Summerland Solar & Storage Project

Environmental Inventory Phase

Submitted to:

District of Summerland

On

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Prepared by:

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Makonis Project No: 2019-106

Makonis Consulting Ltd

Contents

1.0 Introduction

Makonis Consulting Ltd was retained to complete an environmental inventory, phase one, for a potential solar array and provide strategies to guide development in a responsible environmental manner. Makonis Consulting Ltd prepared the following environmental document for the District of Summerland.

1.1 Project Description and Setting

The subject area is located east of Prairie Valley Rd in Summerland, and currently divided into four legal parcels, whole and partial, based on Summerland Geographical Information System (GIS) mapping[1]

- Lot 2, Plan KAP8353 DL 2543; PID 009-833-722; 13500 Prairie Valley Road
- Lot 18, Plan KAP 182, DL 2543, except plan 13580 KAP60859 KAP72843; PID 012-646-695; 12591 Morrow Ave
- PID 012-646-717; (no legal information attached)
- Future road right-of-way: Ottley Ave

The project site is approximately 10.4hectares (or 25.7acres), Figure 1.

The subject properties are under the jurisdiction of the District of Summerland and consequently must conform to the Official Community Plan (the OCP) and meet requirements as per the development permit application process. This environmental assessment embodies the elements under the Terms of Reference: Environmental Assessment Reports, and Schedule B, Summerland Policy Manual; Number 300.4, adopted November 10, 2014.

Based on the review of the project, the scope provided of the proposed development and the requirements per the District of Summerland, the objectives of this assessment are to:

- ESA mapping to confirm whether or not the project footprint includes sensitive lands. This includes consideration of public information on ecosystems and species, plus mapping on the ground.
- Addressing Critical Habitat using a three-step process: identify mapping, determine if attributes are present, prescribe measures to prevent destruction.
- Address requirements for inventory with a focus on species with mapped Critical Habitat species and known occurrences on/near property. If inventory would not contribute meaningfully to mitigation/avoidance, then provide a rationale for why it is not needed.
- Addressing Ungulate Winter Range values/implications of development.
- Provide mitigation avoidance and monitoring advice where possible.
- Systematic methods-based impacts assessment/finding - if the project proceeds consistent with the environmental report advice, what is impacted/how effective is the proposed mitigation/avoidance in addressing impacts; what impacts are residual/not mitigated.

[1] https://mapping.summerland.ca/ April 25, 2019.

2.0 Background Review

The following section summarizes the known environmental conditions of the area, including a desktop review with respect to terrestrial and aquatic habitat and species and ecosystems at risk. Information presented in this section is pre-existing. The sources reviewed include the following, but not limited to:

- Biogeoclimatic and Ecosystem maps.
- Orthographic photos.
- BC Conservation Data Centre (CDC).
- Ecocat, Ecosystems Report Catalogue.
- Habitat Wizard.
- BC Soil Information Finder Tool.
- Water Licences database, Provincial database.
- Okanagan Habitat Atlas

The review conducted before the fieldwork is essential to ensure that aspects and sensitive features are not over-looked and held in-hand during the project.

2.1 Climate

Climate plays an important role with soils or lack of vegetation and topography in forming the ecosystems for a site.

The subject area lies within the western flanks of the Okanagan Valley, which is in the rain shadow of the Coast and Cascade Mountains and contains some of the warmest and driest areas of the province and in Canada[2]. Characterized as a continental climate, the Okanagan Valley is known for long warm, dry growing seasons and cool winters with moderate snowfall. Air moving into the area generally loses most moisture on the west-facing slopes of the coastal mountains, before reaching the Okanagan. There are occasional eruptions of hot, dry air from the Great Basin extending from Mexico to Canada, which in the summer, bring clear skies and hot temperatures. In winter and early spring, there are frequent outbreaks of cold, dense, arctic air.

Records from Environment Canada at Summerland[3] near the subject property can be considered to reflect the weather and climate of the area:

> • The annual daily average temperature is 9.6°C, with average lows in January to – 1.5°C and average highs in July to 21.4°C. Coldest months are December and January, where daily average temperatures are below 0 °C. July and August are typically the higher daily temperatures, averaging above 20°C with extremes recorded to 38.5 °C.

[2] Lloyd, D, K. Angove, G. Hope and C. Thompson. 1990. A guide to site identification and interpretation for the Kamloops Forest Region. B.C. Min. of Forests, Victoria, B.C

[3] http://www.climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html

Precipitation information was taken from Penticton station[4], as the Summerland data appeared incomplete.

- Average precipitation is 346 mm, falling predominantly as rain. The average rainfall is 298.5 mm, and average snowfall is 58.7mm. May to June are typically the wettest months with heaviest snowfalls in December and January. Extreme rain events have increased in frequency over the last number of years, where August has seen daily rain events with >45 mm.

2.2 Topography and Landscape

The subject property located in the mid-western region of Summerland, B.C, at the head of Prairie Valley. Vehicle site access is from Prairie Valley Road. The subject area totals 10.4 hectares, in which elevation ranges from 532 to 588 meters above sea level (masl). The lowest point is in the south-east and rises in elevation to the northern boundary.

Part of a larger ridgeline extending in a north-south direction, the aspects vary but are mostly south-west or south-east. Small pockets of cool aspects are noted, as well a significant benched area mid-section of the study.

Using the B.C. Soil Information Finder Tool (SIFT)[5], five soil polygons were found overlapping the subject area. Soil types consist predominantly of Kruger and Rockface materials, with small portions along the northwest, south, and central areas designated as Giants Head, Burnell Lake, Gravel Pit, and Gammil and Paradise. Except for the gravel pit, soil texture within the subject area is expected to be predominantly sandy loam that drains well to rapidly.

2.3 Ecosystems

Climate, topography, and surface geology influence the site hydrology, which in turn influences the biological resources on site. This ecological principle is fundamental in most Ecological Landscape Classifications. The vegetation assessment utilizes the Biogeoclimatic Ecosystem Classification[6] (BEC), which is used extensively throughout British Columbia to report and describe terrestrial ecosystems. This ecological classification system enables biologists, foresters, resource managers, planners, and other stakeholders to use a common framework and currency for exchanging fundamental knowledge. In the BEC system, the climate is the most significant determinant of ecosystems, influencing the soil characteristics, which in turn influence the vegetation, its composition, and structure.

The subject property is in the Okanagan Basin Okanagan Very Dry Hot Ponderosa Pine biogeoclimatic subzone variant (PPxh1), which occurs at low to mid-elevations between the

[4]climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=Penticton&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=1053&dispBack=1

[5] Wittenben. U. 1986. Soils of the Okanagan and Similkameen Valleys. Ministry of Environment Technical Report 18. 238pp.

[6] Meidinger, D. and J. Pojar (compilers). 1991. Ecosystems of British Columbia. Special Report Ser. 6, Ministry of Forests, Victoria, BC.

lower Bunchgrass zone (BGxh1) and the higher Interior Douglas-fir zone (IDFxh1) in the Okanagan Valley. These subzone variant units in BEC are larger regional ecological units comprised of smaller site-specific ecological units, or site series in BC's BEC system. The Ponderosa Pine zone is a mosaic of grassland and forest communities that is known as the warmest and driest forest in BC due to its southerly latitude[7]. These areas are dominated by species such as Ponderosa Pine (*Pinus ponderosa*) and Douglas Fir (*Pseudotsuga menziesii var glauca*), with understory species consisting of Common Snowberry (*Symphoricarpos albus*), Tall Oregon-grape (*Mahonia aquifolium*), Saskatoon (*Amelanchier alnifolia*), Arrow-leaved Balsam Root (*Balsamorhiza sagittata*), Bluebunch wheatgrass (*Agropyron spicatum*), and Pinegrass (*Calamagrostis rubescens*).

South Okanagan Terrestrial Ecosystem Mapping (TEM) polygons mapped at 1:20,000 scale for the area were reviewed for surficial materials, site ecosystems and modeled sensitive designations for the subject property[8] [9]. Seven TEM polygons intersected the study area to some degree in whole or part. Original TEM from 1995 interpretations were later remodeled to update the site ecosystem codes in 2009 throughout the Okanagan used by municipalities in development permit identification areas.

The following ten updated site ecosystems interpreted for the seven polygons related to the study area mapped in 1995:

(Ecosystem Map Code) : (Ecosystem Name)

- PW: Ponderosa pine – Bluebunch – Idaho fescue
- GP: Gravel Pit
- WB: Bluebunch wheatgrass – Balsamroot
- PT: Ponderosa pine – Red three-awn
- CV: Cultivated vineyard
- CF: Cultivated field
- FB: Rough fescue – Bluebunch wheatgrass
- DS: Douglas-fir – Ponderosa pine – Snowberry – Spirea
- CO: Cultivated orchard
- PC: Ponderosa pine – Bluebunch wheatgrass – Cheatgrass

NOTE: Terrestrial Ecosystem Mapping (TEM) is a provincial standardized process in inventory, delineation, and map production of provincial ecosystems in British Columbia[10]. Polygons delineated on a bioterrain base with vegetation, topography, and soils in a three decile system to describe ecosystems across a landscape.

[7] Lloyd, D, K. Angove, G. Hope and C. Thompson. 1990. A guide to site identification and interpretation for the Kamloops Forest Region. B.C. Min. of Forests, Victoria, B.C

[8] Lea, E.C., R.E. Maxwell and W.L. Harper of the Resources Inventory Branch, British Columbia Ministry of Environment, Lands and Parks. 1998. Biophysical Habitat Units of the South Okanagan Study Area. Victoria. 40pp

[9] Iverson, K. and A. Haney. 2009. Refined and Updated Ecosystem Mapping for the South Okanagan and lower Similkameen Valley 2009. 40pp.

[10] Resources Inventory Committee. 1998. Standards for Terrestrial Ecosystems Mapping in British Columbia. Ecosystems Working Group of the Terrestrial Ecosystems Task Force, Victoria, B.C.

The 2012 Sensitive Ecosystem Inventory (SEI) modeled to the 1995 base maps with the above polygons include:

(SEI map code) - (SEI category)

- WD – wooded coniferous
- GR – grassland
- NS – not sensitive

2.4 Aquatic Review

Review for any wetlands, streams, or water bodies in or near the subject property looked at the provincial mapping program Habitat Wizard[11].

Habitat Wizard showed a stream crossing the subject property that flows into Prairie Creek near Dale Meadows Road. The stream appears to be an artifact from Terrain Resource Information Management (TRIM) mapping and found on National Topographic System (NTS) mapping. The stream is not identifiable on Habitat Wizard. See section 2.5 for further clarification.

