

APPENDIX A



ENVIRONMENTAL SUMMARY

**OKANAGAN HILLS
NEIGHBOURHOOD PLAN
ENVIRONMENTAL IMPACT ASSESSMENT
VERNON, BC**

**EBA File No: 0805-5800196
March 2004**

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VERNON, BC

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EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) has been retained by Ekistics Management Inc. (Ekistics) to provide an Environmental Impact Assessment (EIA) for the proposed Okanagan Hills Neighborhood Plan Development as an update to a 2001 Environmental Management Plan also prepared by EBA. The executive summary that follows outlines the work background and scope, a brief project and Subject Property description, and the results of the sensitivity analysis, impact assessment and recommendations report components.

The Corporation of the City Of Vernon requires that an EIA be submitted to the Community Services Department at City Hall along with the Neighborhood Plan application as part of their Neighborhood Plan Review and Approval Process. The scope of work for this project involved fulfilling these EIA requirements of the City of Vernon Neighborhood Plan application process. The development of a Sensitivity Assessment figure was one primary objective, to guide environmentally conscious development decisions. The incorporation of the recently released *Sensitive Ecosystems Inventory: Bella Vista – Goose Lake Range 2002, Volumes 1-3* (SEI) was also part of the work scope and served as a valuable source of information. Two previous reports pertaining to this site have been prepared, by Pottinger Gaherty Environmental Consultants Ltd. in 1995, and by EBA in 2001. These reports also contained information valuable to this report, and are referenced throughout the document. The 2001 EBA report is included as an appendix.

The Subject Property is located 3.5 kilometers west of the City of Vernon in the highland area between the east and north arms of Okanagan Lake. It is approximately 300 hectares (750 acres in size and contained in an area zoned as an Urban Growth Area within the Vernon Official Community Plan. The proposed development will include a hotel and commercial area, winery and vineyards, residential areas (lots of various sizes), an 18-hole golf course, and an interpretive center and trails.

The Subject Property is exposed to the warm and dry climate typical of the Okanagan Valley. Geology is of oceanic and volcanic origin. Numerous ravines from glacial meltwater are evidence of modification by more recent glaciation. Soils are generally coarse-textured and well drained, with areas of shallow soils and exposed bedrock. The southern portion of the Subject Property is quite sloped, while the northern half is more level. Surface water is limited to a few wetlands in depressions on the upper portion of the Subject Property. The ravines occasionally hold water on an irregular basis throughout the year.

Biologically the Subject Property is within the Okanagan Very Hot Dry Interior Douglas-fir biogeoclimatic zone. Grasslands are the dominant vegetation type. Tree and shrub cover is confined to pockets where moisture is more available, and mostly seen on the northern portion of the Subject Property. Ecosystem Types were used to describe the ecosystems on the site, largely as detailed in the professionally developed SEI. The Ecosystem Types used for the Subject Property are the Grassland, Disturbed Grassland, Broadleaf Woodland, Mature Forest, Open Coniferous Forest, Wetland / Riparian, and Modified Landscape Ecosystem Types.

A detailed wildlife study was not conducted on the Subject Property. Wildlife suitability lists were presented within the earlier EBA report (2001). However, EBA gathered anecdotal evidence of a number of common ungulate, predator and furbearer wildlife species such as mule and white-tailed deer, black bear, cougar, lynx, bobcat, coyotes, red fox, raccoons and porcupines. A wide variety of birds have been observed including golden eagles, bald eagles, many species of hawk, turkey vultures, western meadow larks and other songbirds, and numerous owl species. Burrowing owls were observed yearly near the western property boundary up to and including during summer 2001 but have not been observed since that time. Northern Pacific rattlesnakes and other snake species have been observed on the Subject Property on numerous occasions, and Western painted turtles are common in many of the wetlands found within the Bella Vista Highlands.

Species of provincial and national concern occur in all of the ecosystem types found on the study area. The Grassland and Disturbed Grassland Types in particular are important to relatively high numbers of provincially Red-Listed (threatened or endangered) and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status bird, rodent and mammal species. All native plant communities found in the Grassland Type are listed by the BC Conservation Data Center (CDC) as being of concern.

A sensitivity analysis of the above physical and biological site properties resulted in four sensitivity assessment categories. **Very High Sensitivity** areas were designated around high value (relatively undisturbed) wetlands, intact riparian or woodland habitat surrounding wetlands, or steep and sensitive ravine areas connecting to wetland / riparian areas. **High Sensitivity** areas were based on criteria such as potential slope stability concerns (Slope Stability Class IV), relatively intact, undisturbed or rare ecosystems, or a highly sensitive condition (eg. shallow soils). **Moderate Sensitivity** areas had possible slope stability concerns (Slope Stability Class III), minor disturbance with ecosystems still intact, or were within scarce ecosystems on the Subject Property. **Low Sensitivity** areas were based on heavy disturbance, high modification and weed invasion ratio, or were on an ecosystem common over the Subject Property, with no expected slope instability.

Recommendations were made based both on specific development plan and sensitive site components. Any changes to the development plan should attempt to adhere to the suggestions within the sensitive site components recommendations section. Generally, areas with a Very High Sensitivity designation are to be avoided above all else for development. Avoid areas of High Sensitivity if at all possible, while Moderately Sensitivity Areas can be developed if appropriate mitigation measures are applied. Low Sensitivity areas are preferred for development from an environmental impact standpoint. Some measures to mitigate the environmental impacts of the development have already been implemented as a result of information exchange between EBA and the project planner.

Revegetation/Weed Control, Wildlife Management and Stormwater Management Plans should be created prior to development. Buffer zones should be used near wetlands and ravines. Utilize “treed and herbaceous roughs” in golf course design. Minimize cleared areas to limit spread of weeds. Reduce building footprints as much as possible, particularly where soils are

shallow, on rocky areas or within intact or scarce ecosystem types. Use minimal cuts and fills when constructing roads to reduce visual and environmental impacts.

Further studies such as raptor surveys, and geotechnical and hydrogeological investigations will be conducted in the spring of 2004. **Enhancement opportunities** such as wetland enhancement, restoration of fire-dependant ecosystems and disturbed grasslands should also be considered. An **environmental monitoring program** will be implemented upon the commencement of construction to assist the developer in carrying out recommendations presented within the report. On-site monitoring during construction phases in or adjacent to sensitive areas and periodic visits will ensure that adequate control and protective measures are being implemented.

EBA trusts that this report fulfills or exceeds the environmental assessment needs of the Okanagan Hills Neighbourhood Plan. We are confident that the proposed development will proceed with minor impacts to the existing environment if the recommendations regarding impact mitigation or avoidance to the identified sensitive areas are followed to the greatest extent possible.

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1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) has been retained by Ekistics Management Inc. (Ekistics) to provide an Environmental Impact Assessment (EIA) for the proposed Okanagan Hills Neighborhood Plan Development as an update to a 2001 Environmental Management Plan also prepared by EBA. This EIA ensures that the most recent information available with respect to land and habitat inventories as well as changes to the scope of the development itself are incorporated. This will allow the proponent to relate specific existing site conditions to resource management planning with confidence throughout project development.

This report provides an ecological inventory of the proposed site for planning purposes, with reference to previously prepared reports and other relevant documents. This report also includes an impact assessment and recommendations to mitigate or eliminate these impacts. A key component of the report is the mapping portion. The main body of the report then provides more detailed support for mapping criteria.

1.1 Background

Two previous reports pertaining to this site have been prepared. A report by Pottinger Gaherty Environmental Consultants Ltd. (PGL) (1995) provides details on existing climate, geological conditions, vegetation, wildlife, cultural and archaeological values among others. As project development did not occur at that time, EBA Engineering Consultants Ltd. was hired in January 2001 to provide an update to this environmental evaluation. This report can be found in Appendix B and provides a number of recommendations with respect to the site that still exist as viable options. Both of these previous reports are valuable reference tools.

1.2 Objectives

The Corporation of the City Of Vernon (CoV) requires that an EIA be submitted to the Community Services Department at City Hall along with the Neighborhood Plan application as part of their Neighborhood Plan Review and Approval Process (CoV, 2002). The Terms of Reference for the EIA are as detailed in Appendix C. The scope of work for this project involved fulfilling these EIA requirements of the City of Vernon Neighborhood Plan application process. Table 1 (next page) correlates the CoV EIA Terms of Reference (TOR's) with the report section addressing each requirement.

TABLE 1 – City of Vernon TOR's and corresponding EBA Report Sections

City Of Vernon TOR's	Relevant EBA Report Sections
1) Land Use	Section 3.1
2) Vegetation	Section 3.3.1
3) Wildlife	Section 3.3.2
4) Threatened, rare and endangered species	Section 3.3.3
5) Environment sensitivity analysis	Section 4.0
6) Recommendations	Section 5.0
7) Fish and wildlife habitat enhancement	Section 5.4.2
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Due to the recent release of a detailed inventory study involving the project site, the scope of work for this report included the incorporation of data contained in the *Sensitive Ecosystems Inventory: Bella Vista – Goose Lake Range 2002, Volumes 1-3* (SEI) (Iverson, 2002; Iverson & Shypitka, 2002; Sarell & Haney, 2002).

1.3 Methods

A thorough review of previous work determined any reporting requirements additional to the prior reports. Any report components subject to change were updated using a variety of methods. The most recent available aerial photographs were collected and reviewed, with field assessments conducted in mid-September.

The development of user-friendly mapping was determined to be a primary need directing this assessment. The ultimate objective was a Sensitivity Assessment figure (Figure 6) for the study site integrating the information contained in the 2001 EBA report, the SEI (Volumes 1-3) all in the context of EBA's professional judgement. A key tool for this was an orthographically rectified and geo-referenced aerial photograph of the study site, which formed the basis for much of the mapping component of the project. Species referred to in the report body are described according to their common names. Tables 2 and 3 give the Latin or Scientific names of all species mentioned.

Resource Inventory Committee (RIC) standards were not considered appropriate for the wildlife inventory portion of this project, due to the relatively short timeline for the assessment, the timing of fieldwork, and the lack of a finalized development plan to guide these very detailed studies.

2.0 PROJECT DESCRIPTION

The Okanagan Hills site, hereafter referred to as the Subject Property, is located 3.5 kilometers (km) west of the City of Vernon in the highland area between the east and north arms of Okanagan Lake (Figure 1). Photo 1 (Appendix A) shows a view of the Subject Property from the western Vernon. The Subject Property covers approximately 300 hectares (750 acres). The development plan to be superimposed on the Subject Property is described below.

2.1 Development Plan

The proposed development plan was created by Ekistics Town Planning (2003), and is shown on Figure 7. It includes a hotel and associated commercial facilities, a winery, and an 18-hole golf course and residential housing subdivisions on the northern half of the Subject Property. The proposed commercial area is approximately central, surrounded by integrated residential and golf course areas. Another strip of development along the southern edge includes further residential development, vineyards and a winery.

EBA understands that the lower lots and vineyards will likely be developed in 2004. The golf course and the main road accessing the rest of the Subject Property will be constructed concurrently. The remainder of the development will occur at later dates.

On-going communication between EBA personnel and planners has resulted in various modifications to the development plan as described above, in order to accommodate environmental sensitivities identified by EBA. For example, the golf course layout was altered to protect some sensitive ravines after an on-site exchange of information.

3.0 ENVIRONMENTAL INVENTORY

The following section presents the results of the biophysical inventory of the Subject Property. Previous studies are referred to where necessary to avoid informational repetition.

3.1 Subject Property Land Use

The Subject Property is bordered to the south by Bella Vista Road, with the Okanagan Indian Reserve #1 (undeveloped) to the north and west. The area to the east of the Subject Property is currently undeveloped, privately owned ranchland outside of the Agricultural Land Reserve (ALR). The Subject Property is within an area zoned as an Urban Growth Area within the Vernon Official Community Plan (CoV, 2002).

