Appendix 13-A

Murray River Coal Project: 2010 to 2013 Wildlife Baseline Report

HD Mining International Ltd.

MURRAY RIVER COAL PROJECT
2010 to 2013 Wildlife Baseline Report




Rescan™ Environmental Services Ltd.
Rescan Building, Sixth Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

August 2013

MURRAY RIVER COAL PROJECT
2010 TO 2013 WILDLIFE BASELINE REPORT

August 2013
Project #0194106-0003-0012

Citation:
Rescan. 2013. *Murray River Coal Project: 2010 to 2013 Wildlife Baseline Report*. Prepared for HD Mining International Ltd. by Rescan Environmental Services Ltd.: Vancouver, British Columbia.

Prepared for:

HD Mining International Ltd.

Prepared by:

Rescan™ Environmental Services Ltd.
Vancouver, British Columbia

Executive Summary

Rescan™
Engineers and Scientists

Executive Summary

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal mining, mainly from open pit mining. HD Mining is proposing to access deeper zones of the coal field (600 to 1,000 m below surface) through underground mining techniques.

To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by Rescan Environmental Services Ltd. (Rescan). Project-specific studies began in 2010 and have continued through 2012. As appropriate and available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into analysis.

This report presents a cumulative summary of all wildlife information compiled for the Project to date. Baseline data provide current information about the wildlife species and habitat conditions found within the Project area. Baseline data are necessary to prepare a description of the environmental setting, and to assess potential effects of the Project on wildlife. This information will be used to plan the Project, including mitigation and management planning to minimize potential Project effects on wildlife. The field program summarized in this report was conducted by Rescan Environmental Services Ltd. (Rescan) between 2010 and 2012. A winter track survey for ungulates and furbearers was conducted by EDI Environmental Dynamics Inc. (EDI) for HD Mining (Appendix 3.2-5). The results of habitat suitability modeling conducted by EDI are presented in a separate report.

The main objectives of the wildlife baseline program were to:

- compile a regional list and document the presence of wildlife species of conservation concern within regional and local study areas (RSA and LSA, respectively);
- estimate the relative abundance and determine the spatial distribution of wildlife species; and
- collect data on species habitat associations to inform mitigation and management strategies.

Results of the wildlife baseline studies combined with regulatory requirements provide a framework of considerations to be included in the environmental assessment. Field studies focused on the mammal community (ungulates, bats, furbearer species), the bird community (raptors, wetland birds, and landbirds), and the amphibian community (western toads) within the RSA and LSA. Baseline data collection was supplemented with available literature on wildlife species, with emphasis on findings from studies conducted within the region.

Baseline surveys for ungulate were focused on mountain ungulates (mountain goat and caribou). During baseline surveys for ungulates in the summer of 2010, six ungulate species were observed: moose, mountain goat, mule deer, northern caribou, Rocky Mountain elk, and white-tailed deer. During mountain ungulate aerial surveys, 138 mountain goat and 5 caribou were recorded in the summer of 2010, all of which were observed outside of the LSA. In addition, an important habitat feature for ungulates, a mineral lick/wallow, was detected along the west side of Murray River just north of the Infrastructure Investigation Area. The Murray River RSA overlaps one approved ungulate winter range (UWR u-9-002) for

mountain goats and caribou and another UWR for moose, Rocky Mountain elk, and mule deer is located just outside of the RSA to the north (UWR u-9-001).

Surveys for bats were conducted at three sites in the RSA. Bats were detected at all three survey sites, and at least two species of myotis were detected: little brown myotis and another myotis species. Both hoary bat and silver-haired bat have been identified during previous inventories in the Tumbler Ridge area (Finavera 2011). Little brown myotis was also caught in mist nets during the same inventory. Therefore, at least three species of bats can be expected to occur in the Project area.

A total of 10 raptor species were identified in the RSA during baseline studies in 2010. Nests were observed for one bald eagle and two ospreys. One of the osprey nests and one bald eagle nest were both located within the southwest portion of the LSA, approximately 300 m and 480 m from the west Infrastructure Investigation Area, respectively. Two species of concern expected to occur in the RSA were confirmed to be present during baseline surveys: peregrine falcon (Threatened under Schedule 1 of SARA) and northern goshawk (species of concern in the Peace region; BC MOE 2005).

Wetland bird surveys were conducted during the breeding period in 2010, during fall staging in 2011, and during spring staging in 2012. Twenty-three wetland bird species and 709 individual birds were identified throughout the RSA during 2010 breeding surveys. Breeding evidence (broods, nest, or pairs) was confirmed for 20 species at 50 locations; 5 dabbling ducks, 6 diving ducks, 2 geese/swans, 3 loon/merganser, 3 shorebirds, and 1 water-dependent bird (sora). A total of 42 broods were detected; the majority of broods were observed on pond habitat. Broods were detected at a total of 13 sites within the LSA; two of these were within the Infrastructure Investigation Area. The remaining 14 sites where broods were observed were outside of the LSA.

Aerial and ground surveys were conducted within the RSA and LSA in October 2011 to document wetland bird species presence during the fall staging period. A total of 16 wetland bird species and 634 individual birds were detected either incidentally or during these surveys at lakes, rivers, or wetlands throughout the RSA. Potentially important staging habitat within the LSA was identified at a sewage treatment cell (WB19) and two large, shallow ponds (WB16 and WB18) adjacent to the LSA; 10 species and 72 individuals were counted at these sites, three of which were species of conservation concern (surf scoter, horned grebe, and red-necked phalarope). The highest abundance of birds was observed during aerial surveys on lakes in Bearhole Lake Provincial Park, along Murray River in the southwest of the RSA, and near Quality Lake. High abundance of wetland birds at these sites likely indicates that these areas provide high quality fall staging habitat.

Aerial and ground surveys were conducted within the RSA and LSA in May 2012 to document species presence during spring staging. A total of 23 wetland bird species and 740 individual birds were detected either incidentally or during these surveys at lakes, rivers, or wetlands throughout the RSA. One species of conservation concern, the harlequin duck, was detected during the aerial surveys in the upstream (southern) portion of Wolverine River.

Surveys for landbirds (e.g. songbirds) were conducted in 2010, during which 72 species were detected. The most commonly observed species were cliff swallow, yellow-rumped warbler, Swainson's thrush, warbling vireo, Wilson’s warbler, and white-throated sparrow. The highest diversity of songbirds was observed within the Infrastructure Investigation Area on the west side of Murray River and outside the LSA but within the RSA. Evidence of breeding (e.g. nests) was recorded within the LSA for four species: tree swallow, cliff swallow, barn swallow, and yellow-bellied sapsucker. No evidence of breeding was recorded within the Infrastructure Investigation Area.

Amphibian surveys were conducted in summer, 2010. Four species of amphibians were detected: western toad, Columbia spotted frog, wood frog, and long-toed salamander. Amphibians were recorded at 10 survey sites, eight of which were breeding sites (i.e., locations where amphibians within breeding life stages were recorded), four of which were within the LSA. One additional breeding site was detected incidentally within the LSA during other wildlife baseline surveys in July. Western toad was the most commonly observed breeding amphibian. Six locations (including the one site recorded incidentally) contained western toad tadpoles and/or toadlets, including two sites where over 500 individuals were counted. Three western toad breeding sites were located within the LSA.

Table of Contents

Rescan™
Engineers and Scientists

MURRAY RIVER COAL PROJECT
2010 TO 2013 WILDLIFE BASELINE REPORT

Table of Contents

List of Figures

FIGURE **PAGE**

List of Tables

TABLE **PAGE**

List of Plates

PLATE **PAGE**

List of Appendices

1. Introduction

Rescan™
Engineers and Scientists

1. Introduction

HD Mining International Ltd. (HD Mining) proposes to develop the Murray River Coal Project (the Project) as a 6 million tonne per annum (6 Mtpa) underground metallurgical coal mine. The property is located approximately 12.5 km south of Tumbler Ridge, British Columbia (Figure 1-1), and consists of 57 coal licences covering an area of 16,024 hectares. The Project is located within the Peace River Coalfield (PRC), an area with a long history of metallurgical grade coal mining, mainly from open pit mining. HD Mining is proposing to access deeper zones of the coal field (600 to 1,000 m below surface) through underground mining techniques.

In October 2011, HD Mining submitted an application to the BC Ministry of Energy and Mines and Ministry of Environment seeking permission to complete a bulk sampling program as part of exploration of the property. In March 2012, HD Mining received approval to conduct a 100,000 tonne bulk sample for the purpose of conducting testing to assist in developing markets for the coal.

Beyond the bulk sample program, in order to develop a full mine at the proposed 6 Mtpa, the Project is subject to both the BC and Canadian environmental assessment processes. Development of any infrastructure for the full mine is not permitted before the requirements of these processes are met.

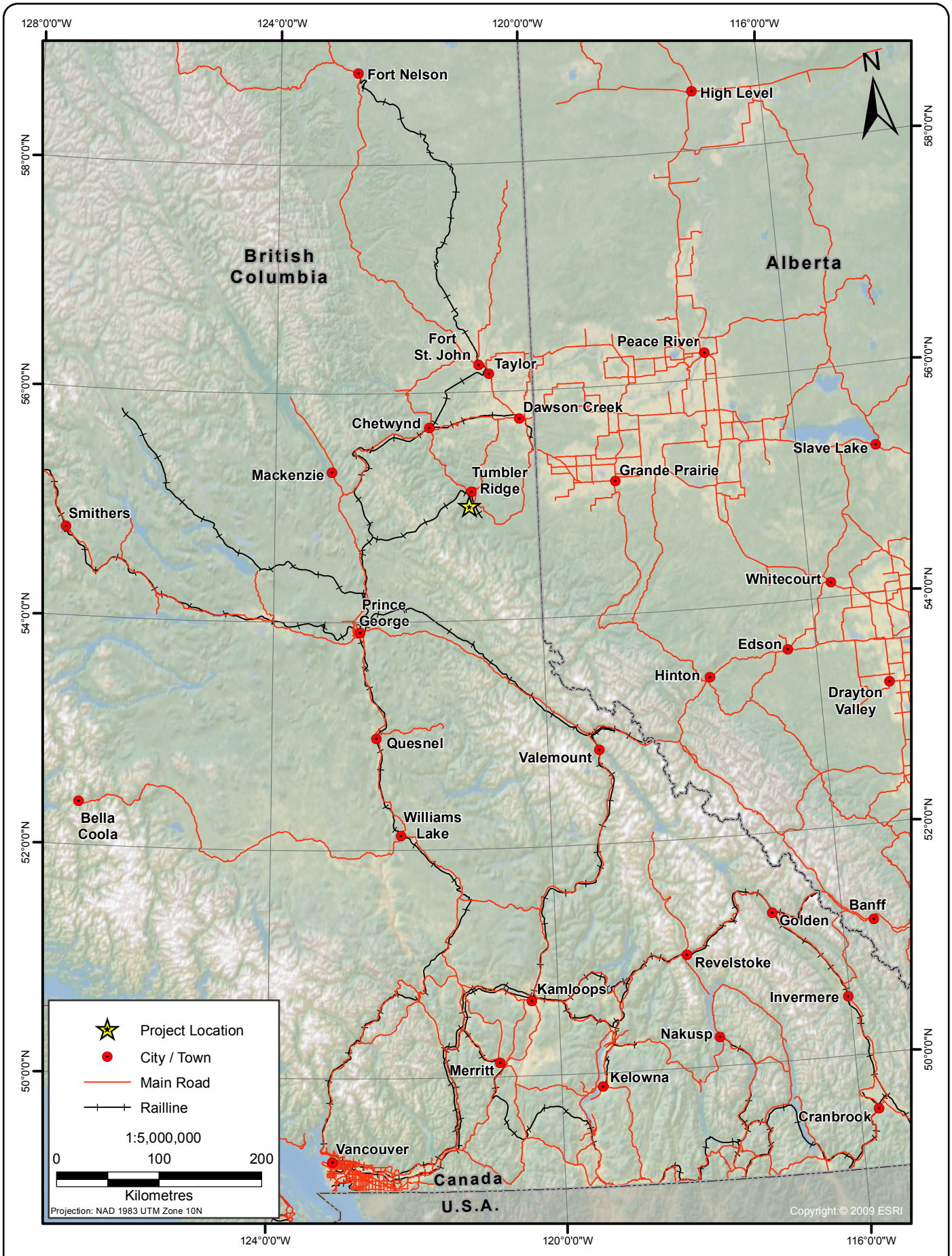
To support HD Mining's planning and development of the Project, and to contribute to the environmental assessment process, environmental and socio-economic baseline studies were initiated by Rescan Environmental Services Ltd. (Rescan). Project-specific studies began in 2010 and have continued through 2012. As appropriate and available, historical data from government sources and neighbouring projects, as well as traditional use/knowledge information, have been compiled and incorporated into analysis.

In order to help guide the scope of baseline studies, regional and local study areas (RSA and LSA, respectively) have been developed (Figures 1-2 and 1-3). The RSA (277,000 ha) is intended to encompass an area beyond which effects of the Project would not be expected. It is also intended to be ecologically relevant based on the home range of key wildlife species known to inhabit the region. The LSA (7,541 ha) encompasses an area surrounding the proposed Project infrastructure within which direct effects from the Project may be anticipated. Its boundary has also been developed following natural terrain and drainage boundaries in order to be ecologically relevant. For consistency, the same RSA and LSA are used for all environmental studies.

This report presents a cumulative summary of all wildlife information compiled for the Project to date. Baseline data provide current information about the wildlife species and habitat conditions found within the regional and local areas. Baseline data are necessary to prepare a description of the environmental setting, and to assess potential effects of the Project on wildlife. This information will be used to plan the Project, including the mitigation and management planning to minimize potential Project effects on wildlife.

The main objectives of the wildlife baseline program within the RSA and LSA were to:

- compile a regional list and document the presence of wildlife species of conservation concern within the study areas;
- estimate the relative abundance and determine the spatial distribution of wildlife species; and
- collect data on species habitat associations to inform mitigation and management strategies.



hd Mining | MURRAY RIVER COAL PROJECT

Project Location

Figure 1-1

Rescan™ Engineers & Scientists

PROJECT # 0194106 GIS # MUR-15-058 VERSION # T0.10 April 10 2013

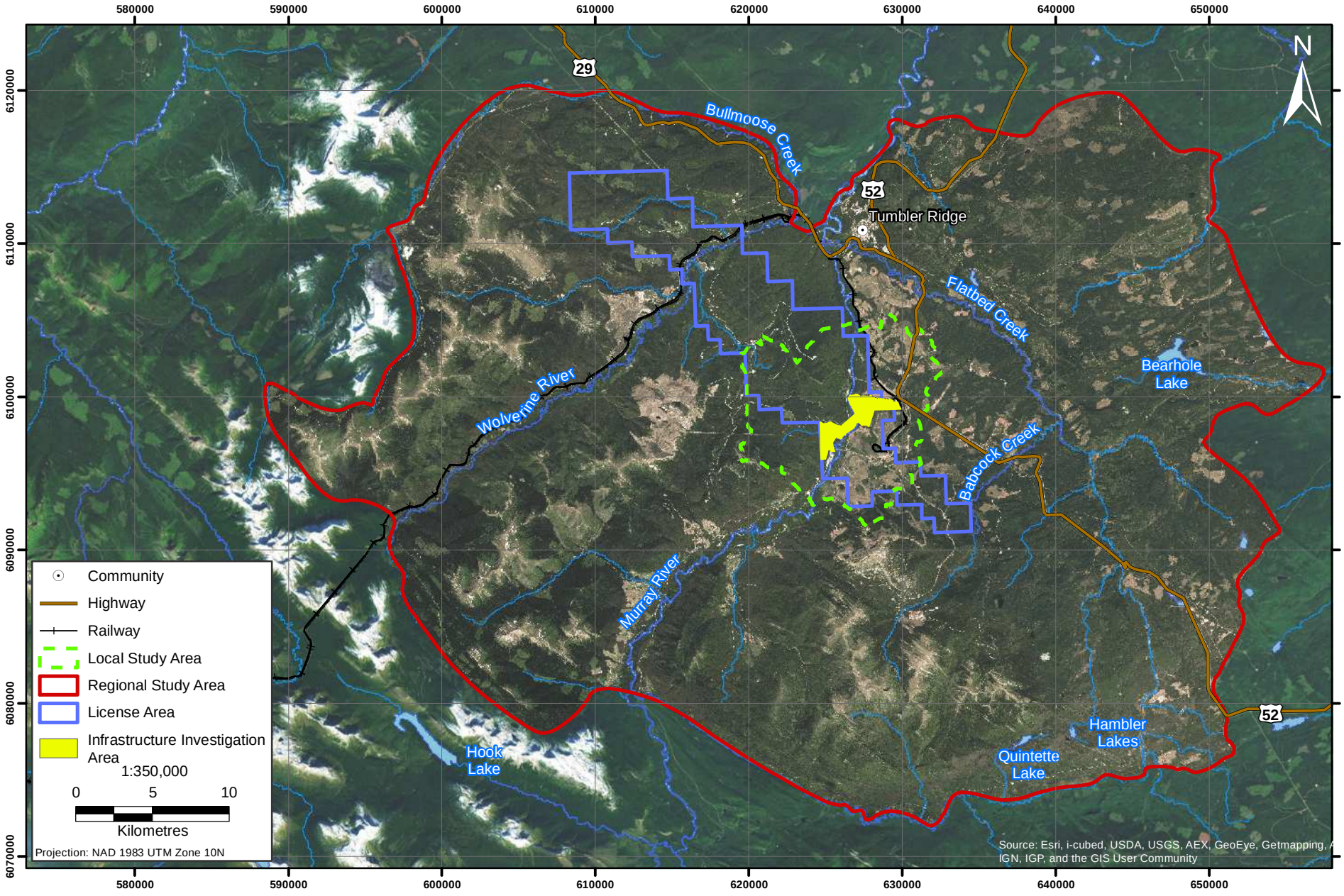


Figure 1-2

hcl Mining

MURRAY RIVER COAL PROJECT

Project Study Boundaries

Figure 1-2

Rescan™ Engineers & Scientists

The following chapters outline the available background information that supports the study (Chapter 2); followed by chapters for each wildlife group. Each chapter provides background information on each wildlife group, outlines methods and rationale used to identify survey sites to collect Project-specific data, summarizes the results of data collection, and synthesizes the key findings of the baseline program.

