Final

SUZUKI PROPERTY ECOLOGICAL ASSESSMENT

Bainbridge Island, Washington

Prepared for

March 2017

City of Bainbridge Island

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1. INTRODUCTION

At the request of the City of Bainbridge Island (City), Environmental Science Associates (ESA) has conducted an ecological assessment of the Suzuki Property (the 'property'), an undeveloped City-owned parcel. The purpose of this assessment is to characterize the baseline ecological conditions of the property in order to inform the design of a proposed residential development. As described in ESA's scope of work, the primary elements of this ecological assessment include a forest survey (conducted by ESA's subconsultant Tree Solutions, Inc.), an aquifer recharge and soil infiltration study, and characterization of the habitat features on the property, including a pond, wildlife corridor, stream, and forest habitat. The methods and findings of the ecological assessment are described in this report, along with a set of management recommendations for avoiding and minimizing potential impacts to habitat factures and ecological functions.

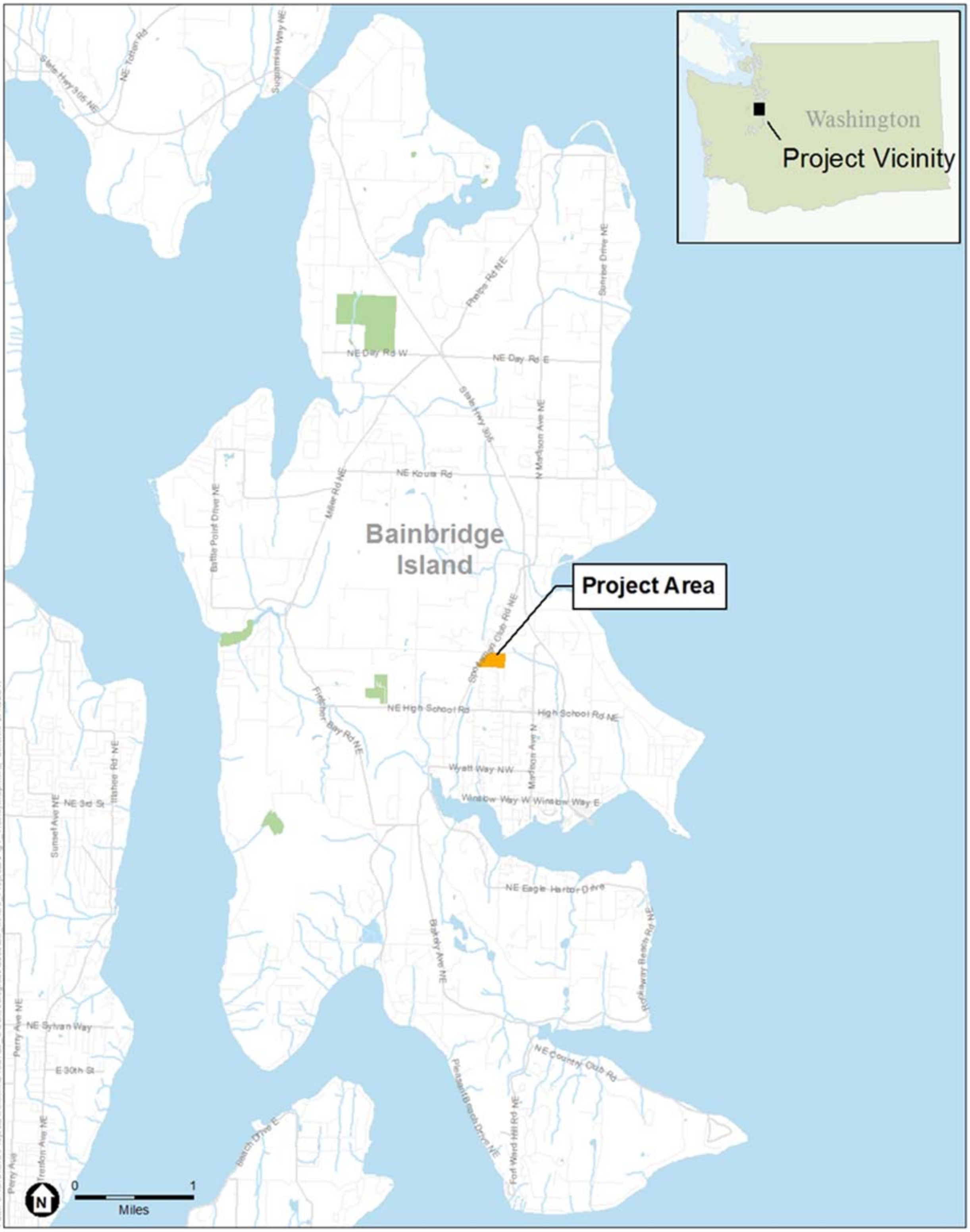
1.1 Site Description

The Suzuki Property is 13.83 acres in area, and located at the southeast corner of NE Brooklyn Road and Sportsman Club Road NE (Figure 1). The property is bordered by NE Brooklyn Road to the north, a gravel road and school bus facility to the east, a residential subdivision to the south, and Sportsman Club Road to the west. The NE New Brooklyn Road frontage has been improved with a sidewalk and there is a trail on the property that parallels Sportsman Club Road NE.

The property is undeveloped and entirely wooded, with the exception of a pond located along the southern property boundary. Topography on the majority of the property is flat or gently rolling, with moderate slopes in the western portion down towards Sportsman Club Road.

1.2 Proposed Development

The Suzuki Property was purchased by the City in 2000 and was originally intended to be the site of a combined police-courthouse building and a "decant facility" to dispose of sludge collected from street sweeping and storm-drain cleaning operations. Due in part to neighborhood opposition to the proposed projects, the development of the facilities did not occur and the property remained undeveloped.



SOURCES: OSM, 2016; ESA, 2016

Figure 1
Suzuki Property Vicinity Map

In November 2014, the City held a Community Workshop to solicit community input on whether and how the property should be sold, and what use should be made of the property. Workshop participants urged the City Council to develop the property in a way that benefits the community (Bainbridge Island, 2015). In June 2015, the Suzuki Ad Hoc Committee recommended that the City Council prepare a Request for Proposals (RFP) seeking proposals for the development of the property, with a goal of selling the property to a developer that proposes a project compatible with the surrounding residential uses that would also enhance and benefit the neighborhood and community. The RFP was issued in September 2015. The development priorities listed in the RFP included a varied housing mix (e.g. homes and apartments), permanent affordability, green and sustainable construction, and open space and community gardens.