Prairie Creek is noted within 500meters to the south along Dale Meadows Road.

No other water bodies or wetlands are in proximity to the subject area during the background information reviews.

2.5 Historical Orthophotography Review

1938 ortho imagery obtained from provincial archives for the subject area was georeferenced in ARCgis with an RMS error of 3.2 using nine control points. Stereo pairs of aerial photography were assessed with a stereoscope and interpreted data transferred into ARCgis, Figure 2.

The subject area in 1938 was relatively untouched. An irrigation flume was in place along the northern subject area that went from west to east. A road accessing the flume was seen entering from the north. No other disturbances noted in 1938.

Under stereoscope analysis, the central part of the subject area noted a glacial-fluvial bench in 1938. This feature was north to south and created a bowl facing west. Crest of the bowl was approximately mid-section of the existing gravel pit seen today.

Trees were sparse in 1938, and most to the area was open grasslands, in contrast to 2019, where tree density for the subject property had more than doubled.

No streams, water bodies, or wetlands were noted in 1938.

[11] http://maps.gov.bc.ca/ess/hm/habwiz/ (accessed May 6, 2019)

2.6 Known Sensitive or At Risk Species & Ecosystems

Conservation Data Centre (CDC) of British Columbia review for potential and known sensitive species and ecosystems[12].

Ponderosa Pine BEC zone within the Regional District of Okanagan-Similkameen (RDOS) contains ninety-four listed animal species. CDC listed sixty-seven as blue and twenty-seven as red-listed species. Of ninety-four, forty-eight were listed by the Committee on the Status of Endangered Species in Canada (COSEWIC), and the Species at Risk Act (SARA) listed forty (Data review: May 7, 2019).

The CDC mapping showed the American Badger (*Taxidea taxus*) as potentially occurring in the subject region (CDC occurrence #74373).

Prairie gentian (*Gentiana affinis*) is known species in the Summerland area with a location on the east slopes of Giants Head.

A masked occurrence[13] overlaps the subject area. The Conservation Data Centre and Regional Biologist determined the details of this occurrence are needed to ensure there are no harmful effects to the species of interest in planning the proposed development (comm April 29, 2019).

Thirty-four at risk plant species were listed for the area, one yellow-listed (secure, may have subspecies listed as -blue, or -red), fourteen blue (special concern), and five red-listed (extirpated, endangered, or threatened) under Provincial Conservation Status.

Lastly, twenty-seven ecological communities at risk are listed for the area, one yellow-listed (secure), nine blue (special concern), and seventeen red-listed (extirpated, endangered, or threatened) under Provincial Conservation Status. Only three come under the protection of the Forest and Range Practices Act of BC to minimize impacts on wildlife.

Critical Habitats

Two known federally listed critical habitats shown for the project area was in CDC iMAP.

- Lewis's woodpecker critical habitat ID 62584 Object ID 130485
- Western tiger salamander critical habitat ID 39, object ID 67940, connectivity habitat (blotched tiger salamander red-listed, southern mountain population endangered)

A third federally listed critical habitat listed with Environment and Climate Change Canada considered in this assessment was for snakes.

[12] B.C. Conservation Data Centre. 2018. BC Species and Ecosystems Explorer. B.C. Minist. of Environ. Victoria, B.C. Available: http://a100.gov.bc.ca/pub/eswp/ (accessed Jun 5, 2019)

[13] Masked Occurrences are confidential records held by the province or federal governments for species protection.

3.0 Site Inventory

Field surveys were April 17 and 24, 2019; May 2, 6, 13, and 15, 2019 by John Grods R.P.Bio. Visits were to identify environmental features, document wildlife, and plants, establish and create an ecosystem baseline used to develop the Environmentally Sensitive Areas (ESA) rankings.

3.1 Plants

Plant surveys aimed to complete a plant list for the study area as well as to investigate the site for B.C. CDC and COSEWIC-listed rare plant species, a list of plant species recorded in table one. All habitats, ecosystems in the subject area were visited. Plant species and plant lists recorded. The survey was done simply wandering through habitat and noting the species observed. This method deviates from the provincial protocols of a static plot in that a much larger area and all habitats and variations are visited. Thus, there is a higher likelihood that all plant species in the subject area were more likely to be reported than if limited to small point plots. This method also enables a comprehensive classification of habitats for the ecosystem mapping inventory, section following.

No CDC or COSEWIC listed species in the Ponderosa Pine biogeoclimatic zone were found during the field visits on the subject property.

3.2 Terrestrial Ecosystem Mapping

The subject area lies within the Okanagan Basin Okanagan Very Dry Hot Ponderosa Pine (PPxh1) regional ecosystem from BEC and was mapped to 1:1,500 scale for this Solar & Storage project (figure 3).

Using Provincial methods to complete the baseline ecosystem mapping for this project, the visitation for the subject area was 100% of polygons delineated to a provincial Survey Intensity of Level One. However, effort to delineate ecosystems to less than three per polygon due to the large scale map product of 1:1,500 does differ from provincial standards. Enabling specific mitigation and avoidance design in the next phases of this project. Some instances of multiple ecosystem units persisted at this scale in a polygon delineation. The subject area was stratified by surficial material, soil, and vegetation before field visitations. Polygon boundaries and core polygon attributes were noted and refined during the field visits. Core attributes for this project were:

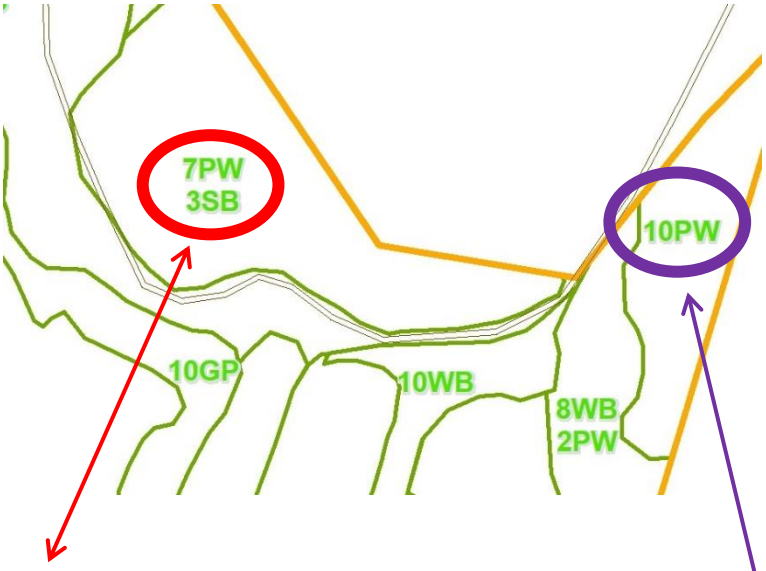
- Ecosystem Unit (recorded up to two ecosystem units per polygon)
- Decile (percent of coverage in polygon)
- Site modifier(s)
- Structural stage
- Surficial material and expression

John Grods R.P.Bio has twenty-three years of ecosystem mapping experience in British Columbia and western Canada and certified by the province of British Columbia as a TEM

practitioner (Certified: WIS1-0649) and provincial field sampling, Describing Ecosystems in the Field (Certified: WIS9-0269).

The following ecosystem descriptions for the subject area is known as an Expanded Legend in TEM methods, described the context of the project. The map – codes seen on the ecosystem map, figure 3, are referenced in greater detail below.

How to Read an Ecosystem Map:



7PW: 70% of the polygon is PW
3SB: 30% of the polygon is SB

10PW: 100% of the polygon is PW

Each map code is unique in the provincial ecosystem database and is associated with each description listed below.

Ecosystem Unit Name	Map Code	Conservation Status
Exposed Soils	**ES**	none

Exposed soils for the study were all human-caused. Most occurrences are ongoing impacts. Hikers, walkers, mountain bikers, and joggers observed using these features at every visit to the site.

These exposed soils were seen as old access, landings laydown areas, gravel pit, walking, and biking trails. The margins of these conditions are associated with invasive-noxious weeds.

Estimated Area: 0.31ha

Ecosystem Unit Name	Map Code	Conservation Status
Gravel Pit (abandoned)	**GP**	none

Gravel extraction has not occurred on the site for some time; however, the exposed excavations are slow to regenerate as observed on the subject property. Several spoil piles, concrete infrastructure, and pipes noted throughout the site. Cottonwood, a natural post-disturbance species often taking advantage of exposed soils and reduced competition, is seen along with Ponderosa pine re-establishing the area. Review of 1938 ortho-imagery showed the eastern portion of the gravel pit was a glacialfluvial bench. This bench extended from the existing flume west into the mid-section of the gravel pit. The western portion of the gravel pit noted to be down cut and filled in on the south-west slopes.

Estimated Area: 3.77ha

Ecosystem Unit Name	Map Code	Conservation Status
Cultivated Vineyard	**CV**	none
A vineyard encroached into the subject property from the south, 12914 Prairie Valley Road. Estimated Area: 0.12ha		

Ecosystem Unit Name	Map Code	Conservation Status
Road Surface	**RZ**	none
Access to the site is from Prairie Valley Road has been paved into the abandoned gravel pit. Estimated Area: 0.15ha		

Ecosystem Unit Name	Map Code	Conservation Status
Rural	**RW**	none
A portion of the orchard from 12302 Prairie Valley Road has encroached into the site. Several out-buildings noted with agricultural laydown areas surrounding. Estimated Area: 0.10ha		

Ecosystem Unit Name	Map Code	Conservation Status
Bebb's willow – Bluejoint reedgrass	**Ws03**	Provincial: Blue
This feature noted on the access road up to the site where the historical slope cut has exposed seepage. This feature was not noted in the 1938 review but seen as a westerly sloped grassland at that time. Many of the birds noted in this inventory observed at this wetland. Provincially this unit is of special concern; however, in the Okanagan, wetlands have been significantly impacted historically. This unit also falls under the Water Sustainability Act. Riparian Areas Regulations do not apply. Estimated Area: 0.04ha		

Ecosystem Unit Name	Map Code	Conservation Status
Giant Wildrye (transitional wetland)	**Ga05**	Provincial: Red
Common in the Okanagan where groundwater – seepage is near the surface, not at the surface. Soils are alkaline and often wetter throughout the year. Mapped throughout the Okanagan TEM's as grassland, "GW" or Gs, this unit has been updated provincially as a transitional wetland unit. Estimated Area: 0.05ha		

Ecosystem Unit Name	Map Code	Conservation Status
Trembling aspen – snowberry – Kentucky bluegrass	**AS**	Provincial: Red
The ecosystem is noted in the north-west of the project area, located between a more significant slope to the north and rock knob to the south. Soil are typically moisture receiving and finer texture within these units seen in the Okanagan. Estimated Area: 0.03ha		

Ecosystem Unit Name	Map Code	Conservation Status
Field sedge wet meadow	**Gs03**	Provincial: Red

This ecosystem found in a natural draw between a bedrock knoll and south-facing slope. This habitat would see natural subsurface water flows and deeper, longer persisting snow pockets. Soils here were finer and deeper than the surrounding areas.