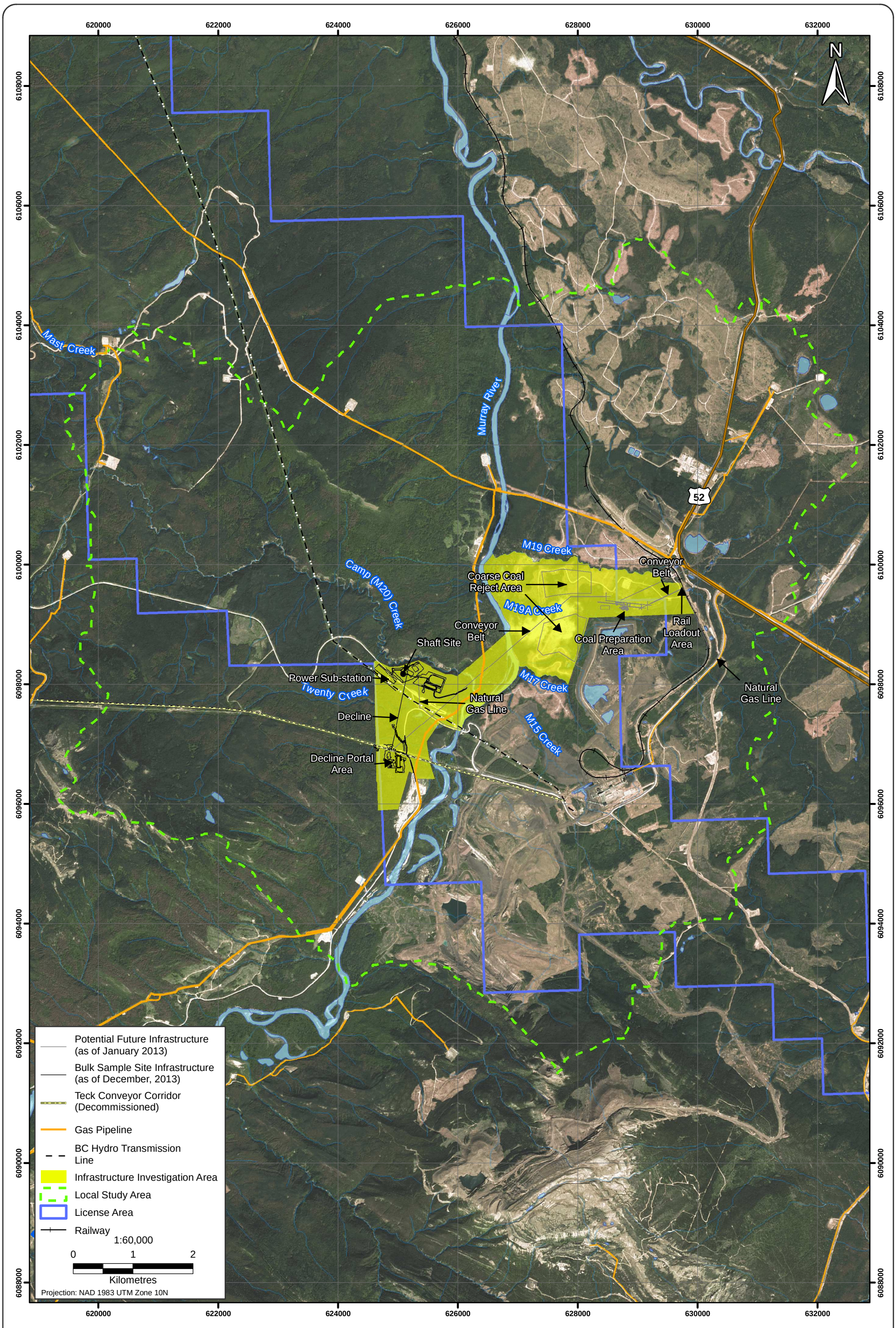


Figure 1-3

MURRAY RIVER COAL PROJECT

Preliminary Site Layout

Figure 1-3

2. Background Information

Rescan™
Engineers and Scientists

2. Background Information

2.1 DATA SOURCES

Baseline field data were collected to provide current information on the distribution and relative abundance of wildlife species inhabiting the RSA and LSA. The scientific literature and information provided on government agency websites was reviewed to provide descriptions of the general ecology of species, including information on historical distributions, population estimates and trends, and habitat preferences, as well as to identify sensitive species. Where available, existing wildlife inventories and First Nations Traditional Use and Knowledge (TU/TK) associated with the LSA and RSA were summarized within each species chapter.

2.2 APPLICABLE LEGISLATION

Wildlife and wildlife habitat are protected under several forms of federal and provincial legislation, such as the BC *Wildlife Act* (1996a), the Canada *Migratory Birds Convention Act* (1994a) (MBCA), the Canada *Species at Risk Act* (SARA: 2002a), the BC *Forest and Range Practices Act* (2004a) (FRPA), and the BC *Water Act* (1988) (Table 2.2-1). These provincial and federal acts, along with best practice guidelines and standards, help ensure development projects are designed and carried out in compliance with applicable legislation and in a manner that will not cause harm to the natural environment.

Table 2.2-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat

Act or Regulation	Implications for Management
BC *Wildlife Act* (1996a)	• Protects most vertebrate animals from direct harm or harassment except as allowed by regulation (e.g., hunting or trapping). Legal designation provides additional protection for selected red- and blue-listed species and their residences. • Section 34 of the Act specifically protects birds and their eggs from possession, molestation, injury, or destruction; the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons, and burrowing owls year-round; and the nests of all other birds when the bird or their egg are in the nest. • Section 9 of the Act specifically protects a beaver or muskrat house, den, or dam from disturbance, molestation, or destruction, except in the case of trappers licensed under the Act. • Alteration or removal of a dam is permitted under the Wildlife Act "to provide irrigation or drainage under lawful authority for the protection of property" and for drainage purposes with specific restrictions. To remove a beaver dam or muskrat house, the Ministry must be notified at least 45 days in advance of the removal project.
Canada *Migratory Birds Convention Act* (1994a)	• Prohibits the taking or killing of migratory birds, their nests, and eggs, and the deposition of harmful substances in areas frequented by migratory birds. • Species protected include waterfowl, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns.

(continued)

Table 2.2-1. Summary of Relevant Acts or Regulations for Wildlife and Wildlife Habitat (completed)

Act or Regulation	Implications for Management
Canada *Species at Risk Act* (2002a)	• Protects wildlife on federal lands as well as the critical habitat of those species listed on the "List of Wildlife Species at Risk", and protects all SARA-listed migratory birds. • Section 137 amends the Canadian Environmental Assessment Act (*CEA Act*) to clarify, for greater certainty, that EAs must always consider effects to listed wildlife species, their critical habitat, or the residences of individuals of that species. • Section 79(2) states "the person must identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."
BC *Forest and Range Practices Act* (2002)	• Section 149.1 of the Act authorizes the minister responsible for the *Wildlife Act* to establish one or more of the following: • An area as an ungulate winter range and objectives for the ungulate winter range (see Section 1.4.1); • An area as a wildlife habitat area and objectives for the wildlife habitat area (see Section 1.4.2); • A general wildlife measure (i.e., wildlife habitat feature: see Section 1.4.3); • Categories of wildlife for the purposes of subparagraphs above; • Section 150.5 of the Act authorizes the establishment of riparian reserve zones, riparian management zones, and riparian management areas for different classes of streams, wetlands, and lakes.
BC *Water Act* (1988)	• Any proposed works in or about a stream must protect fish and wildlife habitat. • The Act applies to the quantity and quality of water on which fish or wildlife depend directly or indirectly to carry out their life processes, and spawning grounds and the nursery, rearing, food supply, and migration areas. • Under Part 7 of the BC Water Act Regulation, works must meet the standards under Section 42 (1) and (2), regardless of the type of work, including: • the timing window or the period(s) of time in the year during which the change can proceed without causing harm to fish, wildlife, or habitat; • the minimum instream flow or the minimum flow of water that must remain in the stream while the change is made; • the removal of material from the stream or stream channel in connection with the change; • the addition of substance, sediment, debris, or material to the stream or stream channel in connection with the change; • the salvage or protection of fish or wildlife during or after the change is made; • the protection of natural materials and vegetation that contribute to habitat or stream channel stability; • the restoration of the worksite after the change has been made; • the requirement to obtain an approval from the federal Department of Fisheries and Oceans in connection with the change.

In particular, Section 34 of the *Wildlife Act* (1996b) protects most vertebrate animals from direct harm and harassment and specifically protects birds, eggs, and occupied nests from possession, molestation, injury, or destruction. The Canada MBCA prohibits the killing of migratory birds or depositing harmful substances in areas frequented by migratory birds, and also protects their eggs and nests. Under the FRPA, areas that are important or critical to ungulates and sensitive wildlife are protected and managed as Ungulate Winter Ranges (UWRs) and Wildlife Habitat Areas (WHAs). General wildlife measures are established for UWRs and WHAs, which include regulations such as prohibiting road

construction and/or disturbance within established buffers around UWR and/or WHA boundaries, unless an exemption is provided.

Standards and best practices are guiding statements that allow development to occur in a way that will avoid, limit, or mitigate effects on aquatic and riparian habitats, water quality and quantity, fish and wildlife species, and public safety and property. As defined in the *Standards and Best Practices for Instream Works* (BC MWLAP 2004f), "standard" is a regulatory requirement that must be followed or achieved in the design and completion of developments. "Best practice" is a recommended method or technique that should be followed to ensure the standards are met and effects are mitigated. Best management practices and guidelines relevant to the Project include the following:

- *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia* (BC MWLAP 2004b).
- *Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia* (BC MOE 2005).
- *Migratory Birds Environmental Assessment Guideline* (Milko 1998a);
- *British Columbia Environmental Assessment Guidelines for Grizzly Bears and Black Bears* (MacHutchon 2001);
- *Accounts and Measures for Managing Identified Wildlife – Northern Interior Forest Region* (BC MWLAP 2004a)
- *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia* (BC MOE 2006a).
- *Environmental Best Management Practices for Urban and Rural Land Development: Special Wildlife and Species at Risk* (BC MOE 2004);
- *Wildlife Guidelines for Backcountry Tourism/Commercial Recreation* (BC MOE 2006b).
- *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* (APLIC 2006).
- *Standards and Best Practices for Instream Works* (BC MWLAP 2004f).
- *Wetlands Environmental Assessment Guideline* (Milko 1998b).
- *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia* (WSP 2009).
- *Implementation Plan for the Ongoing Management of South Peace Northern Caribou (Rangifer tarandus caribou pop. 15) in British Columbia, March 2013 – Draft (*Ministry of Environment *In prep.)*.

2.3 REGIONAL SETTING

The Project is located on the Rocky and Hart Ranges plateau in northeastern BC. This area has a northern interior continental climate characterized by long, cool winters, warm springs, and short, cool summers (Economic Development Office 2009). The Project is located within the District of Tumbler Ridge and within the larger Peace River Regional District. The Project is located within South Peace Wildlife Management Unit 7-21. Four registered traplines and two guide outfitter territories overlap the Licence Area.

The Project Licence Area is located within the boundaries of the Dawson Creek Land and Resource Management Plan (LRMP). The LRMP covers an area of 2.9 million hectares of land between

Fort St. John and Prince George, and is subdivided into 12 Resource Management Zones (RMZ). The Project Licence Area overlaps with two of the RMZ's, the Major River Corridors RMZ (Murray River 3A, 3D subzones) and the Foothills RMZ (Bullmoose Creek 5F and Mount Anderson 5D subzones).

The Foothills RMZ falls under the General Resource Management provincial land use category, which includes lands:

- To be managed for a wide range of resource values
- Where conflicts between land uses are managed in an effort to integrate resource development with environmental and conservation values
- Where investment in resource development and enhancement may be encouraged in areas with few land use conflicts.

The Major Rivers Corridor RMZ is designated as a Special Resource Management land use category that is further subdivided based on the major resource values with high priority in land and resource planning and development. These lands contain extractive resource values which may be of significant social and economic benefit to the province. Resource development is permitted but must consider and address all significant values identified. The intent is to assess risk and to adequately manage any conflict. The Major River Corridors category includes major river valleys that have significant fish and wildlife habitat, recreation, tourism and scenic/visual quality values.

River riparian areas and river valleys provide important habitats and habitat connectivity for ungulates, furbearers, bears and migratory songbirds. South and southwest facing slopes provide important habitat for ungulates. The river corridors are generally areas of higher natural biodiversity. An important landscape unit level requirement for maintaining biodiversity is to manage land and resource development to ensure there is connectivity across the landscape, especially between river valleys and upland areas. These are important travel routes for small mammals, ungulates, and carnivores.

2.4 SPECIES OF CONSERVATION CONCERN

The provincial and federal conservation status was determined for species that potentially occur in the RSA. The Conservation Data Centre (CDC) ranks species of conservation concern in BC into two categories – red-listed species are considered to be either endangered or threatened, and blue-listed species are designated as species of special concern. Species assessed as not at risk are yellow listed. Under the provincial Conservation Framework, species of conservation concern have been identified using additional criteria (Bunnell et al. 2009). In particular, stewardship responsibility, defined by the proportion of a species' global range found in the province, is combined with criteria for species vulnerability and threat to assign a conservation priority ranking to each species (1 highest priority to 6 lowest priority). The framework is particularly relevant for prioritizing common, yellow-listed species with large portions of their global range within BC, in addition to rare species at their range peripheries, many of which are blue- or red-listed (Bunnell et al. 2004).

At the federal level, species assessments conducted by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) are used to legally designate species at risk under Schedule 1 of the federal *Species at Risk Act* (*SARA*).

In this report, species of conservation concern are considered to be CDC red- and blue-listed species, priority 1 and 2 species designated under the provincial Conservation Framework, species assessed by COSEWIC as endangered, threatened, or of special concern within Canada, and species legally listed as at risk on Schedule 1 of the federal SARA.

Of the wildlife species likely to occur regularly within the Project area, two amphibians, 16 bird species, and 10 mammals are designated as species of conservation concern (Table 2.4-1).

Table 2.4-1. Species of Conservation Concern Likely to Occur Within the Local Study Area

Common Name	Scientific Name	Global Rank	Provincial Rank	BC List	COSEWIC	SARA	BC Conservation Framework Priority (Goal #)
Large Mammals							
Grizzly bear	*Ursus arctos*	G4	S3	Blue	SC		2
Wolverine, *luscus* ssp.	*Gulo gulo luscus*	G4T4	S3	Blue	SC		2
Furbearers							
Fisher	*Martes pennant*	G5	S2S3	Blue			2
Ungulates							
Mountain caribou	*Rangifer tarandus*	G5T2Q	S1	Red	T	1	2
Small Mammals							
Little brown myotis	*Myotis lucifugus*	G5	S5	Yellow	E		5
Northern myotis	*Myotis septentrionalis*	G4	S2S3	Blue	E		2
Long-eared myotis	*Myotis evotis*	G5	S4S5	Yellow			2
Eastern red bat	*Lasiurus borealis*	G5	S1	Red			
Silver-haired bat	*Lasionycteris noctivagans*	G5	S4S5	Yellow			2
Hoary bat	*Lasiurus cinereus*	G5	S4	Yellow			2
Landbirds							
Barn swallow	*Hirundo rustica*	G5	S3S4B	Blue	T		2
Bay-breasted warbler	*Setophaga castanea*	G5	S2B	Red			2
Black-throated green warbler	*Setophaga virens*	G5	S3B	Blue			1
Canada warbler	*Cardellina canadensis*	G5	S3S4B	Blue	T	1	2
Cape May warbler	*Setophaga tigrina*	G5	S2B	Red			2
Connecticut warbler	*Oporornis agilis*	G4	S2B	Red			2
Olive-sided flycatcher	*Contopus cooperi*	G4	S3S4B	Blue	T	1	2
Rusty blackbird	*Euphagus carolinus*	G4	S3S4B	Blue	SC	1	2

(continued)

Table 2.4-1. Species of Conservation Concern Likely to Occur Within the Local Study Area (completed)

Common Name	Scientific Name	Global Rank	Provincial Rank	BC List	COSEWIC	SARA	BC Conservation Framework Priority (Goal #)
Waterbirds							
Clark's grebe	*Aechmophorus clarkii*	G5	S1B	Red			2
Horned grebe	*Podiceps auritus*	G5	S4B	Yellow	SC		
Western grebe	*Aechmophorus occidentalis*	G5	S1B,S2N	Red	C		1
Harlequin duck	*Histrionicus histrionicus*	G4	S4B,S3N	Yellow			1
Surf scoter	*Melanitta perspicillata*	G5	S3B,S4N	Blue			
Red-necked phalarope	*Phalaropus lobatus*	G4G5	S3S4B	Blue	C		2
Raptors							
Northern goshawk, *laingi* ssp	*Accipiter gentilis laingi*	G5T2	S2B	Red	T	1	1
Peregrine Falcon, *anatum* ssp.	*Falco peregrinus anatum*	G4T4	S2B	Red	SC	1	2
Amphibians							
Columbia spotted frog	*Rana luteinventris*	G4	S4	Yellow	NAR		2
Western toad	*Anaxyrus boreas*	G4	S3S4	Blue	SC	1	2

C = Confirmed presence; L=Likely to occur

3. Mammal Community

Rescan™
Engineers and Scientists

3. Mammal Community

3.1 OVERVIEW

Baseline studies on mammals were conducted between 2010 and 2013 and included desk-based and field research. This inventory focused on mammal species of conservation concern or of social, economic, or biological importance, and expected to occur in the RSA. Specifically, baseline studies focused on ungulates and bats. Studies were designed to collect baseline information on species presence and distribution. The following sections summarize the aerial and ground-based surveys conducted in 2010. Snow track surveys for ungulates and furbearers were also conducted during winter 2013 (full report in Appendix 3.2-5).

