Oak Creek Open Space Assessment and Management Plan

Calapooia Watershed Council
Brownsville, Oregon
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Executive Summary

View of Oak Creek Open Space from Elk Run Street.

The Oak Creek Open Space Assessment and Management Plan was developed in partnership with the City of Albany for the purpose of understanding environmental and cultural resources of the site, and planning ways to enhance, restore and conserve those resources for watershed health and community quality of life. The Calapooia Watershed Council received an Oregon Watershed Enhancement Board (OWEB) grant in 2014 to: contract preliminary monitoring and data gathering; work with a technical advisory committee to examine and refine results; conduct community outreach to share results and cooperatively develop management measures for the 233 acre Oak Creek Open Space.

In summary, the assessment found:

- The area has exceptional habitat potential for avian and bat fauna because of its proximity to waterways, location, size, and continuity with other landscape and habitat features. A relatively large number of bird and bat species were detected using or potentially using the area.
- Vegetation includes both high value native components, such as oak woodland and decrepit older trees used by native wildlife, and a moderate amount of invasive species. High priority invasive species, such as yellow flag iris and false brome should be treated as soon as possible.
- Opportunity exists for converting existing cover to potential vegetation cover with increased habitat value in parts of the site.
- Wetlands have relatively high scores for many wetland functions and values, particularly in the areas of water quality, fish and wildlife habitat, and in public use and recognition. Wetland ecological condition is somewhat compromised due to the prevalence of invasive and non-native vegetation in wetland areas.
- Water quality is good to poor in Oak Creek, but Oak Creek water quality data is limited. The Calapooia River is currently managed for Total Maximum Daily Load reductions of temperature and bacteria.
- Aquatic habitat in the lower Calapooia has been altered overtime by development but maintains a good amount of high quality fish habitat.
- Education and engagement opportunities exist for youth and community members including interpretive signs, ecological education events for residents, volunteer stewardship projects, and student field trips.
- Recreation, such as walking and bird watching and other low-impact activities, will be promoted. Dogs and cats should be controlled during nesting seasons in order to conserve ground nesting birds, and pet waste properly disposed.

Chapter 1: Introduction

Purpose of Effort

The Calapooia Watershed Council, in partnership with the City of Albany, received grant funds from the Oregon Watershed Enhancement Board in 2014 to prepare an assessment and management plan for the Oak Creek Open Space. This city-owned area is comprised of 233 acres located within the urban growth boundary dominated by deciduous riparian forest, wetland and mosaic habitat.

Herbaceous meadow with White Oak trees.

The purpose of the Oak Creek Open Space Assessment and Management Plan is to:

- Improve understanding of the environmental and cultural resources of the site
- Inform choices to restore or improve habitat and water quality conditions
- Improve community enjoyment of and pride in the site through education, stewardship and low-impact recreation

A table of recommended conservation actions is the Appendix in Table A-1. Each habitat chapter concludes with its own table of recommendations.

Methods

Information for the assessment was gathered from various sources including contracted surveys (wildlife, and vegetation and wetlands) and existing information from Albany Parks and Recreation and Public Works, and previous assessments completed by River Design Group in 2014-2015, see Table 1-1 below.

Calapooia Watershed Council staff developed the assessment document, met with the Willamette Stewardship Team Albany Reach (WSTAR) committee for technical advice, coordinated community input and developed the management plan with City of Albany based on recommendations from stakeholders.

Table 1-1: Sources of assessment data

Parameter	Source
Vegetation, rare and invasive species	Carex Working Group
Wetlands and other habitat types	Carex Working Group, Merlin Ecological
Fish and wildlife	ODFW, Merlin Ecological
Aquatic Habitat	River Design Group
Oak Creek water quality	Calapooia Watershed Council
Hydrology	River Design Group and Cardno, Inc.

Assessment Area

Watershed Setting

The Oak Creek Open Space is located in the lower Calapooia Watershed (see Figure 1-1) and is bordered, in part, by Oak Creek and the Calapooia River. The two waterways converge just north of the assessment area, and less than four miles upstream from the Willamette confluence. Oak Creek is the largest tributary to the Calapooia River; flowing 23 miles northwest from its head waters above Lebanon, meandering across the agricultural valley buffered by gallery hardwood forests and into the southwest corner of Albany.

The Calapooia-Oak Creek site contains a diversity of vegetation and topography owing to its landscape position near the confluence of two major valley-bottom streams, and to its history of human use. Vegetation cover forms complex patterns of forest, woodlands, shrublands, open areas, and aquatic and shoreline habitats. In some areas, uplands and wetlands are so finely intermixed that significant areas are impractical to map separately and are referred to as wetland-upland mosaics

There are 3.6 miles of stream inside or bordering the assessment area including the Calapooia River, Oak Creek and its tributaries, see Figure 1-2. Wetland and wetland-upland mosaic areas are interspersed throughout the area. Most soils on site consist of poorly drained to moderately well drained silty clay loams.

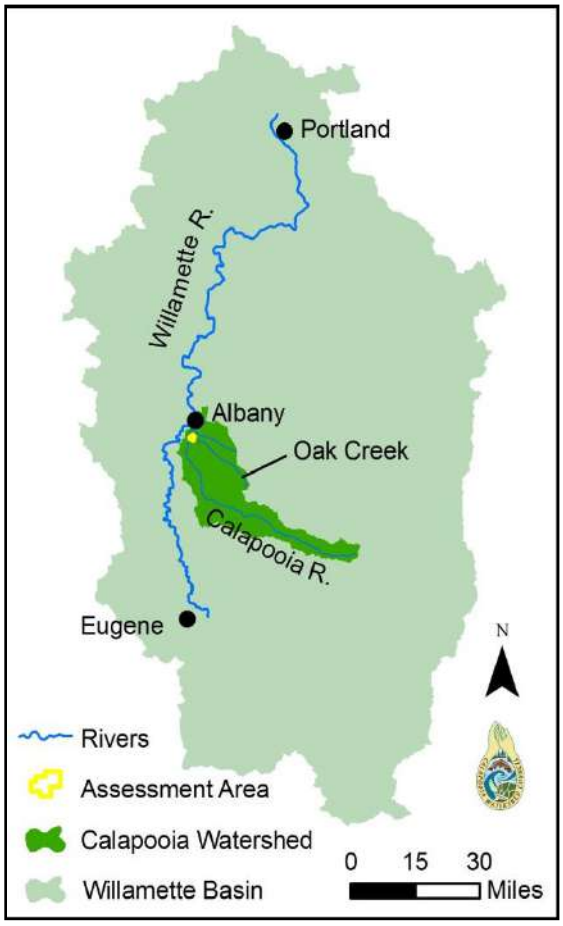

Figure 1-1: Assessment area location in the Calapooia Watershed and Willamette Valley.

Oregon Conservation Strategy

All of the Oregon Conservation Strategy habitats for the Willamette Valley are addressed in this assessment. Strategy habitats are native habitats identified by the Oregon Conservation Plan (ODFW 2006) as important for conserving rare and declining species and for maintaining a diversity of native species. Strategy habitats identified, by the Oregon Department of Fish and Wildlife, for the Willamette Valley are aquatic, riparian, oak woodlands, wetlands and grasslands, wetlands. Chapters 2 through 6 of this document are aligned with these strategy habitats. Oak woodlands are part of Chapter 4: Forest. Figure A-1, in the appendix, shows the location and extent of each of these habitat types. Wetlands and riparian areas overlap with the other types.

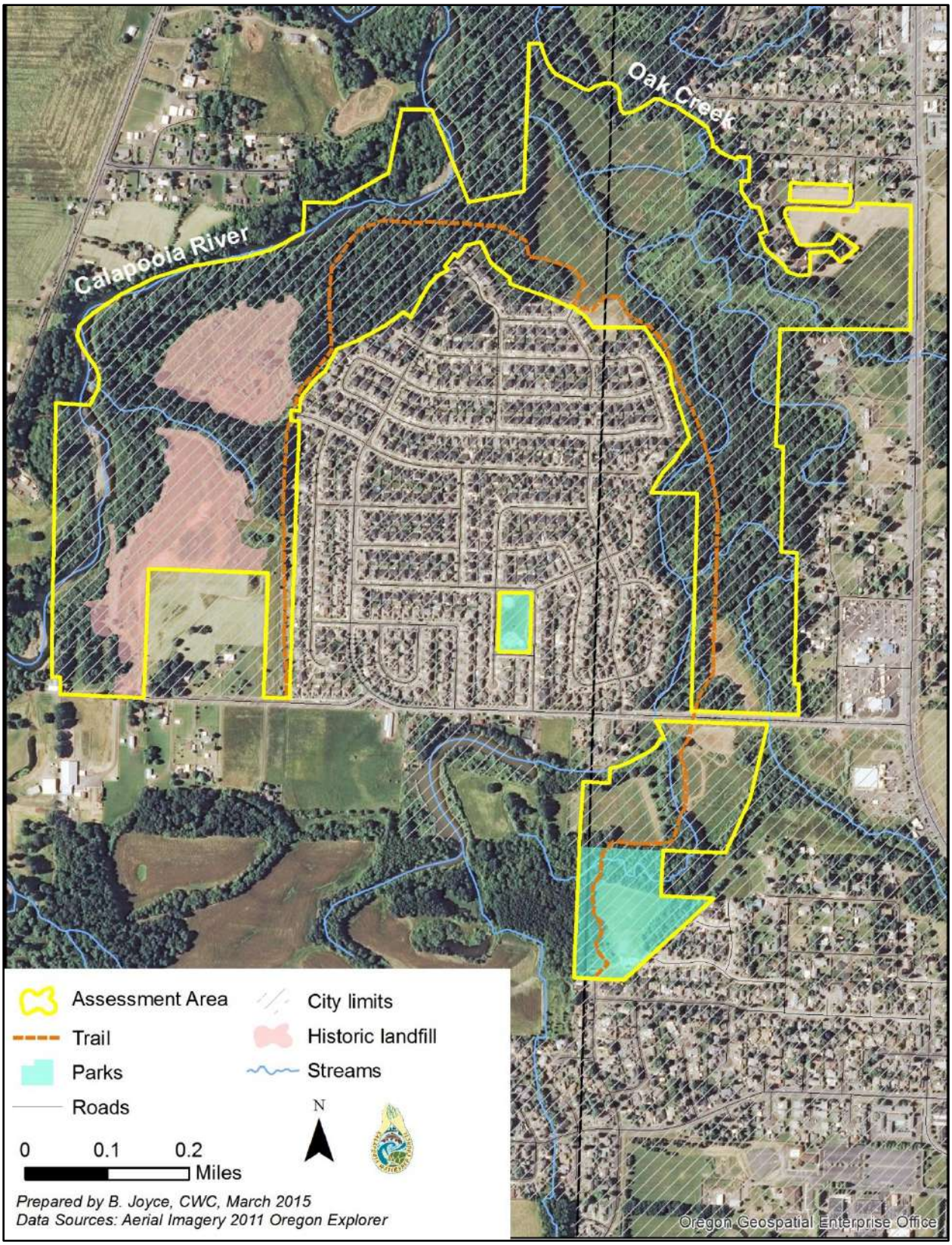

Figure 1-2: Oak Creek Open Space Assessment Area.

Contemporary Landuse

The highest concentration of residents within the watershed is within the city of Albany, primarily along the east side of the lower Calapooia River and Oak Creek.

The property has had a mixture of past land uses, including native American use, farming, landfills, wetland mitigation, and City Parks. In the late 1990s a new housing development, Oak Meadows, was built adjacent to the assessment area on land previously used for growing grass seed. In 2014, 94 acres were donated to the City to become part of the Open Space.

A large portion of the Oak Creek Open Space assessment area to the north and east is managed as natural area under conservation easement owned and managed by the City. Additionally, there are two community parks; Doug Killin Park, inside the housing development, and Teloh-Calapooia Park; at the south tip of the assessment area. Dough Killen Park was was established in 2010, around the same time that Teloh-Calapooia Park was updated with features such as a bioswale for stormwater treatment, paved walkways and a playground. An unpaved multi-use trail, beginning at Teloh-Calapooia Park, extends north through the assessment area (Figure 1-2 above). The trail is used for dog walking, bird watching, hiking and running.

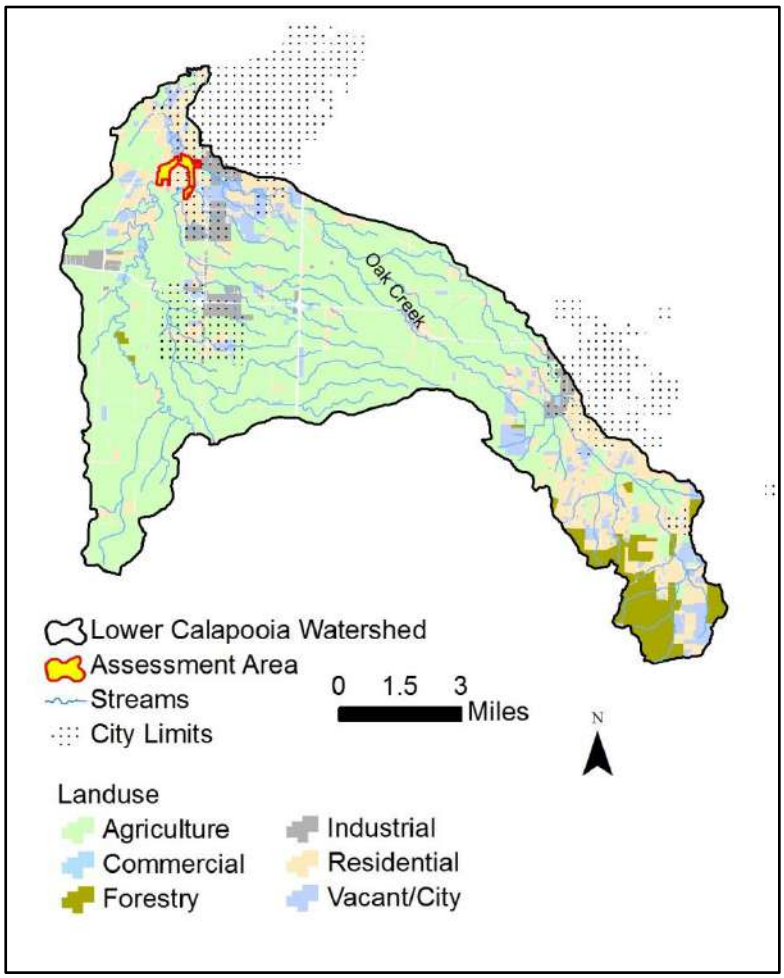

Figure 1-3: Landuse in the lower Calapooia watershed.

Landuse	Acres	%
Agriculture	35015	66%
Commercial	261	0.5%
Forestry	2641	5%
Industrial	1858	4%
Residential	9351	18%
Vacant / City	3551	7%

Table 1-2: Landuse amounts in lower Calapooia watershed. (2013)

Landuse adjacent to the assessment area is a mix of agriculture, residential, industrial and other vacant or city-owned property. The assessment area is just inside the Albany urban growth boundary and city limits. Landuse in the lower Calapooia watershed region is shown in Figure 1-3 and Table 1-2. The lower watershed area is primarily agriculture (66%), with residential landuse (18%) making up the majority of remaining area. While the Calapooia River and Oak Creek's

furthest headwaters flow from forest land, the majority of the stream meanders through agricultural land on the valley floor.

Historical Landuse

Relatively little is known about the Willamette Valley's indigenous cultures compared to other areas in the Pacific Northwest. At historic contact, the Kalapuya people occupied the Willamette Valley from Willamette Falls at Oregon City to the Upper Umpqua River. Thirteen subgroups have been identified, each composing an autonomous village or villages with localized dialects. Settlement systems were confined within a defined territory, usually a drainage system. They were usually located along major rivers or tributaries. Permanent villages with houses were occupied during the winter, typically between November and April, and the Kalapuya followed a hunting and gathering subsistence strategy with plant foods being the most important in the Kalapuya diet. (Clayton, 2007)

The Kalapuya were using the Oak Creek Open Space site over 5000 years ago. Oregon's State Archeologist, Dennis Griffin, makes the following conclusions about the site in 2011.

> *Archeological excavation reports revealed a multi-component site initially occupied about 5,100 years ago and then occupied again around 2,250 B.P. Significantly, the site is on the Calapooyia-Senecal surface and thought to be in a non-depositional setting. However, the presence of two vertically separate components indicates vertical accretion, probably resulting from periodic flooding. A fire-altered rock feature, charred camas bulb fragments, and a low-diversity artifact assemblage indicates that the younger (upper) component was a temporary camp used primarily for procuring and/or processing plant remains. The older component lacks fire-altered rock and charred plant*

Google Earth image of project vicinity, May, 1994.

Google Earth image of project vicinity, July, 2014.

Figure 1-4: Before and after the residential development

remains but otherwise has a low-diversity artifact assemblage also reflecting a temporary camp. The apparent change in site function between 5,100 and 2,250 B.P. to include camas processing fits with the timing of camas intensification in the Willamette Valley as proposed by current models. Charred wood from flotation samples reveals that the older component was associated with a closed forest canopy dominated by pine and Douglas fir, while the younger component was occupied when the area was more savanna-like with oak forests.

Camas, *Camassia quamash,* flower

Following European settlement, much of the lower Oak Creek riparian vegetation remained intact while the central area, now developed, was farmed up until the late 1990s, see Figure 1-4.

Remnants of the White Oak savanna habitat that dominated the Willamette Valley prior to European settlement and supported growth of camas, tarweed and other significant food sources for native Americans, is also indicated in the assessment area. These features were often maintained by indigenous native populations that used fire to manage vegetation at the landscape scale. Prairie and oak savanna habitats have largely been converted for agricultural use and rural, urban, and industrial development.

Landfills

Parts of the assessment area along the Calapooia River on the western border were used for burning refuse and later as a municipal landfill between 1946 and 1975. The landfill site was purchased by the City of Albany in 1946 and used as an open burning dump. Albany Sanitation leased the site in 1969 and converted it into a municipal landfill. The landfill was closed down with DEQ approval in 1975. In the early 1980s, it was learned that zirconium fines and chlorinator residues had been dumped at the site. The fines (dust-sized particles) are pyrophoric, meaning they could spontaneously combust if dug up. (Fires had in fact occurred in the past, and were the reason the landfill was shut down). Chlorinator residues are mildly radioactive. The Radiation Control Section of the Oregon State Health Division performed a PA on the site for EPA in 1984. In addition to the radioactivity, leachate tests showed the elevated levels of conductivity and alkalinity

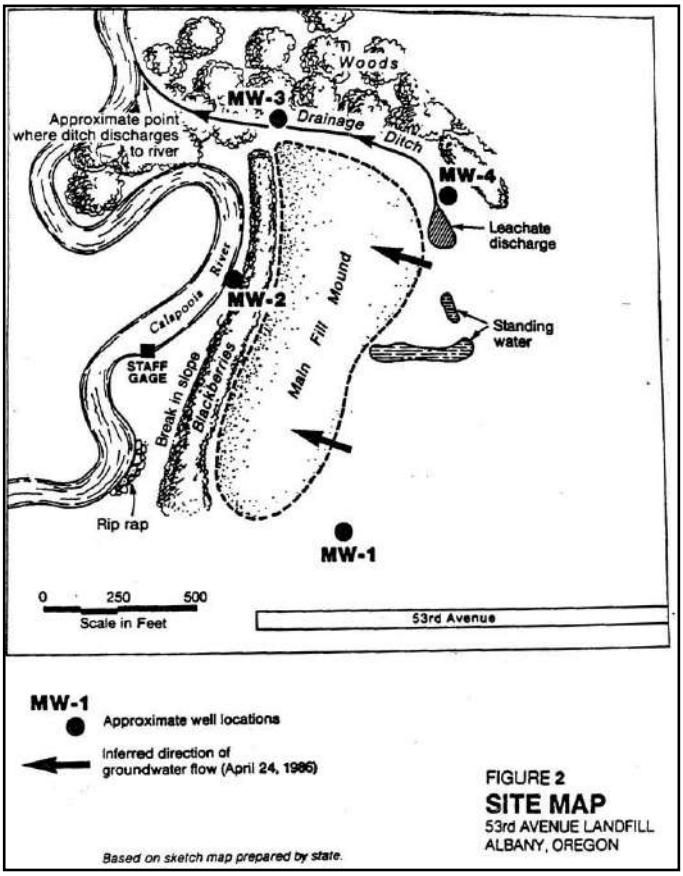

Figure 1-5: Department of Environmental Quality landfill illustration.

expected for a landfill. None of the elevated levels were hazardous. However, the adjacent Calapooia River had levels of iron and cadmium that were over drinking water standards. Four monitoring wells were drilled to check for the migration of radium-226 and -228 in the groundwater. No radium was detected. The Health Division decided to take no further action at the site. A 1995 SI by E&E found no additional serious contamination. The landfill diagram in Figure 1-5 is from the Department of Environmental Quality water quality program website.

Adjacent Planning Efforts

Other assessments and planning processes have been recently completed in the vicinity, including the Calapooia-Albany Assessment and Project Implementation Plan (River Design Group, 2011) which addressed stream habitat conditions in the lower three miles of the Calapooia River (downstream of the Oak Creek confluence), the Willamette River and other nearby waterbodies. Portions of that Plan are cited in this document. The South Albany Area Plan (SAAP) (2013) addresses the direction for future growth and development in the South Albany area including zoning and land use, streets and highways, railroads, natural areas and wildlife along Oak Creek, neighborhood services, and development standards. The SAAP geographic area is west of Hwy 99, and the Oak Creek Open Space assessment area is west of Hwy 99.

One of the community vision statements developed as part of the SAAP says South Albany will be a "Community known for having Oak Creek as its "front yard" (p. 19).

Parks and Recreation Master Plan, City of Albany, Moore Iacofano Goltsman, Inc., 2006

In Spring 2005, the City of Albany began updating its Park and Recreation Master Plan to address the park, recreation and service needs to the community for the next 10 years. The plan describes a strategy for meeting current and future needs, based on a vision set forth by the community about what recreation opportunities and park experiences they wanted, needed, and preferred.

The Master Plan pre-dates the acquisition of significant acreage that connects with the "Oak Creek Greenbelt", reflected as only 52.29 acres in 2006 (does include western landfill area). This area is defined in the plan as a "Natural Area":

> *Natural areas protect and preserve environmentally sensitive areas, such as wildlife habitats, stream and creek corridors, or unique and/or endangered plant species. Public access may be limited at these sites, which often include wetland, steep hillsides, or other similar spaces. Some natural areas may be managed secondarily to provide passive recreation opportunities. These sites may contain trails, interpretive displays, viewpoints, and seating areas (Master Plan, page 12).*

28.7 acre Teloh Calapooia Park, located immediately south of the Oak Creek Greenbelt is classified as a "neighborhood Park", defined as follows:

> *Neighborhood parks provide parks close-to-home recreation opportunities primarily for non-supervised, non-organized recreation activities. These parks typically range from 2-20 acres, although a site may be larger if significantly natural resources land is incorporated into the park. Facilities found in neighborhood parks may include children's playgrounds, picnic areas, trails, tens or basketball courts, minimal parking, and sports practice fields. Neighborhood parks are often located next to elementary schools (Master Plan, page 11).*

Recommendations from the 2006 Master Plan included replacing the playground and providing lighting and parking in Teloh Calapooia Park, with a proposed cost of $149 thousand in 2006. With respect to Oak Creek Greenbelt, there is recommendation for a trail system that could provide linkage with Freeway Lakes Parks along Oak Creek towards Hwy 99 linking several parks including Teloh and the natural area. Also, a Calapooia River Trail and natural area designation was recommended in the Master Plan at the City-owned (former landfill) site near the Calapooia River in southwest Albany. A trail developed in this area would connect to the Oak Creek Greenbelt trail. Since the trail would run along the Calapooia River, the trail corridor would be wide enough to protect natural resources while providing vantage points. The specific recommendation, that came to fruition with the recent acquisition, was to "acquire corridor and develop a 0.5 mile trail along the Calapooia River connecting the proposed natural area to the Oak Creek Greenbelt trail" (Master Plan, page 79).

