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Industrial Land Use Plan Environmental Overview Report

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1.0 INTRODUCTION

1.1 Purpose of Document

The purpose of this environmental overview is to identify environmental sensitivities within the area designated with the Industrial Land Use Plan (ILUP). Triton Environmental Consultants Ltd was commissioned by L&M Engineering Ltd. on behalf of the City of Prince George and Mr. Henry Rempel to provide this report. This report identifies potential direct and indirect environmental effects associated with potential Light Industrial Development within this area.

This report has been prepared to:

- Provide a description of the environmental setting;
- Document baseline environmental conditions (aquatic, terrestrial and wildlife) based on existing information, field data and observations;
- Identify environmental sensitivities within the project area;
- Identify additional environmental investigations that may be required; and
- Provide recommendations for design criteria with respect to air and water quality in the project area.

1.2 Project Area

The Industrial Land Use Plan includes a 1204.44 ha area located just west of the City's Airport (Figure 1). Of the total area, approximately 700 ha has been approved in principle by the City of Prince George Council for use as Light Industrial but it is currently within the Agricultural Land Reserve and designated as Rural Resource (L&M 2007). An exclusion application has been submitted to the Agricultural Land Commission. The project area is located within City limits and occupies the following areas:

District Lots 1434, 746, 748, 2094 2095, and 2159 Cariboo District

The project area is accessible from Highway 16 East along the northern boundary and Highway 97 South along the southern boundary. It is bordered by the Fraser River along the western boundary and the Airport and associated Reserve land along the eastern boundary.

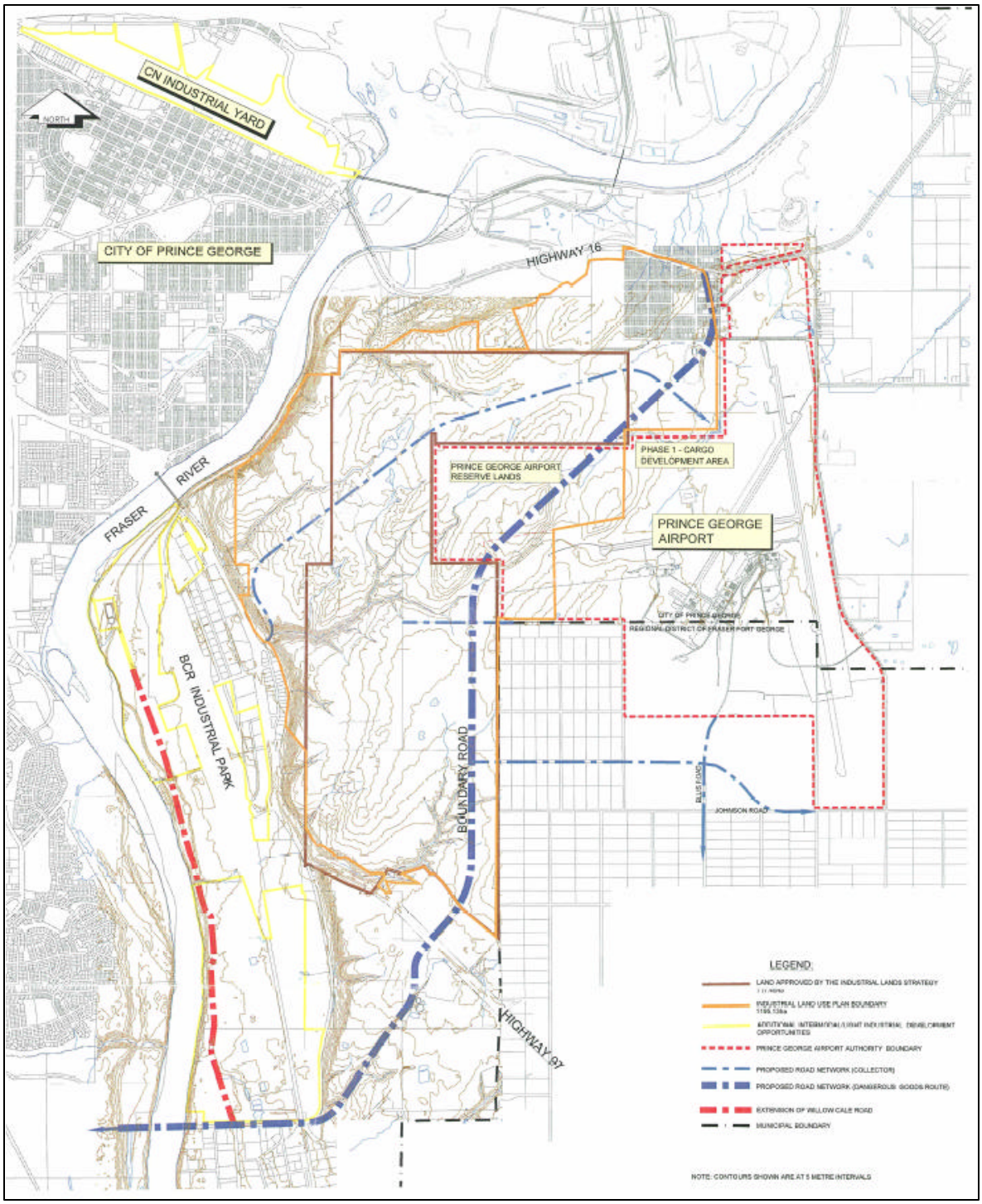

Figure 1. Environmental Overview – Industrial Land Use Plan (L&M 2007)

1.3 Environmental Setting

The project area is located within the City of Prince George, in the Upper Fraser Ecoregion of the Sub-Boreal Interior Ecoprovince. The Sub-Boreal Spruce biogeoclimatic zone (SBS) is characteristic of the region, with hybrid white spruce, subalpine fir, and lodgepole pine predominating (Steen and Coupe 1997). Based on Provincial biogeoclimatic mapping, the project area is located within the Mossvale Moist Cool Sub-Boreal Spruce biogeoclimatic subzone variant (SBSmk1). The SBSmk1 subzone is reported to occur at elevations ranging from 750 m to 1070 m, with lower elevations being found within the Moist Hot Sub-Boreal Spruce biogeoclimatic subzone (SBSmh). The project site is located between 660 and 720 m which would technically place it within the SBSmh; however, the climate and vegetation communities of project area are best described by the (mk1) of the SBS zone. Discussion with a provincial expert (DeLong pers. comm., 2006) pertaining to the elevational boundary between these two subzones in this area have occurred and it has been reported that the mh is intended to represent ecosystems along the Fraser River valley up to the river breaks (along the steep slopes along the Fraser River) and thus does not occur up on the plateau where the project is located (Triton 2006).

The climate of the SBSmk1 is slightly cooler than the other SBS subzones in the Prince George Forest District. The mean annual temperature for this subzone is 1.5º C whereas the mean temperatures for the SBSdw2 and dw3 are 3.4º C and 2.6º C respectively. Precipitation is higher than that of the other subzones of the SBS, with a mean annual precipitation of 727.4 mm and the average snowfall is 306 cm (DeLong *et al*. 1993). Climate data for the City of Prince George is cooler and wetter in its mean values to that describing the subzone. The yearly precipitation in Prince George is around 600 mm with 418.9 mm being rainfall. The extreme minimum temperature was recorded in 1950 at –50 and the maximum was 36 in 1983 (Environment Canada 2008).

Within the SBSmk1 subzone, the dominant tree species include lodgepole pine, and hybrid white spruce (*Picea glauca x engelmanii*). Areas of disturbance tend to be dominated by lodgepole pine and trembling aspen. Late seral and climax stands have more hybrid white spruce and only scattered subapline fir. Douglas-fir appears on drier warmer aspects. Black spruce occurs in wetland areas while black cottonwood occurs within riparian areas. Shrub species include prickly rose (*Rosa acicularis*), thimbleberry (*Rubus parviflorus*), highbush cranberry (*Viburnum edule*), and black twinberry (*Lonicera involucrata*).

The soils within the project area include glacio-fluvial, glacio-lacustrine and anthropogenic soils (i.e. road fill). The soils in mid to upper slope positions are predominantly clayey and soils on the upper bench are fine textured. The geotechnical report completed for the project area indicates that the area is covered by glaciolacustrine silt and clay sediments (GeoNorth 2008).

1.4 Resource Use

The majority of the project area has evidence of historical disturbances including fire, logging, settlement, agriculture, and ROW clearing. Several old roads are now used as ATV trails. A more recent harvested area was located within Area 2 (Appendix 3).

The L.C. Gunn trail is located along the top of the bank above the Fraser River between Highway 16 E and Highway 97S. This is mapped as an existing and proposed trail and greenway in the Official Community Plan for the City of Prince George. The Blackburn City Trail connector is located in the northeast corner of the project area. This connects an existing neighbourhood park in Blackburn to the L.C. Gunn Park.

One area mapped within the Industrial Land Use Plan Boundary (Figure 1) falls outside of the lands approved by the ILS. This area, the Prince George Airport Reserve Lands, is fenced off and posted and therefore was not assessed on the ground during the field assessment. A

separate Environmental Impact Assessment was completed for the Airport by another consultant.

2.0 ASSESSMENT METHODOLOGY

2.1 Background Information

Prior to conducting field assessments, 1:20,000 Terrestrial Resource Inventory Mapping (TRIM) and various internet services were consulted to identify the drainage network in the project area. The Fisheries Information Summary System (FISS) internet site (Ministry of Environment 2007) was searched for information regarding known fish distributions and species likely to be found within the project area. The Triton internal library was also searched for any previous works completed on the streams of concern within the project area.

The Official Community Plan for the City of Prince George (2001) was also reviewed to help identify any Natural Sensitive Areas, riparian development permit areas, groundwater protection development permit areas, and the park trail system.

2.2 Fish Habitat – Field Assessments

Since all mapped streams within the project area had been previous sampled, detailed assessments were not required and fish sampling was not conducted. Field assessments were conducted between May 8th and May 13th, 2008 and general comments regarding rearing, spawning and overwintering potential as well as channel widths were recorded. All other unmapped drainages encountered during the field assessments were photo-documented and geo-referenced. The information collected during the literature review and the field assessments provided the stream classifications.

All drainages were classified according to the stream classification guidelines under the *Forest and Range Practices Act*. Any drainage or sediment transportation concerns were also documented.

2.3 Terrestrial Ecosystems and Plant Species at Risk

Prior to completing the field assessment, the British Columbia Conservation Data Center (CDC) Species and Ecosystems Explorer web tool (BC CDC 2008) was used to identify ecosystems (plant communities) at risk that could potentially occur within the project area using biogeoclimatic zone (SBS) and Forest District (Prince George) as search criteria. A list of plant species at risk was also generated using the CDC web tool based on search criteria including both subzone variants (SBSmk1 and SBSmh) with the Prince George Forest District. The field crew familiarized themselves with the ecosystems and plant species at risk prior to completing the field assessment to ensure they would be recognized in the field.

Observations of dominant plant species assemblages in relatively homogenous areas (similar meso-slope position and aspect) as well as relative soil moisture and nutrient regimes were sampled to support ecosystem classifications in order to identify the presence of any rare or unique terrestrial ecosystems. A review of Vegetation Resources Inventory (VRI) maps and available orthophotography was conducted to identify potential occurrences of ecosystems at risk, non-forested ecosystems and old growth polygons. Polygons identified as potential occurrences of ecosystems at risk, non-forested ecosystems and old growth coniferous forest were targeted for sampling in the field.

It should be noted that given the timing of the assessment and the late onset of spring, a complete detailed plant inventory was not feasible. The determination of a rare plant species presence in the project area was more based on targeting preferred habitats and less dependent random searching during the field assessment.

2.4 Wildlife Habitat and Wildlife Species at Risk

Prior to the site visit, the BC CDC Species and Ecosystems Explorer web tool (2008) was used to identify fauna at risk that could potentially occur within the project area. Direct (observations of wildlife) and indirect evidence of wildlife utilization (tracks, scat, den sites, raptor nests) were recorded during field assessments. An effort was also made to assess the

potential for rare and endangered wildlife species to utilize habitats or habitat features within or adjacent to the project area. The overall suitability of the area to sustain species of management concern was also assessed based on landscape features and patterns of land use.

For the purposes of this project, the evaluation of wildlife habitat values was based on cross-referencing known or suspected wildlife species occurrence and activity within biogeoclimatic site series units (plant community types), with known habitat affinities of wildlife species. Specific reference is made to the project area, based on historical records and ecosystem descriptions.

A number of habitat variables were assessed during the field survey in order to attribute values for particular wildlife species or groups of species in terms of providing primary habitats, including:

- seral stage;
- surface water features;
- standing dead (snags);
- down and dead woody debris;
- forage abundance and availability; and
- old growth attributes (veteran trees, multiple canopy layers, etc.).

