SITE CONSERVATION PLAN

River Island Natural Area

Barton, Oregon



October 2014

Metro

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SECTION 1: INTRODUCTION

1.1 Context

River Island Natural Area is located near Barton County Park on the Clackamas River, a tributary to the Willamette River. The Clackamas River supplies drinking water to over 200,000 people and supports significant runs of federal and state listed fish species, including Chinook and coho salmon, steelhead trout, cutthroat trout, bull trout and pacific lamprey. River Island's abundant native habitats including oak savanna, riparian forests and upland forests support diverse wildlife populations including anadromous salmonids and native turtles.

The Clackamas River Basin has been used by people for thousands of years. The River Island Natural Area was reported to be within the traditional territory of Clackamas, a Chinookan-speaking tribe who lived on the Willamette River near Willamette Falls, along the Clackamas River, and on nearby tributary streams. French and English fur traders began to explore the area in the early 1800s bringing diseases which decimated tribes in the Pacific Northwest. Oregon City was founded in 1829 at Willamette Falls to take advantage of the water power to run a lumber mill. Additional use of the area followed including for transportation, commodity extraction and human settlement.

In 1996 a major flood event altered the Clackamas River at the River Island Natural Area, cutting off a meander bend and occupying an active gravel mine which was previously protected by a dike. The cutoff reduced stream length by approximately 3600 feet and eroded 1,380,000 cubic yards of gravel from the area. Metro acquired a majority of the site after the flooding events and currently owns 234 acres at River Island. For an in-depth description of the historical context of the River Island Natural Area, see Appendix A.

This site conservation plan is a tool for protecting and enhancing the unique characteristics of the site while allowing compatible access by the public. It includes an overview of the history of the site, existing conditions, conservation targets and recreation and access objectives for the site.

1.2 Goal and objectives of the conservation plan

The goal of this conservation plan is to describe a course of action that will protect and enhance the area as an environmental and recreational resource for Clackamas County and the Portland metropolitan region. With rare and unique plants, fish and wildlife habitats, River Island Natural Area will be preserved as a historical remnant of the Willamette Valley, providing an ecological showcase of native habitats and wildlife. A salmon-bearing stream and floodplains add value for wildlife and water quality. The area will be maintained and enhanced, to the extent possible, in a manner that is faithful to its original natural condition and important ecological functions.

To achieve this goal, the conservation plan establishes a series of priority objectives, including:

- Restore and maintain high quality habitat including remnant Oregon white oak savanna, upland forests, riparian forests, and aquatic habitats.
- Provide opportunities for research and education.
- Develop appropriate funding strategies to implement restoration and visitor experience opportunities such as conservation education, tours, volunteer stewardship and recreation.

Metro's natural areas bond acquisition program and River Island target area

During the last 18 years, two voter-approved natural areas bond measures have allowed Metro to protect 14,000 acres across the region – the equivalent of more than two Forest Parks, or nearly enough land to cover the city of Beaverton. Voters have protected more than 100 miles of river and stream banks, opened three nature parks and supported hundreds of community projects. Metro continues to buy land in 27 key target areas, chosen for their water quality, wildlife habitat and outdoor recreation opportunities.

Additional information about the 2006 natural areas bond measure and goals and objectives for the Clackamas River target area can be found on the Metro web site, www.oregonmetro.gov/naturalareas.

Since 1999, Metro has acquired 234 acres in the River Island area of Clackamas County, preserving this area for conservation. Table 1 below shows the history of purchases at River Island Natural Area.

Table 1: Properties comprising River Island Natural Area purchased under the 1995 and 2006 bond measures.

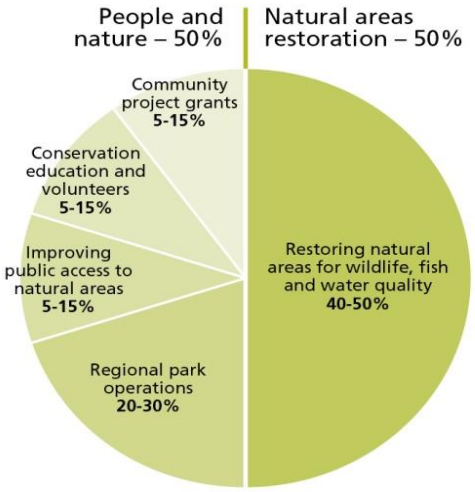
Property name (previous owner)	Acres	Bond year	Date acquired	Management
Clackamas County	0.78	1995	08/07/2001	Metro
Parker-Northwest	239.00	1995	09/17/1999	Metro
Schneider	0.39	1995	02/28/2003	Metro
Anderson	0.69	2006	02/26/2008	Metro
Thompson	0.34	2006	02/27/2008	Metro
Imhoff	0.53	2006	04/23/2013	Metro
Stennett	0.54	2006	04/24/2013	Metro
Corey	0.54	2006	04/09/2013	Metro

Metro's natural areas and parks levy

By law, capital bond measures must be used for capital investments such as property acquisition. Metro can't use bond funds for restoring and maintaining its natural areas. The Metro Council chose to purchase natural areas and defer long term restoration and maintenance on some of these properties until dedicated funds could be secured.

In May 2013, the region's voters approved a five-year local option levy to care for Metro's growing portfolio of natural areas and regional parks (Figure 1). About half of the levy funds will go towards natural area restoration and maintenance. The levy is the first of its kind in the U.S. The citizens' investment will raise about $10 million per year to maintain and improve water quality; preserve regional parks, natural areas and stream frontages; maintain current and implement new restoration projects; and provide limited new access opportunities.

Figure 1. 5-year levy allocations
(Approximate)



The levy will make a difference for most of the 14,000 acres of natural areas that Metro oversees. Projects are currently underway for most of the six areas receiving levy funds. Although the levy will be funded over five years, it will likely take several additional years to complete our work under the funds. Some of the strategic restoration actions identified in this plan will be funded with the levy .

SECTION 2: PLANNING PROCESS SUMMARY

2.1 Planning area

This conservation plan addresses conditions, plans and activities for the site's 234 acres. Metro ownership and an outline of the planning area can be found as Map 1 and a site map found as Map 2.

2.2 Planning process

Developing a useful site plan means adequately providing for a site's preservation, enhancement and management. This plan will build on previous restoration and management efforts while acknowledging that future conservation requires analysis of the site, meaningful engagement of stakeholders and integration of historical, current and future needs. This plan includes several important elements: identification of conservation targets, access and recreation needs, and implementation of projects.

A two-tiered approach is used to improve natural resource conservation and integrate meaningful human experiences through physical and visual access. The plan recognizes that the conservation of species, habitat and natural features must occur simultaneously with the provision for human access to these

natural systems. Education and exposure are the cornerstones for protecting natural ecosystems for decades to come. This two-tiered approach also recognizes that conservation and access have different stakeholders, different funding sources and different strategic approaches. Initially the plan reviewed the overarching project goals and objectives common to both conservation and access. The project team then developed conservation and access strategies independently. Conservation is discussed in Section 4 of this document. Access is discussed in Section 5.

Planning project goals

The planning goals for both the natural resource conservation and visitor experience portions of this plan are listed below.

Natural resource conservation

- Map and define major habitat types.
- Establish habitat and species conservation targets.
- Define key ecological attributes and analyze stresses (threats) and their sources for the conservation targets.
- Establish and prioritize strategies to restore habitat.
- Identify and prioritize actions to implement; define funding needs and implement.

Visitor Experience

- Analyze existing public use of River Island Natural Area and identify existing site uses that are safety concerns, illegal, hazardous, and/or damaging to the natural resources.
- Implement early site management actions to promote appropriate use of site and eliminate illegal, hazardous, and damaging site uses.
- Develop a comprehensive understanding of current and desired visitor experiences.

SECTION 3: EXISTING CONDITIONS

This section of the conservation plan provides background on existing conditions for the River Island Natural Area.

3.1 Physical environment

The topography of the River Island Natural Area consists of a lower contemporary floodplain set within historical abandoned floodplain terraces. A constructed dike runs north-south along the western edge of the abandoned Clackamas River channel and around the former gravel pit areas. Large ponds exist in areas that were former gravel mining pits. The upper terraces are occupied by oak savanna, conifer forest and mixed coniferous/deciduous forest. The lower floodplain is occupied by riparian forest. The abandoned Clackamas River mainstem channel runs along the eastern edge of the River Island Natural Area and is occupied by dense early successional floodplain forest. See Map 3 for topography.

Geology

The geology of the lower Clackamas River watershed is characterized by volcanic and sedimentary formations that are found between the Cascade Mountains and the Portland Basin. Five major geologic units in the area of the River Island Natural Area include two volcanic units (the Sardine aka the Rhododendron Formation and the Boring Lava flows) and three sedimentary units (Troutdale Formation, Sandy River Mudstone and Alluvial deposits).

Soils

The properties of soils found within a watershed influence to a large extent the movement of water through and within the soil layers, as well as the vegetation that can grow in them. Information on soils in the soil survey of the Clackamas area (NRCS, 1985; 1998) is published by the USDA Natural Resources Conservation Service (NRCS; formerly the Soil Conservation Service). Descriptions and percent coverage of the River Island Natural Area are located in Table 2 and the soils are displayed in Map 4.

Table 2: Descriptions of soil group properties

Map Unit Name	Description	Area (acres)	Percent of site
Camas gravelly sandy loam	This very deep, excessively drained soil formed in mixed sandy and gravelly alluvium. Soils are on floodplains. Slopes are 0 to 5 percent.	45.70	19.49
Cloquato silt loam		5.28	2.25
Newberg loam	This deep, somewhat excessively drained soil is on floodplains. It formed in mixed alluvium. Slope is 0 to 3 percent.	42.75	18.23
Pits	Remnant gravel pits.	34.63	14.77
Riverwash	Barren alluvial areas, typically coarse textured.	4.92	2.10
Wapato silty clay loam	This very deep, poorly drained soil formed in loamy mixed alluvium. Soils are on floodplains and saturated with water (hydric) during the winter season unless artificially drained. Slopes are 0 to 3 percent.	9.76	4.16
Water	Open or flowing water	70.84	30.21
Woodburn silt loam	This deep, moderately well drained soil is on broad valley terraces it is formed in stratified glaciolacustrine deposits. Slopes 3 to 8 percent.	8.35	3.56
Xerochrepts and Haploxerolls, very steep	This map unit is on terrace escarpments. Slope is 20 to 60 percent.	12.24	5.22

A description of River Island's physical environment including geology, channel-forming processes and soils of the watershed can be found in Appendix B.

3.2 Streams and wetlands

The Clackamas River is a large tributary of the Willamette River. The River Island Natural Area is located at approximately river mile fifteen on the Clackamas River. The contributing watershed area is approximately 785 square miles and originates in the high Cascades, and meanders north and westward until its confluence with the Willamette River. The Clackamas River Watershed is located in the Willamette Valley physiographic province, a broad alluvial plain that spans the lowlands between the Coast Range and Cascade Mountains. The watershed is a complex network of underlying soil formation types formed by water, volcanic inputs, and continental uplift.

Today, the River Island reach of the Clackamas River can be described as a moderate gradient (0.4%) semi-confined channel. The Clackamas River channel through River Island Natural Area can be described as a single-threaded channel, with point and mid-channel gravel bars. The channel exhibits primarily riffle-pool morphology, with occasional glides. Substrate ranges from boulders to silts, but is predominately gravels and cobbles. Within the area of historical mining there are numerous off-channel "ponds" filled with six inches to two feet of silt deposits.

Springs and tributaries

Four intermittent streams form from springs emerging from the upper and middle benches of the surrounding lands. Goose Creek is the only named tributary in the area, entering the River Island Natural Area on from the north and flowing through the abandoned mainstem Clackamas River channel. Site hydrology is displayed in Map 5.

Wetlands

One small portion of the eastern side of the River Island Natural Area appears to have a wetland impounded behind a small access road. Although classified as a Riverine Wetland by the National Wetland Inventory (NWI), NWI mapping was completed in 1981 and field indicators suggest little, if any, of the area meets jurisdictional criteria for wetland characteristics. Minimal hydric soils and no hydrophytic vegetation indicate little historical presence of wetlands (Adamus 2005). These riparian forests and historical wetlands were vastly altered by the former gravel mining operations. Currently, the mainstem channel avulsion has resulted in a trend reducing open pond areas and converting them to floodplain landcover.

3.3 Major habitat types

Historically, the floodplain and uplands of the River Island Natural Area were filled with dense forests of cottonwood, maple and fir. Soil mapping of mollisols (within areas mapped as newberg loam) suggests that historically portions of the site and surrounding lands may have been Oregon white oak savanna. Today, the River Island Natural Area's terrestrial habitats can be characterized by three primary types: Oregon white oak savanna, riparian forest and upland conifer-hardwood forest, Map 7 shows these habitat types present at the site and Map 6 shows historical vegetation.

Oak savanna

Oregon white oak habitats are identified as conservation priorities within both the Oregon Conservation Strategy and the Regional Conservation Strategy for the Greater Portland-Vancouver Metropolitan Area. Native dominated oak savanna and prairie have largely disappeared in the Metro region.

Oak savanna is essentially prairie with a few trees per acre. Savanna is characterized by widely spaced, open canopy trees dominated by Oregon white oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. In healthy oak savanna habitat, total native woody cover is typically 5 to 30 percent, and canopy architecture represents an appropriate mix of large open grown oak trees and younger tree recruitment that will replace older trees when they die. In healthy native prairie and emergent wetland habitats, native herbaceous plant species (grass and wildflower) typically compose over 90 percent of the vegetation cover, with less than 5 percent cover of woody vegetation.

Key plants

Native forbs found in this habitat may include camas, brodiaea lily, Oregon sunshine, large rose mallow (Sidalcea), Oregon saxifrage, large leaf lupine, tarweed, collinsia and bracken fern. Native grass species found in this habitat may include Roemer's fescue, California oat grass, tufted hairgrass, slender hairgrass and blue wildrye. Shrubs found in this habitat may include poison oak, spiraea, snowberry and tall Oregon grape.

Key wildlife

Partners in Flight uses "focal species" – birds highly associated with important features of a habitat type – to direct habitat management that will benefit the full suite of species using that habitat. Partners in Flight identifies the following focal species for Willamette Valley grassland or savanna habitats: Western meadowlark, Vesper sparrow, Common nighthawk, American kestrel and Northern harrier. Oak woodland focal species include, among others, White-breasted (slender-billed) nuthatch, Downy woodpecker, Western wood-pewee, Bushtit, Chipping sparrow, and Bewick's wren. Other birds utilizing oak, savanna and emergent wetland habitats may include White-crowned sparrow, Rufous hummingbird, Western bluebird, Lazuli bunting and Red-tailed hawk, as well as waterfowl, rails, herons and shorebirds in wetter habitats. Other wildlife utilizing this mix of habitats may include Pacific chorus and Northern red-legged frogs, garter snake, rubber boa, butterflies, black-tailed deer, coyote, fox, various native rodents, and possible insect species of concern.

Current extent and attributes

River Island Natural Area includes 29 acres of Oregon white oak savanna habitat located on the south side of the river on a historic terrace. Large open grown Oregon white oak trees can be seen in this area along with patches of young pine and Oregon white oak plantings.

Riparian forest

Widespread development and land use activity affect habitat quality and complexity, water quality and watershed processes in lower Willamette and Columbia tributaries. Stream habitat degradation is primarily due to past and current land-use practices that have affected properly functioning stream channels, riparian areas and floodplains, as well as watershed processes. The Lower Columbia Salmon Recovery and Fish & Wildlife Sub basin Plan identifies the Clackamas River and its tributaries as primary

habitat necessary to the recovery of coho and winter steelhead, and as important contributing habitat for fall Chinook and chum salmon (Primozich and Bastash 2004).

Key plants

Native forbs found in this habitat may include Pacific waterleaf, false hellebore, nodding beggartick and skunk cabbage. Sedge and rush species found in this habitat may include slough sedge, awl-fruited sedge, dewy sedge, slender rush, common rush and spreading rush. Shrubs and trees found in this habitat may include red alder, Oregon ash, Western red cedar, cottonwood, big leaf maple, Pacific ninebark, red-osier dogwood, Sitka and Pacific willow, red elderberry and Douglas' spiraea.

Key wildlife

Within the riverine habitat, a colony of Bank swallows has used the area over the years, and has been absent recently. This species is uncommon west of the Cascades, and the history of the River Island colony has been noted and tracked by local avian biologists. Other riparian species to track within this habitat include: Tree swallow, Violet-green swallow, Western kingbird and Olive-sided flycatcher; they may indicate availability of a healthy insect population. Other birds utilizing this habitat may include Green heron, Great blue heron, Wilson's and other warblers, and American goldfinch. Other wildlife species that regularly use this habitat include Pacific tree frog, Northern red-legged frog, various salamanders, common garter snake, black-tailed deer, elk, coyote and fox. Note that Northern red-legged frogs have not been observed within this habitat at River Island. Western toads can use the riverine area on the east side of the site.

Current extent and attributes

River Island Natural Area includes approximately 139 acres of forested riparian habitat. Some variations of canopy structure in this habitat type include cottonwood, red alder/western red cedar and red alder/Douglas fir community types. Most areas of riparian forest within the site are severely altered due to past mining operations at the site.

Upland conifer-hardwood forest

Upland coniferous and mixed conifer/deciduous forests are the dominant habitat of the region. Low-elevation Pacific Northwest old-growth forests typically are dominated by the conifers Douglas-fir, western red cedar and western hemlock, with grand fir and hardwood species also occurring. Under historic conditions, trees of many of the dominant species lived to be 350 to 750 years old or older and frequently had diameters of eight feet or more. Plant and animal use of forests follows the changes in forests over time, with different suites of species dominating depending on forest age, canopy closure and site conditions. Biodiversity is higher in forests where some light reaches the forest floor and where standing and fallen dead wood is ample and of mixed age and size. Forests younger than 60 years dominate western Oregon due to current forestry practices, and the decline of old growth-associated species reflects these changes in overall forest structure across the region.

Stands of forest can be categorized by the age of trees, species and composition of understory species. Upland forests in the greater Portland-Vancouver region provide primary habitat for at least 94 species and are used by at least 129 more species (Portland-Vancouver Regional Conservation Strategy 2012).

Key plants

Native forbs found in this habitat may include sword fern, licorice fern, false Solomon's seal, false lily of the valley, trillium, fairy bells, miner's lettuce, stinging nettle, hedge-nettle and heal-all. Shrubs and trees found in this habitat may include Pacific yew, Pacific madrone, bigleaf maple, red alder, Douglas fir, Grand fir, Western red cedar, black hawthorn, Western serviceberry, tall and dull Oregon grape, mock orange, blue and red elderberry, salal, red huckleberry, Indian plum and snowberry.

Key wildlife

A few of the Partners in Flight-identified focal bird species for coniferous forests at various successional stages to be considered at this site include: Brown creeper, Pileated woodpecker, Band-tailed pigeon, Varied thrush (winter); Townsend's warbler, Black-throated gray warbler, Hutton's vireo, and Cooper's hawk. Other species may include Douglas' squirrel, common garter snake, rubber boa, elk, black-tailed deer, mountain lion, bobcat, coyote, fox, weasel and a variety of small mammals.

Current extent and attributes

The site includes 51 acres of upland coniferous-hardwood forest habitat, with tree age in the range of 2 to 100+ years. Some variations of canopy structure in this habitat type include Grand fir/big leaf maple, Douglas fir/big leaf maple/red alder and big leaf maple/Douglas fir community types.

3.4 Native fish and wildlife

Hundreds of wildlife species or their sign have been observed at River Island Natural Area. Many of these wildlife species, including amphibians, reptiles, birds and mammals use the site for breeding, nesting, foraging and migration. The site has diverse cover, breeding and travel habitats which provide numerous food sources including seeds, fruit, pollen sources, bark and insects. This would include species such as hawks, falcons, Neotropical migrants such as willow flycatcher and solitary vireo, and gallinaceous birds such as ruffed grouse or non-native ring-necked pheasant. Small and large mammals and birds also provide food for species such as raptors and large predatory mammals including cougar, which is known to occur in the area. Open water ponds provide foraging and basking habitat for painted (and possibly pond) turtles. Forest habitats could support additional small mammals including Douglas' squirrel and several bat species. Open savanna habitats could support striped skunk. Other possible species for this site include wood rat, chipmunks, voles and mice, mink, weasel, bobcat, black bear, black tail deer and elk.

