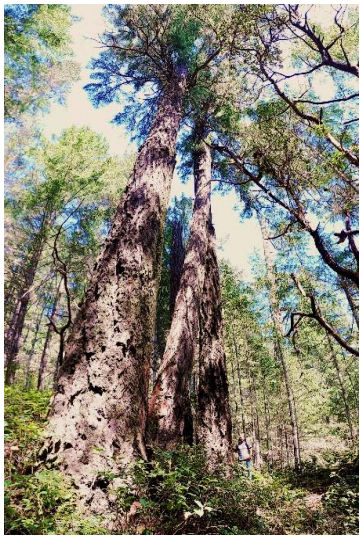
TERRESTRIAL ECOSYSTEM MAPPING SITE SERIES DESCRIPTIONS *of the* HOMER M^{C}CREA COVENANT

T'Sou-ke Territories (Sooke, Vancouver Island)



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to

Habitat Acquisition Trust

July 2018

ACKNOWLEDGEMENTS

This project was carried out in T'Sou-ke First Nation territories and was with permission from covenant owners Patti Homer and son Paul; with thanks to Dr. Val Schaefer for all his guidance; Dr. Andy Mackinnon for answering odd questions; Kem Luther and Moralea Milne during the Habitat Acquisition Trust BioBlitz; Rachel Grigg, Jack Ucciferi for their company; Jess Boquist for being the best soil pit sounding board; Catherine and Cal Keogan for their patience; and *most especially* HAT's Habitat Management Coordinator and fellow Californian, Wendy Tyrrell.

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SUMMARY AND APPROACH

This field study initially sought to address accessible priority sites within the Homer McCrea covenant in the form of a restoration site assessment and invasive plant species management strategy for future covenant management plans actioned by the collective of covenant stewards, including the Habitat Acquisition Trust (HAT). Broad management goals for the Homer McCrea covenant are "maintaining the trail through the property and managing invasive species" (The Land Conservancy, 2010).

***Figure 1**: Facing west, overlooking the Sooke River draw, toward the Homer McCrea covenant area, seen from South Larkspur—elevation 260m above sea level. (Image: Britton Jacob-Schram)*

HAT identified the following components to be included in the invasive plant species management strategy (IPSMS):

- Site assessment and history;
- Overall condition or status of invasive plants in the most sensitive areas (at the minimum);
- Priority site(s) to target;
- Best Management Practices (BMPs) for each invasive plant targeted for removal;
- Workplan, including budget needs for events, disposal recommendations, and any funds needed for supplemental planting of native species or seeding;
- Monitoring plan for ensuring the strategy is successful and allowing for adaptive management if not.

However, after reviewing the 2010 draft baseline report and initial site visits to the covenant in fall 2017 and spring 2018, HAT and the researcher determined the scope of the project instead should be to provide stakeholders with more fulsome detail to the 2010 draft baseline report—to ground-truth assessments included in the baseline report—as well as identify and propose corrections to deficiencies or gaps in the surveyed information from 2010.

Deliverables for stakeholder-directed ER390 research were altered in early 2018 to the following, applying basic field surveying methods:

- Take part in a BioBlitz of the covenant area, with HAT staff and managers and expert local naturalists Kem Luther and Moralea Milne, noting species or ecosystems of significance (May 2018);
- Deliver to HAT a compendium of recommendations, areas of significance, noting potential invasive plant species management strategies (spreadsheet provided to HAT, June 2018);
- Derive site series for the eight polygons included in the draft baseline (June-July 2018);
- Provide HAT with separate document of geographic coordinates for eight soil pits (July 2018);
- Provide HAT with a basic Terrestrial Ecosystem Map (TEM) using the 2010 draft baseline report's final polygon map as a base layer (August 2018);
- Identify deficiencies in data or mapping information in draft baseline report (August 2018).