Both small and large terrestrial mammals occur within the RSA. 'Furbearers' refer to mammals that are harvested for their pelts. Furbearers are important socially and economically to hunters and trappers, especially to those of First Nations communities. Fur remains an important natural resource, contributing to the economy of local communities and government revenue through royalty payments. Small mammals are also a major food source for many predatory birds and some mammals, such as grizzly bears (Cross 1988).

Grizzly bears are a provincial and federal species of conservation concern. The grizzly bear is currently blue-listed in the province (BC CDC 2010) and is designated an Identified Wildlife Species under the Identified Wildlife Management Strategy (IWMS) (BC MWLAP 2004), as well as being assessed as a species of Special Concern under COSEWIC (COSEWIC 2002).

3.2 UNGULATES

3.2.1 Introduction

Harvesting of ungulate species in BC provides an important social and economic resource to First Nations, and to resident and non-resident recreational hunters. Maintaining large areas of high value habitat and the functional integrity of winter range are key management objectives to maintain healthy, viable populations of ungulates in BC. Minimizing disturbance to ungulates is also important, especially during sensitive periods of the life cycle, such as during calving and the early post-calving periods.

Northeastern BC is home to a number of ungulate species, including moose (*Alces americanus*), Rocky Mountain elk (*Cervus canadensis nelsoni*), white-tailed deer (*Odocoileus virginianus*), mule deer (*O. hemionus hemionus*), mountain goat (*Oreamnos americanus*), thinhorn sheep (*Ovis dalli*), Rocky Mountain big-horned sheep (*Ovis canadensis*), and caribou (*Rangifer tarandus*). In the 1990's, wood bison (*Bison* bison athabascae) were reintroduced to northeastern BC. Within the Murray River RSA, the species with the highest probabilities of occurring year round are moose, Rocky Mountain elk, white-tailed and mule deer, mountain goat, and caribou.

Baseline information on ungulates in the RSA were collected during aerial surveys in 2010, from winter snow track surveys in 2013 (for details see Appendix 3.2-5), and from incidental observations of ungulates made during all baseline wildlife studies. Methods and results these surveys and incidental observations are presented and discussed in the following sections.

3.2.1.1 Caribou

Three different ecotypes of caribou occur within BC: boreal, northern mountain, and southern mountain. These ecotypes are split on the basis of distinct patterns of habitat use and diet/feeding behaviour (BC MWLAP 2004d). Of these three ecotypes, both northern mountain ("northern") and southern mountain ("mountain") caribou may occur in the Murray River RSA (BC MWLAP 2004d; GeoBC 2011). Both ecotypes of caribou are on Schedule 1 of the *Species at Risk Act* (2002b) and are listed as threatened (mountain) or special concern (northern). Additionally, northern caribou are on the BC Blue List and mountain caribou are on the BC Red List. Caribou are also an Identified Wildlife Species under the BC Identified Wildlife Management Strategy (BC MWLAP 2004d).

Caribou in BC are distributed within several subpopulations, referred to as herds. The estimated population of northern caribou in BC is approximately 16,235 individuals divided amongst 26 herds and mountain caribou number approximately 1,905 individuals within 13 distinct herds (BC MWLAP 2004d). The Quinette herd of northern caribou is the closest subpopulation to the Murray River Project and can be found within the RSA year round. Five other herds occur in surrounding areas, including the Kennedy Siding, Burnt Pine, and Moberly northern caribou herds to the northwest, the Redwillow-Narraway northern caribou herd to the southeast, and the Hart Ranges mountain caribou herd to the southwest (COSEWIC 2002b; BC MWLAP 2004d; GeoBC 2011). In 2002, the Quintette herd size was estimated at 154 individuals (D. R. Seip 2002) and by 2004 this herd had increased to approximately 200 individuals and was considered stable (BC MWLAP 2004); however, recent surveys suggest the current herd size has decreased to approximately 114 – 129 animals and the population is considered to be declining (Seip and Jones 2013). In the province, the status of the Quintette herd is Vulnerable (BC MWLAP 2004d).

Caribou are terrestrial and arboreal lichen specialists, subsisting mainly on several lichen species during the winters (BC MWLAP 2004d). During the summer, a wider range of forage is exploited, including forbs, graminoids, lichens, fungi, and leafy browse (BC MWLAP 2004d). Many caribou herds are characterized by shifts in elevation between and within summer and winter ranges. Low elevation forested habitat and high elevation alpine habitat is used by northern and mountain caribou during both winter and summer; however, mountain caribou tend to exploit higher elevation habitat more consistently than northern caribou (BC MWLAP 2004d). The use of winter range by caribou varies between years, as it is influenced heavily by snow pack (COSEWIC 2002b). VHF (very high frequency) and GPS collared caribou from the Quintette herd appear to select alpine and parkland habitats throughout the year, such as those on Quintette Mountain and Mount Speiker (Jones 2008). A relatively limited use of lower elevation conifer forests by collared caribou was detected, with only a few females calving below the treeline and a few individuals that descended into fir and spruce stands during the winter (Jones 2008).

3.2.1.2 Moose

Moose commonly occur throughout the forested areas of BC. In 2000, the provincial population estimate for moose was approximately 170,000 animals, over 70% of which occurred in northern BC (Blood 2000b). Moose population counts were conducted in 1998 and 2006 within Peace Region wildlife management unit (WMU) 7-21, a 6,731 km2 block of land which encompasses the Tumbler Ridge area. In 1998, a population of approximately 1,619 moose ± 19.30% at 90% confidence was recorded (Rowe 2008). In 2006, the population was considered to be either unchanged or slightly higher than the 1998 estimate, totaling approximately 2,044 animals ± 19.29% at 90% confidence (Rowe 2008). To ensure a sustainable sex ratio for healthy, reproductively stable populations, provincial moose management objectives suggest that a bull/cow ratio of 30 bulls per 100 cows be maintained (Hatter 1998 in BC MOE 2008). A recent population count for WMU 7-21 (2006) suggests that the population is well within this objective at 51 bulls/100 cows ± 19% at 90% confidence (Rowe 2008).

Moose are browsers, foraging on stems and twigs of woody plants in winter, and the leaves of succulent shoots of shrubs and trees during the rest of the year (Bowyer, Ballenberghe, and Kie 2003). In the Peace Region, moose are common in areas that provide these types of forage, including riparian and alluvial habitats, burns, cut blocks, and wetland complexes (Woods 2003). These habitats are particularly important during the winter in the Peace Region (Woods 2003). Moose in the mountainous areas of the Peace Region appear to migrate seasonally along an elevational gradient, the timing of which depends on weather, such as snowfall. Movement patterns of moose, such as the selection of seasonal home ranges and migration routes, may be learned as young individuals follow their mothers (Sweanor and Sandegren 1989). As a result, migratory movements tend to follow traditional routes; however, migration patterns can be highly variable from year to year, depending on the extent and duration of snowfall (Bowyer, Ballenberghe, and Kie 2003).

3.2.1.3 Rocky Mountain Elk

Rocky Mountain elk are one of the two subspecies of elk found in the province, the other being the Roosevelt Elk (*C. c. roosevelti*) of Vancouver Island and the Sunshine Coast (Blood 2000a). Rocky Mountain elk are distributed within mountainous areas along the Rocky Mountains and associated ranges. The provincial population of Rocky Mountain elk was approximately 40,000 in 1997, with around 18,000 of these occurring in northern BC (Shackleton 1999; Blood 2000a). Within the Peace Region, the population of elk was estimated at 890 individuals in the late 1980's (Harper 1988). A late-winter reconnaissance-level inventory of several known ungulate wintering areas in the Peace and Fort Nelson Forest Districts (FD) in 2004 recorded a substantially higher number of elk (4,703 individuals; BC MWLAP 2004e). At least 240 elk were counted along the Pine and Murray river systems during the winter of 2004 (BC MWLAP 2004e).

Rocky Mountain elk are generalist grazers, subsisting mainly on graminoid plants (e.g., fescues and sedges) throughout the year. Woody browse may also be important during the late summer and fall (Geowest 2000). Because of their broad forage preferences, Rocky Mountain elk can be found in a variety of habitat types including coniferous, mixed wood, and deciduous forests; wetlands; and subalpine avalanche chutes and rock outcrops (Geowest 2000). In the Peace Region, shrub-grassland habitat of south and west-facing river escarpments has been identified as important wintering range for Rocky Mountain elk (Harper 1988). Burned areas (either naturally or prescribed) also appear to be important habitat because of the early seral stage vegetation communities that establish after the burn (Woods 2003). Rocky Mountain elk are migratory, moving between lower elevation grasslands occupied during the winter, to higher elevation forested habitats and subalpine basins and avalanche chutes in the spring and summer. The timing of migration, much like moose, appears to be linked to environmental conditions (i.e., snowfall; Morgantini and Russell 1983). Migration routes likely follow the bottoms of major river corridors (Morgantini and Russell 1983).

3.2.1.4 White-tailed Deer

White-tailed deer are a ubiquitous deer species across North America; however, within the province, this species is at the northern edge of its range. With a provincial population of approximately 65,000 individuals, white-tailed deer are most numerous in the southern portions of BC (Blood 2000e). In the Peace Region, most white-tailed deer occur along the Peace River and associated tributaries (Blood 2000e). During a winter inventory of known ungulate wintering areas in 2004 within the Peace and Fort Nelson FDs, 12 individuals were observed along the Peace River and in the Hudson's Hope area (BC MWLAP 2004e).

White-tailed deer are generalist browsers, consuming a wide range of grasses, forbs and shrubs throughout the year (D. A. Demarchi 1986; Ehlers, Bennett, and Corbett 1998). White-tailed deer are highly dependent on security and thermal cover, such as that provided by conifer, mixed wood, and

deciduous forests, and feeding and cover areas must be in close proximity (V. Stevens and Lofts 1988; Woods 2003). There is paucity of information on the year round habitat selection and movement patterns for white-tailed deer in the Peace Region. Mixed wood forests appear to offer the best availability of forage and cover for white-tailed deer during the winter (Woods 2003).

3.2.1.5 Mule Deer

Mule deer is the nominate subspecies of *O. hemionus* in the province; the other two subspecies (Columbia and Sitka Black-tailed deer) are restricted to the coastal areas of the province, including Vancouver Island and Haida Gwaii. Approximately 165,000 mule deer occur in BC, with between 20,000 to 25,000 inhabiting the northern regions (Blood 2000d). Like white-tailed deer, mule deer in the Peace Region are most abundant along the Peace River and associated tributaries. A total of 643 mule deer were recorded during a late-winter inventory in the Peace and Fort Nelson Forest Districts, all of which were recorded along the Peace and Pine Rivers and in the in the Hudson's Hope area (BC MWLAP 2004e).

Mule deer are similar to white-tailed deer in forage and habitat selection; however, they appear to be less dependent on cover throughout the year (Woods 2003). Typical food items are shrubby browse with succulent vegetation such as graminoids playing a larger part in their diet during the spring and summer (Ehlers, Bennett, and Corbett 1998; Blood 2000d). In the Peace Region, steep south facing habitats have been identified as important wintering range for mule deer; a variety of open south aspect areas ranging from open, shrubby slopes to mixed wood and deciduous forests are used (Goulet and Haddow 1985; Hatler 1990). Like many of the other ungulates of BC, mule deer migrate between winter and summer ranges (Wallmo and Regelin 1981). Seasonal ranges are often separated by elevation, with winter habitats occurring at lower elevations and deer dispersing to upland habitats in the spring and summer (Wallmo and Regelin 1981).

3.2.1.6 Mountain Goat

Mountain goats are widely distributed throughout the province and can be found in most major mountain ranges except those on coastal islands (e.g., Vancouver Island and Haida Gwaii; Blood 2000c). While suitable habitat for mountain goats is found throughout the province, mountain goats are most numerous in northern BC, as well as the southern Rocky Mountain and Coast Mountain ranges (Blood 2000c; M. W. Demarchi, Johnson, and Searing 2000). The total number of mountain goats in BC was estimated at between 39,000 to 65,500 individuals in 2008, approximately 7% (2,000 to 4,000) of which occur within the Peace Region (Mountain Goat Management Team 2010). Isolated small herds of goats are known to occupy several mountains within and in the vicinity of the Murray River Project, including Mount Speiker, Mount Reesor, Bullmoose Mountain, Babcock Mountain, and Quintette Mountain (BC Research 1979; Antoniuk 1994; BC MWLAP 2004e).

The mountain goat is a generalist herbivore, grazing and browsing on alpine and sub-alpine grasses, sedges, rushes and forbs in summer, and on a variety of shrubs, conifers, mosses, and lichens in winter (BC MOF 1997). The critical element of mountain goat habitat is escape terrain, which consists of rocky bluffs and cliffs that provide goats with good visibility and are generally inaccessible to predators (Shackleton 1999). Goats are seldom found further than 500 m from escape terrain throughout the year (Fox 1983; Gross et al. 2002; RTEC 2006b). Winter is an important season for mountain goats as there is limited availability of habitats that provide a combination of escape terrain, suitable forage, and cover during this critical period.

3.2.2 Objectives

The objectives of this study were to:

- document the occurrence of all ungulate species expected to be present in the RSA and LSA;
- determine the distribution and relative abundance of mountain goat and northern caribou during summer;
- determine herd composition (e.g. cow-calf ratios) of mountain goat and caribou during summer; and,
- identify characteristics of occupied habitat for all ungulate species observed.

3.2.3 Methods

3.2.3.1 Aerial Surveys

In this report, mountain goat and northern caribou are collectively referred to as mountain ungulates. Mountainous terrain within the RSA was divided into 12 distinct survey units (SUs) prior to aerial surveys, covering approximately 1,722 km^2 of the RSA (Figure 3.2-1). Survey units encompassed suitable habitat that could be used by mountain ungulates. SU's were delineated using topographic features that could limit the movement of animals between units. For example, low elevation valleys are unfavourable habitat for mountain goats, as goats are more vulnerable to predation in the absence of escape terrain. Delineating survey units in this way avoids double counting individuals, because it is unlikely that individuals would move between adjacent survey units during the survey; therefore, it is likely that survey units were statistically independent, ensuring higher accuracy and precision of population estimates for mountain goats and caribou within the RSA.

The methods used to inventory mountain ungulates adhered to the aerial survey protocol established by the Resource Information Standards Committee of BC (RIC 2002). This included the use of a helicopter with two observers, a pilot, and a navigator. The helicopter maintained an average speed of approximately 100 km/hour. Helicopter speed changed with mountain ungulate sightability - faster over open areas where sightability was good and slower over areas where visibility was obscured by vegetation cover. Survey effort was predominately directed in areas above the treeline because these mountain ungulates are unlikely to use low elevation forested habitats to any great extent. Flight lines followed topographic contours or identifiable features, and were spaced at approximately 200 m intervals. Flight paths were recorded using a hand-held Garmin GPS 76 unit with an external antenna.

For each animal observation, a GPS waypoint was recorded and animals were classified by age and sex (i.e., goats were classified as adults or kids, caribou were classified as bull, cow, or calf) (RIC 2002). Animals that could not be classified by age with confidence were recorded as unidentified. For each mountain ungulate observation, the vegetation cover and habitat suitability rating (HSR) were recorded, based on topographic and vegetative features used for habitat suitability modelling. A HSR of one represented the most suitable habitat relative to provincial benchmarks, while a HSR of six represented habitat devoid of important habitat features.

During the aerial survey, sightings of other ungulates were noted and a location was recorded wherever possible. Observations of ungulates during other wildlife baseline studies in 2010 were also recorded as incidental observations.

3.2.3.2 Data Analysis

The total number of goats and caribou observed during aerial surveys was summed, and average group size (i.e., total count of animals seen at each observation) was calculated. The number of young (i.e., kids/calves) per 100 adults (goats) or 100 cows (caribou) was also calculated. Survey estimates were not adjusted for sightability, as no suitable model exists for estimating sightability for mountain ungulates during aerial surveys in BC (RIC 2002; Ayotte 2005).