Native Fish

Anadromous fish occurring in the Clackamas basin include spring and fall Chinook, Coho salmon, winter steelhead, summer steelhead (non-native), migratory cutthroat trout and Pacific lamprey (Runyon and Salminen 2005). Resident native fish that occur in the Clackamas River include cutthroat trout, rainbow trout and bull trout. Bull trout, once thought to be eliminated from the basin, have been reintroduced beginning in 2011 and in both 2011 and 2012 the fish were observed spawning (2013 Allen and Koski). Other resident fish potentially occurring in the project area include sculpin, longnose dace, speckled dace, shiners, brook lamprey, suckers and northern pikeminnow.

Western Painted Turtles

Previous visual surveys for turtles documented basking and feeding in multiple ponds at River Island Natural Area; more extensive surveys are under way in 2014. They probably overwinter in permanent, relatively quiet water behind beaver dams and in former rock pits. For nesting, they probably use gravel piles and open areas that seldom flood. They feed and bask in quiet waters that warm during summer and grow algae and aquatic plants. Down wood and open ground in sunny areas are favorite basking features. Turtles will travel a quarter mile or more across upland areas seasonally to meet their needs. The western painted turtle is an Oregon Conservation Strategy species and the population at River Island Natural Area is probably part of a larger population inhabiting the lower Clackamas River. Northwestern pond turtles may also use the site but have not been documented there to date; they have been documented within a few miles of River Island. Both native turtle species are vulnerable to human disturbance, nest destruction, poaching and road kill.

Biodiversity connectivity (corridors)

Native animals and plants require the ability to establish or re-establish local populations in a specific location to persist in a region over time. Furthermore, ongoing breeding interaction between small populations can create a larger, more genetically robust meta-populations. In areas such as ours, where significant habitat fragmentation has occurred, relatively narrow, linear connections (corridors) can help meet these needs.

In 2010-2011, Metro hosted a series of biodiversity corridor workshops on behalf of The Intertwine Alliance. The results were compiled and made available to participants via a map server. The workshops gathered the opinions of wildlife and habitat professionals in the region; the results are best professional opinion only, are not meant to be property specific, and make no attempt to prioritize or assess on-the-ground issues such as barriers. Nonetheless, the information can provide valuable insight into existing and potential connectivity from River Island Natural Area to other important habitat areas in the region. Biodiversity corridors in the area of River Island Natural Area include:

- Upstream and downstream along the Clackamas River riparian corridors. The corridor to the east provides a connection to the Cascade Range.
- To the north to Deep Creek and North Fork Deep Creek drainages. This corridor provides connections to the east buttes.
- To the south to Foster Creek and Clear Creek drainages and large forested areas. South and east provides a connection to Bureau of Land Management forest lands in the upper Clear Creek watershed.

Climate change adaptation considerations

At the River Island Natural Area, stressors from climate change will likely derive primarily from increased competition from invasive species, intensified summer drought and altered hydrology and water temperature. Altered hydrology may result in flashier streams from more severe winter storms and decreased summer flows from loss of snowpack, reducing or degrading native fish and riparian habitat. However, there could also be potential floodplain benefits from flashier streams – for example, larger

floods could inundate floodplains for longer time periods. In forests, drier summer conditions could curtail tree growth and increase the risk of stand-replacing wildfires.

Metro will need to be vigilant in Early Detection-Rapid Response activities for invasive species, and more staff and financial resources may be needed to deal with invasive species in the future. Establishing native plants where needed now can help defend the River Island Natural Area against invasive species. The potential for altered hydrology increases the importance of riparian forest health and width, as well as looking at the larger landscape for biological connectivity. Creating and enhancing in- and off-channel habitat in the near future, including increasing the resilience of such habitat elements against altered hydrology, can help enhance native fish habitat. These activities are addressed in this conservation plan and the related Site Stewardship Plan.

SECTION 4: CONSERVATION

This section provides a comprehensive framework for conservation planning at River Island Natural Area. This framework generally follows The Nature Conservancy's Conservation Action Planning template (The Nature Conservancy, 2007) and includes analyzing the site, establishing conservation targets, evaluating key ecological attributes for each conservation target, analyzing threats affecting conservation targets and developing action plans to abate serious threats. More detailed information is available in Appendix C.

4.1 Conservation targets

Conservation targets are composed of a species, suites of species (guilds), communities and ecological systems that represent and encompass the full array of native biodiversity of the site, reflect local and regional conservation goals and are viable or at least feasibly restorable (The Nature Conservancy, 2007). Map 8 illustrates the conservation targets at River Island.

The methodology for determining conservation targets and key ecological attributes is discussed in detail in Appendix C.1, Conservation Targets, and Appendix C.2, Key Ecological Attributes. Using onsite natural habitat types and regional conservation planning efforts as guides, conservation targets were selected that encompass the site's biodiversity values and regional conservation priorities. These conservation targets are:

- Oak savanna
- Riparian forest
- Mixed conifer-hardwood forest
- Native fish (Species Target)
- Native Turtles (Species Target)

The habitat conservation targets represent the most regionally rare and threatened major habitat types present at the site, as well as patches of coniferous forest, one of the region's most representative habitats. The site's habitat diversity, connectivity at the landscape level and importance to anadromous

fish and native turtles can help conserve rare and at-risk species and keep our common native species common. More detail about each of these conservation targets can be found in Appendix C.1.

4.2 Key ecological attributes

Key ecological attributes (KEAs) are the features that define that target and aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (The Nature Conservancy, 2007). KEAs define the conservation target's viability. They are the biological or ecological components that most clearly define or characterize the conservation target, limit its distribution or determine its variation over space and time. They are the most critical components of biological composition, structure, interactions and processes, and landscape configuration that sustain a target's viability or ecological integrity. KEAs are rated from poor to good. This rating helps establish the restoration goals and guide us in development of restoration actions for the conservation targets.

Appendix C.2 (Key Ecological Attributes) describes the site's KEAs and indicators for each of the five conservation targets in more detail.

4.3 Threats and sources

An effective conservation strategy requires an understanding of threats (stresses) to targets and the sources of those threats. Adjacent development and subsequent disruption of natural systems place stress on the resource and its inhabitants and threaten the health of the greater ecosystem. At River Island Natural Area, the following threats are evident:

- Increased competition (by invasive plant species)
- Altered fire regime
- Altered vegetation structure
- Human disturbance (historic and on-going)
- Altered hydrology

The methodology for defining threats and sources was established by The Nature Conservancy. It is a well-established, objective methodology with a scientific basis, and is described in more detail in Appendix C.3, Threats and Sources.

Information on River Island Natural Area's conservation targets, KEAs, significant threats and management actions to address those threats is summarized in Table 3 below. More detailed information is available in Appendix C.1, C.2 and C.3, and in the River Island Stewardship Plan. The following section outlines short- and long-term management strategies for conservation targets.

Table 3: River Island Natural Area conservation targets

Conservation target	Attributes of healthy habitat
Oak savanna	Oak savanna is essentially prairie with a few trees per acre. Savanna is characterized by widely spaced, open canopy trees dominated by Oregon white oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. In healthy oak savanna habitat, total native woody cover is typically 5 to 30 percent, and canopy architecture represents an appropriate mix of large open grown oak trees and younger tree recruitment that will replace older trees when they die. *Current cover* Approximately 29 acres
Riparian Forest	Riparian forests in this case are associated with streams and are relatively linear. Healthy riparian forests are relatively wide (100-200+ feet each side of stream) with few gaps and have a good mix of native trees and shrubs with good native species diversity in all layers. Downed wood and snags are important components. *Current cover:* Approximately 139 acres
Mixed conifer-hardwood forest	An abundant natural habitat of the region, low-elevation Pacific Northwest old-growth forests are typically dominated by Douglas fir, western red cedar, and western hemlock, with Willamette Valley ponderosa pine, grand fir and hardwood species also occurring. Plant and animal use of forests follows the changes in forests over time, with different suites of species dominating depending on forest age, canopy closure and site conditions. Biodiversity is higher in forests where some light reaches the forest floor and where standing and fallen dead wood is ample and of mixed age and size. The size of habitat (patch size) is a key consideration for wildlife diversity. *Current cover:* Approximately 51 acres
Native fish habitat	River Island provides important habitat to native salmon, steelhead and lamprey species. Native fish require habitat complexity along the main stem river and off-channel areas for rearing at different times of the year, an intact riparian forest provide shade and organic matter and gravel and rocky substrate for spawning. *Current cover:* Approximately 12,900 linear feet of stream including 5800 feet on Goose Creek and 7,100 feet on the main stem Clackamas River.
Native turtles	Western painted turtles are residents of the open water habitats at River Island Natural Area and they rely on other habitats for basking and nesting, including riparian and upland forests and sparsely vegetated open areas. *Current cover:* 11 – 20+ acres of open water (ponds) and off channel habitat. Seasonally variable in acreage, an overall trend of open water (ponds) converting to floodplain is occurring at River Island.

SECTION 5: STRATEGIC RESTORATION AND STEWARDSHIP

5.1 Restoration

This conservation plan outlines strategic actions to be carried out at River Island Natural Area over the next 10-15 years. They are based on the short- and long-term goals for the conservation targets. The strategic actions described here are general courses of action to achieve these objectives and not highly prescriptive courses of action. Specific prescriptions and projects will be developed by Metro staff to address site-specific conditions encountered in the areas targeted for restoration action.

Because of the historic uses at the River Island, much of the site is in need of intensive restoration. The information below summarizes conservation targets' key ecological attributes, significant threats to the habitat, and strategic restoration and stewardship actions that can be taken to keep or bring the KEAs into the desired range.

Conservation target: oak savanna

Short-term goals 2012-2016

- Retain existing open areas with legacy Oregon white oak trees as savanna habitat.
- Decrease the cover of woody tree and shrub cover to less than 20 percent.

Long-term goal

The long-term desired future condition is to have all condition key ecological attributes at good or very good levels and providing suitable habitat for prairie and Oregon white oak-dependent wildlife species. More specifically we hope to increase habitat for pollinators and ground nesting birds like western meadowlark. The size key ecological attribute will be maintained at fair due to the limited possibility of expansion of the savanna habitat at the site.

Key ecological attributes outside normal range of variation

- *Native grass and forb species presence:* limited number of native plant species present.
- *Native grass and forb species abundance:* limited abundance of native plant species present
- *Canopy cover vegetation structure:* trees and shrubs encroaching (some planted) into the prairie.

Critical threats that are considered very high and high

- *Altered native herbaceous species composition:* non-native species out-compete native grass and forb species.
- *Altered fire regime:* fire suppression promotes encroachment of woody shrub and tree vegetation, leading to lack of open structure and conversion to shrub.

Strategic restoration and stewardship actions

- Control non-native invasive species to increase abundance of native plant species
    - Ongoing invasive species treatments will be targeted at reducing the cover of non-native broadleaf weeds (Himalayan blackberry, Canada thistle, and Scot's broom) to less than 30 percent cover. Stewardship treatments would occur between 1 and 2 year intervals.
- Remove or selectively thin pine trees to allow young Oregon white oak trees to become established. Cage planted Oregon white oak trees to wildlife browse and maintain until plantings are free to grow.
- Develop a restoration plan to identify opportunities for restoring and possibly expanding the savanna habitat areas of River Island Natural Area.

Conservation target: riparian forest

Short-term goals 2012-2016

- Increase percent cover of native tree and shrub (vegetation structure) and native tree and shrub richness in all riparian and floodplain forest habitat areas.
- Increase continuity of riparian forest cover by decreasing gaps in woody vegetation.
- Increase floodwater access to the floodplain. Floodwaters should inundate the floodplain during moderate to high flow events in the winter.

Long-term goal

The desired future condition is to have the majority of the key ecological attributes ranked as very good thereby maintaining and restoring habitat suitable for riparian forest-dependent wildlife species. Healthy riparian areas are also linked to native fish and native turtle conservation listed below.

Key ecological attributes outside normal range of variation

- *Native herbaceous layer richness:* limited number of native herbaceous species present.
- *Gaps in wood vegetation:* numerous large gaps of continuous forest cover exist.
- *Standing and downed dead trees:* lack of intact mature forest has resulted in limited quantities of downed wood.
- *Floodwater access to the floodplain:* floodwaters only inundate the floodplain during extreme high water events in the winter.

Critical threats that are considered very high and high

- *Altered native species composition:* non-native species out-compete native plant species.

Strategic restoration and stewardship actions

- Restoration actions will be initiated to control non-native invasive species and increase the cover of native trees and shrubs. This action may require 3-5 years of maintenance to insure plantings are successful.
    - Native tree and shrub plantings should be focused in riparian areas that have less than 30 percent canopy cover. Maintain some gaps in vegetation in open water (pond) areas to support native turtle conservation.
    - Invasive species management of reed canary grass, blackberry, Scots broom, thistle and other common broadleaf weeds should be focused in areas of restoration plantings.
- Early detection and treatment of invasive species should target garlic mustard, false brome, knotweed and spurge laurel. Treatments would occur between 1 and 2 year intervals. Treatment on adjoining private and public lands should be explored to reduce long term risks of re-establishment.

Conservation target: Mixed conifer hardwood forest (upland closed forest)

Short-term goals 2012-2016

- Increase the number of mature trees.
- Increase the canopy cover of native tree and shrub cover to greater than 50 percent cover.
- Maintain diversity in the age and structure of young conifer stands.

Long-term goal

The desired future condition is to have all key ecological attributes ranked as good to very good thereby maintaining and restoring habitat suitable for upland conifer forest-dependent wildlife species. This habitat type is most likely to see increase in use by large migratory mammals like elk, deer and cougar.

Key ecological attribute outside normal range of variation

- *Number of mature trees:* Lacking larger conifers.
- *Standing and downed dead trees*: most upland coniferous forest areas on the site lack dead wood. This is primarily due to historical logging and the age of the trees.

Critical threats that are considered very high and high

- *Altered native herbaceous species composition:* non-native species out-compete native species, particularly Himalayan blackberry, thistle and teasel.
- *Standing and downed dead trees*: most upland coniferous forest areas on the site lack dead wood. This is primarily due to historical logging and the age of the trees.

Strategic restoration and stewardship actions

- Restoration actions will be initiated to control non-native invasive species and increase the cover of native trees and shrubs.
    - Native tree and shrub plantings should be focused in areas that have less than 50 percent canopy cover. Some ½ to 1 acre openings within the forest should be left free of canopy cover to promote native turtle conservation.
    - Invasive species management of blackberry, Scot's Broom, and other common broadleaf weeds should be focused throughout this habitat at the site. Treatment will help promote nature forest regeneration and optional growth of mature trees.
- Restore areas with compacted soils such as old home site foundations and mining areas. Testing for soil nutrients may be necessary in some areas.
- Early detection and treatment of invasive species should target garlic mustard, false brome, and spurge laurel. Treatments would occur between 1 and 2 year intervals. Seek information from adjoining landowners on presence of these invasive species to determine the level of threat.

Conservation target: native fish habitat

Short-term goals 2012-2016

- Restore geomorphically sustainable habitat complexity given current and forseeable sediment, land use, large wood, and recreational regimes.
- Increase the complexity of in-stream habitat in the Clackamas mainstem and increase high quality habitat in accessible off channel areas.
- Remove or otherwise address the impacts of old dikes, roads and settling ponds (remnants of the mining operation) that alter the natural hydrology of the site.
- Increase key pieces of large wood (greater than 24 inches DBH, length greater than 30 feet) within the floodplain and off channel areas.

Long-term goal

The desired future condition is to have all key ecological attributes ranked as good to very good thereby maintaining and restoring habitat suitable for native fish species present in the Clackamas River and its tributaries. More specifically, the long term goal is to support the recovery of ESA-listed coho, steelhead and Chinook populations.

Key ecological attributes outside normal range of variation

- *Key pieces of large wood:* historical logging on the site (and upstream in the watershed) has reduced the number of key large wood pieces (greater than 24 inches DBH, length greater than 30 feet) in the stream and off channel habitats.
- *Off channel habitat:* off channel habitat existing but are in poor condition and are not accessible during biologically important times of the year.
- *Substrate:* spawning gravel is limited. Gravel migrating into the site from upstream sources is captured by old gravel pits.

Critical threats that are considered very high and high

- *Simplified stream structure:* lack of side channel, sparse riffle-pool sequences and limited large wood that provides complex habitat for fish.
- *Altered hydrology:* dikes constructed during mining operations impede floodwater access to much of the site.

Strategic restoration and stewardship actions

- Restoration actions will be initiated to restore habitat suitable for native fish species present in the Clackamas River and Goose Creek at River Island Natural Area.
    - Address dikes, roads and settling ponds (remnants of the mining operation) to improve hydrology to the floodplain and reduce channel migration to near natural rates.

- Install large wood structures to create complex habitats. Focus investment of large wood placement to off channel and floodplain areas.
- Improve connectivity to Goose Creek and off channel habitat.

Conservation target: native turtles

Short-term goals 2012-2016

- Continue to provide habitats found at River Island Natural Area, including basking, feeding, overwintering and nesting habitats.
- Increase the number and dispersion of suitable nesting areas. Increasing dispersion may reduce nest predation and other destruction.
- Retain habitat for beavers that in turn provide impoundments and down wood used by turtles.

Long-term goal

The long-term desired future condition is to maintain conditions that will support a viable population of native turtles by having all key ecological attributes functioning at good to very good levels.

Key ecological attributes outside normal range of variation

- *Availability of basking sites:* We suspect there are insufficient basking sites and structures
- *Upland forest condition:* Duff in upland forests lacking; needed for overwintering and aestivating pond turtles
- *Availability and dispersion of nesting habitat:* Provide multiple, dispersed nesting areas.

Critical threats that are considered very high and high

- *Nest and hatchling protection: Any concentration of nests due to limited nesting habitat makes them more vulnerable to predation or destruction by other means. Juvenile turtles require shallow, warm water with ample vegetation for feeding and hiding; this may be limited at River Island.*
- *Nest site disturbance and disturbance of basking and feeding turtles:* unauthorized uses, like hunting and dogs, cause additional stress on turtles.

Strategic restoration and stewardship actions

- Assess turtle presence and quality of habitat at River Island Natural Area and adjacent lands. This work is under way as of spring 2014. This information will be incorporated in restoration project planning and design.
- Restoration actions identified in upland forest, riparian forest and native fish can also help to improve habitat for native turtles. The following actions should be incorporated into all restoration projects.
    - Maintain open areas and gaps in vegetation of forested areas when planting native trees and shrubs.
    - Install exclusion fencing or other measures prior to turtle nesting (May) when work must occur in nesting habitat.
    - Monitor turtle activity during restoration project work. Secure permits and arrange for rescue and relocation of turtles and other wildlife as needed when construction or other work involving heavy equipment, dewatering and other relevant action occurs.

- Install new and maintain existing basking logs or structures.
- Create and maintain additional nesting areas with suitable privacy from human disturbance.

5.2 Prioritizing strategic restoration and stewardship actions

It is important to prioritize restoration and stewardship activities for several reasons. Budgetary or time constraints are likely to limit how much work can be accomplished at a given site. Specific actions may rise to the top due to the scarce or unique nature of a habitat type or because abating a certain threat now will save time and money in the future. Table 4 assigns priority rankings to key actions; this does not mean that the other actions are not important, simply that they are not the most important actions within the next 3-5 years.

Table 4: Priority status for River Island Natural Are conservation targets

Conservation target	Priority
Savanna	Medium
Riparian forest	High
Mixed conifer hardwood forest	Low
Native fish	High
Native turtle	High

5.3 Ongoing stewardship and restoration programs

The following actions represent ongoing systems or programs that are in place and practices that will be continued and/or enhanced. These actions align with maintaining the conservation targets in good or very good condition.