Estimated Area: 0.03ha

Ecosystem Unit Name	Map Code	Conservation Status
Selaginella – Bluebunch wheatgrass rock outcrop	**SB**	Provincial: Yellow

Rock outcroppings observed along the south-east ridgeline and small knoll on the westerly boundary. This habitat noted as weathered bedrock where vegetation could get a sparse foothold. Bitteroot noted in these two locations.

Estimated Area: 0.63ha

Ecosystem Unit Name	Map Code	Conservation Status
Bluebunch wheatgrass - Balsamroot	**WB**	Provincial: Blue
Grassland was common throughout the subject area and often intermixed with ponderosa pine forest (PW). These units for the area not impacted by traditional cattle grazing condition of these grasslands was considered "good" (class 3) to "excellent" (class 4) from an observational assessment to grasslands across the Okanagan. Several trails noted in this habitat for the project area. Estimated Area: 1.32ha		

Ecosystem Unit Name	Map Code	Conservation Status
Fescue – Bluebunch wheatgrass	**FB**	Provincial: Red
This grassland unit has been significantly reduced in extent on the subject property from 1938. It appears the historical glacialfluvial bench was this unit along the top in 1938. Now only seen on the south-facing slope and small remnants left not impacted in extracted gravel operations. Fescue grasslands are most often favoring coarse drained conditions to persist, like glacialfluvial terraces seen in this project. Estimated Area: 0.18ha		

Ecosystem Unit Name	Map Code	Conservation Status
Ponderosa pine – Bluebunch wheatgrass - Cheatgrass	**PC**	none
Found on the steeper natural slopes along the northern subject area. Most trees here are recent additions for the most part in the last 80 years as grassland encroachment. Several veteran trees noted up slope outside the subject boundary. Estimated Area: 0.74ha		

Ecosystem Unit Name	Map Code	Conservation Status
Ponderosa pine – bluebunch wheatgrass – Idaho fescue	**PW**	Provincial: Blue
A common habitat in the Okanagan and the Summerland area. Where the condition of this habitat in the project area and the Okanagan is a result of fire suppression and tree in growth into grasslands. Trees historically were here a more open forest condition with interspersed grasslands. Douglas-fir, a shade-tolerant species, has led to in-growth and increased coarse woody debris and decreased plant species in these conditions. Estimated Area: 2.34ha		

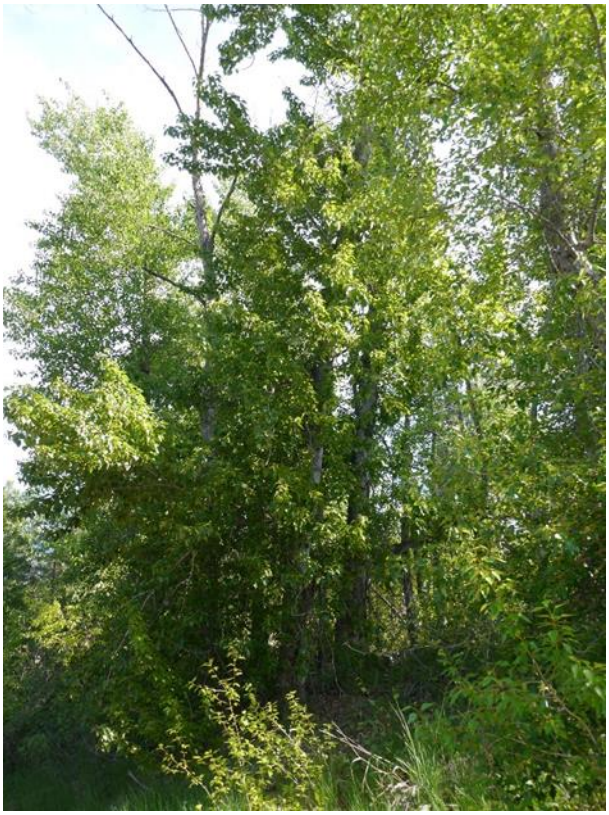
Ecosystem Unit Name	Map Code	Conservation Status
Douglas-fir Ponderosa pine – Snowberry – Pinegrass	**SP**	Provincial: Red
This ecosystem found in a cool aspect. Mostly young Douglas-fir as this area also had a drop structure for the historical flume in this location. This habitat was one of the few treed sites in 1938 for the subject property. Estimated Area: 0.28ha		

Ecosystem Unit Name	Map Code	Conservation Status
Ponderosa pine – Red three-awn	**PT**	Provincial: Blue
Associated with the few rock outcroppings and shallow soils, this habitat also persisted from 1938. Open forested with shallow rock overlain with medium to coarse soils, interspersed with grasslands. Estimated Area: 0.08ha		

Ecosystem Unit Name	Map Code	Conservation Status
Ponderosa pine Cottonwood – Snowberry	**PA**	Provincial: Red

This unit is an artifact of post-disturbance and alteration of groundwater from gravel extraction above. This area in 1938 was a wetter rose – giant wildrye habitat. Adjacent to the willow wetland Ws03. Several older cottonwoods observed with smaller cavities and dead tops. Cottonwoods are one of BC's native post-disturbance tree species on moist to wet soils, as seen on lakeshores, riverbanks, and cut-blocks; and can persist for decades. These early seral stage habitats are important for cavity-nesting and bat roosts, also providing diverse structure and plant composition as foraging opportunities for many wildlife species.

Estimated Area: 0.12ha



Ecosystem Unit Name	Map Code	Conservation Status
Talus	**TA**	none

Associated with the few rock outcroppings and shallow soils, this habitat also persisted from what as seen in 1938.

Estimated Area: 0.03ha

Ecosystem Unit Name	Map Code	Conservation Status
Snowberry – rose – Kentucky bluegrass	**SR**	Provincial: Blue
Moist, medium-textured soils this habitat persisted from 1938 — described throughout the Okanagan occurring on gentle slopes with medium-textured soils in depressions, moisture receiving sites, seepage slopes. These units are more frequent and larger further north in the Okanagan valley or higher in elevation. This feature reduced in size since 1938. Estimated Area: 0.15ha		

3.2 Wildlife

Birds

Birds were observed and recorded on all field visits to the subject property. The following table two were birds observed at the subject area during the site visits.

TABLE TWO. Birds observed 2019 for the project area.

Common Name	**Latin Name**
Yellow-rumped warbler	*Dendroica coronata*
Song sparrow	*Melospiza melodia*
Golden crowned sparrow	*Zonotrichia atricapilla*
Northern Flicker	*Colaptes auratus*
Common Raven	*Corvus corax*
Black-billed Magpie	*Pica hudsonia*
American Crow	*Corvus brachyrhynchos*
European Starling	*Sturnus vulgaris*
Chipping Sparrow	*Spizella passerina*
Calliope hummingbird	*Stellula calliope*
Rufous hummingbird	*Selasphorus rufus*
Pygmy nuthatch	*Sitta pygmaea*
Fox sparrow	*Passerella iliaca*
California quail	*Callipepla californica*
Mourning Dove	*Zenaida macroura*
Red-tailed Hawk	*Buteo jamaicensis*
American Robin	*Turdus migratorius*
Pine Siskin	*Spinus pinus*
Dusky Flycatcher	*Empidonax oberholseri*
Wilson's Warbler	*Wilsonia pusilla*
Spotted Towhee	*Pipilo maculatus*

Owls were addressed through field inventory, as a priority species group. Several species are known to have occurred in the general area. A study by Lisa Scott R.P.Bio had located the Western Screech-owl (*Megascops kennicottii*) west of the subject area (2.5kilometers) in an additional in 2015[14]. Personal observations noted in past years north-east, ~600meters, of the subject area of a Great Horned owl (*Bubo virginianus*). This owl has been noted in this area for several years (D. Shanner R.P.Bio pers comm.).

No owls noted during the field visitations. Western screech-owl survey was conducted on April 24, 2019, in the evening after sunset. Playback calls were conducted at several locations across the study area for a minimum of 15 minutes.

[14] Eco-Matters Consulting. 2015. Environmental Assessment of Prairie Valley West area of Summerland. Prepared for District of Summerland. 38pp.

Screech-owl is non-migratory and has a small territorial home range of 50ha and found below the 1000meter elevation[15]. Western Screech-owl uses tree cavities made by the larger woodpeckers, northern flickers, and Pileated Woodpeckers. Therefore, a potential for Western screech-owl to occur on-site given the habitat and larger tree cavities. Cannings and Davis have indicated Great Horned owls are known to prey upon Western Screech-owls and Barred owls (*Strix varia*) as well are known threats. With a known Great horned owl actively in proximity to the subject property may preclude the presence and nesting of Western Screech-owl. Both owls (Great and Screech) may use the site for foraging during some point of the season.

Lewis's Woodpecker (*Melanerpes lewis*) records from eBird.org show recent sightings (1996 - 2017) in the Summerland area. The subject area does fall within Lewis's Woodpecker critical habitat, where the attributes[16] were assessed and reviewed during field visits. To summarize, the basic needs for Lewis's are open dry Ponderosa pine or Douglas-fir, grasslands with fire-maintained systems of low stem density, veteran trees, and standing snags. Following Lewis's CH attributes from SARA recovery plan were assessed:

- Potential nest trees, alive or dead:
    - Ponderosa Pine, Black Cottonwood, or Douglas-fir (burned or not burned), Trembling Aspen, Paper Birch, Western Larch, or Subalpine Fir (*Abies lasiocarpa*); and
    - >30 cm dbh in Ponderosa Pine or Black Cottonwood stands, or >24 cm dbh in burned stands; and
    - with cavities 5 cm in diameter or greater, or classified as decay class 2 or higher, which are trees of a significantly advanced stage of decay to facilitate excavation by Lewis's Woodpeckers.
- Foraging where
    - standing trees not exceeding 35% canopy closure to provide perching, foraging and food caching substrate;
    - presence of fruit-bearing shrubs and perennial grasses in an understory layer for several life requisite needs.
- Threats as possible with this project
    - Urban development (medium impact)
    - Utility and service lines (low impact)
    - Recreational activities (low impact)
    - Fire suppression (medium impact)

No Lewis's Woodpeckers noted during the site visitations. However, they do not exhibit strong nest - territory fidelity and may use several trees or sites. Figure 4 shows the potential of suitable

[15] Cannings, Richard; Helen Davis. 2007. The status of the Western Screech-owl (macfarlanei subspecies) Megascops kennicottii macfarlanei in British Columbia. 21pp.