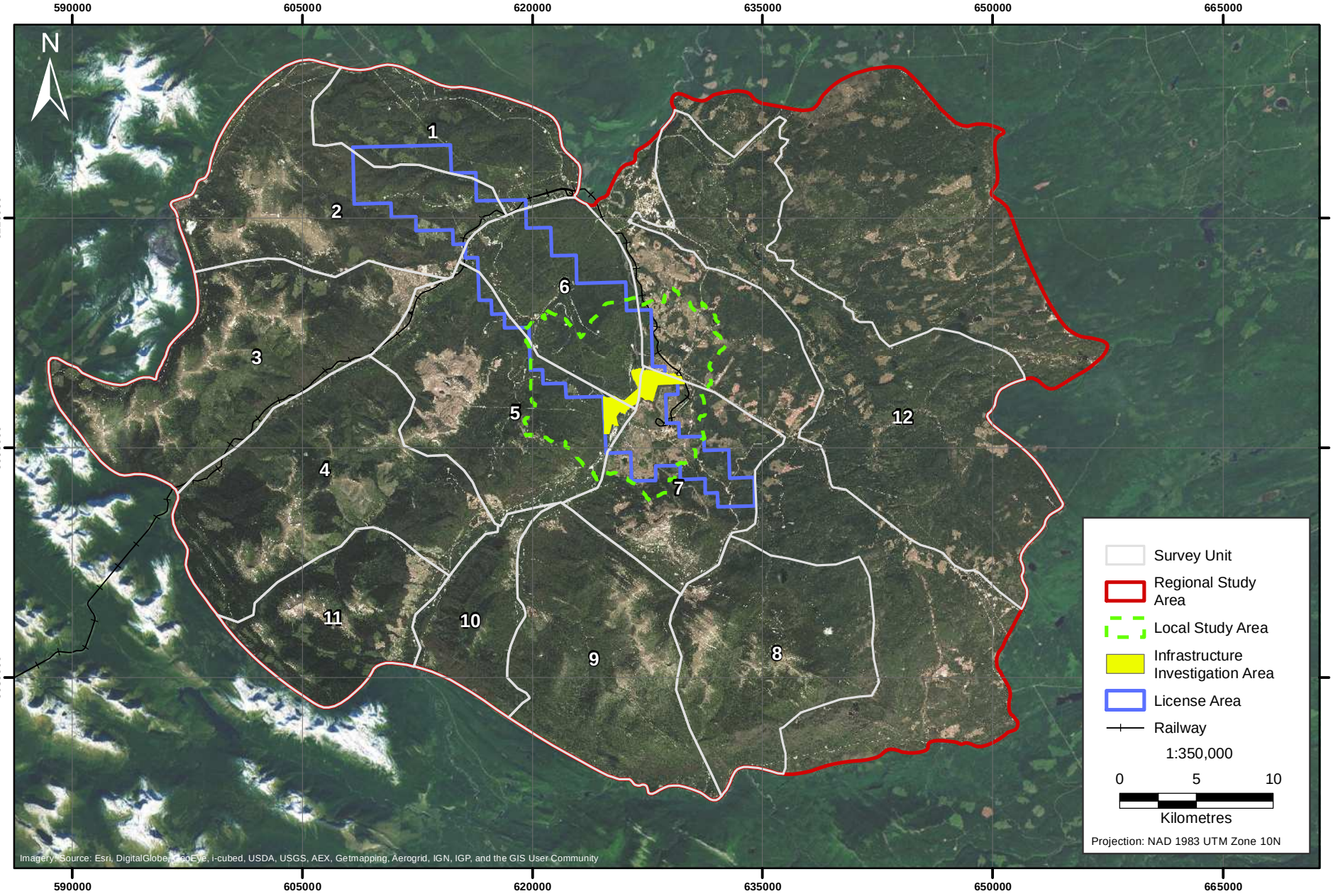


Figure 3.2-1

hd Mining

MURRAY RIVER COAL PROJECT

Mountain Goat and Caribou Survey Units, Summer 2010

Figure 3.2-1

Rescan™ Engineers & Scientists

Elevation, slope, and aspect were assessed at each group observation. The topographical features at each observation were derived from a Digital Elevation Model (DEM) with 1:20,000 Terrain Resource Inventory Mapping (TRIM) data. The observed aspect or aspect bearing was adjusted to make aspect a linear variable (i.e., observed aspect minus 180°). The result gives aspect values ranging from 0 to 180. Values near 90 are considered neutral (i.e., east or west), while those less than 90 indicate a warmer south aspect and greater than 90 indicate cooler northerly aspects.

3.2.4 Results

3.2.4.1 Aerial Surveys Observations

Summer aerial surveys for mountain ungulates were conducted on July 19 and 20, 2010 using 6.8 hours of flight time. All but one SU was surveyed from the air; SU 6 lacked suitable escape terrain and was surveyed from the ground on July 20 (Appendix 3.2-1). Maps of survey flight lines are presented in Appendix 3.2-2.

Mountain Goats

A total of 138 goats were observed in 22 groups within seven SUs (Figure 3.2-2; Table 3.2-1; Appendix 3.2-3). Adults accounted for 83% of all goats observed; the overall ratio of kids to adults was 21 kids per 100 adults. The group size of mountain goats ranged from 1 to 46 individuals, averaging 6.3 ± 2.1 individuals (± Standard Error). Most observations (65%) consisted of more than one individual. The majority of goats were observed in SU 5 (32%) and SU 7 (33%). These two SUs are associated with previous mining projects, including the Quintette Mine (SU 7) and Wolverine Mine (SU 5) (Plate 3.2-1). No goats were recorded within the LSA (Figure 3.2-2).

Table 3.2-1. Summary of Mountain Goat and Northern Caribou Observations during Aerial Surveys, 2010

	No. Goats			Kid-to-Adult	No. Caribou			
Survey Unit	Total	Adults	Kids	Ratio	Total	Cows	Bulls	Calves
1	0	0	0	-	0	0	0	0
2	13	12	1	0.08	0	0	0	0
3	4	4	0	-	1	0	1	0
4	1	1	0	-	1	0	1	0
5	44	34	10	0.29	0	0	0	0
6*								
7	46	38	8	0.21	0	0	0	0
8	0	0	0	-	1	0	1	0
9	7	6	1	0.17	0	0	0	0
10	0	0	0	-	0	0	0	0
11	23	19	4	0.21	2	1	1	0
12	0	0	0	-	0	0	0	0
Total	138	114	24	0.21	5	1	4	0

** Survey unit visually inspected from the ground on July 20, no animals were detected.*

The average elevation of goat groups was 1,691 ± 37 m (90% ranged between 1,497 and 1,890 m; Appendix 3.2-3). The majority of observations (90%) were generally on slopes between 14° and 44° (mean 28° ± 3°; Appendix 3.2-3). Goats were observed on a range of aspects. Nine groups were observed on warmer, south facing slopes, nine groups were detected on cooler, northerly slopes, and four groups were observed on slopes with a neutral thermal advantage (e.g., east or west facing slopes; Appendix 3.2-3).

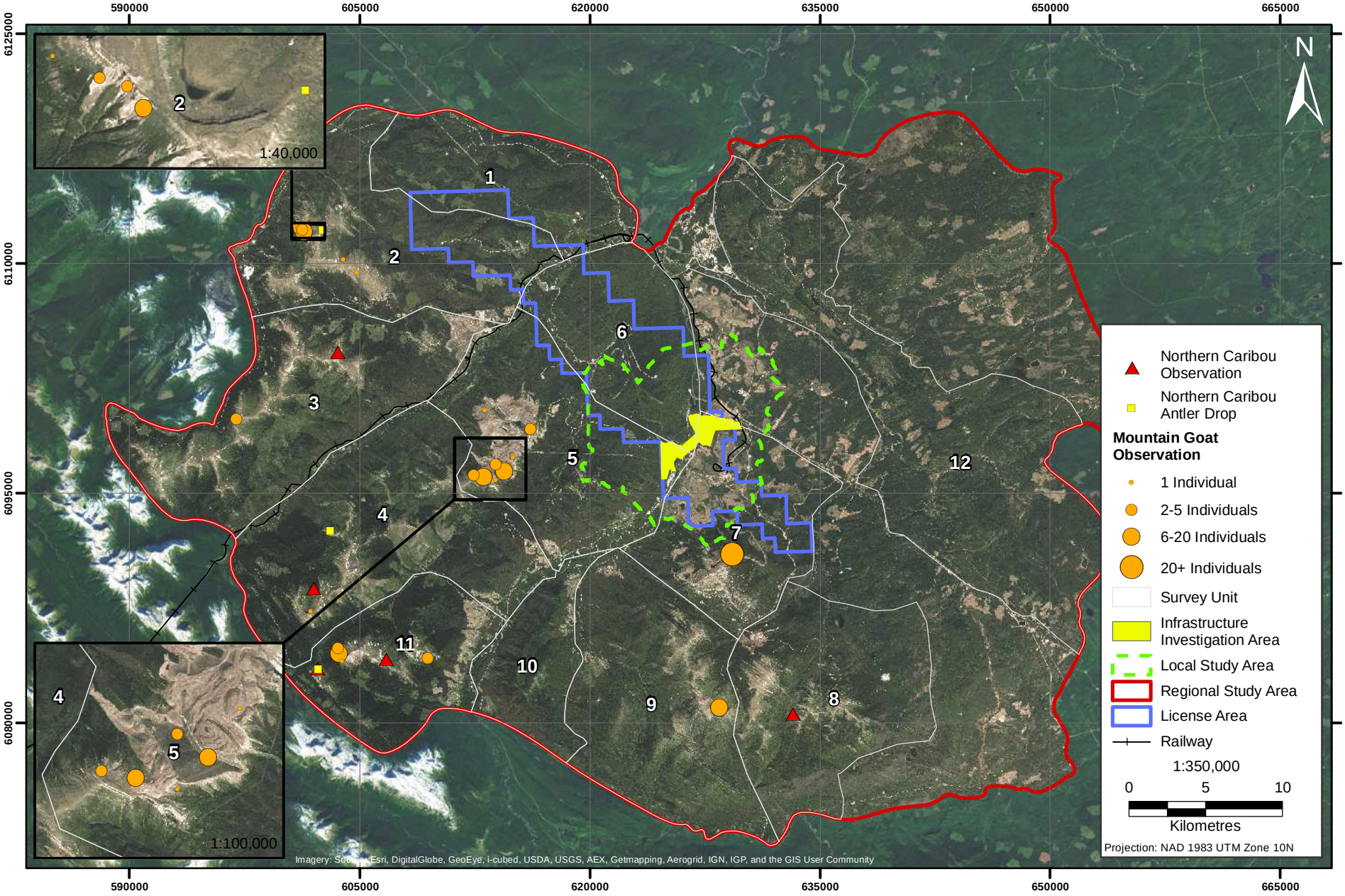


Figure 3.2-2

hdMining

MURRAY RIVER COAL PROJECT

Mountain Goat and Northern Caribou Aerial Survey Observations, 2010

Figure 3.2-2

Rescan™ Engineers & Scientists

Plate 3.2-1. Mountain goats observed near the Wolverine Mine (SU 5; left) and Quintette Mine (SU 7; right).

Caribou

A total of five individual caribou were observed within four SUs during aerial surveys, four males and one female (Figure 3.2-2; Table 3.2-1; Plate 3.2-2). Calves were not observed (Table 3.2-1). In addition, there were observations of shed caribou antlers in alpine areas within SUs 2, 4, and 11 (Figure 3.2-2; Appendix 3.2-3). The small sample size precluded a spatial analysis of caribou observations. No caribou were recorded within the LSA (Figure 3.2-2).

Plate 3.2-2. Northern caribou bull observed in SU 11.

3.2.4.2 Results of Winter Track Survey

To augment aerial surveys conducted during summer, data on the presence of ungulates within the LSA during winter were collected using snow track surveys between March 19 and 24, 2013 (Appendix 3.2-5). Wildlife tracks were surveyed along ten transects totaling 19.7 km. Based on deer preference for low elevation and warmer sites during winter, the LSA was stratified into two zones (above and below 1,000 m), and three aspect ratios corresponding to their temperature gradients – cold, neutral, and warm. The majority of the LSA consists of neutral aspect sites - 40% low elevation and 20% higher elevation. Lower elevation, warm sites cover 20% of the LSA. Approximately one third of the sampling effort was spent along higher elevation transects (5.9 of 19.7 km).

Deer tracks were only observed at lower elevation sites (< 1,000 m), and the majority of these (92%) were observed on warmer aspects. Tracks of elk, mountain goat, and caribou were not detected. Moose tracks were observed across all aspect categories at lower elevation sites, and at neutral sites above 1,000 m. Moose tracks were not observed in coniferous forest.

3.2.4.3 Incidental Observations

All of the other four ungulate species that are expected to occur in the Murray River RSA were observed incidentally during wildlife baseline studies in 2010 (Figure 3.2-3; Table 3.2-2; Appendix 3.2-4). Most incidental observations were recorded in July.

Table 3.2-2. Incidental Observations of Ungulates, 2010

Species	No. Observed			Total
	May	June	July	
Deer Spp.	0	0	4	4
Rocky Mountain Elk	0	6	8	14
Moose	3	1	6	10
Mule Deer	2	0	1	3
White-tailed Deer	5	1	2	8

Moose and Rocky Mountain elk were the most frequently detected species in 2010. Moose were observed on six separate observations totalling 10 individuals. A dropped moose antler was also recorded in May (Figure 3.2-3). In July, two moose were observed with young; one cow with a calf and another with twins (Figure 3.2-3; Appendix 3.2-4). Elk were observed on five separate observations totalling 14 individuals, including two groups of five or more individuals (Figure 3.2-3; Table 3.2-2; Appendix 3.2-4). Of the deer species, more white-tailed deer were recorded than mule deer, and four deer could not be identified to species (Table 3.2-2). Most incidental observations were recorded outside of the LSA; only one Rocky Mountain elk, two mule deer, and one white-tailed deer were recorded within the LSA.

Ungulate sign was also recorded during 2010, including winter browse activity, pellets belonging to multiple species, and a mineral lick/wallow (Figure 3.2-3; Appendix 3.2-4). Heavy browse on riparian vegetation was observed along Murray River near the Murray River Bridge, as well as winter pellets belonging to moose and deer, and possibly Rocky Mountain elk and northern caribou (Appendix 3.2-4). The mineral lick/wallow was also recorded along Murray River just downstream of the Murray River Bridge, and had evidence of recent use (Figure 3.2-3; Appendix 3.2-4). Winter browse and pellets belonging to moose were also recorded downstream along Murray River and along the Wolverine River (Figure 3.2-3).

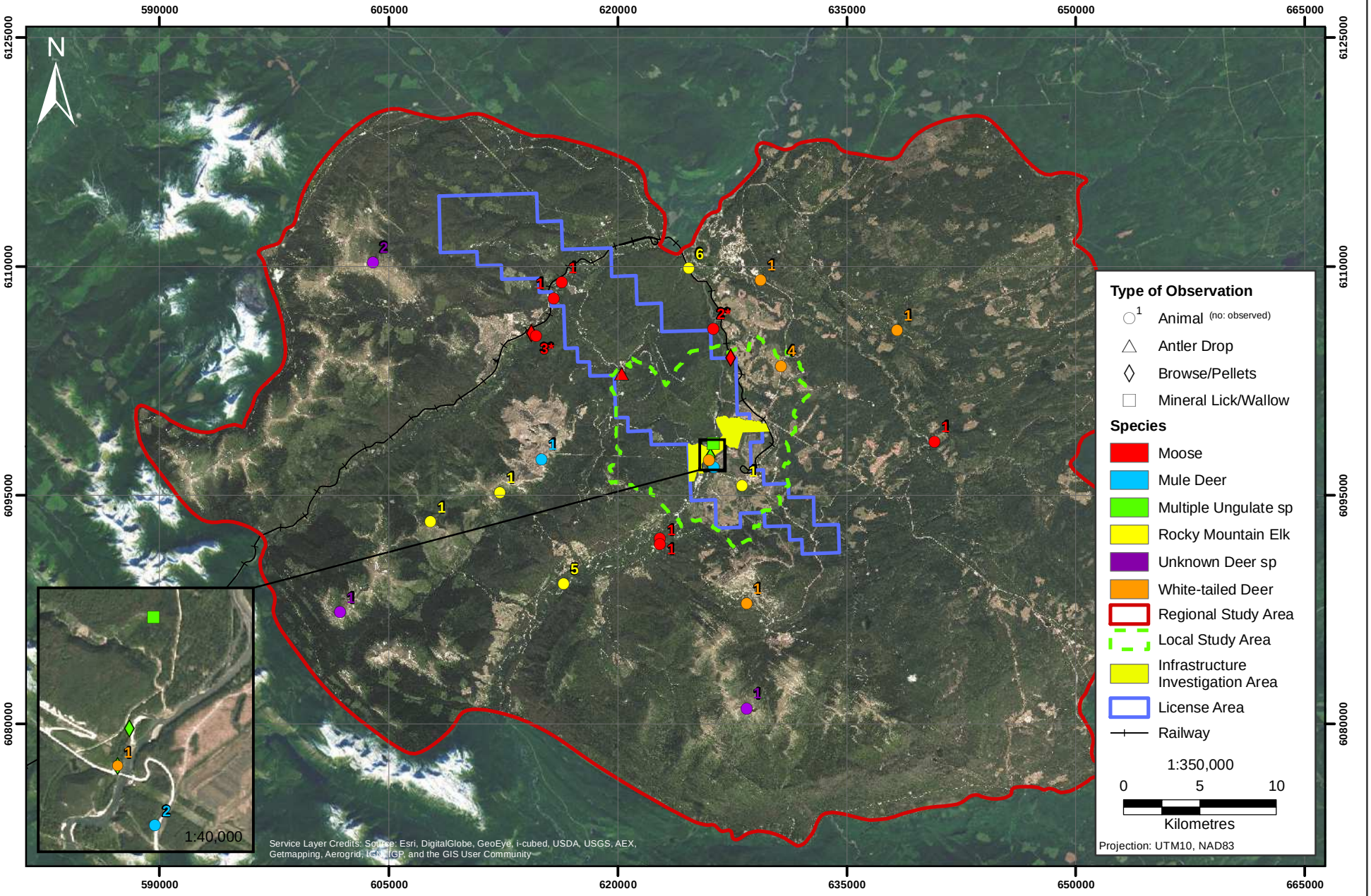


Figure 3.2-3

hd Mining

MURRAY RIVER COAL PROJECT

Incidental Observations of Ungulates, 2010

Figure 3.2-3

Rescan Engineers & Scientists

3.2.5 Discussion

All ungulate species expected to occur within the RSA were observed during baseline surveys for ungulates in the summer of 2010: moose, mountain goat, mule deer, northern caribou, Rocky Mountain elk, and white-tailed deer. A total of 138 mountain goat and 5 caribou were recorded during aerial surveys, all of which were observed outside of the LSA. A total of 14 Rocky Mountain elk, 10 moose, 8 white-tailed deer, 3 mule deer, and 4 unknown deer were observed incidentally in 2010. Most of these observations were also recorded outside of the LSA. In addition, a mineral lick/wallow, an important habitat feature for ungulates, was detected just north of the potential Infrastructure Investigation Area on the west side of Murray River.

