



Ecological Assessment

WATMOUGH BAY PRESERVE ADDITION (“HIGGINS”)

Prepared by



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Assessment team

The assessment team for this project included Kwiaht botanist Madrona Murphy; Kwiaht wildlife ecologist Russel Barsh; and Kwiaht restoration landscaper Brett Jensen; with the assistance of Kwiaht herpetologist Christian Oldham, ornithologists Beth St. George and Joseph Behnke, and research apprentices Ramona Tellez (San Diego University), J. Ray-Keil (University of Hawaii), and Roan Ontjes-deGroot (Orcas Island High School). Valuable insights were also provided by Lopez Island neighbors; descendants of the traditional indigenous owners of this reef-net site; and San Juan County Land Bank staff.

Methodology

The Kwiaht assessment team visited the subject property nine times from May through October 2022 to make visual observations of soils, plants, and wildlife, and to maintain five programmed recording devices. Field surveys were ordinarily conducted with a custom modified version of the GeoPaparazzi app that embeds GPS coordinates and form notes in photos taken with a tablet or mobile phone; and through conversion to Excel files, can be uploaded to ArcGIS and QGIS. Data collected by direct field observation included:

- Soils, including exposed anthropogenic (cultural) substrates
- Plant species and the edges of thickets and plant communities
- Birds and other terrestrial wildlife by sight, scat and sign
- Pollinators visiting wildflowers, weeds, and fruit trees
- Kelps and other seaweeds anchored in the intertidal zone
- Cultural features such as structures, rock piles, and excavations

In addition, the Kwiaht team conducted a beach seine on the north shore of the property in April to determine whether the fish community, including migratory salmon and forage fish, was more or less the same as Watmough Bay beach, which Kwiaht researchers seine biweekly from spring through fall annually. An 80-foot seine was deployed, and more than 600 fish were identified.

Programmed electronic sensors and data loggers were deployed at five locations for the duration of this assessment project:

- Wildlife Acoustics SM4BAT Mini dual channel (bats, birds, small mammals) in garden
- Wildlife Acoustics SM4 stereo (birds) in shrubby grass near the east beach
- Meidase motion-triggered color/IR trail cameras in orchard and at woodland pond
- Wildlife Acoustics SM4 cabled hydrophone in the kelp facing Boulder Island

These recording device enable the assessment team to hear and see wildlife 24-7 over a period of several months. Cameras have an effective range of 100 feet and can monitor up to an acre of open space or a smaller area confined by trees or shrubs, such as a game trail. Acoustic recorders can monitor 3D space up to several acres depending on the strength of the signals; SM4 devices were operated with a x16 gain to respond to faint or distant wildlife vocalizations.

1. Project background.

Acquired by the San Juan County Land Bank in 2022, the Watmough Bay Addition (“Higgins”) parcel consists of approximately 11 acres of shoreline beaches, bluffs, and upland that were part of a homestead patented by Sampson Chadwick in 1876. It includes a rocky promontory overlooking Boulder Island, Rosario Strait, and Watmough Bay (or “Bight” on early maps) that has locally been known as Chadwick Point or Watmough Head.

This Assessment was prepared at the request of the Land Bank to inform the development of management plans for the property, which is connected by a foot trail to other public lands (Land Bank and San Juan Islands National Monument) in the Watmough Bay seascape. Data, conclusions and recommendation in this document provide an overview of the biological and cultural resources on the property, including native and exotic species, and both indigenous occupation and post-Contact use and structures.

2. Site context.

• Landscape characteristics

Two sandy beaches are divided by a rocky promontory best known at Watmough Head. The east beach opens onto a kelp forest and Rosario Strait, and the north beach forms a part of the entrance to Watmough Bay. The head itself offers spectacular views of inner Watmough Bay and Chadwick Hill towering above it; Boulder Island (part of the San Juan Islands National Wildlife Refuge administered by USFWS); and Rosario Strait with Mount Erie and the snow-capped Cascades and Mount Baker in the background.

The upland has been occupied and used as a reef-net fishing camp since at least 1,800 years BP, and as a Euro-American style home, farm and orchard since the 1870s. Part of the garden and orchard remain, as well as an early 20th century frame house (with later additions), barn, chicken coop and tool shed, and a small artificial pond dating to the mid-20th century. Most of the upland is open meadow dominated by non-native grasses and shrubs. The southwest corner of the parcel is wooded, with conifers dating to the mid-20th century.

• Geophysical substrate

Bedrock exposed at the head and adjacent shoreline belongs to the Lopez Structural Complex bedrock series, chiefly composed of graywacke, an ocean floor sandstone composed of very fine grains of volcanic material, estimated 120-170 million years old (Brown, 2016). Ribbon cherts, characteristic of the outcrops at nearby Point Colville, appear to be absent.

The most recent USGS soil survey identified the substrate at this property as mainly Rock Outcrop/Haro Complex (blue on map), with the wooded SW corner Whidbey gravelly loam, 3 to 15 percent slopes. Haro is defined by USGS as “Glacial drift mixed with colluvium derived from metasedimentary rock” generally 10-20 inches thick overlaying bedrock, moderate to highly porous, ecologically “prairie bald”. Thin soil as such ranges from sandy to gravelly loam with barely an inch of organics.

USGS describes Whidbey gravelly loam as composed of a thin layer of decomposing plant material; 2-6 inches of soft friable brown gravelly (15%) loam; and up to several feet of pale brown friable gravelly (45%) loam. These young post-glacial soils have very little clay, are relatively porous, and can support the large, ancient conifers that persist scattered along the south coast of Lopez Island.

Most of the exposed soils in the culturally modified herbaceous area exhibit an admixture of charcoal and/or ash, and those closest to the remaining house include ashy broken shells of clams and other shellfish (map and photos). Midden exposed by mowing 20 feet east of the house contained mostly calcined ashy remnants of large butter clams (*Saxidomus gigantea*) and steamer (Pacific littleneck) clams (*Leukoma staminea*), with a few fragments of mussels, cockles, thatched barnacles, and chitons; the last two shellfish being representative of Coast Salish rather than Euro-American diets.

- **Historical and oral-historical context**

Suttles' (1951) authoritative ethnography of the San Juan Islands, which formed the basis of Indian Claims Commission judgments in favor of the Samish, Swinomish, and Lummi nations' land claims in the 1970s, describes the pedigree of a reef-net salmon fishing site at Watmough Bay that was still in indigenous hands in the 1890s, when two of the fishing captains, Charley Edwards and Joseph Cagey, were extensively interviewed by Richard Rathbun, a researcher for the United States Fish Commission (Barsh, 2021). According to Victor Underwood, Senior, who was interviewed by Suttles (1951, 197), the reef-net batteries at Watmough Head and Iceberg Point were owned in the 19th century by two brothers, S̓x̓éʔs and Edward Syəclénəx^w (father of Charley Edwards), together with the brothers Harry X̓wəl̓x̓wáltən (*aka* Whulholten) and Burney Kwəlqəlénəx^w all of whom self-identified as Samish; that is, with the cedar plank-house villages at Guemes Island and Samish Island. Charley Edwards' descendants today are enrolled at Swinomish (as Samish) and include the Day family. Whulholten, known to settlers as Harry Samish, was the ancestor of the McDowells, leaders of the Samish in Anacortes from the 1920s to Ken (McDowell) Hansen's death in 2006. One of Ken's daughters lives on Lopez.

Culturally and historically, the Watmough Head area is linked most closely to Samish and the Samish-ancestry community at Swinomish. There are indirect links to the "Mitchell Bay Tribe" (originally from the Garrison Bay plank-house village) on San Juan Island through the mother of Henry Cayou, and thus also to the present-day Cayou descendants, mainly enrolled at the Swinomish Tribal Communities. Henry's mother was close kin to Harry Samish as well, and in her final years lived in Harry's plank-house at Lummi after settlers burned down his house at Samish Island. This is a basis for Lummi interests in south Lopez.

Archaeological excavations in the wetlands behind Watmough Bay beach by the University of Washington in 1968, results of which were never published (field notes and collections are at the Burke Museum), found evidence of salmon processing and pole netting of seabirds.

A joint Samish Tribe-BLM-University of Washington archaeological excavation on Watmough beach in 2004, in which Barsh was a co-PI, discovered evidence of 1,800 years of reef-netting (Hatch, 2005), as well as remains of a stone firepit that Samish, Swinomish and Tulalip cultural people identified confidently as a ceremonial site for singing home the sockeye salmon each summer. Salmon-calling songs, one of which was recorded in the 1940s, were associated with ownership of reef-net sites.

As far as existing evidence goes, reef-net gears were anchored at the south edge of the kelp forest that extends from Watmough Head to Boulder Island. The summer homes of captains and crew were approximately where the historical house is located at Watmough Head today; they would have originally been lean-tos constructed of cattail mats, replaced by wood cabins by the early 20th century. Salmon caught by the reef-nets were processed at Watmough Beach together with birds netted in the wetland. The beach would also presumably have been used to repair and store the reef-net boats over the winter (as better documented for Reef Net Cove at Iceberg Point).

Sampson Chadwick erected a frame house on the property about 1876 after marrying Adelia Bradshaw of Port Townsend, whose mother was S'Klallam; her family was related by marriage to the Edwards and Harry Samish families, and connected to Louie George at Fish Bay Creek on San Juan Island, the S'Klallam watchman for south San Juan and Lopez reef-net sites, who was also married into Samish. Despite Lopez folklore that depicts Chadwick and his "Addie" suffering from conflict with "the Indians," they lived among the Samish reef-netters and their S'Klallam in-laws at Watmough Head, and there are family stories suggesting that Adelia, like Mary Brown, a Samish woman married to a homesteader near Hummel Lake, functioned as a go-between and peacemaker as the Euro-American community on Lopez began to grow.

- **Maps and historical structures**

The earliest map of the property was prepared by the U.S. Coast and Geodetic Survey in 1889 (Gilbert, 1889); unfortunately, the original was damaged, leaving the coasts from Watmough Head to Point Colville smudged. A cleared area corresponding to historical descriptions of the Chadwick homestead can be identified, georeferenced, and transposed to a modern aerial photo (Map), nonetheless. This reveals that Chadwick's garden was located where the fenced garden area can be seen today. If Chadwick's house was mapped, the symbol was obscured. No orchard was mapped in 1889, although one appears in an aerial photo from the 1930s. It is likely that the orchard was planted in the 1900-1910 period when tree-fruit production in the islands expanded rapidly, as described by agricultural historian Boyd Pratt.