Stewardship

Metro's Natural Areas Program is committed to long-term stewardship of River Island Natural Area. Metro staff will conduct multiple site walks of the site per year to monitor natural resource condition and public use of the natural area. As determined necessary by staff, specific treatments or actions will be implemented to ensure that the health and condition of the natural area is maintained. Some periodic stewardship actions that are implemented by Metro staff include visits to monitor for illegal use of the site, clean-up of illegal dumping, invasive species management, mowing of buffer and roadside areas for fire safety, replacing signage and response to complaints. Table 5 describes high and medium priority maintenance action at the site. Additional details about the stewardship of the site can be found in the River Island Stewardship Plan.

Table 5: High and medium priority stewardship actions

Activity	Frequency/Duration	Priority
Site walk	4 times per year	High
EDRR (weed invasion treatments)	Every 1-3 years	High
Culvert and road inspections	1 time per year	Medium
Property line encroachments	1 time per year	Medium
Entry/rule sign inspection	2 times per year	Medium
Building maintenance and repair	4 times per year	Medium
Gates and fence inspection	4 times per year	High

Invasive species management

Invasive plant species can impact the habitat values for which land is conserved. Natural lands are not fully protected unless they also are managed for the features that first motivated preservation. Invasive species can change community structure, composition and ecosystem processes on these lands in ways that may not be anticipated or desirable. Careful management can minimize these negative impacts. Metro has initiated an early detection and rapid response program for invasive species including false brome, meadow knapweed and garlic mustard, which have been documented in the area. Invasive species will be controlled by hand pulling or herbicide application as they are detected in the natural area. Other invasive plant species will be controlled as part of restoration projects or ongoing natural area maintenance. See Appendix C.4 for a list of invasive species.

Wildfire response plan

Within the life of this plan Metro will develop a wildfire response plan For the River Island Natural Area. The plan will identify on-site fire suppression resources and concerns, key Metro staff, responding agencies, partners and additional contacts, and adjacent landowner contacts. Ensuring that a wildfire on the natural area does not impinge on adjacent private property is of the highest priority. Additional details about wildfire planning can be found by inquiring at Metro.

5.4 Long-term strategies

The following actions may be necessary to achieve the long-term goals of this site conservation plan.

- Commercial thin in the mixed conifer deciduous forests habitat areas.
- Acquisition of fee title or conservation easements of adjoining private lands adjacent to expand riparian forest and oak savanna habitat areas. Provide information as necessary to adjoining landowners about Metro's willing land owner acquisition process.
- Removal or relocation of maintenance roads and the home site.

SECTION 6: VISITOR EXPERIENCE

6.1 Existing site use by public

Presently, public access to River Island Natural Area is neither discouraged nor actively promoted by Metro. People have been recreating informally on the site since the time it was purchased. Public access has been primarily isolated to the existing road networks. At this time, the use of the existing road network by the public is relatively light. There are no signs or trail maps to assist in wayfinding within River Island Natural Area.

- Illegal activities – The property has had past issues with illegal activities such as hunting and dog walking.
- Primary maintenance road - A concern for existing public use is the continual erosion of the left bank of the Clackamas River. The existing site access road ends abruptly at the eroded bank and may pose a risk for either vehicles or pedestrians accessing the site.
- Visitor parking along Eden Road - On street parking causing possible unsafe conditions for both visitors stepping out of vehicles along street, and issues with sightlines for neighbors pulling out of their driveways.
- Secondary maintenance road to Oak Savanna – Road has been damaged by flooding and erosion and is currently limiting access by maintenance vehicles to this area. The maintenance road is currently also a primary route for informal public access to this area.

During a future comprehensive planning process, thoughtful consideration will go in to the balance of access and conservation of the natural resource area. Some of the potential opportunities/constraints that will be discussed include the natural area experience, environmental education and stewardship, local recreational demand, resource impacts, patch fragmentation, wildlife corridor disruption, public right-of-way access, land use and development permit requirements, long term operations and maintenance, as well as capital development and maintenance funding.

Map 10 illustrates current access to the River Island site.

6.2 Programmatic (education and volunteers)

Metro's regional parks and natural areas were created to intentionally give residents within our region opportunities to enjoy, experience, participate in, and understand the natural world. Conservation education staff at Metro work with schools, civic organizations and the general public to provide nature programs that thoughtfully connect people to Metro's parks and natural areas. Schools and civic groups who are interested in programs contact Metro to request a program. Public walks are advertised in Metro's quarterly "Big Backyard" publication. Information about conservation education programming is also available on Metro's website, www.oregonmetro.gov.

Education program

Currently River Island Natural Area is utilized two to three times per year for nature walks that are open to the public. The themes that have encompassed these programs have included salmon lifecycles, mushrooms, bird identification, prairie ecology and open house tours to showcase Metro's natural areas program. From an education perspective, River Island Natural Area's unique natural and cultural history holds strong potential for education programming. Metro has no plans for significant expansion of River Island Natural Area as an educational site beyond its current usage.

Volunteer program

The primary goal of the volunteer program is to provide a variety of high-quality, meaningful volunteer opportunities that add value and capacity to Metro's work. Through these opportunities, community members are able to learn about and enjoy River Island Natural Area, work alongside fellow community members, learn new skills or polish existing ones and gain the satisfaction of contributing to the long-term health and livability of their communities.

Wildlife monitoring volunteers

Metro's volunteer wildlife monitoring program provides valuable information about Metro's natural areas while offering a unique and in-depth service opportunity for community members. By focusing on indicator species, such as amphibians and birds, volunteers provide data to help Metro's science and stewardship team gauge the progress of its restoration efforts and track the effects of public use on wildlife.

Native Plant Center volunteers

Metro's Native Plant Center, located near Wanker's Corner in Tualatin, provides an important supply of rare locally adapted native seeds and plant stock to support Metro's natural area restoration projects. Staff and volunteers collect, grow and distribute native species for planting at restoration sites throughout the region.

Restoration volunteers

The restoration volunteer program focuses on providing groups of all kinds the opportunity to contribute to the health and vitality of our parks, natural areas and cemeteries. Primarily involving a short-term commitment of one day, restoration volunteers experience an engaging, hands-on learning opportunity with immediate, tangible results.

Volunteer site stewards

The natural area site steward volunteer program enhances Metro's parks and natural areas for community members and creates healthy habitat for fish and wildlife through active monitoring of site conditions and use by both people and wildlife, and personal and group restoration, stewardship and educational activities. The steward program provides opportunities for committed volunteers to take an active, leadership role in Metro's natural areas. The steward engages in hands-on small restoration projects for the site as well as monthly monitoring. Stewards can take on crew leader roles with volunteer groups for restoration educational projects at the site.

Youth Ecology Corps

Metro's Youth Ecology Corps (YEC) is a parks and natural areas levy funded program to provide job readiness training, on-the-ground conservation work experience and environmental education to teens who are disconnected from school and/or the workforce. This program is run in partnership with Mount Hood Community College's Project YESS program. YEC participants support the stabilization, restoration and maintenance of Metro's parks and natural areas while learning about stewardship through hands on work projects.

6.3 Site management

Metro's management of the site will include enforcement of the posted rules to provide protection for wildlife and water quality, and to protect the safety and enjoyment of any person visiting these facilities.

Special use permits

Special use permits are required for certain regulated and non-traditional uses of parks and natural areas to ensure public health and safety and to protect natural resources, properties and facilities owned or managed by Metro. Special use permits are required for commercial film, video or photography; educational activities or educational events; festivals and organized sports activities; use of amplified sound; equipment or other elements posing a safety threat or public nuisance; concession services; site restoration or alteration, biological research, scientific collection (soil, wildlife or vegetation disturbance of any kind); any organized activity, event or gathering involving 25 or more people.

Archeological resources

River Island Natural Area is steeped in history and may contain archeological resources. In 2014, a Cultural Resources Study for the River Island Natural Area was completed by Historical Research Associates. For an in depth description of the historical context of the River Island Natural Area, see Appendix A.

If an archaeological resource is discovered during any site investigation, alteration or improvement, Metro will work with the State Historic Preservation Office to sensitively address the find. If any damage or unlawful use is identified, Metro would also partner with the Clackamas County Sheriff to investigate.

Dogs

One of the most difficult management issues for public access is the introduction of dogs by visitors. Research shows that even if dogs stay on the trails, they are perceived as predators by wildlife. The zone of influence of a dog, even on leash, can be several hundred feet on either side of a trail. Because of the potential disturbance to wildlife and wildlife habitat, dogs are not allowed within River Island Natural Area. Educational signage, self-policing and strict enforcement are all needed to effectively manage this sensitive issue.

Signage

As part of the integration of people into a natural area the need for regulatory, wayfinding and interpretive signage becomes necessary. The development of a signage plan for River Island Natural Area would be part of the future comprehensive plan and subsequent design/development process. Typically, interpretive themes are identified during the planning effort and those themes are further vetted during design/development. Wayfinding and regulatory signage is developed once the trail network is finalized. As aspects of the comprehensive plan are implemented, i.e., formalized access points, new trails, gates, etc., signage would be added to help inform and orient the visitor.

6.4 Strategic actions

No immediate actions are proposed for this phase of the project. Existing site signage and infrastructure will be maintained as necessary. Issues identified in section 6.1 will be addressed either through current maintenance practices and enforcement or through a future comprehensive planning process.

6.5 Beyond five years or as needed

In the future there may be increased demand to access and recreate at River Island Natural Area. Future access improvements will need a more in-depth analysis of opportunities and constraints for trails and public access, including meetings with neighbors and the public and developing a detailed trails master plan. This is likely to be initiated within 5-10 years.

SECTION 7: COORDINATION

The conservation plan has laid out the history and context of River Island Natural Area conservation for the next five years. For those projects to be realized, coordination will be needed on a number of fronts. Important coordination points include:

- Monitoring restoration efforts to track effectiveness and make changes to the priorities and goals as needed.
- Coordinating with neighbors and local stakeholders to implement projects.
- Funding to realize the strategic restoration and access actions identified in this plan.

7.1 Monitoring framework

Monitoring at the River Island Natural Area is an integral part of an adaptive management approach to restoration and stewardship. Monitoring will be done to evaluate habitat, population responses to management action, as well as progress toward achieving habitat and population objectives.

The monitoring strategy is based on threats and key ecological attributes associated with conservation targets. Generally the greatest threats to River Island Natural Area are traced to:

- Increased competition by invasive plant species
- Altered fire regime
- Altered vegetation structure
- Human disturbance (historical and on-going)
- Altered hydrology

Monitoring addresses threats directly and indirectly, by tracking changes in certain ecological attributes. It implements techniques that are well-established and continues many monitoring efforts already in place. Recent and current monitoring activities have included remote sensing/GIS, amphibian and avian breeding season surveys, and monitoring the success of revegetation efforts. The monitoring plan is likely to change over time, including monitoring of key ecological attributes.

Monitoring techniques

Some monitoring techniques are used to monitor more than one conservation target. This discussion is intended to provide a general introduction but not detailed methods.

Remote sensing/GIS

Several metrics for health of conservation targets relate to canopy cover and size of a habitat. Where a desired condition is a minimum canopy cover, it can be estimated with GIS software using current aerial photography. Similarly, important connections within the natural area and to off-site habitat can be inspected with aerial photographs.

Transects

These are lines or strips of ground along which measurements are made of plant species presence or absence. Permanent transects can be installed and tracked over the years to track progress toward goals. They are useful in tracking the cover and composition of native plants and invasive species in prairie and Oregon white oak savanna habitat areas.

Avian point counts

Avian (bird) surveys during breeding season follow an established and widely used protocol that allows data sharing with other scientists. By tracking changes in the bird community, Metro can detect changes in habitat function as restoration projects mature. The species present can indicate if a suitable habitat for sensitive species is present.

Pond-breeding amphibian surveys

Four species of pond breeding amphibians (Northern red-legged frog, Pacific chorus frog, Northwestern salamander, and Long-toed salamander) are tracked using a visual encounter survey of oviposited egg masses. These surveys are conducted within assigned wetland units. Surveys for two of the target species use search time to measure density, i.e. masses identified per search hour.

Ocular estimates

Ocular (visual) estimates can be used to determine the presence or absence of a species within a short timeline and at a very low cost. This method of monitoring is typically used to determine intervals for treatments or success of a planting.

Photos

Permanent photo points are established to provide long term documentation of changes to habitats over time. Typically photo points are marked by a permanent landscape feature or metal stakes and photos are taken at a landscape scale over long term periods of time.

Conservation targets and monitoring techniques

Oak savanna

A combination of transects, avian point counts and GIS work will be used to monitor key ecological attributes of this conservation target. Avian point counts will be focused on the oak savanna habitat areas.

Riparian forest

A combination of photo points, GIS work and ocular estimates of plant and wildlife species will be used to monitor key ecological attributes of this conservation target.

Mixed conifer hardwood forest

A combination of photo points and ocular estimates of plant and wildlife species will be used to monitor key ecological attributes of this conservation target.

Native fish

Metro will collaborate with the Oregon Department of Fish and Wildlife to provide monitoring data for this conservation target. Monitoring is part of their annual stream survey of the Clackamas River and is subject to staff availability and allocation of resources in annual budgets.

Native turtle

Metro will collaborate with the Oregon Department of Fish and Wildlife to monitoring this conservation target. Monitoring will include annual or bi-annual survey for presence or absence of turtles at River Island Natural Area. Monitoring will also be necessary for any project work within 1600 feet of any know turtle habitat.

7.2 Funding

Costs in Tables 6 are general estimates for the purpose of understanding the magnitude of costs to implement the structural elements of the plan, as described in Sections 4 and 5 of this conservation plan. The costs are estimated on hiring contractors to complete the work and include a construction contingency for time and materials. In addition to these project implementation costs we have included staff time and annual stewardship costs for River Island Natural Area in Table 7.

Table 6: Conservation target strategic restoration action cost estimates

Strategic action	Cost
Savanna	
Invasive species treatments	$15,000
Selectively thin pine trees	$7,500
Develop restoration plan	$25,000
Riparian forest	
Plant native tree and shrubs + invasive species treatments	$330,000
Upland forest	
Plant native tree and shrubs + invasive species treatments	$65,000
Restore compacted soils at old home sites, roads and mining sites	$15,000
Native Fish	
Implement prioritized stream restoration actions. Possible actions may including: removal of dikes, placement of larger wood and improving connectivity to Goose Creek.	$5,000,000 to $7,000,000
Native Turtles	
Study presence and quality of habitat	$1,500
Install and maintain turtle basking structures and logs	$25,000
Total	**$5,484,000 to $7,484,000**

Table 7: Annual stewardship cost estimates

Annual stewardship	Cost
Mowing in Savanna habitat area	$1,500
Mowing of roadside vegetation and treatment of invasive weeds	$500
EDRR surveys and invasive weed treatments (entire site)	$2,500
Maintenance of existing Infrastructure (roads, gates, and signs)	$2,000
Total (per year cost)`	**$6,500**

7.3 Public involvement

As restoration and maintenance projects are developed and the comprehensive plan process is initiated, Metro will provide local stakeholders and residents near River Island Natural Area with pertinent information about the work before it is implemented. Project information may include background on the project, timing, cost, materials types and other information as necessary for the public to be aware of the project and its implications.