SITE SERIES AND SITE DESCRIPTIONS

TEM Map Code	Location within Covenant Area	CWHxm Site Series
DSgc5sC	P1 (2010 baseline) 48.42317°N, 123.71753°W 10U 5363584N / 446915E	03 – FdHw-Salal

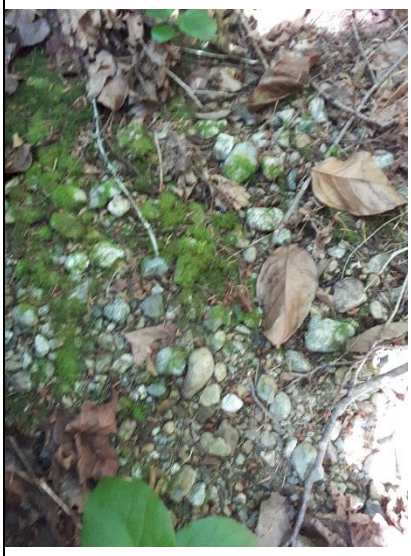

***Figure 2-4, left to right**: Ephemeral streambed 15 meters south of P1 soil pit; fire-scarred old-growth Pseudotsuga menziesii, 50m southwest of P1 soil pit; humic layer at P1 soil pit. (Images: Britton Jacob-Schram)*

SITE DESCRIPTION

Site series is lower slope (meso slope position) on a small bench site, downslope (east) of more mounded terrain; terrain was smooth to moderate, level. Site precedes a sheer fall east toward Sooke River. L-layer largely comprised of needles and herb-layer detritus; mycelial layer present. Salal-dominated microsite, with less infrequent *Mahonia nervosa* (dull Oregon grape), and *Vaccinium ovatum* (evergreen huckleberry) in understory; noted immature yews within 10m radius. Overstorey includes established *Tsuga heterophylla* (western hemlock), *Thuja plicata* (western redcedar), infrequent *Pinus contorta* (shore pine); with some remnant, fire-scarred old-growth *Pseudotsuga menziesii* (Douglas-fir). Site features moderately deep, rapid to well-draining sandy-loamy soil, uniform in color. Organic soil horizon extended to approximately 50cm before reaching a layer of compact colluvial material. Coarse fragment by volume >70%.

Assumed modifiers: d, m, w
Modifiers used: g, c

Indicator species:

- *Gaultheria shallon* (salal), indicating "acidic, nutrient poor soils characterized by mor humus forms", the species can become dominant in open-canopy CWHxm and "is a common and serious competitor in the early stages of conifer stand development", forming extensive root systems.

SITE CHARACTERISTICS

• Elevation (m)	84m
• Slope	2%
• Aspect	80°
• Surficial material	Organic
• Soil colour	Munsell 6
• Drainage	Well
• SMR	2-3
• SNR	VP

• *Mahonia nervosa* (dull Oregon grape), "moderate indicator of nutrient medium, fine to coarsely textured soils with moderately dry to fresh soil moisture regimes and thin, friable mor and moder humus forms" and "persistent on cutover sites". • *Kindbergia oregana* (Oregon beaked moss), "shade-tolerant indicator of nutrient poor to nutrient medium, moderately dry to fresh soils…. The interwoven mats of this species help to protect the forest soils from raindrop erosion, particularly on steep slopes". • *Taxus canadensis* (yew), "a moderate indicator of fresh to moist, mineral and organic soils, particularly soils associated with seepage zones" (Ringius and Sims 1997). Noted: Polygon includes one of the larger old-growth Douglas-fir on site (10U 5363543N 446903E); DBH taken (154.46cm).		

TEM Map Code	Location within Covenant Area	CWHxm Site Series
HKcv5sC	P2 (2010 baseline) 48.42066°N, 123.71967°W 10U 5363506N / 446764E	Zonal (01) – HwFd - Kindbergia

