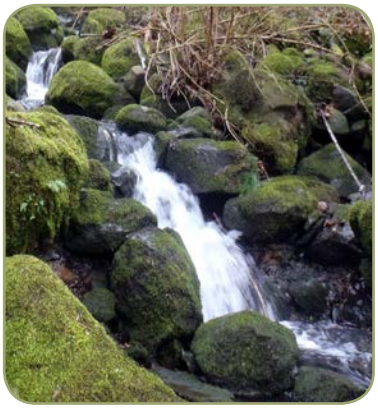
SITE CONSERVATION PLAN

Newell Creek Canyon Natural Area





REVIEW DRAFT | November 2014

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SECTION 1: INTRODUCTION

1.1 CONTEXT

Newell Creek Canyon Natural Area is located within the Newell Creek Watershed in Clackamas County, Oregon along the eastern border of Oregon City. The headwaters of the 1,800-acre watershed originate atop the bluffs above Oregon City, winding through steep canyons, connecting with Abernethy Creek, and eventually flowing into the Willamette River below Willamette Falls. Metro's ownership in the drainage totals more than 304 acres divided among three distinct sites. This conservation plan addresses only the largest area of Metro's ownership, Newell Creek Canyon.

Newell Creek Canyon Natural Area occupies 219 acres within a steep forested canyon containing high quality cedar forest, large tracts of deciduous dominated upland forest and numerous small tributaries all centered around Newell Creek. The creek is home to federally endangered species fish species, lamprey and the red legged frog. Newell Creek Watershed was studied by Clackamas Community College John Inskeep Learning Center in 2002. Sections of this plan, including the historical context, geology, soils, streams and wetlands, major habitat types and wildlife habitat are derived from the center's restoration and conservation strategy.

The Newell Creek Canyon Natural Area site conservation plan is a tool for protecting and enhancing the unique characteristics of the site while allowing access by the public. This conservation plan has been developed by Metro staff and 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 important plant, fish and wildlife habitats, Newell Creek Canyon Natural Area will be preserved as a historical remnant of the Willamette Valley's natural ecosystem, providing an ecological showcase of native habitats and wildlife. The salmon-bearing stream, wetlands and floodplains add significant value for wildlife and water quality. The area will be maintained and enhanced to the extent possible, in a manner that is congruent with its original natural condition. Only those visitor experiences that are compatible with the environmental objectives of the conservation plan will be encouraged.

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

- Restore and maintain high quality habitat including upland forest, riparian forests and Newell Creek.
- Provide visitor experiences in Newell Creek Canyon Natural Area that are supported by appropriate types and levels of access.
- Provide opportunities for research and education to local schools.

1.3 METRO'S NATURAL AREAS BOND PROGRAM AND NEWELL CREEK TARGET AREA

During the last 18 years, two voter-approved natural areas bond measures have allowed Metro to protect over 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 Newell Creek target area can be found on the Metro web site, www.oregonmetro.gov/naturalareas.

Since 1996, Metro has acquired more than 304 acres in the Newell Creek area of Clackamas County, preserving this area for conservation. The table below shows the history of land purchases at Newell Creek Canyon Natural Area.

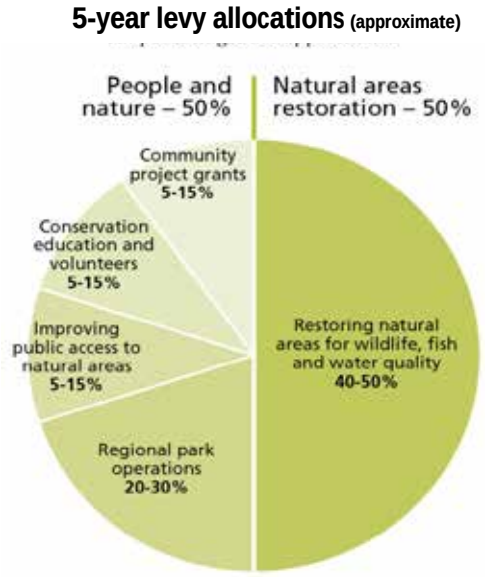
Metro natural area bond purchased land in Newell Creek Canyon

Property name (previous owner)	Bond year	Date acquired	Management
Younger	1996	02/14/1996	Metro
Spencer	1996	11/15/1996	Metro
VanDerWerf/Niemeyer	1996	12/02/1996	Metro
Newell Crest Joint Venture	1996	01/10/1997	Metro
Welsh Family Trust	1996	02/05/1997	Metro
Chapin	1996	03/17/1997	Metro
McEwen	1996	10/03/1995	Metro
Northridge	1996	01/31/1996	Metro
Switzer	1996	11/07/1997	Metro
Younger	1996	05/21/1998	Metro
Trachsel	1996	12/31/2002	Metro
Klingman	1996	01/16/2004	Metro
OR Dept. of Transportation	1996	08/08/2003	Metro

Metro's natural areas and parks levy

By law, 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. Metro Council chose to purchase natural areas while they were available and affordable, 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. As the figure shows, 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; and maintain current and implement new restoration projects.

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 work under the funds. Strategic restoation actions identified in this plan will be funded with levy dollars.

1.4 HISTORICAL CONTEXT

By the 1840s, Oregon City became the terminus for the Oregon Trail, the route of one of the largest voluntary human migrations in history. One can imagine that every acre of ground surrounding the small settlement was quickly evaluated for potential settlement, building materials and farming. One small creek was named for Robert Newell, a mountain man and trapper who arrived in Oregon City in 1840. A self-taught backwoods healer, he was nicknamed "Doctor Newell." He was instrumental in establishing Oregon statehood and was twice elected as Speaker of the House of Representatives.

In the 1850s, surveys conducted throughout the Willamette Valley found a watershed almost entirely covered by a forest of conifers. Notes from those surveys also make reference to patches of burned timber – forests were seen as impediments to early settlement and were often cleared by burning. Settlers frequently lost control of these land-clearing blazes. There are no survey entries for the inner canyon, but it is likely that its year-round moist condition kept most fires at bay.

More detailed information about the history of Newell Canyon can be found in Appendix A.

SECTION 2: PLANNING PROCESS SUMMARY

2.1 PLANNING AREA

This conservation plan addresses conditions, plans and activities for the site's 219 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 visitor experiences through physical and visual access. The approach recognizes that planning for the conservation of species, habitat and natural features is best done simultaneously with the provision for human access to these natural systems. However, this two-tiered approach also recognizes that conservation and access have different stakeholders, funding sources and 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 strategies are addressed in Section 4 of this document and access strategies 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 stress sources for each conservation target.
- Establish strategies and actions to restore habitat.
- Identify and prioritize actions to implement; define funding needs and implement.

Visitor experience

- Engage a range of public partners within Oregon City to ensure an open and meaningful public process.
- Develop a range of visitor experiences appropriate for the economically and culturally diverse neighborhoods within Oregon City.
- Develop a range of access opportunities that provide desired visitor experiences and preserve sensitive habitats.
- Develop a final master plan that meets local regulatory and permitting requirements to ensure timely delivery of the natural area and parks levy access project.
- Plan access improvements with accurate construction estimates to ensure project remains within overall levy budget.

SECTION 3: EXISTING CONDITIONS

This section of the conservation plan provides background on existing conditions for Newell Creek Canyon Natural Area.

3.1 PHYSICAL ENVIRONMENT

Located within Oregon City, Newell Creek originates near Clackamas Community College and winds north to its confluence with Abernethy Creek, a tributary of the Willamette River. Newell Creek supports significant native populations of fish, including coho salmon, cutthroat trout and steelhead. The presence of these native fish and the relatively large size of the bordering undeveloped land make the canyon biologically notable. The natural area includes a native forest of red cedar, Douglas fir, big-leaf maple and red alder with an understory of fern, snowberry and salmonberry. Lands surrounding Newell Creek Canyon Natural Area are predominately zoned for urban and industrial uses.

Geology

There are two key geologic formations in Newell Creek – the relatively level "Boring" basalts of the upper terrace, and the cemented sands and gravels that form the architecture of the canyon. The Boring basalts are characterized by reddish colored soils with large, embedded boulders. Oregon City residents are familiar with red soil exposed along road cuts. The clusters of boulders that decorate nearly every entry drive in the upper watershed have been excavated from this red soil matrix. The sand and gravel layer is composed of Troutdale and Sandy River formations. These lie under the younger Boring basalt and are exposed within Newell Creek Canyon. There are also older rocks buried under the entire watershed, known as Columbia River basalts. These are the base rocks for our entire region, having originated from a series of lava flows tens of millions of years ago. They are as much as 900 feet thick in places. These are the dark, sturdy rocks that form the bluffs along the Willamette River in Oregon City, and much of the Columbia River Gorge. Over time they were gently folded and faulted, resulting in topographic highs and lows. In some of these topographic lows, such as Newell Creek Canyon, thick sediments were deposited on top of the Columbia River basalt, filling in the depression.

The Sandy River Mudstone and Troutdale Formations consist of mudstone, siltstone, sand and gravel. Both were laid down by the ancestral Columbia River, which once flowed far south of its present course, right through where Oregon City now stands. One can envision these formations as a layer cake, with some layers much denser than others. The dense layers made from fine sediments tend to block water from penetrating down. This results in local high water tables or springs. The Troutdale Formation has two levels. The lower consists of gravel and sand derived from basalt pebbles and cobbles, but also includes minor amounts of granite and quartzite. These cemented gravels are quite permeable and can stand over 100 vertical feet. The upper consists of finer grained sands, silts and clays that are from local volcanic debris, but also includes basalt gravel layers.

Soils

Most of the Newell Creek Watershed has residual soils, formed by gradual weathering of the Boring lavas. In parts of the canyon, this soil is mixed with external sources, including deposits from the Missoula Floods dating from over 14,000 years ago. Thus, the red colored soil at the top of the canyon gives way to tan colored, silty clays, which developed directly on the Sandy River and Troutdale formations. The contact zone between bedrock and soil is usually gradual rather than abrupt, and can be identified as a zone of weathered or soft bedrock. This contact point is of great importance, because each soil layer has different strength and many of the landslides appear to originate here.

The Natural Resources Conservation Service has divided soils of the watershed into five series: Bornstedt, Helvetia, Jory, Woodburn, and Xerochrepts/Haploxerolls. The first four soils are deep and moderately well drained. In most of the steeper portions of the canyon, the soils are colluvial, as they have been transported down slope from their place of origin. These are a mixture of the Boring Lava red clays and gray Sandy River Mudstone/Troutdale soils. They are generally thinner than the alluvial, or flood deposited soils, but sometimes appear as very deep blocks, indicating old landslides.