Previous impacts to the Subject Property included building of roads and trails, widespread cattle grazing, and logging in the northern portion (Photos 2 and 3) (EBA, 2001; PGL 1995). No further logging has taken place on the Subject Property since the time of the 2001 reporting. Cattle are still grazed, although earlier improvements to the number of animals and the timing of the grazing have much reduced the impacts that this activity was having on the Subject Property. Photo 4, taken from a similar viewpoint as the 2001 Photos 6 and 7 (page 10 in Appendix B), shows these improved conditions.

Informal recreational use and the resulting impacts have not changed since 2001. The Gray Canal running along the southern boundary of the Subject Property is mapped on Figure 3 (CoV, 2001). Field investigation shows this feature as a narrow dirt road, with no apparent evidence of structures associated with prior historic use. Analysis of recent aerial photographs suggests that a road roughly bisecting the Subject Property has seen greater use since the writing of the 2001 report (Figures 2-6).

3.2 Physical Environment

The physical environment in terms of climate, geology, soils and topography has not changed since either the 1995 or 2001 reports. The drainage and surface / ground water descriptions have been updated as below. Subject Property features such as rock/shallow soils, and ravines considered important to site development, are shown on Figure 4. Photo 4 shows a rock outcrop, while Photo 5 shows a ravine (Appendix A). Although neither the rock outcrop or ravine areas are defined as an ecosystem type for the purposes of this report, they tend to support specific sets of plant and animal species. For instance, Table 3 shows rare species generally found in the 'rock outcrop' type of environment. The information contained in the Gully and Ravine and Rock Outcrop Habitat Zones (EBA, 2001) and Sparsely Vegetated Ecosystem Type (Iverson, 2002) sections are also still relevant.

3.2.1 Drainage

Drainage is typically good due to the dominantly coarse-textured soils. The Subject Property is generally drained from north to south by a number of gullies and V-shaped ravines (Figure 3). The irregular drainage patterns are typical of structural or bedrock control. According to conversations with L. Snyder, the two eastern main ravines on the Subject Property do see flow at times when water is more abundant, particularly at night (L. Snyder, pers. com., September 29, 2003).

Fisheries resources are not present on the Subject Property, as none of the water on the Subject Property is connected to fish-bearing waters at present.

3.2.2 Soils

Soils on the Subject Property are typically well-drained (PGL, 1995). Colluvial origin contributes a moderate to high percentage of coarse fragments, so that precipitation tends to drain downward instead of collecting on the surface to then move and erode or carry sediment. Soil characteristics are of interest due to their considerable role in influencing soil erosion on a given site, primarily through effects on water behavior.

Water and wind are the primary agents contributing to soil erosion on the Subject Property. The degree of erosive damage that either of these can do is influenced by the speed at which they move, and the vegetation covering the soil surface. Wind speeds could be considerable, as the site is in a relatively exposed location. The generally dry conditions could contribute further to wind erosion. The speed at which water could move over the site is variable, depending primarily on slope. Precipitation on the Subject Property is not excessive, but there are a number of steep ravines that could carry water quickly down the slope.

The existing vegetation is playing a considerable role in controlling erosion on the Subject Property. Plant roots secure the soil in place, and slow down water flowing over the ground's surface. Root penetration also acts to reduce soil compaction, so that water can infiltrate more quickly. Plant foliage decreases the erosive power of falling precipitation. However, the present vegetative cover is sparse on many areas of the Subject Property and the dry conditions are not ideal for natural plant re-establishment.

3.2.3 Surface Water

The northern boundary of the Subject Property bisects a small lake (Figure 3). The portion of the lake within the Subject Property may go dry during late summer, as it is relatively shallow. An intermittent riparian area extends to the south of the lake and may carry ephemeral water flows varying with the lake water levels. Similar riparian meadows with potential seasonal water are found scattered across the northern portion of the Subject Property (Photos 6 and 7). Generally surrounded by heavier vegetation, these features are located in small-scale depressions in the landscape. A larger wetland is located to the south of the lake in the northeast corner of the Subject Property (Photos 8 and 9). As it is relatively deep, this feature appears to hold water for the entire year.

3.3 Biological Environment

The biological environment of the Subject Property has not changed fundamentally since either the 1995 PGL or 2001 EBA reports. However, the challenges presented by describing biotic complexity means frequent progressive changes to descriptive standards and methods. This section of the report will therefore put the information described in previous reports into the context of current inventory and descriptive techniques.

3.3.1 Ecosystem Types

Figure 4 presents the Ecosystem Types found on the Subject Property, with brief descriptions of each as below. Typical plant species are given due to their key role in ecosystem definition. This data is largely a translation of the ecosystem mapping information contained in the SEI (Iverson, 2002), with some exceptions due to specific site requirements. The section below will simply summarize each of the ecosystem types used and correlate each with the pertinent SEI Ecosystem Types and 2001 report Habitat Zones to allow further reference into greater detail as desired. Table 4 shows the plant, bird, mammal and amphibian species or communities of concern found associated with each ecosystem type, while the 2001 report lists more common species on pages 3 to 7 in Appendix B.

3.3.1.1 Grasslands

Grasslands occur on sites where moisture is insufficient to support tree growth. On sites with more extreme lack of moisture, grass species such as bluebunch wheatgrass, rough fescue and Idaho fescue with root systems designed to capture all available moisture are dominant. Shrubs like common snowberry and rose occur in Grassland ecosystems in small depressions or other areas where somewhat more moisture is available (Iverson, 2002).

Grassland ecosystems are one of BC's most threatened (Iverson, 2002), and support high numbers of rare species (Table 4). These sites are often highly desirable for development and agriculture, and fire suppression has encouraged an overabundance of larger shrubs and possibly trees. The provincial rarity of the Grassland ecosystem is echoed within the Subject Property. This ecosystem is currently seen only in isolated patches, primarily in the north of the Subject Property where human encroachment has been less than that seen below. Photo 10 shows an example of this ecosystem type on the Subject Property. The 2001 report categorized this ecosystem as a Sagebrush Grassland Habitat Zone. The description of it as such is consistent with the Grassland Ecosystem Type used here.

3.3.1.2 Disturbed Grasslands

The Disturbed Grassland ecosystem is the most dominant type within the Subject Property, especially in the southern portion of the site where ease of access by humans is greater. These areas were historically Grasslands, but site disturbance has resulted in a weed invasion of 20% – 50% by such species as cheatgrass, diffuse knapweed, Dalmatian toadflax and sulfur cinquefoil (Photo 11).

It should be noted that Disturbed Grasslands are still of considerable habitat value to many species, and have great potential for rehabilitation to their original grassland state. This ecosystem type was not differentiated specifically in the 2001 report. Some grassland in the southern portion of Figure 4 labeled as Modified Landscape has been disturbed beyond the criteria of the Disturbed Grassland type (Photo 3).

3.3.1.3 Broadleaf Woodlands

Broadleaf ecosystems are generally found where more moisture is available to plant growth, without actually being near surface water. They tend to be quite sensitive to disturbance because of their moist soils. These woodlands are scattered somewhat sparsely throughout the study area, tending to coincide with sheltered areas and broad depressions in the landscape (Photo 12). Trembling aspen forms the basis for the vegetation associated with broadleaf woodlands, with shrub under stories of common snowberry, rose, Saskatoon, and tall Oregon-grape (Photo 13). These ecosystems tend to have rich and well-developed soils, and their thick shrub layers are vital as thermal shelter, nesting, and foraging habitat for many species as shown in Photo 14.

Due to the general lack of moisture in the regional ecology, a number of rare plant associations containing aspen are Red-Listed (endangered or threatened provincially) for this. Broadleaf woodlands were not particularly distinguished as one of the Habitat Zones in the 2001 report, but the plant species associated with this ecosystem are mentioned as occurring in many of the gullies and ravines on the site.

3.3.1.4 Mature Forest

Mature Forest includes coniferous, deciduous and mixed forests of mature age (80-240 years of age for the relevant biogeoclimatic subzones) (Ministry of Forests, 1997). Their greater age allows a more complex stand structure (multi-layer) to develop, creating conditions unlike those found in younger forests (Photo 15 and 16). Tree species are generally Douglas-fir, ponderosa pine, trembling aspen, or paper birch, with common snowberry, Saskatoon, tall Oregon-grape, Nootka rose, Douglas maple and mock-orange shrub species in the understorey.

Within the Subject Property, this forest type may have occurred over much of the more moderately sloped northern portion. However, logging activities have greatly reduced the present coverage of this type, and presently there are only three areas of Mature Forest in the northwest corner, along the western boundary of the Subject Property and immediately south of one of the larger wetlands. The logged areas are shown on Figure 4 and Photo 4, as the Modified Landscape area in the northwestern portion of the Subject Property. The Mature Forest ecosystem type was simply included in the Coniferous Forest Habitat Zone in the 2001 report.

3.3.1.5 Open Coniferous Forest

Open Coniferous Forest Ecosystems are characterized by relatively open stands of Douglas fir and ponderosa pine trees (Photo 17). Dense tree growth is limited by a lack of moisture or shallow soils over rocky areas. These shallow soils make this ecosystem vulnerable to disturbance. Saskatoon, bluebunch wheatgrass and rough fescue dominate in the understory in areas where soil and moisture are sufficient.

The Open Coniferous Forest ecosystem type is not common in the Subject Property. Only a small pocket was identified on a rocky knoll in the northwestern corner. The Coniferous Forest type was one of the Habitat Zones mentioned in the 2001 report, but was used in a much broader sense than intended here. While the 2001 report used the term to describe any forest composed of coniferous trees, this report intends the Open Coniferous Forest type to mean particularly open and moisture-limited Douglas fir and ponderosa pine forest. The SEI refers to this forest type as Coniferous Forest.

3.3.1.6 Wetlands / Riparian

Because of the scarcity of permanent wetlands on the Subject Property, many wetter areas may fluctuate between Riparian and Wetland dominance depending on water availability. This report has combined these two ecosystems for mapping purposes.

Wetland ecosystems occur where standing water has created specific water-saturated or low-oxygen soil conditions. They therefore have unique plant communities associated with them. Wetlands are particularly vulnerable to disturbance, and their high productivity provides quality plant and animal habitat disproportionately high to their area (Iverson, 2002).

Wetlands are broken down by a wide variety of methods, but will be grouped into marsh, meadow and shallow water wetland ecosystems for the purposes of this report. **Meadow wetlands** have water at or near the soil surface for a short period only, with Baltic rush, Nuttall's alkaligrass, foxtail barley and seashore saltgrass for common plant species. **Marshes** have water at or near the soil surface for much of the year, with sedges as dominant plant species. They are often on the edge of shallow water wetlands or larger water bodies. **Shallow water wetlands** have standing water either intermittently or permanently with an area less than 50 ha if water depths are greater than 2 m. Submerged or floating aquatic plants such as duckweed and water smartweed are characteristic (Iverson, 2002).

Riparian ecosystems form the ecological transition between aquatic and terrestrial communities. Their value to wildlife and plants is similar to wetlands in that it is very high in comparison to the area occupied, and their dependency on moisture makes them equally vulnerable to environmental impacts. They are generally found in a linear band surrounding rivers, creeks, wetlands and lakes, where the generally abundant available moisture supports a rich diversity of life.

Because of their transitional nature, the species found in riparian areas are a unique reflection of the aquatic and terrestrial communities on either side. Species such as trembling aspen, black cottonwood and Douglas-fir form the overstorey, with common snowberry, red-osier dogwood, thimbleberry, Douglas maple, water birch, rose and star-flowered Solomon's seal in the understorey. The SEI divides Riparian ecosystems into either gully or fringe ecosystems, although neither of these are recognized within the Subject Property. These ecosystems were also called Riparian Habitat Zones in the 2001 report.