A large number of mountain goats (90 individuals; 65% of total) were observed within the Wolverine and Quintette mine reclamation areas. It has been well documented that mountain goats are seldom found further than 500 m from escape terrain year round (Fox 1983; Gross et al. 2002; RTEC 2006b). Limited natural escape terrain (e.g., rocky, barren outcrops of 40° to 70° slope) is available within these areas; however, there are areas within reclaimed mines where the topography approximates escape terrain. Natural escape terrain is also located above the Quintette Mine reclamation area on Mount Babcock and to the west of the Wolverine Mine reclamation area.

The mountain goat observations made during the summer surveys are consistent with general selection patterns by goats. Goats were primarily observed on elevations between 1,497 and 1,890 m. During the growing season (spring through fall), goats move from lower elevations occupied during the winter to higher elevations, tracking snowmelt and emerging vegetation (Mountain Goat Management Team 2010). As a consequence of habitat preference for suitable escape terrain, goats are rarely found on slopes of less than 25° throughout the year (Fox 1978; Schoen and Kirchoff 1982). The results of the summer survey suggest that goats may be utilizing gentler slopes than expected, as they were observed on slopes from 14° to 44°.

Goats may select a wide range of aspects during the summer. Snow will melt sooner on warmer southern aspects and vegetation phenology progresses quicker than on northern faces; however, cooler northern faces may provide animals with a refuge from heat and flying insects during summer. This pattern was generally observed during this study, with an equal amount of goat groups detected on cooler or warmer aspects, with few groups on neutral aspects (directly east or west).

The paucity of northern caribou observations recorded during the summer aerial survey precluded any detailed analysis of topographic features; however, information on habitat selection can be drawn from behaviour of collared individuals from the Quintette herd (Jones 2008). During the summer, Quintette caribou were predominately located in fir forests, parkland areas, and the alpine. Habitat use was generally limited to areas above 1,300 m. The Quintette caribou were located on a variety of slopes, ranging from nearly flat to 40°and appeared to prefer west and east facing slopes (Jones 2008). During a recent population census conducted in March 2013, the largest numbers of Quintette caribou were located on Mt. Babcock and on Mt. Spieker (D. Seip and Jones 2013); however, the survey concluded an overall population decline of about 30%, mainly from these two areas (D. Seip, pers. comm.). The Quintette herd was the only herd of the southern mountain population that was thought to be stable, but now appears to be declining.

Results of winter snow track surveys in 2013 support current knowledge that deer prefer lower elevations with warmer south-facing aspects. A high degree of selection by deer for warmer sites is indicated by high track counts (92% of all deer tracks) in lower elevation, south-facing aspects, though these sites covered only 20% of the LSA. Moose tracks were observed at sites over a wider temperature gradient, and at higher elevations, which reflects the ability of moose to move through and forage in deeper snow.

Mineral licks or wallows are an important habitat feature for ungulates (Klaus and Schmid 1998; Rea, Hodder, and Child 2004; Ayotte, Parker, and Gillingham 2008). Ungulates use these features for mineral supplementation mainly during the summer (Rea, Hodder, and Child 2004; Ayotte, Parker, and Gillingham 2008), but may also use them in early spring or during the winter (e.g., moose and elk; Couturier and Barrette 1988; Ayotte, Parker, and Gillingham 2008). Mineral licks or wallows used by moose, elk, and deer are generally found at lower elevations and tend to be wet mineral upwellings, whereas lick locations utilized by mountain goats are found at higher elevations and tend to be dry, exposed soils containing sodium and other minerals. Caribou may make use of low or high elevation licks; however, they may not need to compensate for mineral deficiencies as much as other ungulate species (Woods 2004). A significant mineral lick or wallow may be designated as a Wildlife Habitat Feature (WHF) and managed under the BC Forest and Range Practices Act (2004a).

In addition to important ungulate habitat features, the BC Ministry of Environment (MOE) has mapped ungulate winter range (UWR) throughout the province, defined as areas that are necessary for the winter survival of ungulate species. UWR and associated objectives are mandated under the authority of Sections 9(2) and 12(1) of the *Government Actions Regulation* (BC Reg. 582/ 2004b) and *Forest and Range Practices Act* (Section 149.1; 2004a). The Murray River RSA overlaps one approved ungulate winter range: UWR u-9-002 (MOE 2006). UWR u-9-002 covers 535,151 ha of area, of which 85,374 ha overlaps with the RSA. Two types of winter range are identified within this UWR: high elevation winter range for mountain goats and northern mountain caribou (38,022 ha), and low elevation winter range for northern mountain caribou (47,352 ha). In addition, another winter range for moose, Rocky Mountain elk, and mule deer is located just outside of the RSA to the north (UWR u-9-001; MOE 2006). UWR u-9-001 identifies several winter range polygons within low elevation floodplain forest. Two of these polygons, totalling 706 ha, are located along Murray River.

The BC MOE also identifies Wildlife Habitat Areas (WHAs), defined as areas that are necessary to meet the habitat requirements of Identified Wildlife Species. Identified Wildlife include species that are at risk and regionally important wildlife that the Minister of Environment designates as requiring special management attention under the Forest and Range Practices legislation (MWLAP 2004). WHAs are mapped to conserve those habitats considered most limiting to a given Identified Wildlife. The Murray River RSA overlaps an approved WHA for the Quintette caribou herd, part of the southern population of northern mountain caribou. This WHA identifies approximately 58,059 ha of calving and rutting grounds for the Quintette herd, of which 48,632 ha overlaps with the RSA.

3.3 WINTER TRACK SURVEYS FOR FURBEARERS

In British Columbia furbearers are legally designated species that have traditionally been hunted or trapped for their fur. To provide baseline information on the presence and distribution of furbearers in the LSA, winter snow track surveys were conducted between March 19 and 24, 2013 (Appendix 3.2-5). Wildlife tracks were counted along ten transects totaling 19.7 km. Survey effort for furbearers focused on American marten, which is sensitive to human disturbances but is usually abundant enough to derive adequate sample sizes for inferences about habitat associations. Based on American marten habitat selection identified elsewhere (Lofroth 1993), the LSA was stratified into mature and young coniferous, mixed wood, and deciduous forests. Less than 5% of the LSA is covered by deciduous forest, 44% is coniferous forest (20% mature, 24% young), 20% is mixed wood forest (12% mature and 8% young), and 31% is not forested.

American marten tracks were most often found in mature and young coniferous forest (1.23 and 0.49 tracks/km/day, respectively), but also in mature mixed wood forest (0.30 tracks/km/day). Tracks were not found in deciduous forest, young mixed wood forest, or in non-forested areas. These results are consistent with other studies that demonstrated habitat selection by American marten for forests

that provide cover in winter, as well as structural features like downed wood that provide subnivean habitat for their small mammal prey (Sherburne and Bissonette 1992).

Two species of furbearers that are expected to occur within the study area are listed as species of conservation concern. The wolverine (*Gulo gulo*) and fisher (*Martes pennanti*) are provincially blue-listed, and the wolverine has been assessed by COSEWIC as a species of 'special concern'. Tracks of these species were not observed during winter track counts in 2013.

3.4 BATS

3.4.1 Introduction

Recent research shows that bats occur over a wider range of ecological conditions than previously documented, such as at northern latitudes and cooler mid to high elevation habitats (Lauson 2006; RTEC 2006a, 2008). Two species of bats that likely occur in the Project area – the little brown myotis (*Myotis lucifugus*) and the Northern myotis (*M. septentrionalis*) - are species of conservation concern due to recent large-scale population decline from white-nose syndrome (COSEWIC 2012). Following emergency assessments, both species were designated as "endangered" by COSEWIC in 2012. Neither species has been listed under SARA to date. The northern myotis is also blue listed at the provincial level (BC CDC 2010a). Determining the presence of these species in the proposed development area is required to meet the obligations of provincial regulations under the BC *Wildlife Act* (1996b).

3.4.2 Objectives

The objective for baseline surveys for bats was to document the presence of bat species in and around the Project area, focusing on the little brown myotis and Northern myotis.

3.4.3 Methods

3.4.3.1 Echolocation Call Survey

A list of bat species that likely occur within the LSA and RSA (Table 3.4.1) was compiled using species range maps, data from other field studies conducted in the region, and inferences from species habitat requirements (Nagorsen and Brigham 1995; BC CDC 2010b, 2010a). Inventory methods adhered to RISC standards (RIC 1998). Bats were surveyed by recording the ultrasonic calls that bats emit for echolocation of their insect prey. This method uses a broad band bat detector (Anabat II, Titley Scientific Ltd), which converts the ultrasonic sounds of bats to sound frequencies that are audible to humans. When characteristics of bat calls, like pitch and intensity, are plotted over time, they show a visual representation of each call, or sonogram. By analyzing sonograms, bats can usually be identified to genus, and sometimes to species. Sample sonograms of species likely to occur in the LSA and RSA were compiled to assist in species identification.

Surveys were conducted at three locations from July 18 to 20, 2010 (Figure 3.4-1) between dusk and dawn, when species are most active (RIC 1998). One night was spent surveying at each location. Location, weather conditions, and survey time were recorded at each survey site, as well as descriptions of habitat type (Appendix 3.3-1). Survey sites were located in areas that provide good foraging habitat for bats; for example, low elevation areas adjacent to riparian or wetland areas where flying insects are easily accessible and abundant. In addition, all sites were next to mature forest that may provide snags suitable for day or night roosts during cooler weather. Survey sites 1 and 2 were located within the LSA. Site 1 was located at the Murray River Bridge and site 2 was located adjacent to existing mine infrastructure. Site 3 was located outside the LSA adjacent to Flatbed Creek.

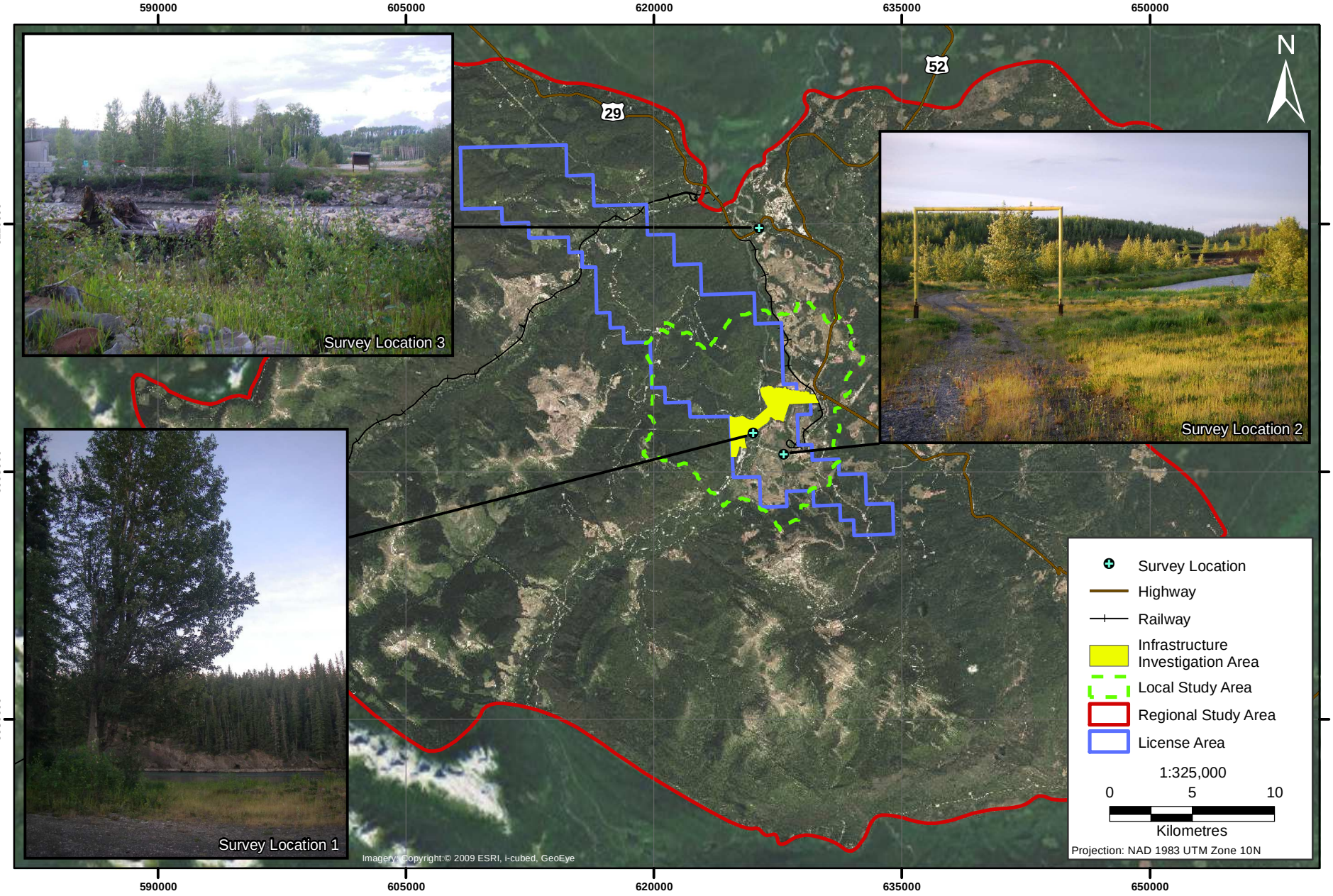


Figure 3.4-1

hd Mining

MURRAY RIVER COAL PROJECT

Bat Survey Locations, 2010

Figure 3.4-1

Rescan™ Engineers & Scientists

Table 3.4-1. Bat Species Likely[1] Occurring within the Study Area

Common Name	Scientific Name	Examples of Call Characteristics[2]		
		High Freq. (kHz)	Low Freq. (kHz)	Maximum Duration (ms)
Long-eared myotis	*M. evotis*	>100-97	54-40	1-3
Northern myotis	*M. septentrionalis*	110-80	38-40	1-3
Little brown myotis	*M. lucifugus*	78->60	38-40	2-5
Silver-haired bat	*Lasionycteris noctivagans*	37-30	25-26	3-6
Long-legged myotis	*M. volans*	89	40	10
Big brown bat	*Eptesicus fuscus*	33	28	10
Eastern red bat	*Lasiurus borealis*	45-50	30-35	6-10
Hoary bat	*L. cinereus*	27-30	25-20	6-10

[1] *Nagorsen and Brigham (1995), RTEC (2006a, 2008), Finavera 2011; Rescan (unpublished data).*
[2] *Fenton and Bell (1981), RIC (1998), O'Farrell, Miller, and Gannon (1999).*

3.4.3.2 Sonogram Analysis

Sonograms of bat echolocation calls were produced from downloaded Anabat files using AnaLookW v. 3.3q. While foraging, bats emit calls with varying frequencies (kHz) and durations (ms), which are separated into three phases: search, approach, and terminal phases (Simmons, Fenton, and O'Farrell 1979; Fenton and Bell 1981). Search phase calls tend to be evenly spaced from one another, as the bat actively searches for prey. During the approach and terminal phases, calls are emitted progressively closer to one another, as the bat identifies and targets the prey item (Simmons, Fenton, and O'Farrell 1979; Fenton and Bell 1981).

To differentiate between species and genus, the frequency and duration of the recorded calls were compared to available published accounts and voucher sonograms for several species (Fenton and Bell 1981; RIC 1998; Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003). Search and approach phase calls are most diagnostic for species identification. In particular, the lowest or fundamental frequency of search and approach phase calls has been used to distinguish between species (Fenton and Bell 1981; O'Farrell, Miller, and Gannon 1999). For example, the search phase calls of the silver-haired bat exhibited a fundamental frequency of around 25 kHz in several studies (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003). However, reliable differentiation between species in the genus *Myotis* is difficult (RIC 1998). A number of *Myotis spp.* are classified as "40 kHz Myotis" because various species in this genus have overlapping characteristics of echolocation calls. These species share a search phase call that descends to a fundamental frequency of 40 kHz over a duration of 1 to 2 ms (e.g., Plate 3.4-1) (Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003; RTEC 2006a, 2008).

The list of potentially occurring species was used to refine the selection of species identified as a 40 kHz myotis. Species that were categorized as likely to occur were given greater consideration over those that were categorized as possibly occurring.

3.4.4 Results

3.4.4.1 Evaluation of Potential Species

Ten species of bat potentially occur within the LSA and RSA, four of which are likely to occur and six possibly occur (Table 3.4-1). This list provided the basis for sonogram analysis.

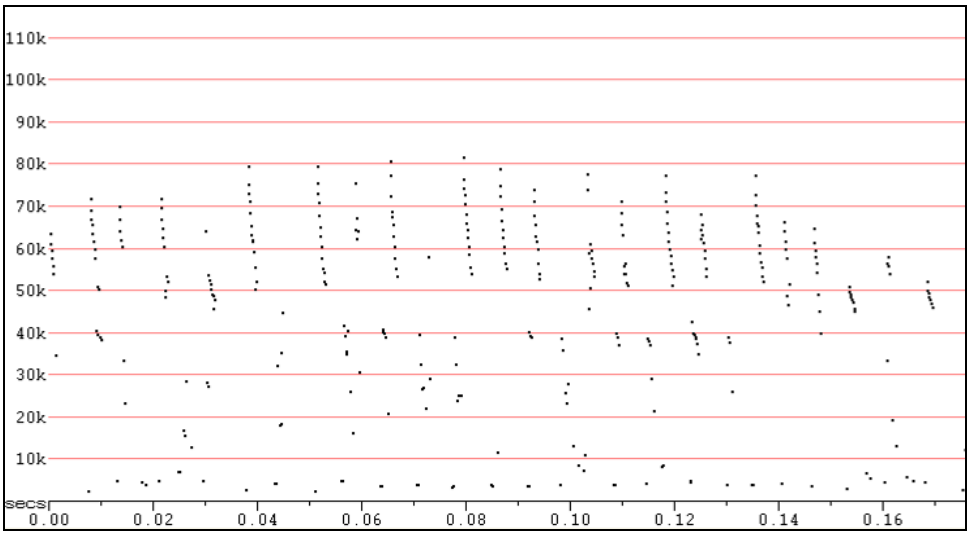


Plate 3.4-1. Sonogram of a search phase call of a "40 kHz Myotis" foraging, frequency (kHz) is recorded on the y-axis, duration along the x-axis (sec) (RTEC 2008).