Chadwick reportedly built the core of the house remaining on the property in the late 1870s, and added rooms to it in stages. It is located where the 1889 map of cleared land implies a structure existed. Chadwick family history, preserved by the Lopez Island Historical Society, indicates that like other early Lopez "settlers," the Chadwicks kept a garden and ran sheep on the coastal meadowland. Early photographs of Chadwick, his wife and children, show this

house and what appears to be the still-standing barn in the background about a century ago. Although somewhat ramshackle and probably structurally compromised, Chadwick house is the oldest “pioneer” home remaining on Lopez Island. It is also notable as the home of one of the many mixed-ancestry families that dominated early modern Lopez from the 1870s to the 1940s; some of which remain on the island today.

The 1889 map clearly shows a kelp forest extending from Watmough Head to Boulder Island. Reef-nets would have been anchored on the south side of the kelp, possibly partially cut into the edge of the kelp canopy, and open to streams of sockeye salmon turning north from the Strait of Juan de Fuca into Rosario Strait on their migration to the Fraser River. According to Suttles (1951), this reef-net site was named Xwčénkwənəŋ – a word that suggests fishing with a net “cut into” or “across” the kelp, in Straits Salish.

A number of rockpiles are present on the property composed native graywacke together with small rocks of glacial origin. The largest rockpile appears to consist of shot rock, *i.e.*, probably 20th century. Weathered, rounded rocks characterize the smaller rockpiles, which could have been sledged out of plowed fields (a practice widespread in the islands historically). At least one distinct ring of fire-cracked rock was observed in the overgrown portion of the orchard, nearly buried in a pavement of water-worn pebbles and midden. If pre-Contact indigenous rock structures were originally present, they were disturbed long ago.

3. Qualitative description of vegetation types and habitats.

- **Plant community classification**

In the classification scheme published by Chappell (2006, at 25), the underlying community is or was the “*Festuca rubra* – (*Grindelia stricta* - *Camassia leichtlinii*) Association,” but has been highly modified replacing much of the native herbaceous component with Eurasian grasses and weeds, notably sweetbriar and Himalayan (Armenian) blackberry, which is transforming patches of the original prairie to shrubland. Differences in weeds define much of the variation within the landscape today.

- **Dominant plant species present**

The herbaceous landscape is fragmented but represents two broad domains: relic prairie or meadow, rocky and untilled but extensively colonized by non-native grasses and weeds, with small scattered patches of native wildflowers such as Camas, Hooker’s Onion, and Chocolate Lily; and cultivated, plowed, augmented, and otherwise physically modified soils, mainly non-native herbaceous and woody plants, including historical lawns, garden, orchard, and remains of historical and pre-Contact dwellings and workspaces. Within these domains, a number of overlapping plant associations can be identified by their dominant species as defined below. Map 1A locates these associations in full detail. Map 1B collapses them into four functional groupings: (1) woody native species; (2) woody non-native species; (3) herbaceous and largely native; and (4) cultivated and disturbed areas dominated by non-native grasses and weeds.

- ❑ **ACGL – *Acer glabrum*** (Douglas maple) NATIVE FOREST
On the west side of the parcel is a patch of native *Acer glabrum* that includes native shrubs *Rosa nutkana*, *Rubus ursinus*, and *Symphoricarpos albus*; native forbs including *Galium aparine* and *Heracleum maximum*; and invasive grasses such as *Agrostis stolonifera*.

- ❑ **AEHI – *Aesculus hippocastanum*** (Horse Chestnut) CULTIVATED
A single large *Aesculus hippocastanum* was planted between the house and the basketball court. The understory consists of grasses (*Festuca arundinacea* and *Dactylus glomerata*), *Conium maculatum*, and a patch of ornamental *Crocsmia*.

- ❑ **AGST – *Agrostis stolonifera*** (Creeping Bentgrass) NON-NATIVE HERBACEOUS
Along the driveway and old barn are mown and unmown areas dominated by *Agrostis stolonifera*. These areas also include *Bromus hordeaceus*, *Dactylus glomerata*, *Festuca arundinacea*, *Holcus lanatus*, and *Lapsana communis*, *Taraxacum officinale*, *Rumex acetosella*, *Trifolium arvense*, *Conium maculatum*, *Vicia hirsuta*, *Vicia sativa*, *Geranium molle*, *Trifolium dubium*, *Hypochaeris radicata*, and *Cerastium glomeratum*.

- ❑ **BALD – Rocky balds**, HERBACEOUS
Outcrops scattered throughout the meadow areas are extensively covered in lichens and mosses and generally include *Aira caryphyllea*, *Aira praecox*, *Bromus hordeaceus*, *Elymus glaucus*, *Vulpia myuros*, *Allium acuminatum*, *Brodiaea coronaria*, *Rumex acetosella*, *Vicia hirsuta*, *Vicia sativa*, and *Selaginella wallacei*. Also sometimes present are *Rosa nutkana* or *Lithophragma parviflorum*.

- ❑ **BRDI – *Bromus diandrus*** (Rip-gut Brome) NON-NATIVE HERBACEOUS
Along the shoreline, a few patches dominated by Rip-gut Brome include salt-tolerant native vegetation such as *Grindelia stricta* and *Plantago maritima*.

- ❑ **BRHO – *Bromus hordeaceus*** (Soft Brome) NON-NATIVE HERBACEOUS
An isolated patch of non-native *Bromus hordeaceus* on the east shore of the parcel that includes salt-tolerant natives, e.g. *Festuca rubra*, *Grindelia stricta* and *Plantago maritima*.

- ❑ **BRSI – *Bromus sitchensis*** (Alaska brome) HERBACEOUS
A limited patch dominated by native *Bromus sitchensis* that includes non-native grasses and herbs such as *Aira praecox*, *Bromus hordeaceus*, *Dactylus glomerata*, *Eschscholtzia californica*, *Cirsium arvense*, *Rumex acetosella*, *Torilis arvensis*, *Trifolium dubium*, *Vicia hirsuta*, and *Vicia sativa*.

- ❑ **CAOB – *Carex obnupta*** (Slough sedge) HERBACEOUS
This community only occurs around the pond in the forested southern part of the parcel.

- ❑ **ELGL DAGL – *Elymus glaucus*- *Dactylus glomerata*** (Blue Wild Rye-Cat Grass) NON-NATIVE HERBACEOUS

Tall grasses dominated by native *Elymus glaucus* and non-native *Dactylus glomerata* are found in the fields farther from the house and garden. They include *Bromus hordeaceus*, *Bromus sitchensis*, *Vulpia myuros*; *Achillea millefolium*, *Cerastium glomeratum*, *Plantago lanceolata*, *Pteridium aquilinum*, *Rubus ursinus*, and *Sanicula crassicaulis*.

- ❑ **FEAR – *Festuca arundinacea*** (Tall Fescue) NON-NATIVE HERBACEOUS

Tall Fescue dominates the mown fields surrounding the house and orchard, which include *Agrostis stolonifera*, *Bromus hordeaceus*, *Bromus sitchensis*, *Dactylus glomerata*, *Elymus repens*, *Lolium perenne*; *Cerastium glomeratum*, *Conium maculatum*, *Convolvus arvensis*, *Erodium cicutarium*, *Geranium molle*, *Lapsana communis*, *Torilis arvensis*, *Sisymbrium officinale*, *Trifolium dubium*, *Trifolium repens*, *Trifolium subterraneum*, *Vicia hirsuta* and *Vicia sativa*.

- ❑ **FEAR DAGL – *Festuca arundinacea*- *Dactylus glomerata*** (Tall Fescue-Cat Grass) NON-NATIVE HERBACEOUS

Areas of tall grasses dominated by *Festuca arundinacea* and *Dactylus glomerata* that also include *Bromus hordeaceus*, *Elymus repens*, *Festuca rubra*, *Holcus lanatus*, *Lolium multiflorum*, *Lolium perenne*, *Poa pratensis*; *Brassica rapa*, *Cerastium glomeratum*, *Cerastium tomentosum*, *Cirsium arvense*, *Cirsium vulgare*, *Conium maculatum*, *Crepis capillaris*, *Galium aparine*, *Geranium molle*, *Lapsana communis*, *Papaver rhoeas*, *Rumex crispus*, *Sisymbrium officinale*, *Sonchus asper*, *Torilis arvensis*, and *Taraxacum officinale*.

- ❑ **FEAR ELGL DAGL – *Festuca arundinacea*-*Elymus glaucus*-*Dactylus glomerata*** (Tall Fescue-Soft Brome-Cat Grass) NON-NATIVE HERBACEOUS

Areas of tall grasses that are dominated by *Festuca arundinacea*, *Elymus glaucus*, and *Dactylus glomerata* that also include *Aira praecox*, *Bromus hordeaceus*, *Holcus lanatus*, *Vulpia myuros*; *Cerastium glomeratum*, *Hypochaeris radicata*, *Sisymbrium officinale*, *Sonchus asper*, *Vicia hirsuta*, and *Vicia sativa*. Some areas also include native shrubs *Rubus ursinus* and *Symphoricarpos albus*.

- ❑ **FEAR VUMY – *Festuca arundinacea*- *Vulpia myuros*** (Tall Fescue-Rat's-Tail Fescue) NON-NATIVE HERBACEOUS

Areas dominated by tall *Festuca arundinacea* and short *Vulpia myuros* that also include *Bromus hordeaceus*, *Dactylus glomerata*, *Conium maculatum*, *Hypochaeris radicata*, *Plantago lanceolata*, *Torilis arvensis*, *Trifolium dubium*, and *Vicia sativa*.

- ❑ **FERU – *Festuca rubra*** (Red fescue) HERBACEOUS

Along the shorelines of this parcel are small patches dominated by *Festuca rubra* that include *Grindelia stricta* and, in the southeasternmost patch, *Camassia leichtlinii*. Most of these patches have been invaded by non-native grasses *Holcus lanatus*, *Aira caryophylla*,

Aira praecox, and *Bromus hordeaceus*, and non-native forbs *Plantago lanceolata* and *Vicia sativa*. Scattered native forbs include *Allium acuminatum*, *Armeria maritima*, *Brodiaea coronaria*, *Claytonia exigua*, *Claytonia rubra*, *Fritillaria affinis*, *Lepidium virginicum*, *Plantago elongata*, *Plantago maritima*, *Sanicula crassicaulis*, *Trifolium oliganthum*, *Trifolium willdenovii*, and *Triteleia hyacinthina*. Historically, these patches would conform to Chappell's (2006) *Festuca rubra*- (*Grindelia stricta*—*Camassia leichtlinii*) Association.