Hydrology

Calapooia River (adapted from Cardno, 2013)

Flows in the Calapooia River vary greatly throughout the year due to seasonal precipitation and summer use of water (CWC 2004). The average monthly January flow in Albany is 55 times the average August monthly flow. Nearly 90% of the runoff occurs during the six wettest months (November through April). The magnitude of annual runoff also varies. Rain-on-snow flood events have been responsible for the largest floods of record. These events typically occur between December and February when warm storms rain on the snowpack. Figure 1-6 includes the average mean daily discharge for the Calapooia River at the former USGS gage (14173500) located at the SW Queen Avenue Bridge. The gage was active from 1941 until 1981 when it was abandoned. The hydrograph shows the dramatic range of discharge previously mentioned. Summer time low flows are typically less than 50 cfs while spring flows are typically over 1,000 cfs. Fall rains from November through December also create dramatic spikes in river discharge.

Table 1-3: The flood frequency for the Calapooia River from the discontinued USGS gage at SW Queen Avenue Bridge. The 41 year period of record spanned from 1941 to 1981.

			Confidence Limits Flow (cfs)	
Percent Chance Exceedance	Return Interval (yr)	Computed Flow (cfs)	0.05	0.95
0.2	500	45,446	64,063	35,392
0.5	200	41,095	56,798	32,412
1	100	37,610	51,103	29,987
2	50	33,938	45,232	27,389
4	25	30,050	39,173	24,583
10	10	24,494	30,840	20,452
20	5	19,853	24,226	16,854
50	2	12,610	14,738	10,827
80	1.25	7,454	8,764	6,133
90	1.11	5,497	6,624	4,319
95	1.05	4,207	5,217	3,152
99	1.01	2,448	3,250	1,649

Figure 1-7 includes a plot of instantaneous peak discharge measurements also from the USGS SW Queen Avenue Bridge gage. The 1956 and 1961 floods are the largest peaks in the period of record, topping 30,000 cfs. Most peak events ranged from 5,000 cfs to 20,000 cfs, or approximately a 5 year event. A log-Pearson III flood frequency analysis was completed using the annual peak flow data. The flood frequency for the Calapooia River is included in Table 1-3.

In summary, Calapooia River flows exhibit substantial variation from high winter and spring flows to low summer flows. Because the Calapooia River is unregulated by dams, the contemporary hydrograph is similar to historical conditions. Agricultural water use in the watershed is minimal as the dominant crop, grass seed, requires minimal irrigation.

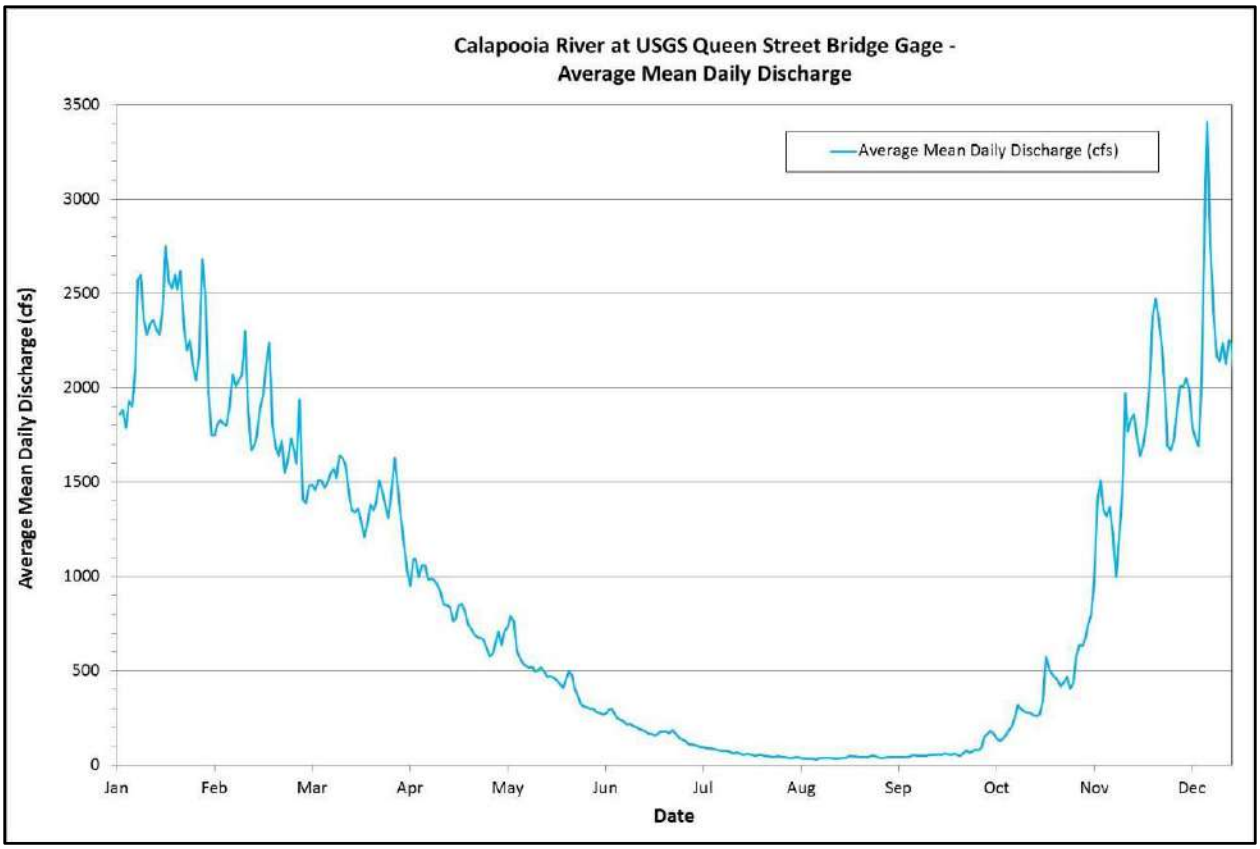

Figure 1-6: Average mean daily discharge for the Calapooia River measured at the former USGS gage station at SW Queen Avenue Bridge. The graph illustrates the large difference between low summer time flows and winter and spring high flows. The average mean daily discharge calculations are based on the 41 year period of record (1941 to 1981). Table provided by River Design Group.

Oak Creek

Recent local hydrological analysis and modeling comes from a report by Cardno, Inc. that was produced for Albany Public Works end of 2013. Oak Creek basin has the greatest flows through Albany and flows into the Calapooia River just north of the Oak Creek Open Space assessment area. Oak Creek is comprised of two primary streams- Oak Creek and South Oak Creek. Creek flows create "Freeway Lakes County Park" at I-5 crossing where it is impounded for recreation purposes and releases flow west toward the urban areas of Albany. Right before meeting the river, the small tributary of Cathy Creek flows into Oak Creek and is included in the Entrix 1D/2D modeling analysis (Figure A-3 in the appendix). Table 1-4, below, describes the areas of the lower and the upper basin that were delineated and modeled for large storm events with 9 gauge locations. The hydrograph, in Figure 1-7, demonstrates the significant flows from the January 2012 flood that drowned the Willamette basin for a short time.

1964 Flood at the confluence of Oak creek and Calapooia River

Oak and Cathey Creek			
Hydrologic Summary			
Total Area	6,132 ac	Building Area	339 ac
Total Impervious Area	1004 ac	Other Impervious Area	665 ac
Percent Impervious	16.4 %	Pervious Area	5,128 ac
Number of Delineated Sub-Basins	197		
Upstream Basin Delineation			
Oak Creek		South Oak Creek	
Total Area	20,176 ac	Total Area	5,091 ac
Total Impervious Area	1412 ac	Total Impervious Area	764 ac
Percent Impervious	7 %	Percent Impervious	15 %
Hydraulic Summary			
Number of Links	906	Ditch Segments	17
Number of Nodes	909	Ditch Length	1.76 miles
River Segments	309	Conduit Segments	580
River Length	41.95 miles	Conduit Length	18.48 miles

Table 1-4 Model summary sheet for the entire Oak Creek basin, Entrix, January, 2012

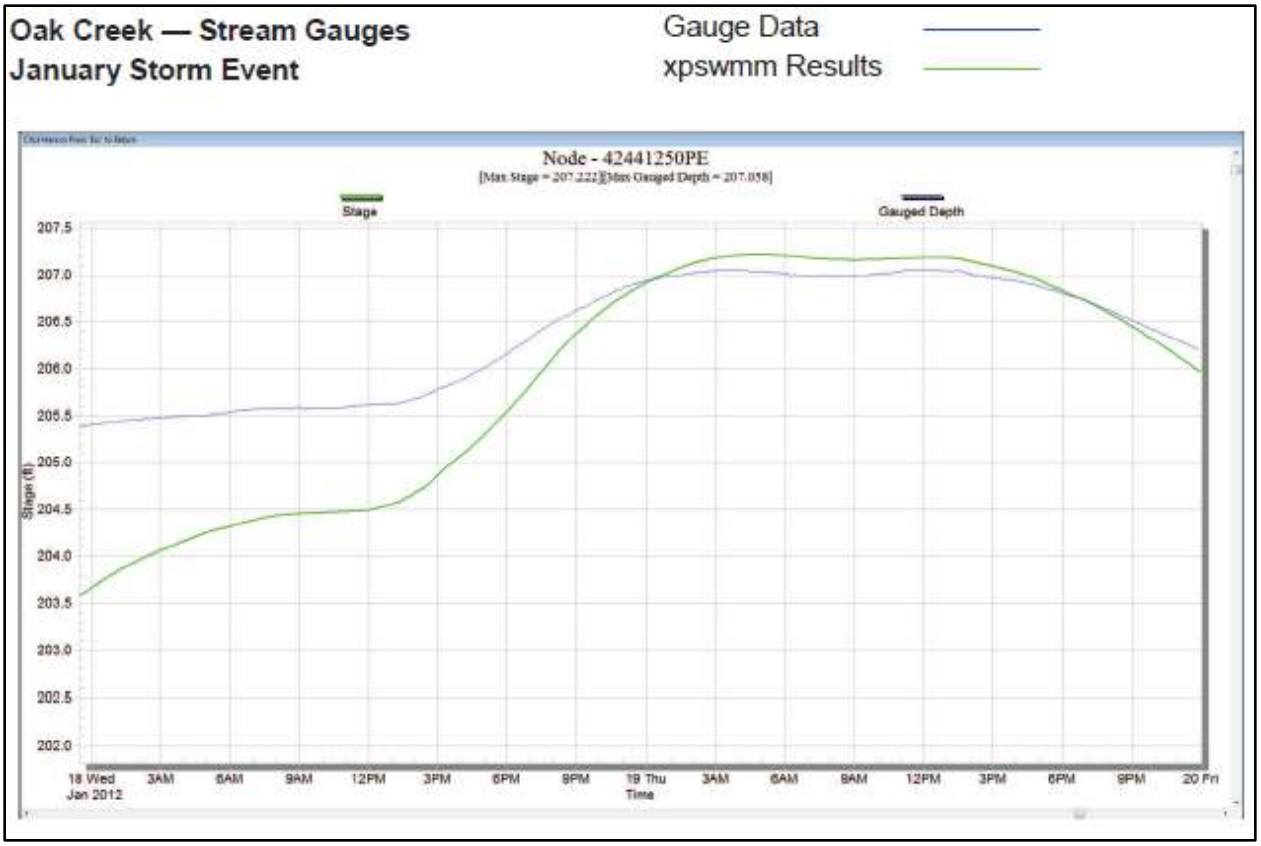

Figure 1-7 Calibrated modeling results of the large storm event of January 2012

Chapter 2: Aquatic Habitat

This chapter describes conditions in and near the assessment area related to fish, aquatic habitat, and water quality. Aquatic stream habitats are compromised by water quality conditions, channel simplification, and loss of native riparian vegetation (see Chapter 3: Riparian Habitat). Information is associated with parts of the assessment area or nearby waterways and is not intended to describe all aquatic conditions for the Oak Creek Open Space. Parts of the Lower Calapooia River described below are adapted from the *Calapooia River-Albany Assessment and Project Implementation Plan* (River Design Group, 2011) which addresses the lower three miles of the Calapooia River, all of which are downstream of the Oak Creek Open Space. More thorough aquatic studies should be conducted. Recommended actions are listed at the end of this chapter in Table 2-1.

Fish Use

Fish in the Lower Calapooia River (adapted from River Design Group, 2011)

The lower Calapooia River provides habitat for migratory and resident fish species. Federally threatened (USFWS 1999) anadromous Upper Willamette River (UWR) winter steelhead and spring Chinook salmon move through the lower watershed during spawning migrations to the upper Calapooia River.

The resident fish population includes native and introduced species. Summertime elevated water temperatures coincide with low river flows. The USGS calculated a mean summer water temperature of 68°F in the lower Calapooia River at Albany (ODFW 1992). Native cyprinid, minnow, and sucker species are more tolerant than the native salmonid species to warm water temperatures. Introduced warmwater fish species such as carp, largemouth bass, and sunfishes prosper in the higher water temperatures and low velocity environment that characterizes the lower Calapooia River from July through September.

A list of Fish species in the Calapooia-Albany Assessment project reach is in the Appendix in Table A-3.

Fish in Oak Creek

Lower Oak Creek provides important access to floodplain and off-channel habitats during high flows but less is known about actual fish use of the stream.

Oregon Department of Fish and Wildlife (ODFW) sampled for fish use in Oak Creek, the Calapooia Slough and nearby tributaries on multiple occasions. The most recent being on May 16, 2014. The 2014 sample sites are shown in Figure 2-1, below. The Oak Creek site (A) and Calapooia Slough (B) both had a dozen minnow traps set overnight. Traps at site A produced two sculpin, one three-spined stickleback and a crayfish. Traps at site B produced no fish but did catch many red-legged

Figure 2-1: 2014 ODFW fish sampling sites.

frog tadpoles. Sampling at site C was done using a dip net. The dip net produced six western mosquito fish along with rough skinned newts.

ODFW and the City of Albany completed fish sampling on tributaries in the area in 2001 including five sites on Oak and Cathy Creeks in the project vicinity. Sampling was completed using a backpack electrofisher or minnow traps at selected sampling sites. The goal of the sampling was to determine presence/absence of fish species with particular interest pertaining to native species' use of tributary streams. Sampling was limited in extent and effort and results suggest the species assemblage at that point in time, rather than over a broader range of seasons and conditions.

Fish species present in the 2001 ODFW survey include native and non-native fish species, but no salmonids were detected in the survey. Native fish include Redside shiner, Dace, Largescale sucker, Sculpin, Mountain whitefish (rare), Threespine stickleback, Chiselmouth, and Northern pikeminnow. Non-native species include Largemouth bass, Smallmouth bass, Bluegill, Western mosquito fish, Yellow bullhead, and Brown bullhead.

Introduced fish species likely prey upon and compete with native species for habitat space. Interactions between predatory introduced species such as largemouth and smallmouth bass and native juvenile steelhead and Chinook salmon are of most concern. Other warmwater introduced species such as the sunfishes and carp may also compete with native cyprinid, sucker, and minnow species.

Aquatic Ecology

Lower Calapooia River (adapted from River Design Group, 2011)

The lower Calapooia River is a dynamic river environment characterized by alternative riffle and pool habitats, backwater and alcove habitats, frequent large wood, and morphological features that are annually modified by high flows. Figure A-3 in the Appendix shows floodplain inundation during high flows at the Calapooia-Oak Creek confluence area. Whole trees and accumulated large wood are common habitat-forming structures in the reach. Trees appear to be recruited from both upstream sources and the adjacent floodplain (Figure 2-2 below).

Figure 2-2: A large wood aggregation on the lower Calapooia River. Aggregations accumulate smaller debris over time but may also mobilize during higher magnitude runoff events.

Side channels include tributaries and floodplain swales that are temporally connected to the Calapooia River. Perennial tributaries discharge to the river year-round while floodplain swales may only activate during winter and spring when river flows are at the annual maximum. For example, narrow straight tributary channels would provide higher water velocities and potentially coarser channel bed substrates. Alternatively, low gradient, broad floodplain swales that occupy historical channel locations may be characterized by standing water and silty beds.

Alcoves are characterized by smaller floodplain ponds proximate to the river channel. Similar to

side channels, alcove activation is often dependent on river stage. Low elevation alcoves would be connected year-round while higher elevation features may be inundated only during storm flows. Like side channels, alcoves provide habitats that complement the mainstem channel, providing refuge from high velocity flood flows. Broad habitat conditions that are provided by diverse floodplain environments expand the number of species these environments can support.

As the channel migrates within the riparian corridor, trees will be recruited to the river. River-adjacent floodplains provide transitory storage for large wood, fine sediment, and other debris that is transported by the river. These features create and maintain dynamic environments that support native species.

> *Like side channels, alcoves provide habitats that complement the mainstem channel, providing refuge from high velocity flood flows.*
>
> – River Design Group

In reaches where the historical floodplain has been modified for agriculture, eroding and stabilized streambanks are more common. These areas also coincide with the extent of the contemporary channel migration zone. The recent history of channel migration in the [lower Calapooia] assessment reach suggests the lower Calapooia River has migrated very little. Conserving and expanding riparian forests throughout the reach is one recommendation for reducing future land loss associated with channel migration.

Although bank erosion is a prominent process in the reach, the historical air photo review suggests the river has only experienced moderate channel migration over the past 80 years. Bank stabilization on outside meanders, particularly at the extent of the channel migration zone, have likely contributed to the minimal channel changes. More rapid bank erosion is occurring at two outside meanders that have been affected by riparian vegetation removal for power line protection and agriculture. High quality habitat is common in the lower Calapooia River. Large wood accumulations, a mostly intact riparian zone, and river-floodplain connectivity provide diverse habitats for fish and wildlife.

Lower Oak Creek

The habitat in the lower Oak Creek and Calapooia River confluence area is relatively intact for a Willamette Valley urban tributary system. Large riparian corridors protect the stream from direct urban impacts, native vegetation provides forage, protection and shade for native fish and aquatic species, and the instream habitat is dynamic with good sinuosity, slow backwater habitats, and good deep pools with wood debris.

Figure 2-3: Incised and undercut banks typical in alluvial flats.

Oak Creek is incised and undercut in several locations of the project area (see Figure 2-3), however this geomorphic feature-type is common in lower sections of streams in the alluvial flats of the Valley and is not necessarily caused by urban flow modification or riparian buffer degradation. The floodplain is relatively intact in this section of Oak Creek, and upstream, helping to minimize unnatural rates of bank erosion. Localized aggradation and erosion can be caused by undersized and misplaced culverts in the stream and small tributaries, which should be repaired. Channel encroachment by invasive reed canarygrass and Yellow flag iris can cause unnatural aggradation and accelerate the spread of more aquatic invasive plants.

Water Quality

Oak Creek

Water quality is a good indicator of upstream conditions and can have significant impacts on downstream habitats and uses. Water quality data were collected from the Oak Creek stream crossing at Hwy 99, shown in Figure 2-4. The stream flows northwest of the sampling station along one northeast border of the Open Space. Samples were tested monthly for two years from November, 2012 to October, 2014. This Oak Creek water quality sampling station was part of a larger effort, initiated by the Calapooia-Santiam monitoring partnership, including 18 stream sites in the region. Eight parameters are presented and compared to standards, where standards exist. A summary of conditions is illustrated in Figure 2-5. It is important to keep in mind that these data are grab samples and should only be used for screening purposes.

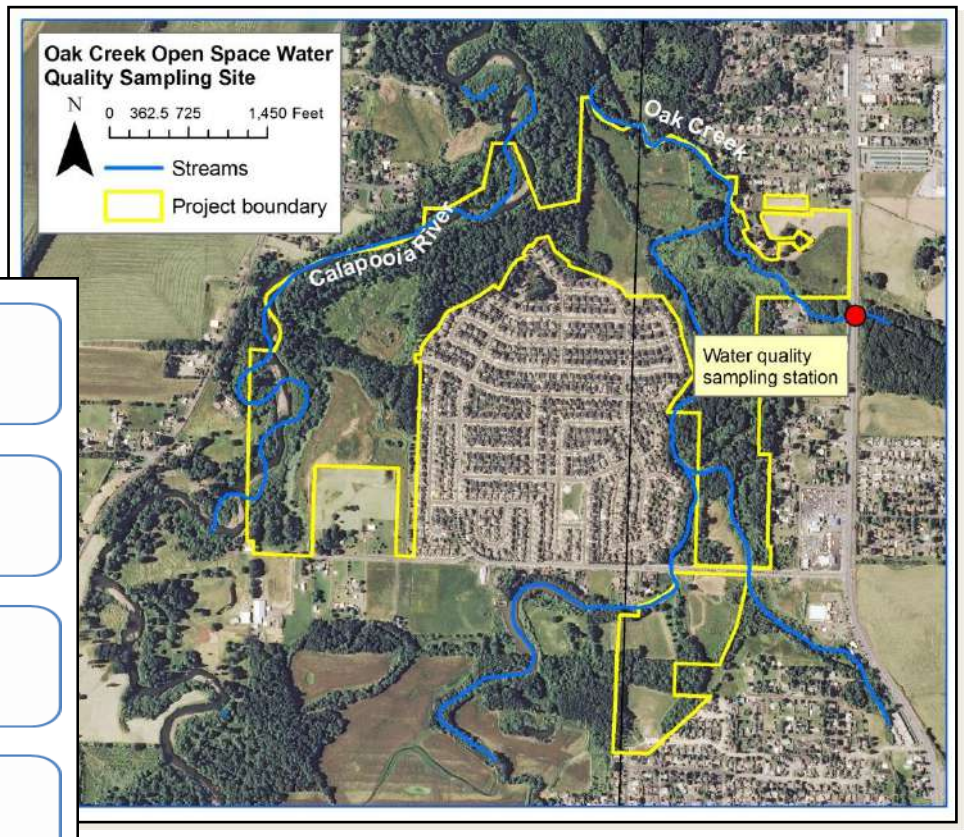

Figure 2-4: Oak Creek water quality sampling site location

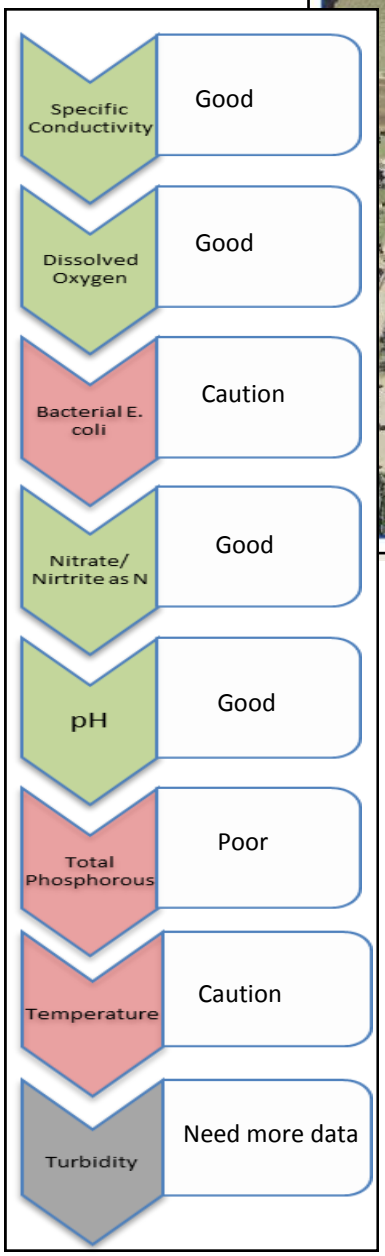

Figure 2-5: Summary water quality conditions

Specific conductivity

Specific Conductivity is the ability of water to carry an electric current. Water temperature, the concentration of dissolved salts and the soil type can influence specific conductivity values. The concentration of salts in the water generally increases as one moves downstream. Salts are introduced to the waterway via human alterations. In the Willamette Valley, concentrations are generally below 150 mhos/cm. There is no State water quality standard for specific conductivity, however the US EPA recommends that streams supporting good mixed fisheries have a range between 150 and 500 µhos/cm.