3.4.4.2 Echolocation Call Survey

On July 18, 2010, observers recorded a total of 12 detections from the Anabat II detector at survey site 1 (Figure 3.4-2; Appendix 3.3-2). Four detections were recorded the following night at survey site 2, and 42 detections were recorded on the final night at survey site 3 (Appendix 3.3-2).

3.4.4.3 Sonogram Analysis and Species Detected

A total of 26 full sonograms were developed from Anabat sequence files: three sonograms from survey site 1, one from survey site 2, and 22 from survey site 3. Several sequence files (n = 32) did not contain sufficient information for identification of species.

The echolocation calls that were recorded at survey site 1 had a high frequency between 80 and 90 kHz and a fundamental (low) frequency of about 40 kHz: call duration was on average less than 2 ms (Plate 3.4-2). These call characteristics are within the range exhibited by "40khz Myotis", including the commonly occurring *M. lucifugus* (Fenton and Bell 1981; RIC 1998; Madison et al. 2003; McCaffrey, Rodhouse, and Garrett 2003).

The sonogram produced at survey site 2 had a high frequency of 80 khz, a low frequency of 30 to 35 khz, and a duration of 2 ms (Plate 3.4-3), typical of *Myotis* spp.

Two different types of call characteristics were recorded at survey site 3, suggesting that there were at least two different species foraging in the area. Three sonograms had high frequencies between 28 to 30 kHz that descended to a low frequency of 25 kHz and lasted for approximately 10 ms (Plate 3.4-4). These call characteristics match that of hoary and silver-haired bat. The remaining sonograms had call characteristics indicative of a *Myotis* spp., namely call ranges between 90 kHz and 40 kHz.

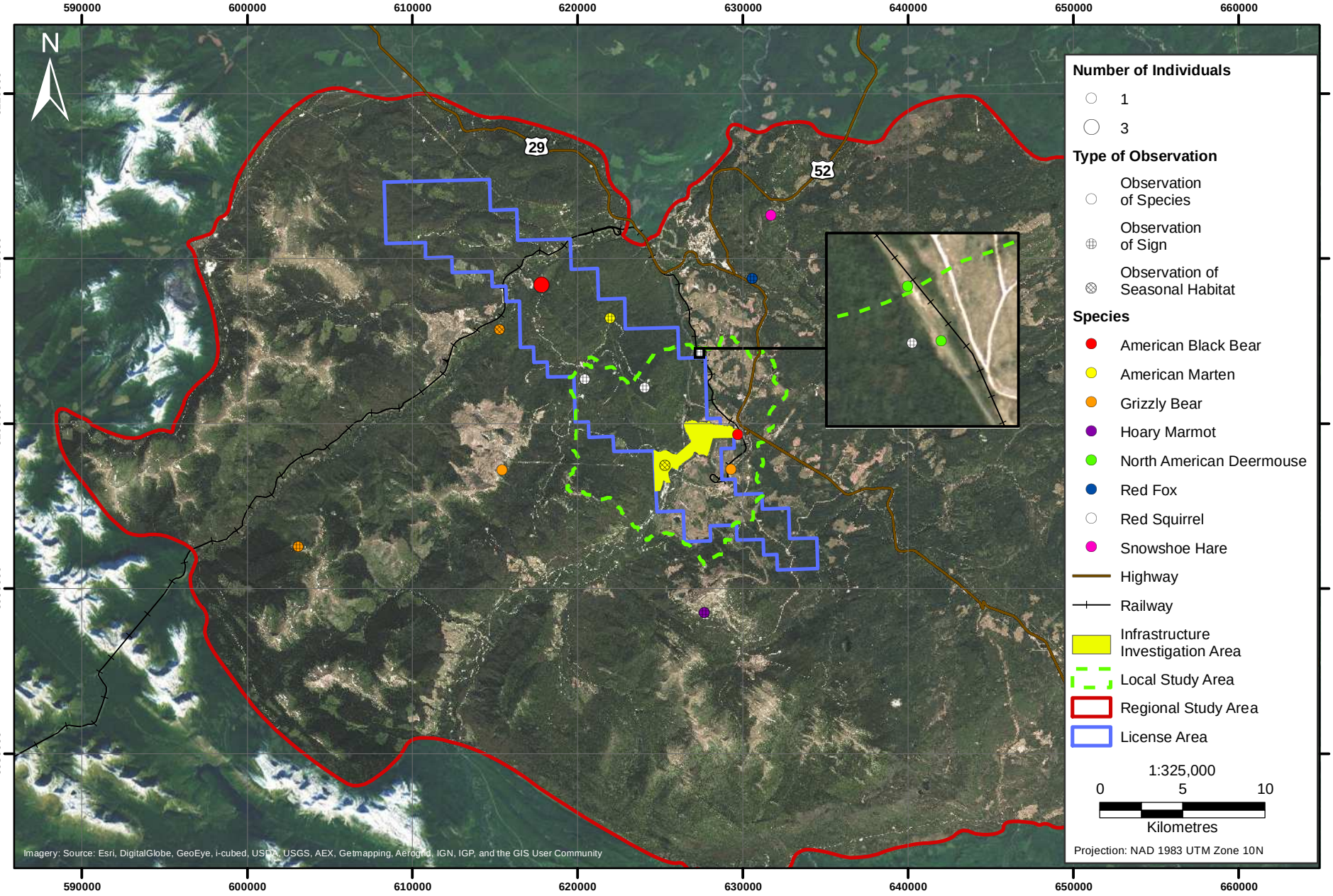


Figure 3.4-2

MURRAY RIVER PROJECT

Incidental Observation of Mammals, 2010

Figure 3.4-2

Rescan Engineers & Scientists

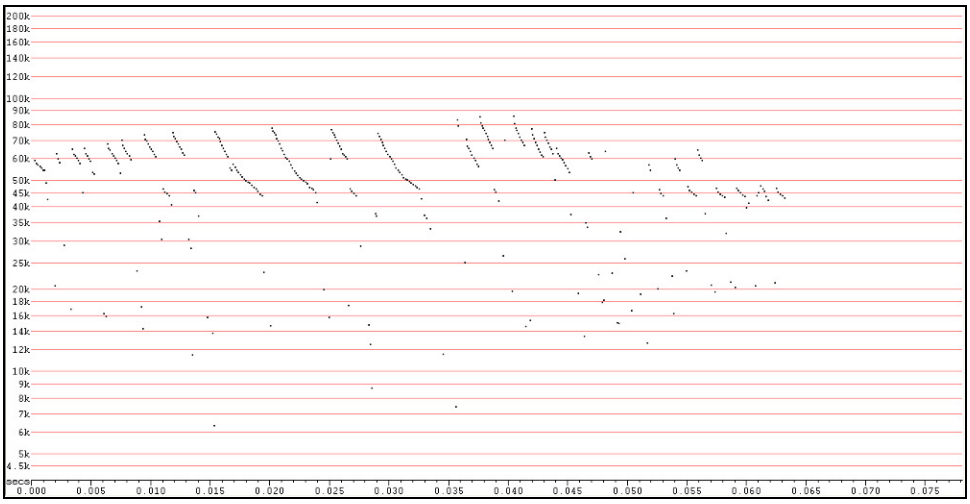


Plate 3.4-2. Example of "40khz Myotis" sonogram attained from Anabat sequence file at survey site 1. Frequency (kHz) is recorded on the y-axis, duration along the x-axis (sec).

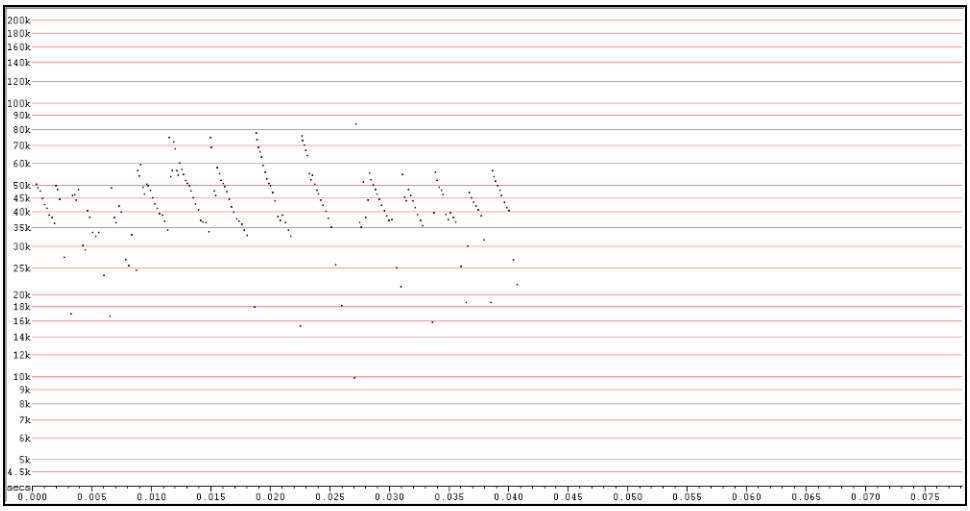


Plate 3.4-3. Myotis spp. *sonogram from survey site 2.*

3.4.5 Discussion

Bats were detected at all three survey sites within the study area. At least two species of myotis were detected, one of which may be the little brown myotis. *M. septentrionalis* and *M. evotis* were not detected - both species produce search phase calls that usually exceed 100 kHz, which is greater than the echolocation calls recorded during these surveys. In addition, either a hoary or silver-haired bat was detected at survey site 3 adjacent to Flatbed Creek. Echolocation sonograms are used cautiously when identifying bats to species, as little is known about variation in calls, differences in regional dialect, influence of environmental variables (e.g., humidity, direction) on echolocations, and sonogram development.

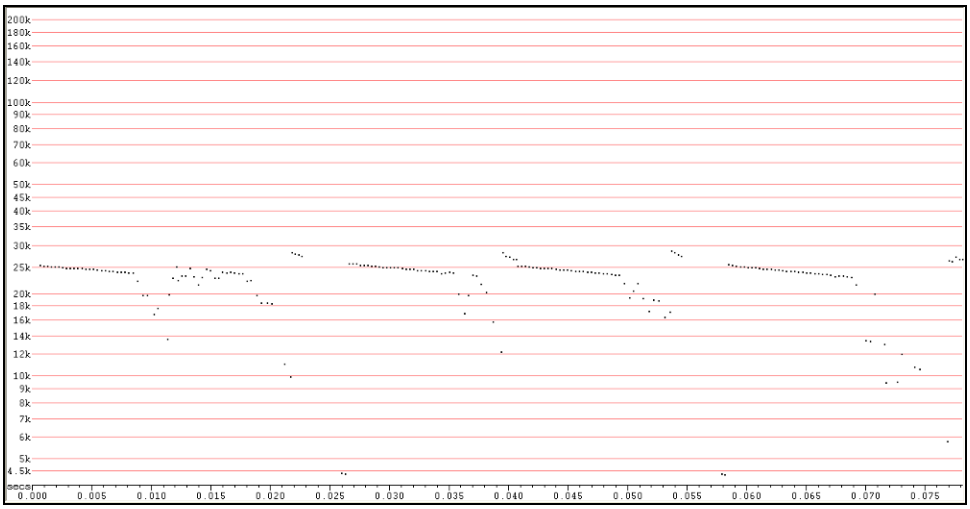


*Plate 3.4-4. Potential silver-haired bat (*Lasionycteris noctivagans*) or hoary bat (*L. cinereus*) at survey site 3.*

Bats use a combination of habitat types during the year, primarily mature to old forests with snags for roosting and riparian areas for foraging (Nagorsen and Brigham 1995; Ormsbee 1996; Sasse and Pekins 1996; Grindal, Morissette, and Brigham 1999; Vonhof and Wilkinson 1999). Large diameter trees and snags provide cavities for breeding, and roost sites underneath rugged bark for a number of bat species. Riparian areas are an example of edge habitat that can provide bats with suitable habitat for both foraging and roosting. Bat activity observed during this study in riparian areas along Murray River and Flatbed Creek indicates that there is potentially adequate habitat for bats in these areas.

3.5 INCIDENTAL OBSERVATIONS OF MAMMALS

To document the presence of other mammal species in the RSA and LSA, incidental observations of mammals or their sign were recorded between May 18 and July 26, 2010, and in May 2012 by Rescan biologists during baseline studies. The UTM location, date, species, number of individuals, or type of sign observed were recorded wherever possible. Incidental observations of ungulates are presented in Section 3.2.

Eight terrestrial mammal species or their sign were incidentally observed between May 18 and July 26, 2010 (Figure 3.5-1; Table 3.5-1; Appendix 3.4-1). Signs observed included bones, scat, and other evidence of use (e.g., feeding and denning; Plate 3.5-1). Black bear was the most commonly observed species. A hoary marmot and several marmot colonies were observed in alpine areas within the RSA (Appendix 3.4-1). Two grizzly bears were observed and an excavation noted in an alpine area to the west of the Wolverine Mine (Figure 3.5-1; Plate 3.5-1). Two deceased North American deer mice were observed along the rail line to the Wolverine Mine site (Figure 3.5-1; Plate 3.5-1). American marten, red fox, and red squirrel sign were detected (Plate 3.5-1). There were also two notable observations of good quality seasonal habitat for two species; high quality spring habitat for grizzly bear along the Wolverine River and potential winter habitat for American marten within the Infrastructure Investigation Area on the west side of Murray River (Figure 3.5-1). Of the eight species observed, all species are furbearers with the exception of the grizzly bear and deer mouse. The UTM coordinates for three black bears, one hoary marmot, and five marmot colonies were not recorded; therefore, they are not illustrated on Figure 3.5-1.

Table 3.5-1. Terrestrial Mammals Incidentally Observed in Summer 2010 and 2012, and Winter 2013

		Detection(s)			
Common Name	**Scientific Name**	**Animal**	**Summer Sign**	**Winter Tracks**	**Seasonal Habitat**
Large Carnivores					
American Black Bear†	*Ursus americanus*	7	1		
Grizzly bear	*Ursus arctos*	2	1		1
Lynx	*Lynx Canadensis*			Detected	
Coyote	*Canis latrans*			Detected	
Wolf	*Canis lupus*		1	Detected	
Red Fox†	*Vulpes vulpes*		1		
Furbearers					
American Marten	*Martes americana*		1		1
Hoary Marmot	*Marmota caligata*	1	6		
American beaver	*Castor canadensis*		1		
Red Squirrel	*Tamiasciurus hudsonicus*		3	Detected	
Snowshoe hare	*Lupus americanus*	1	1[1]	Detected	
Small Mammals					
Deer mouse	*Peromyscus maniculatus*	2			
Weasel spp.				Detected	
Mouse spp.				Detected	
Vole spp.				Detected	

†Also furbearing species [1]Tracks in snow (Appendix 3.2-5)

In addition, winter snow track surveys conducted in winter 2013 for deer and American marten resulted in incidental observations of small mammals and large carnivores (Appendix 3.2-5; Table 3.5-1). Snowshoe hare, red squirrel, weasel, mice and vole tracks were detected across all elevations and temperature gradients, and all forest types except mature deciduous forests. Tracks of lynx, coyote, and wolves were detected in the LSA, primarily at lower elevations.

a) Deer mouse carcass

b) Deer mouse carcass

c) Red Fox skull

d) American Marten scat

e) Red Squirrel midden

f) Grizzly Bear den/excavations

Plate 3.5-1. Examples of incidental observations of mammal sign.

4. Bird Community

Rescan™
Engineers and Scientists

4. Bird Community

4.1 OVERVIEW

The following sections report on the results of field baseline studies conducted during the breeding bird seasons in 2010 and 2012 in the area of the proposed Project. Surveys were conducted for terrestrial and riparian dwelling raptors, wetland birds (e.g., ducks, geese, shorebirds), and landbirds (e.g., songbirds, woodpeckers, grouse) to estimate species abundance and diversity, and describe habitat associations within the LSA and RSA. Monitoring of birds is important throughout the planning, implementation, and development phases of a project, as a necessary step in meeting the obligations of federal and provincial regulations, and because birds are effective indicators for environmental change (Niemi and McDonald 2004). Migratory birds, with the exception of raptors, are protected under the federal *Migratory Birds Convention Act* (1994b). Bird species and their nests, including raptors, are also afforded protection under the provincial *Wildlife Act* (1996b) – for example, it is an offence to destroy any occupied raptor nest. Several protective measures are required for species at risk listed on Schedule 1 of the federal *Species at Risk Act* (2002b).

4.2 RAPTORS

4.2.1 Introduction

Raptors (i.e., eagles, hawks, falcons, and owls) are considered ideal indicator species of ecosystem health because they are top predators, have large home range sizes, and use a variety of habitats throughout the year. These life history characteristics make them sensitive to environmental disturbances (Elliott et al. 1997; Steenhof et al. 1999). Declines in raptor populations have been attributed to human activities (Craighead and Mindell 1981). All raptors and their nests are legally protected under the BC *Wildlife Act* (1996b), including inactive stick nests of bald eagles, golden eagles, peregrine falcons, gyrfalcons, and osprey. Documenting nest locations and measuring population dynamics of the local raptor population can assist in monitoring impacts associated with development, and the development of effective mitigation strategies.