The City received four RFP submissions, and in March 2016 the City Council selected the Olympic Property Group (OPG) proposal. The development concept presented in the OPG proposal is called the "Suzuki Farm," and includes affordable housing, a community center, community gardens and orchards, open space preservation, and trails (Figure 2). The proposed concept shows the development concentrated in the northeastern portion of the property, while preserving the remainder of the property as open space. Under the concept, the existing pond would be enlarged for stormwater detention, and an additional stormwater detention pond would be constructed near the southwest corner.[1]

Another outcome of the public process for the Suzuki Property was the identified need for an ecological assessment of the property that characterizes the ecological conditions of the property prior to additional site design efforts (Bainbridge Island, 2016). As a result, the City Council requested a recommendation from the City Environmental Technical Advisory Committee (ETAC) regarding the scope and contents of a potential study. ETAC subsequently held several meetings, walked the property, and invited public input in developing their recommendation. After consideration, ETAC recommended that the following significant ecological features of the property should be identified, described, and evaluated as part of an ecological assessment (Bainbridge Island, 2016): 1) grove of "old trees" located in the southeast section of the property, 2) aquifer recharge potential, 3) human-made pond, 4) stream, and 5) riparian pathway/wildlife corridor.

[1] The site plan shown in Figure 2 is conceptual and developed without City input as part of the RFP process; therefore, the actual development plan may differ significantly from the concept.

SOURCE: Olympic Property Group and Davis Studio Architecture + Design (2016)

Figure 2
Olympic Property Group "Suzuki Farm" Development Concept

2. METHODS AND DATA SOURCES

The following sections describe the methods and data sources used to conduct this ecological assessment.

2.1 Forest Survey

Forest survey methods are described in detail in Appendix A, and summarized here. Forest community types were categorized based upon the definitions and methods described in Hall, et al., (1995) and Chappell (2004). Forest community type boundaries were surveyed by Tree Solutions, Inc. using GPS and then refined by ESA using air photo interpretation.

Survey and assessment of individual trees was focused on the “old trees” area, as identified by ETAC as an area of focus for this ecological assessment (Bainbridge Island, 2016). Tree ages were determined using a micro-resistance recording drill and a manual increment borer. Tree health and structure were evaluated using visual tree assessment (VTA) method, which involves analyzing trees for defects to estimate tree condition and hazard potential. The individual trees that were assessed were marked with aluminum tags.

2.2 Soil Infiltration and Aquifer Recharge

The data sources and methods used to measure soil infiltration rates and estimate aquifer recharge potential on the property are described in detail in Appendix B, and summarized here. Data sources used to conduct these evaluations included:

- National Resources Conservation Service (NRCS) Soil Survey data (NRCS, 1980).
- *Conceptual Model and Numerical Simulation of the Groundwater-Flow System of Bainbridge Island, Washington* (USGS, 2011).
- *Review Findings and Recommendations and Critical Aquifer Recharge Area Assessment* (Aspect Consulting, 2015).

Soil infiltration was measured at six different locations on the property, using the methodology detailed in the NRCS Soil Quality Test Kit Guide (1999a). This test involves filling a metal ring placed on the soil surface with water, and recording the time it takes for the water to infiltrate into the soil. Additionally, a subsurface infiltration test was performed using methods similar to the Environmental Protection Agency (EPA) Falling Head Percolation Test Procedure (1980). This test is often used in the design of low impact development (LID) facilities. For this subsurface test, a 2-foot-deep hole was excavated and filled with approximately 9 inches of water, and the rate of water infiltration was measured. In addition to the infiltration testing, soil characteristics were recorded in each of the 6 test holes. Based upon the soil infiltration tests and a review of the existing information listed above, the aquifer recharge potential of the property was estimated, as well as the overall suitability of the property for the use of LID stormwater management measures.

2.3 Wildlife Habitat, Species, and Corridors

Based upon the forest types identified during the forest survey, a scientific literature review was conducted to determine the relative values of the habitats present on the property. An inventory of wildlife species that utilize the property was also conducted. Data sources used for the incentory include:

- Wildlife species observations from a neighboring property owner (L. Marshall, 2016).
- Wildlife species observation conducted by ESA scientists during a one-day site visit.
- WDFW (Washington Department of Fish and Wildlife) Priority Habitats and Species data (WDFW, 2017a).

An identification of potential habitat corridors and connections to the property was conducted; the primary data sources used included a Bainbridge Island wildlife corridor study (Self, 2000) and analysis of aerial photography. The quality and effectiveness of existing wildlife corridor(s) was estimated based upon a review of the relevant scientific literature.

2.4 Wetland Identification

A review of existing wetland inventory data and a reconnaissance-level wetland field assessment of the property was conducted. The field assessment consisted of walking the property and observing the presence of wetland features (i.e. hydrophytic plant communities, hydric soil, and wetland hydrology), per the methods defined in *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Corps, 2010). Based upon the presence of wetland features, the approximate boundaries of potential wetland features were sketched on an aerial photo. The reconnaissance-level wetland assessment did not include formal delineation of wetland boundaries or establishment of wetland data plots; therefore, likely wetland areas on the property are referred to as "potential wetland areas" in this report.

Data sources consulted for the wetland identification included the following:

- City of Bainbridge Island Critical Areas Data (Bainbridge Island, 2017)
- National Wetlands Mapper Inventory (USFWS, 2017)
- National Resources Conservation Service (NRCS) Soil Survey (NRCS, 1980).

Wetland functions and the relative value of the potential wetland areas identified on the property were estimated using the methods described in Hruby (2014).

2.5 Stream Identification

The methods for assessing streams within the property included a field assessment in conjunction with a review of publically available data resources that indicate the presence of streams, including potential fish use and/or presence. The field assessment consisted of walking the property and identifying any channelized features. Any such observed features were analyzed for presence of bed and bank, type and distribution of channel vegetation and substrate, and hydrology sources/flow rates.

Data sources consulted for this evaluation included the following:

- City critical areas data (Bainbridge Island, 2017)
- WDFW Priority Habitats and Species data (WDFW, 2017a)
- WDFW SalmonScape interactive mapping tool (WDFW, 2017b)
- Washington State Department of Natural Resources (WDNR) stream typing data (WDNR, 2017)

3. FINDINGS

The following sections describe the results and findings of the Suzuki Property ecological assessment.