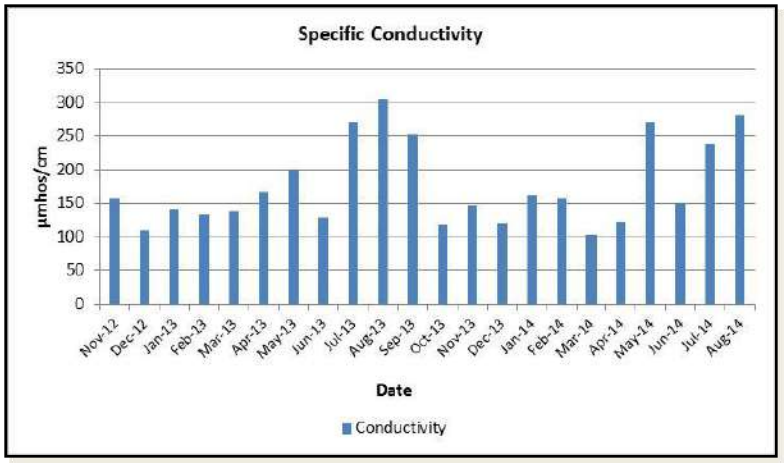

Figure 2-6: Specific Conductivity

Oak Creek specific conductivity generally rose above 150 mhos/cm in the late spring and mid to late summer months. The average amount during the sample period was 176 mhos/cm, with the highest amount, 281 mhos/com, detected in August, 2013. See Figure 2-6.

Dissolved oxygen

The amount of dissolved oxygen (DO) present in streams is crucial for aquatic life and correlates to the temperature of the water. The state requirements for DO (OARS 340-041-0016) vary for individual creeks and the time of year. In general, the level of DO for creeks designated spawning must not be below 11.0 mg/l, cold water aquatic life 8.0 mg/l, cool water aquatic life 6.5 mg/l and warm water aquatic life 5.5 mg/l. (Anderson, 2013) Oak Creek is designated as a salmon and trout rearing and migration area.

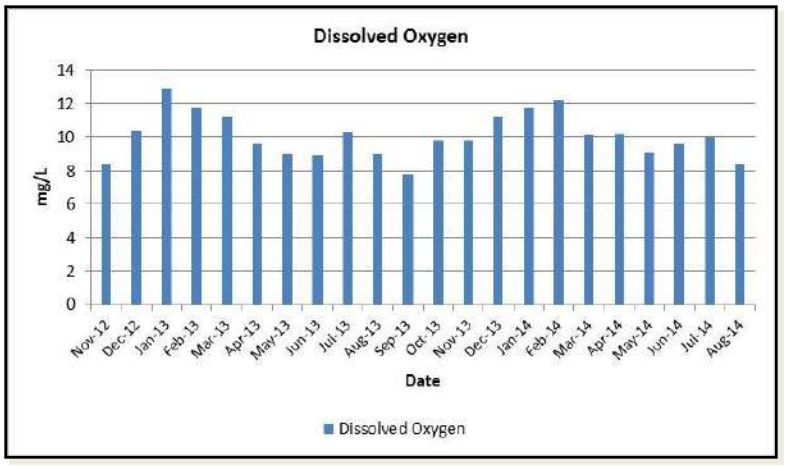

Figure 2-7: Dissolved Oxygen

Oak Creek DO levels, shown in Figure 2-7, were generally good, with an average of 10 mg/l during the sampling period. The highest amount of DO, 12.89 mg/l, was detected in January, 2013. The lowest amount was in November, 2012, and was 8.4 mg/l. Oak Creek is not used for spawning, therefore DO is not a priority concern in lower Oak Creek, based on these data.

Bacteria E. coli

The bacteria E. coli can be used as an indicator in the detection of pathogens harmful to humans. The Oregon Administrative Rules (OARS 340-041-0009) has requirements for the amount of bacteria allowable in surface waters and states: "(B) No single sample may exceed 406 E. coli organisms per 100 milliliters." Bacteria can enter streams through agricultural runoff, leaking septic tanks, sewers, stormwater runoff and wildlife. (Anderson, 2013)

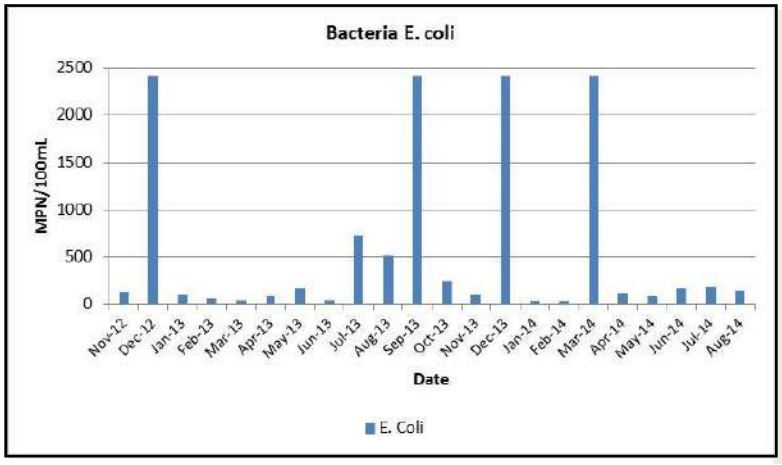

Figure 2-8: Bacterial E. coli

DEQ has established a Total Maximum Daily Load (TMDL) for bacteria throughout the Willamette Basin. In the Willamette sub-basins (including lower Oak Creek), the TMDL calls for an overall reduction in bacteria levels of 65%. The City of Albany is responsible for implementing management strategies to reduce bacteria levels in all rivers and streams within the city limits. This includes bacterial sources that are either publicly or privately owned, as well as bacteria in stormwater runoff from all property within the City. (City of Albany, 2013)

E. coli levels in lower Oak Creek, shown in Figure 2-8, were well below the state standard in most samples. However, on 4 of the 22 sample days, E. coli levels shot up to 600% above the standard.

Nitrate/Nitrite as N

Nitrates are commonly used as fertilizer. Nitrite can be converted into nitrate through biological activity. Excess nitrogen can enter the stream through agricultural run off. Elevated nitrate levels are a hazard to human health. (Anderson, 2013)

Nitrate/Nitrite levels detected in lower Oak Creek, shown in Figure 2-9, were all below the EPA recommended drinking water standard of 10 mg/L. Levels were higher in the winter and early spring months. The average amount of Nitrate/Nitrite was 1.13 mg/L during the study period.

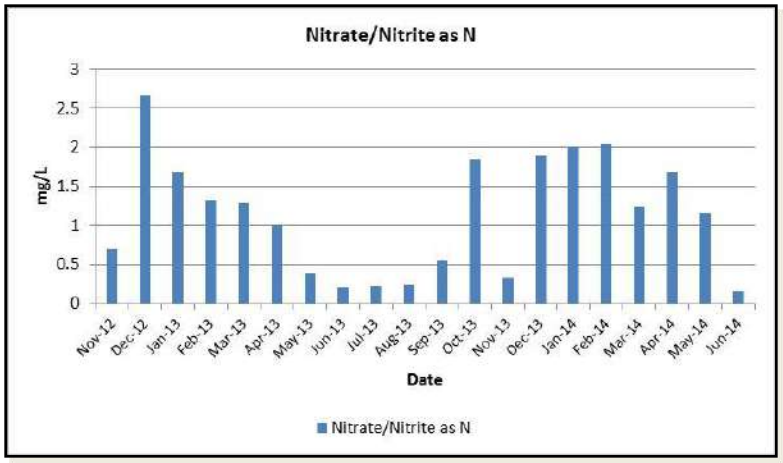

Figure 2-9: Nitrate/Nitrite as N

pH

The pH of the water is determined by the concentration of hydrogen ions present in the water. The pH of water can be influenced by bedrock material, human inputs and photosynthesis. The pH of water can change over the course of a day. Waters in the Willamette Basin must be between 6.5 and 8.5 pH according to OARS 340-041-0345. (Anderson, 2013)

All samples in the lower Oak Creek water quality study, shown in Figure 2-10, had pH levels between 7 and 8.2. Average pH was 7.69.

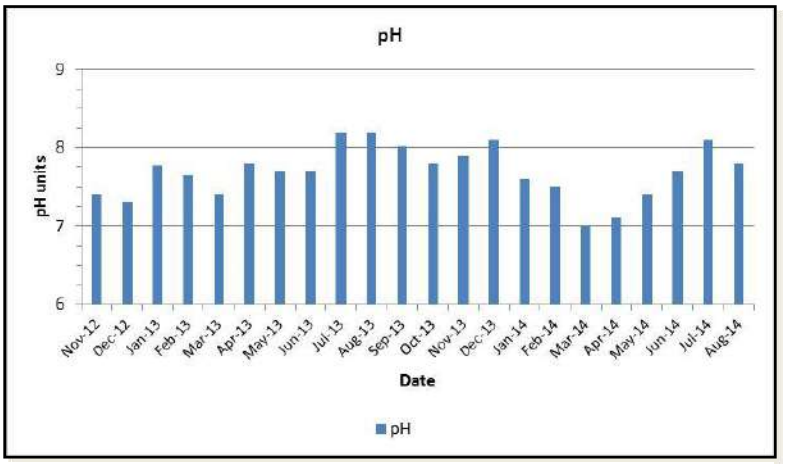

Figure 2-10: pH

Total Phosphorous

Total phosphorus (TP) measures all forms of phosphate within a sample. Sources of phosphorous can include underlying geology, fertilizer run off, waste water or leaking septic tanks. Total phosphorus has been correlated with Total Suspended Solid values in the Mollala basin. High levels of phosphorus can cause algal blooms. (Anderson, 2013)

Average TP levels during the study period, shown in Figure 2-11, were 0.16 mg/L. Phosphorous spiked in the summer of 2013 up to 0.39 mg/L. The nearby Calapooia River has a Total Maximum Daily Load (TMDL) target of 0.02 mg/L for TP (Borok, 2014). All of the Oak Creek samples contained more TP than the TMDL target amount.

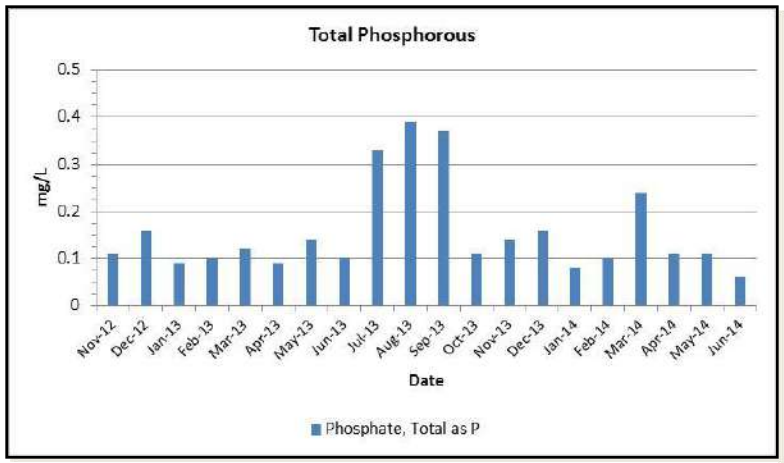

Figure 2-11: Total Phosphorous

Grab temperature

Water temperature is one of the key drivers of aquatic ecosystems. Temperature regulates numerous biological functions, influences dissolved oxygen levels, the fish community present and the aquatic

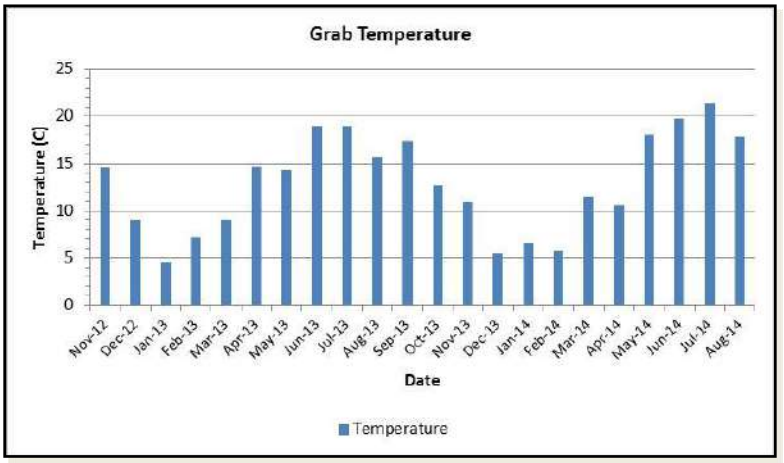

Figure 2-12: Grab Temperature

macroinvertebrate community present. The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration, such as Oak Creek, may not exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit) (see OAR 340-041-0028(4) Biologically Based Numeric Criteria).

The average of grab-sample temperatures during the study period was 13 degrees Celsius, see Figure 2-12. During the summer months of both years, however, grab sample temperatures rose above the standard. Note that grab samples are not the same as the seven-day-average maximum temperature.

Turbidity

The turbidity of water is determined by the amount of light that is able to pass through a water sample. Turbidity is measured by nephelometric turbidity units (NTU). Sediment, algae, and organics are some of the materials that can influence turbidity. The recommendations in OARS 340-041-0036 states that the NTU should not be greater than 10% NTU downstream of a turbidity causing event as measured relative to an upstream point.

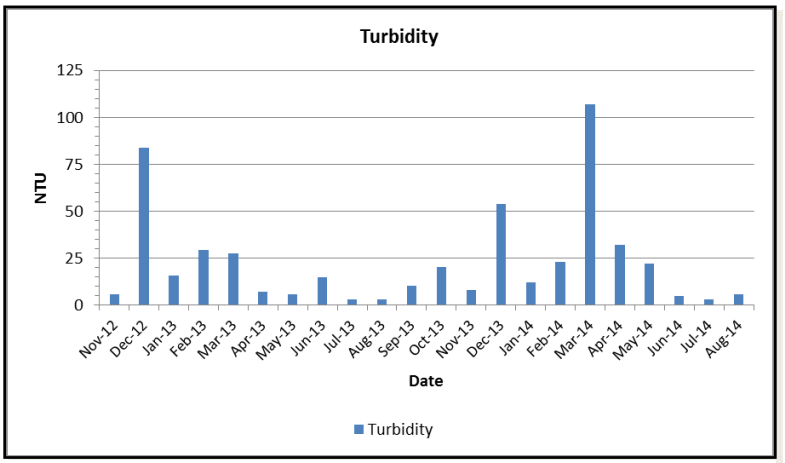

Figure 2-13: Turbidity

Average turbidity was 22.9 NTU with spikes in December, of both years, and March, 2014, see Figure 2-13. Comparison of this turbidity data with upstream data is beyond the scope of this assessment.

Stormwater

The residential development adjacent to the Open Space has a network of municipal stormwater infrastructure that conveys stormwater from the streets into the Open Space toward water bodies (see Figure 2-14). While this is standard practice for stormwater management, it does make the waterbodies potentially vulnerable to runoff and erosion. Herbicides, lawn fertilizer and pet waste could be impacting the Oak Creek Open Space through these stormwater conveyances. Community education about stormwater best management practices, and water quality monitoring would help minimize potential impacts.

Figure 2-14: Storm drainage system

Calapooia River Total Maximum Daily Load Program

Water quality in the Calapooia River is monitored by agency programs. Oregon Department of Environmental Quality water quality monitoring results and regulatory status can be found on the DEQ database at *http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp*.

The lower Calapooia and upper Willamette Rivers are water quality limited due to elevated water temperatures and fecal bacterial concentrations. The Willamette River is also affected by mercury concentration. These water quality limiting factors are being addressed by the Oregon Department of Environmental Quality through the total maximum daily load (TMDL) program. A TMDL defines the amount of a pollutant that can be present in a waterbody without causing water quality criteria to be exceeded. A Water Quality Management Plan was developed to describe the overall framework for implementing the Willamette Basin TMDL. The Willamette River TMDL was approved by the U.S. Environmental Protection Agency in 2006. A City of Albany TMDL Implementation Plan was developed in 2008, with a continuum to the Plan and a Management Strategy Matrix released in 2013. The Matrix contains goals and objectives for improving water quality. A summary of methods for reducing nonpoint source contributions of temperature, bacteria and mercury is in Table A-4 of the Appendix. The main elements of the nonpoint source reduction strategies are listed below.

- Increase stream shade
- Address failing septic systems and provide education
- Stormwater education and management
- Water quality education

Aquatic Habitat Recommendations

Known aquatic habitat conditions are fair to good, but more information is needed to make well informed management and restoration decisions for the Oak Creek Open Space. Aquatic habitat in the lower Calapooia River (downstream of the Open Space) could be improved with reconnecting off-channel habitats, installing log jams and replacing culverts to remove fish barriers. Aquatic habitat and water quality information pertaining specifically to the Oak Creek Open Space and especially Oak Creek and its tributaries is incomplete. Water quality data should be collected to describe water quality changes as Oak Creek and its tributaries pass through the Open Space. Analysis of macroinvertebrate communities may also provide a good supplemental measurement of overall water quality conditions over a broader time frame. Calapooia River water quality is under scrutiny from Oregon DEQ. All of the recommended actions for improving aquatic habitat and water quality (see Table 2-1, below) also support the TMDL implementation actions to improve water quality.

Water quality improvement requires a comprehensive watershed approach to solving pollution problems. A holistic approach takes into account the cumulative effects all activities in a watershed have on overall water quality. To solve water quality problems in a stream, river, lake or estuary, the cumulative impact from all upstream sources including groundwater need to be considered.

Table 2-1 Aquatic Habitat Recommendations				
Type	**Action**	**Result**	**Next Step**	**Priority**
Management	Conserve riparian forest for channel migration buffer.	Reduce land loss due to channel migration	ID narrow buffer locations near channel bends and flag in riparian management for potential channel migration.	L
Management	Measure water quality at additional stream points on Oak Creek and tributaries, with special consideration to using macroinvertebrate studies where feasible.	Improve data base pertaining specifically to Oak Creek Open Space with upstream and downstream data. Flag bacteria, temperature and turbidity.	ID sites on Oak Creek and tribs.	M
Management	Conserve existing in-stream woody debris.	Maintain habitat connectivity and complexity	Periodic monitoring of large wood debris.	H
Restoration	Reconnect floodplain off-channel habitats and replace fish barrier culverts.	Improve habitat connectivity and complexity	ID sites on Oak Creek and tribs.	H
Restoration	Install stable log jams for in-stream habitat.	Improve habitat connectivity and complexity	ID sites on Oak Creek and tribs.	L

Chapter 3: Riparian Habitat

Riparian areas can perform many ecosystem services integral to maintaining healthy water bodies. Functioning riparian areas provide shade that helps keep water temperatures low, riparian vegetation filters runoff before it reaches the stream, and good root structure helps control erosion. Large riparian trees that fall into the channel add complexity; slowing stream flow and forming pools, resting places and cover for aquatic species. Native riparian vegetation supports habitat and nutrient needs of native aquatic and terrestrial wildlife. Riparian areas with diverse age and size classes of native vegetation are better able to provide these services and are more resilient to disturbance.

This chapter describes riparian conditions drawing from three reports contracted by the Calapooia Watershed Council in partnership with the City of Albany. Overall, riparian conditions are good, and importantly, are connected to adjoining riparian areas upstream and downstream. Protection and enhancement through control of invasive species and key habitat elements, such as shade, structural diversity and snag retention are key to maintaining these good conditions.

Riparian Areas

One of the greatest values of the Oak Creek Open Space is its inclusion in a nearly complete riparian forest corridor that stretches from the Cascades to the Coast range. Nearly contiguous forest exists from the Willamette main stem up the Calapooia and to the foothills. Upstream from the Open Space, along Oak Creek, however, there is a substantial break in the wooded riparian corridor of approximately 6.1 miles, with some small forest “islands”. (Coberly, 2014) The existing riparian forest along the Calapooia River and portions of Oak Creek provides good streamside shading, large wood recruitment and habitat (Carex, 2015), with some erosion at specific sites, especially on the Calapooia River (River Design Group, 2011).

Gravel bar habitats occur along the Calapooia River shoreline. These areas of gravel and sand are scoured by annual high river flows. Vegetation is mostly annual species, both native and introduced. Willows, alders, and cottonwoods germinate in these habitats but are usually swept away by winter floods. Over time, as the river channel migrates and sediments build up, gravel bars eventually will be vegetated by shrubs and trees and develop into riparian forest, and new gravel bars will form. (Carex, 2015)

In reaches where the historical floodplain has been modified for agriculture, eroding and hardened stream banks are more common on the Calpooia. These areas also coincide with the extent of the contemporary channel migration zone. The recent history of channel migration suggests the lower Calapooia River has migrated very little. (River Design Group, 2011)

Oregon white oak and Oregon ash trees in the riparian area

Bank erosion sites typically exceeded 100 ft in length and ranged from 5 ft to 15 ft high from the top of the bank to the toe of the slope. Eroding banks were generally defined by fine bank materials, steep bank slopes, and poor vegetation conditions. The most sizeable eroding banks are on the outside of meanders where the river is

Riparian forest and wetland

laterally migrating into adjacent floodplain surfaces. (River Design Group, 2011)

Oak Creek riparian zones are relatively intact in this area other than some farmed zones on the east side of the Open Space. There are small-large wood jams and plenty of vegetated over story to provide cover, shade, and contribute to the stream food web.

Oregon Conservation Strategy

Riparian areas are one of the habitat types with particular priority in the Oregon Conservation Strategy. The Strategy indicates riparian habitats have declined from historic levels and are now greatly reduced in area and connectivity, especially those in low-elevation areas and valley bottoms. Development, logging, road building, agriculture and pasture use have degraded some riparian habitat directly through decreased riparian vegetation, increased sedimentation, and reduced large wood in streams. Runoff containing fertilizers and other contaminants can further impact habitat.

In the Willamette Valley riparian forests have significantly declined with increasing development. Many streams now have only a thin strip of riparian vegetation, and some have none. Despite increasing emphasis on protection of riparian habitats and the formal establishment of the Willamette River Greenway, riparian habitats continue to decline. The Oregon Conservation Strategy identified the Calapooia River as a conservation opportunity area (ODFW 2006), citing its special features as follows: *The corridor along the Calapooia River contains some of the best riparian forests remaining in the valley, and the river supports small populations of native spring chinook salmon and summer steelhead. Studies of wintering shorebird use in the Willamette Valley found the Calapooia drainage to be extremely valuable habitat for killdeer and dunlin.*

(ODFW, 2006)

Invasive Vegetation in Riparian Areas

See Figure A-4 in the Appendix for a map of Oak Creek Open Space invasive vegetation.

Encroachment of non-native species threatens the riparian zones of Oak Creek, specifically reed canary grass which can be found in the channel fringes causing aggradation of sediments, and thus more seed deposition and growth in new areas choking the channel. Reed canarygrass and Yellow flag iris spread are the two biggest threats to Oak Creek aquatic habitats and should be controlled strategically in high value habitat areas, see Figure 3-1, below. (River Design Group, 2011)

A patch of Atlantic ivy is located at the southwest corner of the site on the bank above the Calapooia River. A single patch of butterfly bush was documented just outside the project area on the west bank of the Calapooia River. These sites should be managed to prevent the spread of invasive species into the assessment area.

Figure 3-1: Example reed canarygrass infestation and channel aggradation at cross section station XC24 near Hwy 99 in the northeast area of the Open Space.

Riparian Habitat Recommendations

Conservation and restoration of riparian areas will have synergistic effects in the watershed as riparian functions are preserved or improved, which will improve down steam water quality, provide terrestrial and aquatic habitat complexity and nutrients, and reduce erosion.

Riparian habitat corridors are extremely important in conservation biology, allowing for long term repopulation as well as seasonal movements of species. Habitat improvements in the corridor area have the potential for synergistic effects up and down the watershed as animals can migrate to and from this area easily. Riparian areas are important habitat for bat populations. Bats roost in the old snags found in and near riparian areas and feed on insects over the water (see Chapter 4 for more discussion of bats).

Forest cover should be increased, particularly along the streams and adjacent to sloughs to moderate water temperatures, improve water quality, and shade out blackberry. In the northeastern part of the site Oak Creek's first tributary is currently unshaded for approximately 400 feet and would (see Figure A-2 in the appendix) benefit from having a forested riparian corridor. Broadening forested riparian corridors will increase the buffers between streams and the housing development, adjacent streets, and human activities in general, improving wildlife habitat values. Consideration should be given to the need to retain some solar exposure in sloughs and river side channels to provide basking habitat for Western pond turtles. (Carex, 2015)

Recommended actions are listed in Table 3-1, below.