3.3.2 Wildlife

A detailed wildlife study was not conducted on the Subject Property due to time constraints and because of the size of the Study Area. Wildlife suitability lists were presented within the earlier EBA report (2001). An exhaustive list of all species potentially occurring on the Subject Property is unnecessary for the purposes of highlighting areas of environmental sensitivity. Figure 5 shows potential and currently used primary Wildlife Movement Corridors¹ incorporated with the proposed development plan. No heron rookeries were found to exist on the site, and timing of fieldwork was not adequate to identify any raptor nests.

An interview was conducted on September 26, 2003 with Mr. Fred Ams whom has been the caretaker of the Subject Property for the past six years. Mr. Ams grew up in the Vernon area and presently keeps his horses on the Subject Property near the central south property boundary. The following information was provided during the interview on the Subject Property.

¹ Primary wildlife movement corridors on the Subject Property are represented by ravines and gullies, which provide additional cover and foraging opportunities for a diversity of species including ungulates, coyotes, northern Pacific rattlesnake, and various species of rodents.

- A herd of approximately 75 mule deer presently reside on the Subject Property year-round. They are found throughout the Subject Property and occasionally local hunters are caught trying to harvest the deer. There are also white-tailed deer, although they are less common. The main deer movement corridors appear to be up the larger ravines. Photo 18 shows mule deer observed on site.
- Fur-bearers on the Subject Property include black bear (2 presently), cougar (2 presently), lynx, bobcat, coyotes (many appear to be dog / coyote hybrids), red fox, yellowbellied marmots, and raccoons. Porcupines occur commonly as well.
- A wide variety of birds have been observed including golden eagles, bald eagles, many species of hawk, turkey vultures (nesting occurs to the east near the TV towers), western meadow larks and other songbirds, and numerous owl species. Burrowing owls were observed yearly near the western property boundary up to and including during summer 2001 but have not been observed since that time. Another pair was reported near the TV tower to the east of the Subject Property but have also not been observed in recent years.
- Northern Pacific rattlesnakes and other snake species have been observed on the Subject Property on numerous occasions. Mr. Ams reports that when he was younger there used to be very large rattlesnakes about 1 metre long commonly found in the upper bush areas. He reports that they were killed off by local residents long ago.
- Western painted turtles are common in many of the wetlands found within the Bella Vista Highlands. They are likely present in the larger wetlands near the north end of the Subject Property, when the ponds contain water.
- Badgers have not been observed on the Subject Property.

Wildlife habitat assessments were conducted during 2002 as part of the SEI. The assessment included wildlife summaries and species habitat models for ten species considered at risk in BC. The wildlife habitat ratings were applied to TEM maps and portrayed as habitat suitability maps, which were used in conjunction with sensitive ecosystem mapping to identify the environmentally sensitive areas as discussed in Section 4.0.

3.3.3 Rare and Endangered Species and Communities

Some of the more common species expected on the Subject Property are still as listed in the 2001 report Habitat Zones (Appendix B). However, species of provincial and national concern can occur in all of the ecosystem types found on the study area (Iverson, 2002). As shown by Table 4, a few specific raptor species such as the Swainson's hawk and the ferruginous hawk make up the majority of these species. Table 4 shows a list of the provincial Red-Listed species potentially occurring on the Subject Property, along with their federal status according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Grassland and Disturbed Grassland Types in particular are important to relatively high numbers of Red-Listed and COSEWIC status bird, rodent and mammal species. All native plant communities found in the Grassland (undisturbed)

Type are listed by the BC Conservation Data Center (CDC) (meaning that they are of concern) (Iverson, 2002). Plant communities in the Riparian and Broadleaf Woodland Types are also listed.

The CDC has record of the following Rare Element Occurrences near the study area:

- Western Harvest Mouse (*Reithrodontomys megalotis*); and
- Blue Vervain (vascular plant – *Verbena hastata* var. *scabra*) (CDC, 2003).

Although neither of these species was specifically observed to occur on the Subject Property, they were found in habitats similar to those that exist on the Subject Property. Therefore their occurrence on the Subject Property is possible. Two additional rare and endangered species (chamomile moonwort and Great Basin nemophila (*Nemophila breviflora*)) are mentioned as occurring adjacent to the Subject Property in the 2001 report, but were not a CDC occurrence at the time of this report.

One anecdotal species occurrence of note is the burrowing owls mentioned in Section 3.3.2 above. These owls are legally designated as an Endangered Species in BC under the Wildlife Act (Table 4). While burrowing owls have not been seen on the Subject Property recently, they may utilize the area again in the future if their habitat is preserved or enhanced. Burrowing owls require soft, deep loamy soils and existing burrows (often abandoned badger dens), surrounded by low herbaceous vegetation on relatively flat terrain (Ministry of Environment, Lands and Parks, 1998). On the Subject Property areas fitting this description are found exclusively around the knoll on the western boundary (shown as Very High Sensitivity on Figure 6). These same areas are also suitable for badger habitat, another Endangered species.

4.0 ENVIRONMENTAL SENSITIVITY ANALYSIS

The environmental assessment was centered on designing ratings to show the level of environmental sensitivity associated with developing any given portion of the Subject Property. Figure 6 illustrates a summary of this assessment. The four ratings (Very High, High, Moderate and Low) reflect professionally developed ecological and engineering (slope stability and soil erosion) concerns combined in the context of EBA's professional expertise. The criteria used to categorize areas of the site as Very High, High, Moderate or Low Development Sensitivity are given below, along with some general development and site management implications.

4.1 Very High Sensitivity Areas

Areas assessed as having this designation are found surrounding the wetlands and valuable supporting forested or riparian habitat on the Subject Property. They were designated based on the following criteria:

- High value (relatively undisturbed) wetlands;
- Intact riparian or woodland habitat surrounding wetlands; and

- Steep and sensitive ravine areas connecting to wetland / riparian areas.

Development in these very high value areas is strongly discouraged. The intention of these areas is to preserve the highly linked wetland and riparian or woodland ecosystem complexes, and development could not likely co-exist with this objective. These two ecosystems together are currently assessed as having the very highest value to the biotic components of the Subject Property.

4.2 High Sensitivity Areas

Areas assessed as having a High Sensitivity to development are scattered over the Subject Property, and were found to have one or more of the following characteristics:

- Potential slope stability concerns (Slope Stability Class IV);
- Potential fire hazard to development;
- Relatively intact or undisturbed;
- Highly sensitive condition (e.g., Shallow soils);
- High potential erosion;
- Rare ecosystem within the Subject Property; and
- High social or interpretive values.

These areas are highlighted as having concerns with respect to site development. The higher slope stability class associated with this rating can present development hazards in terms of stability and soil erosion. The Slope Stability Class IV management are as shown in Table 5 (Ministry of Forests, 1999). High Sensitivity areas also contain some of the rarest and most sensitive ecosystems on the entire Subject Property. The area along the northern edge of the Subject Property shows some High Sensitivity as is consistent with the Vernon OCP mandate to provide a buffer adjacent to Indian Reserve #1 (CoV, 2001). Generally, development should be avoided on these areas if at all possible.

4.3 Moderate Sensitivity Areas

Moderate Sensitivity ratings were assigned to areas of the Subject Property that are less vulnerable to development than Highly Sensitive ones. Below are the general criteria used to designate these areas:

- Possible slope stability concerns (Slope Stability Class III);
- Some possible erosion concerns;
- Minor disturbance, ecosystems still intact;

- Scarce within the Subject Property; and
- Good potential interpretive or educational resources.

The higher slope stability class found on some of these areas could begin to present terrain stability concerns, as reflected in the SEI Slope Stability Class III management implications seen in Table 5 (Ministry of Forests, 1999). It should be noted that while these sites do have some degree of disturbance associated with them, they are not modified by weed invasion or site disturbance to an irreparable extent. These areas therefore provide opportunities for site restoration / enhancement. Generally, areas of Moderate Sensitivity can co-exist with development, although careful impact mitigation should accompany site development to prevent environmental damage.

4.4 Low Sensitivity Areas

A low development sensitivity rating was assigned to areas that are not as valuable to the ecological or structural integrity of the Subject Property for a number of reasons:

- Heavy disturbance;
- Highly modified;
- High weed invasion ratio;
- No expected slope instability (Stability Classes I and II); and
- Common ecosystem over the Subject Property.

Due to the previously disturbed condition of most of these areas, environmental impacts associated with development would be minor. Low Sensitivity areas are therefore the locations preferred for development from the standpoint of minimizing environmental impacts.

5.0 IMPACT ASSESSMENT AND RECOMMENDATIONS

The following impact assessment is intended to highlight the environmental concerns associated with the various project components. The assessment is based primarily on the potential effects of the development components on the previously mentioned Very High, High and Moderate Sensitive areas. The potential impacts on Low Sensitivity areas are not mentioned specifically here because it is felt that these areas overall do not need specific applied protection measures. However, it is assumed that all standard Best Management Practices and precautions will be taken throughout the Subject Property regardless of Development Sensitivity classification.

The 2001 report contains some highly relevant environmental management techniques with respect to reserves and wildlife corridors, access management, and riparian enhancement. This can be seen on pages 12-17 of Appendix B.

5.1 Development Plan Components

This section includes environmental impacts and recommendations specific to the development components of the proposed development plan. Because of the generally broad nature of this EIA, further EIA's may be required specific to individual development phases as they occur.

There are some recommendations common to all development plan components. The primary strategy should be to reduce unnecessary site disturbance throughout the subject property. Revegetation with native species is a key component of environmental management on the Subject Property. The entire hillside is highly visible due to its close proximity to the City of Vernon and surrounding area, and the aridity of the site prevents prompt natural revegetation. It is therefore recommended that a **Revegetation Plan** (incorporating native grassland species) **and a Weed Control Plan** be in place prior to development to ensure minimal loss of dry soils, reduced weed invasion, and improved visual presentation. Stripped soil with low weed invasion ratios should be retained and appropriately stored to assist with revegetation.

The presence of potentially problematic wildlife species has been identified on the Subject Property. It is therefore recommended that a **Wildlife Management Plan** be in place and include measures to prevent or minimize confrontations between humans and predators such as bear and cougar. The Wildlife Movement Corridors shown on Figure 5 will serve as a guide to highlight areas of particular emphasis for this Plan. The Plan should also address methods to prevent the troublesome integration of certain adaptable species such as raccoons into residential and commercial areas, and the potential effect of pets such as cats and dogs.

Due to the extreme value of the areas designated as Very High Sensitivity, the establishment of **Section 210 Restrictive Covenants** is recommended for these areas. These covenants provide legal protection against any further intrusion under the Land Title Act. EBA understands that the current landowners are investigating the potential for deed of land covenants within The Land Conservancy or some other similar system.

5.2 Golf Course

An 18-hole golf course and putting green extending over much of the northern portion of the Subject Property is planned as part of the proposed development. As such, it has the potential to affect all of the Wetland and Mature Forest ecosystems, as well as considerable portions of the Broadleaf Woodlands (aspen copses) and Grasslands. These are all considered to be some of the more sensitive components occurring on the Subject Property. There are therefore a number of general recommendations to minimize disruptive impacts as a result of the golf course. These are as follows:

- Minimize the footprint of highly manicured areas (i.e. tees, greens and fairways).
- Natural out-of-bound areas should be preserved during development or restored following development.