MAPS

Map 1 – Vicinity Map

Map 2 – Site Map

Map 3 – Topography

Map 4 – Soils

Map 5 – Hydrology

Map 6 - Historic Vegetation

Map 7- Current Cover

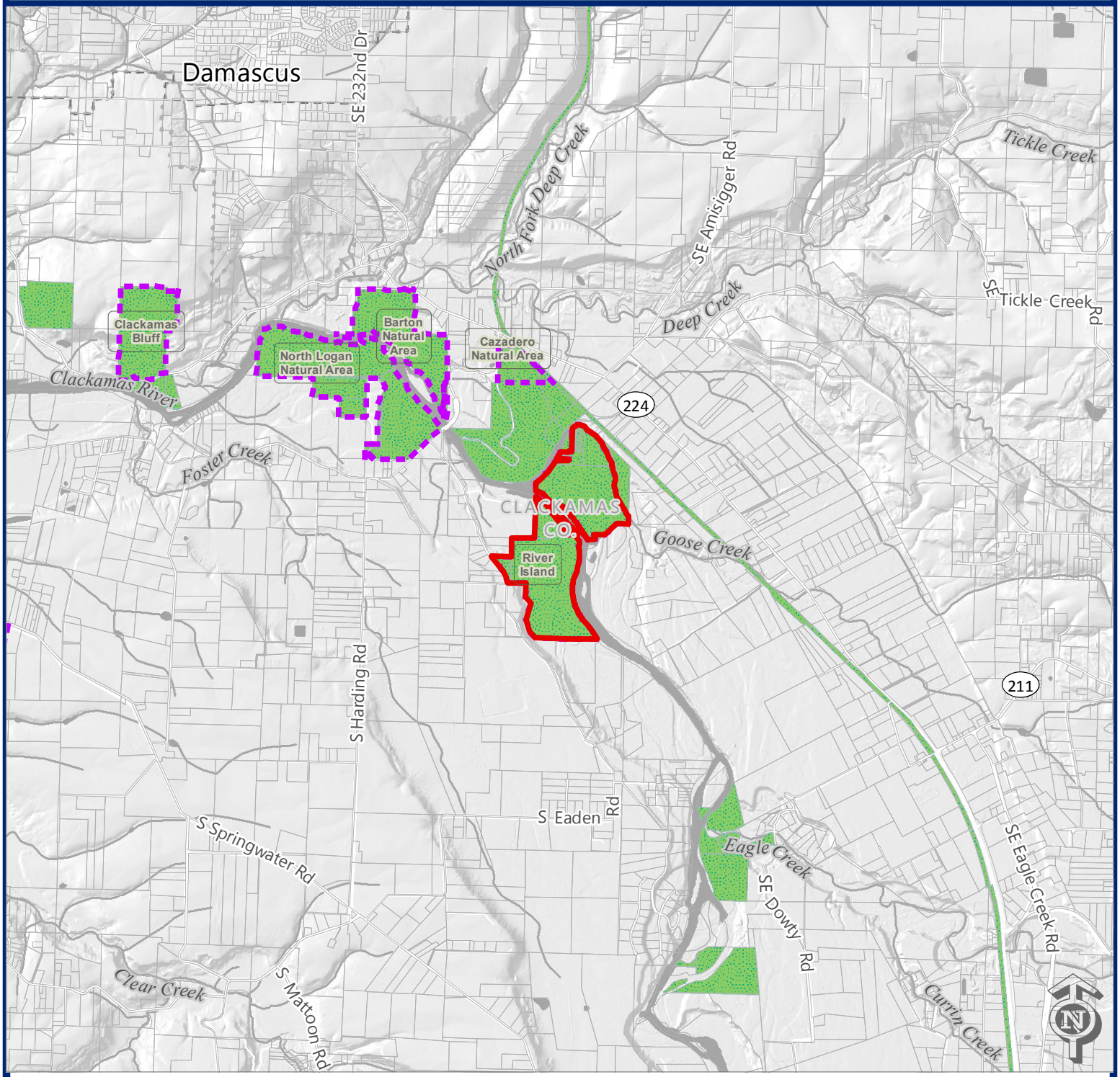
Map 8 - Conservation Targets

Map 9 - Management Status

Map 10 - Access

Vicinity Map

Map 1

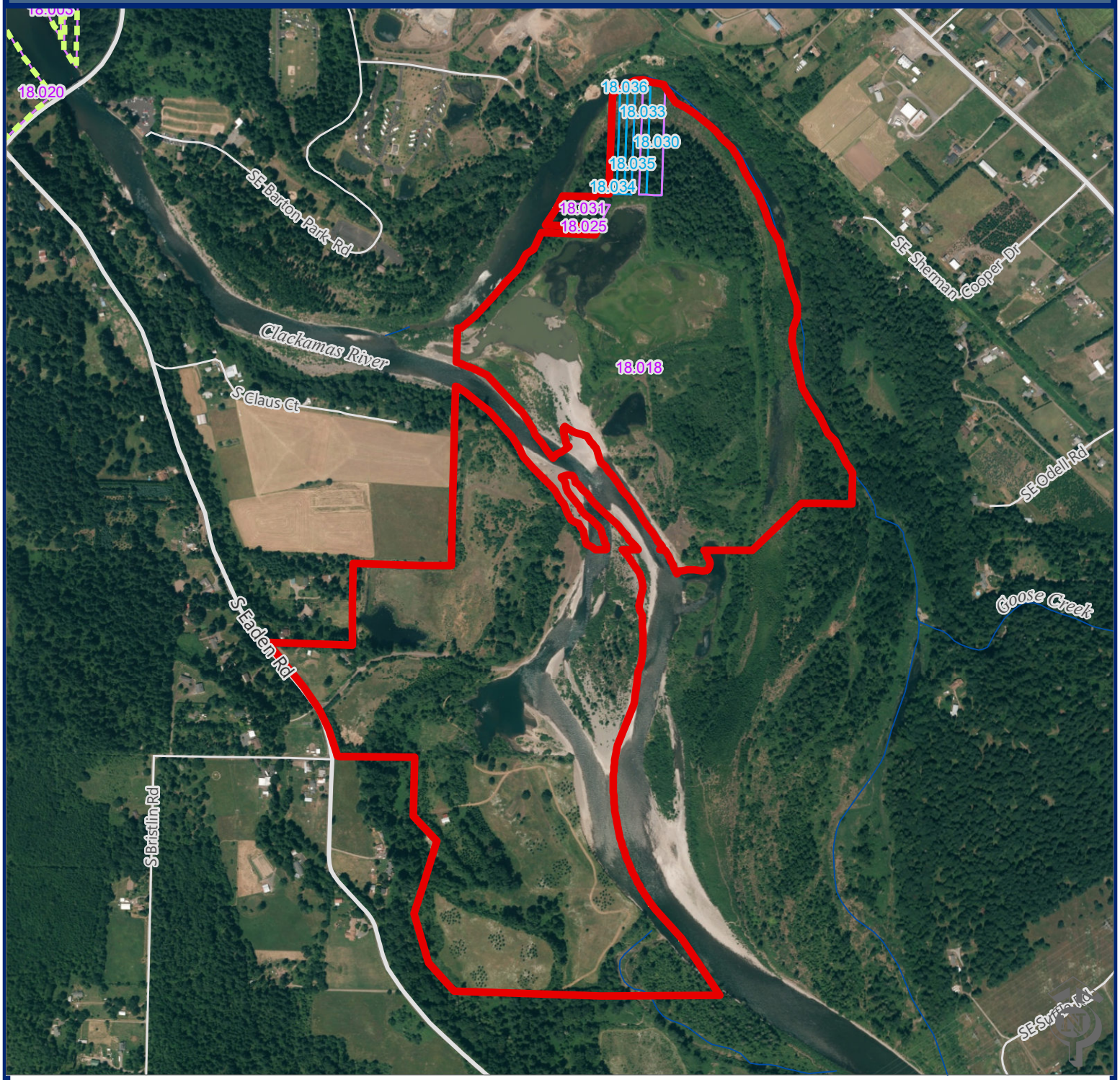


River Island Site Conservation Plan

map date: 3/7/2014

Site Map

Map 2



River Island Natural Area

Other Metro sites

Bond Measure

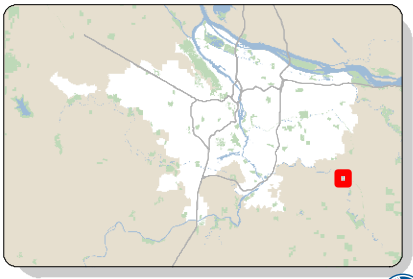
1995 Bond Measure

2006 Bond Measure

Streams

Intermittent stream

Perennial stream



0 1,500 3,000 Feet

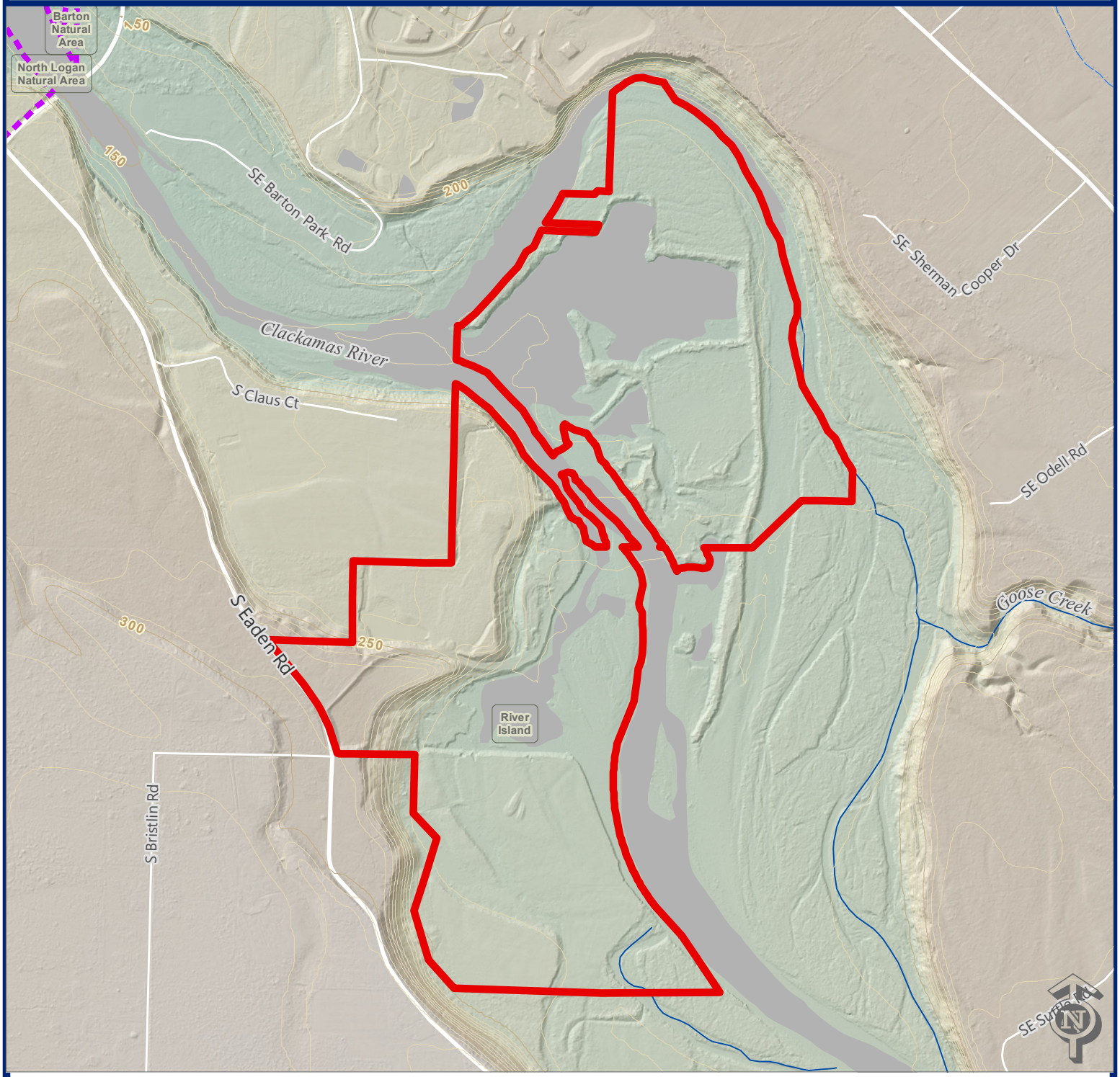
Metro

River Island Site Conservation Plan

map date: 3/7/2014

Topography

MAP 3



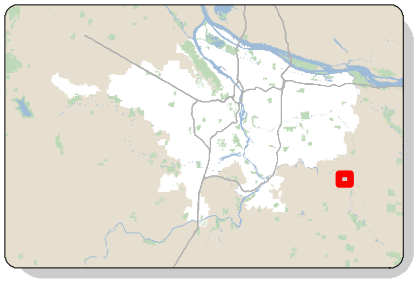
River Island Natural Area

Metro sites

Streams

Intermittent stream

Perennial stream



0 1,500 3,000 Feet

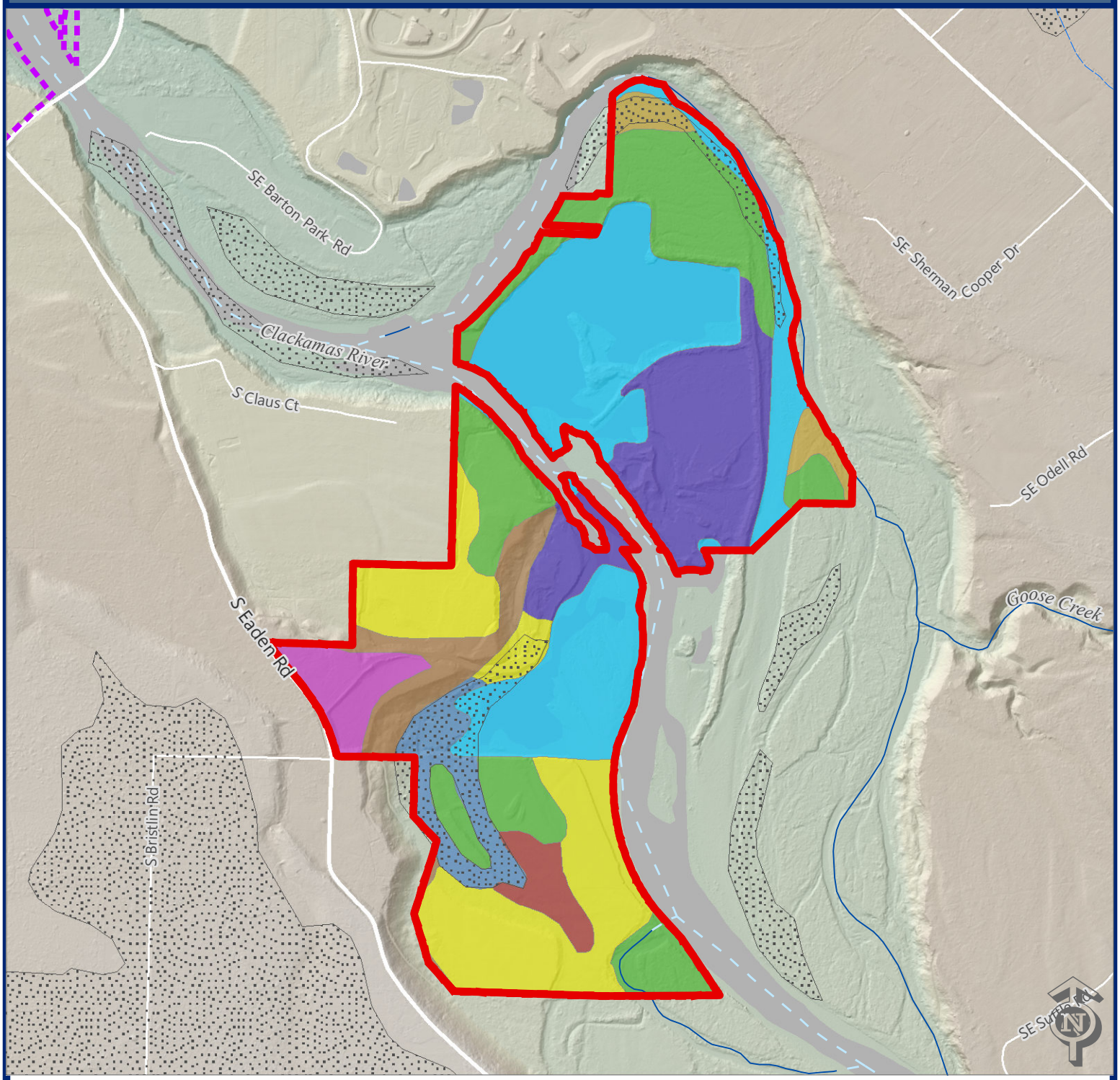
Metro

River Island Site Conservation Plan

map date: 3/7/2014

Soils

Map 4



River Island Natural Area

Other Metro sites

Hydric soils

Site soils

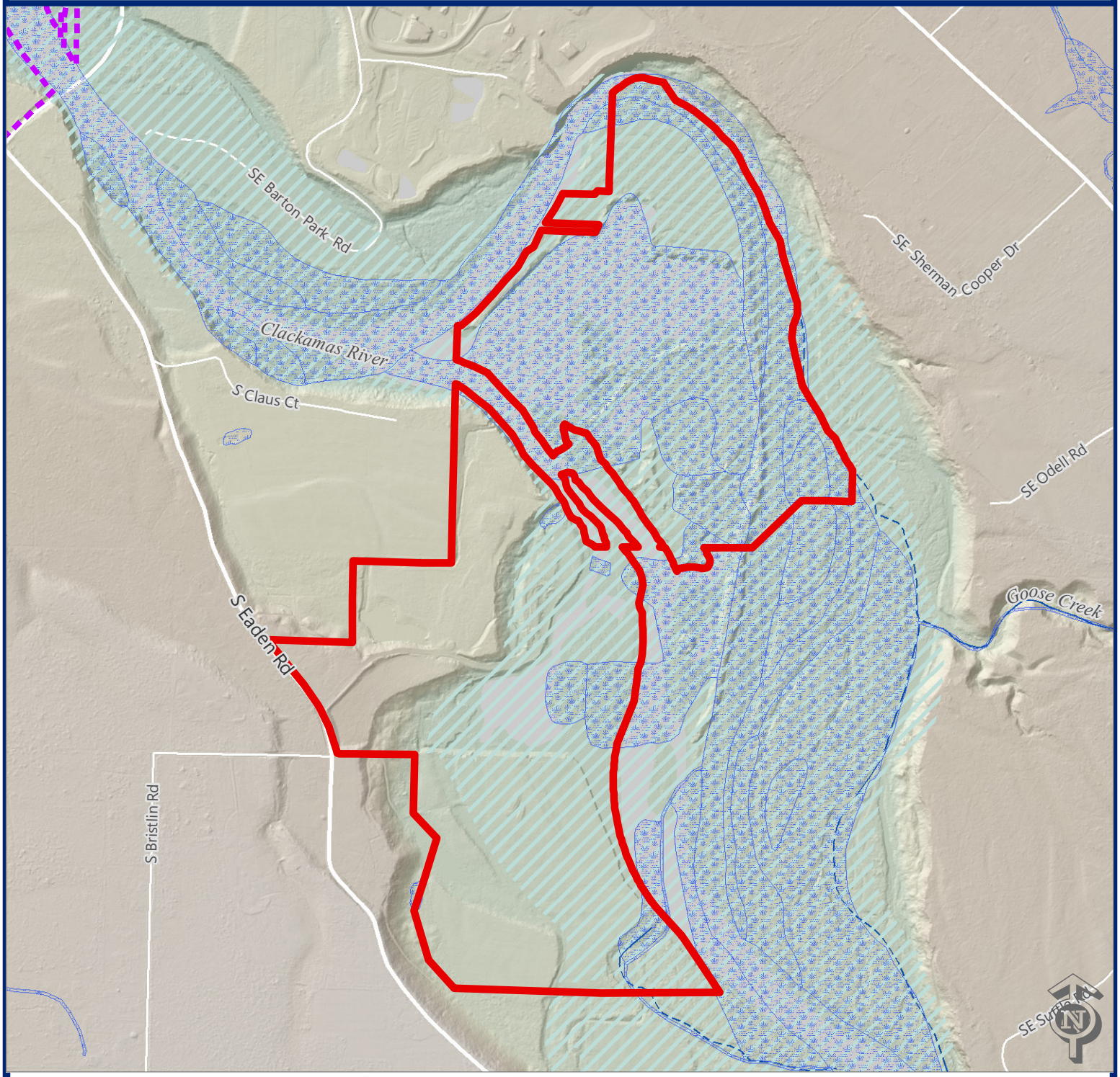
- Camas gravelly sandy loam
- Cloquato silt loam
- Newberg loam
- Pits
- Riverwash
- Wapato silty clay loam
- Water
- Woodburn silt loam, 3 to 8 percent slopes
- Xerochrepts and Haploxerolls, very steep

0 1,500 3,000 Feet

Metro

Hydrology

Map 5



River Island Natural ares

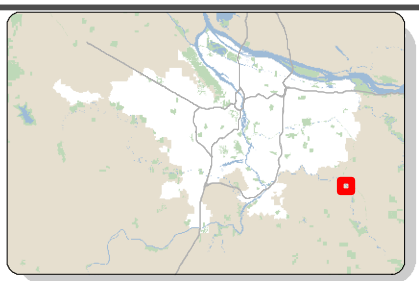
Other Metro sites

Wetlands100 year floodplain

Streams

Intermittent stream

Perennial stream



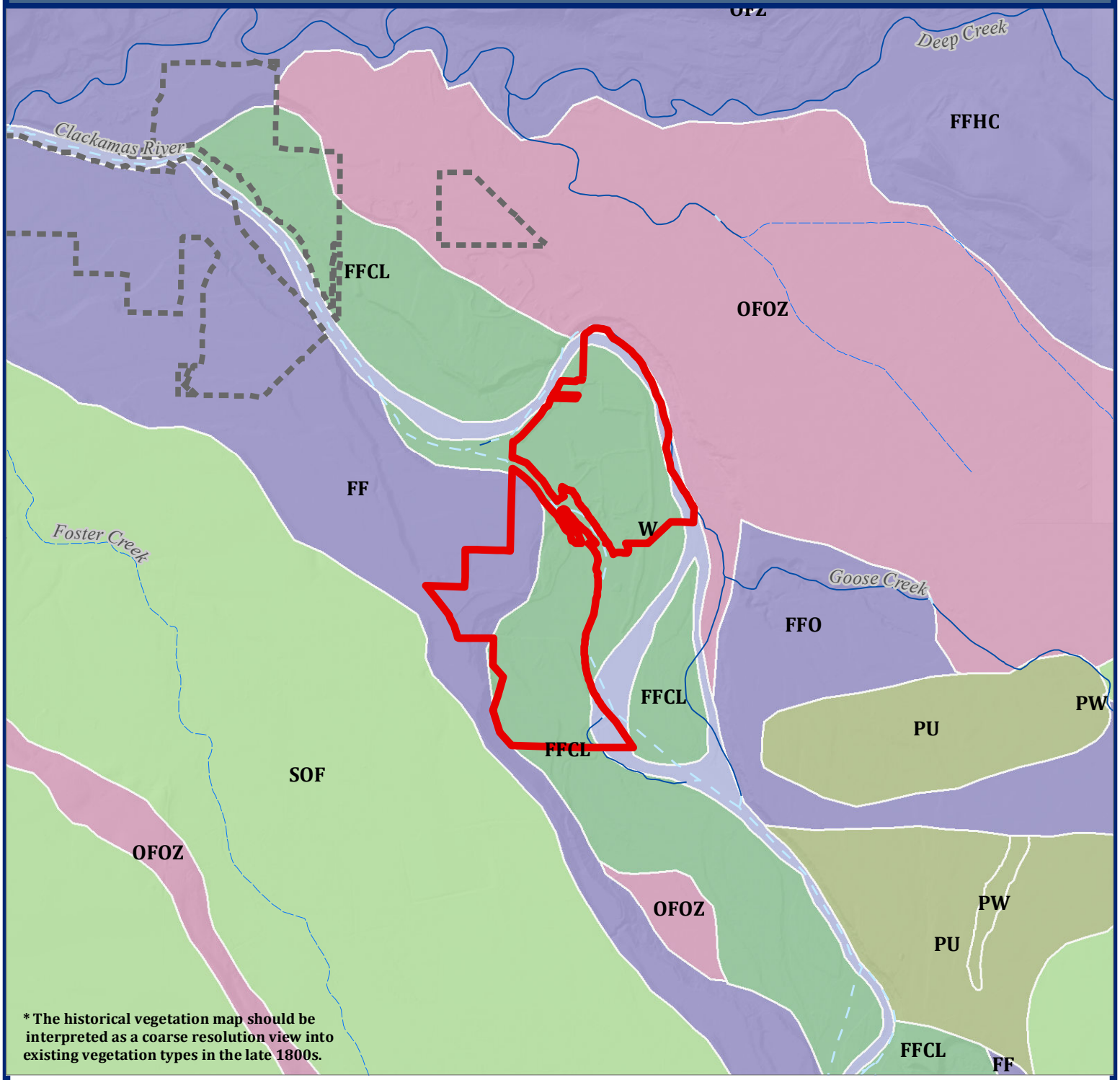
0 1,500 3,000 Feet

Metro

River Island Site Conservation Plan

map date: 3/7/2014

Historical Vegetation (1851-1910) Map 6



River Island Natural Area

Other Metro sites

Historical vegetation

- Closed forest; Riparian & Wetland (FFCL)
- Closed forest; Upland (FF)
- Prairie (PW and PU)
- Savanna (SOF)
- Water
- Woodland (OFOZ)