[16] Environment and Climate Change Canada. 2017. Recovery Strategy for the Lewis's Woodpecker (*Melanerpes lewis*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. vi + 40 pp.

critical habitat attributes for Lewis's Woodpecker compiled from site surveys and ecosystem mapping.

Given Lewis's inability to undertake "heavy" wood excavation and reliance on trees with existing cavities or can only undertake their excavation in highly decayed wood indicates a temporal usage of habitat as the habitat evolves. Noting the northern flickers activity on-site and several potential candidate trees may offer nesting habitat for Lewis's in the future.

Ungulates

Ungulate habitat loss and corridors were of concern and required component in this assessment. Both Mule Deer (*Odocoileus hemionus*) and White-tailed Deer (*Odocoileus virginianus*) do occur in the Summerland area. No deer were observed at any of the site visits, and any further reference of deer species will be to deer in general.

Pellet count plots conducted as part of the field investigations on the study site,[17] as shown in figure 5. Plots were a transect on similar azimuth, segmented by 30meter intervals, of varying lengths and a 2meter width. The mean was 6.0 pellet groups. Pellet-group counts were converted to estimate deer density for each transect per km^2 by an estimated number of pellet groups per day (15.25 pellet groups per day for deer using low elevation area; at 150 days for average usage on-site).

Deer use was observed to be constrained to the perimeter of the subject area. Observed to be outside the trail systems, road, and open gravel pit areas. The average for the overall project area for deer/km^2 for the site was 6.4 which is considered a low capability value for deer.[18]

Snakes

Western Rattlesnake (Crotalus oreganus) and Great Basin Gophersnake (*Pituophis catenifer deserticola*) are known to occur in the Summerland area, and both listed by CDC and SARA. Both the rattlesnake and gophersnake share a recovery strategy as these species require dens, share similar active-season needs and similar threats.

CH attributes summarized[19] overall for all three species are as follows:

- Permanent rock features (fractured rock, deep talus)
- Earthen borrows (i.e., pocket gopher holes)
- Grasslands, or open shrub-steppe
- Riparian – wetlands
- Cliffs (bluffs)

[17] Turner, J. 1987. Habitat inventory of the Trepanier Creek Watershed. Prepared for B.C. Ministry of Environment.
[18] Demarchi, D.A., B. Fuhr, B.A. Pendergast and A.C. Stewart. 1983. Wildlife capability classification for British Columbia: an ecological approach for ungulates. BC Ministry of Environment, Manual 4, Victoria.
[19] Environment and Climate Change Canada. 2017. Recovery Strategy for the Western Rattlesnake (*Crotalus oreganus*), the Great Basin Gophersnake (*Pituophis catenifer deserticola*) and the Desert Nightsnake (*Hypsiglena chlorophaea*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. Part 1, 28 pp., Part 2, A. 37 pp., B. 36 pp., C. 28 pp.

- Retreat structures such as large rock, rock outcrops, talus, bluffs, live or dead shrub, fallen trees, coarse woody debris, concrete structures, and rodent borrows.
- Availability of small mammals, birds, and other snakes
- Below expected maximum elevational for species:
    - Rattlesnake: 1850m
    - Gophersnake: 1700m
- Unsuitable habitat identified are:
    - existing permanent infrastructure (running surface of paved roads or artificial surfaces, buildings);
    - portions of water bodies that are > 1 km from an adjacent shoreline, and
    - elevational limits (listed above)

The subject area was searched several times for the occurrence of snakes or hibernaculum (i.e. dens). Neither snakes or hibernaculum were found during the field visits.

The subject area does present several components of critical habitat attributes listed above, as well, unsuitable habitat. The overall subject site has many decades of long-term usage of a known high-impact activity of critical habitat with "mining and quarrying." However, since this impact activity has ceased, it has since been replaced as a high-use recreational site. Many types of recreational usage were observed at every site visit and are evident in the extensive road - trail network.

Figure 6 is an amalgamation of suitable critical habitat attributes for listed snakes complied from site surveys and ecosystem mapping.

Amphibians

The background review noted several amphibians in the Summerland area. Great Basin Spadefoot (*Spea intermontana*) and Tiger Salamander (*Ambysoma tigrinum*) are two known species in Summerland, both SARA listed[20, 21]. Tiger salamander critical habitat overlapped the subject area. Both species (Spadefoot and Tiger) were considered here given the life cycles, and habitat for the two are quite similar.

In the background review, we were not expecting any wetlands, nor were there any within some distance from the subject area. However, with the discovery of a small wetland on-site, emphasis did shift to monitor the wetland for usage.

The critical habitat for both species is modeled on known breeding locations within wetlands. 500meters for Spadefoot and 1000meters for Tigers are the application distances under the recovery strategies for identification of core-habitat. The CH listed for the Tiger in the subject

[20] Environment and Climate Change Canada. 2017. Recovery Strategy for the Tiger Salamander (*Ambystoma tigrinum*) Southern Mountain population in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 19 pp. + 39 pp.

[21] Environment and Climate Change Canada. 2017. Recovery Strategy for the Great Basin Spadefoot (*Spea intermontana*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 31 pp. + 40 pp.

area is "Connectivity Habitat." Attributes for the Tiger Salamander connectivity critical habitat are:

- Grassland, shrub-steppe, open forest
  - Friable soils that permit burrowing
  - Invertebrate and small vertebrate prey
  - Self-made burrows; mammal burrows (i.e., pocket gopher)
- Unsuitable habitat features are:
  - existing permanent infrastructure (buildings, extensive spans of artificial surfaces, running surface of major paved roads having high traffic volumes);
  - large fast-flowing rivers; and
  - elevations over 1250 m.

Figure 7 is a compilation of suitable connectivity critical habitat attributes for listed Tiger Salamander complied from site surveys and ecosystem mapping.

Spadefoot has been known to travel over two kilometers and would use similar grassland, shrub-steppe, open-forest for life purposes outside of breeding. What Makonis Consulting has found in our radio-tracking studies of Spadefoot in Kelowna was the friable soils are misleading in that we found the spadefoot buried over 80cm deep in soils that required a pick-ax to excavate (Makonis unpublished). Spadefoot did use existing rodent borrows, as well dig their own, but often would then dig off these existing borrows into soils. It is likely the Spadefoot can occur in the subject area and would overlap similar usage needs as the Tiger salamander in Figure 7. No egg masses observed in the wetland in 2019 surveys.

3.3 Environmentally Sensitive Areas (ESA)

District of Summerland in Schedule B, Summerland Policy 300.9 Terms of Reference (ToR) – Environmental Assessment Reports has outlined a conventional four class ranking system used in the Okanagan since 2003[22]. It is essential to note that this system is one of two used in the Okanagan valley where differences between the two systems may introduce misinterpretation. (The other Okanagan system also a four-class system has split ESA – 1 into two; "Very High" as ESA1 and "High" as ESA2 and lacks a "Not Sensitive" category)

District of Summerland 2019 ToR outlines a minimum of several primary components for consideration in ranking ESA. Key points of these values are also reflected in provincial standards[23] when mapping ecosystems at risk.

- Habitat
  - Size: area of occupancy calculated on the portion of occupancy.
  - Context: Considers fragmentation as a measure of the proportion of the landscape that is fragmented. Excellent (1) <5%; Good (2) ≥5% to 25%; Fair (3) ≥25% to 75%; and Poor (4) ≥75% is fragmented.

[22] Ophiuchus Consulting. 2003. Concept Development Plan South Mount Boucherie, Regional District of Central Okanagan.
[23] Terrestrial Ecosystem Task Force Resource Information Standards Committee. 2006. Standard for mapping ecosystems at risk in British Columbia: an approach to mapping ecosystems at risk and other sensitive ecosystems.

- Condition: Is a consideration of composition, structure, and ecological function and is reflected in the following criteria:

  - Excellent (1)

a. Typical climax vegetation.
b. No anthropogenic disturbances or changes to natural disturbance regimes have altered the habitat (including fire exclusion or flood control), no vegetation or soil removal has occurred. Forested ecological communities are generally late seral vegetation. Wetland and riparian communities have intact hydrologic regimes. There is a minimal influence of domestic grazing.
c. No alien species occur at the site.
d. No artificial structures occur at the site.
e. There is little or no internal fragmentation (< 5%) of the occurrence.

  - Good (2)

a. Typical mature seral vegetation.
b. For forested communities, there has been no soil removal or disturbance to soil surface; little or no influence of old roadbeds or skid tracks, no construction evidence, old selection harvesting only, minimal changes to natural disturbance regimes (including fire exclusion or flood control). Forested ecological communities are late seral or mature, or younger if originating from natural disturbance. Wetland and riparian communities have largely intact hydrologic regimes. There is a low-moderate influence of domestic grazing.
c. Minor cover of alien species (<5% except <20% in grasslands) may occur at the site. Some earlier successional species occur.
d. Some artificial structures may occur at the site (< 2% of the total area of occurrence).
e. There is little or no internal fragmentation (<5%) of the occurrence.

  - Fair (3)

a. Anthropogenic disturbances and changes to natural disturbance regimes have occurred. Forested ecological communities are young seral stages after harvesting. There is moderate to high influence of domestic grazing in grassland ecological communities. There may be significant alterations to the hydrologic regime in wetlands and riparian ecosystems.
b. Significant cover of alien species occurs (5-20% in forests and riparian systems, up to 60 % in grasslands). Most of the plants in grassland communities are early successional species.
c. Some artificial structures may be present (less than 10% of the total area).
d. There is minor internal fragmentation (<5%) of the habitat.

  - Poor (4)

a. Significant anthropogenic disturbances have occurred, particularly removal or disturbance of soil materials and vegetation. There are significant alterations to the hydrologic regime of wetlands and riparian ecosystems.
b. Alien species may dominate a vegetation layer or may total more than 20% (>60% for grasslands) cover overall.

c. Significant artificial structures occur (>10% of the total area of occurrence).
d. The element occurrence is fragmented by artificial structures or barriers.