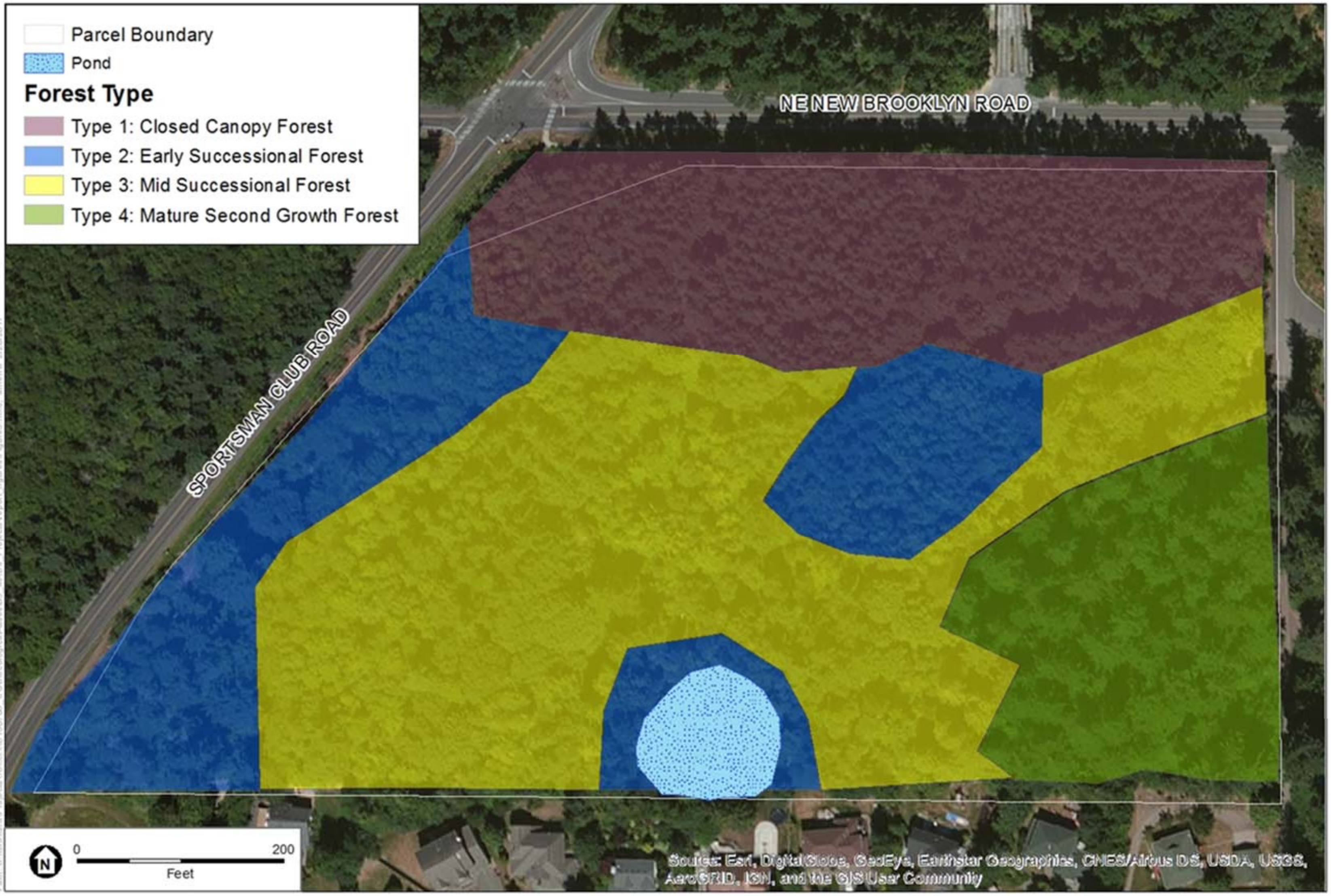
3.1 Forest Survey

Four forest types were identified on the property, which are shown in Figure 3 and summarized below. See the forest survey report (Appendix A) for additional details on these forest types and the data table of individually-surveyed trees.

Type 1: Closed Canopy Forest

The closed canopy forest zone is approximately 3.9 acres in area, and is located along the northern boundary of the property. The zone consists primarily of young Douglas fir trees. Based upon the relatively small size of the trees, the homogenous canopy structures, and the absence of snags and coarse woody debris (e.g. downed trees and logs), it appears that this section of the property was historically cleared and later planted with Douglas fir (likely in the late 20th century). The trees are dense and there are very few gaps in the canopy, which limits understory sapling and shrub vegetation. The understory vegetation that is present consists of trailing blackberry, sword fern, salal, salmon berry, and evergreen huckleberry. The closed canopy forest zone on the property is approximately 3.9 acres in area.

Closed Canopy Forest Zone



SOURCES: Tree Solutions, Inc. (2017), ESA (2016

Figure 3
Forest Zones

Type 2: Early-Successional Forest

Three areas of early-successional forest are found on the property; a patch near the center of the property, an area around the pond perimeter, and another area along the western property boundary. The total coverage of this forest zone on the property is approximately 2.9 acres. Trees observed in this forest zone include red alder, Big leaf maple, bitter cherry, and Pacific madrone. The dominant tree species in this zone is red alder, a relatively short-lived and fast-growing tree. Some scattered conifer trees (primarily Western red cedar and Douglas fir) are present in this zone, but they appear to be outcompeted by the fast-growing alder and understory shrubs. Dominant understory vegetation in this zone consists of salmonberry, sword fern, and Pacific willow, with invasive Himalayan blackberry observed in some areas, particularly where sunlight is available. Some areas, particularly where canopy gaps are present, contain very dense coverage of understory shrubs. The early-successional forest zone contains a generally low density of snags and coarse woody debris.

Early Successional Forest Zone

Type 3: Mid-Successional Forest

The mid-successional forest zone is the predominant forest type on the property; it covers an area of approximately 4.8 acres. This forest type consists of a multi-tiered forest that contains both coniferous trees. There are a moderate amount of canopy gaps in this forest type, which allows for sapling regeneration (primarily western redcedar). The forest appears to be transitioning from a mainly deciduous forest stand to a coniferous forest. Based upon the tree coring results, the age range of trees in this area are between 63 and 67 years old. The dominant tree species in this forest cover type include western redcedar, bigleaf maple, Douglas fir, red alder, and western hemlock. Dominant understory vegetation includes vine maple, evergreen huckleberry, red huckleberry, salal, sword fern, and trailing blackberry. The mid-successional forest zone contains a generally low density of snags, and a moderate density of coarse woody debris.