Much of the rim of the watershed has been developed and therefore has been or is being re-contoured and surfaced with fill. The properties and thickness of this fill vary widely and are site-

specific, generally composed of the local residual soil, basalt gravel, cobbles and sometimes bricks, organic debris, wood, concrete and even garbage in some cases.

Soils present at Newell Creek Canyon natural area

Map soil symbol	Map unit name	Description
91C	Woodburn silt loam	This deep, moderately well-drained soil is on broad valley terraces. Permeability of this Woodburn soil is moderate to a depth of 38 inches and slow below this depth. Available water capacity is about 10 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. Slope is 8-15 percent.
92F	Xerochrepts and Haploxerolls	On terrace escarpments. Deep and well-drained, moderate to moderately slow permeability and rooting depths are 40 to 60 inches or more. Runoff is rapid and erosion hazard is severe. Slope is 20-60 percent.
45C	Jory silty clay loam	Deep and well-drained. Permeability is moderately slow. Available water capacity is about 9 to 11 inches. Effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is moderate. This soil is droughty in summer. Slope is 8-15 percent.
37D	Helvetia silt loam	This deep, moderately well-drained soil is on high terraces. Permeability of this Helvetia soil is moderately slow. Available water capacity is about 11 to 13 inches. Effective rooting depth is 60 inches or more. Runoff is medium and the hazard of water erosion is severe. Slope is 8 to 15 percent.

Landslides

Newell Creek Canyon is well known as a place prone to landslides. All landform features associated with landslides, including scarps, tension crack, shear zones and toes, are found within Newell Canyon. Scarps are found near the top of a landslide and generally begin at the surface as tension cracks. Tension cracks can be found throughout a landslide. Shear zones are located along the sides of landslides, while the toes are at the bottom.

Tension cracks are usually the first sign that a landslide might occur. The pattern of tension cracks can be used as a tool for analyzing stability of the surrounding area. In Newell Creek Canyon, tension cracks are mostly found above scarps and along the upper portions of the sides of active landslides. Tension cracks have openings from 5-30 centimeters wide.

Sag ponds are found throughout the canyon on level benches that lie between major and minor scarps. They appear as shallow local depressions and seasonally fill with water, providing important habitat, particularly for amphibians. Shear zones can be noticed where mature forest vegetation lies alongside a brushy area. The abrupt change in the size or age of vegetation may indicate that the area had been disturbed some years ago.

Landslide toes appear as overly-steep slopes that have a concave shape when viewed from above. Many of these lie parallel to creeks. In some cases, creeks have had to form a new path around the toe. Newell Creek landslides can be divided into three categories: active, inactive-young and inactive-mature. It is common for large inactive-mature landslides to have smaller active or inactive-young slides located on the steep head scarp or toes due to undercutting of the toe by a stream.

Any landslide that has moved within the past 100 years is considered active, which means it has a strong potential for moving again. Landslides that are presently moving typically have fresh signs.

There may be a fresh head scarp, often jagged, very steep and un-vegetated. Landslides that have not moved within the past 100 years have more subtle features. Scarps become smoother due to erosion and are vegetated. Internal depressions begin to fill in and may appear as soggy areas rather than ponds. Slide toes that abut streams often erode back. Overall, 79 landslides have been identified within Newell Creek Canyon; 65 of these are shallow-seated and fairly small. There are at least 14 large, deep-seated landslides.

Landslide scarps in the southern portion of the canyon, especially the deep-seated landslides, are located along the contact between the Troutdale/Sandy River Mudstone Formation and the Boring Lavas. In the northern portion of the canyon, deep-seated landslides are generally located along the perimeter of the canyon where the slopes change from relatively flat to steep. Most of the shallow-seated landslides occur along the locally steeper slopes of creek banks, in man-made fills and on inactive-young and inactive-mature landslides scarps and toes.

Most of the deep-seated landslides in the study area are believed to be inactive and range from young to mature. Many of them date from long before the time of Euro-American settlement and their causes were likely unrelated to human activity. These older slides can be reactivated at any time. The Spady and Dewey Street-Warren Street Landslides are recent and still active. Almost all of these deep-seated landslides have smaller, inactive-young and active, shallow-seated slides within their boundaries. Many of the shallow-seated slides are active and much younger than the deep-seated slides. These slides tend to be associated with cut slopes and fills from recent construction.

3.2 STREAMS AND WETLANDS

Newell Creek Watershed is low in elevation and has been shaped largely by seasonally driven rainfall. The upper terrace that generally follows Beavercreek and Molalla roads has no surface creeks. Historically, rainfall was intercepted by forest cover and water that reached the ground was held in place or allowed to slowly percolate to the groundwater table. Only a small amount ran off the surface during infrequent, large storms. A network of seven surface creeks emerges at the canyon edge. These have steep gradients until they reach the main stem in the canyon bottom.

Numerous springs and seeps feed cool groundwater to Newell Creek throughout the year. There are six subbasins or small watersheds that feed Newell Creek. The main seasonal flows come from two of these. Water originating in the southwest subbasin feeds a ditch informally named "Red Soils" Creek, which flows south past City Hall, turns east at Danielsons, disappears into a pipe and daylights above the canyon behind the Pioneer Car Wash. In the southeast, water from the new Oregon City High School campus and Clackamas Community College feeds a constructed channel that originates at the Environmental Learning Center, and then flows along Beavercreek Road, entering the canyon just west of Highway 213. These two tributaries represent approximately 75 percent of the total surface flow from all the creeks that feed Newell Creek.

Map 3 shows the soils, topography, streams and wetlands present at Newell Creek Canyon Natural Area.

3.3 MAJOR HABITAT TYPES

Newell Creek Canyon Natural Area can be characterized by two major natural habitat types: riparian forest and upland conifer-hardwood forest. Historically the canyon appears to have been primarily old growth conifer forest, dominated by Douglas fir and western red cedar. There was likely a significant hardwood component that included big leaf maple, red alder and black cottonwood trees. Hardwoods were most likely found along streams and wet areas, and in areas of recent disturbance, such as landslides. Big leaf maple is shade tolerant and probably grew underneath taller Douglas fir, western hemlock and western red cedar. Years of logging, road construction, agriculture, power line location and urban development along the canyon rim have gradually taken a toll on the native forest.

At present, the canyon is still mostly forested, but the trees are much smaller and hardwoods are dominant over conifers. Red alder may be the most abundant and widespread tree. Douglas fir trees are scattered in several locations. Western hemlock is hard to find. Western red cedars are still abundant in the lower canyon, near the main stem of Newell Creek, but there are few large diameter old growth trees. A few Pacific yew trees can be found throughout the canyon.

Riparian forest

Riparian forests are forests that border the shores of ponds, lakes, streams, rivers and other water bodies. These forests play an important role in preventing runoff of sediment, nutrients and contaminants from upland areas. They filter and clean water, reduce erosion and provide structural elements like trees and sinuosity that allow in-stream habitats to function. Riparian forests provide homes to most species of wildlife at some point in each species life cycle. Riparian forests throughout the region have been moderately to severely degraded due to resource extraction, development and land use activity.

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, vine maple, black hawthorn, salmonberry, Pacific ninebark, red-osier dogwood, Sitka and Pacific willow, red elderberry and Douglas' spiraea.

Key wildlife

Partners in Flight identifies the following focal species for bottomland shrub and tree habitats: willow flycatcher, red-eyed vireo, yellow warbler, Swainson's thrush, downy woodpecker and yellow-billed cuckoo. Other birds utilizing this habitat may include green heron, great blue heron, Wilson's and other warblers, yellow-breasted chat, black-headed grosbeak, common yellowthroat, song sparrow, ruby-crowned kinglet, downy woodpecker and red-breasted sapsucker. Some of the 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.

Current extent and attributes

The Newell Creek Canyon Natural Area includes approximately 23 acres of forested riparian habitat.

Riparian habitats on the site exhibit variations in species composition based primarily on slope and the age of the tree canopy. Primary plant communities include red alder/big leaf maple/salmonberry and western red cedar/salmonberry. Younger forests tend to be dominated by the alder and maple, while older forests tend to have a larger percentage of conifers, particularly cedars. Areas of more moderate to steep slopes tend to show greater variability in species composition.

Upland forest

Upland coniferous and mixed conifer/deciduous forests (upland forest) are the dominant natural habitat of the region. Low-elevation Pacific Northwest old-growth forests typically are dominated by conifers like Douglas fir, western red cedar and western hemlock, with grand fir and hardwood species also occurring. Under natural conditions, trees of many of the dominant species live to be 350 to 750 years old or older and frequently have 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 and historic forestry practices, and old growth associated species' declines reflect 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. According to the Regional Conservation Strategy, 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 (The Intertwine Alliance, 2012).

Key plants

Native forbs found in this habitat include sword fern, lady fern, wood fern, licorice fern, false Solomon's seal, trailing blackberry, fringe cup, geum, Henderson's sedge, dewey sedge, inside out flower, wild ginger, Columbia brome, trillium, fairy bells, miner's lettuce, stinging nettle, hedge-nettle and heal-all. Shrubs and trees found in this habitat may include Pacific yew, big leaf maple, red alder, Douglas fir, Grand fir, western hemlock, Western red cedar, Oregon white oak, cascara, salmonberry, thimbleberry, hazelnut, Indian plum, vine maple, ocean spray, black hawthorn, Western serviceberry, tall and dull Oregon grape, mock orange, red elderberry, salal, red huckleberry and snowberry.

Key wildlife

Partners in Flight identifies the following focal species for coniferous forests in western Oregon: Vaux's swift, brown creeper, red crossbill, pileated woodpecker and varied thrush (old growth and mature forests); hermit warbler, Pacific-slope flycatcher, Hammond's flycatcher, winter (Pacific) wren, black-throated gray warbler and Hutton's vireo (mature/young/pole forests); and olive-sided flycatcher, western bluebird, orange-crowned warbler and rufous hummingbird (young forests). Other birds utilizing this habitat may include Townsend's warbler, evening grosbeak, Swainson's thrush, Anna's hummingbird, cedar waxwing, bushtit, chestnut-backed and black-capped chickadee, American robin, Steller's jay, Bewick's wren, golden-crowned kinglet and Cooper's hawk. Other wildlife 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

Newell Creek Canyon includes 196 acres of upland coniferous forest habitat, with tree age in the range of two to more than 100 years. Some variations of canopy structure in this habitat type include red alder/big leaf maple, Douglas fir/big leaf maple/red alder and cedar/big leaf maple.

Native fish and wildlife

The Newell Creek Watershed offers relatively high quality habitat, given its urban context. With nearly 700 acres of mixed evergreen and deciduous woodland, there are a large number of wildlife species that can find food and shelter. These potentially include 18 amphibians, 149 birds, 76 mammals and 21 reptiles associated with urban woodlands.