2.5 Reporting

To facilitate the comparison of results from the environmental overview and the air quality components of the project, the overall project area was divided into three sections (Appendix 4). The environmental overview results are described in the Results section for the entire area however, a map for each area was developed to display the field transects with GPS, environmentally sensitive features and drainages (Appendix 3). Recommendations for development with respect to aquatic and terrestrial resources are provided in Section 6.0.

3.0 ASSESSMENTS RESULTS: AQUATIC ECOSYSTEMS

3.1 Fish and Fish Habitat

There are four mapped streams located within the project area; all of which are tributaries to the Fraser River (FISS 2008). Information regarding fish and fish habitat on the Fraser River is extensive and fisheries values are considered to be high, with 26 resident species using the river. Key species for this area include:

- anadromous salmon (*Oncorhynchus sp*);
- bull trout (*Salvelinus confluentus*);
- rainbow trout (*Oncorhynchus mykiss*);
- burbot (*Lota lota*);
- white sturgeon (*Acipenser transmontanus*);
- mountain whitefish (*Prosopium williamsoni*); and
- pygmy whitefish (*Prosopium coulteri*).

Other drainages were observed during the field assessments of which only two are classified as a stream as per the Fish Stream Crossing Guidebook.

Fish species of management concern that occur within the Prince George Forest District include the red-listed white sturgeon (Nechako and Upper Fraser populations), red-listed Arctic Grayling and blue-listed bull trout. Since the known distribution of Arctic grayling does not include the Fraser River drainage, this species is not expected to be present in project area streams. White sturgeon are expected to be absent from project area streams since they are not known to utilize small tributaries. Bull trout are known to occur in the upper Fraser River and its tributaries, however this species is typically associated with mountain streams characterized by clean, cool summer flows, moderate gradients, cascade-pool morphology, and cobble/boulder substrates. Due to the distribution and habitat requirements of sturgeon and bull trout, and the lack of fish bearing streams, neither species would be expected to occur within the project area. However, as these streams flow directly into fish habitat, the water quality and quantity should be maintained as they provide food and nutrients to fish bearing waters downstream.

The following fish habitat information was collected for this area (Table 1). Several non-classified drainages were identified and the majority where found to be tributaries to the main streams. Only two separate NCD's were observed. While portions of these drainages appear to have some flow, it disperses over the forest floor, has no alluvial substrates, and has no definitive channel. They are likely ephemeral, lacking water during summer months. If any water is present during the summer, it will likely be in the form of isolated pools. The location of ephemeral drainages is important for any developmental planning as they have the potential to transport sediment and pollutants to fish bearing waters.

Table 1. Summary of Fish and Fish Habitat Information for Project Area.

Stream Name	WSC	UTM (10U)	Class	Comments*
Zogas Creek	100-563800	517930.5968175	S6	Only the first 400 m is fish bearing. Low overall habitat value.
Unnamed 1	n/a	517680.5968478	NCD	NCD upstream of highway in confined gully. No stream present downstream of road.
NVC	n/a	517496.5969088	NVC	No channel or flow visible during Hwy 97 stream assessment.
NVC	n/a		NVC	No channel or flow visible during Hwy 97 stream assessment.
Unnamed 2	100-565800	517410.5969370	S6	Low overall value, dry in summer. S3 in first 450 m at Fraser River.
Unnamed 3	100-565800-29600	517047.5970653	S6	1.2 m wide channel upstream of highway but no stream downstream. Poor overall habitat value.
NVC	n/a		NVC	Large gully present above the railway tracks and culvert is present below. No flows observed on several visits to that area, even during spring melt.
Unnamed 4	100-568600	518484.5973036	(S4)	Defaulted fish stream as gravels and riffle/pool habitat was observed. However, a culvert barrier is located downstream at the railway crossing. No overwintering habitat observed.
Unnamed 5	n/a	521303.5973239	S4	Barrier located at highway

				culvert
Unnamed 6	n/a	517410.5971492	S6	Small ephemeral stream observed. >20% gradient. Known culvert barrier at railway downslope.
NVC	n/a	517208.5971450	NVC	Gully but no visible channel was observed.

*Triton 2004.

The two largest streams, Zogas Creek and Unnamed 2 have barriers that prevent upstream fish migration into the project area (Plates 1 and 2). Normally, culverts are not classified as barriers as they are deemed temporary structures. However, given the extensive length and permanent nature of the piping, these are considered permanent infrastructures and are unlikely to be modified to allow fish passage. The upstream reaches of these streams are still important as they provide food and nutrients to fish in the Fraser River and to those that may utilize the first 400 m of each of these tributaries.

Unnamed 2 tributary, also referred to the Prime Truck Stream in other assessments (Triton 2004), has some stability concerns. There is continuing headward erosion of the creek bed upstream of the Prime Truck access road crossing (Triton 2004). There is a history of bedload movement and deposition at the highway crossing, which largely appears to be associated with unstable banks and sideslopes over approximately 150 m extending upstream from the existing highway crossing.

According to the Official Community Plan, there are no riparian development permit area however, there are several significant slopes are present within the project area (Appendix 3). These are located in the following areas:

- riparian slopes of Zogas Creek;
- riparian areas of two other unnamed drainages between Zogas and the Fraser River;
- slope along the Fraser River between the Simon Fraser Bridge and the Highway 16 East bridge; and

- the slopes along the north portion of the project area.

3.2 Wetland Areas

> *A given wetland, based on its physical and biological characteristics, can, for example, support water storage, habitat for many species, scenic views, fish habitat, toxic buffering and flood control (Environment Canada 1992).*

Two small, open ponds (approximately 0.10 to 0.15 ha) were found in Area 3 during the field assessment. One was surrounded by cattails (Plate 3) and the other was less established and may likely dry up in the summer months (Plate 4). Two other small, shrubby wetland areas were identified in Areas 1 and 3 (UTMs 10U.519027.5969966 and 10U.519503.5971965 respectively) but no obvious outlets were observed (Plate 5). Both appeared to be natural depressions where snow melt would pond. Two other potential mapped wetland areas could not be assessed as they fell within the fenced area of the Airport Reserve Lands.

Though there are wetland areas within the project area, no riparian development protection permits currently exist. While these ponded areas are non-fish bearing, they will provide habitat for a number of aquatic species such as frogs, reptiles, waterfowl, and other wildlife. These wetlands provide food and nutrients and regulate stream flows and temperatures to downstream fish habitat (Fraser River).

3.3 Water Quality

Wetlands and riparian areas not only provide habitat for a variety of species, they are also important for the maintenance of water quality and quality within the watershed.

> *Wetlands and riparian areas can remove sediment and chemical sorbed to sediment, nutrients, metals, organic matter toxic chemicals and other contaminants (Province of BC 2006).*

The riparian areas provide a filter for potential water contaminants, provide soil erosion control, and provide consistent stream water temperatures. The identified wetlands provide filtration and flow control for the downstream fish habitats of the area's main streams.

While the importance of wetlands has been widely documented, it is possibly that shallow wetlands can contribute to higher water temperatures in downstream habitats. Lower water temperatures result in higher dissolved oxygen concentrations and higher water temperatures can influence spawning and incubation times of salmonids. In addition, the activity of beavers such as dam construction and movement of downed trees from upslope areas into the water may increase the turbidity of the water that may potentially be transported to downstream habitats (Province of BC 2006).

With respect to potential development in this area, streams, drainages and wetlands will require a protective buffer to preserve water quality and quantity. Specific recommendations can be found in Section 6.1.

4.0 ASSESSMENT RESULTS: TERRESTRIAL ECOSYSTEMS

The Ministry of Forests publication A field guide for site identification and interpretation for the southwest portion of the Prince George Forest Region (DeLong *et al* 1993) provides a description of the regional climate, physiography and floristic patterns within the Prince George Forest Region (PGFR). The field guide contains written descriptions, diagrams, vegetation tables and edatopic grids that provide the means of classifying and describing ecosystems at the site series level based on field observations and site data collection. The field guide was used to classify ecosystems in the project area based on field data and observations collected. Field data collected include: plant community description, seral stage, assessment of the degree of representativeness (*i.e.*, to field guide descriptions), and discussion of wildlife habitat values and ecosystem sensitivities.

4.1 Rare Plant Communities

The British Columbia Conservation Data Center (CDC) Rare Natural Plant Community Tracking List for the Prince George Forest District identifies 3 blue-listed plant and 11 yellow-listed plant communities (site series units) in the SBSmk1 biogeoclimatic subzone variant (Table 2). No red-listed plant communities are listed for the SBSmk1. Where there is poor representation of mature natural examples of SBS subzones in protected areas and there has been substantial modification of existing areas, most or all site series units in a subzone often appear on the CDC lists.

Table 2. Listed Plant Communities within the SBSmk 1 subzone of the Prince George Forest District.

Site Series	Species Names	BC Status
SBSmk1/Wb13	shore sedge - buckbean / peat-mosses	Blue
SBSmk1/Wf05	slender sedge / common hook-moss	Blue
SBSwk1/Wm01	beaked sedge - water sedge	Yellow

Site Series	Species Names	BC Status
SBSmk1/Ws50	hardhack / Sitka sedge	Yellow
SBSmk1/09	hybrid white spruce / horsetails	Yellow
SBSmk1/07	hybrid white spruce / oak fern	Yellow
SBSmk1/08	hybrid white spruce / devil's club	Yellow
SBSmk1/01;	hybrid white spruce / black huckleberry - highbush-cranberry	Yellow
SBSmk1/10; SBSmk1/Wb05	black spruce / water sedge / peat-mosses	Yellow
SBSmk1/06;	black spruce / black huckleberry / sweet coltsfoot	Yellow
SBSmk1/03	lodgepole pine / red-stemmed feathermoss - reindeer lichens	Yellow
SBSmk1/02;	lodgepole pine / black huckleberry / clad lichens	Yellow
SBSmk1/05	Douglas-fir - hybrid white spruce / ricegrasses	Yellow
SBSmk1/04	Douglas-fir - hybrid white spruce / knight's plume	Blue

Other vegetation communities of particular importance and sensitivity include non-forested riparian communities and wetlands, which are not described in the site identification field guide for the SBSmk1, but typically have high wildlife values and are sensitive to disturbance. The riparian vegetation surrounding the main streams were observed to consist of young black cottonwood, willows, thistle (*Cirsium sp.*), goldenrod (*Solidago canadensis*), alfalfa (*Medicago sativa*), and other weed species, which do provide some wildlife habitat but have limited riparian function.

Relatively few examples of contiguous, mature forest are present in the project area due to historical and ongoing disturbances associated with harvesting and agricultural activities. This is evidenced by the dominance of mid seral stage, mixed forest vegetation throughout the project area, and the dense network trails utilized by ATVs and 4x4 vehicles (Plate 6).

Four biogeoclimatic site series units were recognized as occurring within the project area. The dominant site series is SBSmk1/01 (Plate 7), forming the matrix around which the other three

ecosystems exist. Forested areas along the streams and non-classified drainages were generally recognized as site series unit SBSmk1/08, while the SBSmk1/04 (Plate 8) ecosystem was identified in the southeastern corner of the project area. A transitional area between SBSmk1/01 and SBSmk1/04 was also observed along the L.C. Gunn Trail at the slope crest adjacent to the Fraser River. Small patches of SBSmk1/05 were occasionally identified on broadly convex slope crests throughout the area (Plate 9).

SBSmk1/01 Hybrid White spruce – Huckleberry – Highbush cranberry site series

In its climax state, the SBSmk1/01 site series unit is recognized by a mixture of lodgepole pine and hybrid white spruce. The understory shrub layers include thimbleberry (*Rubus parviflorus*), prickly rose (*Rosa acicularis*), black twinberry (*Lonicera involucrata*), and black gooseberry (*Ribes lacustre*). This series is slightly drier than the 08 and does not usually contain Devil's club (*Oplopanax horridus*) or oak fern (*Gymnocarpium dryopteris*) but has queen's cup (*Clintonia uniflora*) and bunchberry (*Cornus canadensis*) as abundant herb species. Compared to the 04 and 05 site series units, the 01 typically has moister conditions and lacks Douglas-fir (*Pseudotsuga menziesii*) in the tree layer.

It is anticipated that the regenerating, mixed forest conditions common throughout the project area would be largely characterized by the 01 site series unit at climax.

SBSmk1/04 Douglas-fir – hybrid white spruce / knight's plume

A Douglas-fir dominant tree canopy distinguishes the SBSmk1/04 from other site series units in the SBSmk1. By comparison, the 01 and 05 site series units are generally dominated by lodgepole pine, and occur on moister soil conditions. The 08 also has moister soil conditions, with a dominant forest canopy of hybrid white spruce. The 04 ecosystem is described as uncommon, and localized within the range of Douglas-fir. Approximately 22 ha of this habitat were identified in the southeastern corner of the project area. The key feature of this ecosystem is the large Douglas-fir as this area is within the northern limit of this species. The other plant species found within this ecosystem are not limited on the landscape. Development in this area

can occur if mitigation is provided to help protect the large Douglas Fir. See Section 6.2 for recommendations.