Mid-Successional Forest Zone

Type 4: Mature Second-Growth Forest

The southeastern portion of the property is comprised of a mature second-growth forest, which covers of approximately 1.9 acres. Forest characteristics include moderate to large-diameter conifer trees and a multi-layered canopy with shade tolerant shrub species. Tree species observed in this zone are Douglas fir, western recedar, big leaf maple, western hemlock, and bitter cherry. Dominant understory species include vine maple, evergreen huckleberry, red huckleberry, salal, sword fern, Oregon grape, and trailing blackberry. A moderate volume of coarse woody debris is present on the forest floor, a low density of standing snags was observed.

Based upon the tree coring results, the age range of trees within this forest zone are between 81 to 144 years old. As indicated by the stumps present throughout the property, which show evidence of logging by both crosscut saw and chainsaws, it is likely that this area was logged in multiple events. Based upon historical records of logging, the first major logging event likely occurred in the 1870s.

Mature Second-Growth Forest Zone

3.2 Soil Infiltration and Aquifer Recharge

The soil infiltration testing was performed on February 9, 2017, immediately following a period of relatively high precipitation. Soil surface infiltration rates ranged from 9.3 to 21.8 inches per hour and subsurface rates ranged from 0.7 to 4.5 inches per hour at five of the six test sites.[2] Restrictive hardpan layers were encountered between a depth of 24 to 32 inches in the test pits, which likely limited subsurface infiltration. The higher infiltration rates measured in the surface tests are likely due to soil irregularities that can result in better infiltration, such as roots, insect/worm burrows, and organic material. In general, the subsurface infiltration tests revealed the more limiting infiltration capability of the deeper soils.

Overall, the infiltration rates measured in the subsurface tests indicated a low to moderate infiltration capacity of the soils on the property, which is consistent with Hydrologic Soil Groups B or C as listed in the NRCS Web Soil Survey (2017). Given that Bainbridge Island is made up of mainly Hydrologic Groups A, B, and C, infiltration at the Suzuki property is likely low to average in comparison with the rest of the island.

Most of Bainbridge Island, including the Suzuki Property, is classified as a Critical Aquifer Recharge Area (CARA) for shallow aquifers (Aspect, 2015; USGS, 2011). The shallowest aquifer with the highest potential to be affected by development on the property is the Vashon advance aquifer (the

[2] Due to high groundwater, the surface infiltration test at Test Site 2 was aborted when the test failed to show measurable infiltration after 40 minutes, and the subsurface infiltration test was not performed. This test site is located in the immediate vicinity of a potential wetland area (see Section 3.3.2).

property is not classified as a CARA for deep aquifers). Based on the low to moderate infiltration rates measured on site and the presence of better draining soils within the mapped critical aquifer recharge area outside of the Suzuki property, the site likely has a low to moderate impact on aquifer recharge in comparison to the rest of the island.

See the Soil Infiltration and Aquifer Recharge Report (Appendix B) for additional information.

3.3 Wildlife Habitat and Species

3.3.1 Forest Habitat

Of the four forest types identified on the property, the closed canopy forest zone (Type 1) has the least overall habitat value. The forest consists of a dense, even-aged stand of Douglas fir with a high degree of canopy closure and a sparse understory, which provides comparatively poor quality wildlife habitat as compared to more species- and structurally-diverse forest types (McComb, Spies, & Emmingham, 1993). The lack of canopy openness restricts wildlife access, reduces visibility for spotting prey, and decreases ground temperatures, all of which negatively impacts wildlife habitat quality (Carey, 1996; North et al., 1999). A low diversity of vertical structure and canopy variability, along with minimal understory vegetation, provides few niches for wildlife and prey species, which lowers the overall wildlife species diversity and population levels (Hays & Hagar, 2002; Wilson & Puettmann, 2007). Coarse woody debris and standing snags are largely absent from this forest zone, further limiting habitat quality.

In comparison, the mature second growth forest zone (Type 4) has the highest overall habitat value of the four forest types on the property. The diversity of tree species, ages, heights, and canopy openness provides niches for a variety of wildlife and prey species (Carey, 1996; Carey et al., 1999; Wilson & Puettmann, 2007). The presence of understory deciduous trees and shrubs are especially important, as they provide berries, seeds, and small mammal cover, as well as browsing material for larger mammals (Martin & McComb, 2002; Wender et al., 2004). Additionally, as compared to the closed canopy forest zone, coarse woody debris is abundant in this forest habitat. Coarse woody debris and snags are important components of healthy forest ecosystems, as they provide sites for nests, dens, and burrows; hiding cover for predators and protective cover for their prey; a food course for insects; and other habitat functions (Stevens, 1997). The mature second growth forest zone meets the WDFW (2008) criteria to be considered a “mature forest,” which is a designated State priority habitat type.

The mid-successional forest zone (Type 3) has moderate habitat value, as compared to the closed canopy forest (Type 1) and the mature second growth (Type 4) forest zones. The mid-successional forest zone shares several attributes with the mature second-growth forest zone (Type 4), such as similar dominant tree and understory species. However, course woody debris abundance, plant species diversity, diversity of vertical structure, and level of canopy openness is lower as compared to the mature second growth forest zone, but is significantly higher than what is observed in the closed canopy forest zone.

The remaining forest type on the property (early-successional forest [Type 2]) also has comparatively moderate habitat value. As described in Section 3.1, the early-successional forest zones on the property are dominated by red alder. Various species of birds, mammals, amphibians, and invertebrates depend on red alder; for example, the leaves of red alder support a high number of invertebrates, which serve as the main food source of many songbird species (Jensen, et al., 1995). These zones also contain a dense understory of native shrubs, particularly where canopy gaps are present. Habitat limitations of the early-successional forest zones include low levels of coarse woody debris and snags, the presence of invasive species (primarily Himalayan blackberry) in some locations, and a lower diversity of vertical structure and canopy variability, as compared to the mature second growth forest zone.

3.3.2 Pond and Wetland Habitat

As shown in Figure 3, an approximately 0.25-are human-created pond is located near the southern property boundary. The pond is surrounded by an earthen berm, and is likely maintained by a high groundwater table and/or a clay lining at the bottom of the pond. Douglas fir tree rooted within the berm was determined to be between 71 and 76 years old (see Appendix A for details), which indicates that the pond was likely constructed in the mid-20th century.

Human-Created Pond

The pond is permanently flooded and approximately 10 feet deep, with a seasonal variation of 3 to 4 feet (Bainbridge Island, 2016). Vegetation observed in the pond includes duckweed, water parsley, and yellow-flag iris. Despite the fact that the pond is a human-made feature, it provides habitat for a wide variety of species that rely on open water habitat for all or a portion of their life cycle, such as amphibians and many insects (Sheldon, et al., 2005). Other species use open water areas for obtaining some life requirements (e.g. sources of prey and drinking water), such as deer and herons. The close proximity and uninterrupted connection between the pond and the adjacent forest habitat support both the overall wildlife populations and biodiversity found on the property.