- CDC Listing – Provincial rarity
  - RED (1)
  - Blue (2)
  - Yellow (3)
  - Clear, or not ranked (4)

- Wildlife Species Indices (WSI)
  - Ungulate wildlife suitability ratings condensed from several local TEM projects. High Value: 1 to Nil Value: 6
- Critical Habitat
  - Lewis
  - Tiger
  - Snake

  These values were compiled from local TEM project suitability indices and Critical Habitat attributes as listed in above sections for species. High:1, Moderate:2, Low:3, Nil:4

The ecological values were added within the polygon and ranked accordingly, figure 8 and appendix one:

ESA-1 (≤ 16): 3.13ha

ESA-2 (16 to 19): 3.03ha

ESA-3 (20 to 23): 0.65ha

ESA-4 (≥ 24): 4.22ha

ESA-1 totaled 3.13ha forming a horseshoe pattern for the subject area, reflecting the current and historical disturbances and site use.

4.0 Discussion

This reporting only addresses the Ecological Assessment Phase for environmental reporting. No plans, footprints, or concepts for the proposed solar site were provided. The following discussion attempts to provide general guidelines for the planning and design of the project. Planning and Design for the subject area should be in consultation with a QEP.

The current and historical disturbances for the subject area total over 4.8ha, figure 9. Portions of older disturbance have begun to re-establish towards a natural ecosystem, while adjacent land alterations and groundwater movement have impacted other natural habitats that appeared not to have been disturbed directly.

Recreational usage is an ongoing disturbance for the subject area. The current trail systems are ad-hoc. For the most part, the trails utilize existing disturbance footprints such as the gravel pit, flume, access. However, two trails do cross high-value habitat, labeled '**A**' and '**B**' in figure 9, which has impacted overall ecological values for these ecosystems. Trails, in particular on

slopes, are rutted and created erosional issues into the natural grasslands where weeds were noted. I recommend deactivation and restoration of these two trail networks across ESA-1.

Ungulate usage was observed in general to reflect the horseshoe shape, perimeter of the subject property of higher ESA values. It is no surprise this ungulate usage also coincides with recreational, trail usage and prior disturbance areas. Design of fencing and slopes should be done in consideration to continue to allow for wildlife movement.

Agriculture use has pushed into the subject area in the south-east. Removal and site restoration should increase the natural habitat values for the site and create a buffer to the higher value ESA-1 from the existing agricultural operations to the south-east.

In general, for planning and design, the footprint for a proposed solar site should be focused on the historical and current disturbance areas, except for ESA-1 overlap. ESA-1 should be avoided and restored where disturbed. ESA-2 within the previously disturbed areas should not be impacted more than 10%, or 800m^2 and to maintain a buffer to ESA-1 and overall wildlife corridors.

Wildlife trees identified should be maintained in the designs. Six of the eight trees were noted in the previously disturbed areas, or lower ESA value habitat; figure 8.

Following summarizes key points in planning and design:

1. Plans, design, and development should focus on previously disturbed sites, figure 9.
2. Future trail decisions and planning should consider recommendations within this report. Trails should be left where they were seen, except for two trails currently in ESA- 1.
    a. One trail leaving the upper gravel pit area heading down to Prairie Valley Road labeled as "B" figure 9. This trail should be deactivated and allow for wildlife usage and habitat connectivity. Trail users can be directed to the existing access road that is expected to remain in place to access the upper site.
    b. A bike trail that enters and exits the subject area on the north-east should also be discouraged – deactivated, labeled as "**A**," figure 9. This habitat is a small piece of a more extensive habitat to the north-east that was noted as optimal deer, Lewis's woodpecker habitat.
    c. The flume trail and associated pathways can be maintained as part of the bigger trail network.

High-value Environmentally Sensitive Areas (ESA – 1) should be avoided. Conservation of these sensitive areas is needed to preserve the biodiversity and rarity of these features in the Okanagan.

3. Avoidance of ESA – 1 and long-term protection of these features should be incorporated into plans.
4. The wetland formed as part of the historical disturbance does now fall under the Water Sustainability Act and does provide a sensitive habitat for many species. This feature is to be protected with appropriate buffers in designs - planning. Enhancement of the surrounding exposed soils should be incorporated into future designs.

5. The ESA – 2 located above the access road / below the gravel pit can be targeted for site clean up and restoration (polygon #19 – 10PW). Groundwater has appeared to always be in this location, as noted in the 1938 aerials, and has been altered with the gravel pit operations.
6. ESA-2 within the previously disturbed areas should not be impacted more than 10%, or 800m2 and to maintain a buffer to ESA-1 and overall wildlife corridors.

Wildlife

7. Deer activity is mostly to the outside of the project area in a "U" shape (perimeter of the subject property), following the topography of the site. Habitat connectivity is to be considered in the design of the site. This connectivity is to include connections of ESA – 1.
8. Existing wildlife trees identified during the inventory should be maintained and preserved in the planning and designs. It is expected that more living trees to advance to this stage in time and become a replacement habitat for those currently and previously lost. Fire mitigation or Hazard Tree mitigation is often a significant impact of these specific and essential features. Topping hazard trees, rather than removal is one suggestion to provide replacement. QEP should be consulted in part with fire mitigation or hazard tree removal.

Encroachment from agriculture to the south has impacted the sensitive ESA – 1 habitat. It is estimated that this impact is 2,230m^2 between the storage – laydown and vineyard areas. Restoration of these areas to natural features is recommended.

If further clarification is required, please do not hesitate to contact the undersigned.

Sincerely,

John Grods R.P.Bio

5.0 Figures

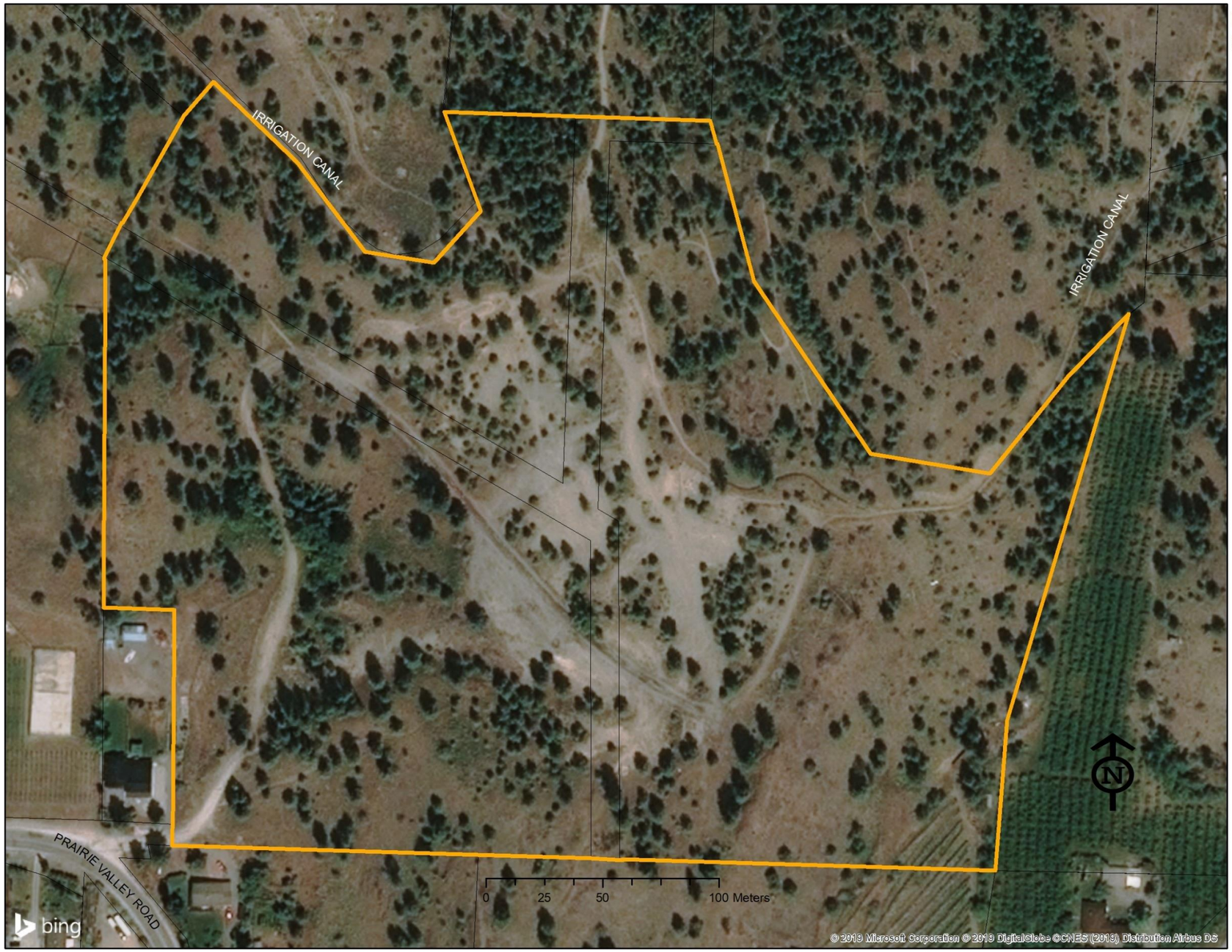
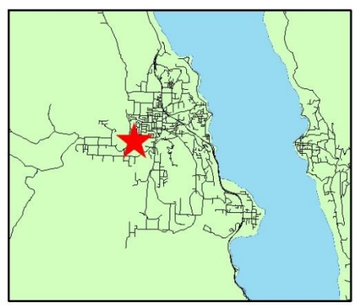


FIGURE 1
SOLAR SITE SUMMERLAND

Project Area
Summerland Legal Lot



SCALE: 1:1,500 Date: 5/21/2019

MAP DRAWN BY: J. GRODS

Makonis Consulting Ltd

FIGURE 2
Solar Site 1938
(Section 2.5)