❑ **Garden**, CULTIVATED

The garden, mostly overgrown by grasses (*Dactylus glomerata* and *Festuca arundinacea*) includes non-native vegetables, ornamentals, and common weeds: *Alcea rosea*, *Allium tuberosum*, *Antirrhinum majus*, *Aquilegia vulgaris*, *Asparagus officinalis*, *Beta vulgaris*, *Brassica oleraceae*, *Centaurea cyanus*, *Centranthus ruber*, *Coreopsis lanceolata*, *Cynara cardunculus*, *Digitalis purpurea*, *Eruca sativa*, *Eschscholtzia californica*, *Foeniculum vulgare*, *Iberis sempervirens*, *Lavendula angustifolia*, *Linum usitatissimum*, *Nepeta* sp., *Nigella damascea*, *Papaver rhoeas*, *Papaver somniferum*, *Rheum rhaponticum*, *Salvia officinalis*, *Salvia rosmarinus*, *Symphytum officinale*; *Brassica rapa*, *Capsella bursa-pastoris*, *Chenopodium album*, *Erodium cicutarium*, *Eurphobia peplus*, *Geranium dissectum*, *Geranium molle*, *Lamium purpureum*, *Malva neglecta*, *Plantago lanceolata*, *Ranunculus repens*, *Rumex crispus*, *Taraxacum officinale*, *Thlaspi arvense*, *Trifolium repens*, and *Verbascum thapsus*.

❑ **HODI – *Holodiscus discolor*** (Oceanspray) NATIVE SHRUB

A few isolated patches of *Holodiscus discolor* occur along the shoreline of this parcel.

❑ **JUBA – *Juncus balticus*** (Baltic rush) HERBACEOUS

An isolated patch dominated by *Juncus balticus* is located between a seep and the east shore of the parcel. This patch also includes native *Achillea millefolium*, *Bromus vulgaris*, and *Cerastium arvense*, as well as non-native *Holcus lanatus* and *Bromus hordeaceus*.

❑ **Orchard**, CULTIVATED

The parcel includes two orchards. The oldest trees are in a shrubby area on the south side of the garden. Interspersed with apple and plum trees are *Rosa nutkana*, *Symphoricarpos albus*, *Heracleum maximum*, and *Dactylus glomerata*. The heritage cooking apple Rhode Island Greening is well represented; there is also an unidentified late-ripening russet. The plums in this orchard are affected by black knot fungus and witches' broom. North of the garden is another orchard—apples, pears and plums—that was kept clear and mown. The understory in this orchard is dominated by *Dactylus glomerata* and *Festuca arundinacea*. On its north side is a row of native *Acer glabrum*. This orchard includes two varieties of pears, an unidentified russet apple, and two more Rhode Island Greenings.

- ❑ **PHER ELRE – *Phalaris arundinacea*-*Elymus repens*** (Canary reed grass-Creeping wildrye)
NON-NATIVE HERBACEOUS

Restricted to a shallow depressional vernal pool on the east side of the orchard, this patch co-dominated by *Phalaris arundinacea* and *Elymus repens* includes *Agrostis stolonifera*, *Festuca arundinacea*, *Holcus lanatus*, *Juncus effusus*, *Cirsium arvense*, *Epilobium ciliatum*, and scattered *Rosa nutkana*, *Rosa rubiginosa*, *Rubus bifrons*, and *Rubus laciniatus*.

- ❑ **Plum, CULTIVATED**

South of the tool shed there is a cluster of shrubby yellow plums. The understory includes *Rubus parviflorum*.

- ❑ **PSME – *Pseudotsuga menziesii*** (Douglas fir)

Douglas firs are scattered along the north and east shores of the parcel, surrounded by meadows. On the north shore a few *Abies grandis*, *Acer glabrum*, and *Arbutus menziesii* are intermixed with the firs. The understory is a continuation of adjacent herbaceous or shrubby vegetation, including *Holodiscus discolor*, *Rosa nutkana*, *Symphoricarpos albus*, and grasses *Festuca rubra*, *Bromus hordeaceus*, *Elymus glaucus*, and *Dactylus glomerata*.

- ❑ **PSME THPL - *Pseudotsuga menziesii*—*Thuja plicata*—*Abies grandis*—*Gaultheria shallon*** (Douglas fir-Western redcedar-Grand fir-Salal) FOREST

In addition to its four defining species, this 1.5-acre forest includes native *Acer glabrum*, *Amelanchier alnifolia*, *Tsuga heterophylla*, *Clinopodium douglasii*, *Holodiscus discolor*, *Linna borealis*, *Lonicera ciliosa*, *Lonicera hispidula*, *Mahonia nervosa*, *Malus fusca*, *Prunus emarginata*, *Rosa gymnocarpa*, *Rosa nutkana*, *Rubus ursinus*, *Adenocaulon bicolor*, *Corallorhiza maculata*, *Fragaria vesca*, *Galium aparine*, *Goodyera oblongifolia*, *Hieracium albiflorum*, *Listera cordata*, *Lysimachia latifolia*, *Osmorhiza berteroi*, *Sanicula crassicaulis*, *Festuca occidentalis*, *Melica subulata*, *Pteridium aquilinum*, *Polystichum munitum*, *Polypodium glycyrrhiza*, and locally rare *Vaccinium parvifolium*. There is a small patch of naturalized garlic (*Allium sativum*) and a scattering of *Ilex aquifolium*. Native vegetation is consistent with Chappell's (2006) PSME-THPL-(ABGR)/GASH Association.

- ❑ **RONU – *Rosa nutkana*** (Nootka rose) NATIVE SHRUB

Patches of native *Rosa nutkana* are found throughout the parcel and may include native *Heracleum maximum*, *Polystichum munitum*, *Rubus leucodermis*, *Rubus parviflorus*, *Rubus ursinus*, *Symphoricarpos albus*, and *Urtica dioica*. They also often include non-native *Rosa rubiginosa* and *Rubus bifrons*. Invasive *Conium maculatum* or *Verbascum thapsus* are also present in some of these rose thickets.

- ❑ **RONU HEMA – *Rosa nutkana* – *Heracleum maximum*** (Nootka rose-Cow parsnip)

A unique patch dominated by herbaceous *Heracleum maximum* that includes significant *Rosa nutkana*. Native *Bromus vulgaris*, *Galium aparine*, and *Elymus glaucus* are present as well as non-native *Bromus hordeaceus*.

- ❑ **RONU RORU – *Rosa nutkana*-*Rosa rubiginosa*** (Nootka rose-Sweetbriar)
In some rose thickets, native Nootka rose and non-native Sweetbriar are co-dominant.
- ❑ **RORU – *Rosa rubiginosa*** (Sweetbriar) NON-NATIVE SHRUB
Non-native Sweetbriar dominates numerous thickets scattered throughout this parcel. In some places it is mixed with native *Rosa nutkana* and *Symphoricarpos albus*.
- ❑ **RORU SYAL – *Rosa subiginosa*-*Symphoricarpos albus*** (Sweetbriar-Snowberry)
In these thickets, non-native *Rosa rubiginosa* and native *Symphoricarpos albus* are co-dominant. Non-native grasses such as *Bromus hordeaceus* may also be present.
- ❑ **RUBI – *Rubus bifrons*** (Himalayan blackberry) NON-NATIVE SHRUB
Rubus bifrons thickets on this parcel tend not to include other plant species.
- ❑ **SYAL - *Symphoricarpos albus*** (Snowberry) HERBACEOUS
A few patches are dominated by native *Symphoricarpos albus*. They often include some *Rosa nutkana* or *Rosa rubiginosa* and *Rubus ursinus*, as well as non-native grasses such as *Festuca arundinacea*.
- ❑ **VIMA – *Vinca major*** (Periwinkle) NON-NATIVE SHRUB
There are two distinct patches of periwinkle on this parcel: a small one near the barn and a far larger one between the house and the western boundary. The patch near the barn includes *Rosa nutkana* and grasses (*Festuca arundinacea*, *Elymus glaucus*, *Dactylus glomerata*). The patch near the house includes non-native Boxthorn (*Lycium chinense*), thistles (*Cirsium arvense* and *Cirsium vulgare*), *Brassica rapa*, *Galium aparine*, *Heracleum maximum*, and *Lunaria annua*; non-native grasses (*Festuca arundinacea*, *Bromus sp.*); and the Soft Rush *Juncus effusus*.
- ❑ **VUMY – *Vulpia myuros*** (Rat’s-Tail Fescue) NON-NATIVE HERBACEOUS
Patches dominated by the short grass *Vulpia myuros* may also include *Aira caryphyllea*, *Aira praecox*, *Bromus hordeaceus*, *Elymus glaucus*, *Festuca rubra*; *Cerastium arvense*, *Cerastium glomeratum*, *Galium aparine*, *Lepidium virginicum*, *Vicia hirsuta*, and *Vicia sativa*.

Patches of **mosses and lichens** remain on outcrops of native rock above the north and east shorelines of the property. Many mossy rocks are hidden beneath tall grasses much of the year. Lichens are most abundant on windswept east-facing outcrops, and include scattered pillows of “reindeer moss”. The south coast of Lopez is recognized for its diversity of lichens, as documented recently by bryologist Fred Rhoades. This eco-assessment did not attempt an exhaustive inventory of lichen and moss species; however, dominant species are included in the plant list in Appendix A.

- **Qualitative assessment of plant species diversity**

The herbaceous plant community is dominated by diverse non-native grasses and weeds, of which some species will pose significant challenges for containment and possible reduction. The native herbaceous component includes scattered patches of Hooker's onion, and more scarcely, great camas (*Camassia leichtlinii*) and Chocolate lily, as well as fringes of gumweed and red fescue along the tops of shore bluffs. As a whole, this relic coastal meadow resembles the Iceberg Point landscape (San Juan Islands National Monument) a few miles distant on the same south coast of Lopez Island; but it is weedier and patchier.

Relic gardens and orchards lend interesting plant diversity to this property. The relatively well-maintained orchard still produces apples and pears, while additional apple varieties can be found in the overgrown south block of the original orchard, and plums nearby on the south side of the tool shed. Among the apples, several Rhode Island Greenings and a Russet (most likely a Golden Russet) were identified, both heritage varieties known to have been popular a century ago in the islands. Most trees had little or no fruit set in 2022 due to stormy spring weather, however, so that a more complete autumn varietal survey was not feasible. Many trees had been harvested before our team had an opportunity to identify them, moreover.