Figure 5*: Image is taken from soil pit centre, looking west over moderately mounded terrain featuring thick Kinbergia oregana. (Image: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series occurs on mounded, rocky terrain; features moderately dry, nutrient-medium (loamy) very shallow (<20cm to root restricting layer), well-draining soil on light-coloured parent material, indicative of poorer soil nutrient regime. Matted F-horizon with mycelial activity. Friable mormoder humus. Low porosity—no gleying; no mottles. Earthworms present. Coarse fragment volume high (>70%), with highly-angular clasts—possibly fire-cracked rock (FCR), with notably black cortices. Water-shedding site with high-variability in soil depth; bryoid-covered boulders frequent, limiting tree cover. Single-storied, coniferous overstory with infrequent *Arbutus menziesii* (arbutus) and *Pinus contorta* (shore pine) with structural stage of 4-5; self-thinning evident, likely due to variable surficial material. Understory vegetation included *Mahonia nervosa* (dull Oregon grape), *Gaultheria shallon* (salal), *Holodiscus discolor* (oceanspray) and *Rosa gymnocarpa* (baldhip rose) in the shrub layer; herb/moss layer included mixed *Kindbergia oregana* (Oregon beaked moss), *Rhytidiadelphus triquetrus* (electrified cat's tail moss) and fescues.	• Elevation (m) • Slope • Aspect • Surficial material • Soil colour • Drainage • SMR • SNR	120m Mid-slope East-facing O (moss) Munsell 4 Well 2-4 P-M

Assumed modifiers: d, j, m **Modifiers used**: c, v **Indicator species**: • *Mahonia nervosa* (**dull Oregon-Grape**) • *Kindbergia oregana* (**Oregon beaked moss**) **Noted**: Sporadic scotch broom.		

TEM Map Code	Location within Covenant Area	CWHxm Site Series
HDkg5tM	P3 (2010 baseline) 48.42175°N, 123.71766°W 10U 446904E / 5363426N	06 – HwCw-Deer Fern

***Figure 6**: Photo is taken facing upslope and to the northwest. Understory dominated by Polystichum munitum (sword fern). (Image: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series occurs on cool aspect (k), approximately 25m southeast of gully dominated by *Acer macrophyllum* (bigleaf maple), *Thuja plicata* (western redcedar) and mature *Alnus rubra* (red alder). Soil horizons included 2-3cm L-layer, 3cm Ah (mor humus), with fine-textured, silty soil (0-20% sand), drained rapidly, and less than 20% coarse fragment by volume. No mottling evident. Earthworms present. Fire was evident: carbonized bits of CWD were found at approximately 15cm in soil profile. *Polystichum munitum* (sword fern) dominated understory beneath relatively closed canopy (90%) with mature western redcedar, and both established and younger, thinning red alder. **Assumed modifiers**: d, j, m **Modifiers used**: k, g **Indicator species**: • *Polystichum munitum* (**sword fern**) "nitrophytic fern characteristic of nutrient rich, moist but strongly drained, seepage soils with moder and mull humus forms," indicative of base-rich parent materials, and "frequent to abundant (often dominant) on water-receiving sites, particularly on those enriched by the surface flow of fine organic materials" (Ringius and Sims 1997).	• Elevation (m) • Slope • Aspect • Surficial material • Soil colour • Drainage • SMR • SNR	77m Lower slope 45% O Munsell 4 Rapid 5 P-VP

Noted: Downslope-leaning immature alders indicating soil instability, slow creep.		

TEM Map Code	Location within Covenant Area	CWHxm Site Series
HDhs5sC	P4 (2010 baseline) 48.42404°N, 123.71766°W 10U 446906E / 5363681N	06 – HwCw - Deer Fern