Table 3-1 Riparian Habitat Recommendations				
Type	**Action**	**Result**	**Next Step**	**Priority**
Management / Education	Preserve remaining riparian corridor on residential property through landowner education and easements.	Maintain contiguous riparian corridor	Outreach to neighboring riparian landowners ID sites on Calapooia	H
Restoration	Control invasive species at 'point' sites, and aggressively replant with native species that will eventually shade out invasives.	Improve overall habitat values and functions	ID sites using existing vegetation maps	H
Restoration	Plant armored banks and promote bioengineering in place of riprap where stabilization is necessary	Improve riparian function	ID sites on Calapooia	L
Restoration	Improve streamside shading with tall riparian trees at specific sites.	Improved water quality and riparian habitat	Plan planting for site in northeast portion of site. (See Figure A-2 in the Appendix)	M
Restoration / Community engagement /Education	Establish or widen wooded buffers between neighbors and site resources, especially near sloughs and water bodies.	Improve overall habitat values / shade	ID landowners for contact.	M

Chapter 4: Forest Habitat

This chapter addresses the area of land containing tree cover within the Oak Creek Open Space. Existing and current vegetation types in this area are introduced along with a rare plant, habitat values for birds and bats are discussed, and invasive vegetation issues are presented with recommended actions for Oak Creek Open Space forests.

Forest and Woodlands

Carex Working Group conducted vegetation surveys in the summer, 2014. Forest cover type polygons were described in the field and are shown in Figure A-1 in the Appendix. Areas with tree canopy cover greater than 70% were categorized as 'forest'. Areas with canopy cover between 30-70% were categorized as 'woodlands'. Forest and woodlands with a relatively even mix of deciduous and coniferous trees were categorized as 'mixed forest' or 'mixed woodlands'.

Mixed Forest

Forested habitats occupy the largest proportion of the site, approximately 100 acres. Of this about 75 acres are uplands, 15 acres are wetlands and 10 acres are wetland/upland mosaic, as shown in Table 4-1. Upland forests are dominated by Oregon white oak, bigleaf maple, Oregon ash, Douglas fir, and grand fir. Wetland forests are dominated by Oregon ash, sometimes mixed with Oregon white oak. Deciduous forest predominates on the east side of the project area, while forested areas on the west side are comprised of a mix of deciduous and coniferous species. Understory shrubs, mostly willow and snowberry, are moderately dense and Himalayan blackberry forms dense thickets in many areas, especially in the eastern part of the site. In the large mixed forest between the residential development and the Calapooia River some understory areas are more open and host a diversity of native herbs.
Historic vegetation in the Open Space is recorded as mixed riparian hardwood forest and oak savanna, with a large expanse of wet prairie immediately adjacent, see Figure A-1 in the Appendix.

Table 4-1. Acreage of Forest Cover Type and Habitat Type

Cover Type	Wetlands	Uplands	Mosaic	Total
Forest	15	75	10	**100**
Woodlands	7	3	2	**12**

Oregon Conservation Strategy

Oak Woodlands Characteristics: Oak woodlands are characterized by an open canopy dominated by Oregon white oak. Depending on the ecoregion and site characteristics, oak woodlands may also have ponderosa pine, California black oak, and/or Douglas-fir, or, on steep slopes, canyon live oak. In general, the understory is relatively open with shrubs, grasses and wildflowers. The tree canopy of an oak woodlands obscures between 30 percent - 70 percent of the sky as you look up at it. Oak habitats are maintained through fire, which removes small conifers and maintains a low to moderate shrub cover.

Oak woodlands once covered almost one million acres in the Coast Range and 400,000 acres in the Willamette Valley. However, the Coast Range now has less than four percent of its estimated historic oak woodlands and the Willamette Valley less than seven percent.

Loss of oaks, particularly large diameter open-structured trees valuable to wildlife, are of particular concern because oak trees have a slow growth rate and require a long time to regenerate, slowing restoration. In addition, reproduction and recruitment of younger trees is poor in many areas. Depending on the area, Strategy Species associated with oak woodlands include Columbian white-tailed deer, chipping sparrow, slender-billed (white-breasted) nuthatch, Lewis' woodpecker, white rock larkspur, and wayside aster.

(ODFW, 2006)

Rare Plant

Carex Working Group conducted plant surveys in summer, 2014. Thin-leaved peavine (*Lathyrus holochlorus),* shown in Figure 4-1, a federal Species of Concern, occurred in four subpopulations on the site, totaling approximately 20 stems. Two patches totaling about 8 stems along the Oak Creek Trail near the northeast corner of the housing development were found. Another patch of 8 stems was located nearby near the edge of the large slough along the eastern boundary of the site. A fourth subpopulation of four stems at the northern tip of the site was documented. All of the subpopulations were located at the edge of upland oak or oak-ash forest with shrubby understories of common snowberry, California hazel, poison oak, and osoberry. Peavine locations are mapped in Figure A-6 in the Appendix. Some of the plants in each patch were in flower or fruit. Habitat information and location coordinates are provided in the Appendix in Table A-5.

Figure 4-1: Thin-leaved peavine

The query of the ORBIC database shows no records of rare plant species previously documented within the project area (ORBIC, 2014). However, a population of thin-leaved peavine was documented in 1979 along Highway 99E opposite Linn-Benton Community College. No other rare plant populations are documented within a two mile radius of the centroid of the site.

Most rare plant species in the Willamette Valley are associated with prairie and savanna habitats. Most of the habitats in the project area have been impacted by past management practices and invasive species. Open areas in north and northeast parts of the site were farmed, and the old landfills on the west side destroyed any native habitats that existed previously. The entire area probably was grazed since shortly after settlement by Euro-Americans. All of the open areas are dominated by exotic species and have low potential as habitat for rare species. Forests and forest edges are often infested with Himalayan blackberry. However, these areas offer some of the best remaining habitats, and forest edges are where thin-leaved peavine occurs.

Birds

Merlin Ecological surveyed birds (and bats) in the summer and fall, 2014. Overall, almost half (19) of the bird species observed were woodland specialists, including a large number of Olive-sided Flycatchers, Varied Thrush, and the Black-headed Grossbeak. Of the Willamette Valley birds in decline, 14 species are woodland specialists; more than any other habitat type. See Figure A-7 in the Appendix for survey locations. A list of all avian species observed is in the Appendix, Table A-6.

Slender-billed Nuthatch

Forest plant species provide various important habitat components for birds and other wildlife. The Acorn Woodpecker and Slender-billed Nuthatch, both Oregon Conservation Strategy species observed on site, are woodland cavity nesters, and require older, more decrepit trees in which to make nests. These species may compete with invasive European Starlings for nest space. Significant oak (*Quercus sp.*) presence provides habitat for Acorn Woodpeckers. Douglas' spirea (*Spiraea douglasii*) and ocean spray (*Holodiscus discolor*) along the slough to the west provides excellent nectar source for butterflies and bees, and ocean spray provides forage for many moths and butterflies. Oregon white ash (*Fraxinus latifolia*), present in mixed woodlands throughout the site, provides excellent roosting habitat for birds, and seeds are eaten by birds and squirrels. Black cottonwood (*Populus trichocarpa*) provides quality roosting habitat for bats. Indian plum (*Oemleria cerasiformis*) and snowberry (*Symphoricarpos alba*) provide fruit (especially important in winter) for birds. Thimbleberry (*Rubus parviflorus*) and hazelnuts (*Corylus cornuta*) provide summer forage for birds and squirrels. Fireweed (*Chamerion angustifolium*) provides an excellent nectar source for bees. Checker mallow (*Sidalcea sp.*) provides food source for weevils.

Varied Thrush is common in Oregon, and occupies mixed woodland habitat with dense underbrush.

Bats

Bat activity was recorded during the fall and winter, 2014, using sonar recorders. Eight of the 12 bat species previously recorded in the Willamette Valley were detected within the Oak Creek Open Space, see Table A-7, in the Appendix, for a list of bat species observed and likely using the area.

Figure 4-2: Snags over a slough in the Oak Creek Open Space

Western Oregon remains relatively warm in winter and many bat species may overwinter here even though there are few caves offering good hibernating conditions. Data indicate wintering bats in the Oak Creek Open Space area. Some bats, such as the big brown bat, will roost in human dwellings throughout the year. However, many bat species will migrate short distances to optimal overwintering habitat. For forest bats, these may be lower elevation sites with good roosting locations (*e.g.* hollow trees), or simply sites far enough south (or north) for critical hibernating temperatures. Several species remain somewhat active in the winter, coming out of hibernation when the temperature rises above 55˚F and is conducive to foraging (Tuttle 1991). The Oak Creek surveys likely captured resident, migrating and overwintering bats.

Figure 4-3: A large oak tree at the margin between residential housing and the Oak Creek Open Space.

The extremely high diversity of species observed at this location is at least partly due to the concentration of large and decrepit conifer and hardwood tree species (see Figures 4-2 and 4-3). All of the species expected to occur in western Oregon are "tree roosting" bats, meaning they spend some of their time roosting in trees. Tree roosting bats typically specialize via roost location, roosting in cavities, under bark, or in foliage, and may further specialize in conifers or hardwoods. The mix of tree species on site contributes to the excellent roost habitat for all species of bats.

Insectivorous bats (such as those found in Oregon) often also specialize on the ecosystem in which they forage, preferring open-water, forest openings, forest edges, or gleaning over the canopy. Our shorter-eared Myotis forage almost exclusively over water, while longer eared Myotis tend to forage within the trees (Lacki *et al.* 2007). Unlike birds, which are often habitat specialists requiring large uniform habitat

patches, bats are very wide ranging and appear to be less affected by habitat patchiness than birds (although patchiness and urbanization do affect bat species abundance and diversity).

It is worthwhile to note that we recorded both commuting-type calls, the long flat call signatures typical of traveling bats, and song-type call signatures, a non-uniform atypical call sequence thought to be associated with mating. This suggests that the forestland is being used as a mating site (bats typically mate during fall while on migration), and may therefore serve as a "nursery" for breeding bats. Breeding bat habitat has become increasingly rare with increased urbanization, reduced forest age, and reduced woodlots in the landscape.

Little brown myotis

Invasive vegetation in the forest

Invasive plant species were surveyed by Carex Working Group in summer, 2014. Invasive plant infestations are shown on a map in the Appendix in Figure A-4. Invasive species are common throughout the project area. Himalayan blackberry and reed canarygrass are most widespread and have had the greatest impact on habitats, particularly in the eastern half of the project area. A variety of other invasives are present on the site at much lower levels, however they have the potential to severely impact habitats.

Himalayan blackberry density is moderate to high in upland forest understories on the east side, and it forms dense monocultural thickets in some non-forested uplands and along forest edges throughout most of the project area. It is scattered in forested habitats on the west side of the project area, but does not dominate understories in dense, continuous thickets as it does on the east side. Forest edges often are dominated by dense blackberry thickets.

Small infestations of false brome and Robert's geranium occur along the Oak Creek Trail and in forest understories. Small patches of Atlantic ivy are scattered in forest understories in the eastern half of the project area. A larger patch is located at the southwest corner of the site on the bank above the Calapooia River. One patch of English ivy was documented off the end of Moose Run. English holly is scattered in upland forest understory. A single patch of butterflybush was documented just outside the project area on the west bank of the Calapooia River.

Blackberry patch in the understory.

Forest Habitat Recommendations

The presence of a complex multi-species forest of large trees with a large proportion of "decrepit" trees makes this area high value and somewhat rare habitat for bats and birds. Management to protect and enhance these forest qualities will benefit Oak Creek Open Space ecology and community.

Woodlands should be managed for adequate recruitment of oaks into the forest structure. Young overtopping firs should be removed to preserve remnant oaks and other woodland, or hardwood, species. Openings in the canopy should be planted with oak and native shrubs so that invasive species do not move into the space.

Potential vegetation cover changes were developed based on current and historic cover, and consideration of which vegetation types are most valuable and practical to restore (Carex, 2015). See Table A-2, in the Appendix, for description of existing and potential vegetation in locations where potential cover varies from existing cover. These areas are mapped in Figure A-2, in the Appendix. Potential changes in forest habitats are mostly changing forest types, and in a couple small areas, changing to oak savanna.

The mixed forest surrounding the north landfill area contains many invasive vegetation 'points' or smaller patches, including, but not limited to false brome, Robert's geranium and yellow flag iris. These should be removed as soon as possible. See Figure A-4 in the Appendix.

Himalayan blackberries provide good cover from predators and good forage during late summer and fall for berry and insect eating birds. However, blackberries appear to provide low-quality nesting habitat for native bird species. Some data has been found for this, with almost twice as many birds and bird species in areas not infested with blackberries (Astley 2011). Blackberries tend to shade out low-growing native plants such as bluebunch wheatgrass and snowberry that provide important forage for seed eaters. Snowberry and other native plants may also provide more stable food source throughout the winter.

Smaller patches and 'points' of blackberries should be removed from the forest and woodland areas with priority in areas near thin-leaved peavine patches and where fir trees are removed to favor oaks. In invasive vegetation removal areas, plant Indian plum, thimbleberry, salmonberry, snowberry, black twinberry, and possibly California blackberry (*Rubus ursinus*) to create a multilayered habitat with foraging and nesting potential.

Several species of birds are dependent upon snags for successful breeding, particularly Acorn Woodpeckers, Violet-green and Tree Swallows, and Slender-billed Nuthatches (Scott *et al.* 1977). Many forest bats, which predominate among Oregon's bat species, are dependent on loose bark or hollow trees for roosting places (Barclay and Kurta 2007). Several species overwinter in hollow trees or under bark. Values vary across forest types, but in general retaining 4 to 7 good quality snags per acre is considered appropriate (Scott *et al.* 1977) in forestry practices. Merlin Ecological recommends retaining at least twice this number in a preserve to err on the side of caution.

Table 4-3 Forest Habitat Recommendations				
Type	**Action**	**Result**	**Next Step**	**Priority**
Management	Preserve old and decrepit trees, with minimal pruning, unless they pose a health risk. Retaining 8-14 good quality snags per acre.	Preserve high value somewhat rare habitat	ID in long-term management objectives and education	H
Management	Annual monitoring of thin-leaved peavine populations.	Maintain overall habitat values	Develop protection and monitoring plan	H
Management	*Immediately* control and eradicate if possible the small, scattered populations of false brome, Robert's geranium before they increase to unmanageable levels.	Improve overall habitat values	Pull immediately and develop monitoring plan	**H**
Restoration	Control competing vegetation at thin-leaved pea vine sites (e.g. Himalayan blackberry) as necessary	Maintain overall habitat values	Control invasives at specific sites shown on map	**H**
Restoration	Remove fir trees that are crowding oaks in mixed forest and mixed woodland areas. Protect areas from invasive vegetation.	Restore oak woodland habitat and oak longevity	ID trees for removal	M

Chapter 5: Wetland Habitat

Carex Working Group assessed wetlands in the summer 2014. Wetland areas were identified based on vegetation, hydric soil mapping, local topography such as channels and depressions, and evidence of wetland hydrology such as surface water, saturated soils, water marks, water-stained leaves, drift lines, and drainage patterns. Wetlands were not delineated based on jurisdictional criteria.

> *Note: The mapping of wetland boundaries for this project does not meet the standards for sampling or mapping accuracy required by state and federal regulatory agencies for delineation of jurisdictional wetlands and should not be used for purposes that would require such a delineation.*

Herbaceous wetlands north of 53rd Avenue; one of the past mitigation sites.

In some areas, uplands and wetlands are so finely intermixed that significant areas are impractical to map separately and are referred to as wetland-upland mosaic or just mosaic. Wetlands cover 61 acres and wetland-upland mosaic makes up 45 acres of the Oak Creek Open Space. Most of the habitat maps in the Appendix show the overlapping wetland and mosaic polygons.

Oregon Conservation Strategy

Conservation Overview: Wetlands provide important habitat for migrating and breeding waterfowl, shorebirds, waterbirds, songbirds, mammals, amphibians and reptiles. In addition to being critical for birds and many kinds of wildlife, floodplain wetlands and backwater sloughs and swamps are impor tant rearing habitats for juvenile salmon. Wetlands have direct value for people because they improve water quality by trapping sediments and toxins, recharge aquifers, store water, and reduce the severity of floods. Restoration and careful management of wet meadow systems and other wetlands can increase sustainable production of forage for livestock and increase late-season stream flows.

Willamette Valley: Almost all remaining wetlands in this ecoregion have been degraded to some degree by altered water regimes, pollution, and invasive plants and animals.

(ODFW, 2006)

Hydric Soils

Hydric soils cover 105 acres of the Open Space and consist of mostly wapato silty clay loam, fluvents-fluvaquents complex, and conser silty clay loam and small amounts of other hydric soils. See Figure A-8 in the Appendix. Over time hydrology of the site has changed and many areas with wetland characteristics are in areas not documented as having hydric soils.

National Wetland Inventory

National Wetland Inventory (NWI) data was used to determine the Cowardin classifications of wetlands on the site. Palustrine emergent and palustrine forested wetlands are the most common, each covering just over 30 acres, with palustrine emergent farmed wetlands covering close to 15 acres. Four other types of Cowardin classifications exist in the Open Space, each under three acres each. See Figure A-9 in the Appendix.

Almost all of the area determined to be current wetland habitat by Carex Working Group coincides with NWI wetlands; the main exception being a portion of the past mitigation project cells. Conversely, most of the area determined as wetland upland mosaic is not on NWI wetlands. Consideration of how site hydrology has changed over time will help determine the best plans and practices for habitat enhancement and restoration.

A slough on the west side with drowned ash trees.

Vegetation Cover Type

Acreages of vegetation cover types within wetlands and wetland-upland mosaics are summarized in Table 5-1, below, and shown in Figure A-1 in the Appendix.

Most of the wetland and mosaic habitat is in forest and herbaceous cover types. Wetland forests are dominated by Oregon ash sometimes mixed with Oregon white oak. Herbaceous vegetation grows on 43 acres of wetland and mosaic habitat. Herbaceous habitats are concentrated in the southeast part of the site in the wetland mitigation areas, in old agricultural fields in the north part of the site, and in the landfill areas in the west side of the Open Space. In herbaceous wetland areas, reed canarygrass, meadow foxtail, creeping bentgrass, common velvetgrass, chess brome, and common teasel are the common dominants.

Five sloughs are located in old flood channels. The slough just west of the residential development and the two on the east side likely are inundated year round, while the other two are seasonally inundated. Vegetation in the sloughs is dominated by yellow pondlily, floating aquatics such as common duckweed, and waterpepper. Exotics in and at the margins of the sloughs include reed canarygrass, Brazilian water meal, and climbing nightshade. Beavers are active in the sloughs, Oak Creek, and the Calapooia River and gnawed trees and shrubs are common in and around the sloughs. A beaver dam at the north end of the slough west of the housing development has raised the water level and drowned numerous Oregon ash trees, which now provide excellent snag habitat for cavity

Table 5-1: Acreage of vegetation cover types in wetlands and mosaic habitat.

Cover Type	Wetlands	Mosaic	Total
Forest	15	10	25
Woodlands	7	2	9
Shrublands	7	5	12
Herbaceous/Shrublands	0	9	9
Herbaceous	24	19	43
Gravel Bar	2	0	2
Slough	6	0	6
Total	61	45	106

nesting birds, and basking logs for Northwest pond turtles.

Wetland/upland mosaic occurs in the two landfill areas where wetland patches are perched on the clay cap of the south landfill and in depressions between filled areas in the north landfill.

Native shrubs mixed with invasives along a slough

Invasive Plant Species in Wetlands

Invasive plant infestations are shown on the map in Figure A-4 in the Appendix. A large portion of the Oak Creek Open Space wetlands and wetland mosaic habitat is inundated with invasive plant species; most notably Armenian blackberry, also known as Himalayan blackberry, and reed canarygrass. These species are the most widespread and have had the greatest impact on habitats, particularly in the eastern half of the project area. A variety of other invasive plant species, including yellow flag iris (shown in Figure 5-2) , are present on the site at moderate to low levels, however they also have the potential to severely impact habitats and especially wetlands. Smaller infestations of invasive plants rank at higher priority for concern since there is a greater likelihood of successful control if treated in the near future.

Figure 5-2: Example of yellow flag iris

Armenian blackberry is the most common invasive species in the Open Space, dominating 107 acres. Blackberry is so common and pervasive efforts to control large infestations are often not cost effective. Blackberry is found in all habitat types in the Open Space, and covers large portions of the wetlands and wetland mosaic habitat. Treating smaller patches of blackberries in other key habitats is discussed in the Forest and Grassland chapters.

Reed canarygrass dominates many of the wetlands and shorelines throughout the site for a total of 32 acres of coverage. Particularly dense infestations occur in open swales in the east and northeast parts of the project area. In these areas it forms virtual monocultures that exclude essentially all other plant species. It also occurs in wet forest and shrubland understories, but is often less dense in these habitats due to overstory shading. Reed canarygrass can be extremely difficult to control. We recommend preventing any new infestations by protecting disturbed soil from seed inundation. Inter-planting of

over story trees that could eventually shade out the reed canarygrass will be helpful, and tress would need to be maintained for several years or until they are 'free to grow'.

Yellow flag iris infestations were found exclusively in or boarding wetlands, in sloughs and wet swale. The largest infestation of yellow flag iris is on the east side of the Open Space in a wetland swale that connects to other water bodies during wet times of the year. The extent of these populations is relatively limited at this time and may be controllable with timely, proper management. This species was also observed being grown as an ornamental on neighboring properties along the east boundary of the project area. Surveys in 2014 identified 18 different infestation points in the project area, with radius up to 30 feet.

Wetlands and sloughs are potential habitat for rare aquatics such as *Howellia aquatilis,* and rare wetland plants such as *Sidalcea nelsoniana,* but neither of these species was documented on the site. Regular monitoring should be conducted to prevent these species from gaining foothold in the Open Space.

Wetland Assessment

Carex Working Group conducted an Oregon Rapid Wetlands Assessment Protocol (ORWAP) survey in February, 2015. Results of the ORWAP are shown in Table 5-2. The methodology for computing the scores are contained in the ORWAP calculator spreadsheet (Adamus et al. 2010a) held by Calapooia Watershed Council, and the ORWAP Manual (Adamus et al. 2010b). The ORWAP method evaluates the wetland functions listed in the table, the local value of those functions, and other attributes based on surrounding land uses, site conditions and position in the watershed, for example. ORWAP uses 221 Oregon wetlands as reference condition for determining scores on a scale of 0-10. This survey considered all the wetlands in the project area as one single wetland, and should not be used for any regulatory purposes. Definitions of the functions are in Table A-8, and components of the grouped services are in Table A-9, both in the Appendix.

The ORWAP results for Oak Creek Open Space wetlands have relatively high scores for many wetland functions and values, particularly in the grouped functions water quality, fish, aquatic and terrestrial support, and in public use and recognition. Wetland ecological condition is compromised due to the prevalence of invasive and non-native vegetation in wetland areas. Wetland stressors are somewhat high due to alterations and exposure to risk. Wetland sensitivity score is very high, reflecting its lack of resistance and resilience to stressors. Overall, the ORWAP results indicate the wetland is

Table 5-2: Assessment scores for wetlands on the Calapooia-Oak Creek Confluence Site using the Oregon Rapid Wetland Assessment Protocol (Adamus et al. 2010a).

Specific Functions	Relative Effectiveness of the Function	Relative Values of the Function
Water Storage & Delay (WS)	2.52	7.08
Sediment Retention & Stabilization (SR)	4.35	5.25
Phosphorus Retention (PR)	8.07	6.17
Nitrate Removal & Retention (NR)	4.52	4.87
Thermoregulation (T)	4.11	10.00
Carbon Sequestration (CS)	2.89	
Organic Matter Export (OE)	7.89	
Aquatic Invertebrate Habitat (INV)	5.95	7.00
Anadromous Fish Habitat (FA)	6.93	10.00
Non-anadromous Fish Habitat (FR)	3.51	8.18
Amphibian & Reptile Habitat (AM)	4.58	10.00
Waterbird Feeding Habitat (WBF)	6.36	4.67
Waterbird Nesting Habitat (WBN)	5.24	3.50
Songbird, Raptor, & Mammal Habitat (SBM)	6.23	10.00
Pollinator Habitat (POL)	7.46	5.00
Native Plant Diversity (PD)	7.28	7.51

Grouped Functions	Group Scores (functions)	Group Scores (values)
Hydrologic Function (WS)	2.52	7.08
Water Quality Group (WQ)	8.07	10.00
Carbon Sequestration (CS)	2.89	
Fish Support Group (FISH)	6.93	10.00
Aquatic Support Group (AQ)	7.89	10.00
Terrestrial Support Group (TERR)	7.46	10.00
Public Use & Recognition (PU)		10.00
Provisioning Services (PS)		4.00

Other Attributes		
Wetland Ecological Condition (CQ)		4.83
Wetland Stressors (STR)		6.68
Wetland Sensitivity (SEN)		10.00

in fair to good functioning condition, apart from invasive species issues, has high ecological values but is vulnerable to stress.