SBSmk1/05 Douglas-fir – hybrid white spruce / ricegrasses

Unlike the 01 site series unit, the 05 typically has some Douglas-fir in the tree species composition and occurs on drier site conditions. However, unlike the 04 site series unit where Douglas-fir is dominant, lodgepole pine is more characteristic in the 05 along with slightly moister soil conditions. This ecosystem was occasionally identified within the project area, however, infestations of mountain pine beetle have killed most of the young and mature lodgepole pine stands. As such, the few small patches where mature examples of 05 existed have functionally reverted to a much earlier seral stage forest.

SBSmk1/08 Hybrid white spruce – Devil's club

The SBSmk1/08 ecosystem is common, but limited to stream edges or flats that receive seepage. Hybrid white spruce is the dominant tree cover, while Devil's club is prominent in the understory, along with gooseberry, highbush-cranberry, and black twinberry. This series is commonly found in conjunction with the SBSmk1/01 but is moister and may have soils that are more nutrient rich. The herb layer is dominated by oak fern (*Gymnocarpium dryopteris*) and lady fern (*Athyrium filix-femina*). The deep gullies within many of the drainages along the western portion of the project area, and drainages on the steep slope leading to the Fraser River are characterized by the 08 site series unit.

Non-forested ecosystems

Non-forested ecosystems within the project area include:

Wetland/open water areas – portions of the project area are covered with open water due to the high amount of beaver activity in the area, or because they are located in a depression on the landscape (refer to Section 3.2 for discussion of wetlands).

Anthropogenic Areas – this includes the maintained roadways, cleared areas around older roads and trails used by ATV's and hikers, and cleared areas associated with agricultural activities.

Adjacent ecosystems

One red-listed ecosystem (SBSmh/04) has been identified during a previous assessment as occurring along the east side of the highway between the Fraser River and Sintich Road (Triton 2006). A few of pockets of this ecosystem fall along the project area boundary (Appendix 3: Figure 3). The Douglas-fir/Douglas maple/step moss (SBSmh/04) community is red-listed as it is rare on the landscape and usually restricted to steep dry slopes with warm aspects, which are sensitive to disturbance and slow to recover from it.

Development in this area is possible given the recommendations for the protection of this listed ecosystem are followed (Section 6.2).

4.2 Rare Plant Species

Plant species have been identified using several keys. Generally the nomenclature follows Hitchcock *et al*. (1973), however The Vascular Plants of British Columbia (Ministry of Forests 1989, 1990, 1991 & 1994) was used where there were discrepancies in the species names used. A comprehensive plant species list of all plant species encountered within the project area has been compiled (Appendix 2) and includes 6 species of trees, 13 species of shrubs, 20 herbaceous species, and 6 moss species.

There are 24 plant species that appear on the CDC blue-list of rare vascular plant species within the SBSmk1 subzone of the Prince George Forest District (BC Conservation Data Centre 2008, Table 3). None of the listed species were observed, however, there is a small

possibility that white wintergreen may exist somewhere in the project area given that other non-flowering species of the same genus were common throughout the dry to moist forested areas (Plate 10). A revisit to the vegetation plot at Waypoint 5 in Area 3 during peak growing months may help to establish whether white wintergreen is present in the project area. Even if this species was found, there is no legislation to prohibit development in this area however, from a biodiversity perspective it would be beneficial to incorporate this area as greenspace or see if this area is not developable given the geotechnical constraints.

It is also possible that beaver flooded areas or the small pond located in the middle of the open field in the northern part of the project area may contain the following blue-listed species: bog rush, crested wood fern, pygmy waterlily, water bur-reed, and/or water marigold. However, if present, it is unlikely these five aquatic species would be impacted by development since standard riparian setbacks would protect them.

Table 3. Red and blue-listed plant species within the SBS zone of the Prince George Forest District.

Species	BC Status	Habitat (Klinkenberg, 2007a)	Occurrence in project area
American sweet-flag	Blue	Shallow water in the montane zone, rare in southern BC east of the Coast-Cascade Mountains	Unlikely occurrence. Not listed in the SBSmk.
arctic rush	Blue	Tidal flats and lakeshores in the lowland and montane zones	Unlikely occurrence. Not listed in the SBSmk.
Austrian draba	Blue	Mesic to dry meadows, cliffs and talus slopes in subalpine/alpine zones	Unlikely as typical habitats not present.
bald sedge	Blue	Sand dunes in the montane zone	Unlikely as typical habitats not present.
bog adder's-mouth orchid	Blue	Bogs and muskegs in the lowland and montane zones	Unlikely occurrence. Not listed in the SBSmk.
bog rush	**Blue**	**Pond margins and peat bogs in the lowland and montane zones**	**Possible occurrence; documented occurrences near Prince George.**
crested wood fern	**Blue**	**Wet swamps & meadows in steppe/montane zones; rare in WC & S BC**	**Possible occurrence; documented occurrences near Prince George.**
Fernald's false manna	Red	Shallow water, marshes, bogs and wet meadows in the montane zone; rare in EC BC	Unlikely occurrence. Not listed in the SBSmk.
meadow arnica	Blue	Wet to mesic meadows and forest openings in montane and subalpine	Unlikely occurrence. Not listed in the SBSmk.
northern bog bedstraw	Blue	Bogs, wet meadows and moist forests in the montane zone	Unlikely occurrence. Not listed in the SBSmk.
plains butterweed	Blue	Dry open meadows and forests in the steppe and montane zones	Unlikely occurrence. Not listed in the SBSmk.
pointed broom sedge	Blue	Moist to wet ditches, lakeshores, marshes and meadows in the lowland and montane zones	Unlikely occurrence. Not listed in the SBSmk.
pygmy waterlily	**Blue**	**Lakes, ponds and slow-moving streams in lowland and montane zones**	**Possible occurrence; documented occurrences near Prince George.**
riverbank anemone	Red	Moist to mesic gravel bars, streambanks and forests in the steppe and montane zones	Unlikely occurrence. Not listed in the SBSmk.
small-flowered lousewort	Blue	Wet meadows, fens and bogs in the montane and subalpine zones; rare in BC north of 52^0	Unlikely as typical habitats not present and project area is north of 52degreeN.
Sprengel's sedge	Red	Moist to wet gravelly or sandy slopes and alluvial woodlands and open sites in the montane zone	Unlikely occurrence. Not listed in the SBSmk.
swollen beaked sedge	Blue	Peat bogs in the montane and subalpine zones, rare in BC east of the Coast-Cascade Mountains	Unlikely occurrence. Not listed in the SBSmk.
tender sedge	Blue	Mesic to dry meadows, shorelines and open forests in steppe and montane zones; rare throughout BC east of Coast-Cascade Mtns.	Unlikely occurrence. Not listed in the SBSmk.
water bur-reed	**Blue**	**Ponds, lakeshores and slow streams in lowland and montane zones**	**Possible occurrence; documented occurrences near Prince George.**
water marigold	**Blue**	**Lakeshores and ponds in the lowland, steppe and montane zones**	**Possible occurrence; documented occurrences near Prince George.**
western dogbane	Blue	Steep, dry, sandy slopes	Unlikely occurrence. Not listed in the SBSmk.
white adder's-mouth orchid	Blue	Moist forests, mudflats, fens and streambanks in the lowland and montane	Unlikely occurrence. Not listed in the SBSmk.

Species	BC Status	Habitat (Klinkenberg, 2007a)	Occurrence in project area
		zones	
whitebark pine	Blue	Mesic to dry slopes in the subalpine to alpine zones	Unlikely occurrence as subalpine and alpine areas were absent from the project area the species is not listed in the SBSmk.
white wintergreen	**Blue**	**Dry to moist forests in the montane zone**	**Possible occurrence; 1 record near Prince George; *Pyrola* spp. common in project area**

4.3 First Nations Traditional Plant Use

A variety of plants have been identified as providing value to First Nations people. Indigenous peoples throughout BC have used plants for food, medicine, tools, transportation, and shelter (Davis 1993). Foods such as berries, roots, fruits, bark, shoots, leaves and lichens have been included in their diets for centuries. Plants also provide forage for the animals on which they hunted and relied on for meat. Table 4 outlines those species of importance and their uses; several of these species were observed during the field assessment.

Table 4. Plant species with traditional uses.

Common Name	**Scientific Name**	**Use**
Douglas-fir*	*Pseudotsuga menziesii*	Medicinal tea, gum.
saskatoon	*Amelanchier alnifolia*	Berries.
paper birch*	*Betlua papyrifera*	Sap used for medicine, bark used for baskets, cradles and canoes.
trembling aspen*	*Populus tremuloides*	Tent poles, deodorizer, absorbent material.
hazelnut	*Corylus cornuta*	Food source - nuts.
black cottonwood	*Populus balsamifira*	Canoes and fire sets.
hookers thistles	*Cirsium hookerianum*	Vegetable.
Oregon grape*	*Mahonia aquifolium*	Berriers, flavour, jelly, beneficial to blood.
red osier dogwood*	*Cornus sericea*	Smoked for lung disease
False Solomon's seal*	*Smilacina racemosa*	Berries, sweetener or flavouring.
highbush-cranberry*	*Viburnum edule*	Berries.
wild raspberry	*Rubus idaeus*	Popular berry.
soapberry	*Sherperdia canadensis*	Confection, ailments, trade item.
wild strawberry*	*Fragaria virginiana*	Berries.
thimbleberry*	*Rubus parviflorus*	Berries.
chokecherry	*Prunus virginiana*	Berries.
common juniper	*Juniperus communis*	Medicinal tea, cleaner, deodorizer.

*Denotes species observed during the field assessment.

Noting that some of these species are present in the project area is primarily to address their importance not only for wildlife but for human use as well. These species are not limited in the area and their presence does not impede development from occurring in this area.

5.0 ASSESSMENT RESULTS: WILDLIFE RESOURCES

5.1 Overview

This section broadly considers all species of mammals, birds, reptiles and amphibians that are known to occur or have significant potential to occur within the project area, with specific reference to wildlife resources within the project area. Special attention is given to wildlife species that are of special management concern at provincial and regional levels, which are primarily administered by the Ministry of Environment (MOE) and the Ministry of Forests and Range (MOF).

Wildlife resources are described according to standard ecosystem and wildlife habitat classification systems presently used by resource managers, which include:

- Biogeoclimatic Ecosystem Classification (Meidinger *et al*. 1991).
- Regional Ecosystem Classification (Demarchi 1993)
- Biophysical Habitat Classification (Demarchi and Lea 1989)

Additional information includes several provincial wildlife initiatives (Stevens 1994), which provide relevant background information adequate to describe wildlife species assemblages, values and sensitivities within the project area. The approach used in the description and assessment of wildlife habitat values is based on cross-referencing baseline references with provincial conservation lists and is supplemented with field data collected in the project.

5.2 Wildlife Habitat Capability

Wildlife habitat capability refers to the ability of the land to sustain a particular subset of wildlife species based on climatic conditions and vegetation potential. Habitat capability is strongly influenced by physiography and landscape level forest patterns. Conversely, it is largely independent of temporal factors such as seral stage and structural and stand level features.

5.3 Wildlife Habitat Suitability

Wildlife habitat suitability refers to the temporal and structural condition of the habitat with respect to sustaining a particular species, or assemblage of wildlife species. Habitat suitability is largely dependant on local factors such as seral stage distribution, and stand level attributes such as stand age, and structural features such as coarse woody debris; some species are habitat dependant while others are attribute dependant. Important habitat attributes include snags or wildlife trees, veteran trees, coarse woody debris, deciduous trees, edges and forest canopy gaps. The occurrence of such attributes in natural, undisturbed settings is a function of seral stage; most are features of mature and climax forest stands. The exception is deciduous trees, which are generally a feature of early seral stages in disturbed forests. A summary of the wildlife values associated with these attributes follows.

Snags and dying trees are particularly important for cavity dwellers such as woodpeckers, chickadees, some owls, and mammals such as marten and fisher. In riparian areas, snags have particularly high value for cavity-nesting ducks and bats (many of which forage over the open water). Snags also provide perches for birds of prey and insect-hawking birds (e.g. swallows and flycatchers), which are important in controlling potential forest pests. Generally, larger snags receive more wildlife use.

The majority of dead or the dying trees in the project area were lodgepole pines that have been impacted by mountain pine beetle infestations. Given their susceptibility to wind-throw, the relative value of this species as a wildlife tree is low due to the characteristically short timeframe they remain standing. By comparison, Douglas-fir snags tend to remain standing longer and can be much larger in size. They were identified occasionally, particularly along the slope crest adjacent to the L.C. Gunn trail and along Highway 97S. Deciduous snags were sparsely distributed on the landscape but are relatively important wildlife trees due to their slow decay rate compared to conifers. Protection of the previously identified wildlife trees is valuable for biodiversity and the majority will be protected within the significant slopes. Other large Douglas

fir which may become snags and wildlife trees were observed in the southeastern section of Area 3. The protection of larger (>40 cm DBH) Douglas –fir will help protect the key feature of the SBSmk1/04 blue listed ecosystem and future wildlife trees. Recommendations for development can be found in Section 6.3.