Two species of conservation concern are expected to occur in the region. The *anatum* subspecies of the peregrine falcon (*Falco peregrinus*) is federally listed as "Special Concern" under Schedule 1 of SARA, and appears on the provincial Red list of endangered and threatened species. Although the northern goshawk (*Accipiter gentilis*) is not federally or provincially listed as at risk, it is considered a species of concern in the Peace region (BC MOE 2005). The northern goshawk is a year round resident and confirmed breeder in the Peace region. Northern goshawks typically nest in old-growth forests with high canopy closure (60-95 percent) and sparse groundcover.

4.2.2 Objectives

Baseline field surveys for raptors were conducted in 2010 to determine the abundance and distribution of raptor species. Specifically, the objectives were to:

- identify nests of cliff and tree nesting raptor species that may be directly impacted by the project; and
- identify species of conservation concern in the LSA and RSA.

4.2.3 Methods

4.2.3.1 Stand Watch Survey

In 2010, stand watch surveys were conducted to document the presence of tree and cliff nesting raptors, with particular focus on raptors within the LSA. A total of three raptor stand watch surveys were conducted over three days in June (June 4 to 6, 2010). Stand watches were conducted in the afternoon following surveys for landbirds. Survey sites were selected based on their potential to support suitable nesting habitat. Site selection was limited by safe vehicle access and by vantage points that provided clear views of raptor activity within available habitat (e.g., tree-tops, cliffs). All survey sites were geo-referenced with a handheld Garmin GPS 60 (advertised accuracy 3 to 15 m). For cliff-nesting raptors, surveyors scanned cliffs with binoculars and high-powered scopes for white-wash and/or the presence of *Xanthoria* spp., an orange lichen that is often abundant near nest or roost sites where bird droppings accumulate. For tree nesting raptors, tree-tops were monitored for perching activity and dense spots in the canopy, which could indicate a nest. Habitats were scanned for bird activity for 30 minutes to 1 hour, depending on visibility (influenced by weather conditions). If no bird activity was detected in an area within 30 minutes, the stand watch was stopped and observers moved to the next survey site.

4.2.3.2 Incidental Observations

Observations of raptors and raptor nests were noted and geo-referenced when they were detected incidentally during other wildlife field surveys. Using GIS mapping of Biogeoclimatic Ecosystem Classification (BEC) zones, raptor locations were summed per BEC zone.

4.2.4 Results

4.2.4.1 Stand Watch Survey

One red-tailed hawk was observed (Table 4.2-1) outside of the LSA on June 5, over a regenerating clear cut surrounded by mature conifer forest (Figure 4.2-1; Appendix 4.2-1). No other raptors were observed during stand watch surveys.

Table 4.2-1. Number of Individual Raptor Species, Nests, and Sign Observed in the Study Area during 2010 Surveys

Species	Scientific Name	No. Raptors Observed during Surveys	No. Raptors and/or Sign* Observed Incidentally	Nest	Total
American kestrel	*Falco sparverius*	0	2	0	2
Bald eagle	*Haliaeetus leucocephalus*	0	3	1	4
Barred owl	*Strix varia*	0	1	0	1
Golden eagle	*Aquila chrysaetos*	0	3	0	3
Merlin	*Falco columbarius*	0	2	1	3
Northern goshawk	*Accipiter gentilis*	0	2	0	2
Northern harrier	*Circus cyaneus*	0	1	0	1
Osprey	*Pandion haliaetus*	0	7	2	9
Peregrine falcon	*Falco peregrinus*	0	1	0	1
Red-tailed hawk	*Buteo jamaicensis*	1	6	0	7
Unknown raptor[1]		0	2*	0	2
Total		1	30	4	35

[1] *Unknown raptor observations were of plucking stations (i.e., structure used by raptors to pluck feathers from prey)*
** Sign observed*

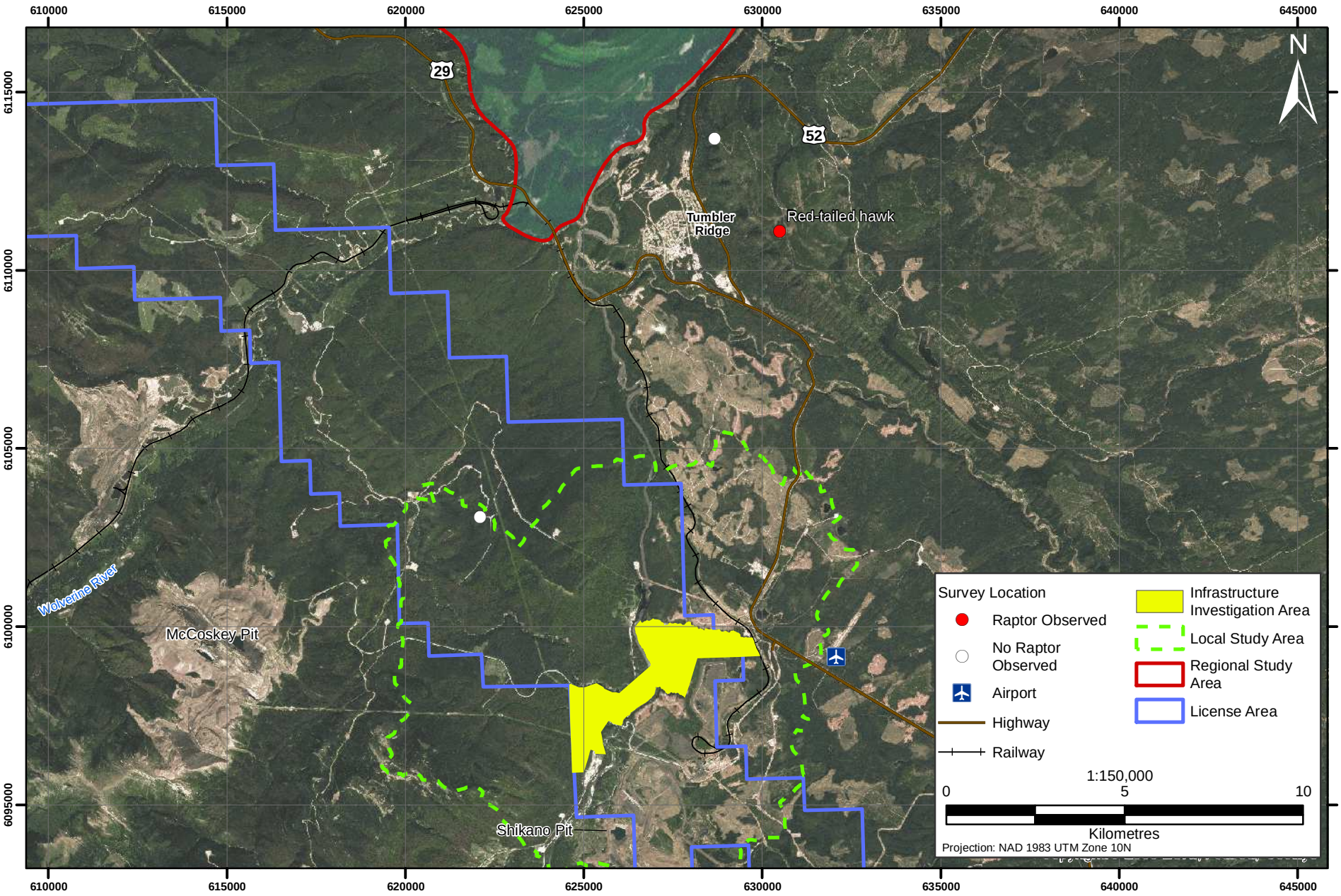


Figure 4.2-1

hdl Mining

MURRAY RIVER COAL PROJECT

Locations of Raptor Stand Watch Surveys and Raptor Observation, 2010

Figure 4.2-1

Rescan Engineers & Scientists

4.2.4.2 Incidental Observations

A total of 34 raptors or raptor sign were observed incidentally during wildlife surveys in the RSA in 2010. Ten species of raptors (28 individual birds observed on 25 separate occasions), two observations of raptor sign (pluck posts; (Figures 4.2-2; Appendix 4.2-2), and four nests (Figure 4.2-3; see "Breeding Evidence" below) were observed. Of the 25 separate sightings of raptors, 22 sightings (24 individuals) were plotted on a map (Figure 4.2-2). The remaining three observations of four raptors (one peregrine falcon and three golden eagle sightings) did not include enough location data to enable them to be plotted on the map. The peregrine falcon and a pair of juvenile golden eagles were sighted flying over the high alpine in the northwest of the RSA in SU 3 during ungulate surveys (for approximate location, refer to Figure 3.2-1). The other golden eagle sighting was observed in the south of the RSA in SU 8 during ungulate surveys. Two plucking posts (i.e., structure used by raptors to pluck feathers from prey) were discovered on June 7 and June 9, 2011, one of which was in the northwest corner of the LSA (Figure 4.2-2).

Ospreys were the most frequently observed raptor species in 2010, with six sightings of seven individuals, and two osprey nests located (Table 4.2-1). Red-tailed hawks were also frequently detected, with six incidental observations. Within the LSA, red-tailed hawks (five individuals), ospreys (four individuals), bald eagles (three individuals), northern goshawk (one individual), and American kestrel (one individual) were observed. It is important to note that this does not indicate the total number of individuals that were observed, as some of these observations could have been the same individual raptors recorded on multiple occasions. Of the individual raptors observed within the LSA, six were within 500 m of proposed infrastructure, and two were within the Infrastructure Investigation Area on the west side of Murray River (Figure 4.2-2).

The majority (77%; n = 24) of raptors or sign with sufficient location information were within the Boreal White and Black Spruce BEC Zone, moist warm variant (BWBSmw; Table 4.2-2). The remaining sightings were within the Boreal White and Black Spruce, wet cool subzone (BWBSwk; n = 5) and the Sub-Boreal Spruce, wet cool subzone (SBSwk; n = 2). One of the raptor plucking posts was observed in BWBSmw, and the other was observed in SBSwk. Observations of four raptors did not have sufficient location information to determine habitat and/or BEC zone.

Raptor Nests

Four nests were incidentally observed in 2010 (Figure 4.2-3); two osprey nests (one of which is within the LSA), one bald eagle nest within the LSA, and one merlin nest within the RSA near Tumbler Ridge. One of the osprey nests was located 300 m from the Infrastructure Investigation Area on the west side of Murray River, and the bald eagle nest was 480 m from the Infrastructure Investigation Area on the west side of Murray River. All four nests were observed within the BWBSmw BEC zone.

4.2.4.3 Species of Conservation Concern

A peregrine falcon (*Falco peregrinus anatum*), a species of conservation concern, was observed on July 20, 2010 in the northwest of the RSA, flying over an alpine meadow. Two northern goshawks were detected on June 3, 2010 and June 9, 2010. Both sightings were in mixed stands of conifer and broadleaf tree species (BWBSmw BEC zone), one of which was in the northeast of the LSA.

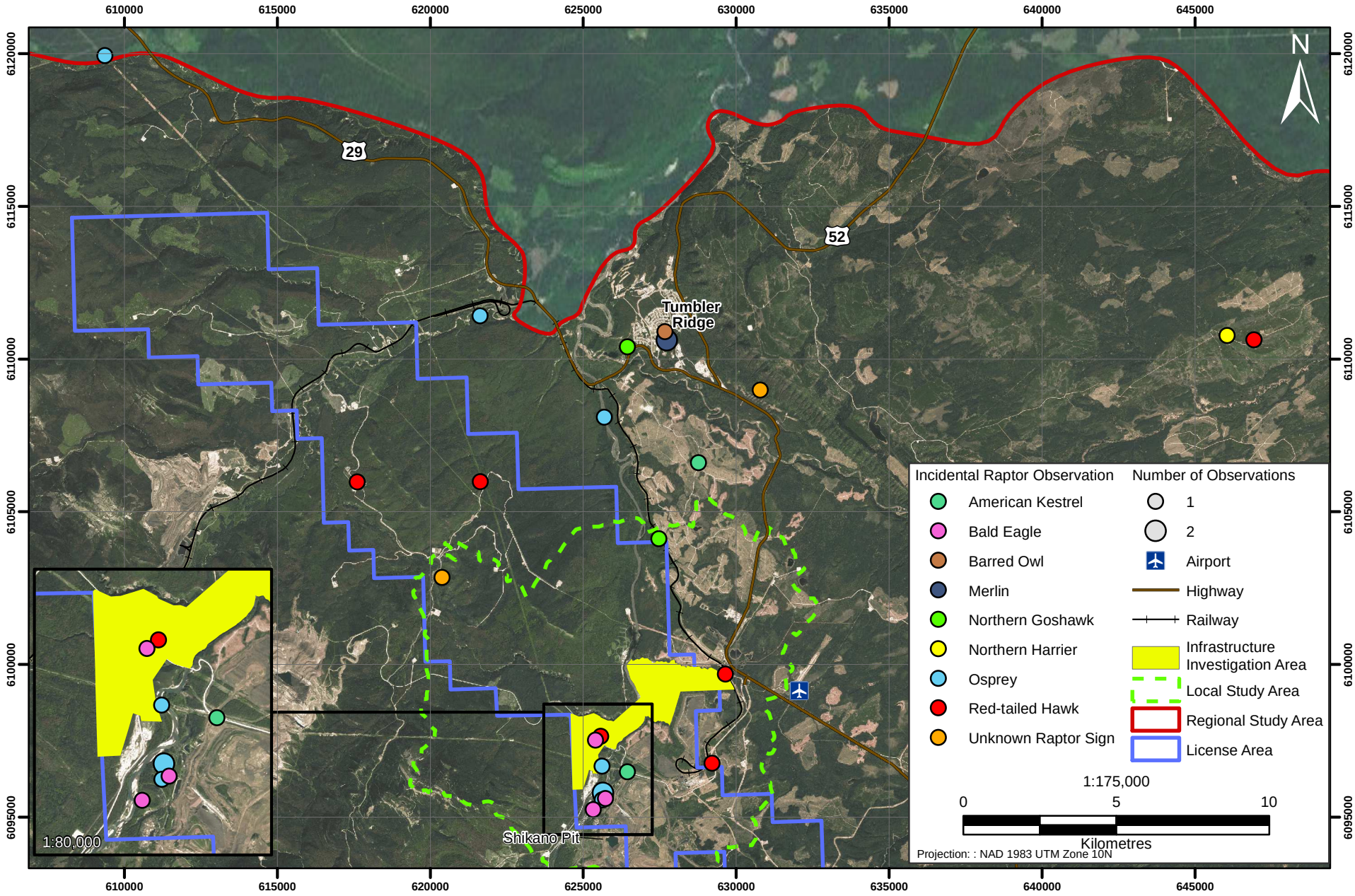


Figure 4.2-2

hcl Mining

MURRAY RIVER COAL PROJECT

Incidental Observations of Raptors and Raptor Sign, 2010

Figure 4.2-2

Rescan™ Engineers & Scientists

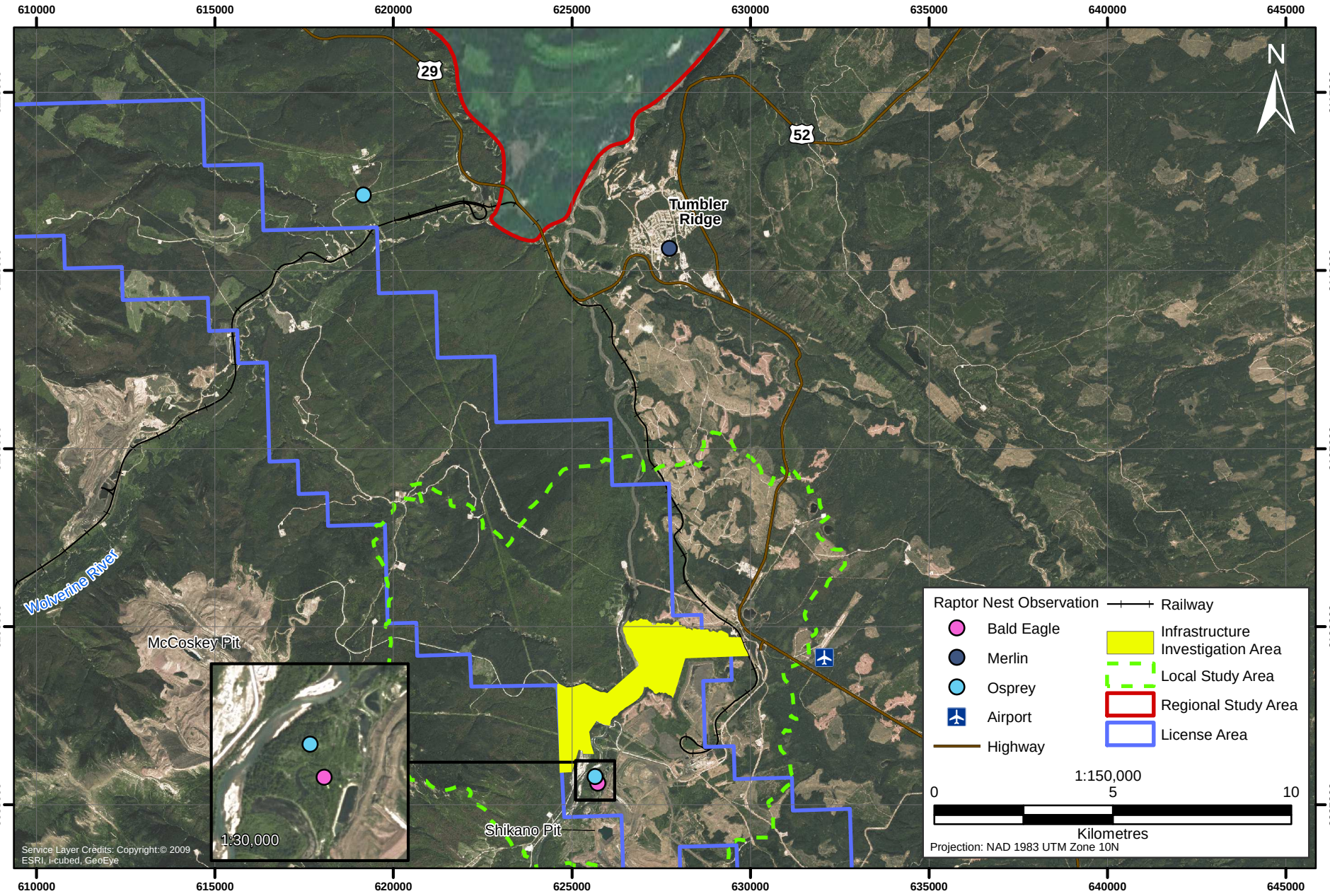


Figure 4.2-3

hcl Mining

MURRAY RIVER COAL PROJECT

Raptor Nest Sites Identified in 2010

Figure 4.2-3

Rescan™ Engineers & Scientists

Table 4.2-2. BEC Zones where Raptors, Nests, and Raptor Sign were Observed during 2010 Surveys