Historical Irrigation Flume

Slope Breaks 1938

Project Area

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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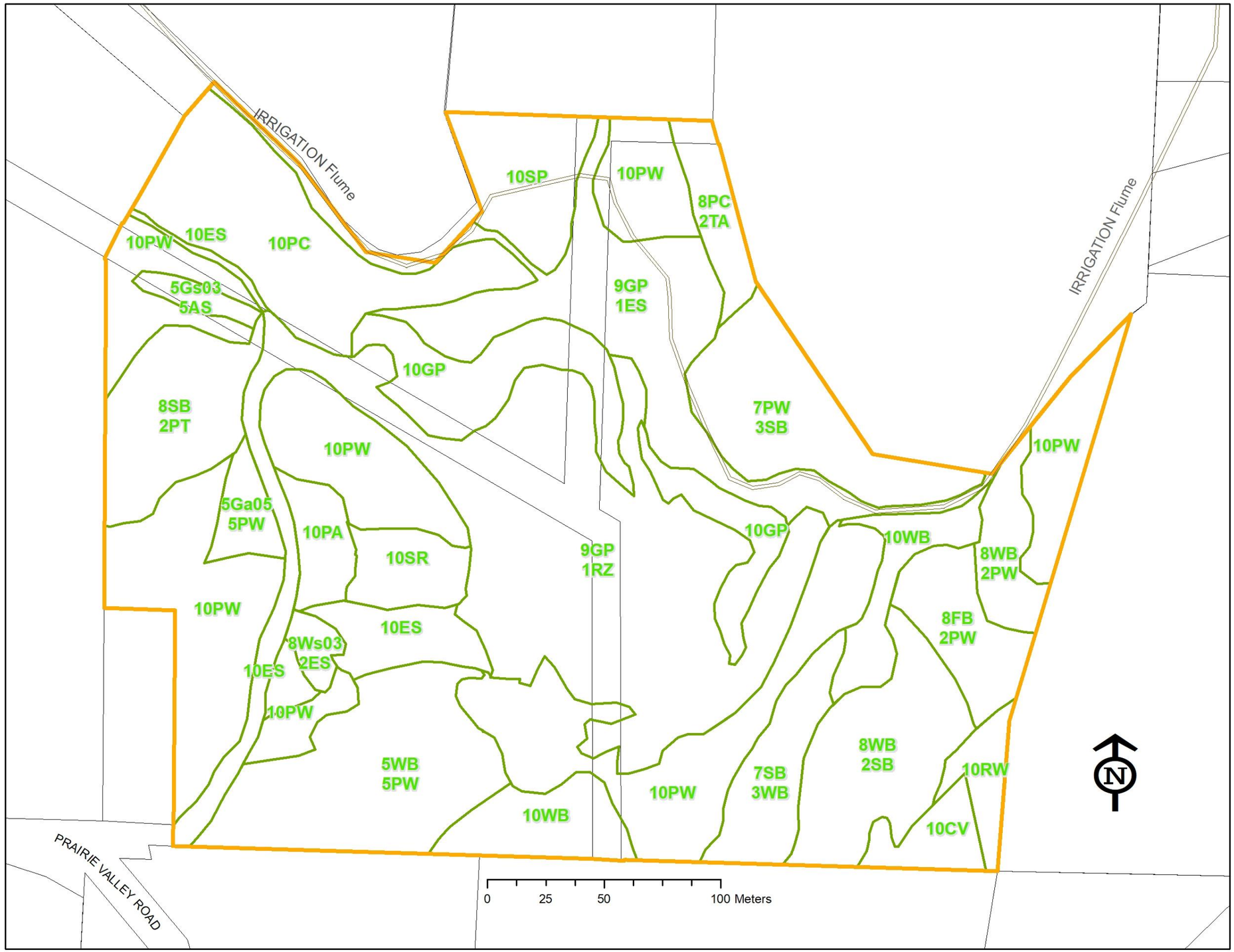
FIGURE 3
2019 Ecosystems
(Section 3.2)



Ecosystems
Historical Irrigation Flume
Project Area
Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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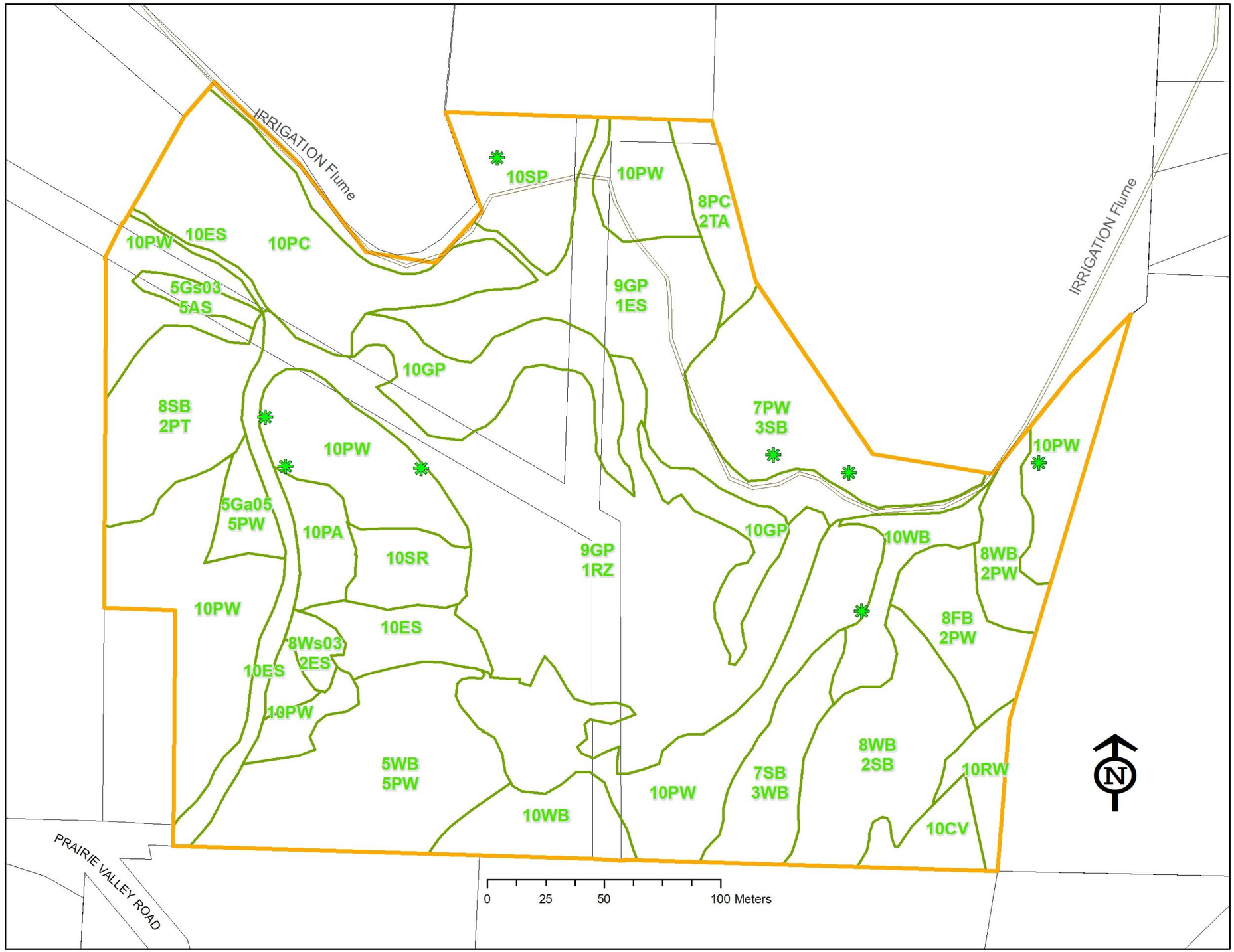
FIGURE 4
Wildlife Trees
(Section 3.2)



Ecosystems
Wildlife Trees
Historical Irrigation Flume
Project Area
Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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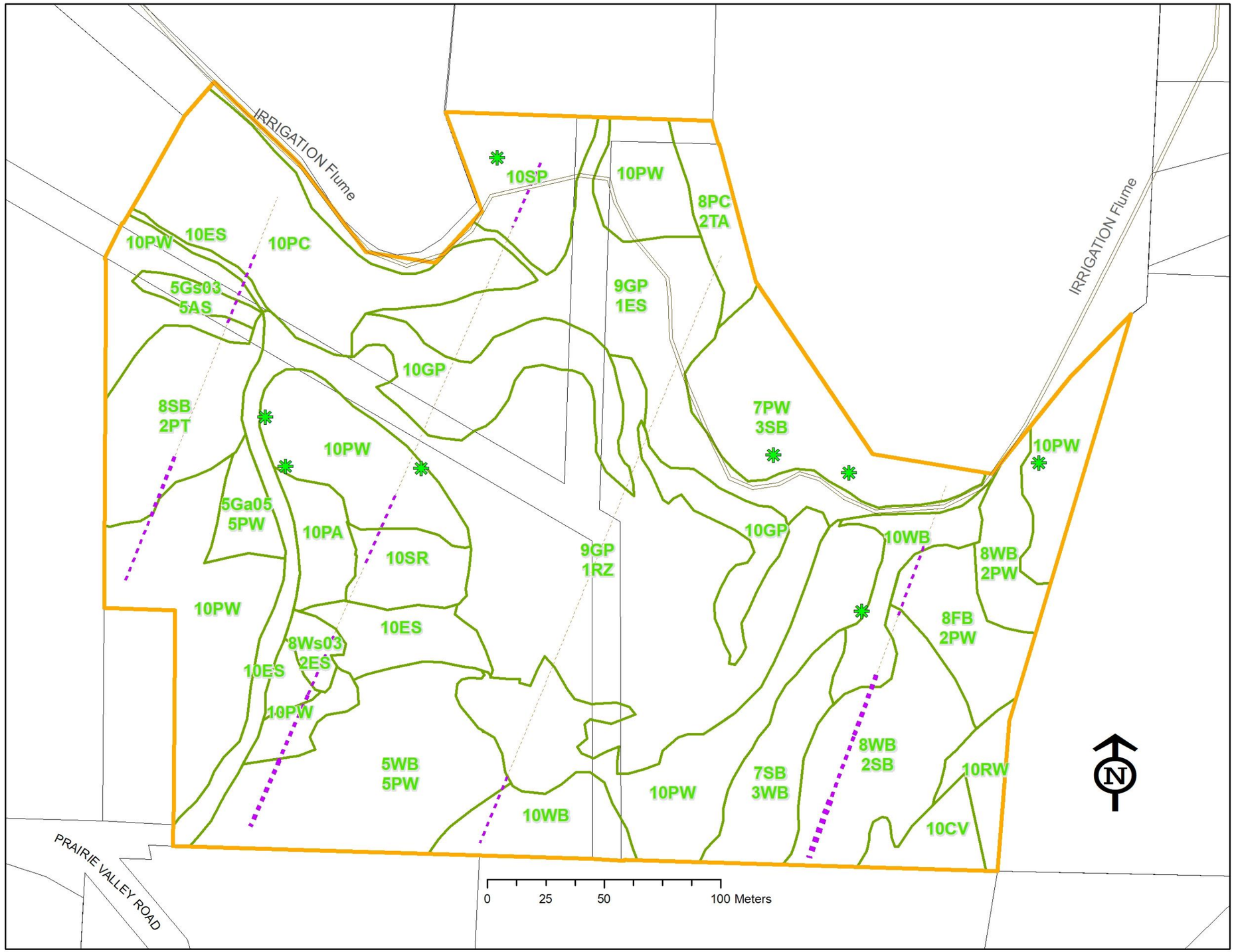
FIGURE 5
Ungulate Pellet Densities
(Section 3.2)



