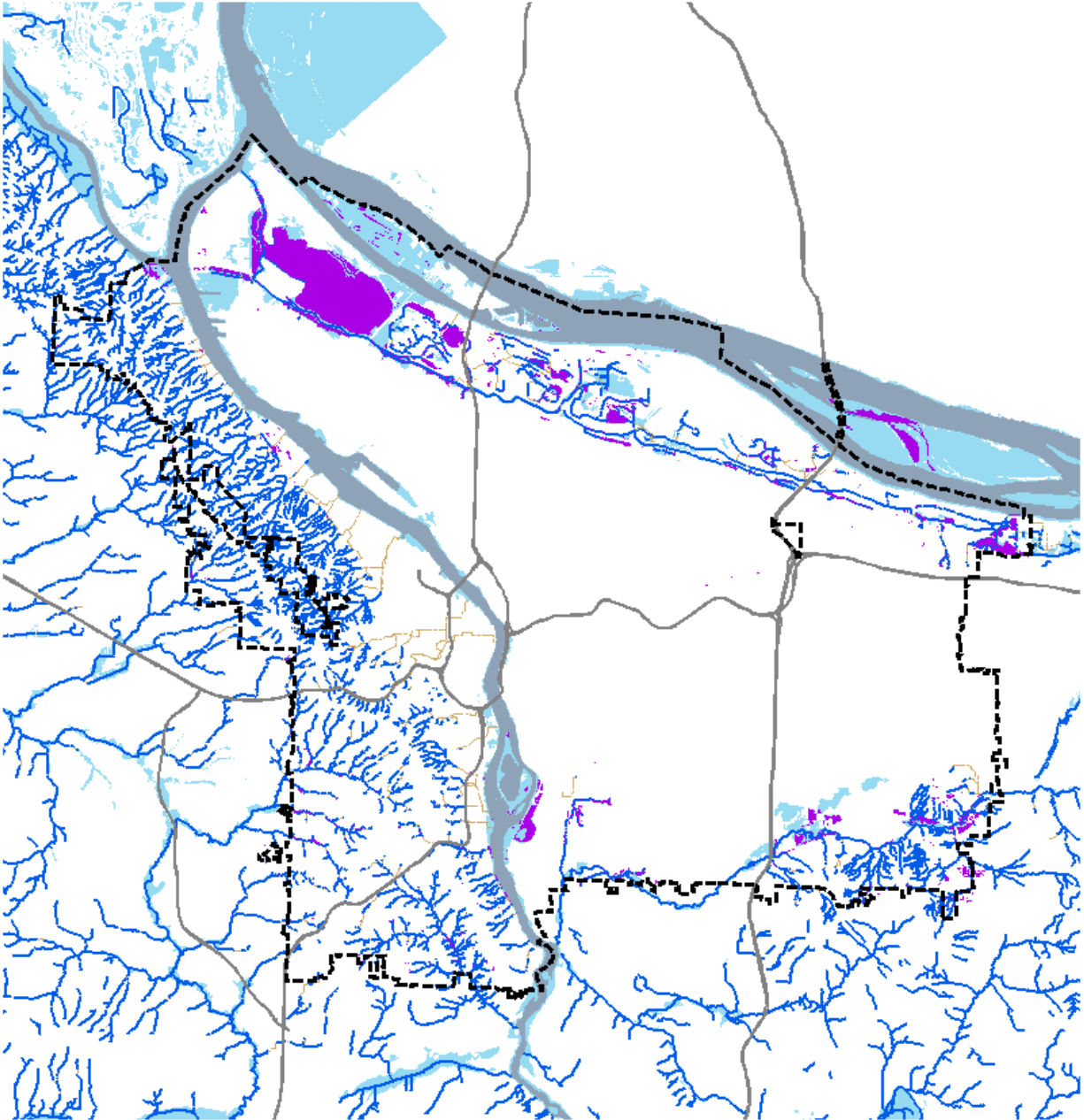
Map 2 – Vegetation Features

Map 3 – Steep Slopes

Map 4 – Special Habitat Areas

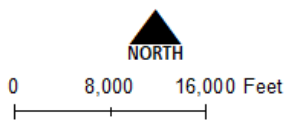
Map 5 – Riparian Corridor Classifications