Wetland Recommendations

Wetland Mitigation Banking

Several areas have potential to be used for wetland mitigation banking to provide future mitigation credits, see Figure A-10 in the Appendix. In particular, the abandoned agricultural fields in the northern part of the site are potentially appropriate for creation and enhancement of wetlands. Currently most of these areas are dominated by invasive or other non-native species. Excavation of areas that are currently uplands would be required to lower the grade enough to maintain wetland hydrology, and revegetation with native wetland species would be necessary to replace the existing non-native upland vegetation. Enhancement of existing wetlands also has potential for generating mitigation credits. These include wetland forest and shrublands, and herbaceous wetlands. Enhancement would mainly involve control of dominant invasive plant species and establishing native wetland vegetation.

A detailed delineation of jurisdictional wetlands currently present would be required to determine exact acreages of wetlands that could be created or enhanced. Close coordination with Oregon Department of State Lands and US Army Corps of Engineers would be essential in establishing a wetland mitigation bank on the site. These agencies require wetland mitigation banks to be managed in perpetuity, thus careful consideration of the cost of ongoing management would be necessary.

Areas west of the Calapooia River were not included as potential mitigation bank sites because of lack of access. The abandoned landfill sites and surrounding habitats were also not included pending a decision on how the landfills are to be managed and what kinds of activities may be appropriate to prevent groundwater contamination and leakage into the Calapooia River. When these issues are resolved the landfills and surrounding areas may provide additional wetland mitigation bank potential.

We estimate that up to approximately 15 acres of wetlands could be created, all in the abandoned agricultural fields north of the housing development. Another 36 acres could be enhanced by controlling invasive species and restoring native wetland vegetation. For the purposes of this analysis we assumed that wetlands occupy 50% of wetland/upland mosaic habitats. Most of the enhancement areas are located in the eastern and northern parts of the project area.

Wetland habitats that could be created or enhanced include wetland prairie, savanna, shrublands and forest. Some of the undulating topography in the abandoned farm fields could be utilized to create a complex of wetlands and uplands, potentially lending itself to establishment of oak savanna with wetland swales, helping the City in its efforts to manage for oak habitats. Recommended actions are listed in Table 5-3, below.

Invasive Species Control

Control of yellow flag iris is a priority species for management due to its growth in many small patches, and its aquatic placement and connection to nearby water bodies during the wet season. Yellow flag iris poses a threat to wetlands by degrading fish and wildlife habitat, out-competing native riparian and wetland vegetation and reducing water storage carrying capacity. The plant reproduces from its rhizomes and extra caution must be taken to clean up any rhizome debris if removing by hand or mechanically. Resins of the leaves and rhizomes can cause irritation to skin. The best method for controlling an infestation of this size would be to apply aquatic-use glyphosate herbicide to cut stems for several years.

Enhancement of existing wetland forest would consist of control of invasive and non-native understory species with replacement through supplemental planting of native species. In some areas conversion to shrub or forest habitat may be the most feasible way to reduce cover of reed canarygrass and blackberries, and re-establish native vegetation. Near streams and sloughs it may be best to emphasize establishment of wetland forest to provide streamside shading and structural habitat elements to ameliorate water temperature and quality, and provide additional wildlife habitat values. Recommended actions are listed in Table 5-3, below.

Potential vegetation cover changes were developed based on current and historic cover, and consideration of which vegetation types are most valuable and practical to restore (Carex, 2015). See Table A-2, in the Appendix, for description of existing and potential vegetation in locations where potential cover varies from existing cover. These areas are mapped in Figure A-2, in the Appendix. Wetlands underlie other vegetation cover types and some of these areas could be managed to support more valuable vegetation types. These areas are highlighted in Table A-2 in the Appendix.

Table 5-3: Wetland Habitat Recommendations

Type	Action	Result	Next Step	Priority
Management	Riparian communities including willow-shrub, emergent grasses and sedges (cutgrass, sloughgrass) should be encouraged and cattails discouraged.	Improve avian habitat and winter food supply	Monitor extent of cattail populations and work to diversify dense stands of cattail.	L
Management	Annual monitoring for Ludwigia peploides and hexapetala	Protect Calapooia backwaters and alcoves from nearby invasive species	Include in maintenance plan, work with Cooperative Weed Management Area group	H
Restoration	Pursue wetland mitigation bank and/or BPA habitat mitigation to help fund habitat restoration	Improve wetland habitats	Prioritize sites using existing wetlands maps	L
Restoration	Immediately remove priority aquatic invasive species, such as yellow flag iris.	Improve wetland habitats	Seek grant funding	**H**
Restoration	Manage widespread invasives; Reed canary grass, and blackberry in *key* locations (i.e. potential Western pond turtle nesting areas) to protect vulnerable habitat. Replace with Spiraea, tufted hairgrass, juncus and sedges.	Improve overall habitat values	Prioritize sites	H

Chapter 6: Grasslands Habitat

The term 'grasslands' encompasses a couple, slightly different plant communities; upland prairie and oak savanna. While open grassy areas exist in the Oak Creek Open Space, the composition of these relatively open areas is very different from historical conditions. This chapter addresses the areas that could potentially be managed for conditions and species more like those in historical grasslands.

Area of historical grasslands at the Oak Creek Open Space, now dominated by chess brome, creeping bentgrass and field bindweed.

Before European settlement, farming and development, the east side of the Oak Creek Open Space was primarily oak savanna. See Figure A-5 in the Appendix for a map of historical vegetation communities. Like the native prairies that once extended across the Willamette Valley region, oak savanna plant communities were dominated by bunchgrasses such as Roemer's fescue, red fescue, and California oatgrass. Savannas are really only distinguished from prairies by the presence of widely-spaced trees. Oregon white oak, ponderosa pine, and Douglas-fir were some of the most common trees that historically occurred on native savannas.

Oregon Conservation Strategy

Willamette Valley: Grasslands, also called upland prairies, are dominated by grasses, forbs, and wildflowers. Grasslands have well-drained soils and often occur on dry slopes. They are similar to wet prairies in structure and share some of the same prairie-associated plants and animals. Oak savannas are grasslands with scattered Oregon white oak trees, generally only one or two trees per acre. Oak trees in savannas are usually large with well-developed limbs and canopies.

Conservation Overview: As a whole, native grasslands are one of the most imperiled habitats in the western United States and are disappearing rapidly around the globe. In Oregon, the greatest loss of grasslands has been in valley bottoms and foothills where they have been impacted by conversion to agriculture, development, and invasive plant species. In some areas, past grazing has impacted grasslands, affecting plant composition and structure. Also, non-native species were historically seeded for livestock forage in some grasslands, decreasing the abundance and diversity of native plants. However, grazing practices become more sustainable over time, and carefully managed grazing can help maintain grassland structure where prescribed fire is not practical or desired. Disruption of historical fire regimes has allowed for shrubs or trees to encroach, replacing grasslands with forest. In addition, some foothill grasslands have been converted to forests through tree planting.
(ODFW, 2006)

Vegetation

Open areas, or areas not considered forest or aquatic, were surveyed by Carex Working Group in summer, 2014. These areas, totaling 106 acres, were labeled as herbaceous, herbaceous/ shrubland, or

shrubland, see Figure A-1 in the Appendix. These 'open' areas cover upland, wetland and mosaic habitat types. Herbaceous is the largest component of the open areas and covers relatively equal amounts of wetland, mosaic and upland areas, see Figure 6-1. Common dominants in herbaceous areas include reed canarygrass, tall fescue, oxeye daisy, creeping bentgrass, velvetgrass, Canada thistle, Queen Anne's lace, redtop, and rough cat's ear. Herbaceous/shrublands are the smallest component, totaling 13 acres of uplands and mosaic habitat. Plants dominant in the herbaceous/shrub areas include blackberry, common velvetgrass, Canada thistle, redtop, spreading rush, and Pacific dewberry. Shrublands are mostly found in the upland aras but also cover wetlands and mosaic. The main dominates in shrublands include blackberry, Nootka rose, common snowberry, reed canarygrass, and Hooker's willow.

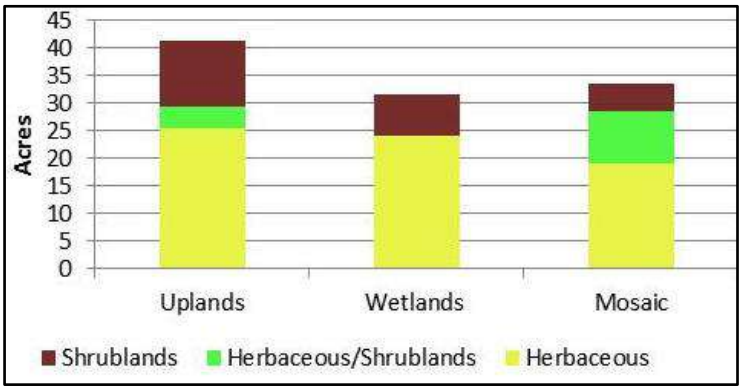

Figure 6-1: Habitat types within herbaceous and shrublands areas

Birds

Overall, long term population trends show that bird species across the U.S. are generally declining. Nearly 30% of all avian species in the contiguous U.S. are in decline (-0.19% per year; Sauer *et al.* 2011). Topping the list are grassland breeding birds, with a long term negative population growth of -1.14 % per year decline average from 1966 until 2012. Ground and low-nesting birds also have substantial long term declines in population numbers.

Western Meadowlark

Surveys of bird species were conducted by Merlin Ecological in summer, 2014. The survey found that, of the Willamette Valley birds in decline, only 5 are grassland specialists, 7 are wetland, 11 are shrub/scrub and 14 are woodland specialists. However, almost all of the grassland specialists are sensitive to habitat patch size, whereas only 1 wetland and 1 woodland species are sensitive to habitat patch size. Of the birds in decline, 16 are ground nesters and 9 nest low in shrub or trees (<10 ft). See Table A-6 in the Appendix.

Several of the conservation concern species which might be expected in this area, but were not observed, are prairie specialists requiring blocks of up to 50 acres or more of open habitat. These include Horned Lark, Vesper Sparrow, Savanna Sparrow, Western Meadowlark, Long-billed Curlew, and Wilson's Snipe.

Three non-native invasive species were observed totaling 54 individuals (Eurasian Starling, Collared Dove, and House Sparrow) which accounted for 21% of the total individuals observed on site. Invasive avian species were primarily observed in manicured park areas, although Collared Doves were also observed in un-manicured herbaceous areas and woodland. Eurasian Starlings were only observed in four locations, two of which were parks with manicured lawns. House Sparrows were observed in a variety of habitats, as were Collared Doves. The Collared Doves are of particular concern, since their population has expanded exponentially in the last few years in Oregon (*Personal communication* Christmas Bird Count data), and their population growth may be linked to the dearth of the once-common Mourning Dove in this survey.

Thirteen "open" habitat species were observed, many of which are generalists, comfortable in degraded habitats. None are prairie or native grassland specialists.

Non-native oxeye daisies on the landfill site.

Invasive Vegetation

The majority of invasive plant species at the Oak Creek Open Space occur within the open habitat labeled herbaceous, herbaceous/shrublands, or shrublands. This is partly due to the lack of shade from overtopping forest canopy and the history of disturbance from agricultural practices in open areas. In some cases invasives are the dominant shrubs, such as Armenian blackberry, that make up the shrublands. Some large areas of herbaceous cover contain only patches of invasives and these are denoted as 'points' on Figure A-4 in the Appendix.

The old agricultural fields in the northern part of the project area also have extensive blackberry infestations, although openings and trails are present. Late season mowing in 2014 beneath the Bonneville Power Administration transmission lines knocked back dense blackberry thickets to ground level allowing much easier access. Without control, the blackberry in these areas will resprout and rapidly regain its previous dominance. The margins and fill slopes of the south landfill area are covered with extremely dense blackberry thickets as are parts of the north landfill area.

Native Nootka rose shrub.

Grassland Recommendations

There are good opportunities to improve habitat values of native grasslands and oak savanna in open non-forest areas. Improvements can be made primarily through vegetation management to expand grassland habitat blocks, control invasive and undesired trees, and enhance or restore wetlands in portions of the area (See Chapter 5 for wetland restoration in open areas). Limiting disturbance to ground nesting birds by humans and pets is also particularly important in these areas. Table 6-1, below, lists the recommended actions for grasslands.

Grassland habitat

Loss of large-tracts of open, undisturbed prairie has caused startling declines in ground-nesting species such as western meadowlarks and grasshopper sparrows that need large territories of 20+ acres/family as well as undisturbed grasslands free of nearby trees and predators.

Open habitats will be reduced as forested habitats naturally increase due to lack of agriculture and controlled burning. However, prairie and savanna habitats could still comprise a significant portion of the total area if the abandoned farm fields are restored to native habitats. With reintroduction efforts these vegetation types could provide essential habitat for native prairie species, including most of the federally listed plant species that occur in the Willamette Valley, and the federally listed Fender's Blue Butterfly and Taylor's Checkerspot Butterfly, and potentially nesting habitat for the Western Pond Turtle.

Management to enhance open habitat for conservation concern bird species could include linking blocks of herbaceous, shrublands and savanna habitats through selective removal of specific trees to enlarge and connect open habitat patches. Young overtopping firs may need to be removed to preserve remnant oak savanna.

Potential vegetation cover changes were developed based on current and historic cover, and consideration of which vegetation types are most valuable and practical to restore (Carex, 2015). See Table A-2, in the Appendix, for description of existing and potential vegetation in locations where potential cover varies from existing cover. These areas are mapped in Figure A-2, in the Appendix. Large areas currently herbaceous cover could be managed for potential prairie and savanna habitats.

Note that prairie and savanna habitats are challenging to establish and maintain. Often, prescribed burning is the preferred method of controlling invading woody vegetation, but burning is very difficult to do at the urban fringe due to concerns about safety and smoke. Managers should carefully consider the benefits and the difficulties of establishing and maintaining these habitats.

Invasive vegetation

Removing invasive weeds on grassland and wet prairie habitats would provide better nesting structure for many grassland species. For example, the Western Bluebird on site may be limited by Cowbird parasitism, and invasive blackberries on shrub/grassland habitat. Streaked-horned Larks and Oregon Vesper Sparrow are inhabitants of large grasslands and may be limited by vegetative structure such as overgrowth of invasives and sod-forming grasses on grassland habitat (Pearson and Altman 2005), as well as grassland patch size, and disturbance by humans, dogs and cats.

It may be impractical to eradicate large swaths of blackberry or reed canarygrass. Therefore control of these species should begin with small patches that are encroaching into herbaceous areas, and or to link herbaceous areas to increase overall contiguous grassland habitat.

Target species to eliminate or reduce should include reed canarygrass (*Phalaris arundinacea*), tall fescue (*Festuca arundinacea*), creeping bentgrass (*Agrostis stolonifera*), and blackberries (*Rubus armeniacus* and similar species).

Replacement species could include tufted hairgrass (*Deschampsia cespitosa*), onespike oatgrass (*Danthonia unispicata*), and Oregon bentgrass or rough bentgrass (*Agrostis oregonensis* and *A. scabra*, respectively) various native rushes and sedges such as *Carex obnupta, Juncus balticus*, native forbs such as *Bidens aristosa*, and the native sunflowers (*Helianthus annus)*. Once native prairie structure is restored, introduction plant species, such as Kincaid's lupine, could be utilized to build habitat necessary for endangered insects such as Fender's Blue butterfly. These species all provide important forage and habitat structure for birds.

Table 6-1: Grassland Habitat Recommendations

Type	Action	Result	Next Step	Priority
Management	Encourage people to stay on trails, and trails should be routed through forest and away from grassland habitats where possible.	Reduce disturbance to sensitive species	Develop trail maintenance and expansion plan	H
Management	Test soils and develop a vegetation management and planting plan for the old landfill areas.	Improve overall habitat values	Assessment of specific site	M
Restoration	Remove a few younger trees between adjacent grassland and shrub habitats to increase the grassland patch size and make it contiguous with nearby habitat patches	Increase grassland patch size	ID specific trees for removal	H
Restoration	Control* invasive vegetation patches ('points' versus 'polygons') on potential grassland habitat before patches become larger infestations. Target species for removal: Reed's canary grass, tall fescue, creeping bentgrass, Armenian blackberries. Replace with: onespike oatgrass, Oregon bentgrass or rough bentgrass, and for wetter areas, tufted hairgrass, native juncus and sedges.	Provide better nesting structure for many grassland species	ID specific patches for removal	H
Restoration	Introduce rare plants (threatened or endangered or species of concern) once native prairie is restored. I.e. Lomatium bradshawii	Build habitat for endangered species	Control invasives, first, at specif sites shown on map	M
Restoration	Remove young overtopping firs in the vacinity of oaks to encourage growth of oaks and oak savanah.	Preserve remnant oak savanna	ID specific patches for removal	M
Restoration	Assess and stabilize landfill contents, remove or process as necessary.	Resolve potential health water quality and health issue	Assessment of specific site	H

* Vegetation removal/ spraying/ mowing should occur after most birds fledge (late June or July) or be done on a small proportion of the habitat at a time to minimize disturbance during sensitive nesting periods

Chapter 7: Community Engagement

The Oak Creek Open Space wraps around a residential housing development and is set within a neighborhood comprising over 1500 tax lots within approximately one square mile surrounding the Open Space. As land managers, the City of Albany would like to increase community enjoyment and appreciation of the Oak Creek Open Space while maintaining the majority of the property as a natural area (accepting Calapooia-Teloh City Park). Community engagement and support can be a major key to vitality and function of any Open Space.

An open community meeting was held at nearby Linn Benton Community College in May, 2015. Over 1500 postcard invitations were mailed to local residents. Community members learned about the habitats and wildlife being studied at the site, provided feedback about management concerns and listed ways in which they value or use the Oak Creek Open Space. A list of community comments is in Table A-10 in the Appendix. In summary, participating residents feel most concerned about potential property development (no property development is planned at this time) that might bring in more people and subsequent undesirable behavior. They would also like to know more about the landfill and are concerned about flooding and weeds. Residents suggested that the Open Space remain more of a neighborhood resource rather than a destination for the wider public. They want the trails to be better maintained and have less garbage and control of invasive species. Residents would be interested in organizing to pick up garbage and pull weeds, they would like to learn more about wildlife and invasives, and want to be informed and involved with Open Space management decisions. Residents value the wildlife and natural setting, and access to trails offered by the Open Space.

Youth Education

The Oak Creek Open Space offers a geographic context for engaging local youth in learning about environmental conditions on the site and over time. As schools adopt new academic standards, such as the Next Generation Science Standards, and graduation requirements such as the Oregon Environmental Literacy Plan, there is increasing need to find creative ways of engaging youth with the sciences in the real world outside of classrooms and across disciplines. The City of Albany works in close partnership with the Calapooia Watershed Council's Youth Education Program which coordinates field trips and lessons to teach youth about their watershed resources. It can be difficult to access sites so close to Albany that also contain the mix of habitats and hydrology found at the Oak Creek Open Space. Educational field trips, stewardship projects and monitoring by students would benefit the local school district and would help build community appreciation for natural resources at Oak Creek Open Space.

Youth prepare to remove invasive species in Teloh-Calapooia Park.

Education opportunities at the Oak Creek Open Space could take place in several forms, listed in Table 7-1, below.

Youth education activities would be closely chaperoned and organized. Students would primarily arrive and leave by bus and would bring a portable toilet. In some cases, students would share the information gained or project results with the nearby community.

Community Education

Opportunities exist for enriching the knowledge of community members about site history, resources and stewardship opportunities. The goal of this community engagement would be to improve stewardship and management of the site and neighboring properties, as well as increase quality of life for those citizens. Understanding of natural and cultural history and the range of plant and wildlife species found on the site could enhance the community experience and sense of pride associated with the Oak Creek Open Space. Some measures, such as controlling dogs and cats during bird ground nesting seasons and best management practices for invasive species and garbage disposal, are specifically needed to improve site conditions. Opportunities for community education and involvement are listed in Table 7-1, below.

Local residents participate in fish surveys.

Recreation

Oak Creek Open Space trails are open to public use, but the City of Albany, as land owner and manager, doesn't envision heavy use of the site by the public, but rather maintaining natural habitats as much as possible with low-impact public use primarily on designated trails. Trail walking, running and site seeing are the most common recreational uses of the Oak Creek Open Space. People also like to bring their dogs there and let them run off-leash. Recommended management actions affecting recreation include trail maintenance and expansion, signs encouraging users to stay on trails and keep dogs on leashes, and installation of waste receptacles. All recommended actions are listed in Table 7-1, below.

Community Engagement Recommendations

If neighbors and visitors of the Open Space understand the importance of its habitat resources and respect its purpose in the community, they will be more likely to be good land stewards and will gain more enjoyment from the Open Space. The City of Albany understands that residents do not want to see development that brings in more visitors, such as parking lots and bathroom facilities. Management measures are intended to improve the current users' experience and sense of pride related to the Open Space.

Table 7-1: Recommended Community Engagement Actions				
Type	**Action**	**Result**	**Next Step**	**Priority**
Youth Education	Field trips to Oak Creek Open Space to practice hands-on watershed science, explore habitats, and conduct monitoring and stewardship activities.	Increased understanding of and respect for the ecological value of the site.	Calapooia Watershed Council plans and collaborates with schools.	**H**
Community Engagement	Community education through walking tours with experts, workshops*, brochures and interpretive signs about site resources.	Increase community awareness and appreciation of the site.	Develop outreach materials and plan. Potentially partner with HOA.	H
Community Engagement	Community engagement through volunteer stewardship events and annual celebration.	Increase community awareness and appreciation of the site, and improve conditions.	Develop outreach materials and plan. Potentially partner with HOA.	H
Recreation Management	Develop trail connecting old landfill area to the Oak Creek Greenbelt trail.	Increase community passive recreational use of the site, keep users on path.	After landfill areas are treated, pending further landfill assessment, develop trail design for least impact to habitats.	M
Recreation Management	Improve trail drainage and stream crossings.	Increase community passive recreational use of the site, keep users on path.	Identify stream/slough crossings and desired design.	M
Recreation Management	Discourage visitors from going off trails with signage and education about sensitive habitats.	Increase responsible use of the site; keep users on path.	Plan in conjunction with interpretive signs.	M
Recreation Management	Disallow off-leash dogs and provide for pet waste disposal.	Protect ground nesting birds and other wildlife, and protect water quality.	Plan in conjunction with interpretive signs, and community education events.	**H**
*Education topics to include proper management of invasive species, importance of controlling dogs and cats outdoors during bird ground nesting season, local hydrology and flooding, clarify property boundaries and address encroachment issues, and stormwater management.				