Ecosystems

Ungulate Pellet Transect

Pellet Density

- 0
- 1
- 2
- 3
- 5

Wildlife Trees

Historical Irrigation Flume

Project Area

Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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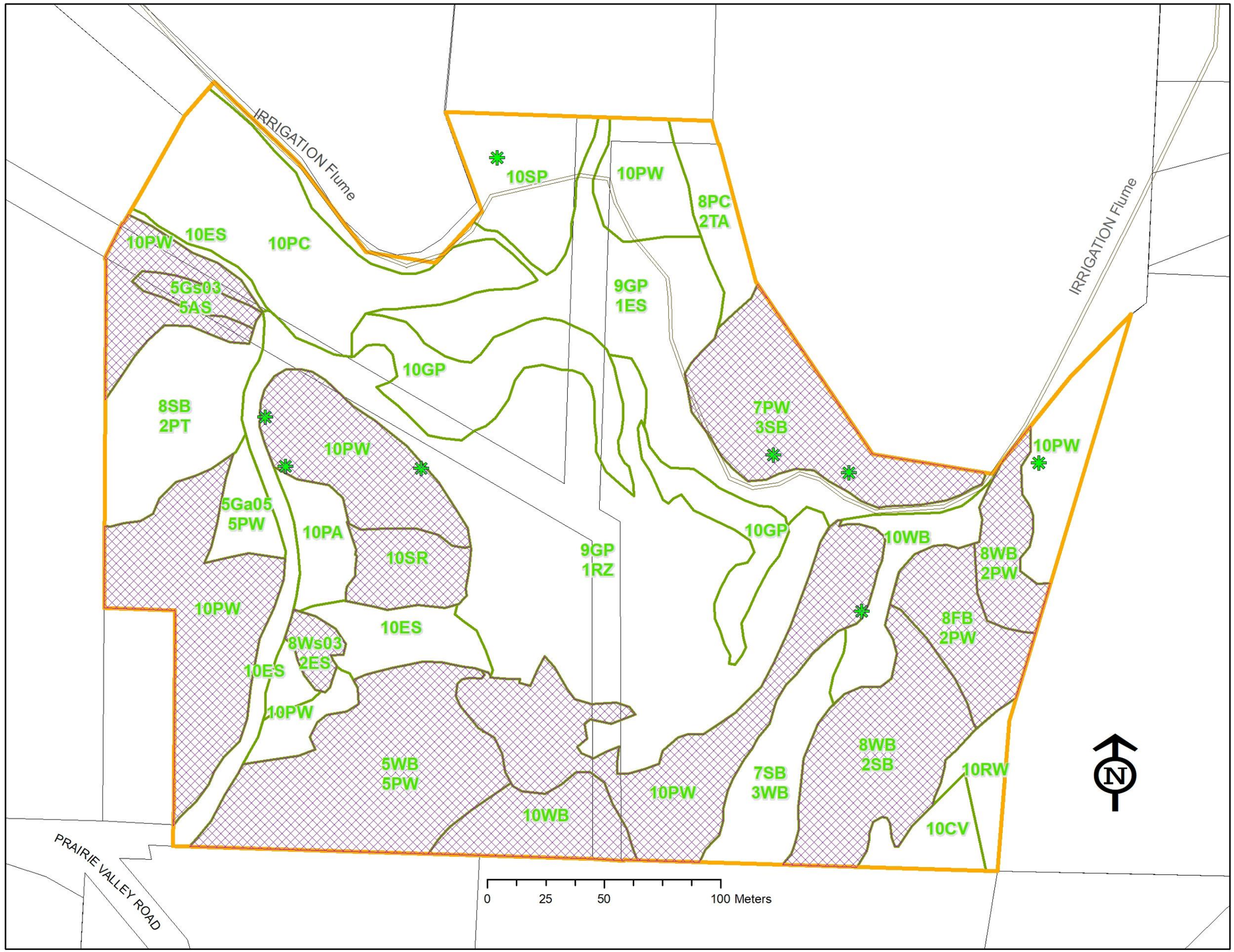
FIGURE 6
Snake Habitat Attributes
(Section 3.2)



- Snake Attributes
- Ecosystems
- Wildlife Trees
- Historical Irrigation Flume
- Project Area
- Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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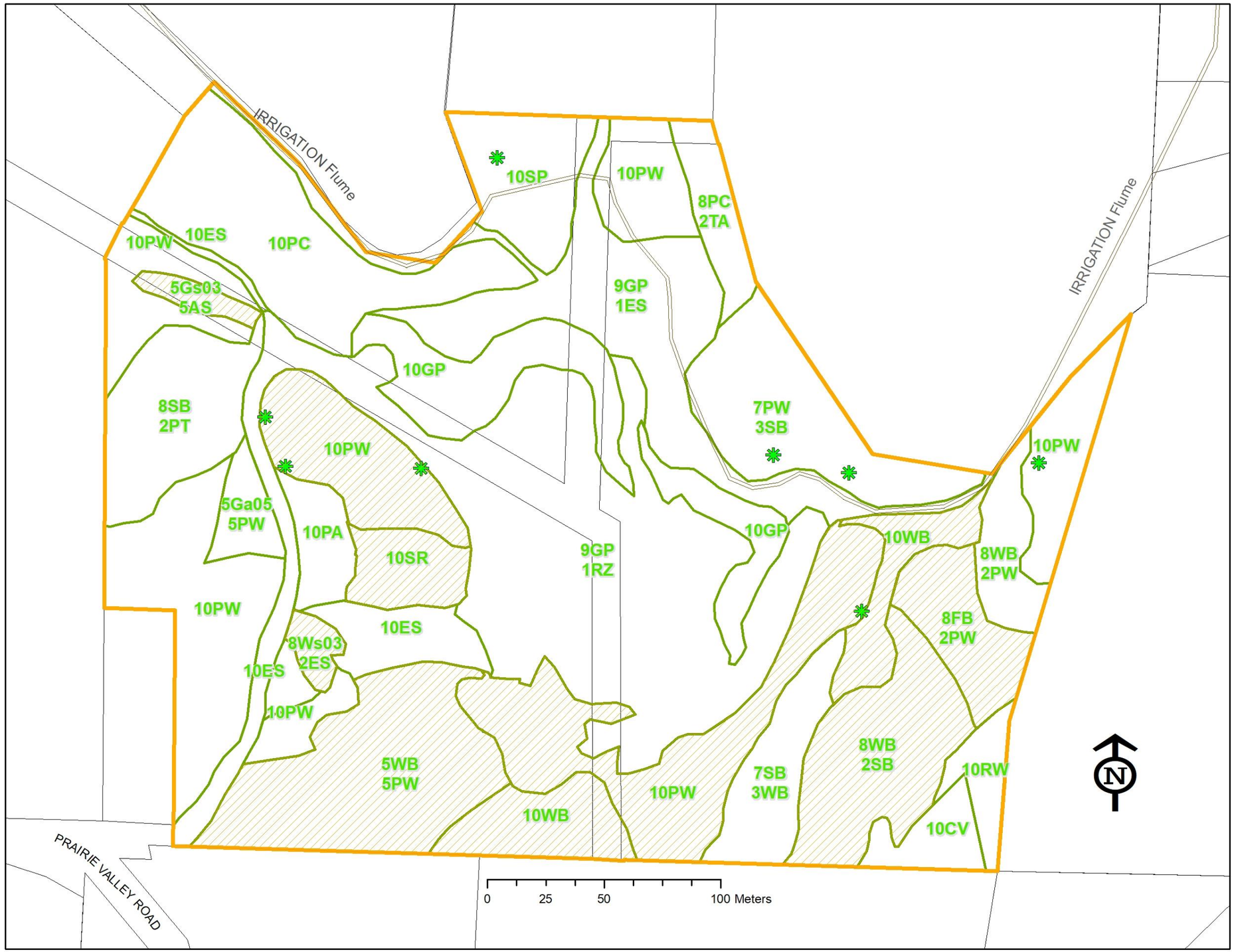
FIGURE 7
Tiger Salamander Habitat Attributes (Section 3.2)



- Tiger Salamander Attributes
- Ecosystems
- Wildlife Trees
- Historical Irrigation Flume
- Project Area
- Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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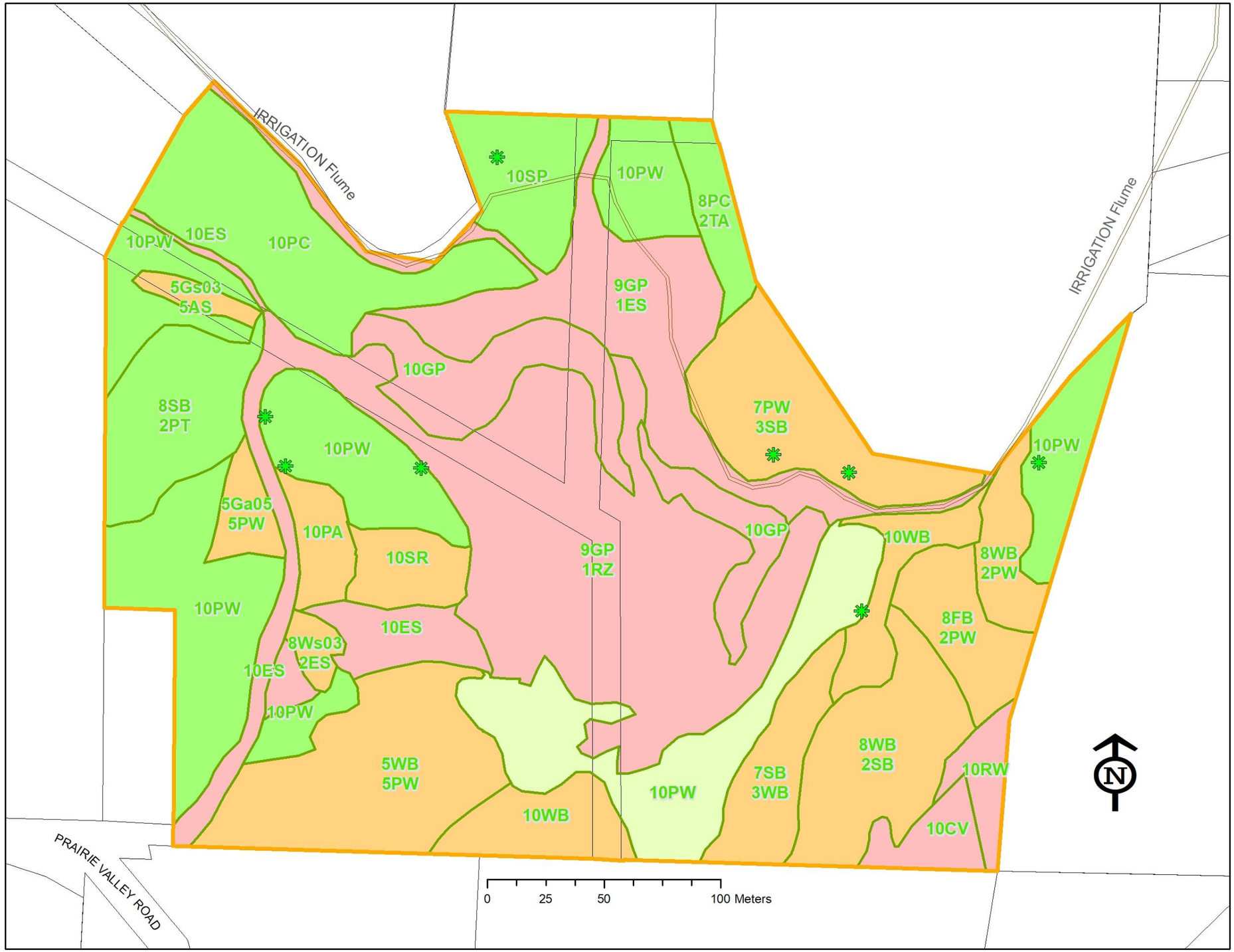
FIGURE 8
Environmental Sensitive Areas
(Section 3.3)