Ornamental flowers abound around the foundations of the house, and remains of the fenced garden. They include a profusion of poppies, catmint, oregano, rosemary and lavender, and a dense sea of periwinkle (*Vinca major*) that has spread to other parts of the property. These ornamentals attract and maintain a diverse community of mostly native pollinators, including four species of bumblebees that probably nest beneath rocks or debris in the wooded part of the property; and cellophane bees (*Colletes*) that nest in exposed soils of the beach bluffs.

The woodland segment of the parcel is mainly composed of Douglas fir with some Western red cedar, Grand fir, and Douglas maple, with a shrub layer consisting chiefly of oceanspray, patches of salal, and several relatively rare (on Lopez) red huckleberries. Understory plants include sword fern, bracken fern, sweet cicely, starflower, sanicle, some Alaska onion grass, and moss. The canopy is dense enough to suppress herbaceous colonization of much of the forest floor, which is densely littered with shed branches and needles.

- **Relative amounts of large down/dead woody debris and standing snags**

As noted below, the wooded portion of the property is relatively young. Apart from the area immediately around the artificial pond, where woody debris was incorporated into the banks, large woody debris and standing snags are absent.

- **Tree size/age classes present and reconstruction of stand history**

There are neither large stumps nor charred bark in the woodland. There are red cedars, alders and willow, but none approach the diameter and age of the Douglas firs that dominate the wooded corner of the property. Pencil cores were taken from six of the largest Douglas firs to obtain an estimate of the date of stand establishment, and the relationship of tree size

(circumference chest height) to age in this stand. All trees had remains of old side branches indicating that they had initially grown in a relatively open environment.

All of the trees sampled were roughly two to three feet in diameter. Growth-ring analysis of these Douglas firs indicates that they established 75-85 years ago, which is to say between the mid-1930s and late 1940s—about the time that island farming went into a Depression-era decline from which it has never recovered fully. A contemporary Lopezian that grew up on a neighboring parcel told the eco-assessment team that he can remember that part of the property having a clear view of the shoreline; this would have been in the 1950s.

Indeed, a small earth-walled pond remains in the midst of the wooded area, possibly built as a reservoir for watering livestock; its walls appear to have been bulldozed from local materials and trash. Based on the age of trees growing on the walls, this was likely done in the 1950s.

The woodland therefore appears to be an artifact of changing land use practices in the mid-20th century. By comparison, individual trees (mainly Douglas fir) scattered above the north and east beaches of the property appear to be somewhat older. A sawn tip-up has 138-(160) growth rings, indicating that it established as early as the 1860s; *i.e.*, when Chadwick arrived and presumably influenced the behavior of the Coast Salish reef-netters that continued to be his seasonal neighbors. On the north shore, these somewhat older trees are rooted in black, charcoal-rich anthropogenic soil, confirming that they established on open ground that had been used by Chadwick's predecessors, rather than shrub- or woodland.

The prior state of the property, whether today it is woodland, shrubland or herbaceous, was almost certainly all herbaceous meadow (Chappell's gumweed-camas association)—except where cedar-plank houses, cattail mat lean-tos, and compost middens formed an island of ashy shells after the Head became a reef-net summer workstation some 1,800 years ago. The landscape was kept open by reef-netters and their families, and after the 1920s presumably by sheep; until the 1950s when removal of sheep permitted the colonization of the land by Douglas firs. The built pond and its maintenance of wetter soils eventually facilitated cedars, alders, and willows.

- Tree health issues such as root rot, insect damage, or drought-related die-off

No tree health issues were observed. Despite the extreme heat and drought of recent years, cedars have green crowns and there was no premature browning or loss of leaves evident in August 2022. There was still water in the small artificial pond, indicative of good retention of rainwater in the Whidbey loam that underlays the wooded portion of the parcel; as opposed to the shallower and more porous Haro outcrop domain, which was dominated by dry grasses by late July.

- Indicators of past conditions such as fire-scarred trees or stumps and soils, as well as analysis of historical and aerial photographs

As noted above, the wooded portion of the property is relatively recent, and lacks evidence of logging or clearing fires in tree bark, tree rings, or soils. Exposed soils throughout most of the parcel contain at least a small quantity of fine, unstratified charcoal, consistent with light flashy fires to suppress weedy grasses and shrubs around traditional camas gardens. Similar soils are scattered across the Iceberg Point landscape where they have been associated with camas gardening over many centuries prior to Euro-American colonization.

The earliest map of Watmough Head is the original USCGS topographic sheet (Gilbert, 1889), which shows much of the north part of the property cleared, presumably for gardens and/or sheep. The next data point in time is the 1932 aerial photograph taken by the Royal Canadian Air Force, in which a differently-aligned cleared area appears, including areas used until very recently for gardening and an orchard. LIDAR imagery reveals additional parts of the property that were excavated or leveled, presumably in the 20th century. Taken together, these records show that the landscape was extensively modified, except close to the shore where rows of rocky outcrops break through the thin sandy soil.

- Invasive species identified and located on maps.

The herbaceous and shrub layers of this landscape are dominated by invasive plant species. Fields surrounding the house, outbuildings and orchard are principally non-native Eurasian grasses and forbs, including taxa widely introduced for feeding sheep such as orchard grass, Kentucky bluegrass, and white clover (Appendix A). The diversity of weeds is remarkable, and indicative of more than a century of varied and changing land use.

While the shrub layer includes native snowberry, it is composed overwhelmingly of invasive thorny European Sweetbriar (*Rosa rubiginosa* aka *eglanteria*), and secondarily by Himalayan and Evergreen blackberry (*Rubus armeniacus* and *R. laciniatus*). These tenacious species will continue to be dispersed by birds that feast on their fruits. Strategic intervention would focus on cutting back these shrubs where they are shading or crowding orchard trees and/or native wildflowers; for example, in the currently overgrown portion of the old orchard where there are a number of heritage varieties.

4. Species requiring special attention

- Presence of any Washington Priority Habitats and Species, any other regulated species, and any species of cultural significance.

Priority Habitats present on this property are *Herbaceous Balds* and *Puget Sound Nearshore*. Balds represent roughly two acres (one-fifth) of the parcel. The parcel also has approximately 1,600 feet of shoreline, with nearly an acre of intertidal rocky reef habitat at low tide, and a half-acre of sandy and gravelly beach. The kelp forest that extends from Watmough Head to Boulder Island should also be regarded as priority habitat under the state kelp conservation plan, adopted earlier this year.

Priority species identified on this parcel are mainly associated with the nearshore and include: juvenile Chinook, Chum, and Pink salmon; juvenile Pacific herring and Pacific sand lance; and juvenile English sole; Copper rockfish, Quillback rockfish, Lingcod, and based on local fishing records, probably Black rockfish as well. Marine birds can be observed foraging in the waters surrounding Watmough Head, including Marbled Murrelets (Federal and State Threatened), Rhinoceros auklets, Buffleheads, Goldeneyes, loons, and grebes. Canada geese nest and graze on Boulder Island, making sporadic forays to Watmough Head.

Members of the assessment team have seen harbor seals, Stellers sea lions, orcas, and minke whales in the immediate area. River otters, minks, and raccoons forage in the intertidal zone of Watmough Head, while bats fly the shoreline in search of insect swarms at night. At least two bat species of regional concern were recorded flying over the orchard in summer 2022.

Bats represent the most diverse and abundant native mammal fauna of the San Juan Islands. A total of 2,771 bat flyovers were recorded during this period, of which 62% were identifiable to species at a level of confidence of 90 percent or better. All nine species of bats known to live in the islands were heard more than once.

It is not surprising that there is bat nocturnal activity over Watmough Head in summer; what is noteworthy is the particular mix of species.* Bat flyovers from early August to the beginning of September 2022 (=62 nights) in order of frequency:

<i>Common name</i>	<i>Scientific name</i>	<i>Total flyovers</i>	<i>Mean nightly</i>
California myotis	<i>Myotis californicus</i>	789	13
Yuma myotis	<i>Myotis yumanensis</i>	431	7
Hoary bat	<i>Lasiurus cinereus</i>	310	5
Little Brown bat	<i>Myotis lucifugus</i>	215	4
Long-legged myotis	<i>Myotis volans</i>	194	3
Silver-haired bat	<i>Lasionycteris noctivagans</i>	79	1
Big Brown bat	<i>Eptesicus fuscus</i>	18	<1
Long-eared myotis	<i>Myotis evotis</i>	13	<1
Townsend's Big-eared bat	<i>Corynorhinus townsendii</i>	8	<1
		1718	28

* There are limited previous bat utilization data for the Watmough Bay area, including several evenings' recordings by the authors of the present report, and one night's harp-trapping in the mid-2010s, all focused on the recharged wetland at the foot of Chadwick Hill.

Dominance of the bat fauna by California and Yuma mouse-eared bats is characteristic of the islands, and consistent over six years of recording at five bioacoustics stations maintained by Kwiaht on Lopez, Orcas and San Juan Islands. These small gregarious bats are very adaptable, appear to be comfortable foraging over the islands' beaches and tidelands, and prefer roosts in islanders' homes and barns. Their proportion of the Watmough Head bat assemblage, a bit more than two-thirds, is not unexpected.

The abundance of Hoary and Silver-haired bats is unusual, however. These large bats roost in small extended family groups in tree cavities, eschewing human structures. Hoary bats seem particularly well represented at Watmough Head, which suggests that there are a significant number of suitable tree cavities in the Chadwick-Colville woodlands. The Point Colville unit of the National Monument is especially rich in ancient conifers, several centuries old, ideal for a large tree-roosting bat species.

Another surprise is the relative abundance of Long-legged myotis, a relatively rare bat that is designated a federal Species of Concern in our region, and is the object of USFS conservation plans in Washington. Further investigations are warranted. More common mouse-eared bats can be misidentified by bioacoustics software as *Myotis volans*. Manual review of recordings would be appropriate, although beyond the resources made available for this study. Efforts should also be made to locate and identify mouse-eared bat roosts in the Watmough-Colville area, especially in older homes and sheds.

There is no evidence of a bat maternity roost in the Chadwick house, although occasional day roosts beneath the eaves and shingles.