Map 6 – Wildlife Habitat Classifications



Map 1: Water Features

Updated: July 2021

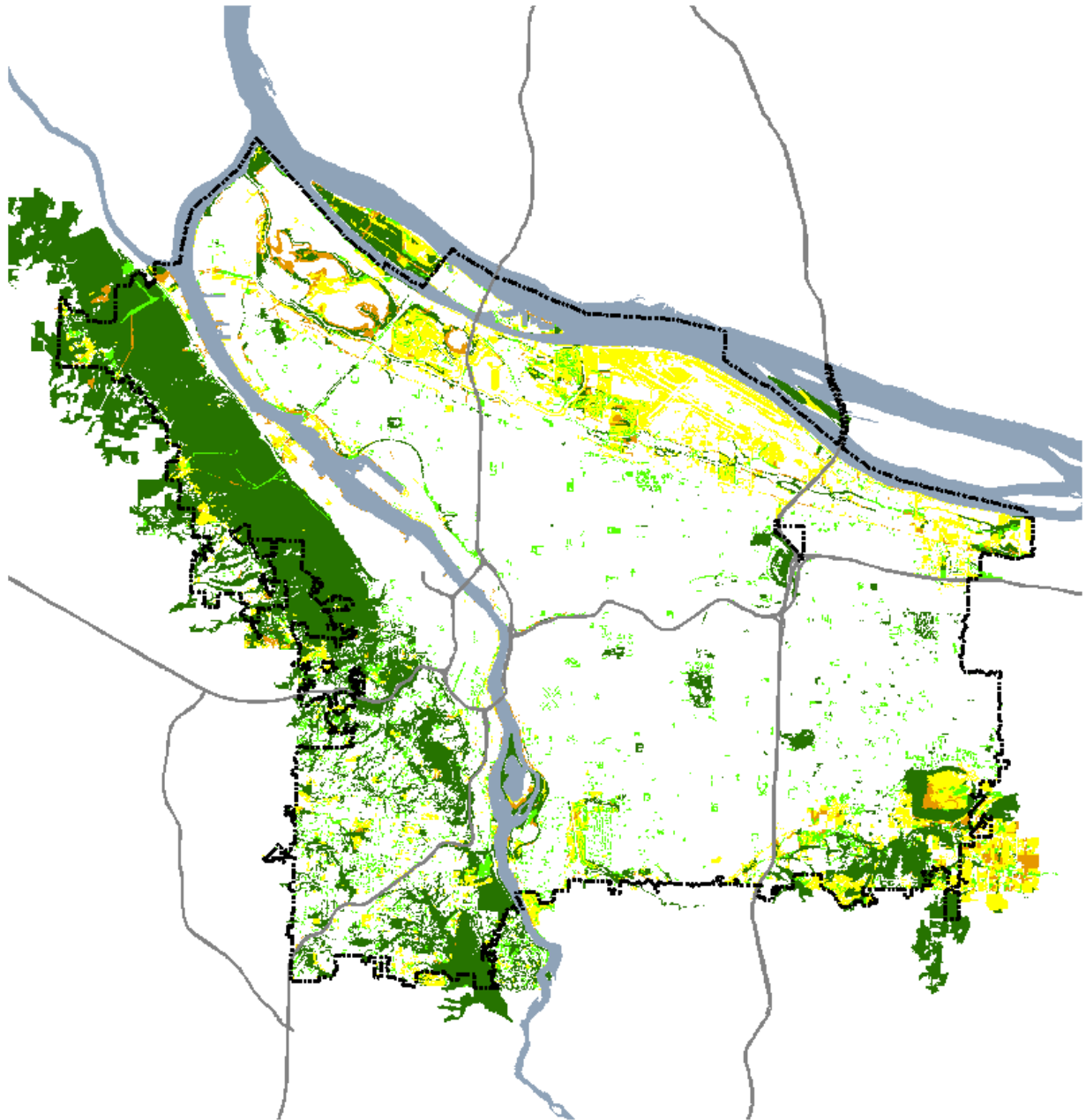


-  City of Portland (USB)
-  Rivers
-  Wetlands
-  Open Stream Channel
-  Piped Stream Segment
-  Flood Area