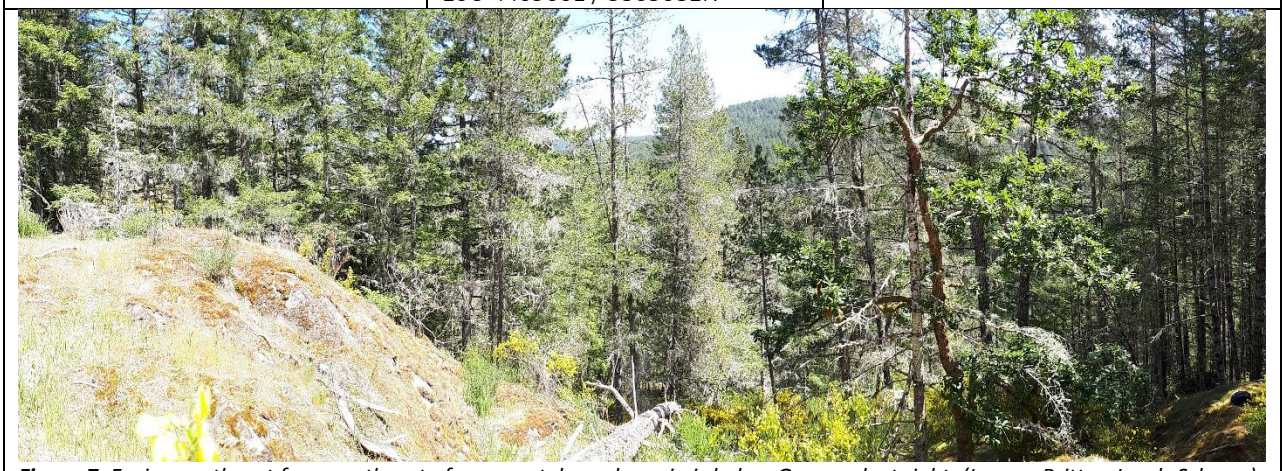

***Figure 7**: Facing northeast from northeast of covenant; boundary pin is below Garry oak at right. (Image: Britton Jacob-Schram).*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series occurs on water-shedding, hummocky terrain, with surficial material varying from organic layering over deep soil pockets to exposed rocky outcrops with thin to absent bryoid veneer. Site series is flanked to the north and south by >3m-wide gullying. Soil was fine-textured (SiL), nutrient-poor, homogenously dark (Munsell 5) in colour. L-layer comprised of needles; matted F-layer with very little mycelial activity (friable moder humus); collembolans (springtails) were noted mid-soil profile (depth to bedrock was 30cm), indicating sufficiently moist soil. Pit drained rapidly; no gleying, nor mottling. Understory of: *Goodyera oblongifolia* (rattlesnake-plantain), *Trientalis latifolia* (broad-leaved starflower), *Holodiscus discolor* (oceanspray), *Vaccinium parvifolium* (red huckleberry—in old-growth stump), *Gaultheria shallon* (salal), *Pachistima myrsinites* (falsebox) and immature *Symphoricarpos albus* (snowberry), over largely moss herb layer. Mainly open canopy with overstory including even-aged stand of *Pinus contorta* (shore pine)—assumed to be established pioneers following most recent disturbance—young *Pseudotsuga menziesii* (Douglas-fir), *Thuja plicata* (western redcedar) (bordering gully) and one established *Quercus garryana* (Garry oak). **Assumed modifiers**: d, j, m **Modifiers used**: h, s **Indicator species**: • *Mahonia nervosa* (**dull Oregon-Grape**) • *Gaultheria shallon* (**salal**) **Noted**: Bedding areas. Old-growth logging (stumps).	• Elevation (m) • Slope • Aspect • Surficial material • Soil colour • Drainage • SMR • SNR	90m Lower-slope 66° O Munsell 5-6 Rapid 5 M-P

TEM Map Code	Location within Covenant Area	CWHxm Site Series
RFgk3ahM	P5 (2010 baseline) 48.42147°N,123.71748°W 10U 5363395 / 446917E	07 – Cw-Foamflower