- Buffer zones of at least 15 meters should be left adjacent to natural water features or steep slopes, and stream crossings should be limited.
- Re-vegetation and landscaping should incorporate native species wherever possible (plan should be developed as suggested above).
- A stormwater management plan should be developed.
- Stormwater should not be directed to wetlands or the dry ravines on the site unless properly treated. Slope stability and erosion potential can be increased exponentially by the unguarded addition of water to the wrong site. Certain soils, particularly those containing some silt, can undergo abrupt changes in cohesion and therefore behavior if saturated with water.
- Turf grass varieties requiring less water should be selected to mimic the natural hydrology of dry areas such as this one.
- Layout should be responsive to water conservation, since layout can have a large effect on the amount of water required to maintain a course.
- Treed and herbaceous roughs should be integrated into the golf course design. Herbaceous roughs, composed of native grasses and forbs such as bluebunch wheatgrass, sheep fescue, balsam root, pasture sage, and snow buckwheat, would create a grassland-type environment immediately adjacent to the manicured portions of the golf course. These would require mowing or prescribed burning annually (late fall to early spring) to discourage woody shrub and tree in-growth. Treed roughs composed of grasses, forbs, shrubs and trees would then surround the herbaceous rough areas.
- Structural diversity in the form of snags and large trees included in this plan would provide habitat and cover for many species. Incorporation of this system into the design of the golf course would create channels of potentially viable ecosystems interspersed with the highly manicured golf course network.
- Connectivity of the roughs should be a component of the layout considerations as well, perhaps utilizing wildlife underpasses to create habitat linkages.
- Selective retention of vegetation should be used effectively to jointly limit access to sensitive steep ravines and gullies (prevent disturbance of wildlife habitat and soil erosion) and link roughs.

Draft recommendations to minimize impacts to the Subject Property as a result of the golf course development have been incorporated into the golf course design. Subsequent changes to the golf course design may occur, based on input from the environmental monitor, to ensure appropriate environmental field-fit.

5.2.1 Residential

The majority of the residential portion of the development is integrated with the greens, tees and fairways of the golf course in the northern half of the Subject Property. The lots are of varying sizes, but are generally small and likely designated for single-dwellings. Many of the more sensitive areas identified as part of the environmental inventory exist in the same upper half of the Subject Property as the main proposed residential development. The residential portion of the development therefore will potentially negatively affect the Wetland, Broadleaf Woodland, Mature Forest and Grassland Ecosystems, as well as many of the sensitive ravines and rock knolls. However, the majority of the residential units are in fact located in Low Sensitivity areas, with just a few areas of infringement on Moderate and High Sensitivity areas.

The southern portion of the Subject Property are some of the most heavily impacted from present and previous activities, in terms of weed invasion, road and trail-building, and cattle. Where development here is concerned, the primary areas to retain and protect are the ravines and small, scattered patches of Broadleaf Woodland. Ravine protection measures are described in Section 5.2.3 and 5.2.4 below. The Broadleaf Woodland areas are of small enough size that simple retention is the primary recommendation.

Because of the widespread nature of the residential development, it is not feasible to relate specific portions directly to individual environmental impacts on sensitive site components. The impact and recommendations section for this portion of the development will therefore take a form more closely resembling an environmental management plan. Potential impacts arising from the residential development are of concern due to their effect on the following sensitive site components:

- Steep and Potentially Unstable Slopes;
- Wetland / Riparian Areas;
- Steep Ravines;
- Gullies and Shallow Ravines;
- Rock / Shallow Soil Areas;
- Mature Forests;
- Broadleaf Woodlands;
- Intact Ecosystems; and
- Rare Species.

Where these components as described throughout the report and shown on Figures 3-6 will overlap with the development plan shown on Figure 7, there are recommendations to reduce or eliminate the resulting expected environmental impacts to each component. These recommendations, as summarized in Section 5.2 below, should therefore be applied wherever possible to minimize negative environmental impacts as a result of the development. Particular care should be taken when developing around the wetlands and ravines, which comprise some of the most sensitive areas on the Subject Property as a whole. Development along the south of the site should allow a 25-30 m buffer along the Grey Canal off-road trail.

Based on the Sensitivity Assessment, EBA recommends that any future development phases proposed within the following areas to require a Development Permit from the City of Vernon:

- Within 30 m or less of a Very High Sensitivity Area; and
- Within an area of High Sensitivity.

5.2.2 Commercial

The commercial portion of the development is comprised of a golf course club house, a hotel, shops and supporting businesses located just north and east of the center of the study area. The majority of the commercial development is therefore within an area designated as Moderate Sensitivity, with the exception of a small area of Highly Sensitive ravine. In this particular case, the Moderate Sensitivity designation was made in order to protect an area of sensitive Disturbed Grassland Ecosystem. Within the actual footprint area of the commercial development, the present grassland will be heavily impacted through building construction and paving. However, as the Disturbed Grassland type is the most common ecosystem over the Subject Property, the impacts to the overall area are not of great concern.

The ravine affected by the commercial portion of the development is sensitive. It appears that the development plan proposes to use this ravine as a permanent conduit for water to a small artificial pond below, thereby altering the ravine ecology substantially. Provided that the ravine is in fact a suitable location for the added water feature from an engineering standpoint, the impacts could be minimal and positive. Many of the recommendations in the Sensitive Components (Section 5.2 below) also could be applied to the commercial portion of the development. The 2001 report also contains some relevant suggestions for impact mitigation. Below are general recommendations to accompany commercial development:

- A geotechnical assessment should be conducted.
- Allow the increased vegetation growth that will accompany the additional water to flourish to create positive side effects through increased habitat for wildlife.
- Vegetation would also help to ensure ravine stability despite the abundance of water, which could make the ravine area more vulnerable in terms of factors such as erosion.
- With this in mind development should also consider an increased buffer from this ravine edge to ensure continued site stability.
- Preservation of on-site native species should accompany development wherever possible, due to the rare and endangered status of Grassland plant communities.
- Allowance for connectivity of the planted areas would provide continuous habitat for small animals and birds.

- Care should be taken to ensure that the surrounding grassland areas are not further contaminated with weed in-growth as a result of development, by minimizing cleared areas and implementing prompt re-vegetation.

5.2.3 Winery and Vineyards

The proposed winery and vineyards are located on the southeastern portion of the Subject Property. As such, it will be within the Modified, Grassland, and Disturbed Grassland Ecosystem types. The winery is located on an area of rock / shallow soil (Figure 3), with the vineyards along the southern edge of the Subject Property and small wine cottages just to the northeast of the winery.

The footprint of the winery itself is not large, and the impacted ecosystem types are not exceptionally rare over the greater study area with the possible exception of the Grassland Ecosystem type. The sensitivity associated with the rock and shallow soils on the site of the center, however, could be of concern. The location of the vineyards should not pose any impacts of concern, provided that the lower portions of the ravines are protected through vegetation retention and avoidance.

In order to address impacts to the small area of intact Grassland Ecosystem, the following measures are recommended:

- All efforts should be made to reduce cleared areas as much as possible, so that maximum grassland remains intact with minimal opportunities for weed invasion;
- Landscaping with non-weed species would be advantageous as well here to prevent the spread of weeds into the grassland;
- Impacts to the rock and shallow soil would also be reduced through a minimal area of development, with efforts to retain rock outcrops through development design and exact building placement;
- Any addition of water to the site should be carefully considered to prevent any erosion of the thin, fragile soils on the area; and
- The Revegetation Plan should be implemented promptly.

5.2.4 Access

A system of roads will be necessary to access the various development areas across the Subject Property. Because of the generally sloped nature of the hillside, many of these will have to cross the Subject Property in an east – west alignment to prevent excessive road grades. They will therefore need to cross a number of ravines. It is recommended that the following techniques be used:

- Crossings employ bridges as an alternative to culverts if possible to minimize impacts to ravines, especially those designated as Highly Sensitive.

- Crossings perpendicular to the slope also serve to minimize impacted area adjacent to the ravines.
- Reduction of cut and fill requirements is a key recommendation to reduce the size of impacted area and present a visually acceptable landscape.

There is also a system of interpretive and recreational trails planned for the site, with the primary trails travelling west from the winery towards the commercial / residential areas further north on the Subject Property. These main trails cross an area of Disturbed Grassland, and a number of ravines rated as Moderate Sensitivity. There are recommendations to minimize impacts as a result of trails:

- The impacts associated with the trails can be minimized by a thorough access management plan, to ensure that the trails do not simply facilitate widespread human movement over the undeveloped lower area of the site.
- Utilize the revegetation plan to reduce weed invasion
- Minimize the size of any cleared areas
- Trails should be located to satisfy access needs to sites of interest and yet to confine travel to less sensitive areas.
- Already impacted areas such as existing roads and trails should be utilized wherever possible.

5.3 Sensitive Environmental Components

The following components are those considered to be of particular environmental sensitivity on the Subject Property. Most of these components are found within the Very High and High Sensitivity areas as mapped on Figure 6, with some in the Moderate Sensitivity areas. These are highlighted here because impacts to these environmental components throughout the course of development are impacts of high concern, to be addressed and mitigated at all possible.

5.3.1 Steep and Potentially Unstable Slopes

The areas assessed as High Sensitivity are often closely associated with Slope Stability Class IV, with the exception of the wetland / riparian areas and most of the ravines. Sites with Slope Stability Class IV are primarily concentrated near the central east and lower west of the Subject Property, surrounding two of the most prominent ravine complexes. These sites have been assigned this stability rating based on surficial material type and texture, slope gradient, drainage, and presence and type of geomorphological process. They were assessed according to accepted terrain analysis methods and standards (Iverson & Shypitka, 2002).

Table 5 outlines standard recommendations in regards to Slope Stability Class IV:

- These areas should be avoided for development purposes due to the moderate likelihood of landslide occurrence following site disturbance.
- Because the stability of slopes is so closely linked to landscape characteristics such as hydrological flow, care must also be taken when developing above or below these potentially unstable areas.
- EBA recommends an on-site inspection by a geotechnical expert prior to development activity on or near these sites, to verify and further define slope instability.

Polygons given a Slope Stability III rating were included in the Moderate Sensitivity category. Sites with Slope Stability Class III are scattered over much of the Subject Property, with the exception of the southeast corner. Approximately half of the area covered by these sites are located adjacent to Stability Class IV areas. The stability ratings criteria are as described above for the Slope Stability Class IV.

Table 5 outlines some management implications for this Slope Stability Class:

- Since stability problems can develop on these areas, best management practices should be followed to decrease slope failure risk.
- Where road construction is concerned, minor slumping along road cuts and excavations can be expected, with a low probability of landslides following construction.
- As with Slope Stability Class IV, EBA recommends an on-site inspection by a geotechnical expert prior to development activity on or near these sites to verify and further define slope instability.

5.3.2 Wetlands / Riparian Areas

All permanent and temporary wetlands on the site (Figure 3) are of very high protection priority, as are the surrounding areas of linked vegetative cover. Below are some recommendations to achieve this:

- All wetlands should be maintained in an intact and natural state with no development as defined by vegetation removal or ground disturbance.
- For all wetlands on the Subject Property, an undeveloped buffer zone of at least 30 m is recommended. Where a wetland is planned for integration into the golf course or a stormwater system, a detailed mitigation / compensation plan should be created to provide a net positive gain in wetland wildlife habitat.
- Retain all existing wetland and surrounding riparian vegetation, or re-establish vegetated buffers with the appropriate native plant species.

- Buffers should be of adequate location and width to protect water inflow and outflow areas of the wetland, and to reduce the effects of surrounding development (edge effects) as much as possible.
- Bridges are often better options than culverts for minimal disturbance.
- Structural features such as the snags or woody debris that can make these areas so important to wildlife should be protected including root zones that provide stability to these structures.
- If safety reasons prevent leaving these structures, in some cases the trunk can be retained as a partial wildlife tree.
- The process of wetland changes such as modification by beaver should be allowed to occur naturally to the greatest extent possible.
- Untreated urban stormwater, agricultural runoff and sediment from construction should be prevented from entering wetlands to maintain water quality, and prevent algal blooms and vegetational changes.
- Impervious (paved) surfaces should be removed from close proximity to wetlands.
- Restrict the use of pesticides, insecticides and fertilizers near wetlands.
- The addition of properly treated stormwater could serve to stabilize water levels within the wetlands and significantly increase their ecological value.
- The breeding and nesting period (April to July) should be avoided by recreating humans (and their pets) as a minimum measure.
- The impacts of wetland use by cattle are much reduced in severity from the time of the 2001 report. It is certainly recommended that this trend of minimized use by cattle be continued where wetlands are concerned.