Yet another important element of the bat fauna is the presence of Townsend's Big-eared bats in the record. Rare in Washington State, and ESA-listed in parts of the United States, this very large and conspicuous bat has two known maternity roosts on Lopez Island totaling 150-200 bats. Individual males are encountered in barns and sheds throughout the island, however. Townsend's bats do not echolocate when they are hunting; instead, they eavesdrop on insect chirps (also in the ultrasound range). In practical terms this means that any recording at all is unusual and represents many more bats than are actually heard.

Mean nightly activity decreased from 45.2 flyovers in July to 14.1 flyovers in mid-August to early September, suggested (as do other bioacoustics records of island bats this year) a steep decline in bat activity in late summer, presumably due to the adverse effect of severe drought on insect swarms.

- Presence of native pollinators and pollinator nesting habitat in relation to areas of native herbaceous vegetation.

Moderate diversity of wild native bees was observed in summer 2022 including four species of bumblebees (*melanopygus*, *mixtus*, *sitkensis*, *vosnesenskii*) as well as individual species of the solitary bees *Agapostemon*, *Andrena*, *Ceratina*, *Lasioglossum*, *Megachile*, and *Colletes*.

We note that 2022 was a challenging year for bees due to wet windy weather persisting into July, by which time the peak flowering season for native wildflowers had passed. Bee diversity may be greater under more “normal” weather conditions. Delayed emergence in 2022 meant that bees were more dependent on the midsummer and late-summer-blooming ornamentals that grow around the Chadwick house. Serious consideration should be given to maintaining, if not expanding, the flower beds around the house as a backup resource for native bees if stormy springs become a norm in the future.

At the same time, we observed a climate-related shift in orchard pollination that has become widespread in the islands: reliance of early-flowering fruits on flies (mainly but not exclusively Syrphidae) rather than bees for pollination. Hoverfly diversity observed at Watmough Head appears to be moderately high with at least a dozen species identified and photographed in three one-hour pedestrian surveys in June and July. For context this represents about 10% of all hoverfly species that have been reported in San Juan County. Extensive untended shrubby and woody areas of the property, especially where some water collects naturally in the spring, are perfect hoverfly breeding habitat.

Nesting habitat is crucial for maintaining native bee populations. Rocks and scruffy piles of small woody debris in the wooded area provide nesting opportunity for bumblebees. Smaller solitary bees are likely to nest in exposed sandy soils, beetle borings in tree trunks, and/or pithy stems of *Rubus* and *Rosa*, which are abundant at Watmough Head.

Sandy soils along the top of seaside bluffs are the typical nesting habitat of cellophane bees, *Colletes*, which we observed often around the house. No digger bees (*Anthophora* spp) were observed, however, although they are also associated with sandy sea bluffs.

The invasive European wool-carder bee *Anthidium manicatum* was observed from August to early October in the flower beds around the house. This aggressively territorial bee has been expanding its range in the islands since the early 2010s but tends to focus on garden varieties of Lamiaceae (Mints) and is unlikely to compete with pollinators of native wildflowers.

- Nearshore species

The high-energy east facing shoreline of the parcel is rich in seaweeds with great diversity. Low subtidal rocks are the least-disturbed part of the property. A preliminary list of species is attached as an Appendix.

Several acres of dense kelp forest extend from Watmough Head to Boulder Island. Anglers (including members of the study team) have found Copper and Quillback rockfishes, Ling Cod, and Kelp Greenling in this habitat, which also attracts rafts of cormorants and gulls.

Since 2009, Kwaht researchers have conducted summer beach seines at the head of the bay, now part of the SJI National Monument. Juvenile Chinook smolts are present in large numbers from May through July each year, with some lingering in the bay as late as October. Most of their diet (79% wet weight) while they are rearing in Watmough Bay consists of young-of-the-

year Pacific Sand Lance and Pacific Herring that also rear in the bay in large aggregations that come and go seasonal from spring to fall. The importance of Watmough Bay to early marine growth and survival of endangered Puget Sound Chinook cannot be overstressed.*

In addition, juvenile Ling Cod and Pacific Cod appear frequently in beach seines conducted by Kwaht each summer, so it is fair to say that the Watmough Bay is a nursery habitat for these economically valuable species as well.

It remains unclear, however, what role the small pocket beaches or rocky reefs at Watmough Head play in the overall ecology of the bay. Narrow and steep with many rocks, the beach on the west side of the Head is challenging to seine. We did succeed in gathering a large sample there in April (Appendix C). The mix of fishes, mainly juveniles, was similar to what we found at the head of the bay, albeit smaller in size on average. The large number of young-of-year Pink and Chum salmon is consistent with our experience of April-May seines in Watmough Bay and elsewhere in the San Juan Islands.

In broad terms, the management of shoreline properties around Watmough Bay will have an impact on the juvenile salmon that spend several weeks feeding there as part of their summer outbound migration. Water quality (including turbidity: Chinook are visual predators) can be compromised by chemical applications, and by ground disturbance that increases silt loads in storm water runoff. The pathway from terrestrial management to forage fish abundance—at least on the small scale of Watmough Bay—is weaker. Herring and sand lance (as well as Pink and Chum salmon smolts) target zooplankton such as crab larvae and juvenile krill, the supply of which is mainly determined by oceanographic forces operating over far greater geographic areas.

In an as-yet unpublished 2020-2021 study, Kwiaht researchers conducted zooplankton tows in upper Watmough Bay, in the mixing zone at the mouth of the bay, and farther outside the bay in Rosario Strait. The question addressed was whether the shallow upper bay produces a distinctive zooplankton community that might attract some fishes. Briefly, some zooplankton taxa (*e.g.* gammarid amphipods, ostracods, larval polychaetes) were indeed most abundant close to the beach. These taxa are significant parts of the herring or sand lance diet, however.†

- Terrestrial wildlife

As noted above, the bat fauna of Watmough Head is especially diverse and includes at least two species (*Myotis volans*, *Corynorhinus townsendii*) that are rare in our region and warrant special attention. Maternity roosts have not been found on the property, but are presumed

* Chamberlin, J., Gamble, M., Connelly, K., Gardner, J., Barsh, R., Keister, J., Beauchamp, D., Schmidt, M., Beckman, B., and Warheit, K. 2017. Assessing early marine growth in juvenile Chinook salmon: factors affecting variability in individual growth in Northern Puget Sound. Seattle: Long Live the Kings.

† R. Barsh, “Foraging strategy, prey preferences and limited competition among forage fishes in the San Juan Islands; implications for Chinook recovery.” Poster presentation, Salish Sea Ecosystem Conference, April 26-28, 2022.

to be located in nearby wooded areas and structures. Restoration of the Chadwick house and barn would be an opportunity to include some bat-friendly roosting spaces.

Black-tailed Columbia deer are conspicuous throughout the parcel, and appeared in more than two hundred photographs, daytime and dark, taken by the motion-activated cameras deployed in the orchard and overlooking the artificial pond in the wooded corner. As a rough metric of deer density, the camera mounted at the pond took 237 pictures over a 30-day period in late summer; deer can be seen in 230 of those pictures; 1-2 deer passed the camera every day. The orchard camera recorded 190 deer (six per day), mainly at night, including a four-point buck, a yearling buck, several does and two fawns. Also recorded were raccoons (four transits, roughly a week apart). Racoons, minks, and otters were identified from scat, trails, and some skeletal remains.

Townsend's voles (*Microtus townsendii*) are abundant throughout herbaceous habitats at Watmough Head, leaving extensive "highways" connecting their burrows. Voles collect and cache winter stores of seeds, bulbs and corms and help disperse native wildflowers, notably Chocolate Lily and brodiaeas. They also attract raptors such as Red-tailed hawks, Cooper's hawks, and Great Horned owls. Voles are abundant throughout public lands from Colville to Iceberg Point, mainly in relic coastal meadows with mixtures of wildflowers and grasses.*

Avian fauna seen and heard, or recorded by our bioacoustics stations in summer 2022 were diverse and reflected the complex mosaic landscape at Watmough Head. Birds identified in field surveys or acoustic recordings are listed in **Appendix D** with indications of their habitat associations. While there is no evidence that bird species rely particularly on the Watmough Head property, the larger Watmough Bay-Chadwick Hill area is notable for nesting Peregrine falcons (on the south face of Chadwick) and as a refuge for migratory waterfowl and seabirds. Nearby Boulder Island attracts large numbers of gulls and geese in summer, and provides at least some nesting habitat for these birds. Some 16 years of Kwiaht beach-seining in the bay have shown that it hosts vast schools of Pacific Sand Lance and juvenile Pacific Herring every spring and summer that feed visiting nesting alcid seabirds such as Marbled Murrelets and Rhinoceros Auklets, as well as juvenile Chinook and other predators.

Wandering terrestrial garter snakes (*Thamnophis elegans vagans*) are unusually abundant on this property, especially in early summer. More than a dozen were encountered during the assessment team's June and early July visits; none were observed after the access lane was mown in July, which may be a seasonal or habitat issue. Snakes ranged widely in size and age. This species is widespread in the islands and often seen swimming in wetlands and ponds hunting fish, frogs and large aquatic insects. Kwiaht herpetologist Christian Oldham recently

* A single morphometric analysis of fewer than ten voles from San Juan County 75 years ago concluded that they comprised a distinct subspecies, *Microtus townsendii pugetti* (Dahquist). A larger sample of island voles collected and measured in 2010 by G. Mottet found no significant difference between the island and mainland populations. Genetic comparisons have not yet been made. Washington State continues to classify island voles as a distinct and "moderately" threatened subspecies, unsupported by extant evidence.

confirmed reports that these snakes eagerly pursue fish in saltwater as well; using captive snakes given access to tanks with nearshore fishes. It is plausible that this species is attracted to Watmough Head by access to its beaches and tidepools.

We encountered both Anise and Tiger Swallowtails (*Papilio zelicaon* and *P. rutulus*), reflecting the contributions of weedy herbaceous areas and shrubby willows to the Lepidopteran fauna. In early September, dozens of Woodland Skippers (*Ochlodes sylvanoides*) were seen visiting the garden and flowerbeds, reflecting the role of grasses as larval food. Not surprisingly, the introduced Cabbage White butterfly (*Pieris rapae*) was also often observed in the garden and flowerbeds throughout the summer. A single Mylitta Crescent (*Phyciodes mylitta*) was found, representing the presence of thistles in the landscape. A large number of Noctuid cutworm moths (*Euxoa spp*, prob. *E. infausta*) were observed in October on the last remaining flower beds around the house.