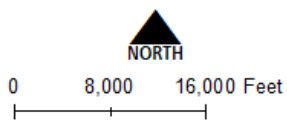
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Map 2: Vegetation

Updated: July 2021

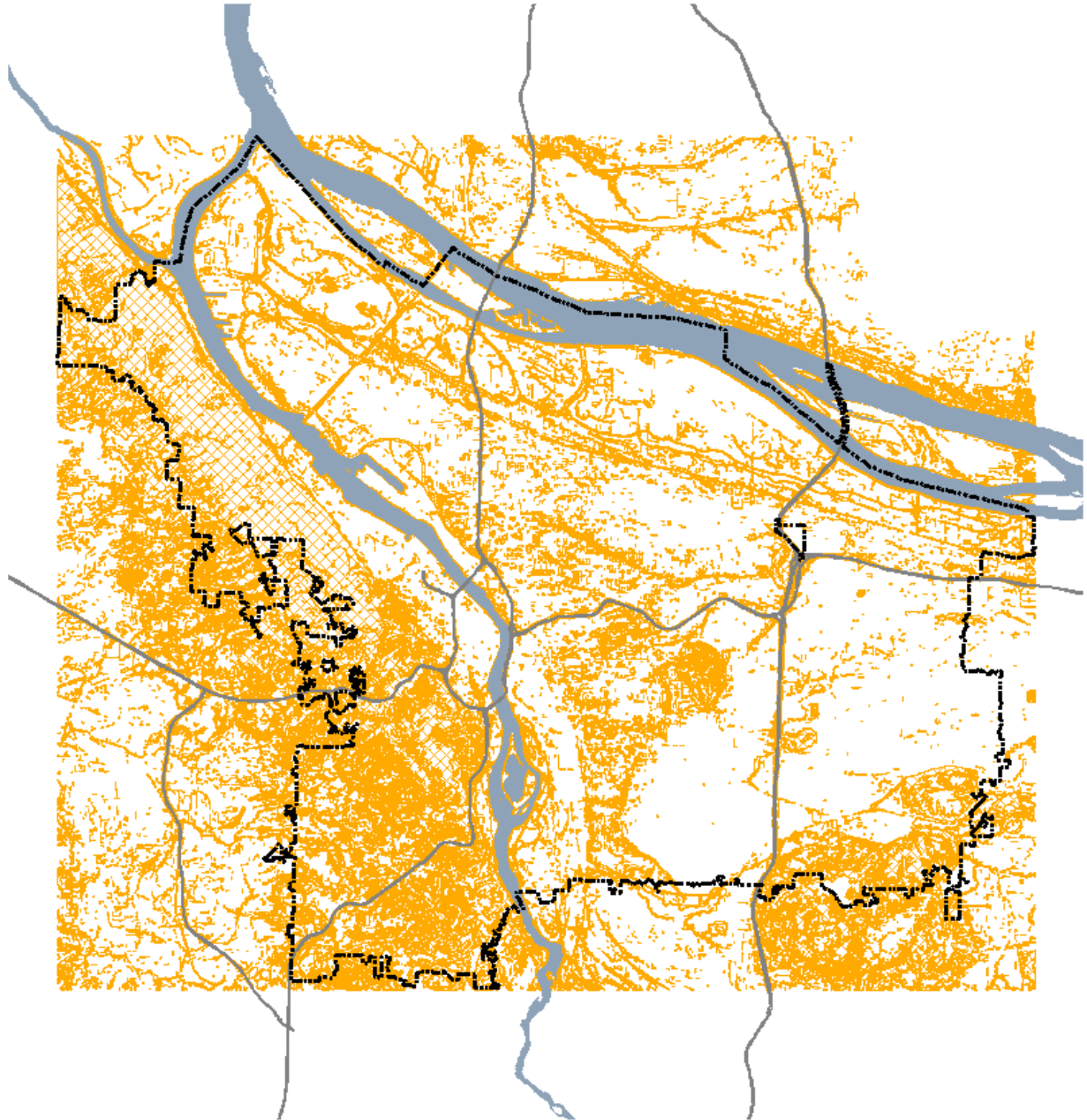


-  City of Portland
-  Forest
-  Woodland
-  Shrubland
-  Herbaceous
-  Rivers






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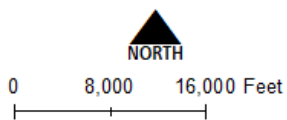
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Map 3: Steep Slopes