Along with the pond, three potential wetland areas were identified on the property, which are shown in Figure 4 and described below. Wetlands provide many valuable environmental functions, such as water quality improvement, flood water storage, and habitat for plants and animals (Sheldon, et al., 2005). The ability of a wetland to provide these functions is dependent upon a variety of factors, such as the wetland's topography and position in the landscape, water regime, proximity to adjacent habitats, and vegetative composition.

SOURCE: ESA (2016)

Figure 4
Potential Wetland Areas

Potential Wetland Area 1

Potential Wetland Area 1 is a depressional feature located near the center of the property. The dominant vegetation in the area is primarily red alder trees, with some scattered western red cedar trees. The understory is dominated by salmonberry, with patches of salal, sword fern, and trailing blackberry, primarily on the fringes of the wetland area.

During the December 15, 2016 site visit, shallow ponded water was observed in the middle of the potential wetland area. The area is isolated (i.e. there is no obvious surface water outlet).

Potential Wetland Area 1

Potential Wetland Area 2

Potential Wetland Area 2 is a linear swale feature located in the east-central portion of the property. The area slopes to the west, and drains into the ditch along Sportsman Club Road (see Section 3.3.5). The dominant vegetation in the area is primarily red alder trees with an understory of salmon berry, with some scattered patches of sword fern, trailing blackberry, and red elderberry along the wetland area boundary. During the December 15, 2016 site visit, areas of soil saturation and water seeping from the hillside were observed.

Potential Wetland Area 2

Potential Wetland Area 3

Potential Wetland Area 3 is a depressional feature located near the southwest corner of the property. The area drains southward into the ditch along Sportsman Club Road (see Section 3.3.5). The dominant vegetation in the area is primarily red alder trees and mature willows, with an understory of salmonberry and soft rush. During the December 15, 2016 site visit, ponding was observed in the area, and water was observed flowing out of the area into the adjacent ditch.

It appears that a portion of the wetland is seasonally flooded (meaning that the observed ponding persists for at least two consecutive months out of the year). Therefore, as opposed to the other two potential wetland areas identified on the property, Potential Wetland Area 3 may provide breeding habitat for amphibians.

Potential Wetland Area 3

3.3.3 Wildlife Species

Many different wildlife species have been observed on the property, including a variety of songbirds, waterfowl, and raptors; frogs, salamanders, and newts; painted turtle, Douglas squirrel, coyote, river otter, and white-tail deer. Many of these species, particularly the river otters, painted turtles, and amphibians, were observed within or in close proximity to the pond. The resident of a house located directly south of the pond on Commodore Lane NW has collected wildlife observation data of the pond vicinity for several years, these data is presented in Appendix C. During a one-day field visit on December 1, 2016, ESA biologists also recorded species observations which are presented in Appendix C.

A sample of wildlife observed in the pond (clockwise from upper left): painted turtle, river otter, great blue heron, and wood duck (Photos courtesy L. Marshall)

The WDFW Priority Habitats and Species (PHS) database (2017a) does not include species data for the property. However, of the observed wildlife species on the property, seven species are listed as priority species by WDFW (Table 1).

TABLE 1
WDFW-LISTED PRIORITY SPECIES OBSERVED ON THE SUZUKI PROPERTY

Species	Listing Criteria
Pileated woodpecker	#1: State-Listed Species[1] *(Sensitive)*

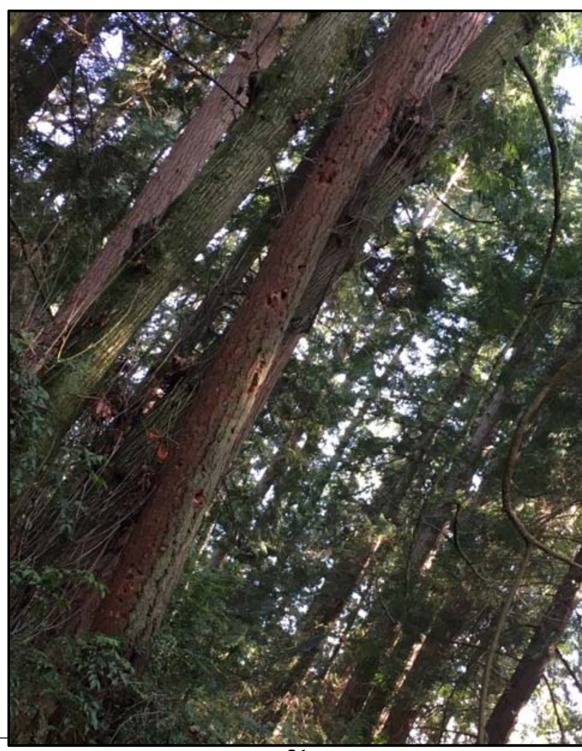
Species	Listing Criteria
Bald eagle	#1: State-Listed Species[1] *(Candidate)*
Great blue heron	#2: Vulnerable Aggregations[2]
Wood duck	#3: Species of Recreational, Commercial, and/or Tribal Importance[3]
Common goldeneye	#3: Species of Recreational, Commercial, and/or Tribal Importance[3]
Bufflehead	#3: Species of Recreational, Commercial, and/or Tribal Importance[3]
Hooded merganser	#3: Species of Recreational, Commercial, and/or Tribal Importance[3]

[1] State-listed species are native fish and wildlife species legally designated as Endangered, Threatened, or Sensitive (WAC 232-12-011). State Candidate species are fish and wildlife species that will be reviewed by WDFW for possible listing as Endangered, Threatened, or Sensitive according to the process and criteria defined in WAC 232-12-297.

[2] Vulnerable aggregations include species or groups of animals susceptible to significant population declines, within a specific area or statewide, by virtue of their inclination to aggregate.

[3] Native and non-native fish and wildlife species of recreational or commercial importance, and recognized species used for tribal ceremonial and subsistence purposes, who biological or ecological characteristics make them vulnerable to decline in Washington or that are dependent on habitats that are highly vulnerable or are in limited availability.