Interesting but not unusual invertebrates encountered on the property included the native side-band snail *Monadenia fidelis*, which climbs trees to feast on algae and lichens; and the red-backed jumping spider (*Phidippus johnsoni*). The open field and meadows are patrolled regularly by numerous dragonflies including the Blue Dasher (*Pachydiplax longipennis*) that undoubtedly rely on the artificial pond in the woodland for their early aquatic life stages.

Seven-spot ladybird beetles (*Coccinella septempunctata*) are abundant around the formerly-fenced garden; they were introduced from Europe about 50 years ago, and are widespread in our area. Native ladybird beetles are present at Iceberg Point nearby, but none were seen at Watmough Head in the course of this assessment.

Recommendations

1. Highest value, access and use

Small patches of iconic native wildflowers remain along the shoreline, despite being engulfed in weedy Eurasian grasses; they are scenic, and can be maintained by hand-clearing some of the grasses without soil disturbance. Listed species are absent. The highest value of this land, apart from its scenic appeal, is its cultural remains and their stories, pre- and post-Contact. Very few sites in San Juan County boast visible evidence of thousands of years of continuous occupation. Taking advantage of the opportunity thus provided, while respecting the fragile cultural “fingerprints” that remain on the property, suggests limiting access to moderate foot traffic and well-marked trails. The Chadwick house may require additional measures, whether or not it is restored for interpretive displays or other uses.

2. Value to the larger landscape

Watmough Head is part of a larger Watmough Bay ecosystem that includes ancient conifers at Point Colville, extensive wetlands, and cliffs and caves on Chadwick Hill, as well as the kelp forest that connects the Head to Boulder Island. Management decisions should take account of the contributions of Watmough Head to this larger landscape, including its orchard, flower meadows, ornamental garden and fields. Eagles, vultures and Peregrine falcons on Chadwick, Townsend’s and Hoary bats presumably roosting at Colville, alcid seabirds foraging in the bay, and rockfishes in the kelp forest, utilize habitats located at, or affected by Watmough Head. In particular, if extensive clearing and/or replanting is carried out at Watmough Head, special attention should be given to physical and chemical impacts of this activity on the nearshore.

3. Cultural resources consultation

In the light of the property’s cultural significance, consultations with descendants of the indigenous families that lived and fished there most recently (from Chadwick’s lifetime to the 1920s) are imperative for respectful management and accurate interpretative programs. An interpretive program developed cooperatively with the families that long occupied the site would be distinctively rich and help bring indigenous and non-indigenous islanders together. Consultations relating to interpretation and public education should be separate from the notifications and approvals required for any disturbance (or exploration) of pre-Contact archaeological sites, which route through WA-DAHP and Tribal THPOs rather than descendant families and knowledge-keepers.

4. Preserve heritage orchard trees

Among the many pre- and post-Contact cultural remains at the property are fruit trees that represent heritage varieties planted 75-100 years ago. Apples and pears have been relatively well maintained in the orchard; plums were also found abandoned near the toolshed, among them a yellow freestone variety that would have been valued for canning and drying before the “prune craze” of the early 20th century. These trees form part of a compelling, distinctly

island history of Native American women that helped plant and tend the state's earliest fruit orchards, such as the Cayou orchard at Deer Harbor (ca. 1868) and Brown orchard on Lopez (ca. 1875), which both remain on private lands. It is not implausible that Chadwick's S'Klallam wife maintained the first trees at Watmough Head; she was related to the Cayou and Brown families. Apples, pears and plums on the property are arguably the most important plants to protect, maintain, and interpret for visitors.

5. Maintain habitat for wild native bees

Native wildflowers on the coastal margins of the property appear to be pollinated principally by solitary ground-nesting bees established in the surrounding shallow soils, such as *Andrena* and *Agapostemon*. This pattern can also be seen at Iceberg Point, and at American Camp on San Juan Island. Early spring storms limit pollinator flight distance along exposed shorelines. Bumblebees with their long flight range may visit, adding significantly to pollination services, but are more sensitive to weather. Protecting ground-nesting bees is a good reason to avoid mowing or trails near patches of native wildflowers along the east shore of the property.

Bee density—in particular bumblebees—is considerable around the ornamental flowers that ring the house and form patches within the remains of the fenced garden. The scruffy woods provide nesting habitat for bumblebees, and ornamentals are undoubtedly most of what they eat; we observed relatively few on native wildflowers along the bluff edge, or on weeds such as the widespread *Hypochaeris* in grassy fields east of the house and garden. If the Salish Sea region continues to experience extended summer droughts, ornamental flower beds around the Chadwick house will be an important oasis for native bees, especially in late summer after native wildflowers have all gone dormant.

6. Weed containment and reduction

The Watmough Head property is exceedingly weedy. Three weedy communities are present: extensive fields of Eurasian tall grasses with scattered herbaceous weeds such as thistles and Hairy Cat's Ear (*Hypochaeris radicata*); dense thickets of shrubby Sweetbriar and blackberries; and a dense bank of Periwinkle (*Vinca*) on the north side of the Chadwick house. A particular concern is Hedgeparsley (*Torilis arvensis*), present in fields around the garden and orchard at Watmough Head but not yet widespread on Lopez Island. Its sticky burs have earned it the nickname "sock-destroyer". It spreads rapidly on clothing. Consideration should be given to warning visitors to check cuffs, leggings, socks and shoes for burs before leaving the property.

Mowing is advisable for any fields that will be used by visitors, to prevent weeds from fruiting and reduce the likelihood of weed seeds leaving the property on visitors' clothing. However, mowing should be avoided in undisturbed parts of the property, where ground-nesting birds and garter snakes would likely be injured.

Shrubby thickets of non-native plants can be cut back by hand, avoiding ground disturbance, where they are encroaching upon relatively well reserved coastal wildflower meadows, or on the surviving but overgrown portions of the orchard. Manual shrub removal will realistically

need to be focused where established native plants and historic orchard trees can be saved. Chemical treatment should be avoided because of the proximity of weedy areas to shorelines and nearshore habitat.

7. Wildfire risk and preparedness

Dominant Eurasian grasses covering most of the property represent a significant fire risk in droughty summers, and frequent public visitors will increase the likelihood of ignitions. This is reason to restrict public access to well-marked trails through areas that can be mowed (or hand-cleared of encroaching shrubs) to separate potential fuels from people. Needless to say, camping and fires of any kind, as well as excavations for fires or latrines, should be prohibited. Signage advising visitors not to smoke because of the risk of wildfire are recommended.

Use of prescribed fire in this landscape—although it may be tempting for treating extensive, persistent occurrences of invasive grasses and shrubs—is strongly discouraged. The existing weedy seed bank around the property is such that any soil exposed by burning will quickly be recolonized by the same weedy species; and any small relic populations of native wildflowers may be lost. The Eurasian grasses that currently dominate the fields at Watmough Head are pyrophilic, moreover; they are adapted to prairie fires, and are more likely than other plants to survive a fire.

8. Research and monitoring

Watmough Head offers an excellent vantage for monitoring marine birds and mammals that congregate in the adjacent kelp forest, on Boulder Island, and in the waters of Rosario Strait. Acoustic recorders are inconspicuous, do not disturb wildlife, and require (at most) a monthly battery check. The instruments used to prepare this report have internal microphones and plug-in hydrophones. Cluster-analysis software makes use of machine learning to filter data autonomously, once “classifiers” have been validated by knowledgeable human reviewers.

The property also represents an archive of several thousand years of human activity assuming that at least some of the accumulated cultural deposits around the Chadwick house remain intact. Accessing this record would complement excavations conducted at nearby 45SJ280 in 1968 and 2004, but would necessarily require the approval and participation of descendants and Tribal authorities.

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APPENDIX A
Terrestrial plant list, Watmough Head

Prepared for Kwiaht by Madrona Murphy

Plants marked with an asterisk (*) are considered to be non-native on Lopez Island

Trees and shrubs		
Apocynaceae	<i>Vinca major</i>	Periwinkle*
Aquifoliaceae	<i>Ilex aquifolium</i>	English holly*
Berberidaceae	<i>Mahonia nervosa</i>	Low Oregon grape
Caprifoliaceae	<i>Linnaea borealis</i>	Twinflower
	<i>Lonicera ciliosa</i>	Trumpet honeysuckle
	<i>Lonicera hispidula</i>	Pink honeysuckle
	<i>Symphoricarpos albus</i>	Snowberry
Convolvulariaceae	<i>Convolvus arvensis</i>	Field bindweed*
Cupraceae	<i>Thuja plicata</i>	Western red cedar
Eleagnaceae	<i>Shepherdia canadensis</i>	Soapberry
Ericaceae	<i>Arbutus menziesii</i>	Pacific madrona
	<i>Gaultheria shallon</i>	Salal
	<i>Vaccinium parvifolium</i>	Red huckleberry
Grossulariaceae	<i>Ribes divaricatum</i>	Coast black gooseberry
Lamiaceae	<i>Lavendula angustifolia</i>	English lavender*
	<i>Salvia rosmarinus</i>	Rosemary*
Pinaceae	<i>Abies grandis</i>	Grand fir
	<i>Pseudotsuga menziesii</i>	Douglas-fir
	<i>Tsuga heterophylla</i>	Western hemlock
Rosaceae	<i>Amelanchier alnifolia</i>	Serviceberry
	<i>Crataegus monogyna</i>	English hawthorn*
	<i>Holodiscus discolor</i>	Oceanspray
	<i>Malus fusca</i>	Pacific crabapple
	<i>Malus pumilla</i>	Orchard apple*
	<i>Malus pumilla</i> "Rhode Island Greening"	Rhode Island Greening*
	<i>Prunus domestica</i>	Orchard plum*
	<i>Prunus emarginata</i>	Bitter cherry
	<i>Pyrus communis</i>	Orchard pear*
	<i>Rosa rubiginosa</i>	Sweetbriar*
	<i>Rosa gymnocarpa</i>	Baldhip rose