It is highly likely that additional 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, 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 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 on site. Forest habitats could support additional small mammals including Douglas' squirrel and several bat species. Newell Creek, because of its perennial flow and intact riparian habitat, is potentially suitable for river otter. Other possible species for this site include wood rat, chipmunks, voles and mice, mink, weasel, mountain beaver, bobcat, cougar, black bear, black-tailed deer and elk.

Anadromous fish occurring in Newell Creek Canyon include coho salmon, steelhead, migratory cutthroat trout and Pacific lamprey (Runyon and Salminen, 2005). Some spawning activity has been documented but the primary use is by juvenile fish seeking cold water refugia. These juvenile fish likely originate from spawning populations on Abernethy Creek or the Willamette River. Resident native fish occurring in Newell Creek include cutthroat trout, rainbow trout and brook lamprey.

In summer 2000, Adolfson and Associates conducted a survey of fish habitat and species presence within Newell Creek Canyon. A total of 381 fish were detected, including 11 different species. Of these, there were three species of native salmonids (Adolfson Associates, Inc. 2000):

- 48 Cutthroat trout (Oncorhynchus clarki)
- 43 Rainbow trout/steelhead (Oncorhynchus mykiss)
- Coho (Oncorhynchus kisutch)

The greatest numbers of fish were located in the middle reaches of Newell Creek Canyon.

Biodiversity connectivity (corridors)

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

In 2010 and 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 professional opinion only and are not meant to be property specific, nor make any 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 Newell Creek Canyon Natural Area to other important habitat areas in the region. Newell Creek Canyon is both a large habitat patch and a major north-south wildlife corridor. Biodiversity corridors in the area of Newell Creek Canyon Natural Area include:

- Newell Creek riparian corridor south to Abernethy Creek riparian area. This corridor connects to the Willamette River greenway and upstream on Abernethy Creek.
- Connection east and south to the forested hills of the upper Abernethy Creek watershed. This corridor is bisected by Highway 213 and the developed areas of Oregon City.

Climate change adaptation considerations

At Newell Creek Canyon 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 and decreased dry-season flows, reducing or degrading native fish populations and riparian habitat. 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 against invasive species at Newell Creek Canyon Natural Area. 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. These activities are addressed in this conservation plan.

3.4 EXISTING TRAILS AND USE BY THE PUBLIC

To date there has been no formal master plan developed to help identify appropriate levels of public access and use of Newell Creek Canyon Natural Area. However, people have been recreating informally on the Newell Creek site since before it was purchased. Public access has been primarily isolated to the existing trail networks. At this time, the use of the existing trail network by the public is relatively light. There are no signs or trail maps to assist in wayfinding within Newell Creek Canyon Natural Area.

Map 4 shows areas of major habitat types present at the Newell Creek Canyon Natural Area.

SECTION 4: CONSERVATION

This section provides a comprehensive framework for conservation planning at Newell Creek Canyon 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 B.

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).

The methodology for determining conservation targets and key ecological attributes is discussed in detail in Appendix B.1 and Appendix B.2. Using on-site 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. The conservation targets are:

- Riparian forest
- Mixed conifer hardwood forest
- Native fish (species target)

The riparian forest and native fish habitat targets represent some of the region's most degraded habitat types while the patches of coniferous forest are one of the region's most common habitats. The site's habitat diversity, connectivity at the landscape level and importance to anadromous fish 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 B.1.

4.2 KEY ECOLOGICAL ATTRIBUTES

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. KEAs are rated from poor to good. This rating helps establish the restoration goals and guides the development of restoration actions for the conservation targets.

Appendix B.2 describes the site's KEAs and indicators for each of the three conservation targets in more detail.

4.3 THREATS AND SOURCES

An effective conservation strategy requires an understanding of threats 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 Newell Creek Canyon Natural Area, the following threats are evident:

- Increased competition from invasive species
- Altered vegetation structure

- Habitat conversion
- Human disturbance
- 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 B.3, Threats and Sources.

Information on Newell Creek Canyon Natural Area's conservation targets, KEAs, significant threats and management actions to address those threats is summarized in the table below. More detailed information is available in Appendix B.1, B.2 and B.3. The following section outlines short and long-term management strategies for conservation targets.

Newell Creek Canyon Natural Area conservation targets

Conservation target	Attributes of healthy habitat
Riparian Forest	Includes the riparian forest along Newell Creek and its perennial tributaries, as well as associated wetlands. 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 23 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 196 acres.
Native fish habitat	Newell Creek provides important habitat to native salmonids, lamprey and other native fish. The water quality and riparian area is relatively intact and the flow regime has not been altered much compared with many streams in the Portland region. Healthy native fish habitat includes riffle-pool sequences, off-channel habitat, gravel and rocky substrate, and large wood in the stream. Current cover: Approximately 6432 linear feet or 1.2 miles of stream reach.

SECTION 5: STRATEGIC RESTORATION AND STEWARDSHIP

5.1 RESTORATION

This conservation plan outlines strategic actions to be carried out at Newell Creek Canyon Natural Area over the next five to ten 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 will be developed by Metro staff to address site-specific conditions encountered in the areas targeted for restoration action.

Approximately 8-10 acres of riparian habitat are in need of intensive restoration and much of the mixed conifer hardwood forest habitat throughout the Newell Creek site is in need of a moderate level of restoration. This primarily includes removal of non native, invasive species, understory planting of native trees, shrubs and forbs, and maintenance of plantings in order to ensure successful establishment. 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: Riparian forest

Short-term goals 2014 to 2018

- Increase percent cover of native trees, shrubs and herbaceous species (vegetation structure) and increase native tree, shrub and herbaceous species richness in all riparian and floodplain forest habitat areas.
- Eliminate gaps in woody vegetation.
- Maintain Newell Creek floodwater access to riparian and floodplain areas. To the extent feasible, promote beaver activity.
- Establish conditions that will lead to recruitment of snags and large woody debris buildup within the riparian forest.

Long-term goal

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

Key ecological attributes outside normal range of variation

- Richness and percent cover of native trees, shrubs and herbaceous species: portions of the riparian and floodplain habitats are dominated by reed canary grass and other non native weeds and have limited canopy cover of trees and shrubs.
- Gaps in woody vegetation: numerous gaps in intact riparian vegetation 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 very high and high range

- Altered native species composition: logging and long-term human use have simplified the plant communities and have introduced non native species that can out-compete native plant species.
- Altered hydrology: altered hydrology due to logging and upstream development has lead to stream bank erosion, channel damage, loss of gravel and cobble substrate, loss of large woody debris and snags, and overall habitat simplification.

Strategic restoration and stewardship actions

- Restoration actions were initiated by the Greater Oregon City Watershed Council in 2012 to control non native invasive species and increase the cover of native trees and shrubs in the riparian areas of Newell Creek Canyon. Additional planting and maintenance work will be necessary over the next 3-5 years to insure the success of these plantings. These follow up maintenance treatments will be led by Metro.
- Early detection and treatment of invasive species should target all early detection-rapid response (EDRR) species with the goal of preventing establishment of any such species not already present in the natural area. Surveys for and treatment of EDRR species should occur every 2-3 years.

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

Short-term goals 2014 to 2018

- Increase percent cover and richness of native trees and shrubs. Establish shade tolerant conifers, especially grand fir, western red cedar and hemlock trees, in the understory of deciduous dominated stands.
- Remove all non native trees.
- Promote the development of mature trees.
- Maintain and actively recruit standing and down dead trees that can function as wildlife habitat.

Long-term goal

The desired future condition is to have all size and condition key ecological attributes ranked as *good* to *very good*, thereby maintaining and restoring habitat suitable for upland forest-dependent wildlife species. The edge condition key ecological attribute is expected to maintain a *fair* ranking due to the site being bordered on three sides by roads and development.

Key ecological attributes outside normal range of variation

- Richness and percent cover of native trees and shrubs: portions of the site are dominated by non native ivy, holly, laurel and cherry trees and have reduced the cover and richness of the upland forest habitat.
- Standing and downed dead trees: most upland forest habitat areas on the site lack dead wood. This is primarily due to historic logging and illegal use of the site.

Critical threats very high and high range

- Altered native species composition: logging and long-term human use have simplified the plant communities and have introduced non native species that can out-compete native plant species.

Strategic restoration and stewardship actions

- Similar to the riparian forest area, restoration actions were initiated by the Greater Oregon City Watershed Council in 2012 to detect and treat all non native ivy, holly, laurel and cherry trees in forested areas. Additional invasive species treatment work will be necessary over the next 3-5 years to insure the success of these treatments. These follow up treatments will be led by Metro.

- Treat blackberry and other broadleaf non native species along the edges of the natural area and within power line corridors. Once the site has been controlled for 2-3 years the site will need follow up treatments every 2-5 years.
- Restoration actions were initiated by Metro in 2013 to plant native conifer trees (grand fir, western red cedar and hemlock) to fill in areas with less than 75 percent combined canopy cover of trees and shrubs. Tree planting has been focused in areas where invasive species treatments have been completed. Additional plantings and maintenance work will be necessary in 2014 and 2015.
- Plant shrubs on the edges of the forested areas to act as a buffer between the urban developed area and the natural area. Shrubs are excellent pollinator species and also provide a food source for birds and other wildlife. Choose native shrub species that are suited to compete with blackberry and other non native species.
- Early detection and treatment of invasive species should target all EDRR species with the goal of preventing establishment of any such species not already present in the natural area. Surveys for and treatment of EDRR species should occur annually.

Conservation target: native fish habitat

Short-term goals 2014 to 2018

Increase the complexity of in-stream habitat and number of key large wood pieces in Newell Creek.

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 Newell Creek. More specifically the long term goal is to support the recovery of ESA-listed coho and winter steelhead populations for the lower Willamette River.

Key ecological attributes outside normal range of variation

- Complexity of habitat: Newell Creek lacks complex habitat that native fish require for spawning and rearing.
- Key pieces of large wood: historic logging at the site has reduced the number of key large wood pieces in the stream and off-channel habitats.

Critical threats very high and high range

- Altered hydrology and simplified stream structure: lack of complex habitat features and limited large wood that provides complex habitat for fish.

Strategic restoration and stewardship actions

- Study the feasibility and cost to install single or multi-piece large log structures on the main channel of Newell Creek. This action may become more cost efficient when trail work is completed in Newell Canyon.
- Work with Oregon Department of Fish and Wildlife to complete stream surveys and monitoring of Newell Creek with Newell Creek Canyon. Understanding current fish use will help inform future restoration actions.

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 particular threat now will save time and money in the future. The following table 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.

Priority status for Newell Creek Canyon Natural Area conservation targets

Conservation target	Priority
Riparian forest	High
Mixed conifer hardwood forest	Medium
Native fish	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 Newell Creek Canyon Natural Area. Metro staff will conduct multiple site walks 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 responding to complaints. The table below describes high and medium priority maintenance action at the site. Additional details about the stewardship of the site can be found in the Newell Creek Canyon Site Stewardship Plan.