Pileated woodpecker generally nest in snag cavities or in the dead branches of live trees, usually 15 to 80 feet above ground (Audubon Society, 2017). Snag cavities that may provide nesting sites for pileated woodpecker were observed on the property; however, no nests have been observed to date. If present, the nests would like occur in the mid-successional forest zone (Type 3) or the mature second-growth forest zone (Type 4), as suitable nesting snags were not observed in the other forest zones. WDFW PHS data (2017a) shows the nearest documented pileated woodpecker nesting habitat is located approximately 2 miles west of the property, near the corner of NE Tolo Road and NE



Nelson Hill Road.

Snag with cavities observed in the southeastern portion of the property (Photo courtesy L. Marshall)

There are no bald eagle nests or great blue heron rookeries on the property, although these species have been observed utilizing the property for roosting and/or foraging. WDFW PHS data (2017a) show the nearest bald eagle nest located near Murden Cove, approximately 0.75-mile northeast of the property. WDFW also shows the presence of a great blue heron breeding area 0.5-mile east of the property, adjacent to Highway 305.

Wood duck, common goldeneye, bufflehead, and hood merganser are all cavity-nesting ducks, meaning that they require natural cavities or nest boxes to raise their young. Suitable nesting cavities are generally located near water (Seattle Audubon Society, 2017). Nesting sites may be present on the property, although none have been observed to date. WDFW PHS data (2017a) does not show the presence of cavity-nesting duck breeding areas within 2 miles of the property.

3.3.4 Habitat Corridors and Connections

Land development generally results in habitat fragmentation, which is a significant threat to wildlife populations and species (Gilbert-Norton, et al, 2009). The dominant effect of habitat fragmentation is a decline in wildlife population density and species richness. In a fragmented landscape, remnant areas of relatively undisturbed habitat as referred to as “habitat patches.” As the Suzuki Property is surrounded on all four sides by development (arterial roads to the north and west, a gravel road to the east, and a residential subdivision and stormwater detention pond to the south), the entire property can be consisted a habitat patch.

In developing landscapes, the primary option for increasing wildlife migration between habitat patches is the creation of landscape corridors, which are thin strips of habitat that connected isolated patches of habitat (Gilbert-Norton, et al, 2009; Christie & Knowles, 2015). Corridors can be effective maintaining or slowing the decline of wildlife population density and species richness. Corridor effectiveness in dependent upon a variety of factors, such as life cycle needs of the target species, corridor width, length, level of fragmentation within the corridor (e.g. a road crossing) (NRCS, 1999b). The minimum effective corridor width is generally recognized to be approximately 300 feet (USDA, 2008).

The Suzuki Property is identified as part of a “riparian corridor”[3] in the *Bainbridge Island Wildlife Corridor Network* study (Figure 5) (Self, 2000). This corridor, identified as “Link R-14,” is described as connecting riparian habitat along Stream 0321 (Drainage to Murden Cove’s) with riparian habitat along Streams 0325 and 0324 in the North Eagle Harbor watershed. The study was developed by a City summer intern, and the corridor mapping conducted at a relatively coarse scale using air photo interpretation.

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[3] The term “riparian corridor” in the study includes both riparian (stream) corridors, as well as upland areas that link riparian areas.

The mapped corridor crosses developed areas and is interrupted in several locations in the vicinity of the property. To the east, the mapped corridor is bisected by Madison Avenue North approximately 1,000 feet from the property. Just to the southwest of the property, the mapped corridor is narrowed to a width of less than 200 feet between Sportsman Club Road NE and a residential subdivision on Capstan Dr NE, and the mapped corridor crosses High School Road NE approximately 2,000 feet south of the property. These disturbances, particularly the roads, severely limited the effectiveness of the identified corridor. However, given the recorded observations of river otter in the Suzuki property pond, flightless species have the potential of migrating from offsite riparian areas to the property.

SOURCE: Best, 2000

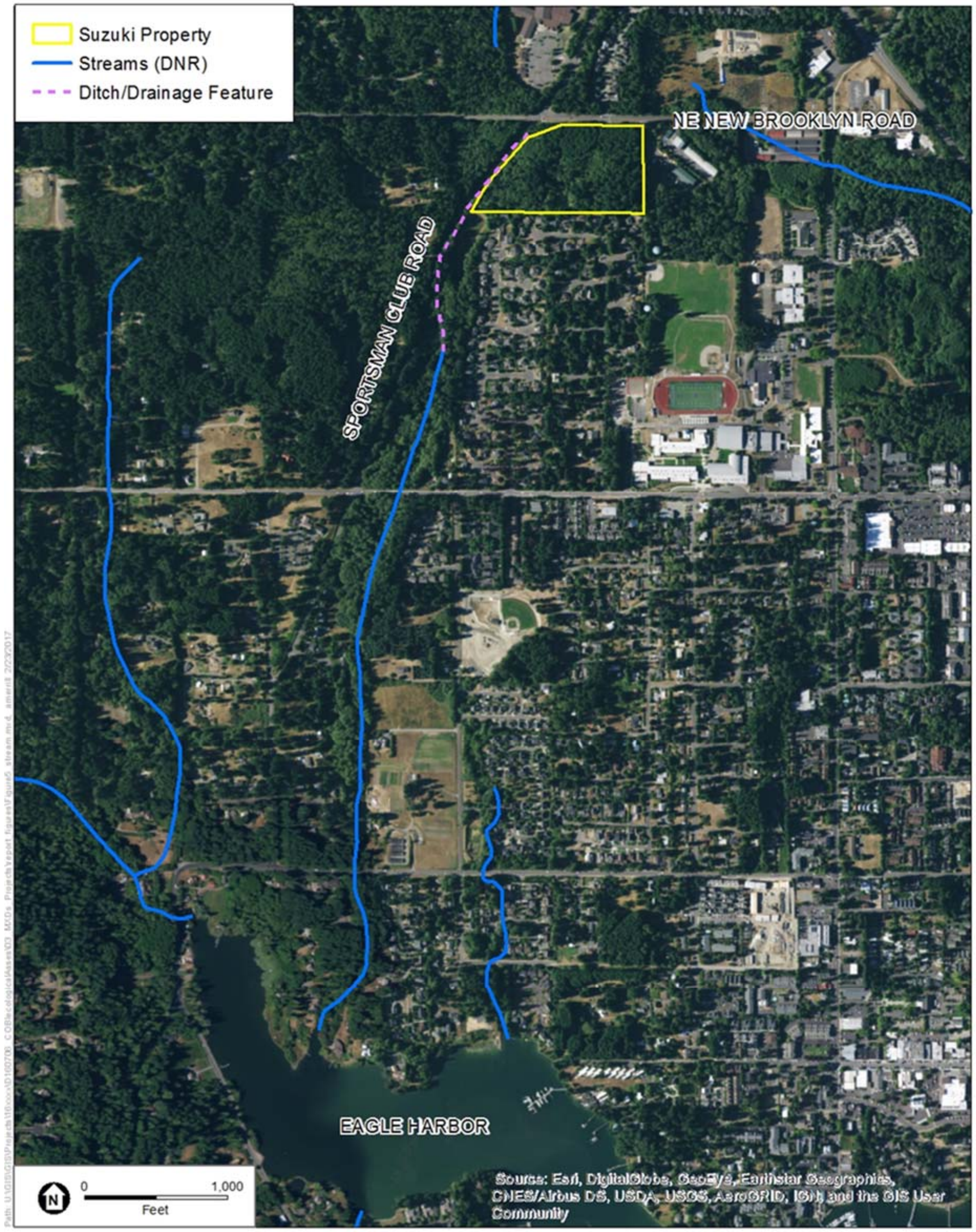
Figure 5
Eagle Harbor Vicinity Habitat Corridor Map