Rosaceae	<i>Rosa nutkana</i>	Nootka rose
	<i>Rubus bifrons</i>	Himalaya blackberry*
	<i>Rubus laciniatus</i>	Evergreen blackberry*
	<i>Rubus leucodermis</i>	Blackcap
	<i>Rubus parviflorus</i>	Thimbleberry
	<i>Rubus ursinus</i>	Trailing blackberry
Sapindaceae	<i>Acer glabrum</i>	Douglas maple
	<i>Aesculus hippocastanum</i>	Horse chestnut*
Solanaceae	<i>Lycium chinense</i>	Goji or boxthorn*
Ferns and Fern Allies		
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	Bracken fern
Dryopteridaceae	<i>Polystichum munitum</i>	Sword fern
Polypodiaceae	<i>Polypodium glycyrrhiza</i>	Licorice fern
Selaginaceae	<i>Selaginella wallacei</i>	Wallace's selaginella
Forbs		
Amaranthaceae	<i>Beta vulgaris</i>	Beet*
	<i>Chenopodium album</i>	Lamb's quarters*
Amaryllidaceae	<i>Allium acuminatum</i>	Hooker's onion
	<i>Allium sativum</i>	Garlic*
	<i>Allium tuberosum</i>	Garlic chives*
	<i>Narcissus pseudonarcissus</i>	Daffodil*
Apiaceae	<i>Conium maculatum</i>	Poison hemlock*
	<i>Foeniculum vulgare</i>	Fennel*
	<i>Heracleum maximum</i>	Cow parsnip
	<i>Osmorhiza berteroi</i>	Sweet cicely
	<i>Sanicula crassicaulis</i>	Pacific sanicle
	<i>Torilis arvensis</i>	Field hedge parsley*
Asparagaceae	<i>Asparagus officinalis</i>	Garden asparagus*
	<i>Brodiaea coronaria</i>	Harvest brodiaea
	<i>Camassia leitchlinii</i>	Great camas
	<i>Hyacinthoides x massartiana</i>	Spanish bluebells*
	<i>Ornithogalum umbellatum</i>	Star-of-Bethlehem*
	<i>Triteleia hyacinthina</i>	Fool's onion

Asteraceae	<i>Achillea millefolium</i>	Yarrow
	<i>Adenocaulon bicolor</i>	Pathfinder
	<i>Bellis perrenis</i>	English daisy*
	<i>Centaurea cyanus</i>	Bachelor's buttons*
	<i>Cirsium arvense</i>	Canada thistle*
	<i>Cirsium vulgare</i>	Bull thistle
	<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis*
	<i>Crepis capillaris</i>	Smooth hawksbeard*
	<i>Cynara cardunculus</i>	Artichoke*
	<i>Grindelia stricta</i>	Puget Sound gumweed
	<i>Hieracium albiflorum</i>	White hawkweed
	<i>Hypochaeris radicata</i>	Hairy-cat's-ear*
	<i>Lapsana communis</i>	Nipplewort*
	<i>Matricaria matricarioides</i>	Pineapple weed
	<i>Mycelis muralis</i>	Wall lettuce*
	<i>Sonchus asper</i>	Prickly sow thistle*
	<i>Taraxacum officinale</i>	Dandelion*
Boraginaceae	<i>Myosotis discolor</i>	Yellow-and-blue forget-me-not*
	<i>Myosotis sp.</i>	Forget-me-not*
	<i>Symphytum officinale</i>	Comfrey*
Brassicaceae	<i>Brassica rapa</i>	Field mustard*
	<i>Brassica oleraceae</i>	Kale*
	<i>Capsella bursa-pastoris</i>	Shepherd's purse*
	<i>Iberis sempervirens</i>	Candytuft*
	<i>Lepidium virginicum</i>	Peppergrass
	<i>Lunaria annua</i>	Moneyplant*
	<i>Sisymbrium officinale</i>	Hedge mustard*
Caryophyllaceae	<i>Thlaspi arvense</i>	Field pennycress*
	<i>Cerastium arvense</i>	Field chickweed
	<i>Cerastium glomeratum</i>	Mouse chickweed*
	<i>Cerastium tomentosum</i>	Snow-in-Summer*
	<i>Sagina maxima</i>	Pearlwort
	<i>Sperularia macrotheca</i>	Beach sandspurry
	<i>Stellaria media</i>	Chickweed*

Crassulaceae	<i>Sedum lanceolatum</i>	Narrow leaved stonecrop
	<i>Sedum spathulifolium</i>	Broad leaved stonecrop
Euphorbiaceae	<i>Euphorbia peplus</i>	Petty spurge*
Fabaceae	<i>Lathyrus japonicus</i>	Beach pea
	<i>Trifolium dubium</i>	Least hop-clover*
	<i>Trifolium oliganthum</i>	Few-flowered clover
	<i>Trifolium repens</i>	White clover*
	<i>Trifolium subterraneum</i>	Subterranean clover*
	<i>Trifolium willdenovii</i>	Tomcat clover
	<i>Vicia americana</i>	American vetch
	<i>Vicia hirsuta</i>	Hairy vetch*
	<i>Vicia nigricans</i>	Giant vetch
	<i>Vicia sativa</i>	Common vetch*
Geraniaceae	<i>Erodium cicutarium</i>	Crane's bill*
	<i>Geranium dissectum</i>	Cut-leaved geranium*
	<i>Geranium molle</i>	Dovefoot geranium*
Iridaceae	<i>Crocasmia aurea</i>	Crocasmia*
	<i>Iris sp.</i>	Iris*
Lamiaceae	<i>Lamium purpureum</i>	Red deadnettle*
	<i>Marrubium vulgare</i>	Horehound*
	<i>Nepeta sp.</i>	Catmint*
	<i>Origanum vulgare</i>	Oregano*
	<i>Salvia officinalis</i>	Sage*
	<i>Clinopodium douglasii</i>	Yerba buena
Liliaceae	<i>Fritillaria affinis</i>	Chocolate lily
Linaceae	<i>Linum usitatissimum</i>	Flax*
Malvaceae	<i>Alcea rosea</i>	Hollyhock*
	<i>Malva neglecta</i>	Cheeses*
Montiaceae	<i>Claytonia exigua</i>	Pale springbeauty
	<i>Claytonia perfoliata</i>	Miner's lettuce
	<i>Claytonia rubra</i>	Red montia
Orchidaceae	<i>Corallorhiza maculata</i>	Spotted coralroot
	<i>Goodyera oblongifolia</i>	Rattlesnake plantain
	<i>Listera cordata</i>	Twayblade
Onagraceae	<i>Epilobium ciliatum</i>	Hairy willow-herb

Orobanchaceae	<i>Triphysaria pusilla</i>	Dwarf owl clover
Papaveraceae	<i>Eschscholtzia californica</i>	California poppy*
	<i>Papaver rhoeas</i>	Field poppy*
	<i>Papaver somniferum</i>	Opium poppy
Plantaginaceae	<i>Antirrhinum majus</i>	Snapdragon*
	<i>Digitalis purpurea</i>	Foxglove*
	<i>Plantago elongata</i>	Slender plantain
	<i>Plantago lanceolata</i>	Narrow-leaved plantain*
	<i>Plantago maritima</i>	Sea plantain
	<i>Veronica serpyllifolia</i>	Thyme-leaved speedwell*
Polygonaceae	<i>Rheum raphonticum</i>	Rhubarb*
	<i>Rumex acetosella</i>	Sheep sorrel*
	<i>Rumex crispus</i>	Curly dock*
Ranunculaceae	<i>Aquilegia vulgaris</i>	Columbine*
	<i>Nigella damascena</i>	Love-in-a-mist*
	<i>Ranunculus occidentalis</i>	Western buttercup
	<i>Ranunculus repens</i>	Creeping buttercup*
Rosaceae	<i>Alchemilla arvensis</i>	Western lady's mantle
	<i>Fragaria chiloensis</i>	Beach strawberry
	<i>Fragaria vesca</i>	Woodland strawberry
Rubiaceae	<i>Galium aparine</i>	Catchweed bedstraw
Saxifragaceae	<i>Heuchera micrantha</i>	Small flowered alumroot
	<i>Lithophragma parviflorum</i>	Small-flowered prairie-star
Scrophulariaceae	<i>Verbascum thapsus</i>	Mullein*
Urticaceae	<i>Urtica dioica</i>	Stinging nettle
Valerianaceae	<i>Centranthus ruber</i>	Jupiter's beard*
<u>Graminoids (grasses, sedges, rushes)</u>		
Cyperaceae	<i>Carex obnupta</i>	Slough sedge
Juncaceae	<i>Juncus balticus</i>	Baltic rush
	<i>Juncus effusus</i>	Soft rush
	<i>Luzula multiflora</i>	Field woodrush
Poaceae	<i>Agrostis stolonifera</i>	Spreading bentgrass*
	<i>Aira caryphyllea</i>	Silver hairgrass*
	<i>Aira praecox</i>	Little hairgrass*

Poaceae	<i>Bromus diandrus</i>	Rip-gut brome*
	<i>Bromus hordeaceus</i>	Soft brome*
	<i>Bromus sitchensis</i>	Alaska brome
	<i>Dactylis glomerata</i>	Orchard grass*
	<i>Danthonia californica</i>	California oatgrass
	<i>Elymus glaucus</i>	Blue wildrye
	<i>Elymus repens</i>	Creeping wildrye, Quackgrass
	<i>Festuca arundinacea</i>	Tall fescue*
	<i>Festuca occidentalis</i>	Western fescue
	<i>Festuca rubra</i>	Red fescue
	<i>Holcus lanatus</i>	Velvet grass*
	<i>Hordium marinum</i>	Mediterranean barley*
	<i>Lolium multiflorum</i>	Italian ryegrass*
	<i>Lolium perenne</i>	Perennial rye*
	<i>Melica subulata</i>	Alaska oniongrass
	<i>Phalaris arundinacea</i>	Canary reed grass*
	<i>Poa pratensis</i>	Kentucky bluegrass*
	<i>Polypogon monspeliensis</i>	Rabbitfoot*
	<i>Vulpia myuros</i>	Rat-tail fescue*

Mosses and Lichens		
Bryophyta (mosses)	<i>Bartramia pomiformis</i>	Apple moss
	<i>Dicranoweisia cirrata</i>	Curly Thatch moss
	<i>Oligotrichum aligerum</i>	Small Hair moss
	<i>Polytrichum proliferum</i>	Awned Haircap moss
	<i>Racomitrium canescens</i>	Roadside Rock moss
Lichens	<i>Cladonia portentosa</i> var. <i>pacifica</i>	Reindeer moss
	<i>Lecanora</i> (aka <i>Glaucomaria</i>) <i>rupicola</i>	White-rim lichen
	<i>Physcia caesia</i>	Blue-gray Rosette lichen
	<i>Xanthoparmelia cumberlandia</i>	Rock-shield lichen
	<i>Xanthoria candelaria</i>	Sunburst lichen