- Ecosystems

ESA

- ESA-1
- ESA-2
- ESA-3
- ESA-4
- Wildlife Trees
- Historical Irrigation Flume
- Project Area
- Summerland Legal Lot

SCALE: 1:1,500 Date: 2019-06-12

MAP DRAWN BY: J. GRODS

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FIGURE 9
Current &
Historical Disturbances
(Section 4.0)

IRRIGATION Flume

IRRIGATION Flume

A

B

PRAIRIE VALLEY ROAD

0 25 50 100 Meters

N

Disturbances
Trails
Historical Irrigation Flume
Project Area
Summerland Legal Lot
A & B Trails to be reclaimed

SCALE: 1:1,500 Date: 2019-10-17

MAP DRAWN BY: J. GRODS

Makonis Consulting Ltd

6.0 Photos

Photo One. Looking north-east at the main gravel extraction area for the site. The upper bench in the background once spanned out into this excavated area to approximately where the red arrow has been positioned.

Photo Two. A bike trail on the north-east that was observed in use several times during the filed visits. This trail passes through ESA- 1 that was noted Lewis's Woodpecker habitat and high deer usage.

Photo Three. Remnants of past historical site usage. Note the depth of excavation from the current floor noted bottom right to previous, top left.

Photo Four. Seepage from excavation cut has allowed horsetail to establish. Wetland noted is just off frame to the right.

Photo Five. Wetland observed during visits. The depth of the wetland was >15cm had all but dried up by mid-May 2019. Many birds were noted using this feature.

Photo Six. One of several wildlife trees noted on the subject site.

Photo Seven. Trail use was seen during each site visit, as shown above. Mountain biking, hikers, walkers, and joggers were all seen. Horse riding signs were observed.

Photo Eight. The portion of historical flume still seen.

Photo Nine. Remnants of past site use still found throughout the study area.

Table One. Plants found in 2019 in the subject area.

Species	Common Name
Acer glabrum var. douglasii	Douglas maple
Achillea millefolium	common yarrow
Amelanchier alnifolia	Saskatoon
Antennaria dimorpha	low pussytoes
Antennaria microphylla	low pussytoes
Antennaria umbrinella	umber pussytoes
Apocynum androsaemifolium	spreading dogbane
Arabis holboellii	Holboell's rockcress
Artemisia frigida	pasture sage
Artemisia campestris	sagewort
Asparagus officinalis	Garden asparagus
Astragalus miser	timber milk-vetch
Balsamorhiza sagittata	arrowleaf balsamroot
Bromus tectorum	cheatgrass
Calamagrostis rubescens	pinegrass
Carex concinnoides	northwestern sedge
Carex sp.	sedge
Castilleja sp.	paintbrush
Thompson's paintbrush	Castilleja thompsonii
Centaurea diffusa	diffuse knapweed
Comandra umbellata var. pallida	pale comandra
Cornus stolonifera	Red-osier dogwood
Delphinium nuttallianum	upland larkspur
Draba verna	common draba
Equisetum hyemale	scouring-rush
Ericameria nauseosa	common rabbit-bush
Erigeron linearis	linear-leaved daisy
Erigeron pumilus	shaggy fleabane
Festuca campestris	rough fescue
Festuca idahoensis	Idaho fescue
Fritillaria pudica	yellow bell
Gypsophila paniculata	Baby's breath
Hesperostipa comata	needle-and-thread grass
Heuchera cylindrica	round-leaved alumroot
Juniperus scopulorum	Rocky Mountain juniper
Koeleria macrantha	junegrass
Leymus cinereus	giant wild rye
Lewisia rediviva	Bitterroot
Linaria dalmatica	dalmatian toadflax
Lithospermum ruderale	lemonweed
Lomatium macrocarpum	large-fruited desert-parsley
Lupinus sericeus	silky lupine
Mahonia aquifolium	tall Oregon-grape
Maianthemum racemosum ssp. amplexicaule	false Solomon's-seal
Matricaria discoidea	Pineapple weed
Medicago lupulina	black medic
Medicago sativa	alfalfa
Opuntia fragilis	prickly-pear cactus

Penstemon fruticosus	shrubby penstemon
Philadelphus lewisii	mock-orange
Pinus ponderosa	ponderosa pine
Poa pratensis	Kentucky bluegrass
Poa sandbergii	Sandberg's bluegrass
Populus balsamifera	Cottonwood
Populus tremuloides	trembling aspen
Pseudoroegneria spicata	bluebunch wheatgrass
Pseudotsuga menziesii var. glauca	Douglas-fir
Ranunculus glaberrimus	sagebrush buttercup
Rhus glabra	Smooth sumac
Ribes cereum	Squaw current
Rosa nutkana	Nootka rose
Rosa woodsii	prairie rose
Selaginella wallacei	Wallace's selaginella
Symphoricarpos albus var. albus	snowberry
Taraxacum officinale	dandelion
Tragopogon dubius	yellow salsify
Trifolium pratense	red clover
Verbascum thapsus	great mullein
Vicia americana	American vetch
Woodsia oregana ssp. oregana	western cliff fern
Zigadenus venenosus	meadow death-camas

Appendix One. ESA stratification for Summerland Solar Field

OBJECTID	Shape_Area	Dec_eco1	Code_eco1	Mod_eco1	Str_eco1	Dec_eco2	Code_eco2	Mod_eco2	Str_eco2	Surf_exp	Cont	Cond	CDC	WSI	CH_Lew	CH_Tig	CH_Snk	ESA_total	ESA
1	18372.27	9	GP		1	1	RZ			N	3	4	4	6	4	4	4	29	4
2	1196.06	10	CV		3					Cb	4	4	4	3	4	4	2	24	4
3	2103.66	10	PW	w	5C					Cb	3	3	2	3	3	3	2	19	2
4	1033.17	10	RW		1					Cb	4	4	4	5	3	4	4	28	4
5	4723.86	8	WB	w	2b	2	SB	w	1a	Cv/R	2	2	2	2	3	2	2	15	1
6	2155.03	10	WB		2b					Cv/R	1	1	2	2	3	2	2	13	1
7	6490.09	10	PW		4C					FG	3	3	2	4	3	4	2	21	3
8	2460.43	7	SB		1a	3	WB	w	2b	R	1	2	1	3	3	4	2	16	1
9	4757.33	7	PW		6C	3	SB	w	1a	Cv	1	2	2	3	2	3	2	15	1
10	1730.48	10	WB	w	2b					FG	2	2	2	2	3	2	2	15	1
11	1822.18	10	PW		5C					FGp	2	3	2	3	3	3	2	18	2
12	6630.26	10	PC	w	6C					Cv	2	2	4	3	2	4	3	20	2
13	2834.06	10	SP		5C					Mb	2	3	1	3	3	4	2	18	2
14	2082.68	10	PW		5C					Mb	2	3	2	3	3	3	2	18	2
15	5411.11	10	PW		6C					Mb	4	2	2	3	2	2	2	17	2
16	540.72	8	Ws03		3b	2	ES		1	N	3	3	1	2	3	2	2	16	1
17	3365.02	10	GP		1					FG	4	4	4	6	4	4	4	30	4
18	1566.06	10	GP		1					FG	4	4	4	6	4	4	4	30	4
19	3332.58	10	PW		6C					Mb	3	2	2	3	2	3	3	18	2
20	1567.99	10	SR		3a					Mb	2	2	2	2	4	2	1	15	1
21	774.19	10	PW	k	6C					Cb	2	2	2	3	2	3	3	17	2
22	6712.59	5	WB	w	2b	5	PW	w	6C	Cb	2	2	2	2	3	2	2	15	1
23	1669.46	10	ES		1					N	1	4	4	6	4	4	4	27	4
24	1255.28	10	PA		5B					Mb	2	2	1	2	2	4	1	14	1
25	977.08	5	Ga05		2b	5	PW		5C	Mb	3	2	1	3	3	2	1	15	1
26	414.17	10	ES		1					N	3	4	4	6	4	4	4	29	4
27	3889.32	8	SB		1a	2	PT		6C	Cv/R	2	2	2	3	3	4	2	18	2
28	545.15	5	Gs03		2b	5	AS		3bB	Mb	1	2	1	2	4	2	1	13	1
29	7927.71	9	GP		1	1	ES		1	FGt	3	4	4	6	4	4	4	29	4
30	204.76	10	ES		1					Cv	1	4	4	6	4	4	4	27	4
31	2351.74	8	FB	w	2b	2	PW	w	6C	Cb	1	2	1	3	4	2	2	15	1
32	1586.75	8	WB	w	2b	2	PW	w	5C	Cb	2	3	1	2	3	3	2	16	1
33	1440.63	8	PC	w	5C	2	TA	w	1	Cv	1	2	4	3	3	4	3	20	2