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Appendices

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Table A-1: Oak Creek Open Space Management Plan Recommendations				
Aquatic habitat	**Action**	**Result**	**Next Step**	**Priority**
Management	Conserve riparian forest for channel migration buffer.	Reduce land loss due to channel migration	ID narrow buffer locations near channel bends and flag in riparian management for potential channel migration.	L
Management	Measure water quality at additional stream points on Oak Creek and tributaries, with special consideration to using macroinvertebrate studies where feasible.	Improve data base pertaining specifically to Oak Creek Open Space with upstream and downstream data. Flag bacteria, temperature and turbidity.	ID sites on Oak Creek and tribs.	M
Management	Conserve existing in-stream woody debris.	Maintain habitat connectivity and complexity	Periodic monitoring of large wood debris.	H
Restoration	Reconnect floodplain off-channel habitats and replace fish barrier culverts.	Improve habitat connectivity and complexity	ID sites on Oak Creek and tribs.	H
Restoration	Install stable log jams for in-stream habitat.	Improve habitat connectivity and complexity	ID sites on Oak Creek and tribs.	L
Riparian habitat	**Action**	**Result**	**Next Step**	**Priority**
Management / Education	Preserve remaining riparian corridor on residential property through landowner education and easements.	Maintain contiguous riparian corridor	Outreach to neighboring riparian landowners ID sites on Calapooia	H
Restoration	Control invasive species at 'point' sites, and aggressively replant with native species that will eventually shade out invasives.	Improve overall habitat values and functions	ID sites using existing vegetation maps	H
Restoration	Plant armored banks and promote bioengineering in place of riprap where stabilization is necessary	Improve riparian function	ID sites on Calapooia	L
Restoration	Improve streamside shading with tall riparian trees at specific sites.	Improved water quality and riparian habitat	Plan planting for site in northeast portion of site. (See Figure A-2)	M
Restoration / Community engagement /Education	Establish or widen wooded buffers between neighbors and site resources, especially near sloughs and water bodies.	Improve overall habitat values / shade	ID landowners for contact.	M
Forest Habitat	**Action**	**Result**	**Next Step**	**Priority**
Management	Preserve old and decrepit trees, with minimal pruning, unless they pose a health risk. Retaining 8-14 good quality snags per acre.	Preserve high value somewhat rare habitat	ID in long-term management objectives and education	H
Management	Annual monitoring of thin-leaved peavine populations.	Maintain overall habitat values	Develop protection and monitoring plan	H

Table A-1 continued				
Management	*Immediately* control and eradicate if possible the small, scattered populations of false brome, Robert's geranium before they increase to unmanageable levels.	Improve overall habitat values	Pull immediately and develop monitoring plan	**H**
Restoration	Control competing vegetation at thin-leaved pea vine sites (e.g. Himalayan blackberry) as necessary	Maintain overall habitat values	Control invasives at specific sites shown on map	**H**
Restoration	Remove fir trees that are crowding oaks in mixed forest and mixed woodland areas. Protect areas from invasive vegetation.	Restore oak woodland habitat and oak longevity	ID trees for removal	M
Wetland Habitat	**Action**	**Result**	**Next Step**	**Priority**
Management	Riparian communities including willow-shrub, emergent grasses and sedges (cutgrass, sloughgrass) should be encouraged and cattails discouraged.	Improve avian habitat and winter food supply	Monitor extent of cattail populations and work to diversify dense stands of cattail.	L
Management	Annual monitoring for Ludwigia peploides and hexapetala	Protect Calapooia backwaters and alcoves from nearby invasive species	Include in maintenance plan, work with Cooperative Weed Management Area group	H
Restoration	Pursue wetland mitigation bank and/or BPA habitat mitigation to help fund habitat restoration	Improve wetland habitats	Prioritize sites using existing wetlands maps	L
Restoration	Immediately remove priority aquatic invasive species, such as yellow flag iris.	Improve wetland habitats	Seek grant funding	**H**
Restoration	Manage widespread invasives; Reed canary grass, and blackberry in *key* locations (i.e. potential Western pond turtle nesting areas) to protect vulnerable habitat. Replace with Spiraea, tufted hairgrass, juncus and sedges.	Improve overall habitat values	Prioritize sites	H
Grassland Habitat	**Action**	**Result**	**Next Step**	**Priority**
Management	Encourage people to stay on trails, and trails should be routed through forest and away from grassland habitats where possible.	Reduce disturbance to sensitive species	Develop trail maintenance and expansion plan	H
Management	Test soils and develop a vegetation management and planting plan for the old landfill areas.	Improve overall habitat values	Assessment of specific site	M

Table A-1 Continued				
Restoration	Remove a few younger trees between adjacent grassland and shrub habitats to increase the grassland patch size and make it contiguous with nearby habitat patches	Increase grassland patch size	ID specific trees for removal	H
Restoration	Control* invasive vegetation patches ('points' versus 'polygons') on potential grassland habitat before patches become larger infestations. Target species for removal: Reed's canary grass, tall fescue, creeping bentgrass, Armenian blackberries. Replace with: onespike oatgrass, Oregon bentgrass or rough bentgrass, and for wetter areas, tufted hairgrass, native juncus and sedges.	Provide better nesting structure for many grassland species	ID specific patches for removal	H
Restoration	Introduce rare plants (threatened or endangered or species of concern) once native prairie is restored. I.e. Lomatium bradshawii	Build habitat for endangered species	Control invasives, first, at specif sites shown on map	M
Restoration	Remove young overtopping firs in the vacinity of oaks to encourage growth of oaks and oak savanah.	Preserve remnant oak savanna	ID specific patches for removal	M
Restoration	Assess and stabilize landfill contents, remove or process as necessary.	Resolve potential health water quality and health issue	Assessment of specific site	H
* Vegetation removal/ spraying/ mowing should occur after most birds fledge (late June or July) or be done on a small proportion of the habitat at a time to minimize disturbance during sensitive nesting periods				
Community	**Action**	**Result**	**Next Step**	**Priority**
Youth Education	Field trips to Oak Creek Open Space to practice hands-on watershed science, explore habitats, and conduct monitoring and stewardship activities.	Increased understanding of and respect for the ecological value of the site.	Calapooia Watershed Council plans and collaborates with schools.	**H**
Community Engagement	Community education through walking tours with experts, workshops*, brochures and interpretive signs about site resources.	Increase community awareness and appreciation of the site.	Develop outreach materials and plan. Potentially partner with HOA.	H
Community Engagement	Community engagement through volunteer stewardship events and annual celebration.	Increase community awareness and appreciation of the site, and improve conditions.	Develop outreach materials and plan. Potentially partner with HOA.	H
Recreation Management	Develop trail connecting old landfill area to the Oak Creek Greenbelt trail.	Increase community passive recreational use of the site, keep users on path.	After landfill areas are treated, pending further landfill assessment, develop trail design for	M

			least impact to habitats.	
Table A-1 Continued				
Recreation Management	Improve trail drainage and stream crossings.	Increase community passive recreational use of the site, keep users on path.	Identify stream/slough crossings and desired design.	M
Recreation Management	Discourage visitors from going off trails with signage and education about sensitive habitats.	Increase responsible use of the site; keep users on path.	Plan in conjunction with interpretive signs.	M
Recreation Management	Disallow off-leash dogs and provide for pet waste disposal.	Protect ground nesting birds and other wildlife, and protect water quality.	Plan in conjunction with interpretive signs, and community education events.	**H**
*Education topics to include proper management of invasive species, importance of controlling dogs and cats outdoors during bird ground nesting season, local hydrology and flooding, clarify property boundaries and address encroachment issues, and stormwater management.				

Table A-2: Potential Vegetation Cover Type Change (See Figure A-1)						
Cover Type	**Dominate Cover Description**	**Potential Cover Type**	**Potential Cover Description**	**Fig. A-2 ID**	**Acres**	**Habitat Type**
Forest Habitat						
Deciduous Woodland	Oregon white oak-Oregon ash/mowed lawns-herbicided areas	Deciduous Forest	Oregon white oak-Oregon ash forest	17	0.29	Mosaic
Deciduous Woodland	Oregon white oak/meadow foxtail-spreading rush-tall fescue	Savanna	Oregon white oak savanna	20	0.36	Mosaic
Deciduous Woodland	Oregon white oak/lawn grasses	Savanna	Oregon white oak savanna	23	0.17	Uplands
Deciduous Woodland	Oregon white oak-Oregon ash/Himalayan blackberry-Suksdorf's hawthorn-Nootka rose	Deciduous Forest	Oregon white oak-Oregon ash forest	29	2.03	Uplands
Deciduous Woodland	Oregon ash/mowed grasses and forbs	Deciduous Forest	Oregon ash forest	1	0.09	Wetlands
Deciduous Woodland	Oregon ash/Nootka rose/reed canarygrass-spreading rush	Deciduous Forest	Oregon ash forest	6	0.92	Wetlands
Deciduous Woodland	Oregon ash-Suksdorf's hawthorn/Nootka rose-Douglas spiraea/reed canarygrass	Deciduous Forest	Oregon ash forest AND/OR willow shrubland	43	1.66	Wetlands
Deciduous Woodland	Pacific willow/Sitka willow-Hooker's willow/Himalayan blackberry/reed canarygrass	Deciduous Forest	Oregon ash-Pacific willow-black cottonwood forest	54	4.64	Wetlands
Mixed Forest	Oregon white oak-Douglas-fir/Oregon ash/Pacific serviceberry-common snowberry-poisonoak/fringecup-Pacific dewberry	Deciduous Forest	Oregon white oak-Oregon ash forest	15	0.38	Uplands
Mixed Woodland	Oregon white oak-Douglas-fir-Oregon ash/Himalayan blackberry	Mixed Forest	Oregon white oak-Douglas fir-Oregon ash forest	13	0.63	Uplands

Table A-2 Continued						
Cover Type	**Dominate Cover Description**	**Potential Cover Type**	**Potential Cover Description**	**Fig. A-2 ID**	**Acres**	**Habitat Type**
Grassland Habitat						
Herbaceous	common velvetgrass-common teasel-meadow foxtail-pennyroyal-hairy hawkbit-creeping bentgrass-Queen Anne's lace	Mixed Woodland	Native shrubland OR Oregon ash-Oregon white oak-ponderosa pine woodland	19	0.48	Mosaic
Herbaceous	creeping bentgrass-common velvetgrass-meadow foxtail	Deciduous Forest	Oregon ash-Oregon white oak forest OR native shrub community OR Oregon white oak savanna	25, 28	0.48	Mosaic
Herbaceous	meadow foxtail-spreading rush-creeping bentgrass	Deciduous Forest	Oregon ash-Oregon white oak forest OR native shrub community OR Oregon white oak savanna	33	1.23	Mosaic
Herbaceous	chess brome-creeping bentgrass-tall annual willowherb-Canada thistle-field bindweed	Savanna	Oregon white oak savanna/woodland AND wetland prairie OR wetland shrubland	37	3.96	Mosaic
Herbaceous	creeping bentgrass-chess brome-common velvetgrass-small-flowered lotus-coast tarweed-clustered tarweed-common teasel	Deciduous Forest	Oregon white oak-Oregon ash forest OR Oregon white oak savanna	47	0.64	Mosaic
Herbaceous	common velvetgrass-creeping bentgrass-tall fescue-meadow foxtail-sweet vernalgrass	Savanna	Oregon white oak savanna OR upland/wetland prairie	51	1.79	Mosaic
Herbaceous	red fescue-common velvetgrass-hairy hawkbit-Queen Anne's lace	Deciduous Forest	Oregon white oak-Oregon ash forest	7	0.22	Uplands
Herbaceous	tall fescue-redtop	Savanna	Oregon white oak savanna	21,24,27	5.12	Uplands
Herbaceous	lawn grasses	Savanna	Oregon white oak savanna	22	0.18	Uplands
Herbaceous	rough cat's ear-soft brome-white clover-hairy hawkbit-annual fescue-common velvetgrass	Savanna	Oregon white oak savanna OR upland prairie	34	0.68	Uplands
Herbaceous	tall fescue-Canada thistle-spreading hedgeparsley-common vetch-chess brome-field bindweed	Savanna	Oregon white oak savanna/woodland AND wetland prairie OR wetland shrubland	36	3.29	Uplands

Table A-2 Continued						
Cover Type	**Dominate Cover Description**	**Potential Cover Type**	**Potential Cover Description**	**Fig. A-2 ID**	**Acres**	**Habitat Type**
Grassland Habitat						
Herbaceous	tall fescue-Canada thistle-Queen Anne's lace-field bindweed	Savanna	Oregon white oak savanna/woodland AND wetland prairie OR wetland shrubland	38	1.65	Uplands
Herbaceous	Himalayan blackberry/tall fescue-rough cat's ear-oxeye daisy-Queen Anne's lace-vetch-chess brome-Canada thistle	Savanna	Oregon white oak savanna OR upland/wetland prairie	40,42	10.47	Uplands
Herbaceous	Oregon white oak-Douglas-fir/common snowberry-osoberry-Himalayan blackberry/Pacific dewberry-cleavers	Savanna	Oregon white oak forest	45	0.69	Uplands
Herbaceous	redtop-white clover-Queen Anne's lace-tall fescue-rough cat's ear	Savanna	Oregon white oak savanna OR upland prairie	50	0.76	Uplands
Herbaceous	tall fescue-Queen Anne's lace-rough cat's ear	Deciduous Forest	Oregon white oak-Oregon ash-bigleaf maple forest	52	0.40	Uplands
Herbaceous	tall fescue-redtop	Deciduous Forest	Oregon white oak-Oregona ash-black cottonwood-bigleaf maple forest	55	0.33	Uplands
Herbaceous	creeping bentgrass-tall fescue-common teasel	Deciduous Forest	Oregon white oak-Oregona ash-black cottonwood-bigleaf maple forest	59	0.30	Uplands
Herbaceous	reed canarygrass-lawn grasses-white clover-hairy hawkbit	Deciduous Forest	Oregon ash forest OR willow shrubland	2	0.75	Wetlands
Herbaceous	dense sedge-one-sided sedge-prairie rush-American sloughgrass-spike bentgrass	Prairie	Wetland prairie?	3,4,5	8.79	Wetlands
Herbaceous	meadow foxtail-dogfennel-sharp-leaved fluellin-birdsfoot trefoil	Prairie	Wetland prairie?	9	2.33	Wetlands
Herbaceous	lawn grasses	Deciduous Forest	Oregon ash forest	11	0.25	Wetlands
Herbaceous	reed canarygrass	Shrublands	Willow shrubland OR Oregon ash forest OR sedge wetland	14	0.73	Wetlands

Table A-2 Continued						
Cover Type	**Dominate Cover Description**	**Potential Cover Type**	**Potential Cover Description**	**Fig. A-2 ID**	**Acres**	**Habitat Type**
Grassland Habitat						
Herbaceous	reed canarygrass	Shrublands	Willow shrubland OR Oregon ash forest OR sedge wetland	14	0.73	Wetlands
Herbaceous	creeping bentgrass-slough sedge-spreading rush-meadow foxtail	Prairie	Oregon ash forest OR willow shrubland OR wetland prairie	26	5.87	Wetlands
Herbaceous	reed canarygrass	Shrublands	Willow shrubland	31	0.96	Wetlands
Herbaceous	reed canarygrass-creeping bentgrass-chess brome-common spikerush-awl-fruit sedge	Prairie	Oregon ash forest OR wetland prairie	39	0.35	Wetlands
Herbaceous	common spikerush-reed canarygrass-creeping bentgrass	Prairie	sedge wetland	41	0.52	Wetlands
Herbaceous	waterpepper-common spikerush-nodding beggarticks	Prairie	sedge wetland	46	0.48	Wetlands
Herbaceous	cocklebur-nodding beggarticks-dodder-clustered tarweed	Prairie	sedge wetland	48	0.32	Wetlands
Herbaceous	reed canarygrass	Deciduous Forest	Oregon ash forest	57	0.38	Wetlands
Herbaceous	reed canarygrass	Deciduous Forest	Willow shrubland OR Oregon ash forest	10, 12	1.20	Wetlands
Herbaceous/ Shrublands	Himalayan blackberry-Nootka rose/bentgrass-tall fescue	Deciduous Forest	Oregon white oak-Oregona ash-black cottonwood-bigleaf maple forest	56	0.50	Uplands
Ornamental Landscaping	ornamental plants/weed cloth	Prairie	Oregon white oak savanna/woodland AND wetland prairie OR wetland shrubland	35	0.15	Uplands
Shrublands	Himalayan blackberry-Nootka rose/reed canarygrass	Deciduous Forest	Oregon ash-Oregon white oak forest OR native shrub community OR Oregon white oak savanna	30	2.40	Mosaic
Shrublands	English hawthorn-Himalayan blackberry-Suksdorf's hawthorn-Hooker's willow-Oregon ash	Deciduous Forest	Oregon ash-Oregon white oak forest OR native shrub community OR Oregon white oak savanna	32	2.76	Mosaic

Table A-2 Continued						
Cover Type	**Dominate Cover Description**	**Potential Cover Type**	**Potential Cover Description**	**Fig. A-2 ID**	**Acres**	**Habitat Type**
Grassland Habitat						
Shrublands	Nootka rose-Himalayan blackberry-common snowberry	Deciduous Forest	Oregon white oak-Oregon ash forest	8	2.94	Uplands
Shrublands	Himalayan blackberry-Nootka rose-common snowberry/redtop-creeping bentgrass-common velvetgrass	Deciduous Forest	Oregon white oak forest OR native shrubland	16	0.59	Uplands
Shrublands	Suksdorf's hawthorn-English hawthorn-Himalayan blackberry/meadow foxtail	Deciduous Forest	Native shrubland OR Oregon white oak-Oregon ash forest	18	1.02	Uplands
Shrublands	Himalayan blackberry-Nootka rose	Deciduous Forest	Oregon white oak-Oregon ash forest OR Oregon white oak woodland OR Oregon white oak savanna	44	1.62	Uplands
Shrublands	Himalayan blackberry	Deciduous Forest	Oregon white oak-Oregon ash forest OR Oregon white oak savanna	49	0.13	Uplands
Shrublands	Himalayan blackberry	Deciduous Forest	Oregon white oak-Oregon ash-bigleaf maple forest	53,60	0.22	Uplands
Shrublands	Himalayan blackberry-Nootka rose-Pacific ninebark	Deciduous Forest	Oregon white oak-Oregon ash forest OR native shrubland	58	0.59	Uplands

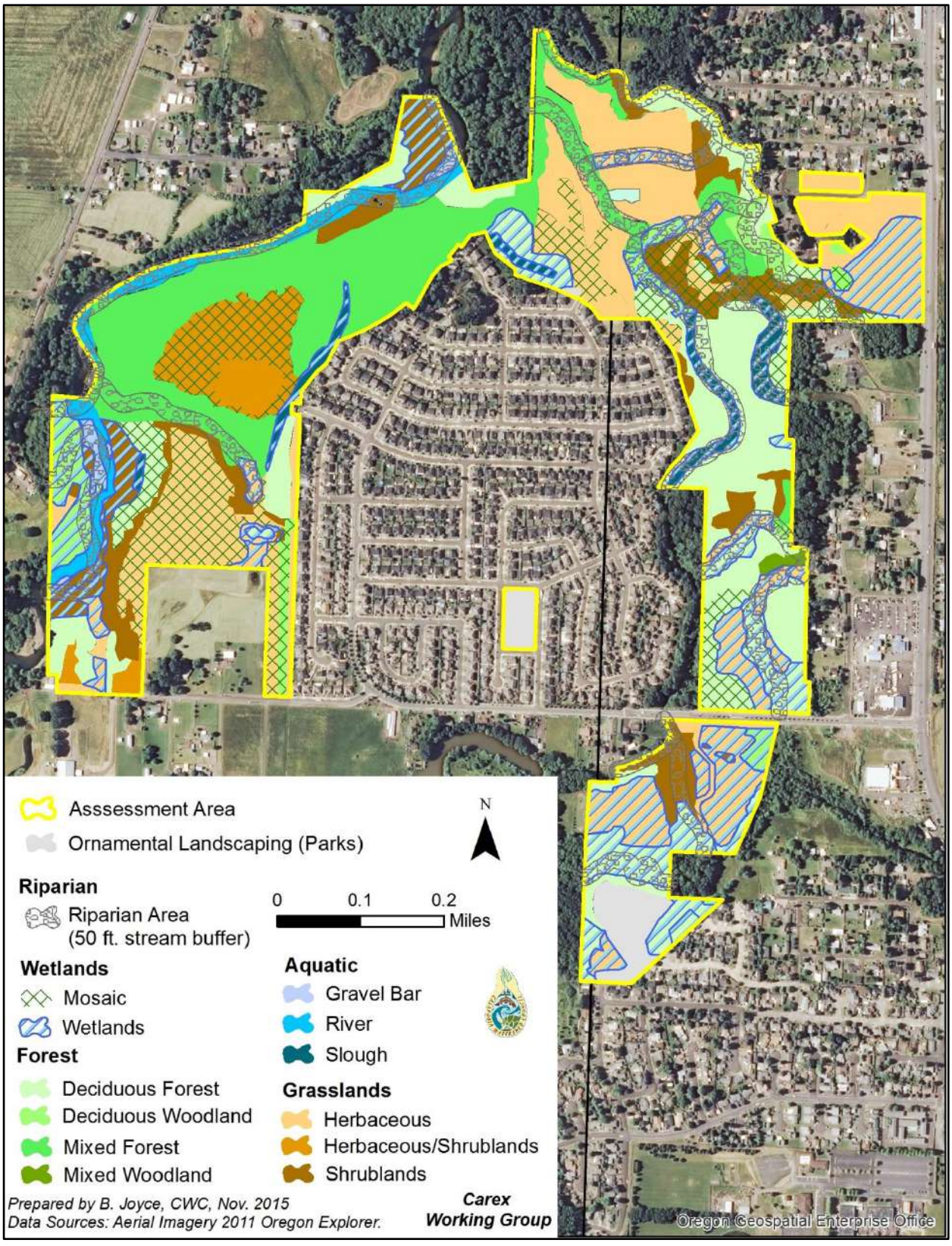

Figure A-1: Habitats based on vegetation cover and hydrology.

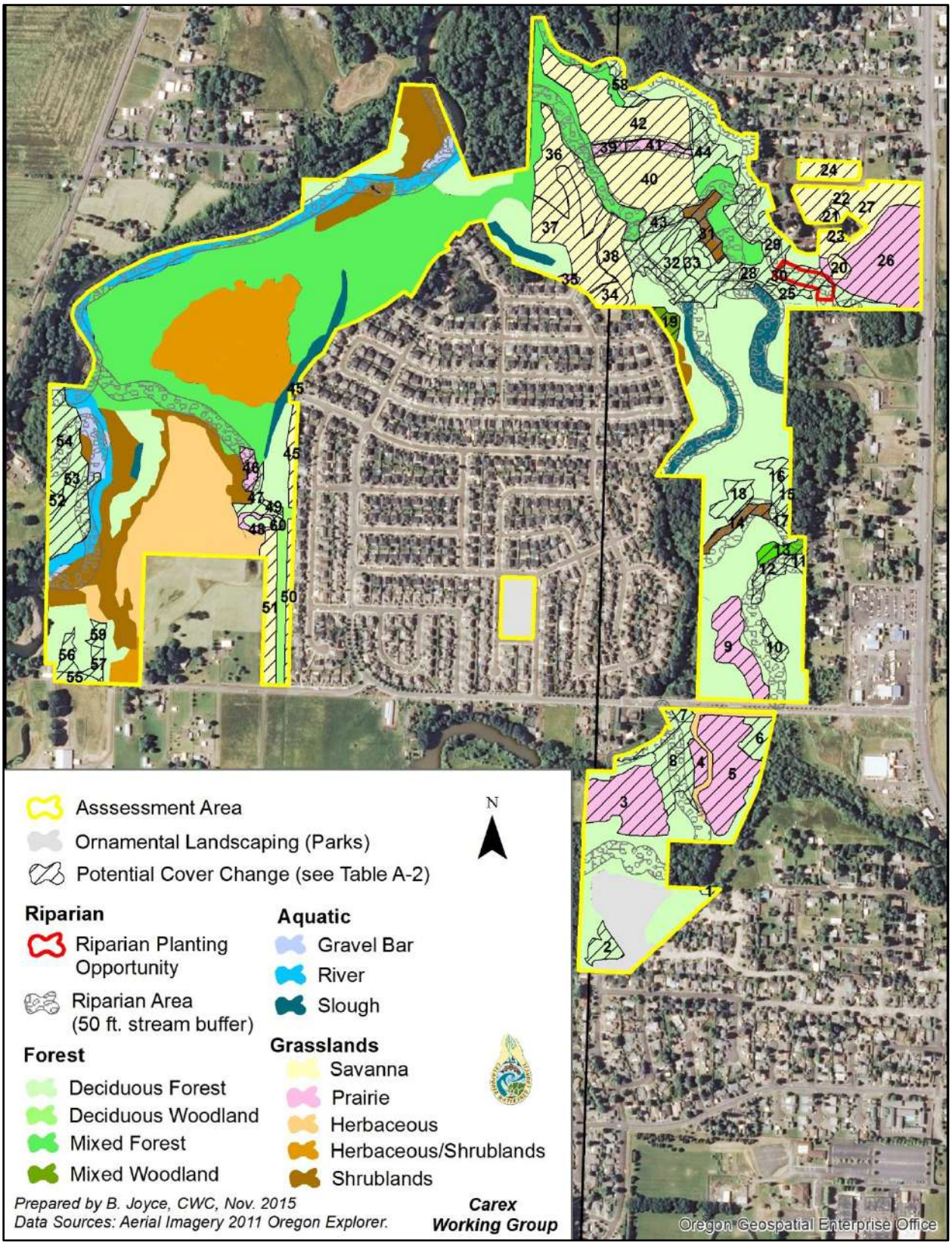

Figure A-2: Potential Vegetation Cover Change and Riparian Planting Area (See Tables A-1 and A-2)