APPENDIX B

Seaweeds of the rocky intertidal zone, Watmough Head

Prepared for Kwiaht by Brett Jensen and Madrona Murphy

Plants marked with an asterisk (*) are considered to be non-native in the Salish Sea

	Common name	Coast Salish cultural use	Currently harvested
<i>Alaria marginata</i>	Winged kelp		X
<i>Callophyllis edentata/crenulata</i>			
<i>Chondracanthus exasperatus</i>	Turkish towel		X
<i>Corallina spp</i>	Coral seaweed		
<i>Costaria costata</i>	Five-rib kelp		
<i>Cymathaere triplicata</i>	Triple-rib kelp		
<i>Egregia menziesii</i>	Feather-boia kelp		
<i>Fucus distichus</i>	Rockweed	X	X
<i>Leathesia marina</i>	Sea cauliflower		
<i>Mazzaella splendens</i>	Rainbow leaf kelp		
<i>Nereocystis luetkeana</i>	Bull kelp	X	X
<i>Pyropia perforata</i>	Purple laver	X	X
<i>Sargassum muticum</i>	Japanese wire weed*		
<i>Ulva intestinalus</i>	Green-string lettuce		
<i>Ulva lactuca</i>	Sea lettuce		X

APPENDIX C

Beach seine results, Watmough Head north beach, April 27, 2022

<i>Common name</i>	<i>Scientific name</i>	<i>Age class</i>	<i>Number</i>
Chum salmon Pink salmon	<i>Oncorhynchus keta</i> <i>Oncorhynchus gorbuscha</i>	Young-of-Year	321
Lingcod	<i>Ophiodon elongatus</i>	Young-of-Year	169
White-spotted greenling	<i>Hexagrammos stelleri</i>	Young-of-Year	158
Staghorn sculpin	<i>Leptocottus armatus</i>	YOY, 1+, 2+	149
Buffalo sculpin	<i>Enophrys bison</i>	1+	1
Kelp greenling	<i>Hexagrammos decagrammus</i>	1+	1
Alaska Pollock	<i>Gadus chalcogrammus</i>	Young-of-Year	1
Pacific sandfish	<i>Trichodon trichodon</i>	Young-of-Year	1
Starry flounder	<i>Platichthys stellatus</i>	1+	1

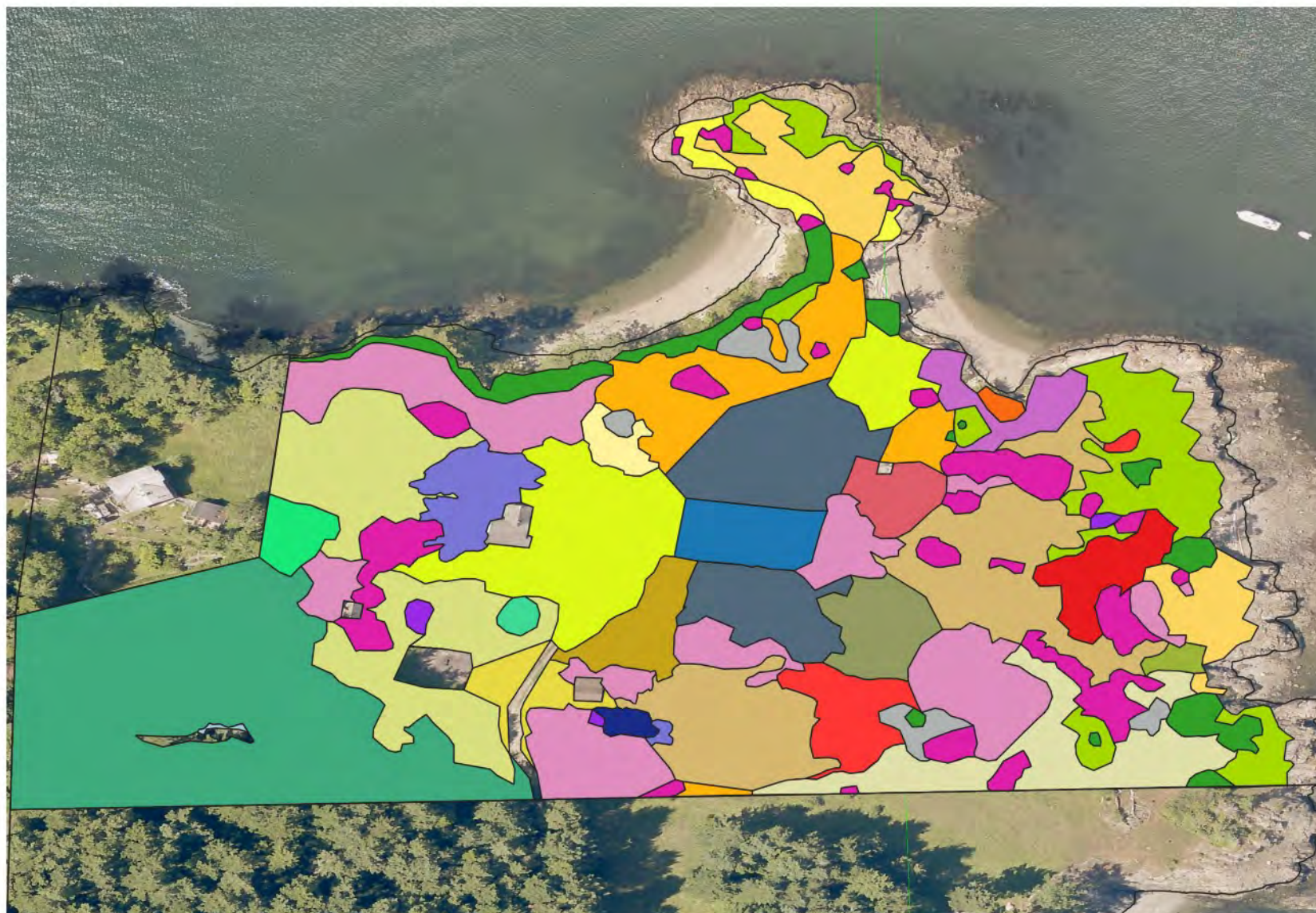
APPENDIX D

Summer birds at Watmough Head*

	<i>Habitat use at Watmough Head</i>
Canada Goose	Coastal meadow; nest on nearby Boulder Island
Great Blue Heron	Beach
Black Oystercatcher	Rocky shoreline
Heermann's Gull	Rocky shoreline; congregate on Boulder Island
Glaucous-winged Gull	Rocky shoreline
Ring-billed Gull	Rocky shoreline
Double-crested Cormorant	Rocky shoreline; congregate on Boulder Island
Bald Eagle	Foraging
Red-tailed Hawk	Hunting
Peregrine Falcon	Hunting; observed to nest on nearby Chadwick Hill
Turkey Vulture	Flyovers; observed to nest on nearby Chadwick Hill
Common Raven	Woodland
Eurasian Collared-Dove	Shrub thickets
Pacific-slope Flycatcher	Woodland
Violet-green Swallow	Orchard, coastal meadow
Anna's Hummingbird	Garden, house flowerbed
Chestnut-backed Chickadee	Conifer woodland
Bushtit	Shrub thickets
House Wren	Orchard, garden
Pacific Wren	Shrubs
American Robin	Orchard, garden, grass/field
European Starling	Garden, grass/field
Spotted Towhee	Garden, grass/field
Dark-eyed Junco	Garden, grass/field
House Finch	Orchard, garden, grass/field
Purple Finch	Orchard, shrub thickets
American Goldfinch	Orchard, garden, grass/field
White-crowned Sparrow	Coastal meadow; ground-nesting around shrubs
Song Sparrow	Shrub thickets
Bullock's Oriole	Orchard
Brown-headed Cowbird	Orchard
Yellow-rumped Warbler	Shrub thickets
Pileated Woodpecker	Woodland
Northern flicker	Woodland
Red-breasted Sapsucker	Orchard

*With the invaluable assistance of Beth St. George

Map 1: Plant communities, Watmough Bay Preserve Addition



Source: Field surveys July-October 2022

0 25 50 m



Watmough Bay Preserve Addition Ecological Assessment 2022

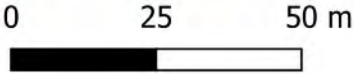


- ACGL
- AEHI
- AGST
- Bald
- BRDI
- BRHO
- BRSI
- CAOB
- ELGL DAGL
- FEAR
- FEAR DAGL
- FEAR ELGL DAGL
- FEAR VUMY
- FERU
- Garden
- HODI
- JUBA
- Orchard
- PHAR
- Plum
- PSME
- PSME THPL
- RONU
- RONU HEMA
- RONU RORU
- RORU
- RORU SYAL
- RUBI
- SYAL
- VIMA
- VUMY

Map 2: Anthropogenic substrates, Watmough Bay Preserve Addition



Source: Field surveys of soil exposures 2022



Watmough Bay Preserve Addition Ecological Assessment 2022



- Cultural materials
- Charcoal, ash only
 - Charcoal, ashy shells
 - Charcoal, scattered patches of ashy shell

Map 3: Historical land use (1889-1932), Watmough Bay Preserve Addition



Source: Historical topographic surveys and aerial photos

0 25 50 m

Watmough Bay Preserve Addition Ecological Assessment 2022



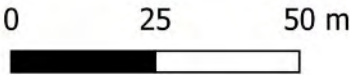
Historical Features

- Cleared field and garden (Gilbert 1889)
- Garden and orchard (RCAF 1932)

Map 4: Landform modifications revealed by LIDAR imaging



Source: San Juan County LIDAR imagery 2009



Watmough Bay Preserve Addition Ecological Assessment 2022



- Landform modifications
- Excavated areas
 - Leveled areas

Watmough Bay Preserve Addition: WILDLIFE images



Columbian deer buck in orchard (Meidase trail camera #1)



White-Crowned Sparrow in overgrown orchard (R. Barsh photo)



Juvenile wandering terrestrial garter snake (R. Barsh photo)



Colletes "cellophane bee" in the garden (R. Barsh photo)

Watmough Bay Preserve Addition: PLANTS & LICHEN images



Great Camas (*C. leichtlinii*) patch (R. Barsh photo)



Unidentified russet variety, overgrown orchard (R. Barsh photo)



Field Chickweed in rock terrace (R. Barsh photo)



Xanthoria and *Xanthoparmelia* on rock terrace (R. Barsh photo)