Detailed wetland assessments and evaluations will be completed in the spring of 2004 to address the above recommendations and assist in the formulation of sound management decisions.

5.3.3 Steep Ravines

The Subject Property has numerous gullies and ravines scattered throughout, with most aligned in a north – south direction. It is the steeper of the ravines that are addressed here, as these ravines are some of the most sensitive areas on the Subject Property. Due to the increasing slopes towards the southern end of the area, most of the steeper ravines within the High Sensitivity zones are found here. There are three particular ravine complexes that have been classified as Very High and High Sensitivity (Figure 6). This is based on a desire to prevent soil erosion, create linkages between the upper and lower slopes of the site, and to protect the valuable aspen and shrub plant communities (Broadleaf Woodlands) often found here.

Recommendations for these areas therefore include measures to achieve these main objectives, with a general policy of avoidance being the foremost recommendation. However, due to the unconsolidated and extensive nature of these ravine complexes, EBA realizes that strict avoidance may not be possible in all cases. A number of specific recommendations are as below:

- To prevent soil erosion, road design should aim to cross ravines as infrequently as possible, and avoid areas of the greatest slopes.
- Bridges should be used in preference to culverts for unavoidable ravine crossings.
- Any road crossings should be perpendicular to the ravine, to create the least area of impact.
- Vegetation within the ravines should be retained, with the dual purpose of erosion mitigation and protection of the many wildlife species dependent on these refuges. Because of the available cover in these ravines, wildlife use them as protected travel corridors to move between the highlands and the valley bottom.
- Any bridges or culverts utilized should be generously designed to allow safe passage of wildlife.
- Interpretive trails should parallel the ravines from the tops of their banks to avoid impacting the slopes within the ravines themselves.
- Trail crossings should coincide with road crossings to minimize disturbance.

5.3.4 Gullies and Shallow Ravines

The gullies and ravines considered under the Moderate Sensitivity rating are generally not steep, as these are included in the Very High and High Sensitivity areas. Because of their reduced slopes, the potential for erosion and other development impacts are also reduced. However, these areas are part of the over all drainage system of the site, and are therefore hydrologically linked to other, perhaps more vulnerable, areas of the Subject Property. Recommendations to protect gullies and shallow ravines are as below:

- All efforts should be made to maintain native vegetation in all gullies and ravines throughout the Subject Property.
- If vegetation is disturbed through development, it must be restored with native species as soon as possible to keep soil and hydrological regimes functionally intact.
- Development should generally avoid these more sensitive areas.
- Bridges are preferred over culverts for unavoidable crossings of these areas, to better allow wildlife passage and minimize disturbance.

- Other management considerations as mentioned above for steep ravines are also applicable, although protection measures are not recommended as strongly as with the highly sensitive steep ravines.

5.3.5 Rock / Shallow Soil Areas

One of the primary issues of concern with respect to these areas is the potential for increased bicycle or motorized vehicle traffic. The lichens and other plant species adapted to these very moisture-limited environments are extremely slow growing, and these activities can very quickly do long-term damage to these areas. Some recommendations are following:

- Trails should not be developed on these areas.
- Other incidental disturbance of these areas should be carefully avoided, to prevent weed invasion and removal of thin soil.
- Although cliffs suitable for rock-climbing are not thought to exist on the Subject Property, this activity should also be restricted to certain small areas. Some of these areas contain talus slopes of loose rock that can become unstable through disturbance (Photo 20). This is especially true at the base of these areas.
- These areas are often habitat to a number of snake species. Measures should be taken to minimize human interaction with these species for the mutual benefit of both parties.
- Snake fences and underpass structures can be used for this purpose.
- Snakes are particularly vulnerable during hibernation, and special care should be taken to ensure that snake hibernacula are not known to the public or disturbed in any way. A survey should be conducted by a herpetologist to assess the property for potential snake hibernacula.
- It is recommended that roads be located at a minimum of 750 meters away from snake hibernacula, and all necessary snake fences, barriers and underpasses be used (Iverson, 2002).

5.3.6 Broadleaf Woodlands

The Broadleaf Woodland Ecosystem Type provides important cover and habitat for a number of species requiring transitional ecology between grassland and riparian ecosystems. This ecosystem is currently providing what is likely the most valuable habitat on the Subject Property. In addition, the aspen copses comprising the vast majority of this type on the Subject Property contains the CDC Red-Listed trembling aspen – common snowberry – Kentucky bluegrass plant community (Table 3).

Natural vegetated buffers are important in maintaining the connectivity of the aspen copses with the landscape. Many of the species that depend so heavily in these

ecosystems also make use of other habitat types as well. Recommendations to preserve Broadleaf Woodlands are as follows:

- Any development is therefore recommended to be at least 15 m from these areas.
- Direct road access to these copses should be restricted wherever possible.
- Because these areas are vital nesting and breeding habitat in particular, development activities should be avoided from the May to August period.
- Use of insecticides should consider the importance of insects as a food source for certain owl and bat species.
- The structural integrity of the aspen copses, such as mature trees, snags or downed trees should be maintained. The shrub layer is especially important for nesting habitat.
- Dangerous trees can be left partially intact if removal cannot be avoided.
- Because hydrology is so important to the long-term function of these woodlands, **maintenance of the hydrological regime is crucial**. This involves ephemeral or seasonal surface water flow as well as subsurface water movement.
- More detailed hydrogeological study than is covered here may be required to ensure that these recommendations are followed.
- Roads, trails and housing developments should be designed to leave hydrological and hydrogeological flow intact.

5.3.7 Mature Forest

Because of the scarcity of this forest type, protection of the Mature Forest Ecosystems on the Subject Property should be of priority. Rare species such as Swainson's hawk, ferruginous hawk, and badger are found in this ecosystem. Mature forests are also important for protection because of their age. It takes upwards of 80 years for these ecosystems to replace themselves, even assuming intact soil conditions and minimal weed invasion. These forest types were traditionally maintained by fire events. Fire suppression has therefore led to a buildup of both fine and coarse fuels. There are some recommendations specific to this ecosystem type:

- Development should not encroach too deeply into these forest types to mitigate risks associated with the wildland urban interface.
- If prescribed burns are deemed logistically impossible, fire hazard to nearby development should seek to reduce fuel loading through raking and removal of needles and other understory debris.

- The structural integrity of these ecosystems is vital to their habitat value, and should be retained wherever possible.
- Large old trees are particularly important to maintain. Many wildlife species are highly dependent on the large trees unique to this forest type for nesting and roosting (Photo 19).
- To maintain snags and larger trees, danger trees can be cut to a minimal extent to remove possible hazards presented by their height.
- Trail and road location can also avoid these areas to eliminate potential conflicts between safety and habitat protection.

5.3.8 Intact Ecosystems

Much of the Subject Property has experienced some degree of ecosystem disturbance. Any intact ecosystems are therefore important to protect and maintain. The wetland, broadleaf (aspen copse), and mature forest ecosystems mentioned above fall into this category.

The sensitivity of the grassland ecosystem to invasion by aggressive species such as knapweed makes this ecosystem a key one for protection. Some recommendations to achieve this are as below:

- Buffers should be considered to protect areas of this ecosystem from invasion by weeds and other development impacts.
- Livestock should be managed very carefully on these areas, as overgrazing can drastically reduce species such as bunchgrass, and encourage less palatable weed species.
- Use of native species in the establishment of gardens and landscaping in developments adjacent to grasslands will help preserve grassland species integrity.
- Any trails through the Subject Property should prevent any off-trail recreation. Many of the bird species using these areas nest on the ground, and are very vulnerable to human and pet movement through the area.
- Scattered trees and snags are important to maintain as wildlife perching and singing sites.
- Encroachment by young trees could be repressed. Traditionally fire would have played this role but in the absence of these events some manual grassland maintenance could achieve the same effect.

5.3.9 Rare Species

Many of the rare species can be found in the ecosystem and habitat types mentioned above. Further study regarding these species is therefore recommended. EBA understands that draft recovery plans are available for species such as the western harvest

mouse, and makes a recommendation that these plans be obtained and possibly implemented. Plans to record and protect any occurrence of rare and endangered species outside of the areas addressed here should be included in any development plans. This could be included in the Wildlife Management Plan.

5.4 Further Studies and Enhancement Opportunities

EBA does suggest that some further studies be done on the Subject Property, particularly in regards to the potential slope stability concerns identified. Further wildlife assessment and hydrogeological studies on the site could also be considered.

There are a number of possible environmental enhancement opportunities on the Subject Property as well, such as wetland improvement, and restoration of disturbed grassland and fire-dependent ecosystems.

5.4.1 Geotechnical Investigations

Geotechnical investigations are the primary further studies recommended by EBA for the Subject Property. Areas identified as having Slope Stability Class IV and III should have a geotechnical on-site assessment performed (BC Ministry of Forests, 1999). These areas have been classified as part of a process somewhat broader than this one, and a qualified professional should verify the resulting classification on the site itself. This individual would be able to elaborate on the site-specific factors that led to the original classification to better design management recommendations. Further studies should be undertaken to determine those areas within the development site that have the probability of a natural hazard occurrence that exceeds 10% in 50 years, as per current Ministry of Transportation standards.

5.4.2 Further Wildlife Assessment

Because of the large size of the site of the proposed development, it was not practical to perform detailed wildlife studies or habitat use mapping on a small scale. However, it is recommended that these be performed prior to individual development phases, with the highlighted areas of concern as identified in this more general assessment and RIC standards used as a guide. This will ensure no previously unidentified use by vulnerable species, and provide data to retain individual site-specific features of value such as den sites or wildlife trees. The rare and endangered species potentially occurring on the Subject Property such as the Western harvest mouse and blue vervain should be particular targets of this further study.

Reptile and amphibian surveys will be completed in the spring of 2004 to assess the presence of rare and endangered species. In conducting these surveys it is expected that considerable incidental observations of small mammal will also be recorded.

A raptor survey is recommended in any areas of the Subject Property where development is proposed. **This survey will be completed prior to development, in spring 2004, when important nesting features are evident.** Such a survey was not performed as part of EBA's 2003 environmental inventory, as summer and fall fieldwork would have been inadequate for this purpose, and the specific areas of development were not finalized.

Wildlife enhancement is possible on the Subject Property depending on the content of the Recovery Plans mentioned above.

5.4.3 Hydrogeological Investigations

Hydrogeological investigations may be required to ensure that ecosystems and their associated habitats are not unexpectedly disrupted by development seemingly removed from protected areas. This may be especially important for maintenance of subsurface water-dependent ecosystems such as Broadleaf Woodlands.

A preliminary assessment has already been completed, with the intention of providing general information. The following conclusions were extracted from the assessment.

Based on the available information, we find that the Okanagan Hills site is favourable for stormwater management using surface detention coupled with subsurface infiltration, assuming that total runoff is partitioned into subbasin flows on the site. We strongly recommend that there be continued integration of stormwater management with overall planning as the development design matures.

The detention structures as illustrated schematically in the October, 2003 Executive Summary of the Okanagan Hills Neighborhood Plan appear to be located in logical areas. The number of structures and their final configuration may vary as the design stormflows are quantified and the development design matures. Such structures will act to some degree to attenuate stormflow peaks.

We recommend that a more advanced assessment and conceptual design study be carried out. This could include a determination of the number and type of management structures required, once the design stormflow parameters are identified. In addition, working with development planners and the engineering team, the approximate location of such structures could be identified.