*** Labels refer to vegetation subclasses. Detailed descriptions can be found in T:\OBMO\GIS\DATA_V\vegetation\Historical**

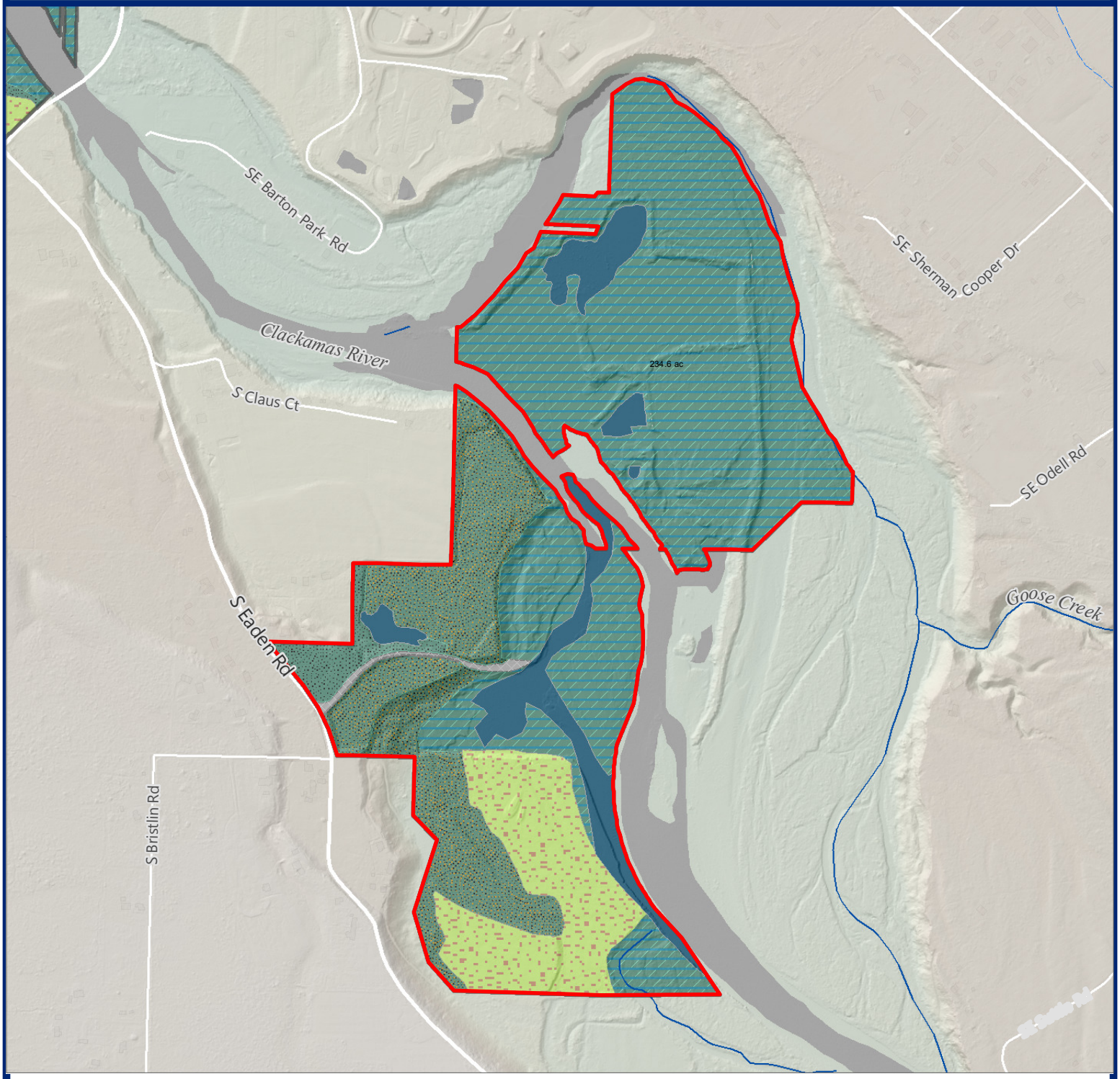
0 2,000 4,000 Feet

Metro

map date: 3/7/2014

Current Cover

Map 7



River Island Natural Area

Other Metro sites

Current cover

Developed - (pervious/non ag)

Open water

Riparian forest

Savanna - oak

Upland forest - coniferous

Upland forest - mixed

N

0 1,100 2,200 Feet

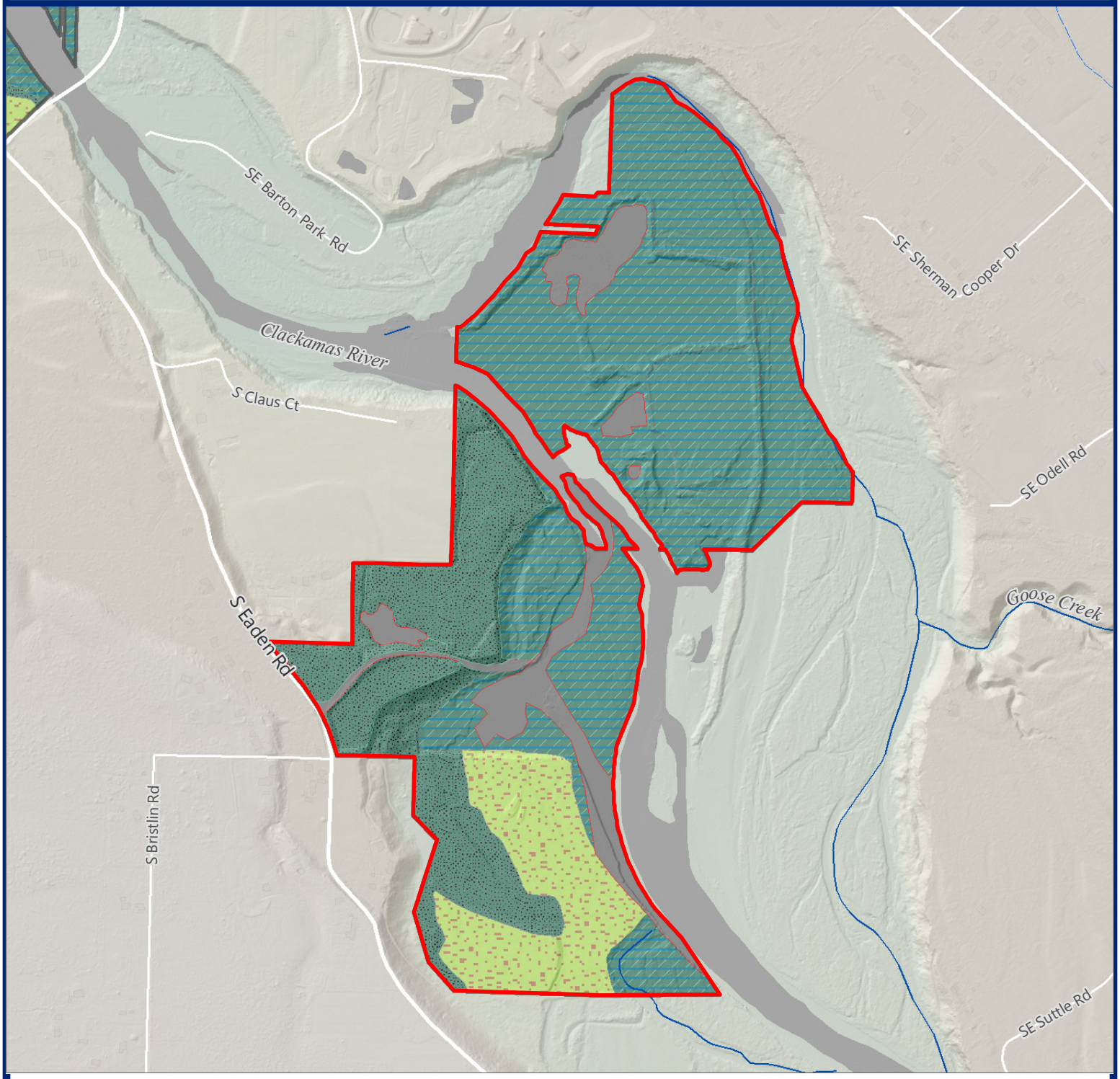
Metro

River Island Site Conservation Plan

map date: 4/22/2014

Conservation Targets

Map 8



River Island Natural Area

Other Metro sites

Conservation targets

- No targets
- Oak savanna
- Riparian forest
- Upland forest

Streams

- Intermittent stream
- Perennial stream

N

0 1,100 2,200 Feet

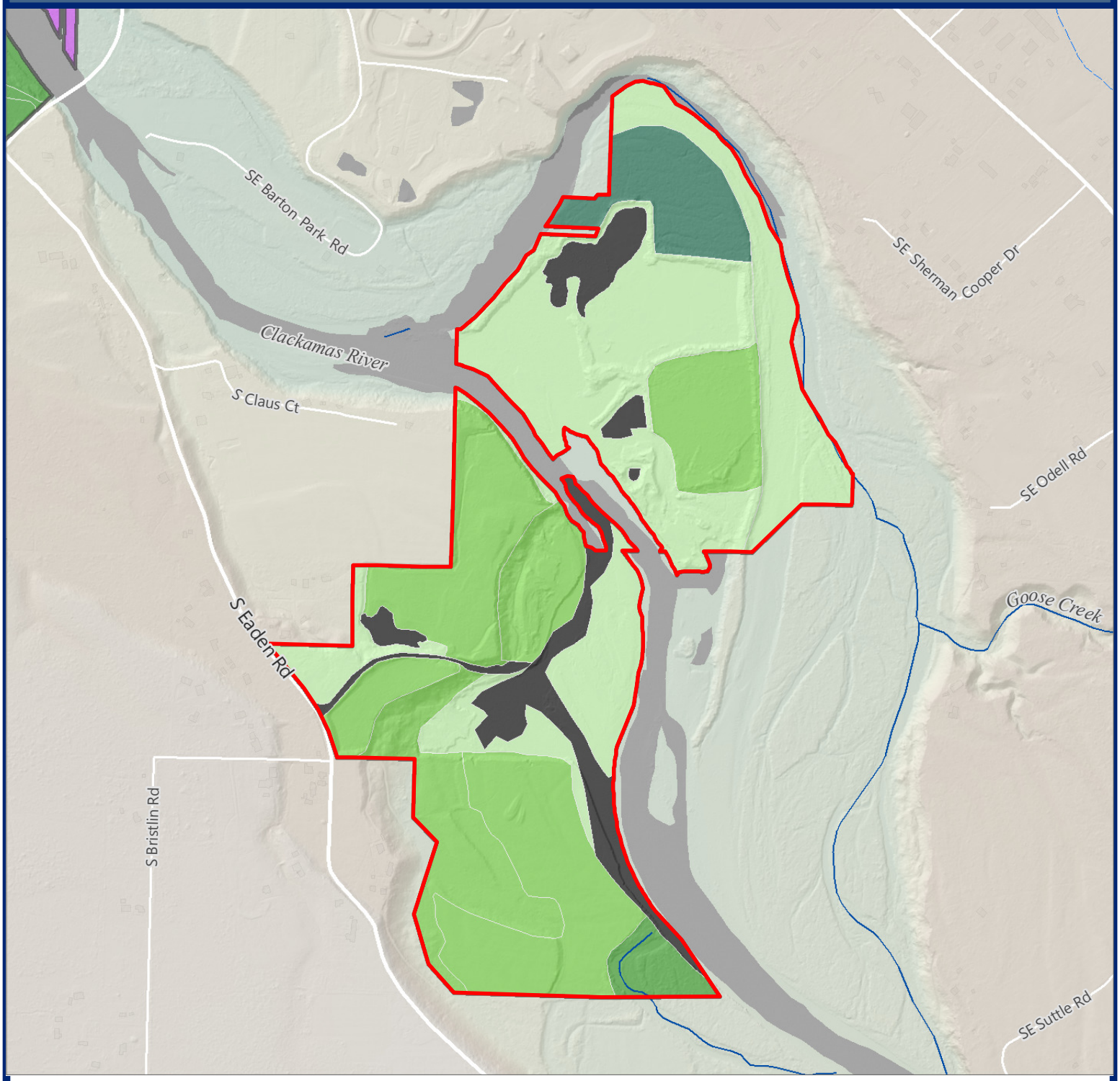
Metro

River Island Site Conservation Plan

map date: 4/22/2014

Management Status

Map 9



River Island Natural Area

Other Metro sites

Management status

- Yet to be classified
- 1 - Initiation
- 2 - Establishment
- 3 - Consolidation
- 4 - Refinement and long-term maintenance
- 9 - No targets (developed)

Streams

- Intermittent stream
- Perennial stream

0 1,100 2,200 Feet

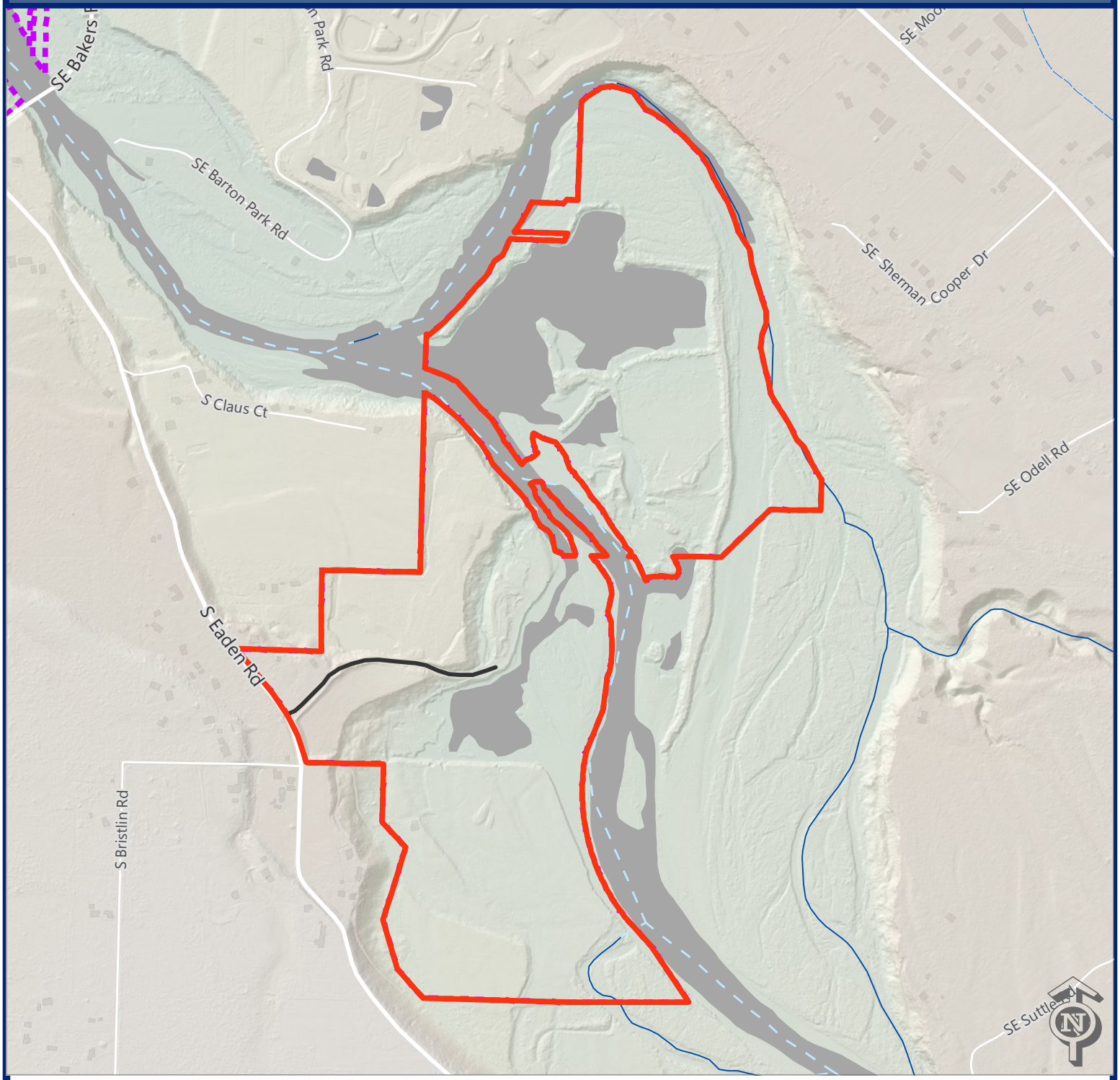
Metro

River Island Site Conservation Plan

map date: 4/22/2014

Access

Map 10



River Island Natural Area

Other Metro sites

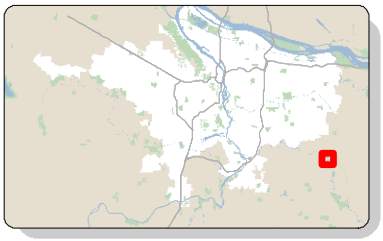
Maintenance road

Streams

Intermittent stream

Perennial stream

Artificial path



0 1,500 3,000 Feet

Metro

River Island Site Conservation Plan

map date: 3/24/2014

APPENDICES

Appendix A – Historical context

Appendix B – Physical environment

Appendix C – Conservation

- C.1 Conservation targets
- C.2 Key ecological attributes
- C.3 Threats and sources
- C.4 Invasive species

Appendix D – References and additional resources

APPENDIX A | HISTORICAL CONTEXT

The following summary is based on Cultural Resources Study for the River Island Natural Area which was completed for Metro by Historical Research Associates in January of 2014.

Native peoples

Archaeological sites that have been discovered in the vicinity of the River Island Natural Area reflect familiarity with and exploitation of the seasonally-available vegetal and faunal resources that were located in the local and regional microenvironments. Sites have been found that date from the early Holocene through to the period of Native American contact with early Euroamerican explorers and pioneers.

Prehistory in the Willamette Valley and the Portland Basin is usually divided into the late Pleistocene and Holocene epochs, with the Holocene subdivided into early, middle, and late periods. Evidence of late Pleistocene (pre-10,000 radiocarbon years before present [RCYBP]) occupation in the Pacific Northwest is suggested by archaeological finds in Washington (Gustafson 1979; Kopperl et al. 2010) and central Oregon (Jenkins et al. 2012). However, there is little evidence of late Pleistocene use of the Willamette Valley or the Portland Basin (Connolly 1994). Researchers have argued that the Burnett Site, located to the west of River Island in the town of Lake Oswego, may date to the late Pleistocene based on the presence of a potentially older style of projectile point (Burnett 1991; Hamilton and Roulette 2005). However, no radiometric dates were acquired from the site and many of the artifacts recovered were more consistent with Holocene-aged typologies.

The early Holocene, dating from approximately 10,000 to 6,700 radiocarbon years before present (RCYBP), is characterized by broad-based hunting with a secondary emphasis on gathering (Minor et al. 1982). Early Holocene sites have been found in the foothills of the Cascade and Coast ranges, at the Willamette Valley edge, and on the Willamette Valley floor, which suggests that groups of this period were familiar with and utilized a variety of environments. The archaeological record within the Clackamas River basin suggests that small bands of people gathered resources over a broad area during the early Holocene (Burtchard et al. 1993).