***Figure 8**: Image taken from recreational trail paralleling eastern covenant boundary, looking north, toward logged area and exposed rock outcrop at centre, described in site description. (Image: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series occurs at water-receiving, toe slope position of riparian ephemeral stream corridor, with relatively flat terrain, sloping gently east toward Sooke River. Upslope gully is U-shaped, boxed in to south by 4-meter-high rock ledge. Logging evident (noted *Acer macrophyllum* stumps and large CWD) at site; vegetation is in state of early-transitional succession, with shrub layer including young *Acer macrophyllum* (bigleaf maple) and *Alnus rubra* (red alder). Pit was placed two meters north of ephemeral creek (running west-east). Site features coarse-textured, sandy (SL), dark (Munsell 5), rich soils, absent of mottles and gleying. Rapidly draining colluvial layer began at a depth of 30cm. Understory included *Pteridium aquilinum* (bracken fern), forbs, *Carex spp*., and trace *Rubus spectabilis* (salmonberry). **Assumed modifiers**: d, j, m **Modifiers used**: g, k Indicator species: • *Tiarella trifoliata* (**three-leaved foamflower**), a nitrophytic herb, and "good indicator for nutrient rich, fresh to very moist but strongly drained soils often characterized by moder and mull humus forms" and "indicates base-rich parent materials", which may compensate for nutrient-removal in rapidly draining soils (Ringius and Sims 1997). • *Galium sp.* (**bedstraw**), indicating rich, fresh to moist soils; associated with early stages of succession (Ringius and Sims 1997). **Noted**: 2010 baseline indicated site as "transitional meadow". Succession has progressed beyond structurally a graminoid-dominated herb substage (e.g. 2b); therefore, applied structural substage of low shrub–3a (shrub layer vegetation <2m; and time since disturbance <20 years) in TEM code. Of logging, property owner notes: "There was some maples but mostly fir, [sic]	• Elevation (m) • Slope • Aspect • Surficial material • Soil colour • Drainage • SMR • SNR	67m Toe (5%) East-facing O, P (pebbles) Munsell 5 Very rapid 5 R

we had to rebuild the little stream after the machines were finally made to stop". Property owner discussed culturally-sensitive harvesting of rushes by Indigenous friends (baseline notes *Eleocaris palustris*, common spike rush, present in P5).		

TEM Map Code	Location within Covenant Area	CWHxm Site Series
DFkv2	P6 (2010 baseline) 48.4232°N / 123.71977°W 10U 5363563N / 446785E	06 – Fd-Sword Fern



***Figure 9-11, left to right**: Festuca spp.; shallow soils on site; looking northeast toward Sea to Sea Regional Park—note Mahonia nervosa in foreground, in deeper soil pocket. (Images: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series is found mid-slope on a moderately steep (30%), xeric, rocky site, with areas of steep slope, transverse topographic prominences and benches, and seepage sites along the northern portion of outcrop. Site features moss and wildflower climax species. Tree canopy is open with mature arbutus and *Pseudotsuga menziesii* (Douglas-fir) along northern and southern borders. Surficial material varied: exposed, lichen- or moss-covered bedrock, hand-sized angular volcanic clasts, or—in micro-depressions and at base of seepage sites—a graminoid-dominated F-layer atop very shallow soils (<20cm). Deeper soil pockets supported *Mahonia nervosa* (dull Oregon grape), *Polystichum munitum* (sword fern), and stunted *Pinus contorta* (shore pine). Micro-depression drained rapidly (noted gleyed surface in nearby seepage, though not within soil pit horizon). Soil profile included: F-layer matted with roots and angular clasts; dry, fine-textured (SiL) soils, uniform in colour, with cormlets and sub-rounded pebbles mid-soil profile; total 9cm to light-coloured bedrock. Assumed modifiers: d, j, m Modifiers used: k, v, x* Indicator species: • *Cladina portentosa* (reindeer lichen), a good indicator of acidic, dry, to	• Elevation (m) • Slope • Aspect • Surficial material • Soil colour • Drainage • SMR • SNR	115m -30% 68° O, R Munsell 5-6 Rapid 2 R

very dry soils, "associated with mor humus forms". • *Brodiaea coronaria* (harvest brodiaea), indicates coarse-textured soils, dry moisture regime; GOERT notes "climax species in dry open grassland sites". • *Mahonia nervosa* (dull Oregon-grape) • *Polystichum munitum* (sword fern) Noted: HAT BioBlitz 2018 recorded red-listed *Githopsis specularioides* (common bluecup) at the edge of the western boundary of this polygon; 2010 baseline indicated site was free of scotch broom; and broom is now established along northern and southern peripheral edges of site. * *Applying site modifier 'x' requires consultation with Regional Ecologist.*		

TEM Map Code	Site Association	CWHxm Site Series
HKhk5sC	P7 (2010 baseline) 48.42066°N, 123.71967°W 10U 5363307N / 446754E	Zonal (01) – HwFd - Kindbergia