5.4.4 Restoration of Fire-Dependent Ecosystems

Restoration of mature forests and grasslands historically dependent on fire events is a potential consideration. This would likely have to be preceded initially by manual thinning in forested areas, with prescribed burns preformed periodically afterwards. Further research into the exact requirements of the mature forest and grassland types on the Subject Property would be necessary by a professional with expertise in both fire and forest ecology.

5.4.5 Disturbed Grassland Rehabilitation

While altered by some invasion by noxious weeds, the majority of plant species found on these grasslands are still native. They therefore have potential in terms of rehabilitation, to restore the areas to a pre-disturbance condition. This would involve further investigation into weed infestation level mapping, site-specific species requirements, and required management regimes. Weeds could be hand-pulled, and native species re-

planted to discourage further weed growth. Periodic monitoring to assess and possibly adjust the rehabilitation program would be a necessary component of this rehabilitation. Permanent sample vegetation plots could be established to streamline the monitoring process.

5.4.6 Wetland Enhancement

Many of the wetlands on the Subject Property are currently of small size and go dry during the late summer and fall. Additions of properly treated stormwater generated by development could effectively serve to enlarge the very ecologically valuable wetland area on the Subject Property. This supplementation would also increase the period of time throughout the year that the wetlands hold water. Although some species are adapted for cycles of wet and dry environments, many other species would make much greater use of the wetlands if water were present year-round.

It is understood that the large pond in the northeast corner of the property is being planned for expansion and for potential use as a storage facility for treated waste water for irrigation purposes. The non-existent riparian vegetation area makes this wetland an ideal candidate for such use. However, a limnological assessment, including water quality and aquatic life, should be conducted prior to alteration of any of the wetlands for irrigation purposes.

Detailed mitigation designs will be prepared for all wetland and riparian communities that will be altered by development.

6.0 ENVIRONMENTAL MONITORING

Environmental monitoring throughout the site development phases should be implemented to assist the developer in carrying out the above recommendations. An Environmental Monitoring Program and supporting Terms of Reference should be prepared to streamline the monitoring process. Construction within or adjacent to sensitive areas should be accompanied by on-site monitoring. Periodic visits should also take place as part of the monitoring to ensure that adequate control measures are being implemented, particularly where any protective covenants or sensitive areas are concerned.

The Environmental Monitoring program could include the following:

- The documentation of erosion and sediment control measures implemented during construction (stabilization of disturbed soils and interception of silt laden runoff).
- The documentation of a sound drainage plan (Stormwater Management Plan) in which post development flows and flow patterns should match those of pre-development.
- Documentation of Revegetation / Weed Control Management Plan implementation.

- Monitoring of wetland enhancement and mitigation plans.

An environmental monitoring program will be implemented for the golf course development. Mitigative actions will follow the recommendations presented in this report. Appropriate field-fit modifications will be made based on input from the environmental monitor.

7.0 CONCLUSION

The primary issues identified by EBA through this environmental assessment of the proposed Okanagan Hills development are summarized by Figure 6 (Sensitivity Assessment). This Figure separates the Subject Property into areas of Very High, High, Moderate and Low Sensitivity, based on a professional compilation of factors such as sensitive ecosystems, slope stability, and habitat value to plant and wildlife species. Very High Sensitivity areas are specifically designed to protect wetlands, and the linkage of these important areas to surrounding high value habitat. High Sensitivity areas are primarily found around less protected wetlands, steep ravines, rare ecosystems, and potentially unstable slopes. Ecosystems that were found to be scarce over the Subject Property, relatively intact grasslands, possibly unstable slopes, and the Grey Canal comprise the Moderate Sensitivity areas. Low Sensitivity ratings correspond with highly impacted and disturbed areas of reduced slopes. The recommendations as mentioned in Section 5.0 are designed to utilize these sensitivity ratings while accommodating the proposed development plan.

8.0 CLOSURE

EBA trusts that this report fulfills or exceeds the environmental assessment needs of the Okanagan Hills Neighbourhood Plan. We are confident that the proposed development will proceed with minor impacts to the existing environment if the recommendations regarding impact mitigation or avoidance on the identified sensitive areas are followed to the greatest extent possible.

This report incorporates and is subject to EBA's General Conditions (Appendix D). This document contains confidential commercial and technical information and must not be released in whole, or in part, to any third party without the expressed written consent of EBA Engineering Consultants Ltd.



Respectfully Submitted,
EBA ENGINEERING CONSULTANTS LTD.

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Hona Sweeney, B.Sc.
Environmental Scientist

Reviewed by:

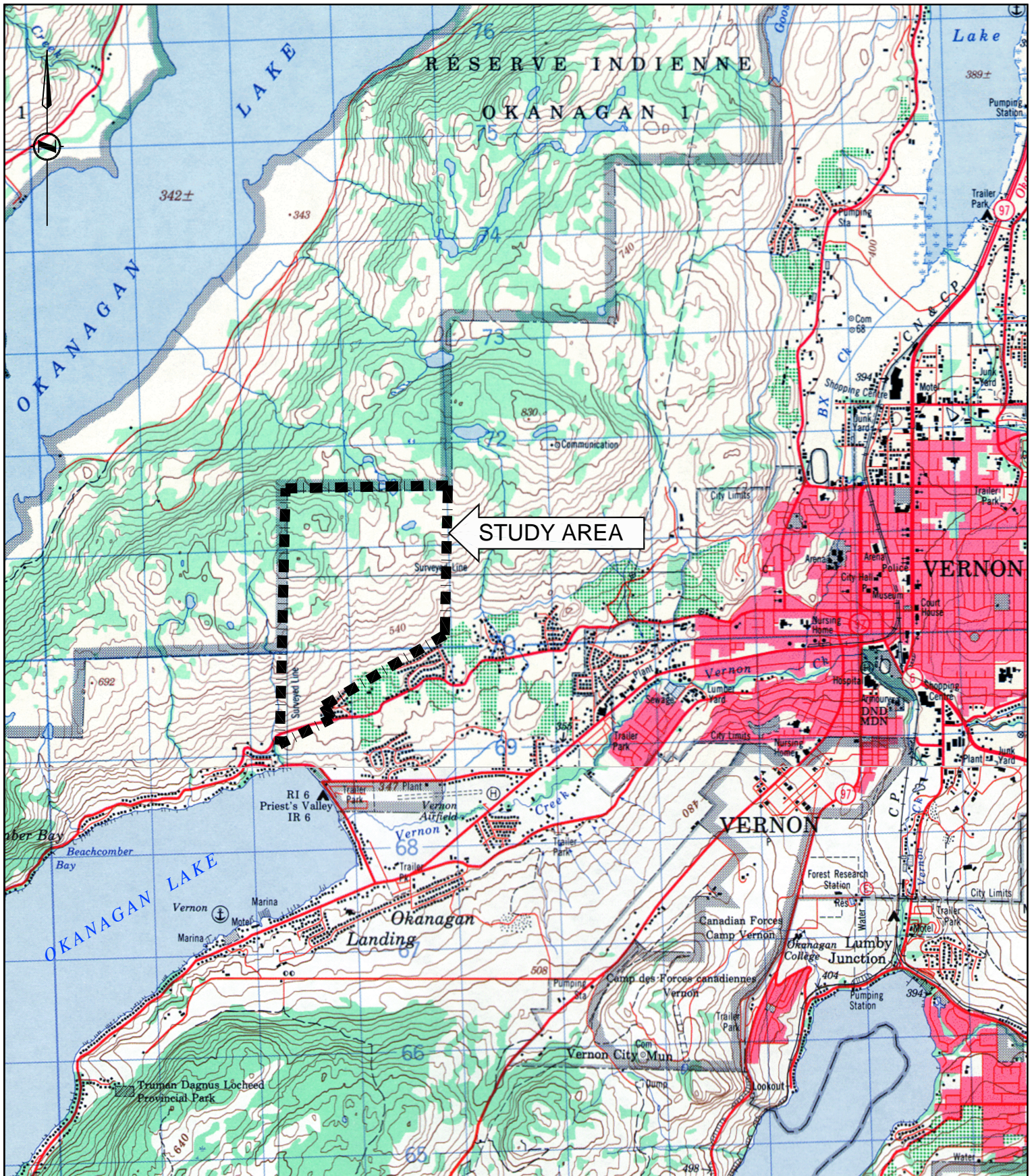
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Senior Review



Darryl Arsenault, M.Sc., R.P.Bio
Environmental Scientist

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EBA Engineering Consultants Ltd. 

PROJECT:

NAD83, UTM 11, GRS80

CLIENT:

ALPHA ZULU MANAGEMENT INC.

LOCATION:

OKANAGAN HILLS

TITLE:

LOCATION MAP

DATE: 26/09/2003

SCALE: 1:50 000

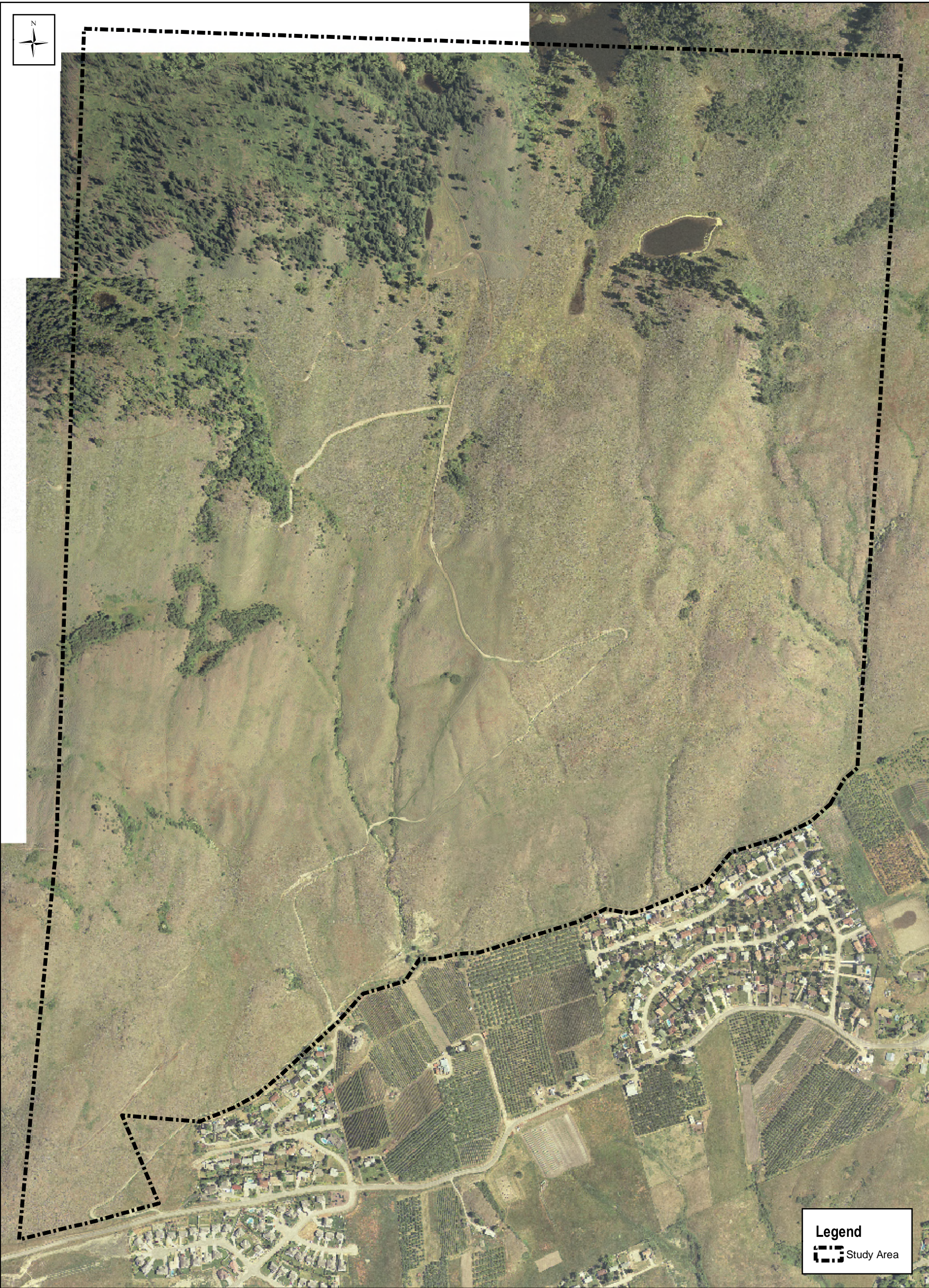
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CHKD: LM