The middle Holocene period (6,700 to 3,400 RCYBP) represents a time of expansion and intensification of subsistence technologies that had already been in place from the early Holocene period (Minor et al. 1982). Burtchard et al. (1993:18) suggest that this period was a time of increased mass-food processing, reliance on storable foods, and decreased mobility. Recurrent use of resource protraction areas and multiple activity locations became more common. Archaeological sites throughout the lowlands and uplands of the Cascade foothills have been found that date to this period.

The climate in the late Holocene period (3,400 RCYBP –present) remained much as it had been during the middle Holocene, as it has continued to the present. As a result, settlement and subsistence patterns did not change significantly. However, there is evidence to suggest that there was an increased focus and reliance on camas during this period, coinciding with significant population growth.

Accounts by early Euroamerican explorers, researchers, and ethnographers documenting the lifeways of Native Americans living in the vicinity of the River Island Natural Area indicate that it lies within the traditional territory of the Clackamas, a Chinookan-speaking tribe who lived on the Willamette River near Willamette Falls, along the Clackamas River, and on nearby tributary streams (Ruby and Brown 1992; Silverstein 1990). Willamette Falls was a major gathering point for the Clackamas peoples, especially during the spring and summer salmon runs. Fish were an important resource year-round, and numerous villages were positioned along major waterways to take advantage of their natural abundance. Winter villages were composed of multiple cedar-plank houses. Temporary summer housing was established at resource gathering locations, such as seed, nut, and berry harvesting areas in the uplands. Gathering in the swampy lowlands within the Columbia Basin provided wapato, a starchy root crop that was a subsistence staple (Coues 1893). Camas was also collected and processed (Drucker n.d.). The Clackamas hunted in the woods and uplands surrounding the Portland Basin, acquiring elk, deer, bear, squirrels, raccoons, beavers, otters, rabbits, and other small and large game.

A number of villages have been reported in the vicinity of Willamette Falls, and at least two village sites have been reported on the Clackamas River upstream from its confluence with the Willamette River. Historically, Clackamas “towns” were positioned as far upriver as Estacada (Drucker n.d.:18). At the time that the Clackamas were encountered by explorers and settlers, the tribe had been heavily impacted by catastrophic disease and acculturation by Euroamericans (Boyd 1990). By the 1850s, Reverend Henry Spalding estimated the number of Clackamas people in the area to be 50 or 60 (Spalding 1859:3). Some of the Indians who survived the epidemics were moved to reservations, while some intermarried with other surviving Native groups (Silverstein 1990:535).

Euroamerican History

The first encounters that Native populations of Clackamas County had with Europeans were in the early 1800s, when French and English fur traders began to explore the area (Clackamas County Planning and Economic Development Division 1988). Diseases to which Native Americans had no defense—small pox, measles, malaria, and influenza—decimated tribes in the Pacific Northwest during that time. In the 1820s, Ft. Vancouver was established in present day Vancouver, Washington, which served as headquarters for the Hudson’s Bay Company.

John McLoughlin, the Chief Factor there, founded Oregon City in 1829 at Willamette Falls in order to take advantage of the water power to run a lumber mill. Meanwhile, missionaries began to enter the area and, by the late 1830s, the first organized groups of settlers traveled to the area on what later became the Oregon Trail.

Burtchard and Keeler (1991:47), in their discussion of past human use of the Clackamas River area, suggested that in the forested uplands surrounding the Clackamas River three primary categories of historic land use occurred, including transient uses, commodity extraction, and human occupation. Transient uses included exploration and use of travel corridors and associated features. While no historic roads or trails were located within the River Island Natural Area , multiple historic roads were positioned nearby, both to the north and south (GLO 1855). One of the roads to the south of the River Island Natural Area was the Barlow Road, an overland route through the Cascade Mountains around Mount Hood (McArthur and McArthur 2003). Additionally, a rail line was built by Portland Water and Light Railroad in 1903–1904 that ran along the north side of the Clackamas River between the modern towns of Boring and Estacada. The line, called the Boring–Estacada Rail Line or the Springwater Line (Tasa et al. 2007), operated until the early 1930s when the trestle at Deep Creek burned down and the line was abandoned (McCamish 2004). Remnants of the rail line grade and trestles remain visible today near the River Island Natural Area (Tasa et al. 2007).

Burtchard and Keeler's (1991) commodity extraction land-use category included such enterprises as logging, grazing, and mining. Dams, fish hatcheries, springboard stumps, and gravel mining enterprises have all been found within or near the River Island Natural Area. Given that the area was historically vegetated by fir, cottonwood, and maple trees (GLO 1855), historic settlers in the vicinity logged large tracts of land to provide space for farming.

Burtchard and Keeler's (1991) land use category of human occupation in the timbered land along the Clackamas River included habitation locations. The River Island Natural Area is positioned within the historic land claims of Joseph Church (DLC 46) and Issac Lasswell (DLC 45) (GLO 1861). Joseph Church was a farmer and minister who travelled cross-country in 1846 to settle in Clackamas County (Rootsweb Contributors 2013). His property included the northern portion of the River Island Natural Area . Issac Lasswell was a farmer that owned the southern portion of the River Island Natural Area until the early 1860s (United States of America, Bureau of the Census 1860). Historic Metsker maps of the location indicate a series of different owners of the subject property after the time of initial settlement (Metsker 1928, 1937, 1951, 1966). Although no houses were depicted on the earliest maps of the location (GLO 1855, 1861), later maps depicted buildings on the terrace overlooking the Clackamas River to the east of the River Island Natural Area (USGS 1914, 1940), and land on both terraces and floodplain was likely farmed through much of the historic period.

River Island Natural Area Mining History

Mining and reclamation operations at River Island were conducted between 1963 and 1999. The compilation of the history of mining operations at River Island presented here is derived primarily from documents relating to environmental permitting that were produced by the mining company or by local, county, and state agencies. Parker-Northwest Paving Company (Parker-Northwest) (1999) detailed the history of the River Island mining operation from 1963 to 1999. A description of the early years of mining activities (from 1963 to 1982) were based on a 1982 letter from Bob Traverso of River Island Sand and Gravel to Gary Naylor of Clackamas County Planning and Permits. The history of site operations will be presented here with emphasis on the cultural and environmental changes that have taken place at the location through time. Unless cited, information is derived from the Parker-Northwest (1999) summary.

1963: Mining operation by River Island Sand and Gravel began under the direction of George Chambless; 200 acres were involved. River bar materials were extracted and processed at the on-site plant.

1967–1971: An 8- to 10-foot high dike was constructed within the mining site to isolate silt ponds from the river and to protect the borrow area and plant site from river flooding (Department of Environmental Quality 1972:2; DOGAMI 1996). The dike effectively blocked river flow in secondary channels within the floodplain and directed flow into a single channel (Wampler et al. 2006). Mining operations were concentrated in-stream during this period.

1967–1975: The site ownership and mining operation changed hands multiple times. Site owner/operators included Loren Obrist, Frank Lamb, John Veatch and Jack Parker, and, finally, Parker-Northwest Paving Company.

1975–1980: Aggregate mining at River Island by River Island Sand and Gravel (operated by Parker-Northwest) continued under interim approval under the Scenic Waterway Act and with operating permits issued by DOGAMI. Mining at River Island received a limited exemption classification from reclamation and bonding requirements due to its history of activity prior to 1971 (i.e., the mining activity was “grandfathered in”). Mining operations were concentrated in the low-lying Clackamas River floodplain.

1980–1982: DOGAMI outlined more stringent exemption rules and required the mining company to implement a reclamation plan for 15 acres of land outside of the exempted portion of the operation that had been stripped of overburden. The reclamation plan was the same as the voluntary reclamation activities that had taken place on other portions of the property—that the area would remain an open space (a lake) for future use as a recreation or fisheries site. The expanded mining area included land on the higher terrace to the west of the river (DOGAMI 1996).

1983–1996: Mining of the site continued; Clackamas County Surface Mining Operation permits continued to be issued by Clackamas County, although reclamation conditions were stipulated, including reuse of stockpiled topsoil, landscape modification to minimize erosion and direct run-off, vegetation protection and plantings, construction of an earthen berm along property frontage with Eaden Road, regrading of overburden, and topsoil replacement.

1993: Floodplain mining had ceased. The mine operator continued to process imported material until 1996 (Wampler et al. 2006:3).

1994: Clackamas County Commissioners and DOGAMI approved the re-zoning of the adjacent Cassinelli property for mining.

1996: Parker-Northwest purchased the Hathaway and Cassinelli properties, although mining permits for the properties were not acquired (DOGAMI 1996). In February, a catastrophic flood impacted the River Island Sand and Gravel property and operations. The Clackamas River channel avulsed, shifting its position from along the eastern edge of the property to flow through the central portion of the property, flooding a series of pits that had been created as a result of the mining operations (Wampler et al. 2006). Part of this avulsion involved a breaching of the human-made dike that had been built along the eastern edge of the mining site.

1996–1999: Mining operations ceased at the property, although reclamation continued. Bonded areas within the property on the upper terrace were returned to pasture, while the lower terrace bonded area was allowed to remain part of the active channel/floodplain (DOGAMI 1999a). Equipment, mechanical debris, and buildings damaged during the flood were removed from the property.

1999: An on-site inspection conducted by DOGAMI found that Parker-Northwest performed reclamation work on the Cassinelli property, which was not included in the company's mining permit (DOGAMI 1999b). River Island Sand and Gravel created 4:1 slopes on the property by stripping the topsoil and stockpiling it outside of the 100-year floodplain.

Parker-Northwest began the process of donating 130 acres and selling 109 acres of former mining land (River Island) to Metro. The remaining on-site equipment and buildings were removed, and the last of the clean-up and reclamation activities were performed by Parker-Northwest.

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APPENDIX B | PHYSICAL ENVIRONMENT

Geology: rocks and landforms

The geology of the lower Clackamas River watershed is characterized by volcanic and sedimentary formations that flowed between the Cascade Mountains and the Portland Basin. Four major geologic units in the area of the River Island Natural Area include two volcanic units (the Sardine aka the Rhododendron Formation and the Boring Lava flows) and two sedimentary units (Troutdale Formation, Sandy River Mudstone and Alluvial deposits).

The Sardine Formation consists primarily of volcanic mudflow breccia that originated from the western Cascade Range in the late Miocene. Continental sedimentary rocks including the Troutdale Formation and Sandy River Mudstone were deposited in the early Pliocene as a result of stream flow from the western flank of the Cascade Range, filling basins in the Willamette Valley lowlands. Boring Lava are basaltic flows which erupted intermittently from vents throughout the region in the late Pliocene and Pleistocene. The Boring lava flows created cinder cones shield volcanoes and lava plateaus throughout the Portland Basin. Finally, erosion and deposition continued as a result of streams transporting material off the Cascade Range and formed the Alluvial deposits present at the River Island Natural Area. Some of the deposited alluvium in the area originates from Pleistocene glacial outflow deposits and some is more recent Holocene deposits (Trimble 1963, WPN 2002).

Geologic channel forming processes

The Clackamas River is a large tributary of the Willamette River. The River Island Natural Area is located at approximately RM 15 on the Clackamas. The contributing watershed area is approximately 785 square miles and originates in the high cascades, and meanders north and westward until its confluence with the Willamette River. The Clackamas River Watershed is located in the Willamette Valley physiographic province, a broad alluvial plain that spans the lowlands between the Coast Range and Cascade Mountains. The watershed is a complex network of underlying lithology types formed by water, volcanic inputs, and continental uplift. Over time, the Clackamas River has incised down through Pleistocene-aged and Estacada Formation Gravels.

Although there is little direct evidence of channel conditions prior to the mid-1900s, field observations, high resolution LiDAR, General Land Office maps, and underlying geology can provide some theories on channel form. During the Pleistoecne era, an era defined by a cooler climate and much higher precipitation volumes, the channel form was likely created by high volume flooding and sediment inputs. Large boulders and cobbles located on abandoned floodplain surfaces (e.g. Estacada surface) indicate that historically the channel moved much larger volumes of water and sediment. As the channel has adjusted to drier and warmer contemporary climactic regimes, the channel no longer had the volumes of water necessary to fill its channel and span the valley floor. Over time, the now “underfit” Clackamas River incised into historical floodplain surfaces leaving behind abandoned floodplain surfaces and terrace deposits which serve as contemporary controls on lateral channel migration. Limits on lateral and vertical migration within the study reach are also imposed by Sandy River Mudstone, a thinly layered combinate of claystone, siltstone, and sandstone within minor inter-layering of pebbly conglomerate, fine-grained tuff, and lignite (Trimble 1963, Evarts 2013).

Today, the River Island reach of the Clackamas River can be described as a moderate gradient (0.4%) semi-confined channel. Typical channel planform study area is a single-threaded channel, with point and mid-channel gravel bars. The channel exhibits primarily riffle-pool morphology, with occasional glides. Substrate ranges from boulders to silts, but is predominately gravels and cobbles. Where the gravel mine pits were located today are large off-channel "ponds" filled with six inches to two feet of silt deposits.

Human impacts on physical environment

Throughout the study reach the channel has been impacted by a number of human alterations. Basin-scale alterations include agriculture, which includes on-going development pressure for conversion to agricultural lands. Agriculture often occurred Additional alterations to the study reach include dams and hydroelectric development. Dams within the study reach date back to grist, saw, and paper mills in the late 1800s within larger-scale hydroelectric development occurring in the 1950s. Prior to fish ladders and dams that operate in "run-of-the-river" conditions, these dams blocked fish passage and altered natural hydrographs. Timber harvest and splash dams have also impacted the natural processes within the study reach. Extensive timber harvest throughout the basin began in the early 1800s, with the first timber mill built in 1825. The adjacent property, Barton County Park, historically was the site of a timber mill (Taylor 1999). This led to the loss of "old growth" sized trees (e.g. four to six feet in diameter) throughout the basin. Prior to the railroad in order to transport these large trees to mills, splash dams and log drives were common place in the mid- to late- 1800s. Logs were pooled behind temporary dams, and then once the dam was released (usually through the use of dynamite), logs rushed down streams, often taking gravels and native large wood jams with them.

At a site-specific scale, human alterations are primarily related to impacts from gravel mining. The River Island Natural Area was operated by Parker NW Paving between 1963 and 1999. Gravel was mined from in the channel and surrounding floodplain areas and processed at an onsite facility. In 1967, a 10 foot tall dike was constructed around the outside of the mine area (the left bank of the channel) to protect mining operations from overland flooding. This dike prevented the natural processes of floodplain inundation and channel avulsion. In 1996, flood flows of 68,900 cubic feet per second overtopped the dike, flowing through the active gravel mining site, filling gravel ponds, and cut off the channel's meander. This rapid avulsion through gravel pits let to rapid incision through the study reach and left behind the remnants of a gravel mining operation in the channel and floodplain (Taylor 1999, Wampler 2006).

Soils

The properties of soils found within a watershed influence to a large extent the movement of water through and within the soil layers. Information on soils in the soil survey of the Clackamas area (NRCS, 1985; 1998) is published by the USDA Natural Resources Conservation Service (NRCS; formerly the Soil Conservation Service). Descriptions and percent coverage of the River Island Natural Area are located in *Table 1*.

Table 1 Descriptions of hydrologic soil group properties

Map Unit Name	Description	Area (acres)	Percent of study area
Camas gravelly sandy loam	This very deep, excessively drained soil formed in mixed sandy and gravelly alluvium. Soils are on floodplains. Slopes are 0 to 5 percent.	45.70	19.49
Cloquato silt loam		5.28	2.25
Newberg loam	This deep, somewhat excessively drained soil is on floodplains. It formed in mixed alluvium. Slope is 0 to 3 percent.	42.75	18.23
Pits	Remnant gravel pits.	34.63	14.77
Riverwash	Barren alluvial areas, typically coarse textured.	4.92	2.10
Wapato silty clay loam	This very deep, poorly drained soil formed in loamy mixed alluvium. Soils are on floodplains and saturated with water (hydric) during the winter season unless artificially drained. Slopes are 0 to 3 percent.	9.76	4.16
Water	Open or flowing water	70.84	30.21
Woodburn silt loam	This deep, moderately well drained soil is on broad valley terraces it is formed in stratified glaciolacustrine deposits. Slopes 3 to 8 percent.	8.35	3.56
Xerochrepts and Haploxerolls, very steep	This map unit is on terrace escarpments. Slope is 20 to 60 percent.	12.24	5.22

APPENDIX C-1

Conservation targets

Introduction

Conservation targets are composed of a suite of species, communities and ecological systems that represent and encompass the full array of native biodiversity of the site; reflect local and regional conservation goals; and be viable or at least feasibly restorable (The Nature Conservancy 2007). Priority conservation targets represent species or habitats that are the conservation focus for a given area or management unit.

Conservation targets establish the basis for setting goals, carrying out conservation actions, and measuring conservation effectiveness. They are the foundation of conservation planning. Key ecological attributes (KEAs) for each conservation target will be evaluated. KEAs are aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (The Nature Conservancy 2007). Viability of the conservation target is inferred by the condition of the KEAs. Analysis of threats affecting conservation targets inform the development of action plans to abate serious threats and monitoring plans to gauge success of the action plans. Conservation targets then should consist of species or communities that will provide the focus of management actions and monitoring. Species or communities that for whatever reason are too expensive to manage or monitor are not good candidates for conservation targets.

Background

Historically, the Willamette Valley was dominated by extensive prairie, oak savanna and woodland habitats totaling approximately two million acres that supported a wide diversity of plant and animal species, including several endemic to the Willamette Basin (Floburg et al 2004). These habitats were primarily maintained by Native American-ignited fires. Agricultural and residential development in the Willamette Subbasin and the cessation of widespread prescribed fires has resulted in a substantial loss of native habitat especially at the lowest elevations, leaving less than two percent of all historic prairies and seven percent of oak habitat extant today.

Methods

Regional conservation plans were referenced to align the conservation goals of the River Island Natural Area Conservation and Management Plan (see Table 1). These plans included the Oregon Department of Fish and Wildlife's Oregon Conservation Strategy (ODFW 2006), The Nature Conservancy's Ecoregional Assessment of the Willamette Valley – Puget Trough-Georgia Basin (Floburg et al 2004), the Northwest Power and Conservation Council's Willamette Subbasin Plan (NWPCC 2005), and Partners in Flight's Conservation Strategy for Landbirds in Lowlands and Valleys of Western Oregon and Washington (Altman 2000). These plans identify both focal habitats and focal species as conservation targets.

The River Island site is large with diverse habitats and species. Reflecting this complexity, several sensitive species and onsite habitats as mapped by Metro staff were used as the foundation for selecting conservation targets.

Results

Using onsite habitat types and regional conservation planning efforts as guides, conservation targets were selected that encompass the site's most threatened biodiversity values as well as regional conservation targets (Table 1). Each of the conservation targets are represented in one or more of the regional conservation plans listed in Table 1.

Table 1: River Island site conservation targets and relationships to other conservation strategies.

River Island Natural Area conservation targets	Oregon Conservation Strategy (ODFW 2006)	Willamette Basin Subbasin Plan (Primozich 2004)	Landbird Conservation Strategy (Altman 1999, 2000)	Ecoregional Assessment (Floburg et al 2004)
Savannah	Grasslands and oak habitats are priorities for the Willamette Valley	Upland and wet prairie	Grassland - savanna	Upland and wet prairie; savanna
Riparian forest	Freshwater aquatic, riparian, and wetland habitats are all priorities for the Willamette Valley	Basinwide priority	Riparian	Riparian forests and shrublands
Upland conifer-hardwood forest	Late successional conifer forests	Old growth conifer forest	Low elevation western hemlock / western red cedar	Douglas fir-western hemlock-western red cedar forests
Native fish habitat	All are strategy species in the Willamette Valley ecoregion[1]	Anadromous fish species and their habitats are basin-wide priorities.	N/A	Ecoregional target species
Western painted turtle	Western Painted Turtle	N/A	N/A	N/A

While not elevated to the level of "conservation targets," certain fish and wildlife species that depend on savannah and riparian habitats are integrated into these habitats' Key Ecological Attributes. These species are rare or declining, and implementing specific management practices may aid their conservation. Some of River Island Natural Area species with special state or federal status are listed in Table 2.