High and medium priority stewardship actions

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

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. Other invasive plant species will be controlled as part of restoration projects or ongoing management of habitat areas. See Appendix B.4 for a list of invasive species.

Wildfire response plan

Metro has developed a wildfire response plan that identifies areas where fire may be allowed to burn up to natural or established firebreaks without risk to natural resource protection areas and structures. The plan identifies on-site fire suppression resources and concerns, key Metro staff, responding agencies, partners and additional contacts, and adjacent landowner contacts. Ensuring that wildfire on the natural area does not impinge on adjacent private property is of the highest priority.

5.4 LONG-TERM STRATEGIES

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

- Commercial thinning in the mixed conifer and hardwood forests habitat areas. Retain all large logs from thinning and leave in the stand for habitat.
- Acquisition of fee title or conservation easements of adjoining private lands adjacent to riparian forest and upland forest areas. Target gaps in ownership.
- Decommission old logging roads and unauthorized trails.

SECTION 6: VISITOR EXPERIENCE OVERVIEW

6.1 CONTEXT AND EXISTING CONDITIONS

Newell Creek Canyon is located just east of downtown Oregon City which has a population of approximately 32,700 residents. The site is located in the northwestern corner of Clackamas County near Hwy 213 and Beavercreek Road. Beavercreek Road and Mollala Avenue border the south and west edges of the main property and include a number of large commercial businesses such as Fred Meyer, Bi-Mart, and Les Schwab Tire Center, along with many other smaller commercial businesses. The main 219-acre property is represented by both the Barclay and Hillendale neighborhood associations. The campuses of Clackamas Community College and Oregon City High School, located just southeast of the site, are located near the headwaters of Newell Creek. Mountain View Cemetery is just west of the main are of the Newell Creek Canyon property. The Forest Edge and Berry Hill apartment complexes are located at the southeast corner of the main property near the intersection of Highway 213 and Beavercreek Road.

Metro maintains two informal access points into the main property. One is located near Nelson's Nautilus at the south side of the property off Beavercreek Road. The second access point is located at the end of Beaver Lane under an existing powerline corridor.

Area Demographics

The following demographic information was established using the Coalition for a Livable Future – Equity Atlas 2.0. The Equity Atlas is based on data from the 2010 census. Populations of color are below 21 percent while the average populations in poverty are below seven percent. Median incomes

range from $55,209 to $76,754. Households with youth (0-17 yrs) are above 23 percent and households with seniors are above 11 percent. The following categories are based on a scale of one (low) to five (high) with low having over one mile proximity and high having one-quarter mile or less proximity. The City of Oregon City was rated for:

- Proximity to public parks 3.55
- Proximity to publicly accessible natural areas 4.29
- Bikeability rating 2.55

Priorities for the Future

SCORP analysis

Oregon Parks and Recreation Department developed the Statewide Comprehensive Outdoor Recreation Plan (SCORP) to guide federal, state and local governments in making policy and planning decisions. SCORP survey participants in Clackamas County were asked their opinions on priorities for the future in and near their community. The percent of the population that participates in an activity are presented for Clackamas County in the following table. The top activities for Clackamas County and proportion of Clackamas County residents are included in the table below.

Clackamas County resident activity participation

Activity	Population participating
Walking on local streets/sidewalks	58.0%
Walking on local trails/paths	56.3%
Sightseeing/driving or motorcycling for pleasure	52.9%
Attending outdoor concerts, fairs, festivals	49.0%
Picnicking	46.1%
Walking/day hiking on non-local trails/paths	45.0%
Relaxing, hanging out, escaping heat/noise, etc.	44.9%
Visiting historic sites/history themed parks	42.0%
General play at a neighborhood park/playground	39.2%

The next table below reports Clackamas County results, with items listed in descending order by mean priority ratings. The top priority needs for Clackamas County residents are soft surface walking trails, access to waterways, picnic areas for small groups and playgrounds with natural materials (natural play areas). Off-street bicycle trails, nature and wildlife viewing areas and paved walking trails rated high as well. Tennis and basketball courts, baseball/softball fields and off-highway vehicle trails/areas rated the lowest on priority investments.

Clackamas County recreation priorities

Item	Mean
Dirt/other soft surface walking trails and paths	3.8
Public access sites to waterways	3.5
Picnic areas and shelters for small visitor groups	3.4
Children's playgrounds and play areas made of natural materials	3.3
Off-street bicycle trails and pathways	3.2
Nature and wildlife viewing areas	3.2
Paved/hard surface walking trails and paths	3.1
Off-leash dog areas	3.0
Picnic areas and shelters for large visitor groups	2.9
Designated paddling routes for canoes, kayaks, rafts, driftboats	2.9
Children's playgrounds and play areas	2.8
Community gardens	2.8
Multi-use fields for soccer, football, lacrosse, etc.	2.8
Baseball/softball fields	2.6
Off-highway vehicle trails/areas	2.6
Basketball courts	2.4
Outdoor tennis courts	2.2

In 2008 Oregon City conducted its own recreation survey to determine what type of facilities would meet the needs of its local residents. The table below shows the percentage of respondents that has a need for each facility type.

Oregon City resident recreational facility needs

Parks and recreational facilities	% Yes
Walking and biking trails	76.8%
Small neighborhood parks	69.9%
Open space and natural areas	60.9%
Large group picnic area/shelter	58.7%
Large community parks	58.7%
Nature trails and nature center	55.5%
Playground equipment	46.8%
Indoor walking/running track	38.0%
Outdoor recreational/leisure pool	36.6%
Outdoor botanical garden	30.0%
Off-leash dog parks	29.0%
Outdoor amphitheater	27.5%
Outdoor tennis courts	23.0%
Outdoor spray parks	21.6%
Skateboarding park	14.5%
Outdoor competition pool	9.8%

6.2 PRELIMINARY LANDSCAPE CHARACTER

The dominant aspect of the landscape character is its topography. Much of the upper rim of the site is steep, where the headcuts of ancient landslides are apparent. In the lower elevations of the site, the topography is less steep, but is still deeply incised right down to the creek edge. Movement throughout the site requires the acknowledgement of the topography and ability to work along faces of slopes in order to travel some of the steeper sections of the canyon. Upper elevations of the site are around 400 feet while the lower portions of the site near the creek are around 150 feet in elevation.

Site entrance behind Nelson's Nautilus

Old logging roadbed

Woody debris in creek

Upper section of Newell tributary behind car wash

Trail along fall line of powerline corridor

Entry point near Beaver Lane

6.3 VISITOR ACTIVITY

Presently, public access to Newell Creek Canyon Natural Area is neither discouraged nor actively promoted by Metro. There is very limited use of the natural area by the public, primarily along the existing trail network.

In 2011, Metro staff conducted an internal process to consider an appropriate level of access for each of its natural areas at a site scale. That process looked at determining, from a working staff perspective, what an appropriate level of access (*low*, *medium*, *high* or *no access*) would be to Metro natural area properties. The access designation is offered here as a starting point, with the understanding that judgment will always be needed on a case-by-case basis and indicates that some part of that site can accept people at the stated level. It does not suggest that the entire site should have that level of access.

At the end of that process, it was determined that in Newell Creek Canyon Natural Area, the level of access is – *Natural Area, High*. The passive recreation opportunities envisioned include trailheads, hiking trails, viewpoints, signage, environmental education tours, etc.

Within the life of this conservation plan Metro expects to make significant progress toward planning for future public access at the site. One goal is to engage the public in a future master plan process. This process would seek stakeholder input to help guide future access and infrastructure investments.

During the 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.

Regional Trail

Oregon City Trails Master Plan has identified a regional trail network called the Beaver Lake Trail. This regional trail is one of five proposed within the master plan. The proposed Newell Creek Trail begins at the end of the Oregon Trail Center and heads south on the east side of Newell Creek Canyon and across Beavercreek Road to Clackamas Community College, where it would link to the proposed Beaver Lake Trail. The master plan mentions that the trail would, "…utilize an old Willamette Valley Southern Railway line that carried passengers and wood products through Newell Creek Canyon to Molalla and Mount Angel from 1915 to 1938" (Alta Planning and Design, 2004). The upper half of the trail would be a paved bike path along the intact railroad grade. The lower half of the trail would be a natural-surface hiking trail traversing the canyon's steep slopes.

6.4 PROGRAM CONSIDERATIONS

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 interested in educational opportunities contact Metro to request a program. Public walks are advertised in Metro's quarterly "Our Big Backyard" publication. Information about conservation education programming is also available on Metro's website, www.oregonmetro.gov.

Education program

Currently Newell Creek Canyon 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 and open house tours to showcase Metro's natural areas program. From an education perspective, Newell Creek Canyon Natural Area's unique natural and cultural history holds strong potential for education programming. At this time, Metro has no plans for significant expansion of Newell Creek Canyon 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 Newell Creek Canyon 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, 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.

Site Management

Metro's management of the site will include enforcement of 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

Newell Creek Canyon Natural Area may contain archeological resources. To date, there have been no formal archaeological investigations. If during any site investigation, alteration or improvement, an archaeological resource is discovered, Metro will work with the State Historic Preservation Office to sensitively address the find. If any damage or unlawful use is identified, Metro would 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 Newell Creek Canyon 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 Newell Creek Canyon Natural Area would be part of the future master 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 master plan are implemented, i.e., formalized access points, new trails, gates, etc., signage would be added to help inform and orient the visitor.

Any future signage developed for the natural area should utilize Metro's signage standards manual. The manual establishes a graphic standard that will be integrated into the entire signage plan. The manual addresses each of the three types of signs: regulatory, wayfinding and interpretive.

6.5 ACTIONS

The following actions are anticipated within the next two years:

- Site access planning will be complete in late 2014 and 2015.
- Permitting and construction documents will be prepared in 2015.
- Construction will begin in 2016.

SECTION 7: COORDINATION

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

- Balancing public access with natural resource (habitat) improvements.
- 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 Newell Creek is an integral part of an adaptive management approach to restoration and stewardship. Based on the monitoring plan developed by Metro, a feedback loop is created between monitoring and management decisions. 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 Newell Creek Canyon Natural Area are traced to:

- Richness and percent cover of native trees and shrubs: portions of the site are dominated by non native ivy, holly, laurel and cherry trees and have reduced the cover and richness of the upland forest habitat.
- Altered hydrology: altered hydrology due to logging and upstream development has lead to stream bank erosion, channel damage, loss of gravel and cobble substrate, loss of large woody debris and snags, and overall habitat simplification.

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, informal amphibian and bird 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 offsite 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 monitor 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 conducted during breeding season follow an established and widely used protocol that allow 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.