***Figure 12**: Image taken from recreational trail near western covenant boundary, looking downslope and east. (Image: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site series is dry, fairly open forest ecosystem, located on western boundary of covenant, in a state of transitional succession. Overstorey consists of *Pinus contorta* (shore pine) and *Pseudotsuga menziesii* (Douglas-fir), interspersed between hummocky terrain featuring lichen-covered rock outcrops. Site is flanked to the west by ephemeral Goodman Creek; a *Gaultheria shallon* (salal)-dominated gully directly to the south; and another gully circumscribes the site, north and east. Site is complexed with thin veneer (bryoid- or lichen-covered) rock outcrops and deeper soil pockets (>50cm) on benched or gently sloping areas. Deadfall common. Plot centre for soil pit was placed west of a stand of established shore pine and *Pseudotsuga menziesii* (Douglas-fir) (55-65% canopy coverage) on a water-receiving level bench, featuring	• Elevation (m) • Slope • Aspect • Surficial material • Drainage • Soil colour • SMR • SNR	112m Mid-slope East-facing O Rapid - Well Munsell 6-7 4-5 P

nutrient-poor, light-coloured, fine-particle soils (SiL); moss-dominated L-layer; matted F-layer with mycelia and darker mor humic layer. Soil pit drained rapidly. No mottling; no gleying. Understorey vegetation dominated by oxylophytic species *Gaultheria shallon* (salal), *Mahonia nervosa* (dull Oregon grape), and *Rosa gymnocarpa* (baldhip rose), the latter being characteristic of dry, nutrient-medium soils; with moderate *Paxistima myrsinites* (falsebox), *Goodyera oblongifolia* (rattlesnake-plantain), *Corallorhiza sp*. (coralroot), with infrequent, *Symphoricarpos albus* (snowberry), *Vaccinium parvifolium* (red huckleberry), *Salix scouleriana* (Scouler's willow), *Holodiscus discolor* (oceanspray), *Amelanchier alnifolia* saskatoonberry (browsed). Rock outcrops characterized by dense moss; outcrops with higher insolation are in climax and feature well-developed *Cladina spp*. Zone 1 for scotch broom—infrequent, however establishing. Assumed modifiers: d, j, m Modifiers used: h, k Indicator species: • *Mahonia nervosa* (dull Oregon-grape) • *Kindbergia oregana* (Oregon beaked moss) • *Goodyera oblongifolia* (rattlesnake plantain) an oxylophytic species (preferring acidic soils), characteristic of Mor humus forms. • *Paxistima myrsinites* (falsebox), a climax shrub that indicates dry to moist SMR with well-draining soils. • *Salix scouleriana* (Scouler's willow; mountain willow): "May hinder natural regeneration and growth of shade-intolerant conifers" (Klinka et al 1989). Noted: Per Green and Klinka (1994), site series zonal (site exhibits more Oregon beaked moss, more Douglas-fir, less western hemlock). Wildlife marking trees present; notable biocorridor transects northern slope, running northeast toward gully. Some young pine are jackstrawed—self-thinning stand (structure 5). Compared to other covenant sites, site distinctly lacking old-growth stumps; site appears to be in state of anthropogenic subclimax (trace dead mature arbutus and in-growth of pine and fir—afforestation possibly due to colonial fire suppression, as opposed to 20th century logging). Canopy cover expected to continue decreasing. Site conditions provide potential for *Quercus garryana* (Garry oak) woodland community.		

TEM Map Code	Site Association	CWHxm Site Series
HDkc5hC	P8 (2010 baseline) 48.41991°N, 123.7173°W 10U 446926E / 536322N	06 – HwCw-Deer Fern