Tree cavities and crevices under the bark of decaying trees provide natural roosts for bats. As a group, the bat species potentially utilizing habitats within the project area may be limited by the general lack of large snags with crevices or cavities, old buildings, caves and rock crevices, which offer the best opportunities for roosting and hibernacula. Many of the potentially occurring bat species are known to favour areas with clearings, open fields, and waterbodies for feeding, including ponded areas. The potential effects of development are difficult to predict with respect to bats, particularly because a focused sampling effort has not been conducted in the project area and therefore, their presence and utilization of resources is unknown. Overall, the development is not prohibited by the potential bat use of the area. Areas not planned for development may be utilized by bats and key habitat features can be incorporate into those areas at the development stage (i.e. bat boxes).

Coarse woody debris (CWD) includes sound and rotting logs and stumps that are generally >30 cm in diameter. CWD and large decomposing stumps sustain a diverse and abundant assemblage of invertebrates and fungi. These invertebrates provide food for many species of mammals, birds, snakes, and amphibians. CWD provides primary nesting and feeding habitat for wrens and is an important insect food source for black bears, particularly when other food sources (berries) are unavailable. The presence of CWD enhances the horizontal structure of the forest floor, providing cover and foraging opportunities for deer mice and shrews, access below the snow for squirrels, marten and weasels, and courtship structures for ruffed grouse. The increased capacity of CWD to retain moisture creates favourable microhabitats for salamanders and frogs. The CWD found in seepage areas may provide favourable habitat for amphibians, particularly during the drier summer months, and primarily for terrestrial species such as the long-toed salamanders (Province of BC 2004a). Large diameter CWD is not

abundant within the project area, however, dead pine stands may soon result in areas with dense CWD concentrations. Since the majority of the CWD within the project area is associated with wetlands and drainages, it will be protected within the riparian buffer areas.

Deciduous trees in a largely coniferous landscape provide habitat diversity that is exploited by many wildlife species. Many songbirds (such as warblers, vireos, and flycatchers) preferentially use deciduous trees as foraging and nesting areas. Many primary cavity nesters prefer deciduous species to conifers, likely because cavity excavation is easier. Aspen and cottonwood are particularly important because mature trees frequently have heart rot. The smaller deciduous trees such as alder, in riparian and adjacent areas are a required component for beaver, a keystone species that creates valuable habitat for many other wildlife species. A summary description of particular wildlife values associated with deciduous tree species common in the project area follows below:

Paper birch - important browse for moose and deer, buds, catkins and new leaves preferred by porcupine, important food for beaver, squirrels feed on flowers and leaf buds in spring, many bird species nest in birch (woodpeckers, owls, hawks, sapsuckers, flycatchers and vireos)

Trembling aspen - important for ungulates, small mammals and birds, important as winter browse for moose and deer, buds, catkins and new leaves preferred by porcupine, important food for beaver, squirrels feed on flowers and leaf buds in spring, ruffed grouse feed on buds and twigs in winter, many bird species nest in aspen (e.g. woodpeckers, raptors, Barrow's goldeneye, hooded merganser, bufflehead, owls, sapsuckers, flickers, flyctachers, nuthatches, western tanager and finches)

Black cottonwood - moderately important winter and spring browse for moose and deer, preferred food of beaver, squirrels feed on flowers and leaf buds in spring, ruffed grouse feed on buds and catkins in winter, important perches for bald eagles in winter, important cavity nesting tree for

woodpeckers, many birds nest in cottonwood (owls, hummingbirds, starling, sapsuckers, western tanager, flickers, grosbeaks and vireos)

Large veteran trees are important sources for future snags and CWD in forests. Because veteran trees are frequently in the early stages of decay, they are often preferred by cavity nesters and birds that forage for insects found under the bark. Raptors often use veteran trees for perching and nesting. The large surface area of large trees maximizes the available habitat per unit area. A black cottonwood located in an open agricultural area was the only large (>1 m diameter) tree was observed within the project area. Some 45 cm to 49 cm diameter Douglas-fir trees were present in the SBSmk1/04 ecosystem in the southeast part of the project area, and adjacent to the L.C. Gunn Trail. Some large veteran trees are also expected within the fenced airport property. These larger trees should be protected from development. Understanding that the location of the connector road may be constrained, flagging of the proposed road location and comparing it to the location of large Douglas fir Road is recommended. The road location may be moved enough such as to avoid these features and have them located in a buffer along the road.

Edges between vegetation communities (such as between forest and field, or between wetland and dry forest) are often frequented by species that use each area to fulfill different life history functions. Edges also provide habitat for species that prefer the often structurally complex transition zone (ecotone) between contrasting ecosystems. Wetland to dry forest transition areas were uncommon in the project area, and were limited to a couple of beaver flooded locations (Plates 11 and 12). Edge habitats along agricultural clearings (Plate 13), previously logged areas (Plate 14), and the dense network of roads and trails were commonly available. Additional edge habitats will likely be created during this development.

Shrub Layers within the project area perform several important functions for wildlife, particularly birds. Many species are important as browse for moose and deer, and the flowers and berries are eaten by many species of birds and small mammals. Dense shrub layers provide

travel and security cover for many wildlife species, as well as nesting opportunities for a wide range of birds. Shrub species of particular value to wildlife within the project area include: thimbleberry, highbush-cranberry, red-osier dogwood, soopolallie, willows, prickly rose, black gooseberry, and red raspberry. The wildlife values of a small group of the aforementioned shrubs are summarized below (Parish *et al.* 1996; Coates 1990)

- *Highbush cranberry* - winter browse for moose, berries eaten by birds and mice, twigs and stems eaten by beaver, warbler nesting
- *Red-osier dogwood* - important browse for moose, berries eaten by small mammals and birds, cover and nesting for birds
- *Willow* – staple winter browse for moose, cover and nesting for birds.

These shrub species may be planted in landscaped areas of the development. Since they are currently present on the landscape, planting similar species may also provide similar functions.

5.4 Wildlife Habitats

Given the size of the project area, a few dominant wildlife habitats are present. In larger areas, a wider range of habitat types are available due to the greater variety of terrain features and seral stages. Based on field observations, it appears that most forested polygons are in a late immature to early mature seral stage, which results in a relatively small average tree size and explains the significant deciduous component. Some older Douglas fir trees were observed along the slope breaks near the Fraser River and Highway 97S.

Important attributes of forests within the project area (for wildlife) include abundant (although young) wildlife trees (lodgepole pine), very scattered large diameter trees, abundant browse, and berry producing shrubs. The attributes and importance of the different habitat types present are discussed in the following sections in the context of wildlife species that may occur in the area.

Attributes of deciduous and mixed forest habitats that are of particular value to wildlife include:

- Aspen is particularly important for cavity nesting species;
- Coniferous trees provide escape cover for birds;
- Abundant insects are present for foraging;
- Deciduous leaves, twigs and buds provide forage; and
- Canopy nesting opportunities.

The age of deciduous trees has a significant influence on wildlife habitat values. Very young aspen forest provides high value forage for moose and mule deer where middle to older trees have little value as browse but greater value for cavity nesting bird species. Mixed forest types are prevalent but have a large deciduous component due to past disturbance throughout the project area. Although most of the regenerating forests are not yet mature enough to produce large (>30 cm) diameter snags, which are preferred by cavity nesters, scattered mature birch do occur.

In addition, the OCP also identified a large area in the middle of the project area as ungulate habitat. Based on field observations, the majority of the project area exhibited ungulate use. Ungulate trails, pellet groups and browse on key foraging species were noted. This habitat is not limited on the landscape nor does it provide critical ungulate winter range. Connectivity corridors throughout the development may protect some of this ungulate habitat.

5.5 Wildlife Diversity in the SBSmk1

In order to determine the local, regional and provincial significance of habitats within the project area, it is necessary to consider the full range of wildlife species known, or with significant potential to occur. Key references that were utilized to achieve this include:

- The mammals of British Columbia (Eder and Pattie, 2001) ;
- The Birds of British Columbia Vol 1, Vol 2, Vol 3, Vol 4 (Campbell *et al*. 1990, 1990, 1997, 2001);
- A field guide to site identification and interpretation for the southwest portion of the Prince George Forest Region (Delong *et al*. 1993);
- BC Conservation Data Centre tracking lists (CDC 2000); and
- Amphibians in British Columbia (Province of BC 2004a).

5.6 Wildlife Species of Management Concern

There are several criteria by which a particular wildlife species may be considered to require special management attention by resource managers, primarily the Ministry of Environment and the Ministry of Forests. These criteria include:

Species of special management concern include:

- species with formal (Federal, Provincial) designation as species at risk;
- species that occur on provincial red, blue and yellow lists;

- species with declining or uncertain population levels (e.g. fisher, bald eagle);
- species that are uncommon or occur at low densities on the landscape;
- species with special habitat requirements (e.g. tree cavities for tree swallow, bufflehead);
- keystone species that create habitat for other species (e.g. beaver, pileated woodpecker); and
- species of commercial or recreational importance (e.g. moose, marten).

The primary warehouse of information on the status of flora and fauna in the province is the BC Conservation Data Centre (CDC). The CDC provides tracking lists for flora, fauna, and plant communities for each Forest District in the province. The District lists identify species that can be expected to occur within the District boundaries, which is often coincident with watershed divides and may include the bulk of some sub-populations of wildlife. These status lists use a colour-coding system to rank the status and management priorities for species at risk. Following is a breakdown and brief description of the status and ranking criteria used in developing these lists:

Red-listed Species:

- candidates for legal designation as threatened or endangered under Federal legislation;
- include threatened species - any indigenous species of fauna or flora that is likely to become endangered in British Columbia if the factors affecting its vulnerability do not become reversed; and
- include endangered species - any indigenous species of fauna or flora that is threatened with imminent extinction or extirpation throughout all or a significant portion of its British Columbia range.

Blue-listed Species:

- considered to be vulnerable or sensitive and are candidates for upgrade to the red-list or downgrade to yellow; and

- include vulnerable species - any indigenous species of fauna or flora that is particularly at risk in British Columbia because of low or declining populations.

Yellow-listed Species

- the yellow-listed species are those considered not at risk in British Columbia and are considered for management emphasis for various reasons including recent declines in population numbers, restricted distribution, losses of habitat, public interest, species that are maintained by ecosystem management and species for which the Province has a global responsibility.

In addition to red, blue, and yellow-listed species, numerous other species are of management concern within the province due to:

- populations that are actively managed;
- species that are of commercial value;
- species with specific habitat requirements (e.g. nest cavities);
- species found at low densities; and
- colony nesters.

5.6.1 Invertebrate Fauna at Risk

The list of species at risk includes four invertebrate species, two butterflies (Mead's sulphur and Jutta arctic) and two mollusks (pygmy fossaria and rocky mountain capshell). Directed field searches for these species were not conducted due to the timing of the field work, which would largely preclude their observation and therefore be inconclusive.

Mead's sulphurs occur in disjunctive populations in subalpine and alpine areas of the Rocky Mountains from central BC and Alberta, south to northern Montana (Klinkenbeard, 2007b), while the Rocky Mountain capshell lives in high elevation lakes between 2675 and 3025 m

(Klinkenbeard, 2007b). As such, these species would not be expected to occur in the project area since the preferred habitat is lacking.

Jutta arctics occur across northern BC and in scattered locations through the Rockies and the Cariboo Region (Klinkenbeard, 2007b). They inhabit spruce bogs and open pine forests, and occasionally alpine tundra. Although the range of the pygmy fossaria is not well described in the literature, there is one documented occurrence near the Prince George area. Pygmy fossaria are amphibious but are often found out of the water. They live on wet mud flats, lakeshores, riverbanks and in marshes, and also among vegetation submerged in shallow water (Klinkenbeard, 2007b). Based on the habitat requirements described for these two species, it is unlikely that the Jutta arctic would be found but conceivable that the pygmy fossaria could exist in association with small wetland ponds within or adjacent to the project area.

In general, the available habitats and plant species that were documented within the project area are common and not limiting on the landscape. Therefore, it is unlikely that they are important for the butterfly or mollusk species at risk, which are more likely to be associated with larger areas of more contiguous preferred habitats.

5.6.2 Vertebrates Species At Risk

The BC Species and Ecosystem Explorer (CDC 2007) was queried for vertebrate species at risk occurring in the Prince George Forest District, resulting in the identification of 16 species, including 3 fish, 8 birds, and 5 mammals (Table 5). White sturgeon and Arctic grayling are the only red-listed species and the remaining 14 species are blue-listed. Seven species have formal COSEWIC designations (1 endangered 4 special concern, 1 threatened/special concern, and 1 not at risk), 10 species are Identified Wildlife, and 4 species are listed under the Species at Risk Act.