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

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 and riparian 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 rely on the Oregon Department of Fish and Wildlife to provide monitoring data for this conservation target. Monitoring is part of their annual stream survey of Newell Creek and is subject to staff availability and allocation of resources in annual budgets.

7.2 FUNDING

Costs listed in following two tables are general estimates for the purpose of understanding the magnitude of costs to implement the structural elements of the plan, as described in sections four and five. The costs are estimated on hiring contractors to complete the work and include a construction contingency for time and materials. Cost estimates for the access and recreation improvements will be determined when the master plan is completed.

Conservation target strategic restoration action cost estimates

Strategic action	Cost
Riparian forest Plant native tree and shrubs + Invasive species treatments	$15,000
Upland forest Invasive species treatments + additional plantings	$63,000
Native fish Study Feasibility of fish restoration project	$5,000
Total	**$83,000**

Annual stewardship cost estimates

Annual stewardship	Cost
Treatment of invasive weeds	$7,000
EDRR surveys and invasive weed treatments (entire site)	$2,000
Maintenance of existing Infrastructure (average of multiple small actions)	$1,000
Total (per year cost)	**$10,000**

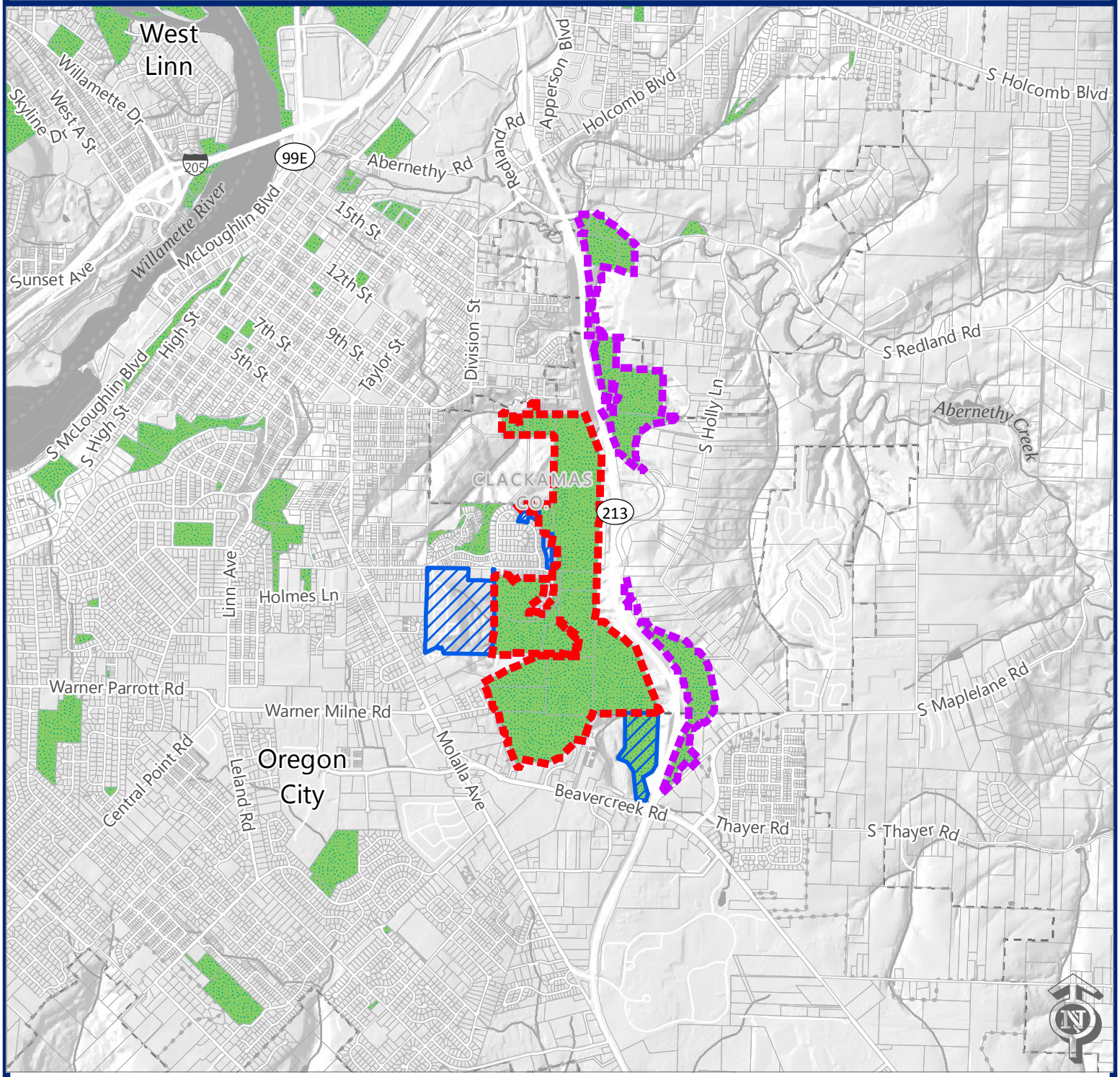
7.3 PUBLIC INVOLVEMENT

As projects are developed and the master plan process is initiated, Metro will provide local stakeholders and residents near Newell Creek Canyon 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