[1] Coho salmon Oregon Coast ESU not native above Willamette Falls

Table 2: Federal and state status for species of conservation interest at River Island Natural Area.

Species of conservation interest	Federal status	State status	OR Conservation strategy species?	Notes
Western Meadowlark (as a surrogate for many grassland-associated birds)	None	Sensitive–Critical	Yes	Partners in Flight focal species.
Coho, Lower Columbia River ESU	Threatened	Endangered	Yes	
Steelhead, Lower Columbia River ESU	Threatened	Sensitive–Critical	Yes	Winter runs.
Chinook, Lower Columbia River ESU	Threatened	Sensitive–Critical	Yes	Fall and spring runs.
Coastal cutthroat trout, SW WA / Columbia R. ESU	Species of Concern	Sensitive–Vulnerable	Yes	
Pacific lamprey	Species of Concern	Sensitive–Vulnerable	Yes	Clackamas River and its tributaries may also have Western brook lamprey, but Pacific are documented on the site.
Northern Red Legged Frog	Species of Concern	Sensitive–Vulnerable	Yes	
Western Painted Turtle	None	Sensitive-Critical	Yes	
Western Pond Turtle	None	Sensitive-Critical	Yes	Not know to inhabit River Island.

APPENDIX C-2

Key ecological attributes at River Island

Key ecological attributes (KEAs) are aspects of a conservation target's biology or ecology that, if missing or altered, would lead to the loss of that target over time (The Nature Conservancy 2007). KEAs define the conservation target's viability. They are the biological or ecological components that most clearly define or characterize the conservation target, limit its distribution or determine its variation over space and time. They are the most critical components of biological composition, structure, interactions and processes, and landscape configuration that sustain a target's viability or ecological integrity. For each KEA, one or more indicators were selected to assess the health of the KEA.

Indicators are measurable entities related to the condition of the KEA (The Nature Conservancy 2007). A good indicator should be:

- ***Biologically relevant:*** The indicator should represent an accurate assessment of target health.
- ***Sensitive to anthropogenic stress:*** The indicator should be reflective of changes in stress.
- ***Measurable:*** The indicator should be capable of being measured using standard procedures.
- ***Cost-effective:*** The indicator should be inexpensive to measure using standard procedures.
- ***Anticipatory***: The indicator should indicate degradation before serious harm has occurred.
- ***Socially relevant:*** The indicator's value should be easily recognizable by stakeholders.

KEA indicators were categorized by type: size, condition or landscape context:

- ***Size:*** A measure of the area or abundance of the conservation target's occurrence.
- ***Condition:*** A measure of the biological composition, structure and biotic interactions that characterize the occurrence.
- ***Landscape context:*** An assessment of the target's environment including ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and many other kinds of natural disturbance, and connectivity such as species targets having access to habitats and resources or the ability to respond to environmental change through dispersal or migration.

The status of an indicator will vary over time either within an acceptable range of variation that sustains the conservation target or beyond a critical threshold that threatens the viability of the conservation target. The range is described as very good, good, fair or poor. The very good and good ratings mean that the indicator is functioning within its acceptable rang of variation. Fair and poor ratings mean an indicator is outside its acceptable range of variation. When information was lacking to define all four categories then only a subset of the four categories was defined.

Definitions for the four categorizes follow those used by The Nature Conservancy:

- ***Very Good***: The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to "natural" as possible and has little chance of being degraded by some random event).
- ***Good:*** The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance.

- ***Fair:*** The indicator lies outside of its range of acceptable variation and requires human intervention for maintenance. If unchecked, the target will be vulnerable to serious degradation.
- ***Poor:*** Allowing the indicator to remain in this condition for an extended period will make restoration or prevention of extirpation of the target practically impossible (e.g., too complicated, costly and/or uncertain to reverse the alteration).

KEAs and their indicators for the River Island's conservation targets are provided in the following tables.

Table 1: Key Ecological Attributes for Oak Savanna at River Island

Category	KEA	Indicator	---------- Indicator rating ----------				Current rating	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Western Meadowlark and grassland bird habitat	Number of potential male meadowlark territories (8 ha, or 20 acre units)	<16 contiguous ha (40 acres) of a mix of suitable habitat such as prairie and degraded prairie, savanna or appropriate pasture habitat, i.e. insufficient habitat for 2 male meadowlark territories.	16-49 ha (40-120 ac) of contiguous prairie or other suitable habitat, i.e. enough suitable habitat for 2 to 5 male meadowlark territories.	49-162 ha (120-400 ac) of suitable contiguous/connected habitat, i.e. enough for 6 to 20 male territories. Alternatively, 3 patches of closely associated suitable habitat, each >16 ha (40 acres) in size.	>162 ha (400 ac) of suitable contiguous or connected habitat, i.e. enough suitable habitat for >20 male meadowlark territories. Alternatively, 3 patches of suitable contiguous or connected habitat, each >57 ha (140 acres) in size.	Poor	Fair	Fair	Estimate via GIS. Western meadowlark territories used as a surrogate for all grassland birds specifically and prairie and savanna system size in general. Literature territory size range avg. 6 ha (14 acres), range 2-14 ha (5-35 acres). Can be a mixture of upland prairie, wet prairie, and possibly suitable savanna habitat as well. The ratings are aimed at improving population viability, but do not necessarily ensure the specified level of viability, as larger areas may be needed if other habitat features are less suitable (Vesely and Rosenberg 2010; Alverson 2009).
Condition	Native Grass and Forb Presence	Native species richness	<20 native herbaceous plant species with high fidelity to the system types present within the patch.	20-39 native herbaceous plant species with high fidelity to the system types present at the patch.	40-59 native herbaceous plant species with high fidelity to the system types present at the patch.	> 60 native herbaceous plant species with high fidelity to the system types present at the patch.	Poor	Fair	Good	Estimate based on habitat inspection. Fidelity is a term that describes the degree to which a native plant species is associated with prairie or oak systems; high fidelity species are always or almost always found in prairie or oak habitats in the WPG ecoregion (Alverson 2009).
Condition	Native grass and forb abundance	Frequency of native herbaceous species in 1 sq m (11 sq ft) quadrats	<2 native high fidelity herbaceous prairie species occurring with >50% frequency and <9 additional species occurring with at least 10% frequency	At least 2 native high fidelity herbaceous prairie species occurring with >50% frequency and at least 9 additional species occurring with at least 10% frequency	At least 3 native high fidelity herbaceous prairie species occurring with >75% frequency and at least 9 additional species occurring with at least 25% frequency	At least 7 native high fidelity herbaceous prairie species occurring with >75% frequency and at least 15 additional species occurring with at least 25% frequency	Poor	Fair	Good	The Nature Conservancy's recommendations to measure prairie/savanna habitat quality (Alverson 2009).
Condition	Native forb and grass abundance	Percent cover native forbs & grasses	<20%	20-30%	30-50%	>50%	Poor	Fair	Good	Good prairie habitats are covered >50% by native species. *Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington* (USFWS 2010).
Condition	Vegetation Structure	Canopy cover (5-30%) and architecture of woody vegetation	Total native woody cover is outside the preferred range (5-30%) over more than half the habitat area.	Total native woody cover is within the preferred range (5-30%) over 50-90% of the habitat area.	Total native woody cover is within the preferred range (5-30%) over at least 90% of the habitat area, but young oak tree recruitment is limited or absent.	Total native woody cover is within the preferred range (5%-30%) over at least 90% of the habitat area, and canopy includes appropriate mix of large open-grown trees and younger tree recruitment.	Poor	Good	Good	Estimate based on site walk or aerial photos when trees are leafed out. If cover is estimated from aerial photography threshold cover categories should be increased by at least 5-10 percentage points. (Alverson 2009)
Landscape context	Proximity (distance) to other target habitat patches	Number of habitat patches ≥ 40 (16 ha) acres within 2 km (1.25 mi)	No patches within 2 km (1.25 mi)	1 patch within 2 km (1.25 mi)	2 patches within 2 km (1.25 mi)	At least 3 patches within 2 km (1.25 mi)	Good	Good	Good	Patches within 2 km include the Metro North Logan Natural Area and privately owned Foster Creek Wetland Mitigation Bank. This KEA covers the issue of meta-populations and value of having other patches of target habitat within dispersal/pollinator distance. The 2 km (1.25 mi) distance may be greater than dispersal of many prairie species, and should be modified when specific dispersal distances for species of interest can be identified (Alverson 2009).
Landscape context	Degree of alteration of surrounding landscape	Percentage of landscape within 2 km (1.25 mile) distance of edge of habitat patch in urban or agricultural categories	Surrounding landscape has >50% urban alteration OR >10% urban alteration combined with >50% agricultural alteration other than field crops (e.g., pastures, hayfields, grass seed, etc. that may provide "degraded prairie" habitat).	Urban alteration 10-50% of landscape OR Non-field crop agricultural alteration can be ≤ 90% if urban alteration is <10%.	Urban alteration 5-10% of landscape. Non-field crop agricultural alteration ≤ 50%.	Urban alteration < 5%; non-field crop agricultural alteration < 10%	Good	Good	Good	Estimate based on aerial photos. Adapted from TNC (Alverson 2009). TNC chose 2km (1.25 miles) based on estimation of travel and dispersal by Fender's blue butterfly. Semi-natural veg. includes non-target native dominated systems, e.g. conifer or hardwood forest or plantation. Agriculture refers to lands actively cropped, excludes lands that may have been cropped formerly. "Urban alteration" includes footprint of residential and industrial development. Assume 0.8 ha (2 ac) footprint per parcel for rural residential development (Alverson 2009).
Landscape context	Edge condition	% of edge bordered by natural habitats and/or managed for conservation	Patch surrounded by non-natural habitats (0-25% natural habitat)	25%+ of patch bordered by natural habitats	50-75% of patch bordered by natural habitats or managed for conservation	75-100% of patch bordered by natural habitats or managed for conservation	Good	Good	Good	Assess via aerial photographs. The intactness of the edge can be important to biotic and abiotic aspects of the site. Derived from Washington DNR's *Ecological integrity assessment: North Pacific dry Douglas-fir forest and woodland* (Crawford 2011).

*Desired future condition

Table 2: Key Ecological Attributes for Riparian Forest at River Island

Category	KEA	Indicator	---------- Indicator rating ----------				Current Rating	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Riparian forest width	Avg. width of riparian forest	<15 m (50 ft) each side of stream	15-30 m (50-100 ft) each side of stream	30-61 m (100-200 ft) each side of stream	>61 m (200 ft) each side of stream	Good	Good	Good	Total width, both sides of stream. Estimate using GIS. Riparian forest width positively correlates with water and wildlife habitat quality, including biodiversity corridors. Width includes both sides of the stream or one side for larger rivers (effective wildlife movement corridor). Title 13 Class I riparian, which accounts for 5 primary ecological functions, is typically within 30-61 m (100-200 ft) on either side of the stream; steep slopes are encompassed in the wider distances. Optimum width won't always be achievable – e.g., could interact with other priority habitats such as prairie. (Environmental Law Institute 2003; Metro's *Technical Report for Fish and Wildlife* Habitat, 2005; Hennings and Soll 2010; Shandas and Alberti 2009; Cole and Hennings 2006)
Condition	Vegetative structure: shrub layer	% native shrub cover	<10% cover	10-25% cover	25-50% cover	>50% cover	Fair	Very Good	Very Good	Estimate via site walk. Indicator categories based on data from local study at 54 riparian study sites. Abundance and species richness of many bird and mammal species is associated with native shrub cover and woody vegetation volume. Puget Sound studies suggest that the fragmentation of upland vegetation and the total amount of riparian vegetation explain the greatest amount of variability in riparian bird communities. (Carey and Johnson 1995; Hennings 2001; Hagar 2003; Shandas and Alberti 2009; Hagar 2011)
Condition	Vegetative structure: tree layer	% native tree canopy cover	<20% cover	20-30% cover	30-40% cover	40% or more	Fair	Very Good	Very Good	Estimate via site walk. Based on data from local study at 54 riparian study sites. In these sites, the best mix of native tree and shrub cover occurred when both were in the 40-60% range. Tree cover In this tended to support healthy shrub communities and helped control European starlings. Note that some species, such as yellow-breasted chat, rely on native shrub habitat rather than forest, therefore if specific species are involved separate KEAs should be developed. (Hennings 2001)
Condition	Native herbaceous layer richness	# native species of grasses, herbs, forbs and ferns, at least half of which are riparian-associated, per 0.4 ha (1 ac)	<5 species	6-12 species	12-18 species	>18 species	Poor	Good	Very Good	Estimate via site walk. Species numbers based on field experience of Marsha Holt-Kingsley and Lori Hennings; currently using species list from McCain and Christy 2005, Technical Paper R6-NR-ECOL-TP-01-05.
Condition	Native tree and shrub richness	# native tree and shrub species per 0.4 ha (1 ac)	<5 species	5-10 species	10-15 species	>15 species	Fair	Very Good	Very Good	Estimate via site walk. Some studies show that native wildlife species diversity (particularly Neotropical migratory songbirds) is associated with native deciduous shrub diversity. (Muir et al. 2002; Hagar 2003; Hagar 2011)
Condition**	Riparian habitat continuity	Gaps in woody vegetation	>2 gaps >50 m (55 yards) OR >3 or more 25-50 m (27-55 yards) gaps	1 or 2 gaps >50 m (54 yards) OR 2 or more gaps between 15-25 m (16-27 yards)	1, 25-50 m (27-55 y) gap OR 2 or more gaps between 15-25 m (16-27 yards)	0 or 1, 15-25 m (16-27 yards) gap	Poor	Good	Good	Estimate via GIS, per km stream length. Riparian contiguity for water quality and wildlife. Allos for continuity and also some mosaic for wildlife that need (or create, such as beaver) openings. Puget Sound studies suggest that the fragmentation of upland vegetation and the total amount of riparian vegetation explain the greatest amount of variation in aquatic conditions. Studies document that some birds and small mammals are unwilling to cross vegetation gaps, with the most typical threshold being 50 m (164 ft) Hennings and Soll 2010).
Condition	Standing and downed dead trees	Average # snags and large wood (> 50 cm, or 20 in, DBH) per 0.4 ha (1 ac)	< 5 snags and <5% down wood	5-11 snags and 5-10% down wood	12-18 snags and 10-20% down wood with moderate variety of size and age classes	> 18 snags and >20% cover down wood in a good variety of size and age classes	Poor	Fair	Very Good	Estimate via site walk. Rankings distilled from multiple references and particularly from *Habitat Conservation for Landbirds in Lowlands and Valleys of Western Oregon and Washington* (Altman and Alexander 2012) and DecAID results for species' use of dead wood in Westside Lowland Conifer-hardwood forests.
Condition	Floodwater access to the floodplain	Degree of connection between stream/ floodplain during high water events	Extensively disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Moderately disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Minimally disconnected by channel incision, dikes, tide gates, elevated culverts, etc.	Completely connected (backwater sloughs, channels)	Poor	Good	Very Good	Measure based on field walk, aerials. Adapted from Washington DNR's *Ecological Integrity Assessment for North Pacific Lowland Riparian Forest and Shrubland*, "Hydrologic Connectivity (Riverine)." Added channel incision. Not appropriate for higher gradient streams. (Stanford et al. 1996; Rocchio 2011)
Landscape context	Offsite riparian habitat condition	% rating at least "fair" for both width and gaps (see above), within 2.5 km (1.6 mi) up- and down-stream of property.	0-25%	25-50%	50-75%	75-100%	Good	Good	Good	Measure using aerial photos for 2.5 km (1.6 mi) stream length, up- and downstream. Several studies suggest the importance of riparian buffer contiguity to water quality, fish and benthic organisms. A 2006 study in and near Damascus, OR found that benthic biotic integrity was significantly correlated with % forested area for 1,500 m (1,640 ft) upstream at 50, 100, and 200 m (55, 109, and 219 ft) wide. Ontario researchers found that the combination of % of forested stream bank and forest width within 2.5 km (1.6 mi) upstream of a site accounted for 90% of the observed variation in water temperatures. (Barton et al. 1985; Wang et al. 2001; Cole and Hennings 2006; Freeman et al. 2007; Olsen et al. 2007)

*Desired future condition

** This KEA may not be appropriate where native turtles are present, because nesting turtles require some open habitat. Patches of bare ground may accommodate turtles and are important to native ground-nesting bees.

Table 3: Key Ecological Attributes for Upland Forest at River Island

Category	KEA	Indicator	Indicator rating				Current status	DFC* for this SCP	Long term DFC	Comments
			Poor	Fair	Good	Very good				
Size	Forested habitat patch size	Patch size (includes native shrub patches or natural clearings)	< 12 ha (30 ac)	12-40 ha (30-100 ac)	40-61 ha (100-150 ac)	>61 ha (150 ac)	Good	Good	Good	Calculate by delineating forest patch in GIS. If more than one patch present, rank based on a composite. In the Puget Sound, most native forest birds were present in patches ≥ 42 ha (104 ac). Local studies suggest a lowest threshold for birds and mammals of about 12 ha (30 ac) (Environmental Law Institute 2003; Donnelly and Marzluff 2004; Soll and Hennings 2010).
Condition	Native tree and shrub richness	Number of native tree and shrub species per ac	<5 species per 0.4 ha (1 ac)	5-8 species 0.4 ha (1 ac)	8-12 species per 0.4 ha (1 ac)	>12 species per 0.4 ha (1 ac)	Fair	Good	Very Good	Estimate overall via site walk. Native wildlife species diversity is associated with native vegetation. A diversity of shrubs is more likely to provide food and shelter for species over the seasons. Shrub diversity is particularly important to pollinators and songbirds. (Hagar 2003; Hennings 2006; Burghardt et al. 2009).
Condition	Vegetative structure: native tree and shrub layer	% native tree and shrub canopy cover (combined)	<25% cover	25-50% cover	50-75% cover	>75% cover	Fair	Good	Good	Estimate overall via site walk. Native bird species richness is associated with the amount of native shrub cover. (Hagar 2003; Hennings 2006). Numbers based on data analysis from local studies at 54 riparian study sites (Hennings 2001). Native shrub cover was as high as ~60%, with highest native shrub cover in the 50-60% tree canopy cover range.
Condition	Mature trees	Number and size (dbh) of species such as Douglas fir, western red cedar, western hemlock and grand fir	Mature trees lacking	<3 per ac with dbh >24 in	3-5 per ac with dbh >24 in	>5 per ac with dbh >24 in	Poor/Fair	Good	Very Good	Recruitment of native trees necessary for long-term health of upland forests. Saplings are < 2m tall. Based on PIF (2000) biological objective for WV large-canopy trees in riparian deciduous woodland.
Condition	Standing and downed dead trees	Average # snags and large wood (> 50 cm, or 20 in, DBH) per acre	< 5 snags and <5% down wood	5-11 snags and 5-10% down wood	12-18 snags and 10-20% down wood with moderate variety of size and age classes	>18 snags and >20% cover down wood in a good variety of size and age classes	Poor	Fair	Very Good	Estimate via site walk. Rankings distilled from multiple references and particularly from *Habitat Conservation for Landbirds in Lowlands and Valleys of Western Oregon and Washington* (Altman and Alexander 2012) and DecAID results for species' use of dead wood in Westside Lowland Conifer-hardwood forests.
Landscape context	Edge condition	% of edge bordered by natural habitats and/or managed for conservation	Patch surrounded by non-natural habitats (0-25% natural habitat)	25%+ of patch bordered by natural habitats	50-75% of patch bordered by natural habitats or managed for conservation	75-100% of patch bordered by natural habitats or managed for conservation	Good	Good	Good	Assess via aerial photographs. The intactness of the edge can be important to biotic and abiotic aspects of the site. Derived from *Ecological integrity assessment: North Pacific dry Douglas-fir forest and woodland* (Crawford/WDNR 2011).