Table A-3: Fish Species in the Calapooia-Albany Assessment project reach (adapted from RDG, 2011)	
Native Salmonid Species	**Notes**
Winter steelhead, *Oncorhynchus mykiss** Spring Chinook salmon, *Oncorhynchus tshawytscha** Cutthroat trout, *Oncorhynchus clarki clark* Mountain whitefish*, Prosopium williamsoni*	Willamette spring Chinook and winter steelhead (both anadromous species) were listed as threatened under the federal Endangered Species Act (ESA) in 1999 and were removed from the list in 2014. Factors contributing to their decline include habitat loss, altered flow regimes, and proliferation of non-native species.
Native Non-salmonid Species	
Lamprey Pacific lamprey, *Lampetra tridentate** Other species	Pacific lamprey are anadromous (adults reside in the ocean and return to rivers and streams to spawn) and brook lamprey are resident species. Pacific lamprey was listed as an Oregon state sensitive species in 1993 due to a serious decline in abundance.
Minnows Speckled dace, *Rhinichthys osculus* Longnose dace, *Rhinichthys cataractae* Northern pikeminnow, *Ptycheilus oregonensis* Redside shiner, *Richardsonius balteatus* Chiselmouth, *Acrocheilus alutaceus* Peamouth, *Mylocheilus caurinus* Oregon chub, *Oregonichys crameri**	Dace occur throughout the watershed, primarily in the Calapooia River and the lower portions of tributaries. *Oregon chub* is a small minnow native to the Willamette River basin. Oregon chub were listed as endangered under the Federal ESA. Chub prefer low gradient tributaries and off-channel habitats such as side-channels and sloughs. Their decline has been attributed to loss of habitats, altered flow regimes, and predation.
Suckers Largescale sucker, *Catostomus macrocheilus* Mountain sucker*, Catostomus platyrhynchus*	
Sculpins Mottled sculpin, *Cottus baurdi* Paiute sculpin, *Cottus beldingi* Prickley sculpin, *Cottus asper* Shorthead sculpin, *Cottus confusus* Reticulate sculpin, *Cottus perplexus* Torrent sculpin, *Cottus rhotheus*	Sculpins occupy streams throughout the watershed, with the greatest abundance in the upper Calapooia River and tributaries.
Sticklebacks Three-spine stickleback, *Gastrosteus aculeatus*	
Troutperch Sand roller, *Percopsis transmontana*	Sand rollers are rare and endemic to the lower Columbia River drainage, including the Willamette River and its tributaries.
Non-Native Species (all non-salmonid)	
Largemouth bass, *Micropterus salmoides* Smallmouth bass, *Micropterus dolomieui* Yellow bullhead, *Ameiurus natalis* Bluegill, *Lepomis macrochirus* Pumpkinseed, *Lepomis gibbosus* Crappie (black), *Pomoxis nigromaculatus* Common carp, *Cyprinus carpio* Brown bullhead, *Ameiurus melas* Western mosquito fish, *Gambusia affinis* Goldfish*, Carassius auratus*	Non-native species prey on or compete with native species for food and habitat space. Non-natives typically proliferate in warm water and disturbed habitats.
*Species of Concern in the Willamette River Watershed	

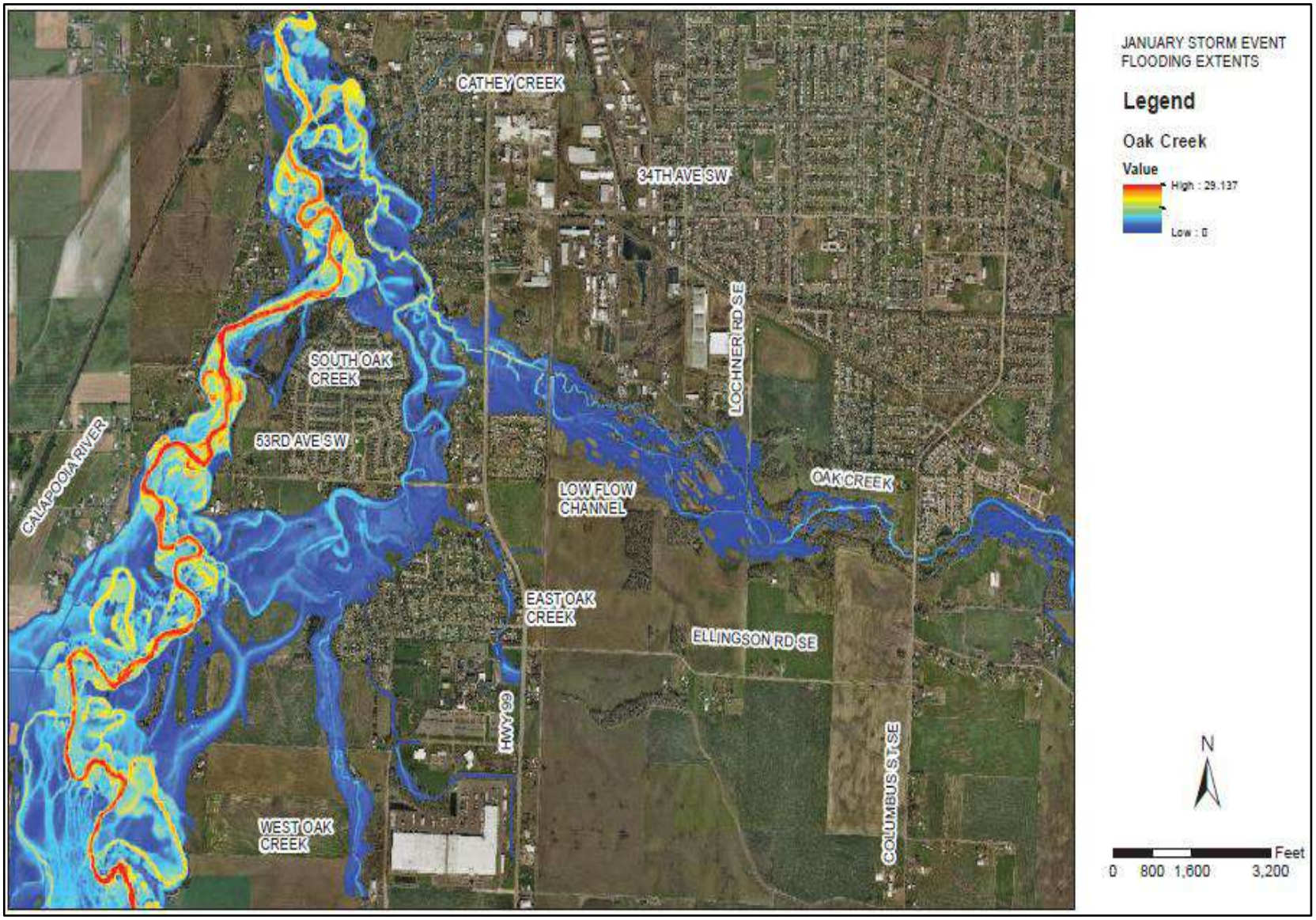

Figure A-3: 1D/2D Mapping Of Calapooia River and Oak Creek, Cardno, Entrix, January, 2012

Table A-4: Management Strategies for addressing nonpoint source parameters in the Calapooia River*		
Temperature	Maximize tree shade on urban streams	
		Focus efforts on city-owned riparian areas, demonstration projects, and tree giveaway programs
		Educate private land owners as opportunities arise
		Monitor short-term plant survival (at 2-3 years after planting) on city-owned riparian area
		Develop a long-term reassessment plan to measure changes in % effective shade
Bacteria	Address failing private septic systems within city limits	
		Continue connection requirement for failing systems
		Solicit input from Counties on known failure and risk areas
		Expand septic survey and update GIS layer
	Educate homeowners about septic system maintenance and how to detect failures	
		Print and distribute information to property owners & at events
	Prevent pet waste from reaching waterways	
		Install additional dog waste stations as opportunities arise
Bacteria and Mercury	Public education and outreach on stormwater impacts	
		Continue public education events such as semi-annual river cleanup or planting events
		Provide stormwater educational programs in local schools
	Public involvement/participation	
		Continue complying with state and local public notice requirements
	Illicit Discharge Detection and Elimination (IDDE)	
		Continue responding to public complaints regarding IDDE
		Maintain GIS stormwater attributes
		Provide education/outreach on IDDE
	Construction site stormwater runoff control	
		Assess and improve BMP requirements as necessary
	Post-construction stormwater management from new development and redevelopment	
		Revise ordinance to include post-construction requirements and enforcement
		Develop and implement structural and non-structural BMP requirements
		Ensure long-term maintenance and operation of BMPs
		Ensure adequate enforcement of the ordinance
	Pollution prevention/good housekeeping for municipal operations	
		Maintain hazardous storage and management in compliance with RCRA, DEQ regulations
		Correct deficiencies or establish correction timelines for municipal facility inspection results
		Provide training for City staff with potential SW impacts
		Stormwater system cleaning and maintenance activities
		Protect City-owned riparian areas against bank erosion, stormwater sheet flow
Temperature, Mercury and Bacteria	Educate the public on water quality	
		Provide informational material to adults/youth
* Adapted from the City of Albany Willamette Basin TMDL Implementation Plan Management Strategy Matrix, June 30, 2013		

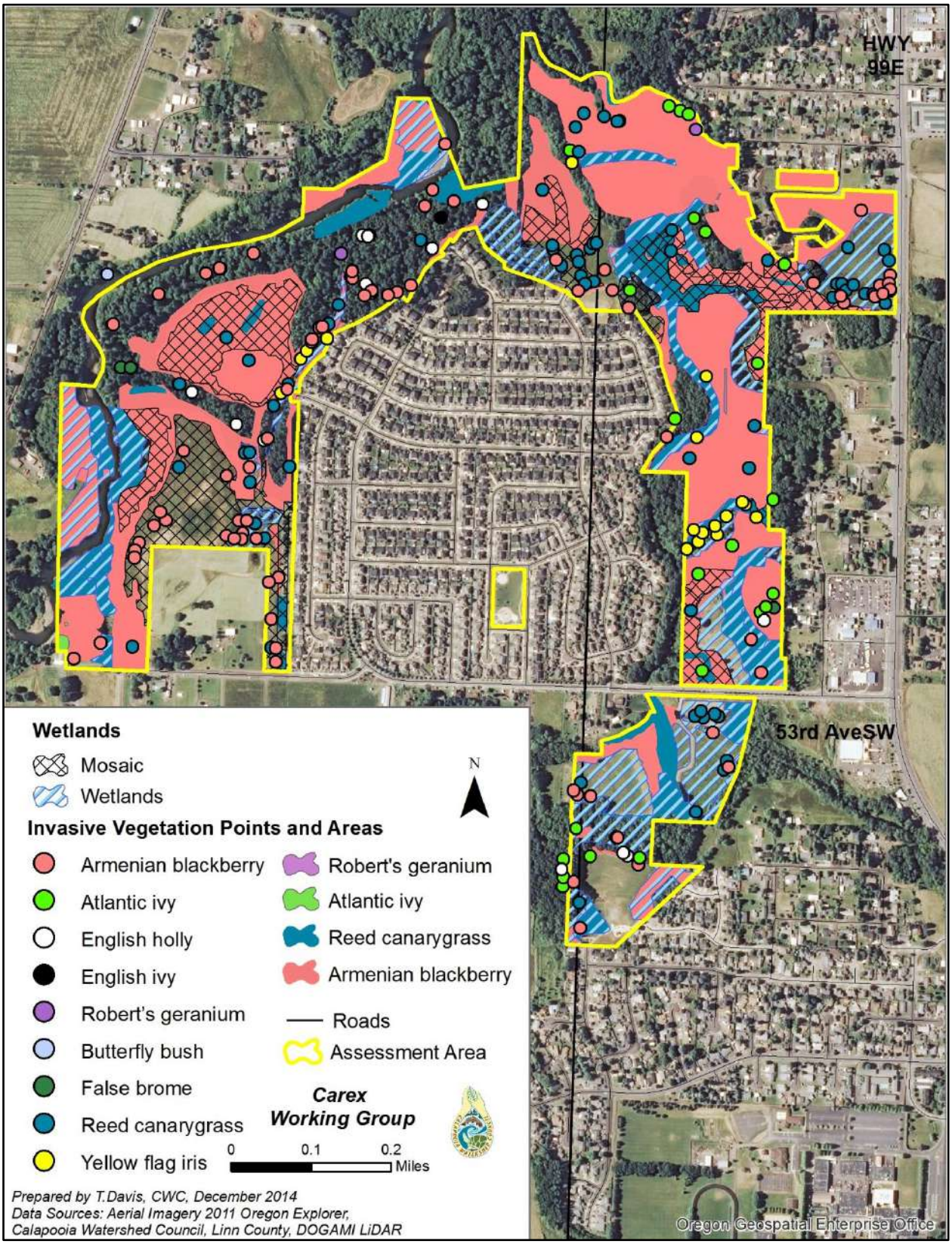

Figure A-4: Invasive vegetation points and areas

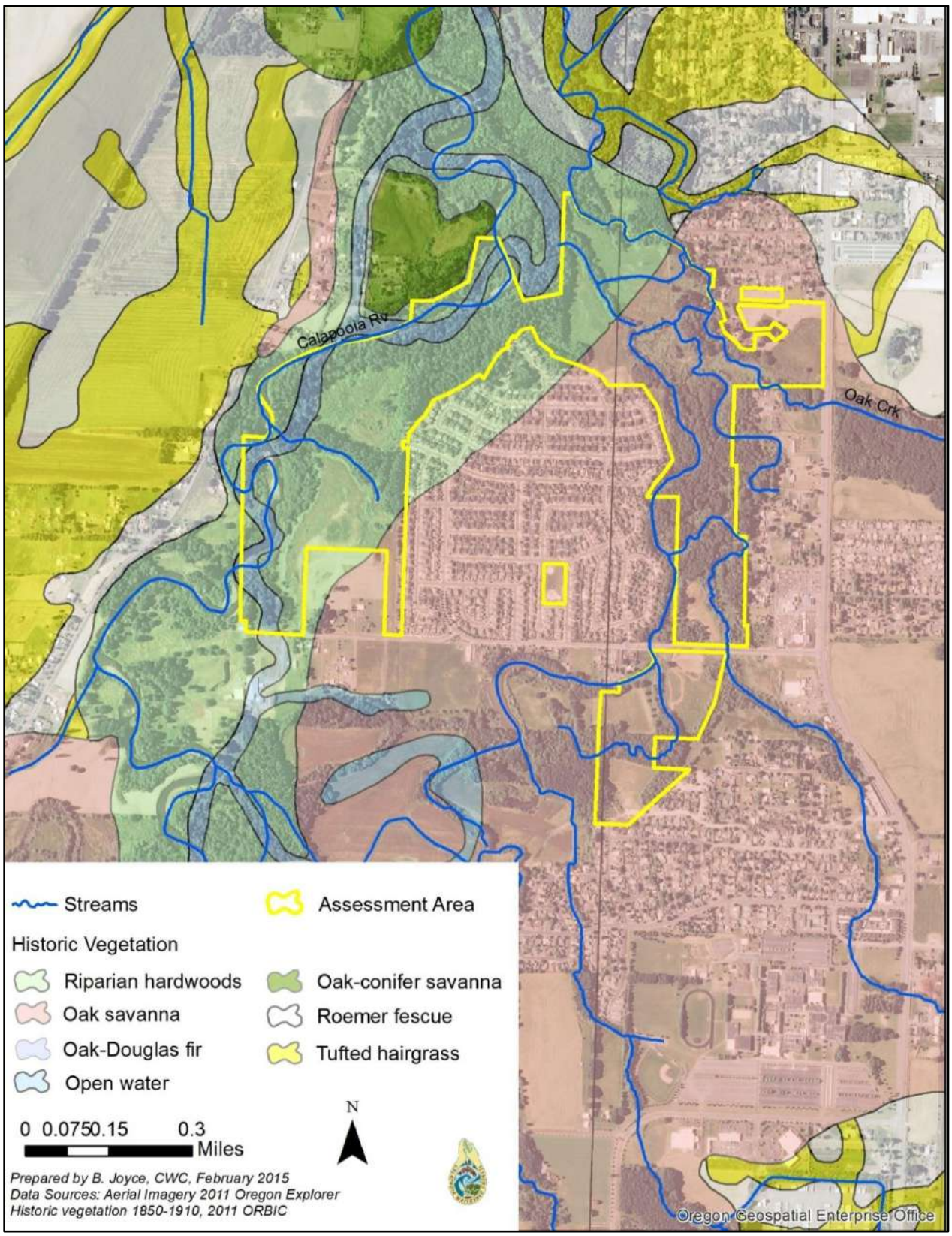

Figure A-5: Historical vegetation

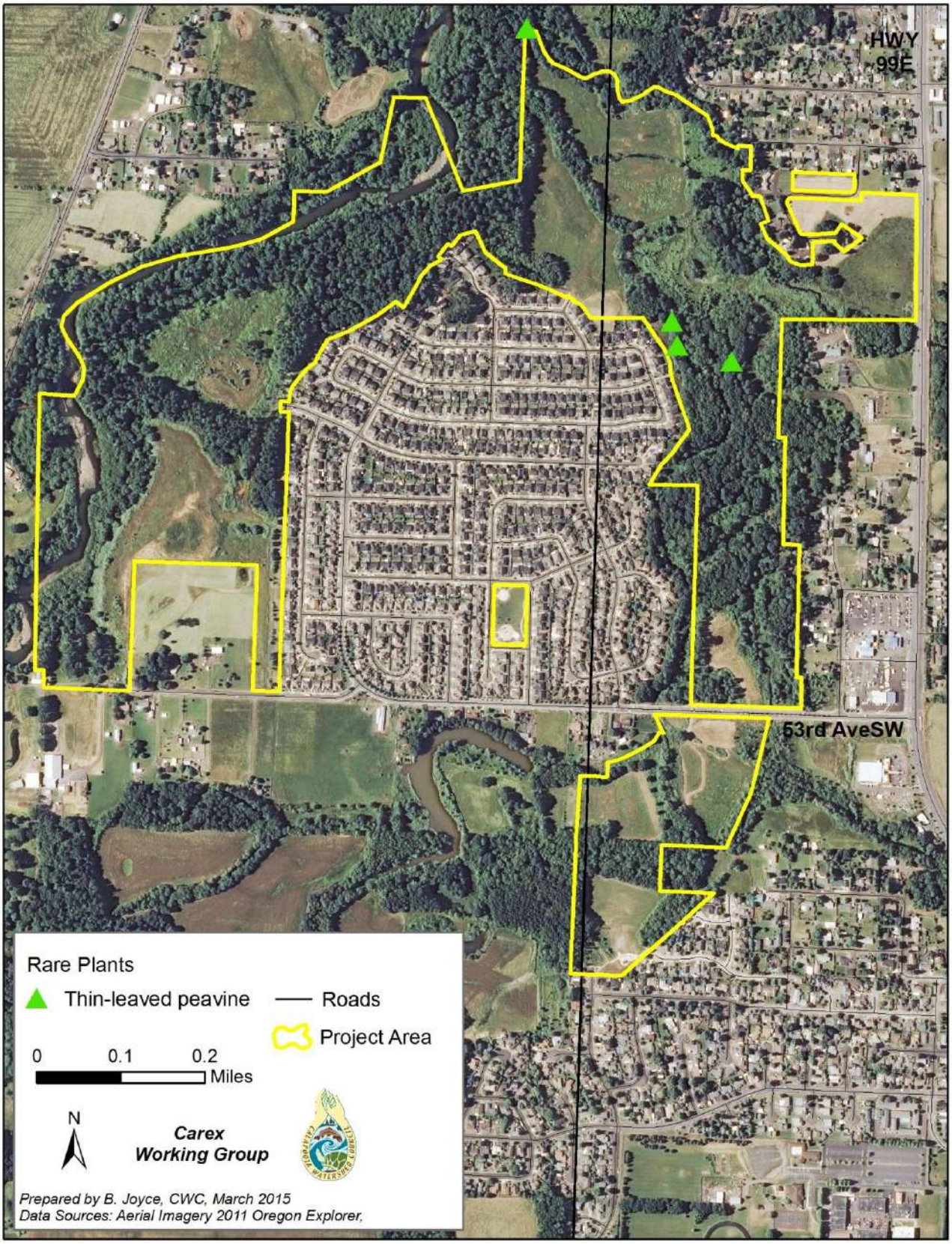

Figure A-6: Rare plant locations

Table A-5: Rare plant population data
Lathyrus holochlorus – subpopulation #1 Date: 4 June 2015 UTM: 10 490521E 4938928N +/- 15 feet Map datum = WGS84 Elevation = 205 feet 4 stems, 0 in flower Located along west edge of Oak Creek Trail near the northeast side of the housing development, approximately 250 feet east-northeast of Salmon Run SW. Habitat: Oak-ash forest edge with shrubby understory. Associated species: *Symphoricarpos albus, Toxicodendron diversilobum, Rubus bifrons, Rubus ursinus, Camassia quamash, Heracleum maximum.*
Lathyrus holochlorus – subpopulation #2 Date: 4 June 2015 UTM: 10 490637E 4938854N +/- 15 feet Map datum = WGS84 Elevation = 205 feet 4 stems, 1 in flower Located along east side of Oak Creek Trail in shrubs between the trail and slough; near the northeast side of the housing development, approximately 200 feet east of the intersection of Salmon Run SW; approximately 150 feet south of subpopulation #1. Habitat: Edge of open oak forest with shrubby understory. Associated species: *Symphoricarpos albus, Corylus cornuta* ssp. *californica, Oemleria cerasiformis, Rubus ursinus.*
Lathyrus holochlorus – subpopulation #3 Date: 25 June 2015 UTM: 10 490533E 4938882N +/- 10 feet Map datum = WGS84 Elevation = 210 feet 8 stems, 2 in flower Located along east side of Oak Creek Trail in shrubs between the trail and large slough near the eastern edge of the site; approximately 500 feet east of the intersection of Salmon Run and Bobcat Ave SW; approximately 350 feet southeast of subpopulation #2. Habitat: Edge of oak forest with shrubby understory. Associated species: *Symphoricarpos albus, Oemleria cerasiformis, Rubus ursinus, Toxicodendron diversilobum.*
Lathyrus holochlorus – subpopulation #4 Date: 30 June 2015 UTM: 10 490226E 4939490N +/- 10 feet Map datum = WGS84 Elevation = 210 feet 4 stems, all in fruit Located near northern tip of site along west side of roadbed that goes north to the neighboring property; just south of metal gate; approximately 0.33 mile north of Osprey Court SW. Habitat: Edge of oak-maple forest with shrubby understory. Associated species: *Symphoricarpos albus, Rubus parviflorus, Ligusticum apiifolium, Geranium robertianum.*