Planning Area



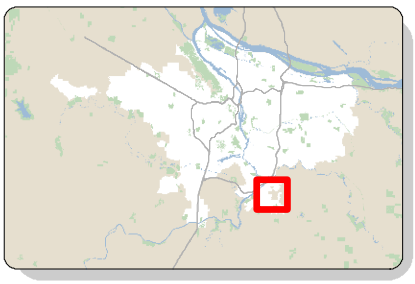
Newell Creek Canyon

Other Metro sites

Park and/or natural area

Managed areas outside Metro site

Oregon City



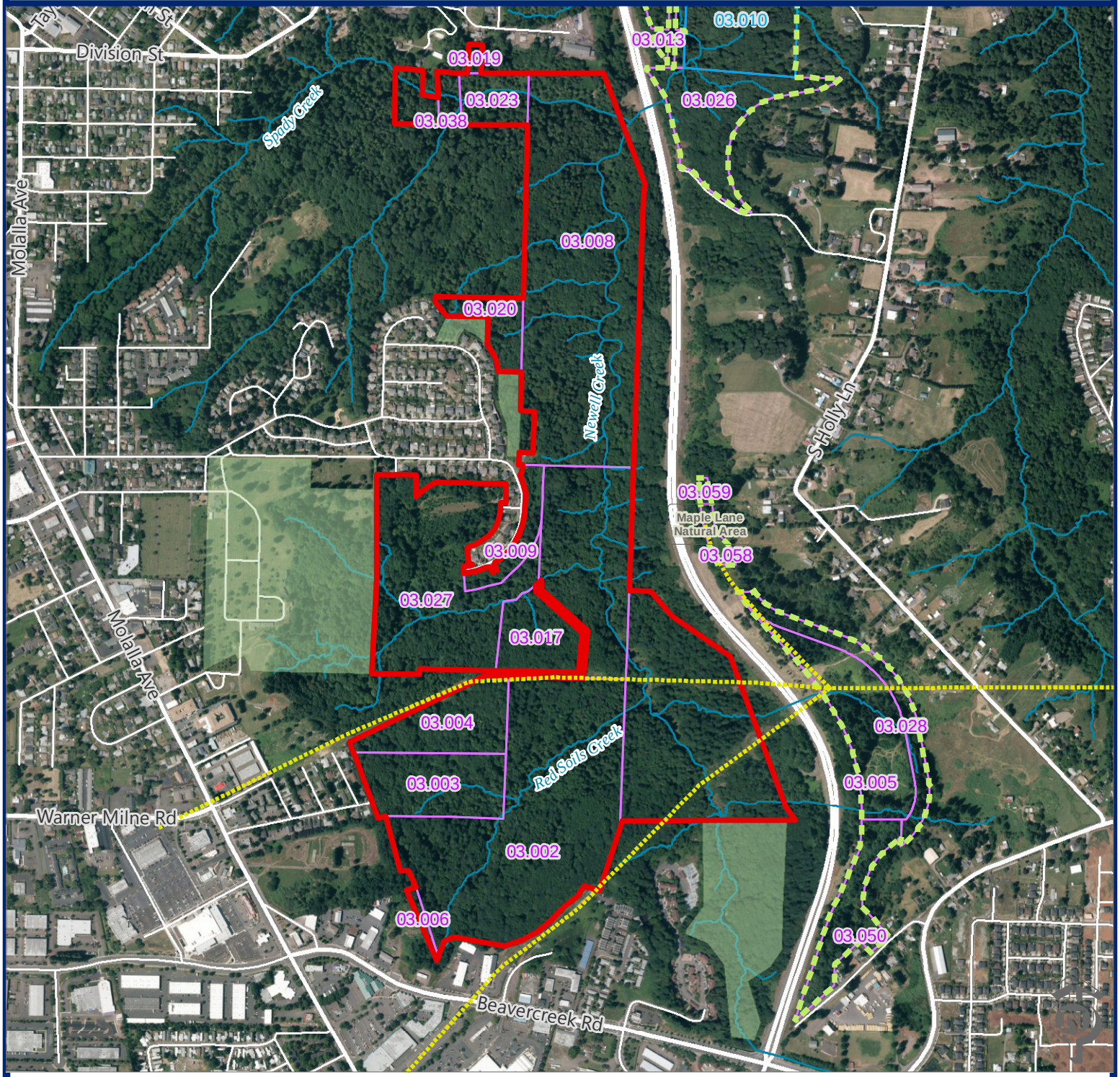
0 0.5 1 Miles

Metro

map date: 3/19/2014

Map 2

Site Map



Newell Creek Canyon

Other Metro sites

Managed areas outside Metro site

Bond Measure

1995 Bond Measure

2006 Bond Measure

Streams

Power lines

0 1,000 2,000 Feet

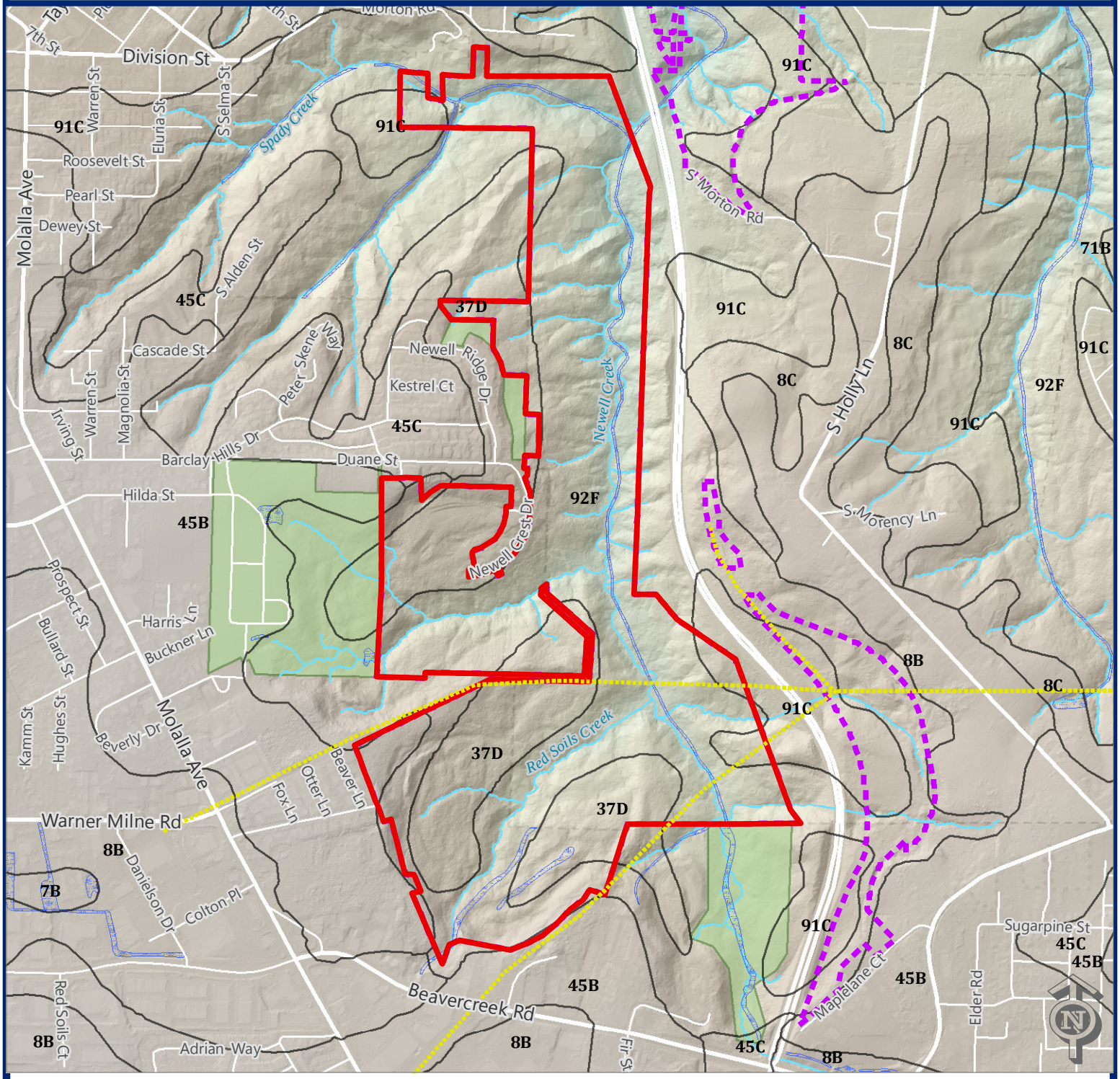
Metro

Newell Creek Canyon Site Conservation Plan

map date: 3/19/2014

Map 3

Soils, Topography, and Hydrological Features



Power lines

Newell Creek Canyon

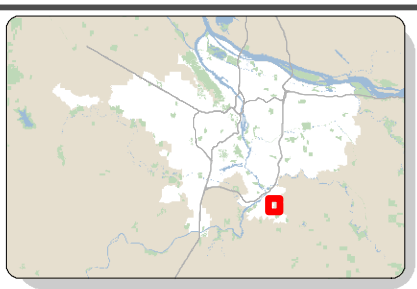
Other Metro sites

NRCS soils

Wetlands

Streams

Managed areas oustide Metro site



0 1,000 2,000 Feet

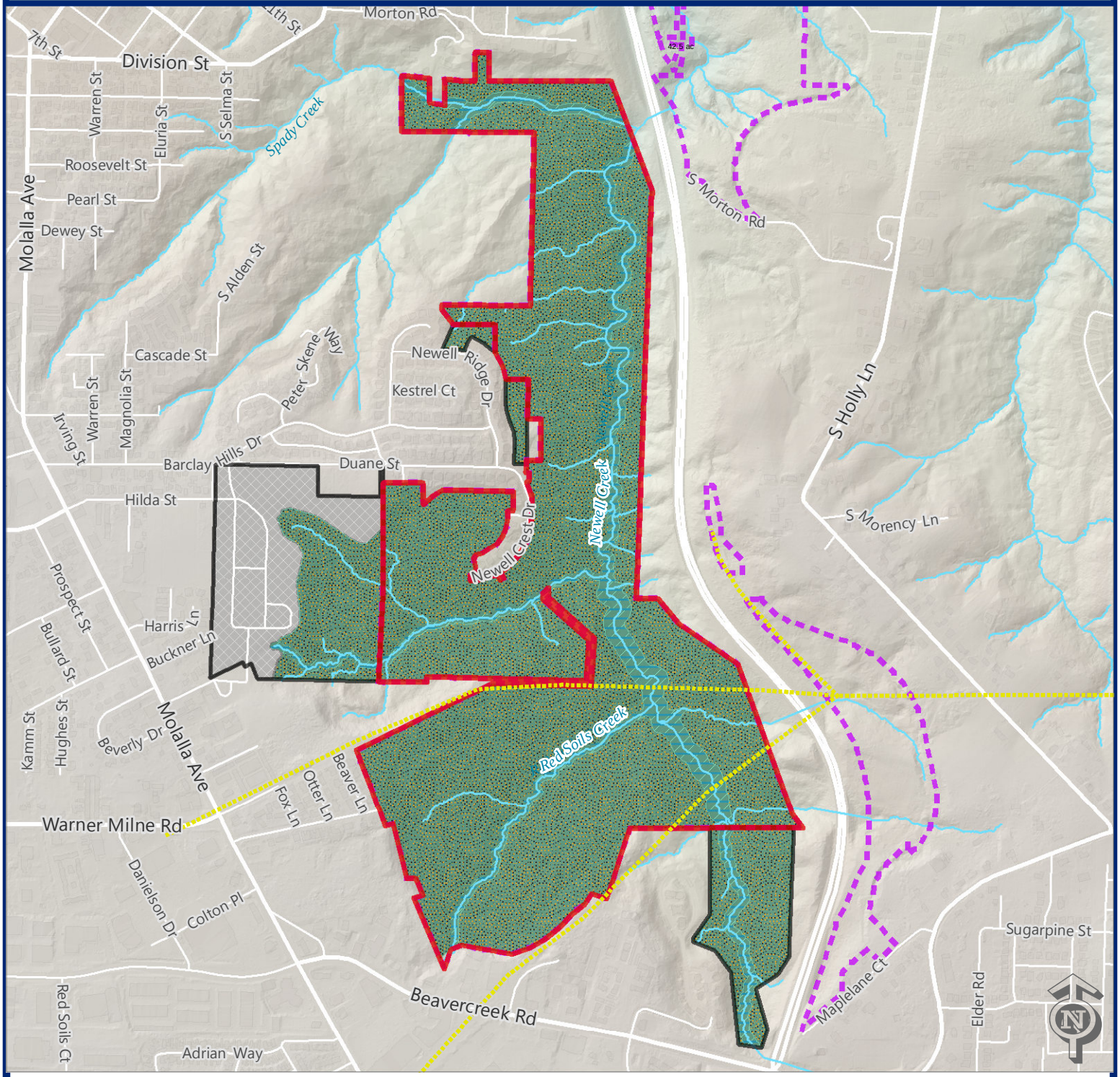
Metro

Newell Creek Canyon Site Conservation Plan

map date: 3/19/2014

Map 4

Current Cover



Newell Creek Canyon

Other Metro sites

Managed area outside Metro site

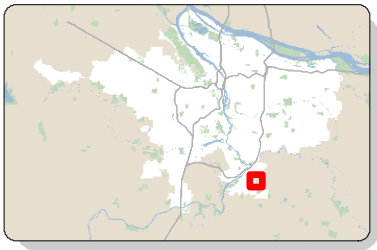
Power lines

Current cover

Developed - (pervious/non ag)