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0805-5800196

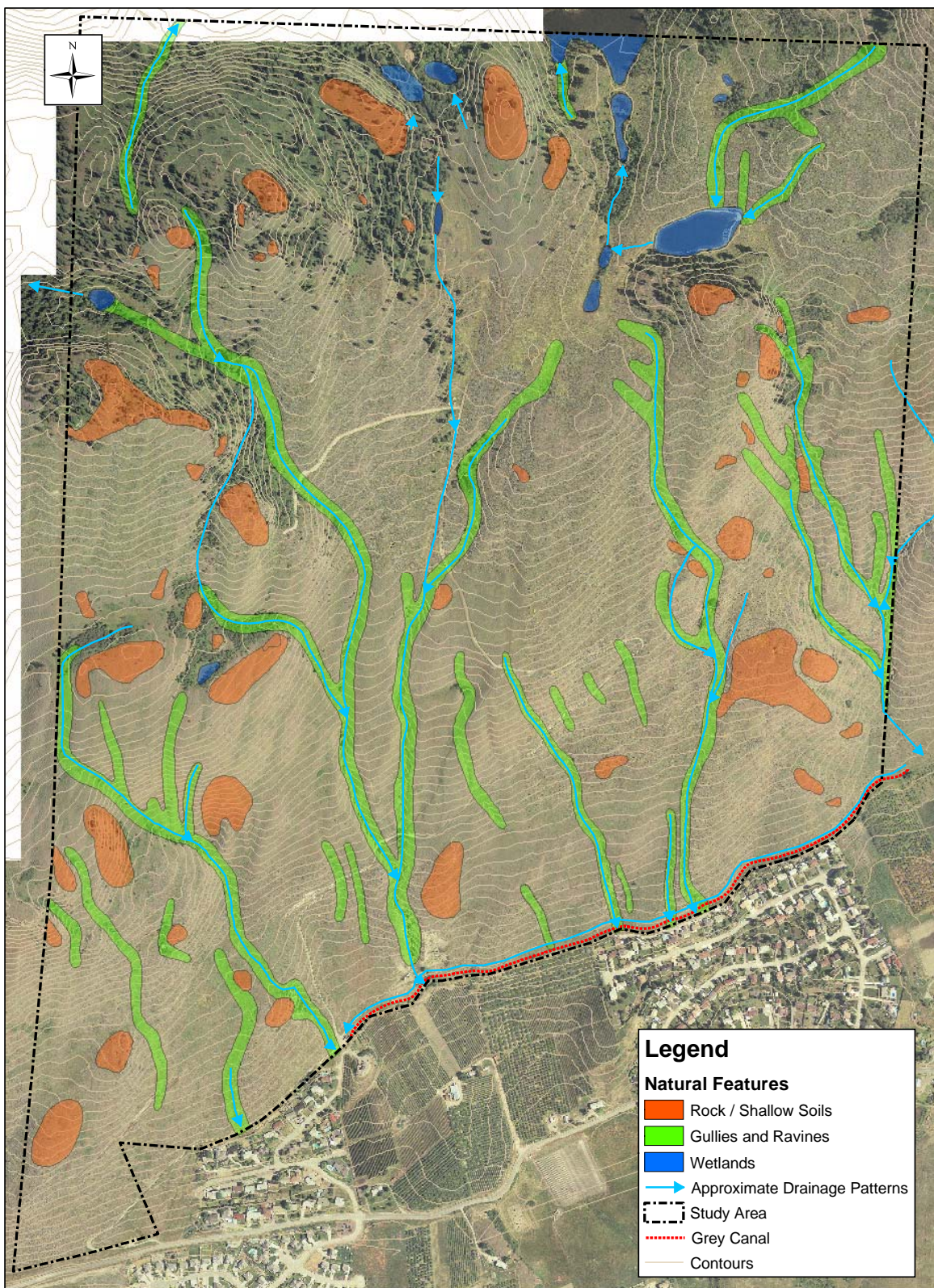
FIGURE 1



0 50 100 200 300
Meters

Source: Study Area - Ekistics

<div>EBA Engineering Consultants Ltd. </div>			Project: Okanagan Hills	
Client: Alpha Zulu Management Inc.			Title: Figure 2 - Study Area	
Projection: NAD83, UTM 11, GRS80				
Date: 23/09/2003	Dwn.: W.D.	Chkd.: H.S.	Scale: 1 : 7,500	EBA File No.: 0805-5800196



Legend

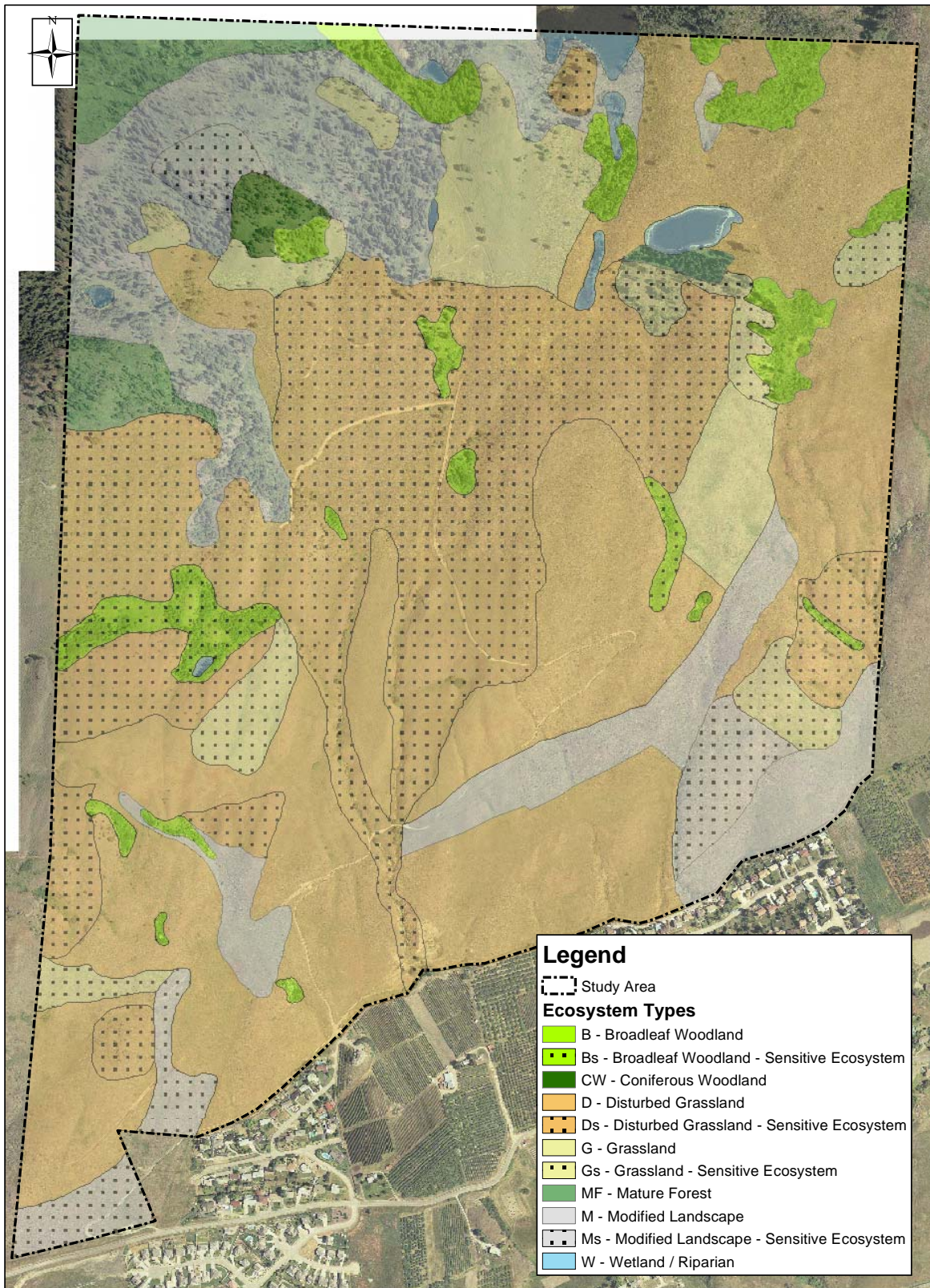
Natural Features

- Rock / Shallow Soils
- Gullies and Ravines
- Wetlands
- Approximate Drainage Patterns
- Study Area
- Grey Canal
- Contours

0 50 100 200 300
Meters

Source: Study Area - Ekistics
Contours - Ekistics

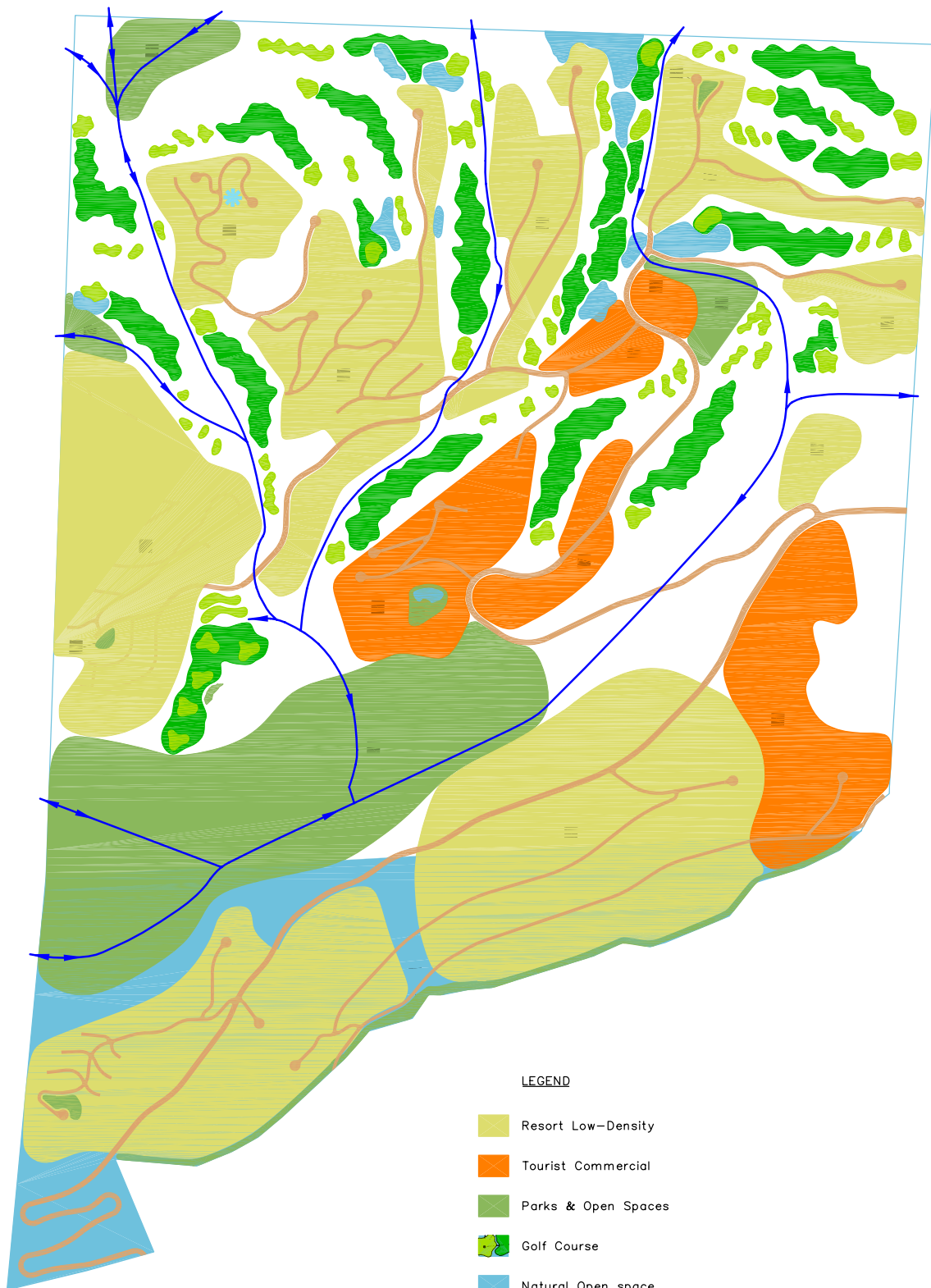
Project: Okanagan Hills			
Title: Figure 3 - Natural Features			
Client: Alpha Zulu Management Inc.			
Projection: NAD83, UTM 11, GRS80			
Date: 23/09/2003	Dwn.: W.D.	Chkd.: H.S.	Scale: 1 : 7,500
		EBA File No.: 0805-5800196	