Table 5. Vertebrate Wildlife Species of Management Concern in the Prince George Forest District.

Species	COSEWIC	BC Status	Identified Wildlife	SARA	Occurrence in project area	Potential effects
American Bittern	No	Blue	No		Unlikely; preferred habitats not present.	None anticipated.
Arctic grayling (Williston Watershed pop.)	No	Red	No		Not present.	None anticipated.
Bobolink	No	Blue	No		Unlikely; preferred habitats not present.	None anticipated.
Broad-winged Hawk	No	Blue	No		**Potential occurrence.**	None anticipated.
Bull trout	No	Blue	Y (Jun 2006)		Unlikely; preferred habitats not present.	None anticipated.
Caribou (northern mountain pop.)	T/SC (May 2002)	Blue	Y (May 2004)	Y	Unlikely; extirpated from area.	None anticipated.
Fisher	No	Blue	Y (Jun 2006)		Unlikely; preferred habitats not present.	None anticipated.
Great Blue Heron, *herodias* subspecies	No	Blue	Y (Jun 2006)		Unlikely; preferred habitats not present.	None anticipated.
Grizzly bear	SC (May 2002)	Blue	Y (May 2004)	Y	Unlikely; preferred habitats not present.	None anticipated.
Long-billed Curlew	SC (Nov 2002)	Blue	Y (May 2004)	Y	Unlikely; preferred habitats not present.	None anticipated.
Northern myotis	No	Blue	No		Potential occasional visitor.	None anticipated.
Sandhill Crane	NAR (May 1979)	Blue	Y (Jun 2006)		Unlikely; preferred habitats not present.	None anticipated.
Sharp-tailed Grouse, *columbianus* ssp.	No	Blue	Y (Jun 2006)		Unlikely; very rare around Prince George.	None anticipated.
Short-eared Owl	SC (May 1994)	Blue	Y (May 2004)		Unlikely; preferred habitats not present.	None anticipated.
White sturgeon (Middle Fraser River pop.)	E (Nov 2003)	Red	No		Not present.	None anticipated.
White sturgeon (Nechako River pop.)	E (Nov 2003)	Red	No	Y	Not present.	None anticipated.
White sturgeon (Upper Fraser River pop.)	E (Nov 2003)	Red	No	Y	Not present.	None anticipated.
Wolverine, *luscus* ssp.	SC (May 2003)	Blue	Y (May 2004)		Unlikely; preferred habitats not present.	None anticipated.

The comprehensive list can be reduced based on known regional distributions, specialized habitat requirements, and extreme rarity to a subset of species that is more reasonable to expect may occur within the project area.

The eight listed bird species are migratory and/or occur at low densities on the landscape in association with particular habitat types. Great blue heron are typically colony nesters and seek mature forests that are relatively free of disturbance from human activities and near suitable foraging areas (Campbell *et al.,* 1990); suitable nest trees and foraging areas may be present along the Fraser River but not within the interior of the project area. Sandhill cranes are generally associated with wet areas but during nonbreeding periods may also extend to dry uplands, grasslands, and agricultural fields. Regardless of the habitat selected, an unobstructed view of their surroundings and isolation from disturbance are requirements (Campbell *et al.,* 1990). Overall, the area is subject to disturbance from aircraft and ATV's and there are no large areas of open water within the project area boundary. Since preferred habitat conditions were not observed within close proximity of the project area for either species, they are not anticipated to be present or require special management attention.

The bobolink, long-billed curlew, and short-eared owl all prefer large, open grassland areas, but will sometimes utilize agricultural areas (Campbell *et al.,* 1990 and Campbell *et al.,* 2001). Given their inherently low densities and the fact that preferred natural grassland habitat is not found within or adjacent to the project area, it is unlikely that these species are present. However, their potential presence cannot be completely disregarded as agricultural areas in the form of hay fields do exist in Area 1; though this area is likely frequently disturbed.

The broad-winged hawk is very rarely sighted in BC and the major breeding areas have primarily occurred outside of BC. Up until recently, the only documented breeding pair in BC occurred in the Peace region (Fraser et al. 1999); however, nests have been found in Prince George (BC CDC 2008). In general, they prefer trembling aspen stands, especially for nesting, which consists of building a stick nest (Goodrich et al. 1996). Trembling aspen was observed

within the project area and one potential nest was observed in Area 1 (Plate 15). This nest was located within the high water mark of the wetland area and would be protected within the wetland buffer.

The general range of the sharp-tailed grouse overlaps with the project area and this species is known to sporadically use the SBSmk1 zone (Stevens 1994). Important habitats for breeding, nesting, and brooding are usually associated with grass dominated openings (Ritcey and Jury 2004). However, other studies show individuals using areas composed predominately of shrub cover (Ritcey and Jury 2004). Given this species seems to be somewhat of a generalist, it is hard to rule out it's occurrence in the project area. However, no occurrences are documented in the project area and due to its sparse density, it is unlikely that this species uses the project area. In addition, the habitat areas such as riparian vegetation and wetland edges that are used by this species, are proposed for protection from any development in this area and thus no additional special management requirements are considered necessary for sharp-tailed grouse.

The American bittern forages and breeds in wet areas with dense growths of emergent vegetation or tall grasses adjacent to freshwater sloughs, marshes, swamps, and shallow protected sections of lakes. Nesting is typical in stands of cattails or sedges with water 5-20 cm deep (Gibbs et al. 1992). The small wetland area that occurs in Area 1 roughly meets this description, however, the cattail stands are small in area, infrequent, and their stem densities seems insufficient to allow for nesting (*i.e.* does not provide enough concealment). Though their presence cannot be ruled out, it is unlikely that American bittern use this area given their highly specific habitat affinities, their sparse distribution on the landscape, the small area and low quality of available wetlands, and the proximity of disturbance (e.g., airport and agricultural activities). Therefore, no special management attention is considered necessary for American bittern.

Ducks and Geese

There are 16 species of waterfowl that can be found within the Prince George area include: American widgeon, Barrow's goldeneye, common goldeneye, green-winged teal, blue-winged teal, bufflehead, Canada goose, gadwall, hooded merganser, horned grebe, lesser scaup, mallard, northern pintail, northern shovelor, red-necked grebe, redhead, and ring-necked duck. Most waterfowl nest in wetlands (mostly marsh and shrub swamp) and riparian areas associated with bodies of open water. During the field assessment a pair of American widgeon were observed in Area 1.

Barrow's goldeneye has been identified as a species of management concern as it is a secondary cavity-nester (non-obligate) in large natural tree cavities or those excavated by pileated woodpecker. This species usually nests riparian forests and it may be adversely affected by the loss or removal of large snags. It is a widespread species in British Columbia and western Alberta in the summer, and common in B.C. coastal waters in winter.

Overall, over-mature aspen and birch trees provide the best nesting opportunities for waterfowl. In the project area, few trees of suitable size were observed.

Osprey

The osprey is a summer visitor that occurs throughout BC. The osprey is a species of special management concern and is conspicuous along the Fraser River. Ospreys are strict fish-eaters and are closely associated with rivers, lakes and sloughs. Ospreys nest near water, usually near the top of live or dead trees, or frequently on man-made structures such as wooden pilings or power poles (Campbell *et al*. 1990). While no nests were observed during the field assessment, osprey have been observed previously along the Fraser River and may nest within the riparian area of the Fraser River.

Woodpeckers

A total of seven species of woodpeckers could potentially occur within the project area, including downy woodpecker, hairy woodpecker, northern flicker, pileated woodpecker, red-breasted sapsucker, three-toed woodpecker, and black-backed woodpecker. The hairy woodpecker is likely the most common species found in the project area and is likely the primary cavity-builder in standing dead trees. Standing dead trees are scattered throughout the project area and those near the perimeter of the wetlands may provide a source of nesting and foraging opportunities for woodpeckers and secondary cavity nesters.

The pileated woodpecker is a species of special management concern, because it is a keystone species that creates habitat for other species and requires large-diameter (>30 cm) trees to build its nest cavities, which are often used by secondary cavity-nesters such as Barrow's goldeneye. Suitable nest trees (>30 cm DBH and > 6m tall) are rare across the project area.

Passerines (Songbirds)

Approximately 70 species of passerines have significant potential to occur within the project area, none of which appear on the provincial red- or blue-lists (CDC 2000). Most of the passerine species are widespread and common in western North America and most are seasonal migrants that breed in the central and northern portions of the province. Most species are neotropical migrants that breed in the north and overwinter in the south, and very few passerines are year-round residents, including black-capped chickadee, dark-eyed junco, gray jay, and pine siskin. Habitats within the project area provide suitable foraging and nesting opportunities for a wide range of songbirds.

Mammals

Grizzly bear (Blue list) and Black bear

Grizzly bears are currently blue-listed for several reasons including: declining numbers, loss of habitat, vulnerability to human disturbances, large home range requirements, and low reproductive rate. It is generally accepted that maintenance of grizzly bears require large relatively undisturbed areas to reduce bear-human conflicts. Most of the potential threats to grizzly bear populations are related to human settlement and road access. However, large, relatively undisturbed areas are becoming increasingly rare, which implies that the majority of grizzly bear habitat will require a coordinated approach to habitat management, as is recommended in *Grizzly Bear Conservation Strategy, (1995)*.

Grizzly bear are typically found at low to moderate densities in the SBS zone within the Prince George Forest District, largely due to the extensive settlement and agriculture. In the SBS, grizzlies typically utilize riparian and wet forests throughout their range during summer for foraging and travel. Grizzly bears require a variety of seral stages to meet seasonal habitat requirements. Important habitats include mature forests, herb-dominated avalanche chutes, subalpine meadows, riparian areas, floodplains, salmon-bearing streams, and habitats containing berry-producing shrubs. Coarse woody debris is an important habitat feature for grizzlies foraging for insects.

Grizzly bear are infrequently observed in proximity to Prince George and are likely to occur at low densities in the general area due to the proximity to human settlement and the limited food resources reduce the suitability of habitats in the project area for grizzly bear. Due to the extremely large home range size and sensitivity of grizzly bear to human settlement, it is unlikely that habitats within the project area are critical to grizzly bear. The occurrence of a grizzly bear den would be unanticipated and considered incidental; although would have significant implications for development requiring discussion with the MOE.

The disturbed forested polygons likely provide habitat for the black bear. Black bears are opportunistic foragers rather than predators and do not require specific habitats to survive.

Black bears will forage on berries, aquatic vegetation, carrion, horsetails and insects (Eder and Pattie 2001). Black bears enjoy feeding on dandelions which can be found in disturbed areas such as roadsides and clearings. Evidence of black bear was commonly observed throughout the project area. Development within the area would need to provide adequate measures to deter bear/human interaction (i.e. proper garbage disposal etc.).

Fisher (Blue list)

Fisher are a wide ranging species that occur in low densities on the landscape and utilize a wide range of habitats including riparian, wetland, burns, mixed and mature coniferous forest. The home range of a single fisher, depending on the quality and amount of available habitat ranges from approximately 1,500 to 3,000 ha and an average density in suitable habitat ranges between approximately one animal per 5,000 to 10,000 ha. Although fishers utilize a wide range of habitats they are known to prefer large areas of contiguous forest. Due to their low densities and large home range sizes, fishers are difficult to manage for and are typically treated under an umbrella approach where key habitats or habitat elements are management targets for groups of species.

Riparian and wetland habitats are important habitats for numerous wildlife species, including fisher, and it is assumed that protecting these habitats will significantly contribute to the management (maintenance) of dependant species. Large diameter standing dead trees are an example of a habitat feature that is particularly important to numerous wildlife species, including fisher. The vast majority of fisher den sites are found in large diameter (>90 cm) dead trees (mostly black cottonwood). Suitable denning trees may not be observed within the project area.

Wolverine (Blue list)

Similar to grizzly bear, wolverines are a wide ranging species that occurs at low densities on the landscape. They are solitary animals and males have territories as large as 200,000 ha; females about 40,000 to 50,000 ha. In contrast to grizzly and fisher, wolverine are habitat specialists, with the greatest overlap in habitat requirements with caribou and grizzly bear. Wolverine are typically associated with remote wilderness areas and high elevation ecosystems where caribou carrion is an important food source. They are known to follow other predators such as grizzly bear to feed on their kills.

Wolverines are infrequently observed. It is unlikely that wolverines would occur within the project area or be significantly affected by future development.

Moose

Moose are a species of management concern as they are used as a management indicator species, their populations and habitats are managed by the province, and they are of social and commercial value. The SBS supports the highest densities of moose and most important moose habitats in the province. Moose are widely distributed, although they are most abundant in the lower elevation plateau forests that are characterized by numerous wetlands and small lakes, as well as extensive river riparian habitats.