Riparian forest

Upland forest - mixed



0 1,000 2,000 Feet

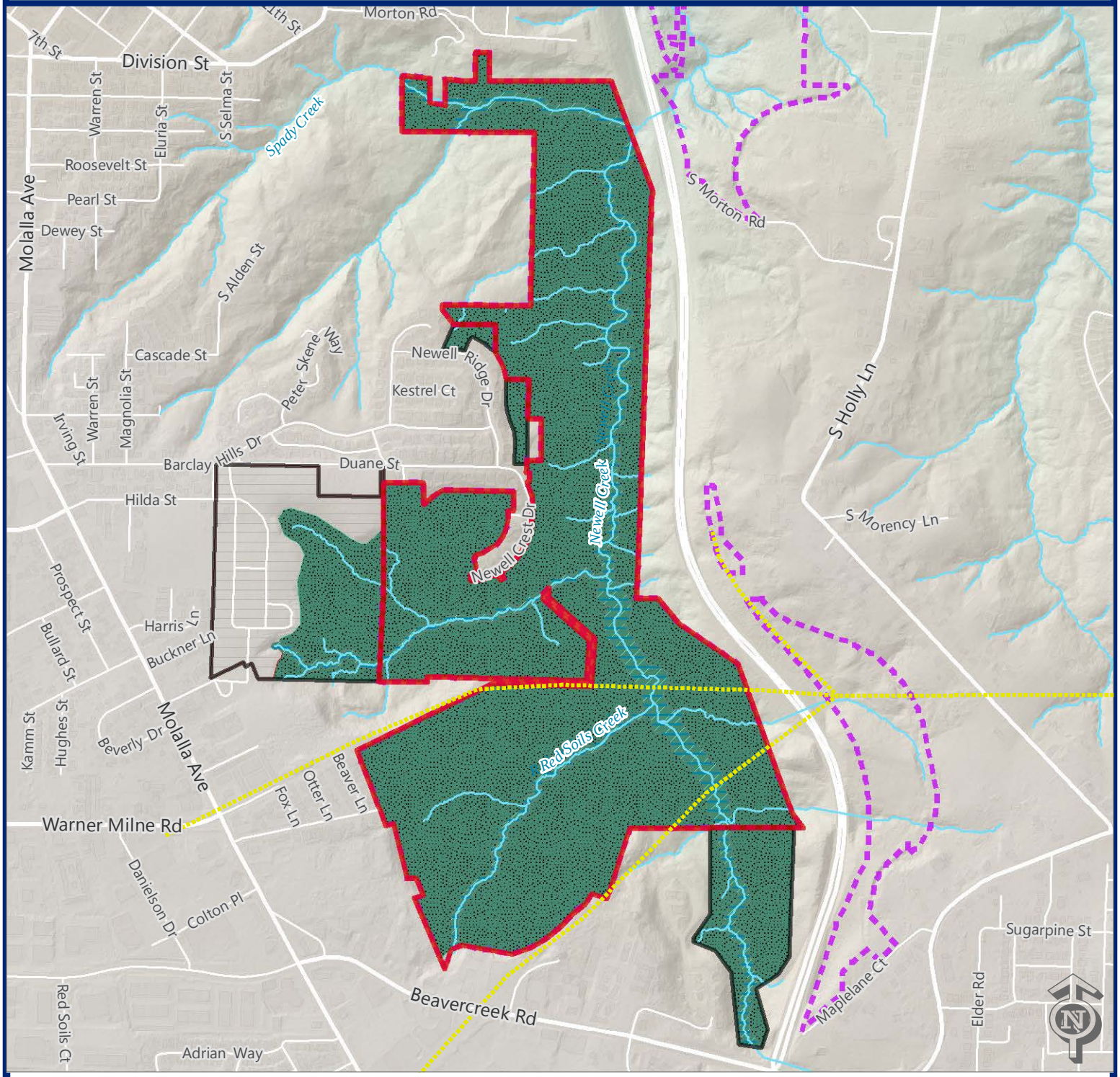
Metro

Newell Creek Canyon Site Conservation Plan

map date: 3/19/2014

Map 5

Conservation Targets



Newell Creek Canyon

Other Metro sites

Managed area outside Metro site

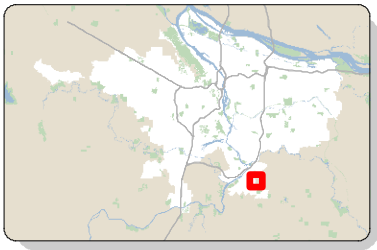
Power lines

Conservation targets

No targets

Riparian forest

Upland forest



0 1,000 2,000 Feet

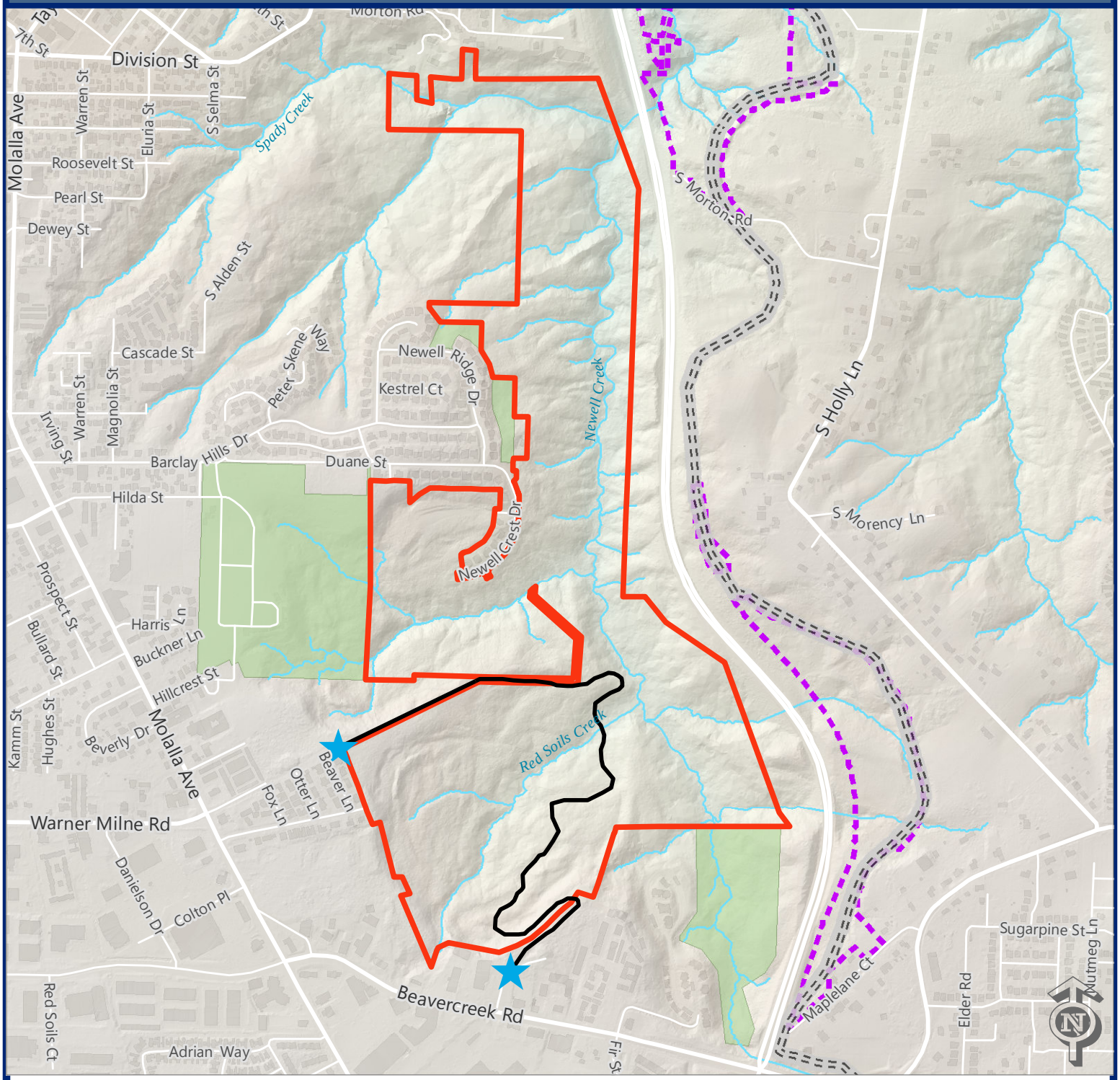
Metro

Newell Creek Canyon Site Conservation Plan

map date: 3/19/2014

Map 6

Access



Newell Creek Canyon

Other Metro sites

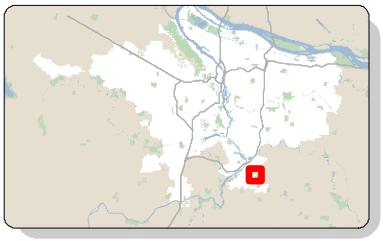
Managed areas outside Metro site

Potential access points

Existing trail

Conceptual regional trail

Streams



0 1,000 2,000 Feet

Metro

Newell Creek Canyon Site Conservation Plan

map date: 3/20/2014

APPENDICES

APPENDIX A | HISTORICAL CONTEXT

The following excerpt is from the Newell Creek Watershed Restoration and Conservation Strategy that was developed by the Clackamas Community College John Inskeep Learning Center in 2002.

By the 1840s, Oregon City became the terminus for the Oregon Trail, one of the largest voluntary human migrations in history. One can imagine that every acre of ground surrounding the small settlement was quickly evaluated for potential settlement, building materials and farming. One small creek was named for Robert Newell, a mountain man and trapper who arrived in Oregon City in 1840. A self-taught backwoods healer, he was nicknamed "Doctor Newell." He was instrumental in establishing Oregon statehood and was twice elected as Speaker of the House of Representatives.

One-hundred and fifty years ago, the Newell Creek Watershed was almost entirely a forest of conifers. The 1850s survey notes for the area surrounding Newell Creek Canyon make reference to patches of burned timber. Forests were seen as impediments to early settlement and were often cleared by burning. Settlers frequently lost control of these land-clearing blazes. There are no survey entries for the inner canyon, but it is likely that its year-round moist condition kept most fires at bay.

From the 1850s through the early 1900s, Newell Creek Watershed became a sparsely settled patchwork of woodlands and farms. Remains of old orchards and outbuildings speak to this early agricultural legacy. By 1900 a housing development called Knob Hill boasted Mt Hood view property along the rim of the canyon near today's Willamette Falls Hospital.

In 1916, just below Knob Hill, near Division Street and Morton Road, Charles Terrill discovered a vein of silica while excavating the basement of his new home. He developed a mining operation that lasted until 1948. Despite high hopes, extracting the mineral eventually proved unprofitable, so the mine was closed leaving a substantial portion of the vein untouched and buried.

By the early 1900s, logging had become a way of life in western Oregon. The steep muddy terrain of the canyon posed challenges to logging crews, but one can still find large stumps showing spring-board notches where hand sawyers perched while falling huge cedars and firs. Loggers made use of portable mills and built temporary plank roads.

In 1908, a Portland engineer envisioned a rail line connecting Oregon City to Molalla and Mt. Angel. Financed by local farmers, the Willamette Valley Southern line was completed in 1915, with a section running along the east side of Newell Creek Canyon. This spur line carried lumber, produce and passengers, later joining the extensive network of interurban electric trains. Local citizens jokingly called it the "three times a week" train because it rarely ran on time. Business was never good, although it was an important link from rural farms to Portland markets. The advent of the automobile cut into business, and a forest fire in 1929 reduced the harvestable timber that might have supported the rail line. The run was closed in 1933 and the line and equipment dismantled by 1938. Sections of the rail grade and berms are still visible at Clackamas Community College and on private property on the east side of the canyon from Maple Lane to Ogden Middle School.

Logging continued on private property through the 1950s and 60s while the upper watershed sprouted houses. Local residents fished, swam, and picnicked in the creek. A go-cart track below Mt.

View Cemetery was a popular recreation site. The eastern headwaters in the upper plateau were still covered with rows of berry vines and orchards. Cedar logs from Newell Creek Canyon were cut, split and sold to farmers for berry trellises. Many Oregon City residents recall their first paid jobs as teenagers picking raspberries in these fields. The berries were processed at the local Smuckers plant, now the site of the Environmental Learning Center.

By the 1960s, Clackamas Community College constructed its first campus buildings on farmland at the top of the watershed. Many of the farms were sold to developers and Smuckers moved on. The Smuckers settling ponds, excavated at Newell Creek's southeastern headwaters, were abandoned. A group of industrious students led by Jerry Herrmann launched the "ecology pond project" to reclaim the site. They transformed it into a park and nature center, later named the John Inskeep Environmental Learning Center. The name of the adjacent Berryhill Shopping Center recalls the area's agricultural legacy.

By the 1970s, the increase in traffic through Oregon City prompted talk of a bypass. A route was chosen through the heart of Newell Creek Canyon. Oregon Department of Transportation completed this section of the Cascade Highway 213 in 1989, locating it through some of the most unstable terrain in the region. This bypass proved to be one of ODOT's costliest endeavors, and brought significant changes to formerly peaceful Newell Creek Canyon. Over 40,000 motorists now travel this route on an average weekday.

In the 1980s and 1990s, Oregon City opened the doors to expansive development. The city envisioned apartment complexes and housing developments all along its eastern boundary on the rim and down the slopes of Newell Creek Canyon. Local activists protested these developments. In 1995, with funding from the green spaces bond measure Metro purchased acreage in Newell Creek Canyon, focusing acquisition efforts on steep slopes destined for development.