0 50 100 200 300
Meters

Source: Cadastral - City of Vernon
Study Area - Ekistics
Water Features - Ekistics
Ecosystems - S.E.I.

Client: Alpha Zulu Management Inc.				Project: Okanagan Hills	
Projection: NAD83, UTM 11, GRS80				Title: Figure 4 - Ecosystem Types	
Date: 23/09/2003	Dwn.: W.D.	Chkd.: H.S.	Scale: 1 : 7,500	EBA File No.:	0805-58-00196




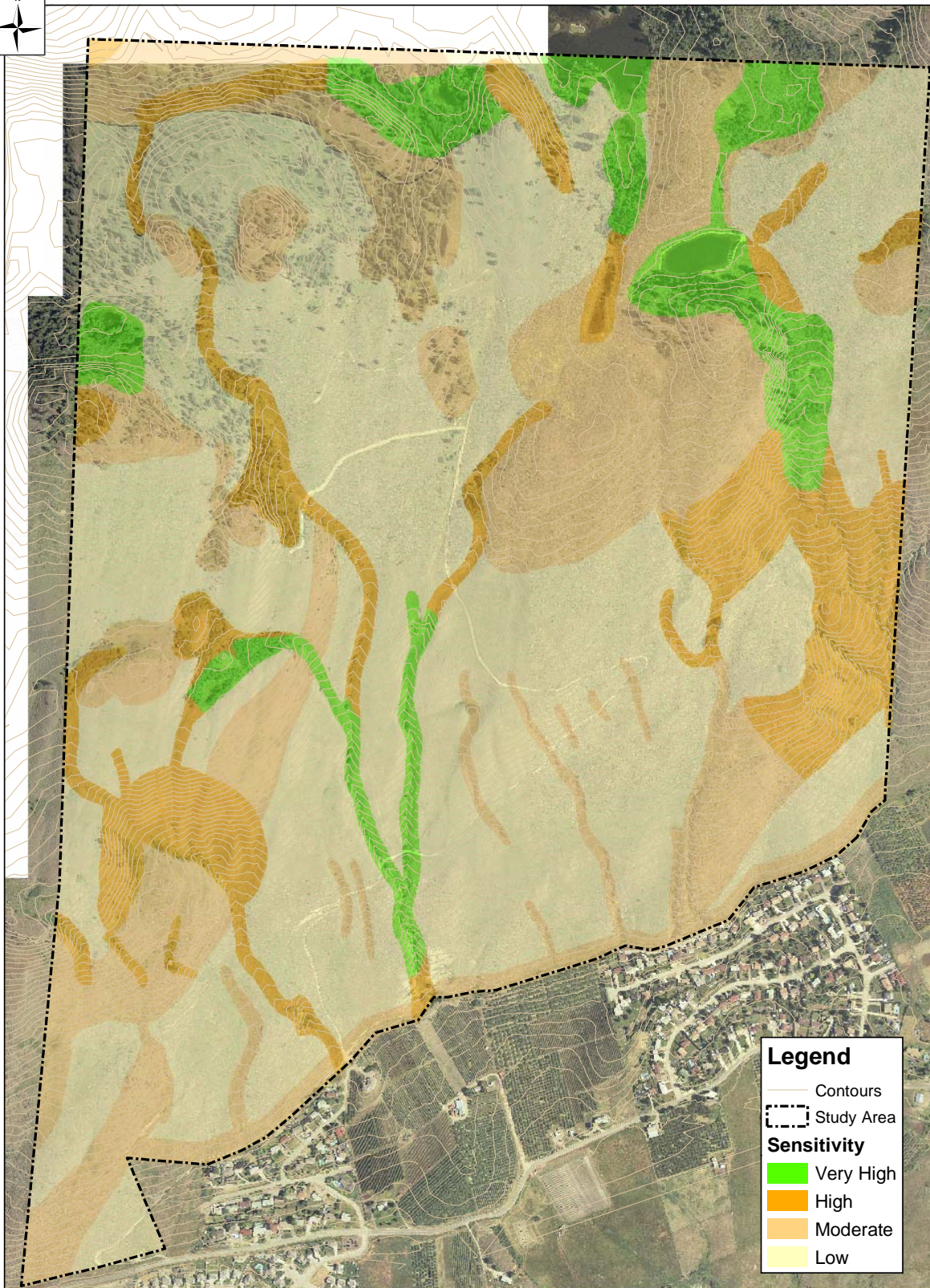
LEGEND

- Resort Low-Density
- Tourist Commercial
- Parks & Open Spaces
- Golf Course
- Natural Open space
- Existing and Future Roadways
- Public & Institutional
- Wildlife Movement Corridors

0 50 150 300m
Meters

Source: Study Area - District

EBA Engineering Consultants Ltd. 			Project: Okanagan Hills	
Client: Alpha Zulu Management Inc.			Title: Figure 5 - Primary Wildlife Movement	
Projection: NAD83, UTM11, GRS80				
Date: 10/06/2003	Draw: J.B.	Check: H.S.	Scale: 1:7500	EBA File No.: 0805-5800196



Legend

— Contours

--- Study Area

Sensitivity

Very High

High

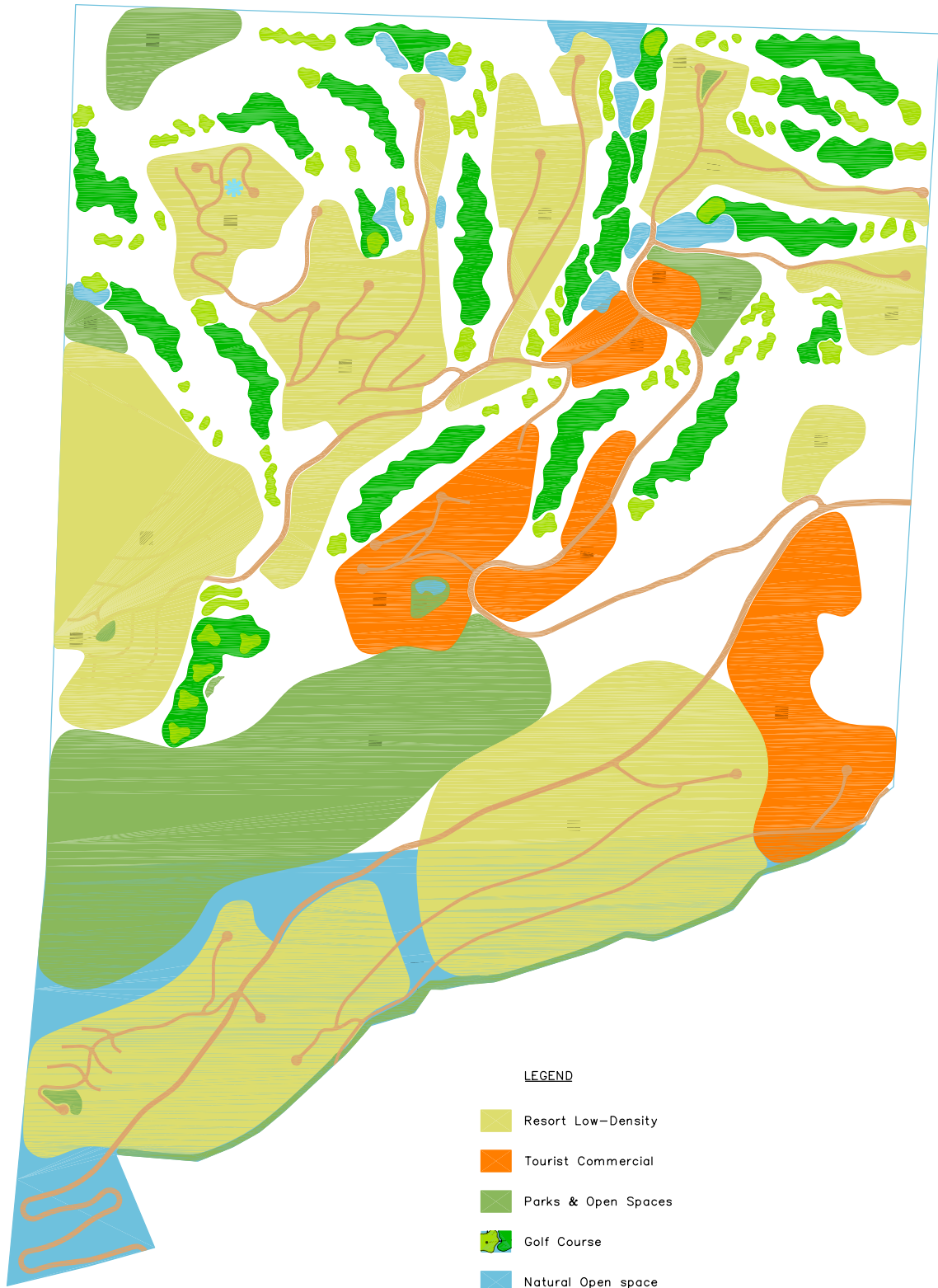
Moderate

Low


0 50 100 200 300
Meters

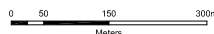
Source: Study Area - Ekistics
Contours - Ekistics

Client: Alpha Zulu Management Inc.			Project: Okanagan Hills	
Projection: NAD83, UTM 11, GRS80			Title: Figure 6 - Sensitivity Assessment	
Date: 23/09/2003	Dwn.: W.D.	Chkd.: H.S.	Scale: 1 : 7,500	EBA File No.: 0805-5800196




LEGEND

-  Resort Low-Density
-  Tourist Commercial
-  Parks & Open Spaces
-  Golf Course
-  Natural Open space
-  Existing and Future Roadways
-  Public & Institutional



Source: Study Area - Existing

EBA Engineering Consultants Ltd. 			Project: Okanagan Hills	
Client: Alpha Zulu Management Inc.			Title: Figure 7 - Development Plan	
Projection: NAD83, UTM11, GRS80				
Date: 10/06/2003	Draw: J.B.	Check: H.S.	Scale: 1:7500	EBA File No.: 0805-5800196