3.3.5 Stream Identification

Several data sources indicate the presence of a stream near the west property boundary, adjacent to Sportsman Club Road. However, these data sources differ in both the extent of the stream features and its fish-bearing status. WDNR (2017) data shows a Type F (fish-bearing) stream originating approximately 1,000 feet south of the property and draining into Eagle Harbor (Figure 6). City critical areas mapping shows the stream as originating further north, approximately 200 feet southeast of the intersection of Sportsman Club Road and NE New Brooklyn Road (Bainbridge Island, 2017). The City data show the stream mapped as Type Ns (non-fish bearing seasonal) from its origin to a point approximately 400 feet downstream, where it is then mapped as a Type F stream. The Type F stream extends for approximately 200 feet into the southeast boundary of the property. The remaining downstream reach of the stream follows a similar path as the WDNR mapping.

The Salmonscape database (WDFW 2017b) also identifies an ephemeral, non-fish-bearing stream stream in the general project vicinity. These data show the stream originating approximately 1,000 feet south of the property. The remaining downstream reach of the stream is mapped by WDFW as following a similar path as the WDNR and City mapping.

During the December 16, 2016 field investigation, a single channelized drainage feature was observed just west of the property boundary, adjacent to Sportsman Club Road (Figure 6). For most of its length along the western property boundary, the drainage feature is between 1 and 2 feet wide. Approximately 150 north of the southern property boundary, a 12-inch diameter culvert conveys the drainage into Potential Wetland Area 3 (Figure 4) The wetland extends to the southern boundary of the property, where it drains through another culvert under an unpaved access road and into what appears to be a second wetland. Any flow appears to continue downstream to the southwest, as indicated by the WDNR stream mapping (Figure 6).During the site visit, the drainage feature was dry upstream of Potential Wetland Area 3. Water was observed flowing southward from the wetland area, just south of the property.



SOURCES: WDNR, 2017, ESA 2017

Figure 6
Streams/Drainage Features in the Suzuki Property Vicinity

In the immediate vicinity of the property, the drainage feature appears to be a human-created ditch with a primary purpose of intercepting and conveying stormwater runoff from Sportsman Club Road. The channel is heavily vegetated with blackberry, rushes, grasses and forbs forming a thick mat of vegetation within the bottom and sides of the channel. Patches of swordfern, an upland plant, also extend adjacent and into the channel. The substrate within the soil is predominantly compacted organic soil and root material, with little natural cobble or gravel observed (some irregular and small patches of angular quarry spalls were observed).

Drainage ditch west of the Suzuki Property

Based on the observed channel, habitat, and hydrology within the drainage feature, it appears that the portion of the drainage feature within the immediate vicinity of the property should not be considered a stream, but rather a manmade stormwater conveyance feature. Drainage appears to come primarily from roadway stormwater runoff and no suitable habitat for fish species is present within the homogenous, linear channel. Downstream of the property, it is likely that the contributing basin area is large enough to create and maintain a stream channel, but these conditions do not occur within the immediate vicinity of the property.

4. MANAGEMENT RECOMMENDATIONS

The most effective strategy for maintaining ecological functions in a developing area is to retain large, connected patches of native vegetation and limit development footprints. This strategy, typically referred to as development "clustering," is consistent with the stated goals in the "Suzuki Farm" development proposal (OPG, 2016), which include preserving open space and enhancing habitat for Bainbridge Island species.

Overall, based upon our site investigation and a review of the relevant ecological data and scientific literature, we recommend focusing the development footprint on the northern portion of the property. This portion of the property, identified in this study as the Closed Canopy Forest (Type 1) zone (Figure 3), has the least overall ecological value as compared to the remaining habitats of the property. We recommended preserving the Mature Second Growth Forest (Type 4) zone in its entirety, as this area, along with the pond, as they are the most ecologically valuable areas of the property. We also recommend that the early successional forest (Type 2) and Mid Successional Forest (Type 3) zones to be retained as much as possible, particularly the portions that provide connections between the Mature Second Growth Forest and the pond, as well as offsite habitats. Ideally, the retained open space on the property would be one large, connected block of habitat, instead of creating multiple patches with interrupted connections.

Specific management recommendations for the different ecological features on the property are described below.

4.1 Tree Protection

Prior creating a site development plan, it is important to look at the forest holistically to determine groves or stands of trees that will be retained. This includes assessing species tolerance to construction impacts, such as soil compaction, root loss, and exposure to changing forest conditions resulting from adjacent tree removal. On the property, trees that are more open-grown with higher live crown ratios (measured as the length of live tree canopy compared to total tree height) are more likely to tolerate new exposure that results from adjacent tree removals. Reversely, trees with lower live crown ratios are more susceptible to windthrow if adjacent trees are removed.

Other tree protection management recommendations include:

- Install tree protection fencing around the critical roots zones of retained trees, and avoid disturbances (such as parking, materials storage, or dumping) within the tree protection area.
- Minimize soil disturbance adjacent to tree protection zones, and use alternative methods (such as hand excavation) to protect roots.
- Minimize root pruning.
- Retain and protect the existing duff layer and understory near retained trees.

For further tree protection details, see the Forest Survey Report (Appendix A).

4.2 Soil Infiltration and Aquifer Recharge

As stated in Section 3.2, the property is located within a designated CARA. Based upon a review of existing information and the results of the soil infiltration testing, the property likely has a low to moderate impact on groundwater recharge, in comparison to the rest of Bainbridge Island. However, considering that groundwater is the sole source of drinking water on the island, utilizing stormwater management strategies that maintain the quantity and quality of aquifer recharge is important, even in areas with more limited groundwater recharge potential. Therefore, we recommend the use of LID stormwater management techniques for the proposed development.