Moose utilize a wide range of habitat types (forested and non-forested) and seral stages to meet different life history requirements (breeding, foraging) and accommodate daily movements (travel, security and thermal cover). Early seral forest in cutblocks, burns in spruce-pine forests, and riparian habitats provide year-round forage for moose. Moose frequent wetlands and shallow lakes through the spring and summer to feed on aquatic and emergent vegetation. Moose find ample browse in cutover areas but use is typically low until stands green up enough to provide cover, which roughly coincides with the onset of the suppression of shrub growth

from the shading of maturing conifers. On average sites, moose utilization is typically greatest in 15-25 year old stands. Most vegetation within the project area is around 40-60 years old with some polygons of 120 years old trees.

Moose require areas of dense cover for travel, security and thermal cover. Riparian corridors along streams with high shrub cover provide resting, hiding, calving and foraging opportunities and are of particular importance. Thermal cover is largely provided by mid to late seral coniferous forest.

The entire project area provides habitat for moose and deer as observed by the abundant browse, pellet groups, ungulate trails and a moose observation in Area 3. The middle of the project area has been identified as a Sensitive Natural Feature by the City of Prince George (2001). The proposed road network (connector) shown on map RFP:01 runs directly through this Ungulate Area.

Moose are somewhat tolerant of development and they are known to browse natural and ornamental shrubs in close proximity to houses in low-density large lot developments, however they are generally secretive. Increased human/wildlife and vehicle/animal interactions are possible given the proposed road layout for this area. Creating wildlife corridors to allow movement throughout the area while avoiding road networks would be critical during the planning and design phase of any development in this area if the maintenance of moose utilization of the area and management of negative interactions are management objectives for the area. Further recommendation details are provided in Section 6.3.

Mule Deer

Mule deer are a species of management concern as they are a management indicator species, their populations and habitats are managed by the province, and they are of social and commercial value. The SBS supports the low to moderate densities of mule deer. Mule deer prefer patchy habitats with a mix of dense forests for thermal and security cover, combined with

open south-facing slopes, deciduous forests, riparian habitats, meadows, and herb-dominated subalpine meadows for foraging. Burns, cutblocks, and south-facing slopes are often the preferred foraging areas. In some areas, arboreal lichens may be an important food source. Warm south-facing aspects are preferred in winter and early spring.

The area proposed for development contains ungulate winter range habitat characteristics such as south facing slopes and slope gradients between 20-40%. Significant slopes have been identified in the City of Prince George Official Community Plan 2001 "Map2: Sensitive Natural Features". These features must be adequately considered in the development of the area.

Amphibians and Reptiles

There are no red or blue-listed amphibian or reptile species recorded in the BC CDC for the Prince George Forest District. Reptile and amphibian species that may be present in the project area include: Western toad (*Bufo boreas*) (a SARA listed species), Spotted frog (*Rana pretiosa),* Wood frog (*Rana sylvatica),* Common garter snake (*Thamnophis sirtalis),* the Western terrestrial garter snake (*Thamnophis elegans),* and the long-toed salamander *(Ambystoma macrodactylum)* (Province of BC 2004).

The reptiles and amphibians are commonly associated with aquatic habitats including river margins and ponds. No amphibian egg masses, tadpoles or hatchlings were observed during the field assessment, however they area likely present due to the abundant wetland habitat. The wetland, ponds and streams provide good breeding habitat and cover for amphibians and reptiles. The vegetation connecting these areas is also important as they provide corridors for migration between the areas and for snakes to access foraging opportunities around the

wetlands. For example, Western toads and long-toed salamanders are largely terrestrial but return to water for breeding.

Protection of the wetlands and vegetation surrounding the wetlands and creation of connectivity corridors should help protect amphibian and reptile habitat within the project area.

5.7 Wildlife Summary

Forested areas such as the mixed upland forests, riparian vegetation and young deciduous forests provide suitable habitats for a number of species. These habitats are considered average, are not limited on the landscape, and therefore are not considered likely to provide critical wildlife habitat for wildlife species of particular management concern. Moose, black bear, and songbirds are evident within these areas but are not limited by these types of habitat. There is a lack of old growth forests and mature black cottonwood, both which may provide critical habitats for other species. Since these are not found within the project area, the habitat is not deemed limiting.

Wetland areas within the project area do provide habitat for amphibian, reptiles (*i.e.*, garter snake) and some waterfowl but due to their size, depth and aquatic vegetation within these areas, would not provide habitat for species of management concern or be limiting upon the landscape. Given the apparent ephemeral nature of the assessed wetland areas, abundant aquatic vegetation has not had the opportunity to grow and thus certain species of ducks and geese would have less available forage.

Species of management concern with significant potential to occur within the project area are limited to moose. The project area does contain significant slopes, some of which are likely used as ungulate winter range. The habitats present around the project area provide moderate levels of capability and suitability for mammals, birds, amphibians and reptiles, and waterfowl, but do not stand out from habitat units located throughout the Prince George area.

6.0 RECOMMENDATIONS

According to best management practices for land development, environmentally sensitive areas should be protected from adverse impacts related to development. In addition, development should be located away from the sensitive areas. According to Environmental Best Management Practices for Urban and Rural Land Development (MOE 2004), an environmentally sensitive area is defined as:

> *"any parcel of land that already has, or with remedial action could achieve, desirable environmental attributes. These attributes contribute to the retention and/or creation of wildlife habitat, soil stability, water retention or recharge, vegetative cover and similar vital ecological functions. Environmentally sensitive areas range in size from small patches to extensive landscape features. They can include rare or common habitats, plants and animals."*

The following summarizes the environmental sensitivities present, best management strategies, and recommendations to guide development such that significant environmental resource values are maintained.

6.1 Aquatic Resources

The aquatic resources present within the project area include seven drainages, two wetland areas and significant riparian vegetation surrounding all watercourses. Two have been classified as default fish bearing and the others may provide fish habitat at their confluences with the Fraser River. Regardless of stream classification, all waterbodies/watercourses in this area would be managed as fish habitat by DFO as they flow into and provide water quality/quantity, flow volumes, nutrient input to fish habitat located downstream.

Two mapped wetlands occur within the Airport Reserve area and were not assessed. It is recommended that a field assessment be conducted in this area if it is added to the ILUP. These wetlands are the headwaters of two of the larger streams and thus may provide additional habitat and water storage capabilities.

6.1.1 Fish and Wetland Habitat

Recommendations and Best Management Practices for protecting fish and wetland habitats within the project area include:

1. Maintain natural drainage patterns.
2. Avoid draining wetlands, regardless of their size, depth or duration. Try to plan development around existing wetlands by incorporating them into parkland or greenbelt areas. Ultimately, development of this site should incorporate these wetland features into the plans. However, if this is not feasible, it is possible with effort and resources to engineer wetlands and other water storage facilities within the development area. The overall premise being that post-development flows are maintained at pre-development levels (see next section) and that any negative impacts to habitat are compensated/mitigated.
3. Create a natural vegetated buffer or leave strip along the length of each drainage (City of PG 2001). A minimum 30 m set back from the high water mark or top of bank depending on steepness of the gully is recommended for industrial developments and high density residential areas (Chilibeck 1993).
4. Do not use local streams or wetlands for unmanaged stormwater discharge. The increased flows can significantly increase erosion and damage aquatic habitats.
5. Create a leave strip surrounding the wetland areas (City of PG 2001). This may be 15 m from the high water mark. This area may be designated as a city park or greenspace. Trails should be designed within the park to avoid fragile or streambank areas that are susceptible to disturbance.

6. Minimize the number of crossings of wetlands or streams. Use boardwalks or bridges within the park and development to avoid impact with wetland areas or drainages.
7. Avoid altering flow regimes of creeks, surface runoff, or groundwater and avoid impermeable surfaces.
8. New roads should have a 35 m setback from portions of drainages with defined stream channels. Given the constraints regarding road locations and that the main connector road may cross the upper tributaries of Zogas Creek, construction is feasible given appropriate mitigation/or compensation. If road construction follows the protocols of the Fish Stream Crossing Guidebook, construction can still occur in this area.
9. Paved parking areas should have 15 m setback from a stream.

These recommendations can be found within documents such as the Land Development Guidelines, Water Quality: General Best Management Practices, Federal Fisheries Act, City of Prince George Official Community Plan, and Streamside Protection Guidelines. These provide general direction for development and are guidelines to ensure that fish and wildlife habitat along with water quality are not negatively impacted.

For example, the infilling of wetlands is not recommended as it would impact the water storage capability of the area, influence downstream fish habitat, remove wildlife habitat from the area. Wetlands can be highly valued by residents; therefore they can be given high visibility, serve as attractive centre pieces to developments, especially in areas slated for industrial use (Province of BC 2006).

6.1.2 Water Qualilty

General BMP's provided by the provincial government to protect water quality include:

1. Avoid infilling or draining of wetland areas by dam removal or breaching.
2. Retain leave strips surrounding streams, wetlands and drainages.
3. Post-development flow volumes should be maintained at pre-development levels.

4. Design and erosion and sediment control (ESC) plans according to the criteria in the Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck 1993).
5. The construction and post-construction ESC plan should recommend that an environmental consultant or other responsible party:
    - provide monitoring to ensure the sediment and erosion control plan is properly implemented during the course of clearing and construction;
    - ensure construction will proceed smoothly without harmful alteration of habitat;
    - provide long-term monitoring for disturbed sites until green-up is established and the soils at the site are stable.
6. Incorporate water treatment features into systems discharging into watercourses to maintain water quality (prevent deposition of materials into watercourses) (City of PG 2001).
7. Require a stormwater management plan be created prior to construction and for post-development including BMPs for source control and removal of contaminants from site runoff.

6.1.3 Stormwater Management

Stormwater generation is anticipated to result from the project due to the conversion of a forested landscape to an light industrial area. When vegetation and soils are replaced by less pervious surface features such as roads, buildings and parking lots, less water is infiltrated into the ground and more becomes surface runoff. Due to the close proximity to the Fraser River, effective storm water management is required to maintain water quality and to protect fish habitat downstream. As such, The Department of Fisheries and Oceans and the Ministry of Environment requires that post-development runoff volumes are equal to the pre-development flows for a 2-year flood event (Chilibeck 1993).

Not only is maintaining water quantity a priority for DFO and MOE, so is water quality. Stormwater runoff from developments often contains contaminants such as suspended solids, toxic metals, hydrocarbons, bacteria, and trace elements. Approved provincial water quality guidelines for freshwater aquatic life include a pH range of 6.5 to 9.0. Recommended water quality guidelines for the maintenance of aquatic life state that:

> *Water leaving a site should contain less than 25 mg/l of suspended solids above the background levels during normal weather conditions and no more than 75 mg/l over background after design storm event. (Chilibeck 1993).*

There are a variety of Best Management Practices (BMP) that can be used in any development both during construction and post-development to help meet these guidelines. Guiding principles in development planning should include minimizing runoff potential, controlling runoff volumes, and providing physical and biological means of water treatment. Some accepted methods of achieving these objectives that can be are applicable to development within the project area include the following:

1. Rooftop detention and retention - large rooftops that allow for permanent detention volumes and temporary retention volumes. Green roofs are an emerging technology that uses vegetation on roof tops to provide infiltration and a source control. Rain cisterns could be installed to collect roof top rainfalls to be used for landscape irrigation or other uses.
2. Vegetated swales - to slow water movement and promote physical and biological filtration, and greater infiltration.
3. Infiltration structures/systems - french drains, infiltration galleries, seepage pits, open bottomed catch basins. It is understood that due to the clay soils of the project area, that infiltration is not entirely feasible. Small amounts of runoff may be infiltrated but overall, stormwater detention ponds will be required.

4. Detention ponds - located in lower slope areas and designed to accommodate wetland plant production. Both dry and wet ponds may be constructed depending on lot size and both have advantages and disadvantages.
5. Vegetation retention - to maximize rainfall interception, infiltration, evaporation and transpiration and to promote slope stability. Raingardens are a potential method for this area. Since landscaping will be incorporated into the development of each lot, raingardens may be dual purpose.
6. Use of gravel roads or porous asphalt instead of regular asphalt to help reduce overall impervious area. Testing of porous pavement has been conducted in Sweden. The porous pavement was more resistant to freezing and frost heave than a comparable impermeable pavement (Backstrom 1999). However, other studies have shown that without a specific maintenance plan in place, porous pavement will not function properly (CWP 2008). Further discussion and research into porous roads and pavement may be warranted if parties feel this could be an option.
7. Overall, a maximum 10% impervious area is recommended. This is found to be a critical threshold with respect to stormwater runoff values (UBC 2008). Given that this is not feasible for this area, this area may be a prime candidate to utilize innovated stormwater management techniques not previously used in the City.