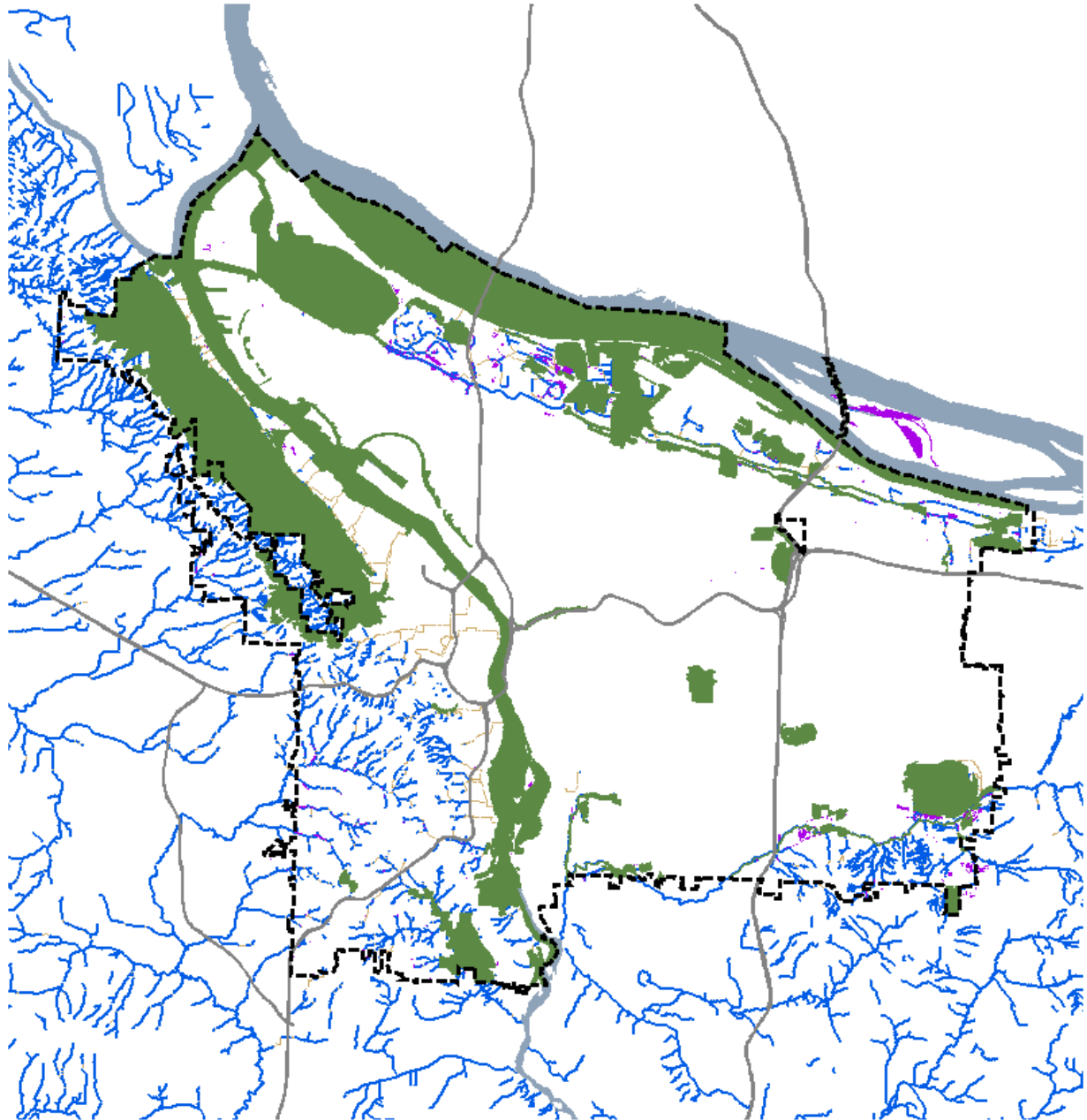
Updated: July 2021

-  City of Portland
-  Rivers
-  Steep Slopes (25% or more)



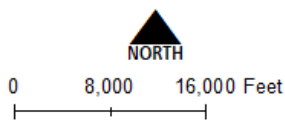
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Map 4: Special Habitat Areas