LID stormwater management techniques remove pollutants from stormwater runoff and reduce impact to the natural hydrologic cycle by infiltrating stormwater onsite through localized facilities, such as rain gardens and bioswales. LID stormwater management benefits aquifer recharge by maintaining the quantity of water infiltration that would occur naturally on an undeveloped site. The suitability of LID facilities is determined by the subsurface infiltration rates and the depth to seasonal high groundwater.

The average subsurface infiltration rate measured on the property was 1.6 inches per hour, which is suitable for some types and sizes of LID infiltration facilities. However, the high water levels observed on the property may limit the opportunity for infiltration of stormwater. The Western Washington Stormwater Management Manual (Ecology, 2012) states that the bottom of infiltration facilities should be at least 5 feet above seasonal high groundwater or other low permeability layer.

There are a several LID stormwater management techniques that are effective in areas with limited soil infiltration capacity and high groundwater tables; these techniques include:

- Limiting impervious surface coverage across the development site.
- Installing “green roofs,” i.e., the building that is partially or complete covered with vegetation and a growing medium, planted over a waterproofing membrane.
- Utilizing impervious pavement for roads, driveways, sidewalks, and other hardscapes.
- Using rain barrels/cisterns to “harvest” rainwater that can be used for irrigation or other non-potable water uses.
- Using lined, vegetated stormwater planters to treat stormwater prior to discharging to a separate infiltration facility.

Prior to site design efforts, we recommend that additional field investigation be performed to better understand the extent of perched groundwater beneath the site, in order to select and design LID stormwater facilities that are appropriate for the conditions of the property.

4.3 Wildlife Habitat

Other than retaining existing native vegetation, there are several methods for minimizing the impacts of development on wildlife habitat. These methods include:

- Locate developments and uses that create noise, such as playgrounds, away from habitat areas.
- Minimize light pollution and maintain naturally dark habitat by minimizing outdoor lighting orienting lighting away from habitat areas.
- Create “buffer zones” of native vegetation between development and existing high-quality habitat areas (such as the Mature Second Growth Forest).
- Limit and/or exclude domestic animal access to habitat areas.
- Utilize native plantings for residential landscaping, particularly plants that create forage and habitat for bird and insect species.

Once constructed, a major amenity for residents of the proposed development will be opportunity to enjoy the wildlife habitat that is literally “in their backyard.” It is expected that human use of the habitat areas would significantly increase over existing conditions. This increase in use has the potential to have a serious detrimental effect on the wildlife and habitat on the property, as increased human use can result in trampling of vegetation, soil compaction, disturbance of wildlife breeding activity, and other negative effects. Fortunately, there are several effective measures to mitigate the impacts of increased human use. Methods include:

- Restrict human use to established paths, in order to avoid disturbance to the majority of the habitat areas.
- Educational materials, such as the installation of educational signage, can help inform residents and visitors on how to enjoy and view wildlife and open space while minimizing disturbance.
- Establishment of a volunteer program to conduct outreach efforts, lead wildlife enhancement projects, and monitor potential wildlife-disturbing activities (such as littering and the creation of informal paths)

Along with minimizing human impacts to habitat areas, there are a variety of opportunities to enhance habitat quality on the property. Habitat improvement opportunities include:

- Removal of invasive species (e.g. Himalayan blackberry and English ivy).
- Establishment of native plantings to increase plant species diversity and vertical structure in the retained forest areas.
- Installation of bat houses and bird nest boxes.

- Increasing habitat structure by installing brush piles and snags throughout the property, particularly in areas where course woody debris density is low. The materials needed to create these habitat structures (tree trunks, brush, and root wads) can be salvaged from trees that are removed during site development.

As the property provides habitat for state-listed priority species, Bainbridge Island Municipal Code (BIMC) requires the submission of a Habitat Management Plan (HMP) prior to site development. Per BIMC Section 16.20.130.C., the HMP must include measures to retain and protect the wildlife habitat and consider effects of land use intensity, buffers, setbacks, impervious surfaces, erosion control, and retention of native vegetation.

4.3.1 Pond

As stated in Section 3.3.2, the human-created pond on the property provides habitat for a wide variety of species that rely on open water habitat for all or a portion of their life cycle. The "Suzuki Farm" development proposal (OPG, 2016) describes enlarging the pond for stormwater detention purposes, as well as constructing a play/gathering space directly adjacent to the proposed enlarged pond (Figure 2). We recommended avoiding disturbance to the pond, given its importance as a habitat feature on the property. Additionally, we recommend maintaining a protective buffer of existing native vegetation around the pond. Ideally, the pond buffer would be a component of the habitat corridor across the southern portion of the site (see Section 4.3.3 below).

4.3.2 Wetlands

Wetlands provide valuable ecological functions (e.g. floodwater storage, water quality improvement, and wildlife habitat), and are regulated at the federal, state, and local levels. The BIMC (Section 16.20.160) assigns protective buffer widths to wetlands; widths range between 25 to 250 feet depending upon wetland category, as determined using the *Washington State Wetland Rating System for Western Washington* (Hruby, 2014). The BIMC permits wetland impacts for some specific uses when no reasonable alternative location is available, such as utility installation and dock construction. But in general, impacts to wetlands and their buffers are only allowed when they are determined to be "necessary and unavoidable" by the City (BIMC Section 16.20.100). Any impacts to wetlands or their buffers must be mitigated for per BIMC Section 16.20.160.H.

Prior to site design, wetlands on the property should be formally delineated, categorized, and documented in a critical areas study (BIMC Section 16.20.090).

4.3.3 Habitat Corridors and Connections

We recommend that a habitat corridor across the southern portion of the property, as described in the *Bainbridge Island Wildlife Corridor Network* study (Self, 2000), be retained. Despite the fact that the mapped corridor is interrupted and narrowed to the east and west of the property, the documented presence of river otter in the pond indicates that flightless species have the potential to migrate to the property from offsite habitat areas. Retaining this corridor would also connect three of the most high-qulity habitat areas on the site: Potential Wetland Area 3, the pond, and the Mature

Second Growth Forest (Type 4) forest zone. In accordance with the scientific literature, we recommend a corridor width of 300 feet or greater.

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Appendix A
Forest Survey Report

Appendix B
Aquifer Recharge and Soil Infiltration Report

Appendix C
Wildlife Observation Tables