*Desired future condition

Table 4: Key Ecological Attributes for Native Fish Habitat (instream) at River Island

Category	KEA	Indicator	Poor	Fair	Good	Very good	Current rating status	DFC for this SCP	Long term DFC	Comments
Condition	Complexity of mainstem Habitat	# of different stream habitat units per 1 mile reach	Less than 5 habitat units	Between 5-10 habitat units	Between 10-20 habitat units	Greater than 20 habitat units	Fair	Good	Good	The number of different habitat units indicates the complexity of the stream reach. Complex stream reaches provide high quality habitat for all life stages of native fish. Habitat units may include glides, riffles, runs, pools, step pools, alcoves, side channels, etc. (*Independent Multidisciplinary Science Team, 2002)*.
Condition	Off-Channel habitat	Presence and abundance of off channel habitat per reach	Few or no backwaters, no off channel ponds	Some backwaters and high energy side channels. Or Backwaters with cover and low energy off-channel areas that are not accessible during biologically important times of year		Backwaters with cover and low energy off-channel areas (ponds, oxbows, etc.)	Fair/Good	Very Good	Very Good	Active off-channel habitat (e.g., side channels, backwaters, alcoves) provide diverse slow-water habitat for salmonids. They provide multiple benefits including, feeding areas, refuge from high flows, overwintering, hiding areas from predation. See *Independent Multidisciplinary Science Team, 2002.* and *National Marine Fisheries Service, 1996.* This KEA is only relevant to unconfined reaches where off-channel habitats can form. In ranking this indicator it will be useful to compare your reach of interest to a reference reach or to the historical condition of the site to ensure this is applicable.
Condition	Key pieces and # of pieces of large wood in wetted areas of the stream and adjacent streambank	Number of key pieces and large wood pieces per 100 m	Less than 1 key piece, Less than 50 pieces large wood	1- 2 key pieces, 50-100 pieces large wood	3 key pieces, 100-200 pieces large wood	4 or more key pieces, 200 or more pieces large wood	Poor	Good	Very Good	Values are relevant to channels with bank-full width (BFW) of 50m or more. Key pieces are defined as logs with a minimum volume of 10.75m^3 (for example a length of 10m and diameter of 0.68m) and that have a rootwad. Large wood is defined as logs greater than 2 m (6.5 ft) in length 10 cm (4 inch) diameter. Key pieces resist downstream transport as well as anchor and retain other pieces of large wood. Large wood pieces influence geomorphic processes important to salmonid survival including sediment and organic matter distribution and pool development, often racking together. See *Fox and Bolton 2007.*
Condition	Substrate in wetted areas of the stream	% area of fines and gravel substrate within riffles per 1 mile reach	Fines >30% and gravel <10% of area	Fines 20-30% and gravel 10-20% of area	Fines 10-20% and gravel 20-35% of area	Fines <10% and gravel >35% of area	Fair	Fair	Good	Visually assess for a stream reach(s) of interest or for entire stream on site. If preferred, measure quantitatively using cross sections ODFW methods. Fines are defined as sand, silt or organics. Gravels are defined as particles that range in size from a small pea to roughly baseball sized substrate. Derived from ODFW 2001.
Condition	Bank Condition	Rate of channel migration	Little or no channel migration is occurring because of human actions preventing reworking of the floodplain and large woody debris recruitment; or channel migration is occurring at an accelerated rate such that channel width has at least doubled, possibly resulting in a channel planform change and sediment supply has noticeably increased	Limited amount of channel migration is occurring at a faster/slower rate relative to natural rates but significant change in channel width or planform is not detectable; large woody debris is still being recruited.		Channel is migrating at or near natural rates.	Poor	Very Good	Very Good	Low gradient alluvial channels adjust laterally via bank erosion and channel avulsions. These processes play important roles in maintenance of long-term aquatic habitat via large wood recruitment, gravel recruitment and creation of new instream habitats. Channel migration can be slowed by human alterations like bank armoring, or increased through watershed alterations like reducing streambank vegetation or increasing impervious cover in a watershed.
Landscape Context	Fish passage	Fish able to move to and from mainstem and tributaries	Passage not possible at a range of flows.	Passage not possible at base/low flows		Passage open year-round	Very Good	Very Good	Very Good	In this context passage barriers are only considered if they are “man-made”. See off channel habitat condition KEA for passage to floodplain habitats which may also be seasonal. See *National Marine Fisheries Service, 1996.*

Table 5: Key Ecological Attributes for Native Turtles

Category	KEA	Indicator	Indicator rating ---------- Poor	Fair	Good	Very good	Current status	DFC* for this SCP	Long term DFC	Comments
Condition	Western painted or pond turtle population	Turtle presence and evidence of recruitment	Adult or juvenile age classes absent or declining in number	Numbers are stable but juveniles are not present	Numbers are stable and juveniles are present	Increasing numbers of turtles including juveniles	Unknown	Good	Very Good	Criteria based on expert knowledge derived from work at Smith and Bybee Wetlands.
Condition	Nest habitat availability	Number of suitable nesting areas within 46 m (150 ft) of water; at least 1.3 ha (0.5 ac) in size	Suitable nesting areas lacking	<5 suitable nesting areas	6-10 suitable nesting areas	> 10 suitable nesting areas within 46 m (150 ft) of water; at least 5 of them >1.3 ha (0.5 ac) in size	Unknown	Good	Very Good	Suitable nest sites have sandy soil with good exposure to the sun, usually within 50m (164 ft) of water (Gervais et. al. 2009).
Condition	Nest habitat distribution	Distribution of suitable nesting areas within 150 feet of water	Suitable nesting areas lacking	Suitable nesting areas limited to 1-2 locations	Suitable nesting areas limited to 3-4 locations	≥5 suitable nesting areas distributed around site	Unknown	Good	Very Good	Suitable nest sites have good exposure to the sun and have low hazard from vehicles, etc. Turtles will nest in gravel roads, sand, fill, bare soil, and even railroad beds.
Condition	Basking site availability	Number of basking sites	Suitable basking sites lacking	Few basking sites available	Sufficient basking sites available	Ample basking sites available at each location where >20 turtles known to occur	Unknown	Fair	Very Good	Lack of basking sites affects habitat suitability (Gervais et. al. 2009).
Condition (pond turtle only)	Upland forest	Presence of and access to upland forest	Upland forest absent or lacking duff	Upland forest with duff nearby, but requires traversing anthropogenic obstacles.		Easily accessible upland forest with thick duff layer	Unknown ?	Good	Very Good	
Landscape context	Nest site connectivity to open water	Access to nest sites	Access to suitable nesting sites blocked	Access to most nesting sites requires traversing man-made obstacle	Access to most nesting sites does not require traversing man-made obstacles	Access to suitable nesting sites unobstructed	Unknown	Good	Very Good	Obstacles include roads and other infrastructure left from the mining operations, nearby roads and parking areas associated with Barton Park.
Landscape context	Dispersal corridors (connectivity) to suitable habitat	Availability and access to off-site suitable habitat	Isolated: suitable habitat lacking beyond site or access blocked.	Limited suitable habitat beyond site or access often requires crossing roads, developed areas, etc.	Ample suitable habitat beyond site but access requires crossing roads, developed areas, etc.	Ample suitable habitat beyond site and aquatic connectivity present	Good	Good	Very Good	

*Desired future condition

APPENDIX C-3

Threats and sources at River Island Natural Area

Introduction

A stress is the "impairment or degradation of the size, condition, and landscape context of a conservation target, and results in reduced viability of the target," (The Nature Conservancy 2007) or, in other words, a degraded key ecological attribute (KEA) that is outside its acceptable range of variation. Stresses may also reduce the viability of nested conservation targets such as grassland birds. A source of stress is an extraneous factor, either human (e.g., policies, land use) or biological (e.g., non-native species) that infringes upon a habitat or species target in a way that results in stress. Put together, stresses and their sources constitute a threat.

Metro follows The Nature Conservancy's method of identifying threats at a site. Analysis of threats to conservation targets at River Island Natural Area involves three parts:

- Identify stresses and apply stress-rating criteria.
- Identify sources of stress, rank and assign threat-to-system rank.
- Use the combination of stress and source ranks to assign overall threat rank.

Threats for each conservation target are identified and ranked as low, medium, high or very high. The most severe threats are those that are likely to seriously degrade or destroy a large portion in the next 10 years or so, and that we are able to reasonably address. Threats that we have no control over receive low ratings. This method helps identify restoration and stewardship activities that can abate the more severe threats. Threat rankings may change over time, for example if invasive species become a much more severe problem in a given conservation target.

Threats and source analysis for River Island Natural Area

Threats for River Island Natural Area conservation targets are listed in Tables 1-5 below. Background on how these threats and sources were ranked can be found in Tables 6-8 below.

Table 1: Threats to oak savanna at River Island Natural Area

Stress	Stress rank	Source of stress	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Extensive non-native grasses and broadleaf weeds	High	High	Non-native broadleaf weeds include black-berry, Scots broom, ivy, thistle spp., and foxglove. Tied to native species abundance and richness KEAs.
Altered fire (disturbance) regime	High	Lack of regular fires	High	High	Buildup of fuels degrades habitat and increases risk of a high intensity fire. Tied to native species abundance, richness, and woody species KEAs.
Human disturbance (recreational activities)	Medium	Demand trails, camping, dogs	Low	Low	Demand trail users trample vegetation, spread invasive weed; humans and dogs disturbing ground-nesting birds. Tied to vegetation structure, native grass and forb KEAs.

Table 2: Threats to riparian forest at River Island Natural Area

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Extensive non-native grasses, broadleaf weeds; limited invasive woody vegetation	High	High	Non-native broadleaf weeds include black-berry, Scots broom, ivy, thistle, and foxglove. Tied to native vegetation and structure KEAs.
Lack of down and standing dead wood	Medium	Previous forest management practices and altered hydrology	Medium	Low	Due to previous forest management practices and altered hydrology (see related stress), which can erode streambanks and near-stream plants and remove sources of dead wood. Tied to dead wood KEAs.
Altered hydrology	Medium	1996 flood event, logging, development in upstream portions of the watershed	Medium	Low	Widespread altered hydrology leads to stream bed and bank erosion, riparian vegetation loss, channel damage, loss of gravel and cobble substrate and overall habitat simplification.
Human disturbance (recreational activities)	Medium	Demand trails, camping, dogs, fishing	Low	Low	Demand trail users trample vegetation, spread invasive weed; humans and dogs disturb ground-nesting birds. Tied to structure, native plant KEAs.

Table 3: Threats to upland forest at River Island Natural Area

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Encroachment of non-native invasive species	High	High	Extensive invasive grasses and broadleaf weeds, esp. false brome and garlic mustard, and invasive shrubs such as Himalayan blackberry. Tied to native species KEAs.
Habitat conversion	High	Conversion from natural forest, prairie or savanna to single age young forest.	High	High	Complete canopy closure stunts trees and prevents development of native herbaceous and shrub layers. Tied to native plant and vegetative structure KEAs.
Lack of downed and standing dead wood	High	Previous forest management practices.	High	High	Snags and down wood are critical habitat elements used by more than 150 species of wildlife in Northwest conifer forests (Hagar 2007). Tied to dead wood KEAs.
Altered fire regime	Medium	Suppression of fire frequency outside natural range of variation	Medium	Low	Increased risk of stand-replacing fires in Douglas-fir forest, where a buildup of fuels would increase risk of a high intensity fire. Tied to all KEAs.
Human disturbance (recreational activities)	Medium	Demand trails, camping, dogs, fishing	Low	Low	Stress to wildlife species utilizing this habitat. Potential loss of habitat and vegetation structure by escaped fire. Disturbance reduces habitat value. Tied to structure/patch size (interior habitat) KEAs.

Table 4: Threats to native fish habitat at River Island Natural Area

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Simplified stream structure, sparse side channel refugia & riffle-pool sequences	High	Altered hydrology, channel morphology due to previous practices and upstream development, deforestation and disturbance	High	High	Salmon require off-channel habitat for rearing. Adult salmon need riffle-pool habitat for spawning, refugia, prey habitat and water oxygenation. Tied to all but fish passage KEAs.
Lack of logs and dead wood in streams	Medium	Previous forest management practices; narrow buffer in some areas	Medium	Low	Large logs provide critical habitat for juvenile fish and form the matrix of large wood jams and structure that provides complexity in the stream. Tied to habitat complexity, large wood KEAs.
Altered hydrology	High	Historic gravel mining, development in upstream portions of the watershed	High	High	Widespread altered hydrology leads to stream bed and bank erosion, riparian vegetation loss, channel damage, loss of gravel and cobble substrate and overall habitat simplification.
Impaired fish passage	Low	Manmade structures that block fish migration including: dams, weirs, culverts	Low	Low	No barriers at the River Island site. Fish passage barriers do exist upstream and should be addressed to improve native fish habitat in the Clackamas River watershed.
Lack of coarse gravels	High	Manmade structures that block sediment transport (e.g., dams)	Medium	Medium	Upstream dams prevent spawning gravels from reaching the River Island site.

Table 5: Threats for Native Turtles

Stress	Stress Rank	Source	Source Rank	Threat Rank	Comments
Limited habitat size	High	Rural development and disconnected habitat areas	High	High	Related to nest site availability and distribution and dispersal corridors KEAs.
Nest and hatchling predation	High	Domestic dogs and wildlife: raccoons, skunks, coyotes	Very High	High	Related to KEA for recruitment.
Limited basking sites available due to lack of natural regeneration and young age-class of trees present	Medium	Invasive species: reed canarygrass competition and other invasive weeds.	Very High	Medium	Related to basking sites KEA.
Altered wetland hydrology	Very High	Dikes and altered connectivity of the river to the floodplain, climate change.	High	Very High	Related to goal of providing suitable conditions for sensitive species.
Nest site disturbance	High	Recreational uses such as hunting,	High	High	Related to population, basking and nesting habitat KEAs.

Background on methods

Identify stresses and apply stress-rating criteria

In identifying stresses, we applied the concept that a stress is any alteration of a KEA that can result or has resulted in a KEA declining below a "good" rating. For each conservation target, KEA indicators with ratings of "poor" or "fair" were analyzed by asking the question "*What types of destruction, degradation or impairment are responsible for the 'poor' or 'fair' rating?"* We also considered those KEA indicators with "good" and "very good" ratings but are likely to degrade to "poor" or "fair" if no management actions are taken.

Stresses are ranked according to two criteria: **severity** and **scope** of the anticipated damage.

Severity: The level of damage to the conservation target that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very high:** The threat is likely to destroy or eliminate the conservation target over some portion of the target's occurrence at the site.
- **High:** The threat is likely to seriously degrade the conservation target over some portion of the target's occurrence at the site.
- **Medium:** The threat is likely to moderately degrade the conservation target over some portion of the target's occurrence at the site.
- **Low:** The threat is likely to only slightly impair the conservation target over some portion of the target's occurrence at the site.

Scope: The geographic extent of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (i.e., given the continuation of the existing situation).

- **Very high:** The threat is likely to be widespread or pervasive in its scope and affect the conservation target throughout the target's occurrences at the site.
- **High:** The threat is likely to be widespread in its scope and affect the conservation target at many of its locations at the site.
- **Medium:** The threat is likely to be localized in its scope and affect the conservation target at some of the target's locations at the site.
- **Low:** The threat is likely to be very localized in its scope and affect the conservation target at a limited portion of the target's location at the site.

Once severity and scope ratings are determined, they are combined to develop a stress ranking using the following stress ranking table (The Nature Conservancy 2007).

Table 6: Stress ranking

	---------- SCOPE ----------			
Severity	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
Low	Low	Low	Low	Low

Identify sources of stress and apply threat to system rank

Sources of stresses are the proximate cause of the stress. A source of stress may be either human activities or biological (e.g., non-native species). Sources of the stress are rated in terms of **contribution** and **irreversibility** as defined below (The Nature Conservancy 2007):

Contribution: The expected contribution of the source, acting alone, under current circumstances (i.e., given the continuation of the existing management/conservation situation).

- **Very high:** The source is a very large contributor of the particular stress.
- **High:** The source is a large contributor of the particular stress.
- ***Medium:*** The source is a moderate contributor of the particular stress.
- ***Low:*** The source is a low contributor of the particular stress.

Irreversibility: The degree to which the effects of a source of stress can be restored.

- **Very high:** The source produces a stress that is irreversible (e.g., wetlands converted to a shopping center).
- **High:** The source produces a stress that is reversible, but not practically affordable (e.g., wetland converted to agriculture).
- **Medium:** The source produces a stress that is reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).
- **Low:** The source produces a stress that is easily reversible at relatively low cost (e.g., off-road vehicles trespassing in wetland).

The contribution and irreversibility of each source across all the stresses to each conservation target is ranked using Table 5, resulting in a source of stress rank for each contribution/ irreversibility combination (The Nature Conservancy 2007).

Table 7: Source ranking

	---------- CONTRIBUTION ----------			
Irreversibility	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	High	High	Medium
High	Very high	High	Medium	Medium
Medium	High	Medium	Medium	Low
Low	High	Medium	Low	Low

In a similar fashion stress and source rankings are combined to develop a threat ranking specific to that conservation target (Table 6).

Table 8: Threat ranking

	---------- CONTRIBUTION ----------			
Stress	**Very high**	**High**	**Medium**	**Low**
Very high	Very high	Very high	High	Medium
High	High	High	Medium	Low
Medium	Medium	Medium	Low	Low
Low	Low	Low	Low	low

APPENDIX C-4 | INVASIVE SPECIES

Table 1 below summarizes a preliminary list of invasive plants requiring control in all or parts of River Island Natural Area, including focus areas and timing for control. Invasive species, with the exception of Early Detection Rapid Response (EDRR) species, will be controlled as part of restoration projects or ongoing management of habitat areas. Photos of EDRR species for identification are listed below. A list of noxious weeds for Oregon, including descriptions and photos, can be found at: www.oregon.gov/ODA/PLANT/WEEDS/statelist2.shtml.

Table 1: Working list of priority non-native species for control at River Island Natural Area (EDRR species common names are bolded in red)

Genus	Species	Common name	Focus area for detection/control	Control timing
Allarium	*petiolata*	**Garlic Mustard**	All	Spring
Brachypodium	*sylvaticum*	**False Brome**	All	Spring/Fall
Centaurea	*pratensis*	**Meadow knapweed**	Savanna	Summer
Cirsium	*arvense*	Canada thistle	Savanna	Spring
Clematis	*vitalba*	Old man's beard	Upland forest	Spring/Fall
Conium	*maculatum*	Poison hemlock	Savanna	Spring
Crataegus	*monogyna*	Common hawthorn	Prairie	Fall
Cytisus	*scoparius*	Scotch broom	Prairie	Fall
Daphne	*laureola*	**Spurge Laurel**	All	Spring/Fall
Dipsacus	*fullonum*	Teasel	All	Spring
Hedera	*Helix*	English Ivy	All	Winter
Hypericum	*perforatum*	St John's wort	Savanna	Spring
Ilex	*aquifolium*	Holly	Upland forest	Fall
Iris	*pseudacorus*	Yellow iris	Forested wetland	Fall
Lunaria	*Annua*	Money Plant	Savanna	Spring
Lythrum	*salicaria*	**Purple loosestrife**	Forested wetland	Summer
Mentha	*pulegium*	Pennyroyal	Savanna	Summer
Phalaris	*arundinacea*	Reed canarygrass	Savanna, Forested Wetland	Fall
Polygonum	*cuspidatum*	Japanese knotweed	All	Summer
Robinia	*pseudoacacia*	Black locust	savanna	Fall
Rubus	*armenianus*	Himalayan blackberry	All	Fall
Solanum	*dulcamara*	Bittersweet nightshade	All	Spring

Photo 1: Garlic mustard

Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

Photo 2: False brome


Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

Photo 3: Meadow knapweed


Images courtesy of Dan Sharratt, Oregon Department of Agriculture

Photo 4: Purple Loosestrife


Images courtesy of Bonnie Rasmussen (left) and Eric Coombs (right), Oregon Dept. of Agriculture

Photo 5: Spurge Laurel


Images courtesy of Randy Westbrooks (left) and King County noxious weed program (right)

APPENDIX D | REFERENCES AND ADDITIONAL RESOURCES

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