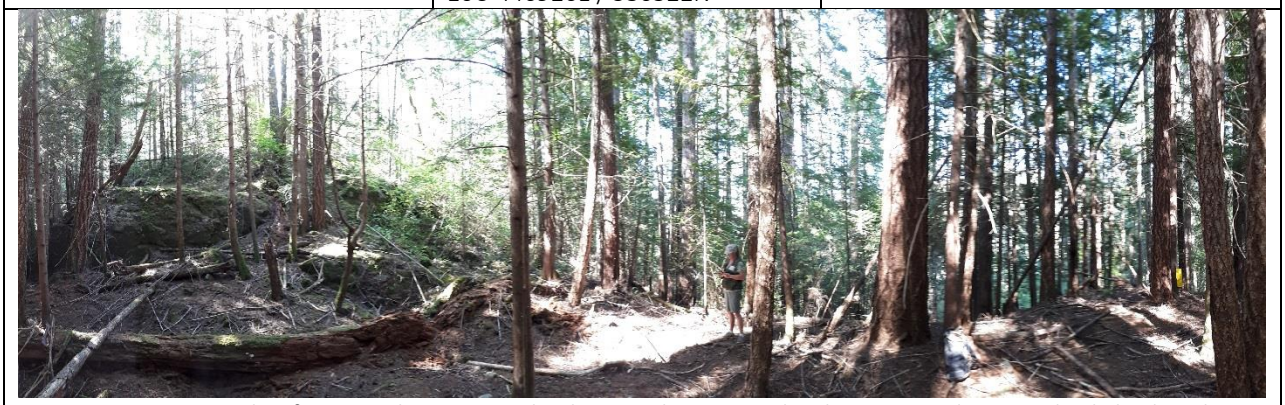

***Figure 13**: Panorama taken facing northeast, atop a level area with suppressed understory. Goodman Creek is behind, to the southwest. Trail wends around large rock outcrop at far left, before entering more open canopy. (Image: Britton Jacob-Schram)*

SITE DESCRIPTION	SITE CHARACTERISTICS	
Site is found northeast of small bridge over Goodman Creek, on flat bench-like terrain (slope <5%), south of a light-coloured, sheer rock outcrop; 160 meters upslope, west of Sooke River. Coarse, moderately well-draining (faintly mottled), loamy sand (LS) soils and mor humus. No earthworms, nor insects visible. Site appears to be part of glaciated riverbed. Soil profile: 2cm L-layer of needles, cones, litter (noted deer fur); 3cm Ah horizon; abrupt transition to 20cm Ae layer—indicating strong leaching into diagnostic (B) horizon and poor to moderate SNR; high proportion of subrounded, faceted gravel- and cobble-sized coarse fragments in A and B horizons (fragments decreasing in size with depth); and 30-cm medium-coloured (Munsell 5-6) Bm horizon, with slight rust-coloured (ferric) mottling, atop compacted colluvial layer. Coniferous, shelterwood forest, dominated by mature *Pseudotsuga menziesii* (Douglas-fir) and *Tsuga heterophylla* (western hemlock) (90% crown closure); suppressed understory <10‰, with sapling *Thuja plicata* (western Redcedar), western hemlock, and Douglas-fir. Undeveloped shrub layer included trace *Mahonia nervosa* (dull Oregon grape), sword fern. Groundcover includes moss-covered large CWD, small CWD, and litter (largely poorly composting needles). Indicator species present included dull Oregon-grape (coverage of <5% herb/shrub layer). Assumed modifiers: d, j, m Modifiers used: k, c Indicator species: • *Mahonia nervosa* (dull Oregon-grape): <5% of herb/shrub layer; "There are some situations when vegetation is generally unreliable for site assessment, for example, when understorey vegetation is poorly developed under a dense forest canopy, and on some recently	• Elevation (m) • Slope • Aspect • Surficial material • Drainage • Soil colour • SMR • SNR	62 <5% 15° O, F^{G} Well Munsell 5-6 5-6 P-M

disturbed areas. In these cases, more or all emphasis should be placed on environmental analysis" (Klinka, et al 1989). Noted: Feeding trees—hairy woodpecker (sighted observation); bear marking (heavily marked red alders near creek); and deer skeleton. Recent (estimated <5 years) fire activity (recreational fire pits). Logging evident, however, noted old-growth stumps are more prevalent on western side of creek.		