More specifically, the Unnamed Stream 2 is known to be unstable in the lower reaches. Any increases to runoff flow volumes may have a negative effect on the downstream slope stability, downstream fish habitat, and capacity of the culvert at the road crossing. The area is currently forested and contains a large wetland area providing storage capacity. Altering the land cover type and/or decrease the storage capacity of the wetland area, will increase runoff flow volumes. The Rational method is commonly used for determining flow volumes in small urban watersheds and is the method presented in the Land Development Guidelines for the Protection of Aquatic Habitat. This watershed has an area of approximately 3.5 km^2, for which a Q_{100} estimate of 2.4 m^3/s was calculated (Triton 2004).

It is recommended that pre-development flow volumes be calculated for the entire development area. Areas of potential storage (i.e. wetlands) should be retained and the development should be planned such that it fits the site. Other natural depression areas could also be utilized for detention structures and riparian setback areas used to help infiltrate runoff.

6.2 Terrestrial Resources

6.2.1 Plant Communities

One red-listed plant community was identified during a previous assessment along the southwestern boundary of the project area. Within this area, a well used trail was also observed (likely wildlife) and a protective setback from the slope break along this section would help protect the red-listed ecosystem and the wildlife corridor. The Biodiversity Guidebook states that the transition environment in an old forest patch may extend up to 200 m into the old patch from an adjacent newly harvested area. If these red-listed areas are considered "patches", a 200 m buffer would be recommended (BCSC 2001). However given that this area is designated "urban development" within the City and is not located on the forest landbase, a 50 m setback is recommended

Red-listed ecosystems are candidates for legal designation as rare and endangered, and are of greatest concern. Although there is currently no legislation preventing development from occurring within these areas, there is an expectation that development and resource extraction activities avoid or mitigate impacts within mature representative examples of red-listed ecosystems. In some cases, rare ecosystems may receive formal or informal protection where they occur within Wildlife Habitat Areas, parks, ecological reserves, or greenspaces, however outside of protected areas designation, only the Minister of Environment has the authority to issue a protective designation. Based on the land development guidelines, red-listed ecosystems should be designated as environmentally sensitive areas and should be protected from

development if possible, or where impacts are unavoidable, they should be mitigated to the greatest extent possible.

One blue-listed ecosystem, the SBSmk1/04 was observed in the southeast corner of the project area. The key feature of this ecosystem that should be protected is the Douglas fir since this the project area is within the northern most limit of this species in BC. Road construction is planned in this area and through mitigation, the larger Douglas Fir can be protected while still allowing road development to occur. It is recommended that the proposed road location be flagged out and then the area reassessed to determine the location of the larger (>40 cm DBH) Douglas fir. These larger trees are more likely to provide soil stability, wildlife habitat, snow interception and are less susceptible to windthrow than smaller trees. If possible, a 50 m buffer is also recommended between the development and the current edge of this polygon. This buffer can be discussed further when a proposed road location is provided.

The presence of yellow-listed plant communities within the development area should not impact the development potential of this area. Yellow-listed communities are present because there is poor representation of mature natural examples of SBS subzones and there has been substantial modification of existing areas, most or all site series units in a subzone often appear on the CDC lists. The majority of the forested areas within the project area have been modified and are in early seral stages and as such do not provide opportunities for the protection of mature representatives examples of desired ecosystems. Development may proceed as long as it is adequately planned.

No other listed plant communities were observed during this assessment. However, it is recommended that a field assessment be completed in the Airport Reserve Lands. This may be completed by the Airport Authority as it is part of the Environmental Impact Assessment completed for the Airport Reserve Lands (PGAA 2008). Given that this area is located within the SBSmk1, it is unlikely that a red-listed ecosystem is present; however, more mature vegetation was observed from a distance and different site series may be present.

The riparian areas surrounding wetland areas and along the drainages should be retained as leave strips in order to function as a wildlife movement corridors, maintain streambank stability, maintain constant water temperatures, and to act as a natural filter to maintain water quality. According to the Land Development Guidelines, the leave strips should be permanently protected and may be reserved as greenspace. A 30 m setback is recommended along the slope break above the Fraser River. This area is already designated as such given that the L.C Gunn trail is located along the slope break and a setback would provide a buffer between the trail and the development.

6.2.2 Plant Species

One blue-listed plant species has the potential to occur within the project area. Observations of pink wintergreen were noted throughout the project area however, given the timing of the assessment, some may have been white wintergreen as proper identification to species level was not feasible. It is recommended that during the field assessment within the Airport Reserve Area, a more detailed vegetation assessment be conducted to determine if white wintergreen is present.

While an Environmental Impact Assessment (EIA) has been completed for the Airport Lands, field assessments have not been completed in the Airport Reserve Lands. The EIA indicates that prior to construction, "a wildlife biologist will be contracted to undertake a detailed assessment of the project area to determine the presence of species identified under the CDC and SARA" (PGAA 2008). At the time of this report submission, confirmation of this stage of assessment was not available from the Airport Authority. Rather than duplicating efforts, discussion with the Airport Authority is recommended to ensure that area is assessed.

6.2.3 Air Quality

The effects of any proposed development in this area on the local airshed is being examined by another consultant. Land use cover and the transformation of forested areas to paved areas will not only influence stormwater management but will also influence the air quality in the area. A balance between meeting stormwater management guidelines and air quality guidelines may require tradeoffs of land use within the development area.

Since this project is still in the conceptual stages and no designed development plan has been determined, providing recommendations with respect to air quality are based on assumptions of the land base cover types at the post-development stage.

To assist with the air quality modeling, this report provided a rough area of land base that should be retained and protected from development. The area occupied by significant slopes, riparian area and setbacks, wetland areas and red-listed ecosystems was calculated. Overall it represented 14.5% of the total land base in the project area.

Table 6. Excluded Areas for Air Quality Modeling.

Project Area	Area (m2)	% of Total Project Area
Total Industrial Lands Strategy Project Area	***12,127,468***	***100.00***
Area 1 Excluded Area	213,673	1.76
Area 2 Excluded Area	747,927	6.17
Area 3 Excluded Area	801,244	6.61
Total Excluded Area	**1,762,844**	**14.54**

*OCP Significant Slopes; Red Listed Ecosystems; Riparian Areas (15m buffered Lakes, Wetlands, Drainages)

Other areas such as stormwater detention areas, may also be added depending upon the results of the other field investigations and the pre and post-development flow values per given land cover types determined at the beginning of the design phase.

6.3 Wildlife Habitats

The project area provides habitat for a variety of species including: moose, deer, beaver, songbirds, waterfowl and other furbearers. No critical habitat for any of the listed species potentially found in this area occurs within the project area. However, a large portion of Area 2 does provide suitable foraging and bedding sites for ungulates. This area is not deemed critical ungulate winter range, which is known to be a limiting factor in the area.

The potential effects of development on wildlife species of management concern and others found within the area could be mitigated by:

1. Ensuring leave strips are present surrounding all wetland and watercourses within the development area. These strips will function as wildlife movement corridors for moose and other mammals. These corridors between wetland, streams and terrestrial habitat are also important for amphibians in order to complete all life stages (Province of BC 2004). Conceptual corridors to maintain wildlife movement will be created. By reviewing non-developable areas (i.e. geotechnical constraints) and the locations of riparian corridors and significant slopes, corridors to provide access from the southern area to the northern area may be created. These corridors will be developed in consultation with all parties at the design stage.

2. Maintaining the wetland and ponded areas provides nesting and foraging habitat for waterfowl. This will also provide habitat for resident beavers. Beaver dams may only be dismantled between March 16th to September 14th (MWLAP 2002).

3. A nest survey should be completed prior to any clearing so as to reduce disturbance to birds and their nests. Vegetation clearing should be conducted between August 1 and April 30th.

4. Provincial BMP's for amphibians and reptiles indicate that preservation of all wetlands, ponds, and pools, small and/or ephemeral is important for amphibians (Province of BC 2004). Leave strips should also be present on ephemeral drainages. Ephemeral drainages tend to be favoured by some amphibians as they can have fewer and smaller predators than permanent wetlands areas.

5. Designation of City trails within the riparian leave strips may increase incidences of wildlife/human interactions. May need to provide signage to inform the public of such possibilities within the park boundaries. For example, the wildlife trail along the southern portion of the boundary and the L.C. Gunn trail along the top of the slope break along the Fraser River provide movement corridors for wildlife and people. If the development requires clearing of other areas within the project area, this area may have an increased use by wildlife. As such, the setback should be wide enough to provide habitat and, if possible the setback should connect this area with other riparian zones.

6. Wildlife trees should be protected. Abundant pine trees may be short term wildlife trees but these are susceptible to blowdown and are usually not large enough to provide habitat for any length of time. Wildlife tree protection should be focused on the Douglas fir. Several of these are located in the area designated for protection from development. Others which may be located in the southeastern portion of the project area may be flagged during a separate assessment once the proposed road location has been flagged on the ground.

Within the Omineca Region, the control of beavers and their habitat has been an issue. The removal or modification of a beaver dam may only be completed in order to protect property as per the Wildlife Act (Section 9). Since no infrastructure is currently present within the development area, an application would need to be submitted by the developer to the Ministry

of Environment to remove the dams. Dam removal would need to ensure that no damage would occur to downstream habitats (i.e. stream scouring from increased flows).

Understanding that if the ponded areas need to be infilled for development, engineered wetlands may provide habitat for waterfowl, amphibians and reptiles if properly designed and their connection to natural areas is maintained (see previous section).

7.0 SUMMARY

As previously mentioned, the project area was broken into three areas to facilitate the Air Quality Modeling component of the assessment (Appendix 4). Environmentally Sensitive Areas observed during this assessment have been summarized by section. Recommendations pertaining to design guidelines or additional investigations are also provided (Table 7).

Table 7. Summary of Environment Sensitivies in the Three Project Area Segments.

Area	Environmental Sensitivies	Recommended Action
1	Unnamed Stream 4	Riparian Reserve Zones and other BMP's from Section 6.1.
	Wetland area	Flag area and protect from disturbance.
	Nest located near alder wetland	Prior to development, further investigation to determine if active. However, the nest should be protected as it falls within the wetland buffer area.
2	Mature Forested Area	Follow up discussions with Airport Authority regarding their EIA of Airport Reserve Lands to determine if they are going to be conducting further investigations themselves in that area. If not, then field assessment of that area should be conducted.
		Flag and protect from disturbance.
	Red-listed ecosystems	Provide 50 m set bank from top of bank.
	Significant Slopes	Ensure wildlife movement corridors are incorporated into the design phase. Linking key areas such as ridge crests, top of slope breaks, riparian zones and wetland areas to provide foraging and movement areas.
	Ungulate Habitat	
	Unnamed Stream 2	Riparian Reserve Zones and other BMP's from Section 6.1.
	Unnamed Stream 6	Riparian Reserve Zones and other BMP's from Section 6.1
3	Zogas Creek	Riparian Reserve Zones and other BMP's from Section 6.1.
	Wetland area	Flag area and protect from disturbance.
	Unnamed Stream 2	Riparian Reserve Zones and other BMP's from Section 6.1.
	Red-listed ecosystems	Flag and protect from disturbance.
	Significant Slopes	Provide 50 m set bank from top of bank.
	Wildlife Trees	Reassess once road location is flagged to see if the large Douglas fir trees can be avoided.

Areas designated as having environmental sensitivities have potential for limited development to occur if it is adequately planned. Since large portions of the project area have been previously disturbed and does not contain critical wildlife habitat, development could proceed following the recommendations and BMP's provided. Overall, the design phase of any development should be done in conjunction with environmental consultation.

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APPENDIX 1

REPORT PHOTOGRAPHS

Plate 1. Date: Aug. 4, 2004. **Comments:** 0.4 m hanging culvert barrier on Zogas Creek at the Highway 97 crossing.

Plate 2. Date: Aug. 4, 2008. **Comments:** Twin 1200 mm hanging culverts (1.6 m high) on Unnamed Creek 2 at old road crossing ~220 m upstream of the Fraser River.

Plate 3. Date: May 13, 2008. **Comments:** Small, ephemeral pond at the western edge of the open field in Area 1. This pond feeds into the beaver flooded drainage flowing west from the field.

Plate 4. Date: May 13, 2008. **Comments:** Small pond surrounded by cattails in the middle of the open field in Area 1. No defined channel drains this pond, but freshet flows would go west to Unnamed Creek 4.

Plate 5. Date: May 13, 2008. **Comments:** Southwest view from UTM 10U.519503.5971965 of an alder wetland in Area 1.

Plate 6. Date: May 13, 2008. **Comments:** Typical young, mixed forest (SBSmk1/01) that characterizes the majority of the project area. Muddy ATV trails such as the one depicted are also common.

Plate 7. Date: May 13, 2008. **Comments:** Mature example of the SBSmk1/01 ecosystem that characterizes the majority of the project area.

Plate 8. Date: May 8, 2008. **Comments:** The dry Douglas-fir forest (SBSmk1/04) located in the southeastern corner of Area 3.