Updated: July 2021

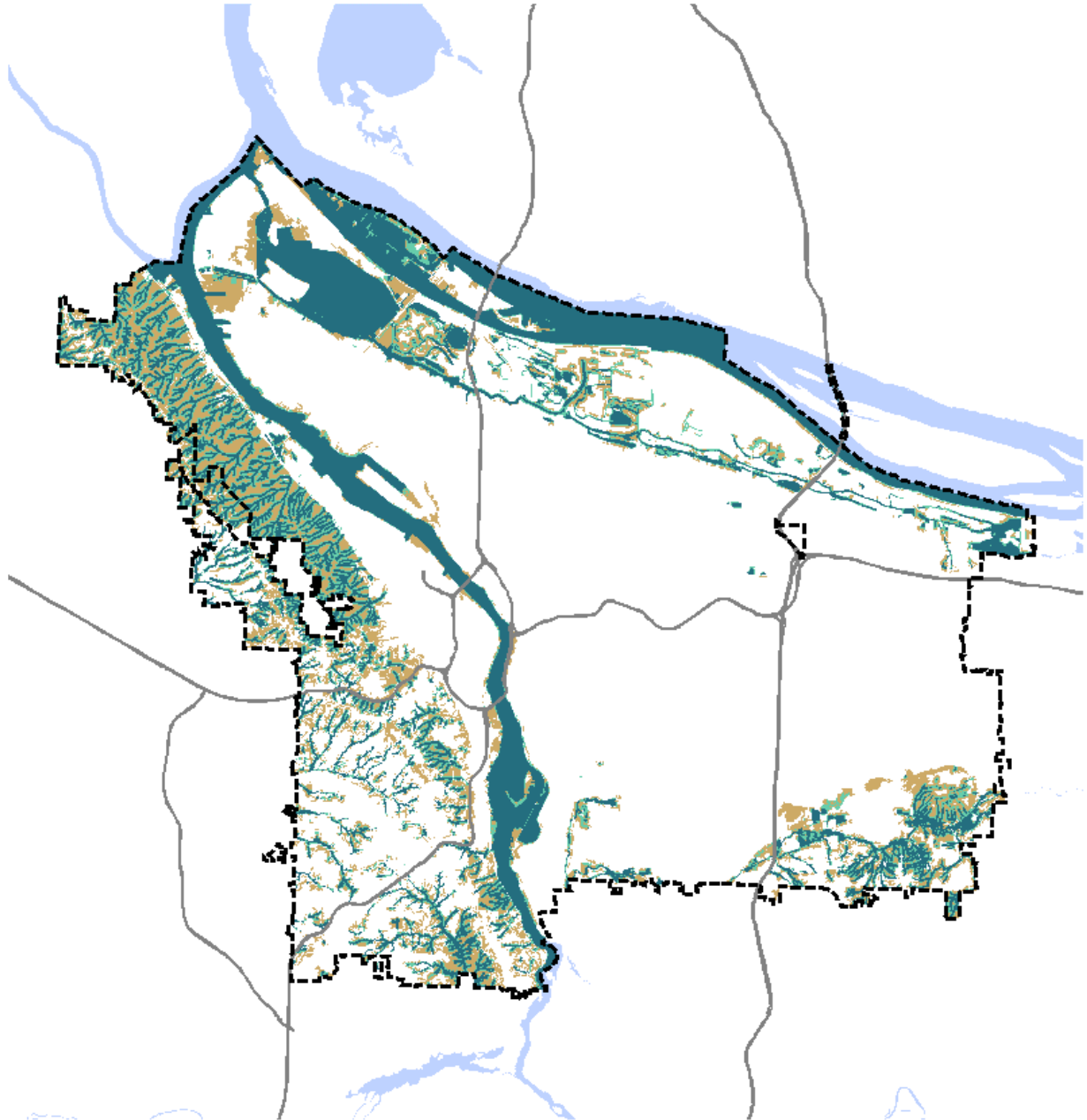


-  City of Portland (USB)
-  Special Habitat Areas (SHAs)
-  Rivers
-  Wetlands
-  Open Stream Channel
-  Piped Stream Segment



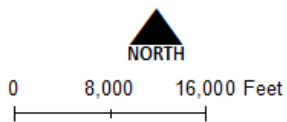
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**Map 5: Riparian Corridors
Habitat Classification**