APPENDIX B.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 are 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.

METHODS

Regional conservation plans were referenced to align the conservation goals of the Newell Creek Canyon Site Conservation Plan (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 (Primozich and Bastasch, 2004) 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.

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 below.

Table 1: Newell Creek site conservation targets and relationships to other conservation strategies

Newell Creek Canyon 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)*
Riparian forest	Freshwater aquatic, riparian and wetland habitats are all priorities for the Willamette Valley	Basin-wide 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

While not elevated to the level of "conservation targets," certain fish and wildlife species that depend on 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 Newell Creek Canyon Natural Area species with special state or federal status are listed in Table 2.

Table 2: Federal and state status for species of conservation interest at Newell Creek Canyon Natural Area

Species of conservation interest	**Federal status**	**State status**	**OR Conservation strategy species?**
Coho, Lower Columbia River ESU	Threatened	Endangered	Yes
Western brook lamprey	Threatened	Species of concern	Yes
Coastal cutthroat trout, SW WA/Columbia River ESU	Species of Concern	Sensitive–Vulnerable	Yes
Pacific lamprey	Species of Concern	Sensitive–Vulnerable	Yes
Northern red-legged frog	Species of Concern	Sensitive–Vulnerable	Yes

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

APPENDIX B.2 | KEY ECOLOGICAL ATTRIBUTES

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 Newell Creek Canyon's conservation targets are provided in the following tables.

Table 1: Key Ecological Attributes for Riparian Forest at Newell Creek Canyon

Category	KEA	Indicator	---------- Indicator rating ---------- Poor	Fair	Good	Very good	Current Rating	DFC* for this SCP	Long term DFC	Comments
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	Very Good	Very Good	Very 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	Good	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	Good	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	Fair	Good	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	Good	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	Very good	Estimate via GIS, per km stream length. Riparian contiguity for water quality and wildlife. Allows 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).

Category	KEA	Indicator	---------- Indicator rating ---------- Poor	Fair	Good	Very good	Current Rating	DFC* for this SCP	Long term DFC	Comments
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	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)	Good	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 2: Key Ecological Attributes for Upland Forest at Newell Creek Canyon

			---------- Indicator rating ----------				Current	DFC* for	Long term	
Category	**KEA**	**Indicator**	**Poor**	**Fair**	**Good**	**Very good**	**status**	**this SCP**	**DFC**	**Comments**
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)	Very good	Very good	Very 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	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	Good	Very good	Very 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	Fair/Good	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	Good	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	Fair	Fair	Fair	Asses 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, 2011).

*Desired future condition

Table 3: Key Ecological Attributes for Native Fish Habitat at Newell Creek Canyon

			---------- Indicator rating ----------				Current rating status	DFC* for this SCP	Long term DFC	Comments
Category	**KEA**	**Indicator**	**Poor**	**Fair**	**Good**	**Very good**				
Condition	Complexity of Habitat	# of different stream habitat units per 305 m (1,000 foot) reach	Less than 2 habitat units	Between 2-5 habitat units	Between 5-10 habitat units	Greater than 10 habitat units	Good	Very Good	Very 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, *Recovery of Wild Salmonids in Western Oregon Lowlands*).
Condition	Key pieces and # of pieces of large wood in wetted areas of the stream and adjacent streambank	# key pieces and large wood per 305 m (1,000 ft) reach	<10 large wood pieces and 0-1 key pieces	10-20 large wood pieces and 2-5 key pieces	20-40 large wood pieces and 6-10 key pieces	>40 large wood pieces and >10 key pieces	Fair	Good	Very Good	Large wood is defined as logs greater than 46 cm (18 inch) diameter and 6 m (20 ft) in length. Note that optimum diameter and length depends on bankfull width; see DSL/ODFW's 2010 *Guide to Placement of Wood, Boulders and Gravel for Habitat Restoration*. Key pieces resist downstream transport as well as anchor and retain other pieces of large wood.
Condition	Substrate in wetted areas of stream	% area of fines and gravel substrate per 305 m (1,000 ft) 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	Good	Good	Visually assess for a stream reach(es) 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 *2000 Reference Site Selection and Survey Results, Report No. OPSW-ODFW-2001-6*, Oregon Plan for Salmon and Watersheds, 2000.
Landscape context	Fish passage	Fish able to move to and from mainstem and tributaries	Complete blockage	Blocked more than half the year	Blocked less than half the year	Passage open year-round	Very Good	Very Good	Very Good	*Could be adjusted for seasonal movement.*

*Desired future condition.

APPENDIX B.3 | THREATS AND SOURCES

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.

Analysis of threats to conservation targets at Newell Creek Canyon Natural Area involves three parts:

- Identify stresses and apply stress-rating criteria.
- Identify sources of stress, rank and assign threat-to-system rank.
- Assign overall threat rank.

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 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 1: 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:

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 2, resulting in a source of stress rank for each contribution/irreversibility combination.

Table 2: 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 3).

Table 3: Threat ranking

	SOURCE			
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

Threat-to-system rank

A threat-to-system rank is a summary ranking for all threats associated with a particular source of stress to a conservation target. Where multiple threats related to the same source of stress occurred, the threat-to-system rank is adjusted by using the "3-5-7" rule as follows:

- Three *high* rankings equal a *very high.*
- Five *medium* rankings equal a *high.*
- Seven *low* rankings equal a *medium.*

Table 7 illustrates the threat-to-system ranking.

Table 4: Conservation target A

	Stress 1	**Stress 2**	**Stress 3**	**Threat to system rank**
Stress rank	High	Medium	Medium	
Source A rank	High	Medium	N/A	High*
Source B rank	Low	N/A	Medium	Medium**

N/A = Not applicable: stress/source combination does not affect conservation target
**, ** See Table 4*

Overall threat rank

The last step in the process is to summarize threats across the system and apply an overall threat rank to each threat (source/stress combination). Overall threat ranks are determined by combining threat-to-system ranks across all system/targets affected by that threat. For each threat, DEA will combine the threat-to-system ranks across all conservation targets into an overall threat rank of *very high*, *high*, *medium* or *low* as determined by the "2 Prime" rule which is as follows:

- Two very high threat rankings yield an overall threat rank of *very high.*
- One very high or two high threat rankings yield an overall threat rank of *high.*
- One high or two medium threat rankings yield an overall threat rank of *medium.*
- Less than two medium threat rankings yield an overall threat rank of *low*.

The overall threat rank represents the degree to which a particular source causes stress to the conservation target.

Table 5: Overall threat rank

	Target 1	Target 2	Target 3	Overall threat rank
Threat A	*High**	Very high	High	High
Threat B	*Medium***	Medium	High	Medium
Threat C	N/A	Medium	Low	Low

**, ** from Tables 5,6*

Threats and source analysis for the Newell Creek Canyon Natural Area

Threats for the Newell Creek Canyon Natural Area conservation targets are listed in tables 6-8 below.

Table 6: Riparian forest

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Increased competition from invasive species	High	Extensive, broadleaf weeds and invasive woody vegetation	High	High	Non-native broadleaf weeds include blackberry, Scots broom, ivy, thistle and foxglove. Tied to native vegetation and structure KEAs.
Altered hydrology	High	Logging and development in the watershed	High	High	Altered hydrology due to logging and upstream development has led to stream bank erosion, channel damage, loss of gravel and cobble substrate, loss of large woody debris and snags and overall habitat simplification.
Human disturbance (recreational activities)	High	Demand trails, camping, dogs	Medium	Medium	Demand trail users trample vegetation, spread invasive weed; humans and dogs disturb ground-nesting birds. Tied to structure, native plant 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.

Table 7: Upland conifer-hardwood forest

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 weeds such as Himalayan blackberry, holly, laurel, clematis and ivy. Tied to native species KEAs.
Habitat conversion	High	Previous forest management practices.	Medium	Medium	Community is simplified due to past logging activities and extensive human use. May not develop old-growth characteristics for very long time. Diversity lacking. Requires replanting and weed control. Tied to native species KEA's.
Lack of downed and standing dead wood	Medium	Previous forest management practices.	High	Medium	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.
Human disturbance (recreational activities)	Medium	Demand trails, camping, dogs	Medium	Low	Stress to wildlife species utilizing this habitat. Ongoing loss of habitat and vegetation structure by escaped campers and other human use. Disturbance reduces habitat value. Tied to structure/patch size (interior habitat) KEAs.

Table 8: Native fish habitat

Stress	Stress rank	Source	Source rank	Threat rank	Comments
Simplified stream structure and lack of complex habitats	High	Altered hydrology, channel morphology due to previous practices and upstream development, deforestation and disturbance	High	High	Salmon require complex habitats. 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 and large wood KEAs.
Impaired fish passage	Low	Manmade structures that block fish migration including dams, weirs, culverts	Low	Low	Currently no barriers at the Newell Creek site. Fish passage barriers do exist on the upper reaches of Abernethy Creek.

APPENDIX B.4 | INVASIVE SPECIES

The table below summarizes a preliminary list of invasive plants requiring control in all or parts of Newell Creek Canyon 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.

Working list of priority non-native species for control at Newell Creek Canyon 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**	Site edges	Summer
Cirsium	*arvense*	Canada thistle	Upland forest, site edges	Spring
Clematis	*vitalba*	Old man's beard	Upland forest	Spring/Fall
Conium	*maculatum*	Poison hemlock	Upland forest, site edges	Spring
Crataegus	*monogyna*	Common hawthorn	Upland forest, site edges	Fall
Cytisus	*scoparius*	Scotch broom	Upland forest, site edges	Fall
Daphne	*laureola*	**Spurge laurel**	All	Spring/Fall
Dipsacus	*fullonum*	Teasel	All	Spring
Hedera	*Helix*	English ivy	All	Winter
Ilex	*aquifolium*	Holly	Upland forest	Fall
Iris	*pseudacorus*	Yellow iris	Riparian forest	Fall
Lunaria	*Annua*	Money plant	Upland forest	Spring
Lythrum	*salicaria*	**Purple loosestrife**	Riparian forest	Summer
Phalaris	*arundinacea*	Reed canarygrass	Riparian forest	Fall
Polygonum	*cuspidatum*	Japanese knotweed	All	Summer
Robinia	*pseudoacacia*	Black locust	Upland forest	Fall
Rubus	*armenianus*	Himalayan blackberry	All	Fall
Solanum	*dulcamara*	Bittersweet nightshade	All	Spring

Garlic mustard


Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

False brome


Images courtesy of Glenn Miller, Oregon Dept. of Agriculture

Meadow knapweed


Images courtesy of Dan Sharratt, Oregon Department of Agriculture

Purple loosestrife


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

Spurge laurel


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

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