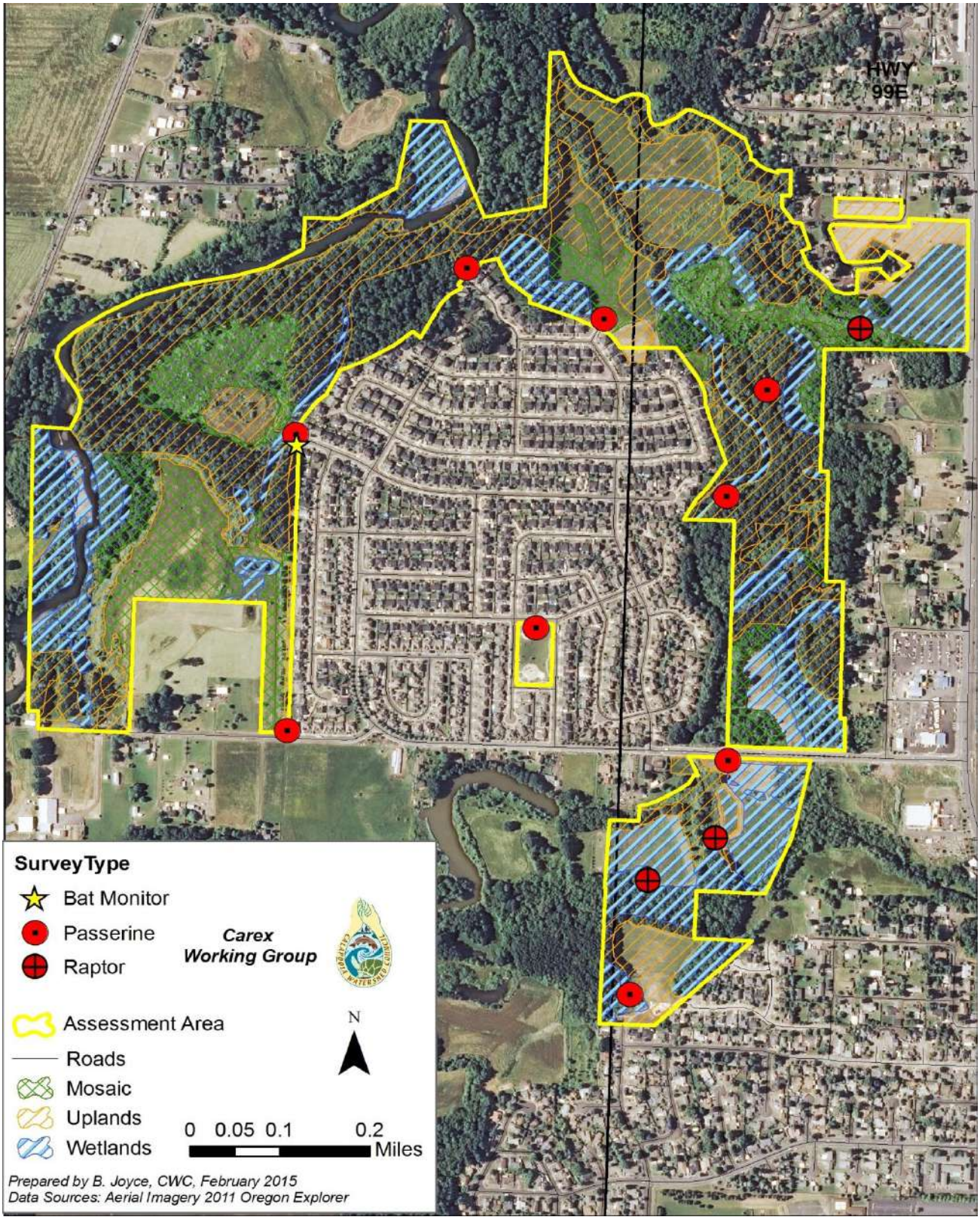

Figure A-7: Bird and bat survey locations

Table A-6: Avian species observed and associated habitat type													
	Grassland					Mixed woodland	Wet prairie		Woodland			Total	Birds per 10 minute survey
Species/Survey point	**1**	**4**	**7**	**8**	**9**	**2**	**11**	**12**	**3**	**5**	**6**	**--**	**--**
Acorn Woodpecker					1	3			1			5	0.63
American Goldfinch	5	3	5	5	5		2		1			26	3.25
American Robin	3	2	2	2	3	2		4	2	6	6	32	4.00
Anna's Hummingbird	2								1	1		4	0.50
Bald Eagle						2						2	0.25
Barn Swallow	1											1	0.13
Black and White Warbler								1				1	0.13
Black-capped Chickadee		1			1				1	2	1	6	0.75
Black-headed Grosbeak					1		1				2	4	0.50
Brewer's Blackbird	5						1					6	0.75
Brown-headed Cowbird						1						1	0.13
Cedar Waxwing							2	2				4	0.50
Cliff Swallow					2							2	0.25
Collared Dove	2		2	1	1						2	8	1.00
Common Yellowthroat							1	1				2	0.25
Downy Woodpecker										1		1	0.13
Eurasian Starling		3	16	5		5						29	3.63
Golden-crowned Kinglet	2				2					1		5	0.63
House Sparrow	3		7			2				5		17	2.13
Mallard	1											1	0.13
Northern Flicker	1					1			2	2		6	0.75
Olive-sided Flycatcher	4					2	1		4	1		12	1.50
Orange-crowned Warbler							1					1	0.13
Red-tailed hawk				1							1	2	0.25
Lesser Goldfinch	2											2	0.25
Scrub Jay		1				1	2	2			2	8	1.00
Song Sparrow		1		2		1	2	1	1			8	1.00
Spotted Towhee		2		3	3		3		5	6	3	25	3.13
Stellar's Jay						1						1	0.13
Tree Swallow		3				3			4	2		12	1.50
Turkey Vulture						1					1	2	0.25
Unknown Sparrow		1										1	0.13
Unknown Vireo									1			1	0.13
Unknown Woodpecker									1			1	0.13
Varied Thrush											1	1	0.13
Violet-green Swallow			1					2				3	0.38
Western Bluebird		3										3	0.38
White-breasted Nuthatch											1	1	0.13
White-crowned Sparrow			3									3	0.38
Wrentit									3			3	0.38
Yellow-rumped Warbler					1							1	0.13
Total	3	2	36	1	2	25	16	13	27	27	20	254	31.75

Table A-7: Bat species observed and potentially using Oak Creek Open Space			
Scientific name	**Common name**	**Observed**	**Willamette Valley**
Antrozous pallidus	pallid bat	No	Likely, but unlikely to be heard[1,3]
Corynorhinus townsendii	Townsend's big-eared bat	No	Possible, but unlikely to heard [2,3]
Eptesicus fuscus	big brown bat	Yes	Common [1.3]
Lasiurus blossevillii	western red bat	Yes	Possible, but uncommon [1,3]
Lasiurus cinereus	hoary bat	Yes	Common migrant [1,3]
Lasionycteris noctivagans	silver-haired bat	Yes	Common migrant [1,3]
Myotis californicus	California myotis	Yes	Possible [3]
Myotis evotis	long-eared myotis	Yes	Very possible, but quiet calls [3]
Myotis lucifugus	little brown myotis	Yes	Common [3]
Myotis thysanodes	fringed myotis	No	Unlikely due to habitat [1]
Myotis volans	long-legged myotis	No	Possible [3]
Myotis yumanensis	Yuma myotis	Yes	Likely [3]
([1]) Barbour and Davis 1969. ([2]) BCI 2012, ([3]) Oregon Department of Fish and Wildlife 2012.			

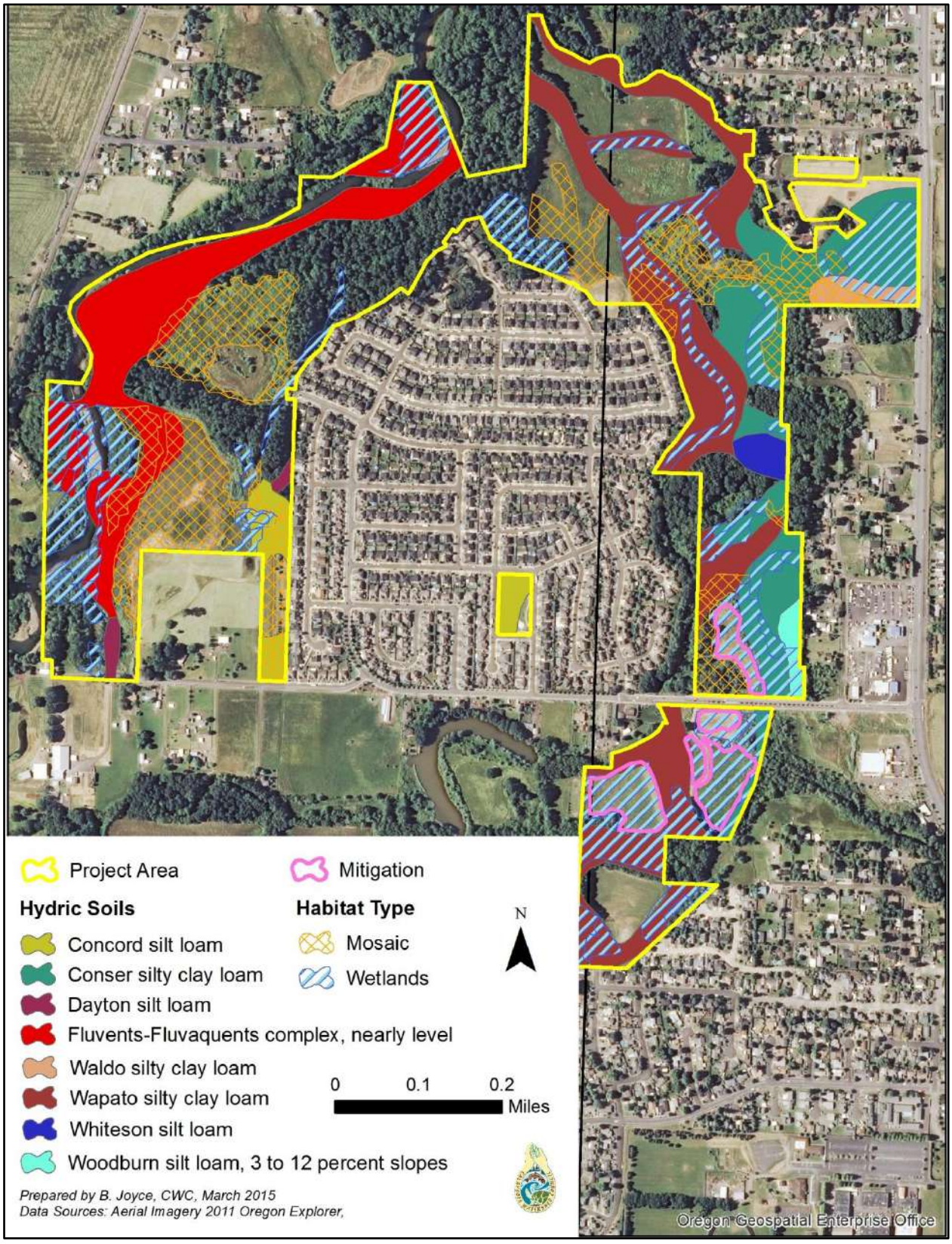

Figure A-8: Wetlands and hydric soils

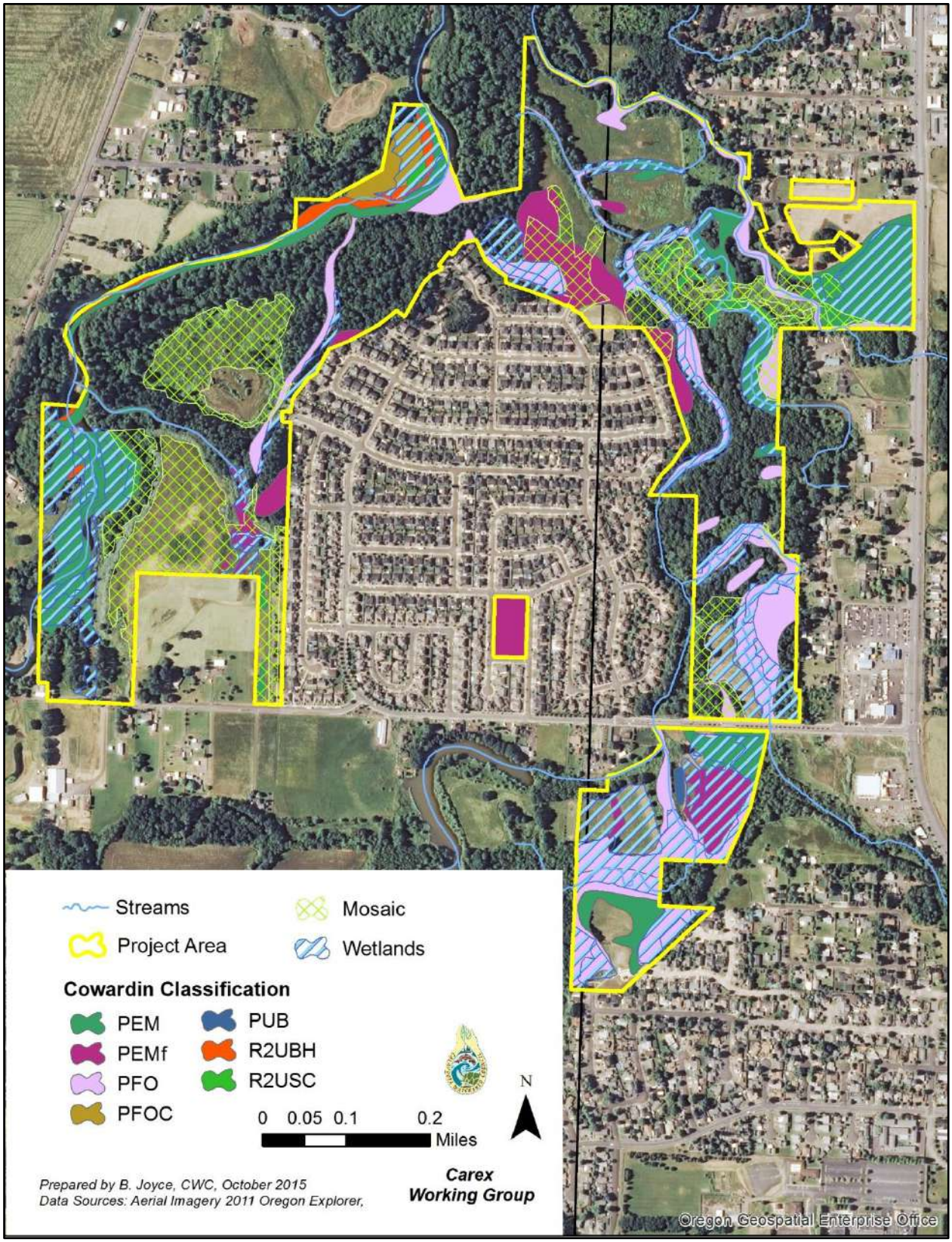

Figure A-9: Cowardin wetland classifications and surveyed wetlands

Table A-8: Wetland function definitions
Water Storage & Delay (WS): The effectiveness for storing of delaying surface water for long or short periods.
Sediment Retention & Stabilization (SR): The effectiveness for intercepting and filtering suspended inorganic sediments thus allowing their deposition, as well as reducing energy of waves and currents, resisting erosion, and stabilizing underlying sediments or soil.
Phosphorus Retention (PR): The effectiveness for retaining phosphorus for long periods (>1 growing season) as a result of chemical adsorption, or from translocation by plants to belowground zones with less potential for physically or chemically remobilizing phosphorus into the water column.
Nitrate Removal & Retention (NR): The effectiveness for retaining particulate nitrate and converting soluble nitrate and ammonia to nitrogen gas, primarily through the microbial process of denitrification, while generating little or no nitrous oxide (a potent "greenhouse gas").
Thermoregulation (T): The effectiveness for maintaining or reducing summertime water temperature, and in some cases, for moderating winter water temperature.
Carbon Sequestration (CS): The effectiveness for retaining both incoming particulate and dissolved carbon, and through the photosynthetic process converting carbon dioxide gas to organic matter (particulate or dissolved), and then retaining that organic matter on a net annual basis for long periods while emitting little or no methane (a potent "greenhouse gas").
Organic Matter Export (OE): The effectiveness for producing and subsequently exporting organic matter, either particulate or dissolved.
Aquatic Invertebrate Habitat (INV): The capacity to support an abundance and diversity of marine and freshwater invertebrate animals which spend all or part of their life cycle underwater or in moist soil. Includes dragonflies, midges, crabs, clams, snails, water beetles, shrimp, aquatic worms, and others.
Anadromous Fish Habitat (FA): The capacity to support an abundance of native anadromous fish (chiefly salmonids) for functions other than spawning.
Non-anadromous Fish Habitat (FR): The capacity to support an abundance and diversity of native non-anadromous fish (both resident and visiting species).
Amphibian & Reptile Habitat (AM): The capacity to support an abundance and diversity of native amphibians and native wetland-dependent reptiles.
Waterbird Feeding Habitat (WBF): The capacity to support an abundance and diversity of feeding waterbirds, primarily outside of the usual nesting season.
Waterbird Nesting Habitat (WBN): The capacity to support an abundance and diversity of nesting waterbirds.
Songbird, Raptor, & Mammal Habitat (SBM): The capacity to support an abundance and diversity of songbird, raptor, and mammal species and functional groups, especially those that are most dependent on wetlands or water.
Pollinator Habitat (POL): The capacity to support pollinating insects, such as bees, wasps, butterflies, moths, flies, and beetles.
Native Plant Diversity (PD): The capacity to support a diversity of native, hydrophytic, vascular plant species, communities, and functional groups, at either the site scale or through contribution to regional-scale native plant diversity.
Wetland Ecological Condition (CQ): Operationally, the integrity or health of the wetland as defined primarily by its vegetation composition. More broadly, the structure, composition, and function of an ecosystem as compared to reference ecosystems operating within the bounds of natural or historic disturbance regimes.
Wetland Stressors (STR): The degree to which the wetland is or has recently been altered by, or exposed to risk from, human and natural factors.
Wetland Sensitivity (SEN): the lack of intrinsic resistance and resilience of the wetland to human and natural stressors (higher score = more sensitive).

Table A-9: Components of grouped services	
Primary Grouped Services	**Aggregated Functions Within Each Grouped Service**
Hydrologic	water storage & delay
Water Quality Support	sediment retention & stabilization phosphorus retention nitrate removal & retention thermoregulation
Fish Support	anadromous fish habitat non-anadromous fish habitat
Aquatic Support	aquatic invertebrate habitat amphibian & reptile habitat waterbird feeding habitat waterbird nesting habitat organic matter export
Terrestrial Support	songbird, raptor & mammal habitat native plant diversity pollinator habitat

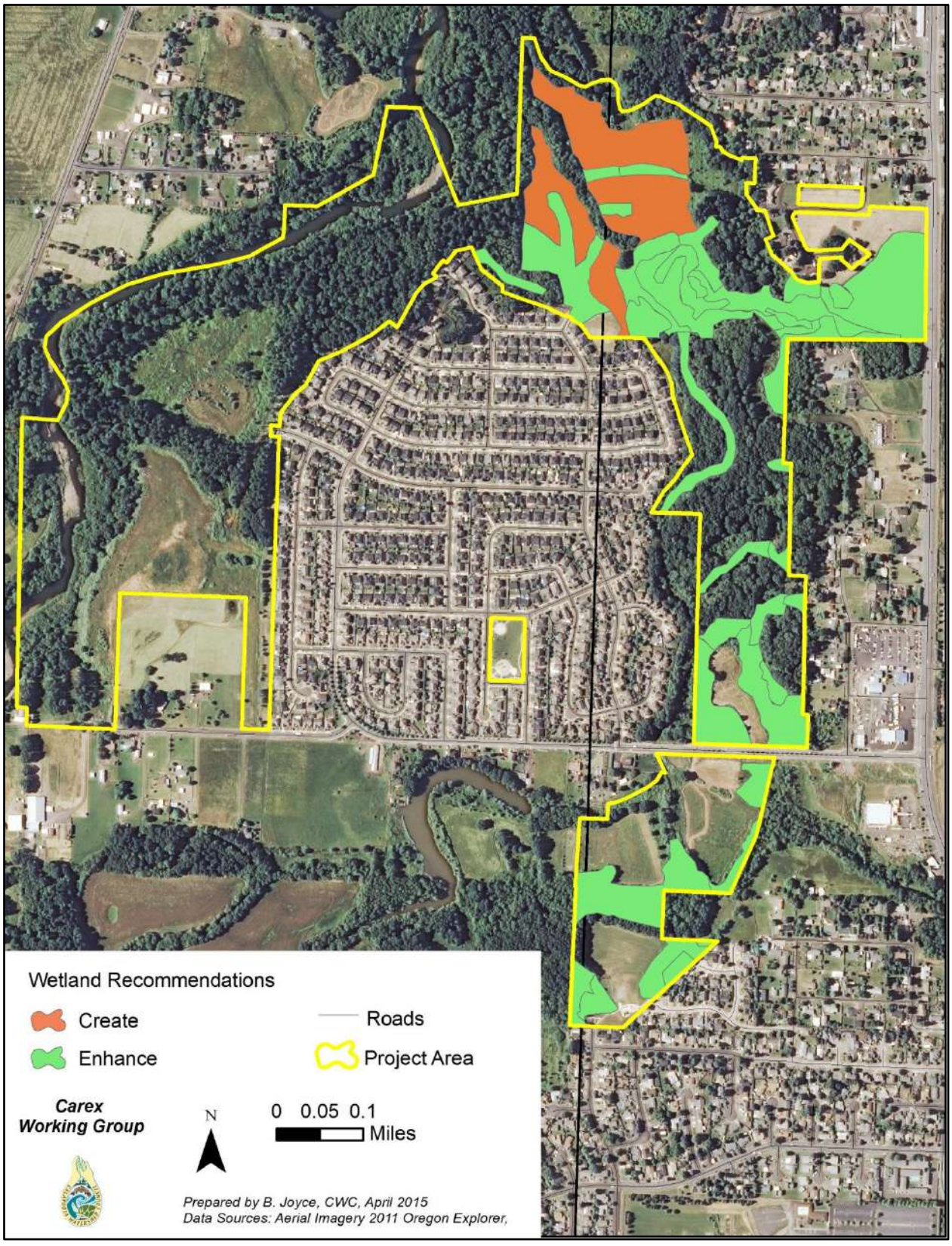

Figure A-10: Wetland creation and enhancement opportunities

Table A-10: Community comments

Input and comments received, regarding the Oak Creek Open Space, from 34 nearby residents during a community meeting in May, 2015.

Concerns

- Don't use because of questionable people
- Monitoring and enforcement would need to go with development
- Need more info about landfill – wells, water quality
- Excited, yet concerned about 'spillover' from public use
- Current uses (illegal) – do something
- Weeds migrating to adjacent land
- Other negative impacts include poor drainage from landfill / public property
- Ask for help from neighbors
- Use = parking, where?
- Trails blocked by floods
- Mallard ducks nesting on ground get disturbed by dogs, clutches lost
- Garbage – teenage hangout (not terrible)
    - Near bike jumps
    - Kids play airsoft, paintball
    - Kids make trails for bikes; tearing up vegetation, leave garbage, erosion
    - Paintball, airsoft
- Long-term:
    - Non defined open space
    - Safety concerns
        - Shooting? / 4 wheelers / motorcycles / BMX
- Restoration vs development

Management Suggestions

- Keep it neighborhood, not public recreation
- Just leave it natural – safe/secret
- No 'park-like' infrastructure
- Landfill – wild, dog park
- Year round trail running:
    - Raise wooden tracks, decking
    - Jackson Frasier wetland example
    - Cinder blocks
    - Trail construction volunteer – Loop
- Garbage cans on trail
- Maintain paths

- Beaver control – prevent water back-up, let tribs go dry to get rid of bull frogs
- Access to swimming hole needs invasives control
- Want to see trails
- Water sampling
- Aquatic habitat

Education Desired / Community Organizing

- "Friends of the Open Space"
    - There'd be interest
    - Theory around 'friends' groups
- Community event - annual event
    - Weed control
    - Poop control and bags, garbage can for poop disposal
- Community groups to pull weeds, also pick up trash
- Identify invasive species – books, brochures, etc.
- Survey birds, wildlife, etc, fish, organized survey sheet to maintain year round
- Cook-off w/invasive species
    - Blackberry
    - Frogs legs
    - Nutria
- Nature center – information kiosk
- Cat owner responsibility
- Need more effective communication w/neighbors
- More info about nature, plants, animals
- Post-signs for meetings
- Community wants to give Input/ know land use
- Community wants to understand effects of changes / be at table
- Better information
- Signs (may help deter negative activity and build pride)
    - Explaining natural area
    - Interpretive
- Post card with link to education materials on webpage
- Facebook page (facebook page for Spring Meadow and Brookfield HOA areas combined is active and used)
- Annual weed pull
- School groups, tours

Current Values and Uses

- Neighborhood likes that it's not a through street
- Natural place, great
- Hawk, deer groups, bald eagle
- White rabbit
- Rumors of homeless, but not major problem
- People feel safe
- Quiet
- Pretty – trees / view
- Open, undeveloped / wildlife
- Soft paths
- Nearby walking
- Convenient, easy to get to
- Animal / Dog-friendly
- Nature study and observation with kids
- Seasons
- Bird watching
- Walk/run trail (seasonal, but even a lot of daily users)
- Trail
- Wildlife
- Creek
- Deer
- Privacy of back yard / wetlands behind
- Lack of development
- Invasive species
- Hiking / running often
- No backyard neighbors
- Path to walk on and walk dogs
- Wildlife, birds
- Natural setting
- Close to town but feeling a little 'country'
- Close to Calapooia swimming hole
- Picking blackberries
- Look for wildflowers
- Hangout to swim – secret swim spot
- Peaceful, no aggressive behavior
- Walking
- Dog walk
- Ave use once per week with family and dog
- Walk 5 times per week
- Nice to have multiple access points
- Photography, art, senior pictures
- Species identification practice
- Swimming