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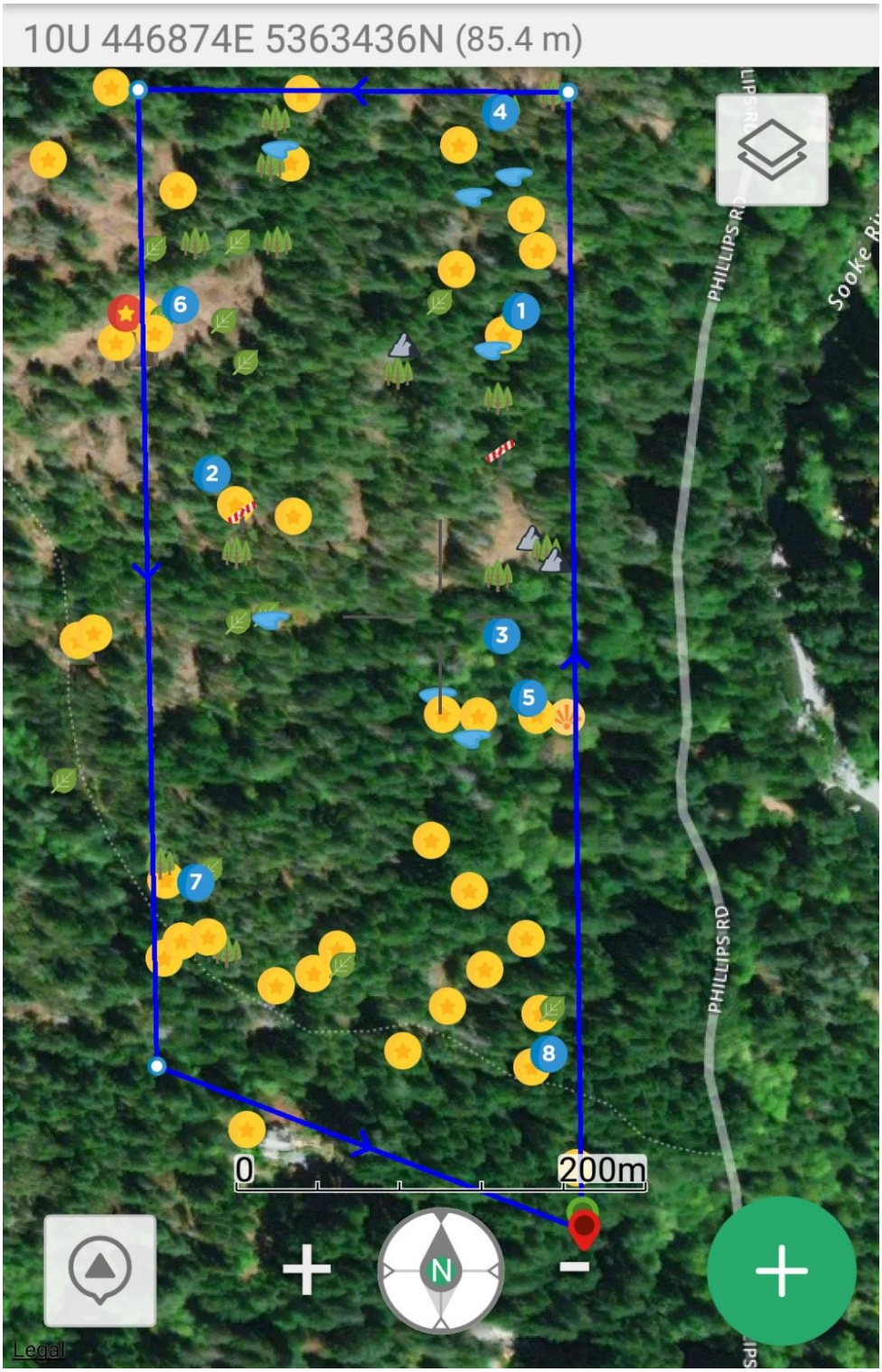

***Figure 14**: Soil pits are marked in blue numbering, mapped by polygon numbers in 2010 draft baseline report. Yellow points of interest markers are being used to provide Habitat Acquisition Trust with onsite information, such as gullying, invasive plant species proliferation in contrast to 2010 draft baseline report, biocorridors, and species of interest. (Map produced with ViewRanger)*