Plate 9. Date: May 13, 2008. **Comments:** Mountain pine beetle impacted lodgepole pine stand within the SBSmk1/05 ecosystem.

Plate 10. Date: May 8, 2008. **Comments:** Pink wintergreen growing at vegetation Plot 1 within the SBSmk1/04 ecosystem in the southeast corner of Area 3.

Plate 11. Date: May 13, 2008. **Comments:** Beaver flooded area in Area 3 on Zogas Creek.

Plate 12. Date: May 13, 2008. **Comments:** Beaver flooded area in Area 1 looking west from the western edge of the open field.

Plate 13. Date: May 13, 2008. **Comments:** Edge habitat along an open field – dry forest interface.

Plate 14. Date: May 13, 2008. **Comments:** Edge habitat along a recent harvest – dry forest interface.

Plate 15. Date: May 13, 2008. **Comments:** Raptor nest on the edge of the alder wetland at the edge of the open field in the northern area.

Plate 16. Date: May 13, 2008. **Comments:** Looking upstream at the undefined drainage from the cattail pond in the middle of the open field in Area 1.

Plate 17. Date: May 13, 2008. **Comments:** Tributary to Zogas Creek at WPT #14.

Plate 18. Date: May 13, 2008. **Comments:** Zogas Creek at WPT #15.

Plate 19. Date: May 8, 2008. **Comments:** Game trail crossed at WPT # 2 in Area 3.

APPENDIX 2.

PLANT SPECIES LIST

Trees

Abies lasiocarpa (N)	subalpine fir
Betula payrifera (N)	paper birch
Picea glauca x engelmanii (N)	hybrid white spruce
Pinus contorta var. *latifolia* (N)	lodgepole pine
Populus balsamifera ssp. *trichocarpa* (N)	black cottonwood
Populus tremuloides (N)	trembling aspen

Shrubs

Alnus incana ssp. *tenuifolia* (N)	mountain alder
Cornus stolonifera (N)	red-osier dogwood
Lonicera involucrata (N)	black twinberry
Mahonia aquifolium (N)	tall Oregon-grape
Oplopanax horridus (N)	Devil's club
Ribes lacustre (N)	black gooseberry
Rosa acicularis (N)	prickly rose
Rubus idaeus (N)	red raspberry
Rubus parviflorus (N)	thimbleberry
Salix spp. (N)	willow
Sheperdia canadensis (N)	buffaloberry, soopolallie
Symphoricarpos albus (N)	snowberry
Viburnum edule (N)	highbush cranberry

Herbs

Actaea rubra (N)	baneberry
Angelica genuflexa	kneeling angelica

Arnica cordifolia (N)	heart-leaved arnica
Chimaphila umbellate (N)	prince's pine
Clintonia uniflora	Queen's cup
Cornus canadensis	bunchberry
Corydalis sempervirens (N)	pink corydalis
Disporum trachycarpum (N)	rough-fruited fairybells
Epilobium sp.	willowherb
Festuca occidentalis (N)	western fescue
Fragaria virginiana (N)	wild strawberry
Linnaea borealis (N)	twinflower
Mitella nuda (N)	common miterwort
Oryzopsis sp.	ricegrass
Petasites frigidus var. palmatus (N)	palmate coltsfoot
Pyrola asarifolia (N)	pink wintergreen
Smilacina racemosa (N)	false Solomon's seal
Spiraea betulifolia (N)	birch-leaved spiraea
Spiraea douglasii (N)	hardhack
Streptopus amplexifolius (N)	clasping twistedstalk

Mosses

Lycopodium annotinum (N)	stiff clubmoss
Pleurozium schreberi (N)	red-stemmed feathermoss
Polytrichum juniperinum (N)	juniper haircap moss
Ptilium crista-castrensis (N)	knight's plume
Rhytidiadelphus triquetrus (N)	electrified cat's-tail moss
Rhizomnium glabrescens (N)	large leafy moss

APPENDIX 3.

PROJECT MAPS:

Figure 1: Area 1

Figure 2: Area 2

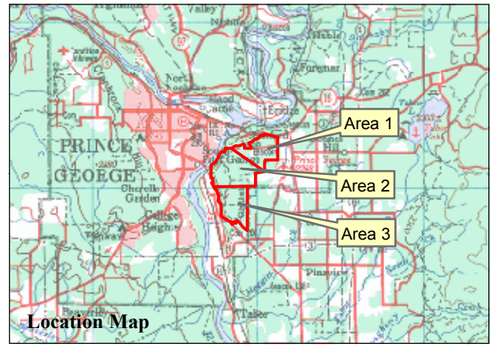
Figure 3: Area 3

PRINCE GEORGE
INDUSTRIAL LAND USE PLAN

Figure 1
Area 1 Project Map

Legend

- Field Waypoints
- Wildlife Tree (Triton 2008)
- Wildlife Tree (Triton 2004)
- Survey Transects
- Features of Interest
- Industrial Land Use Plan Boundary
- Red Listed Ecosystems (Triton 2004)
- OCP Significant Slopes
- LEGAL
- CREEKS
- RAILWAYS
- Contours
- Wetlands



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1	2008/04/23	Initial Draft	SM
2	2008/05/23	Added Transects & Waypoints	SM
3	2008/06/03	Title Change & Lake to Wetland	SM

Basemap Source: Corporate Watershed Base, L&M Engineering Data

Map Datum: UTM NAD 83 Zone 10

Project No: 3921

File No: Map#: 3921_L&M_Industrial\MXD\Area1.mxd

Date: June 3, 2008

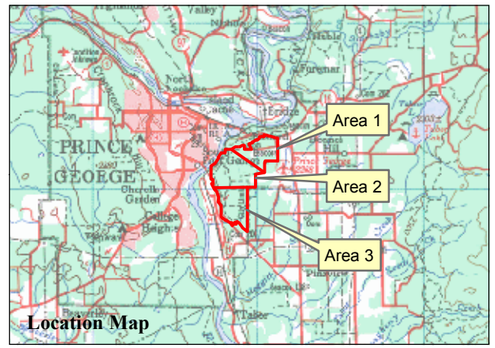
TRITON ENVIRONMENTAL CONSULTANTS LTD.

PRINCE GEORGE
INDUSTRIAL LAND USE PLAN

Figure 2
Area 2 Project Map

Legend

- Field Waypoints
- Wildlife Tree (Triton 2008)
- Wildlife Tree (Triton 2004)
- Features of Interest
- Survey Transects
- Red Listed Ecosystems (Triton 2004)
- OCP Significant Slopes
- Industrial Land Use Plan Boundary
- LEGAL
- CREEKS
- RAILWAYS
- Contours
- Wetlands



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1	2008/04/23	Initial Draft	SM
2	2008/05/23	Transects and Waypoints Added	SM
3	2008/06/03	Title Changes	SM

Basemap Source: Corporate Watershed Base, L&M Engineering Data

Map Datum: UTM NAD 83 Zone 10

Project No: 3921

File No: Map#: 3921_L&M_Industrial\MXD\Area2.mxd

Date: June 3, 2008

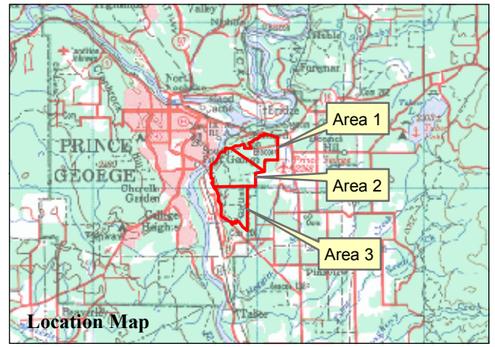
TRITON ENVIRONMENTAL CONSULTANTS LTD.

PRINCE GEORGE
INDUSTRIAL LAND USE PLAN

Figure 3
Area 3 Project Map

Legend

- Field Waypoints
- Wildlife Tree (Triton 2008)
- Wildlife Tree (Triton 2004)
- Survey Transects
- Features of Interest
- Industrial Land Use Plan Boundary
- Red Listed Ecosystems (Triton 2004)
- OCP Significant Slopes
- LEGAL
- CREEKS
- RAILWAYS
- Contours
- Wetlands



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1	2008/04/23	Initial Draft	SM
2	2008/05/23	Added Transects and Waypoints	SM
3	2008/06/03	Title Changes	SM

Basemap Source: Corporate Watershed Base, L&M Engineering Data

Map Datum: UTM NAD 83 Zone 10

Project No: 3921

File No: Map#: 3921_L&M_Industrial\MXD\Area3.mxd

Date: June 3, 2008

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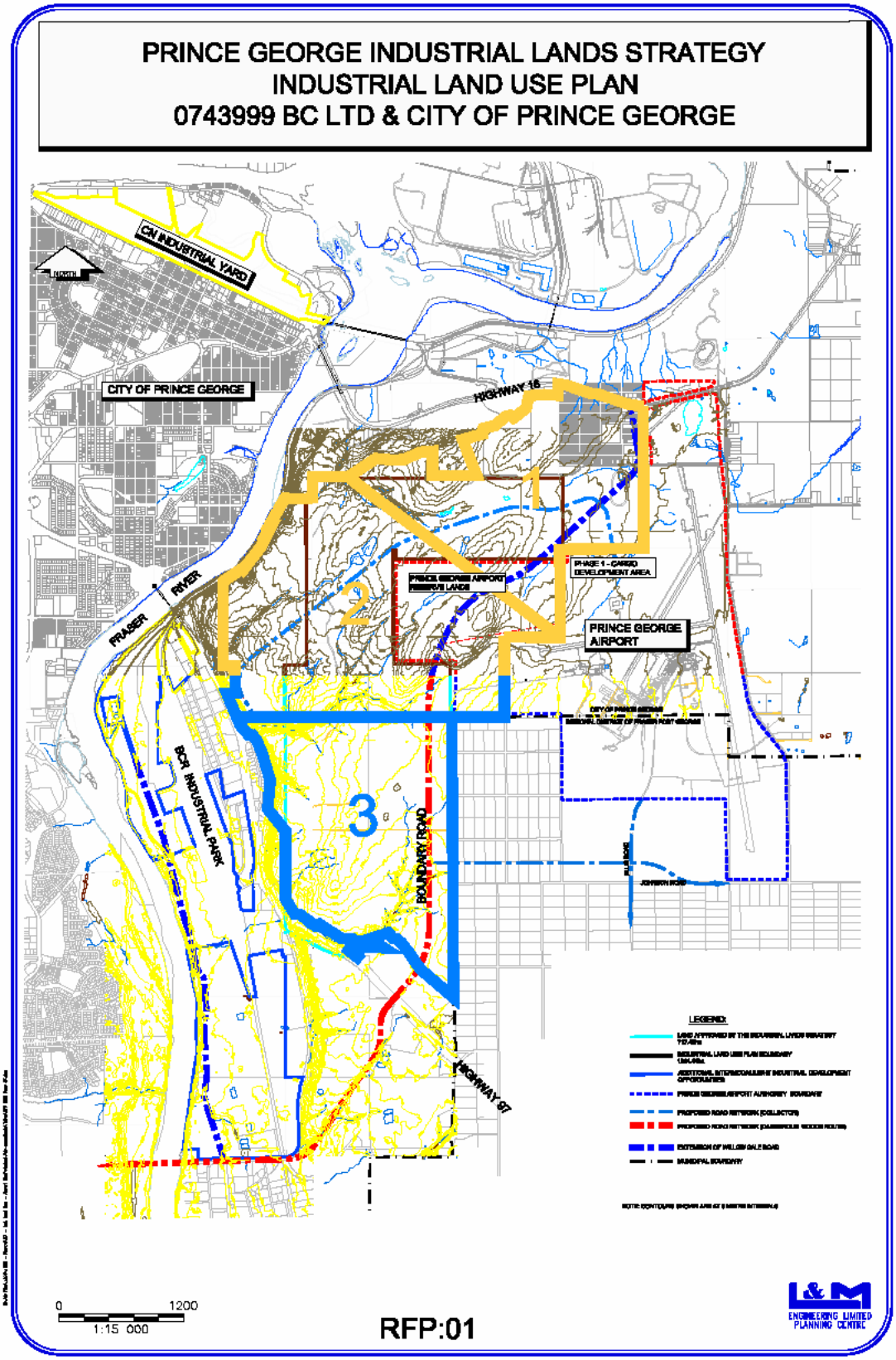
APPENDIX 4.

Air Quality Modeling Areas

(provided by RWDI AIR Inc.)


PRINCE GEORGE INDUSTRIAL LANDS STRATEGY
INDUSTRIAL LAND USE PLAN
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CN INDUSTRIAL YARD
CITY OF PRINCE GEORGE
HIGHWAY 16
PRINCE GEORGE AIRPORT
PHASE 1 - CARGO DEVELOPMENT AREA
FRASER RIVER
BCR INDUSTRIAL PARK
BOUNDARY ROAD
HIGHWAY 97
3
LEGEND:
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