Updated: July 2021

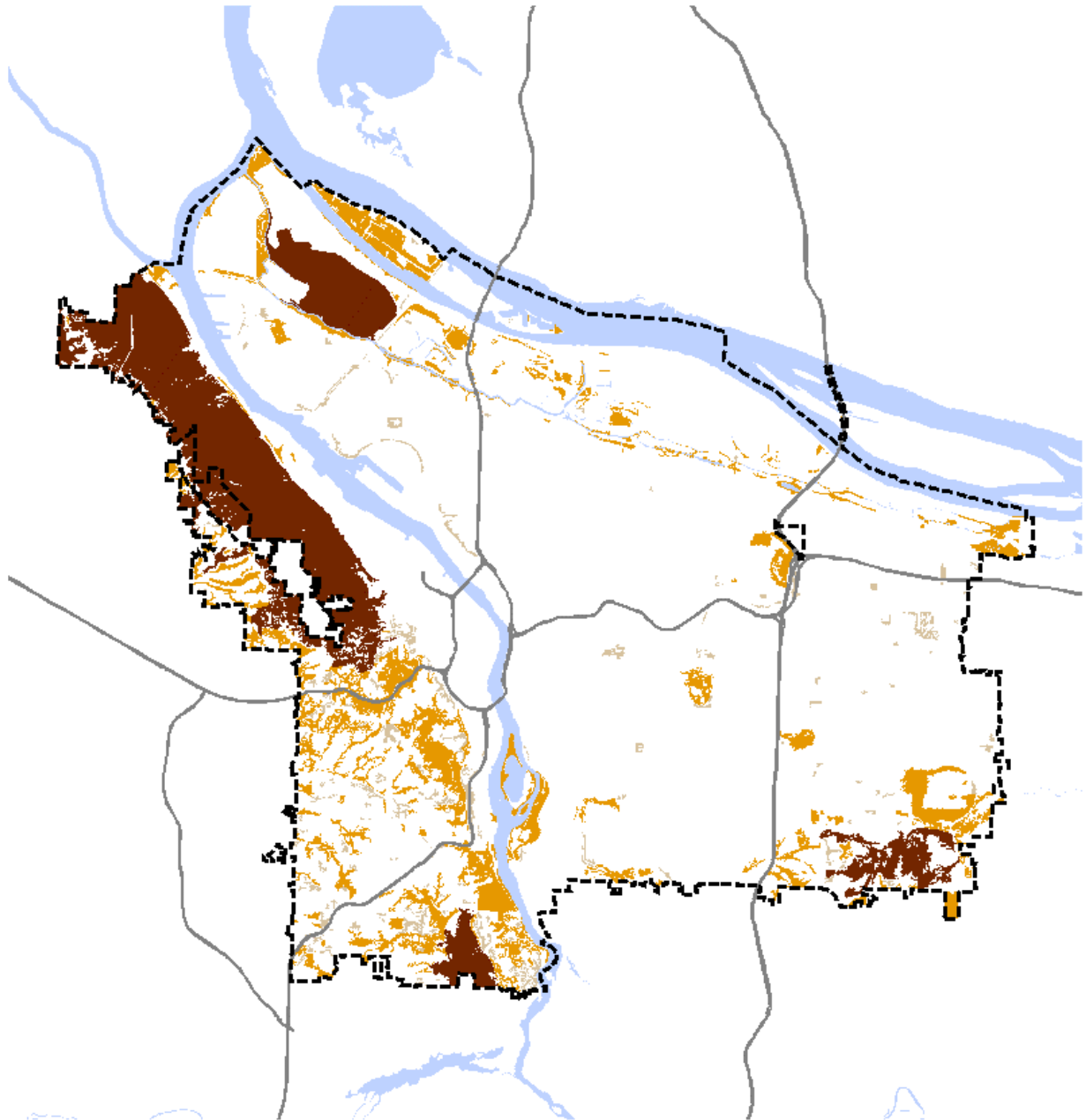


- City of Portland (USB)
- Major Waterbodies
City of Portland (USB)
- Riparian Corridors**
- Class I (high rank)
- Class II (medium rank)
- Class III (low rank)



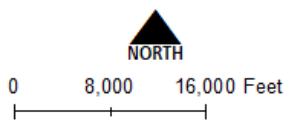
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**Map 6: Wildlife
Habitat Classification**

Updated: July 2021



--- City of Portland (USB)

Blue Rivers

Wildlife Habitat

Dark Brown Class A (high rank)

Orange Class B (medium rank)

Light Tan Class C (low rank)



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The *Environmental Overlay Zone Map Correction Project* plan documents:

Volume 1A – Project Report, Summary of Results and Implementation

The purpose of the Project Report is to document the overall project approach and methodology, summarize public engagement, and provide an at-a-glance summary of the results by resource site.

Volume 1B – Zoning Code and Map Amendments

Amendments to zoning code chapter 33.430, Environmental Zones, as well as other zoning code chapters, and the official zoning maps showing the existing and proposed conservation, protection and scenic overlay zones.

Volume 2 – Resource Site Inventory and ESEE Decisions

For the geographies listed below, each document presents an inventory of natural resource features and functions, a site-specific Economic, Social, Environmental and Energy Analysis (if applicable) and the decisions regarding which natural resource should be protected.

Part A1 – Forest Park and Northwest District, Resource Sites 1 – 20

Part A2 – Forest Park and Northwest District, Resource Sites 21 – 41

Part B – Skyline West

Part C – Tryon Creek and Southwest Hills East

Part D – Fanno Creek

Part E – East Buttes and Terraces

Part F – Johnson Creek

Part G – Boring Lava Domes

Volume 3 – Natural Resources Inventory

A summary of the approach and methodology used to produce the citywide Natural Resources Inventory. The results of the inventory are presented in Volume 2, Part A – G.

Volume 4 – Compliance Report

Compliance with Metro Urban Growth Management Plan Title 13 for Habitat Conservation Areas and Oregon State Planning Goal 5 for significant natural resources that are not a Habitat Conservation Area. The results, recommendations and implementation are reported in Volume 2, Part A – G, and Volume 1, Part B.

Volume 5 – Appendices