Species	BEC Zone			Total
	BWBS mw1	BWBS wk1	SBS wk2	
American Kestrel	2	-	-	2
Bald Eagle	3	-	-	3
Bald Eagle Nest	1	-	-	1
Barred Owl	1	-	-	1
Merlin	2	-	-	2
Merlin Nest	1	-	-	1
Northern Goshawk	2	-	-	2
Northern Harrier	-	1	-	1
Osprey	6	1	-	7
Osprey Nest	2	-	-	2
Red-tailed Hawk*	3	3	1	7
Unknown Raptor Sign	1	-	1	2
Total	24	5	2	31

BWBS mw1 = Boreal White and Black Spruce, moist warm subzone; BWBS wk1 = Boreal White and Black Spruce, wet cool subzone; SBS wk2 = Sub-Boreal Spruce, wet cool subzone.
**Includes red-tailed hawk observed during stand watch surveys*

4.2.5 Discussion

A total of 10 raptor species were identified during baseline studies in 2010. Breeding activity was documented for three species through observations of nest sites or nest building (material carry/pair). Nests were observed for one bald eagle and two ospreys. A pair of merlins was also observed building a nest in a patch of trees near Tumbler Ridge. No nestlings were observed at any of the nest sites. One of the osprey nests and the pair of merlins were observed outside of the LSA. The other osprey nest and one bald eagle nest were both located within the southwest portion of the LSA, approximately 300 m and 480 m from the Infrastructure Investigation Area on the west side of Murray River, respectively. All active raptor nests are protected under the BC *Wildlife Act* (1996b). In addition, to avoid contravention of Section 34(b) of the *Wildlife Act*, a tree or other structure containing a nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl must not be felled, even outside of the breeding season.

Two species of conservation concern expected to occur in the RSA were confirmed to be present during baseline surveys: peregrine falcon, *anatum* subspecies (Special Concern under Schedule 1 of SARA) and northern goshawk (species of concern in the Peace region; BC MOE 2005). The peregrine falcon is a seasonal resident in the Peace region of BC, but there have been no recent breeding records. One peregrine falcon was observed in July 2010, potentially migrating through the area.

Northern goshawks were observed on two occasions in June 2010. One northern goshawk sighting was within the LSA, approximately 340 m from the Infrastructure Investigation Area within the BWBSmw BEC zone. The LSA is known to support high quality northern goshawk habitat. Studies for the Herman Mine identified high quality habitat for northern goshawk along the Murray River, the Wolverine River, and lower Mast Creek (Western Canadian Coal 2007).

Northern goshawks are known to breed in the Peace region. Northern goshawks typically nest in mature and old growth forests with an open understory and closed canopy, and utilize an area of roughly 30 ha around the nest site for foraging (RIC 2001; BC ILMB 2009; Horn et al. 2009). Goshawks also exhibit

fidelity to nesting areas within their home range. The spacing between nests of adjacent goshawk pairs can be from 7 to 11 km (Horn et al. 2009), but spacing of up to 20 km has been observed (Doyle and Mahon 2001). Therefore, the two sightings of northern goshawks may have been of the same individual, or of a breeding pair (Figure 4.2-2).

4.3 WETLAND BIRDS

4.3.1 Introduction

Wetland birds or waterbirds include diving and dabbling ducks, loons, mergansers, geese, swans, shorebirds, and any water-dependent bird species, such as the belted kingfisher and sora. In this report, the term "wetland bird" is used as an umbrella term to encompass species that use wetlands during some portion of the year, either for foraging, breeding, or staging (i.e. temporary stop-overs during migration).

The presence of wetland birds is an indicator of the availability of functional wetland habitat. Wetland birds are also an important game species for local hunters and First Nations. The nests and eggs of migratory wetland birds species are protected under the federal *Migratory Bird Convention Act* (1994b), and identifying species of conservation concern during the breeding season supports conservation measures identified under SARA (2002b) and the BC *Wildlife Act* (1996b).

Identifying species of conservation concern during the breeding season meets the obligations of the *Species At Risk Act* (2002b) and the the BC *Wildlife Act*(1996b). Harlequin ducks are provincially ranked as vulnerable during the non-breeding season, and the surf scoter is blue-listed and provincially ranked as vulnerable during the breeding season. The harlequin duck is of particular concern because it occupies a unique habitat niche and Pacific populations have undergone significant declines (Robertson and Goudie 1999; BC MSRM 2002). The western grebe (*Aechmophorus occidentalis*) is provincially red listed and is a candidate for assessment by COSEWIC.

Waterbirds are an important component of biodiversity. The presence of waterbirds is an indicator of the availability of functional wetland habitat. Waterbirds are often used as indicators of ecosystem health and quality of wetlands, which are crucial for many ecosystem functions, such as erosion control, water and air purification, and flood control. Different species of waterbirds using a lake can represent multiple facets of site productivity, such as the presence of aquatic food resources (e.g., fish species, benthic invertebrates), and water quantity and quality. Waterbirds are often a considerable dietary component for raptors and carnivores, particularly foxes and wolves. Waterbirds, particularly waterfowl, are important locally and regionally as sustenance game species for resident hunters and First Nations.

4.3.2 Objectives

Baseline field surveys were conducted to record the presence and distribution of wetland bird species within the RSA during the spring and fall staging periods, and during the breeding season. In addition, the presence of species of conservation concern was documented to support conservation actions under relevant wildlife acts and guidelines.

4.3.3 Methods

Prior waterbird staging surveys were conducted in the project area by EDI in May 2011 and October 2010 (Appendix 4.3-14); however, the spring staging surveys may have been conducted too late in the spring to adequately inventory the spring staging period in northeastern BC and that important spring and fall staging areas still needed to be identified in the project area. As a result,

Rescan conducted additional spring and fall staging surveys to augment the data set previously provided by EDI.

To document the presence and distribution of wetland birds, aerial and ground surveys for wetland birds were conducted during the breeding season and during spring and fall staging. Aerial surveys were conducted over water bodies that were inaccessible by foot, and included the extents of Murray River, Wolverine River, Flatbed Creek, large water bodies such as Bearhole Lake and Quality Lake, and associated wetlands within the RSA. Aerial surveys were conducted by helicopter flying at speeds of 40 to 100 km/hour depending on weather conditions, and at a height of approximately 30 to 50 m above the water (RIC 1999b). A navigator and one observer recorded all bird observations. A handheld Garmin GPS was used to record the approximate UTM coordinates where birds were detected.

Ground surveys of wetlands were conducted using binoculars and spotting scopes for a maximum duration of 20 minutes and within a 200 m observation radius. During ground surveys, the species, number of individuals, gender (if possible), and behaviour were recorded. When broods were observed, the number of young and brood class were also noted (Table 4.3-1).

Table 4.3-1. Plumage Development in Young Waterfowl

Brood Class	Description
IA	Young are covered in bright down, neck and tail not prominent; 1 to 7 days of age.
IB	Young are covered in fading down, neck and tail not prominent; 8 to 13 days of age.
IC	Young are downed-covered, but colour faded, body elongated; 14 to 18 days of age.
IIA	First feathers appear, replacing down on sides and tail; 19 to 27 days of age.
IIB	Over half of body covered with feathers; 28 to 42 days of age.
IIC	Small amount of down remains, among feathers of back; 28 to 42 days of age.
III	Fully feathered but incapable of flight; 43 to 55 days of age, flying at 56 to 60 days of age.

References: (Gollop and Marshall 1954; Bellrose 1980).

In 2010, two inventories were conducted in the RSA during the breeding season. The first inventory was conducted during the pre-incubation period (before most hens have initiated incubating eggs) in late May. Aerial pre-incubation surveys were conducted over a period of three hours between May 18 and 19 and a total of 15 sites were surveyed from the ground on May 19 and 20 (Appendix 4.3-1 and 4.3-13; Figure 4.3-1). The second inventory was conducted in July during the brooding period when parent birds accompanied their young. An aerial survey was conducted for four hours on July 18, and ground surveys were conducted at 105 sites on July 21-26 (Appendix 4.3-1 and 4.3-13; Figure 4.3-1).

Wetland birds were also inventoried during the fall (2011) and spring (2012) staging periods. During fall staging, aerial surveys were conducted for a total of four hours on October 6, 2011 and ground surveys were conducted at 30 sites between October 4 and 6, 2011 (Appendices 4.3-4 to 4.3-7 and 4.3-13; Figure 4.3-1). During spring staging, aerial surveys were conducted for 5.8 hours on May 2, 2012 and ground surveys were conducted at 30 sites over a period of three days (Appendices 4.8 to 4.13; Figure 4.3-1).

Wetland bird species incidentally observed during other wildlife field surveys are presented. Similarly, all wildlife species (e.g., amphibians, raptors, mammals) that were incidentally observed during wetland bird surveys were recorded. The species, number of individuals, and UTM coordinates of the observation were noted.

4.3.3.1 Data Analysis

For general analyses, waterbirds were grouped as dabbling ducks, diving ducks (including sea ducks), geese/swans, loons/grebes, shorebirds, and riverine birds. Abundance and diversity were calculated for each waterbird group and species.

4.3.3.2 Habitat Classification

For both aerial and ground surveys, wetlands were geo-referenced with a Garmin GPSMAP 60Cx (advertised accuracy ± 10 m) and assigned a wetland type and size. Wetland type was classified into seven categories: creek, river, marsh, swamp, pond, lake, and artificial. Wetlands that were not classified were labelled as unclassified. Streams with an ephemeral or seasonal hydroperiod were classified as creeks; streams and rivers with semi-permanent or permanent hydroperiod were classified as rivers. Marsh habitat was classified on the basis of open water and ≥25% grass, sedges, and associated vegetation. Swamps were comprised of open water and ≥25% shrubs. Ponds were identified as naturally occurring water bodies with organic substrate and substantial emergent vegetation. Lakes were distinguished from ponds as deeper natural-occurring water bodies with predominantly non-organic substrate. Artificial water bodies, which ranged in depth, were evident from their regular shape, location, and relatively small size. Habitat size was classified as small, medium, and large. Small wetlands were ≤0.5 hectares (ha), medium wetlands were >0.5 to <2 ha, and large wetlands were ≥2 ha in area.

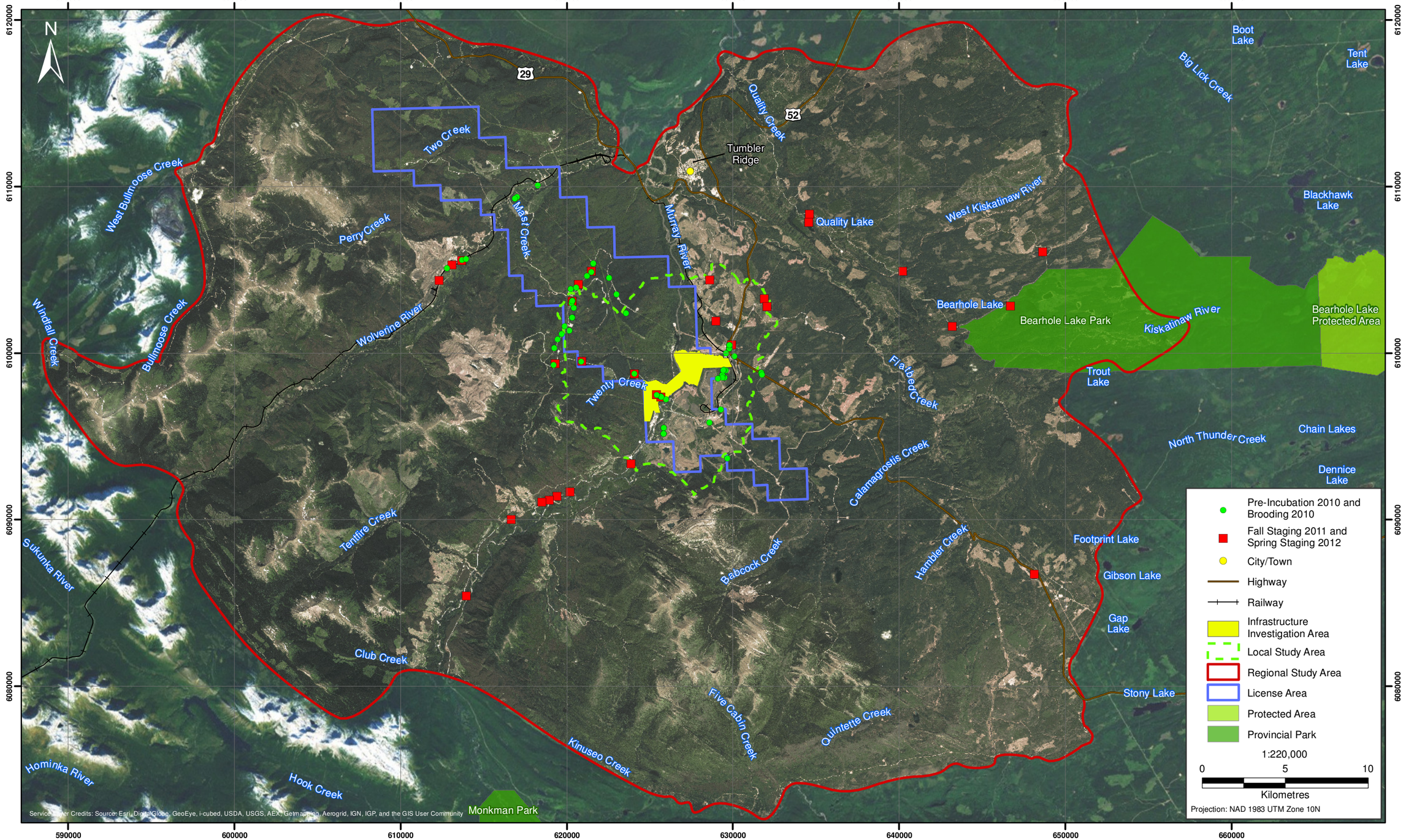
4.3.4 Results

A total of 2,094 birds were observed, representing 35 species from six waterbird groups (Table 4.3-2): dabbling ducks (7), diving and sea ducks (10), loons and grebes (6), riverine birds (3), geese and swans (2), and shorebirds (7). The most commonly observed species were mallard, lesser scaup, ring-necked duck, Canada goose, Barrow's goldeneye, hooded merganser, and American green-winged teal. Five waterbird species of conservation concern were detected: surf scoter (BC Blue listed), horned grebe (COSEWIC "Special Concern" specie), Western grebe (BC Red listed and COSEWIC "Candidate" species), red-necked phalarope (BC Blue listed and COSEWIC "Candidate" species), and harlequin duck (provincially ranked as "vulnerable" during the non-breeding season). In addition, thirteen Western or Clark's grebes (BC Red listed) were observed during the fall staging survey; however, it was not possible to identify individuals to species.

4.3.4.1 Spring Staging Survey

A total of 24 species and 739 individual waterbirds were observed during aerial surveys, ground surveys, and incidentally during the spring staging period (Table 4.3-2; Figure 4.3-2; Appendices 4.3-8 to 4.3-13). Approximately 79% of the total number of birds counted was observed during the aerial surveys. One additional wetland bird species (unknown sandpiper) was detected but not identified to species. Dabbling ducks were the most commonly observed waterbird group observed, accounting for approximately 43% of overall bird observations, followed by diving and sea ducks (38%; Plate 4.3-1), and geese and swans (17%; Plate 4.3-2). The five most abundant species observed were mallard, Canada goose, Barrow's goldeneye, American green-winged teal, and ring-necked duck (Figure 4.3-2). One species of conservation concern, the harlequin duck, was observed during aerial surveys on the Wolverine River.

Ground surveys were conducted at 30 sites (24 in the RSA and 6 in the LSA, 2 of which were within the Infrastructure Investigation Area), and waterbirds were detected at 16 of these sites (Figure 4.3-1). During the ground surveys, the highest concentrations of birds were along the Wolverine and Murray Rivers, and just outside Bearhole Lake Park (Figure 4.3-3). Aerial surveys were conducted over 5.8 hours, covering areas within the RSA, LSA, and Infrastructure Investigation Area. The highest concentrations of birds were observed along the Murray River southwest of the LSA (n = 126), along the Murray River within the LSA adjacent to the Infrastructure Investigation Area (n = 97) (Figure 4.3-4 Inset 2), on and around a mine tailings pond within the LSA (n = 92; Figure 4.3-4 Inset 5), and along Flatbed Creek south of Hambler Creek in the southeast portion of the RSA (n = 77) (Figure 4.3-4).



hd Mining Rescan™ Engineers & Scientists

MURRAY RIVER COAL PROJECT

Figure 4.3-1

Wetland Bird Ground Survey Locations, 2010 - 2012

Table 4.3-2. Total Wetland Bird Observations, 2010 - 2012

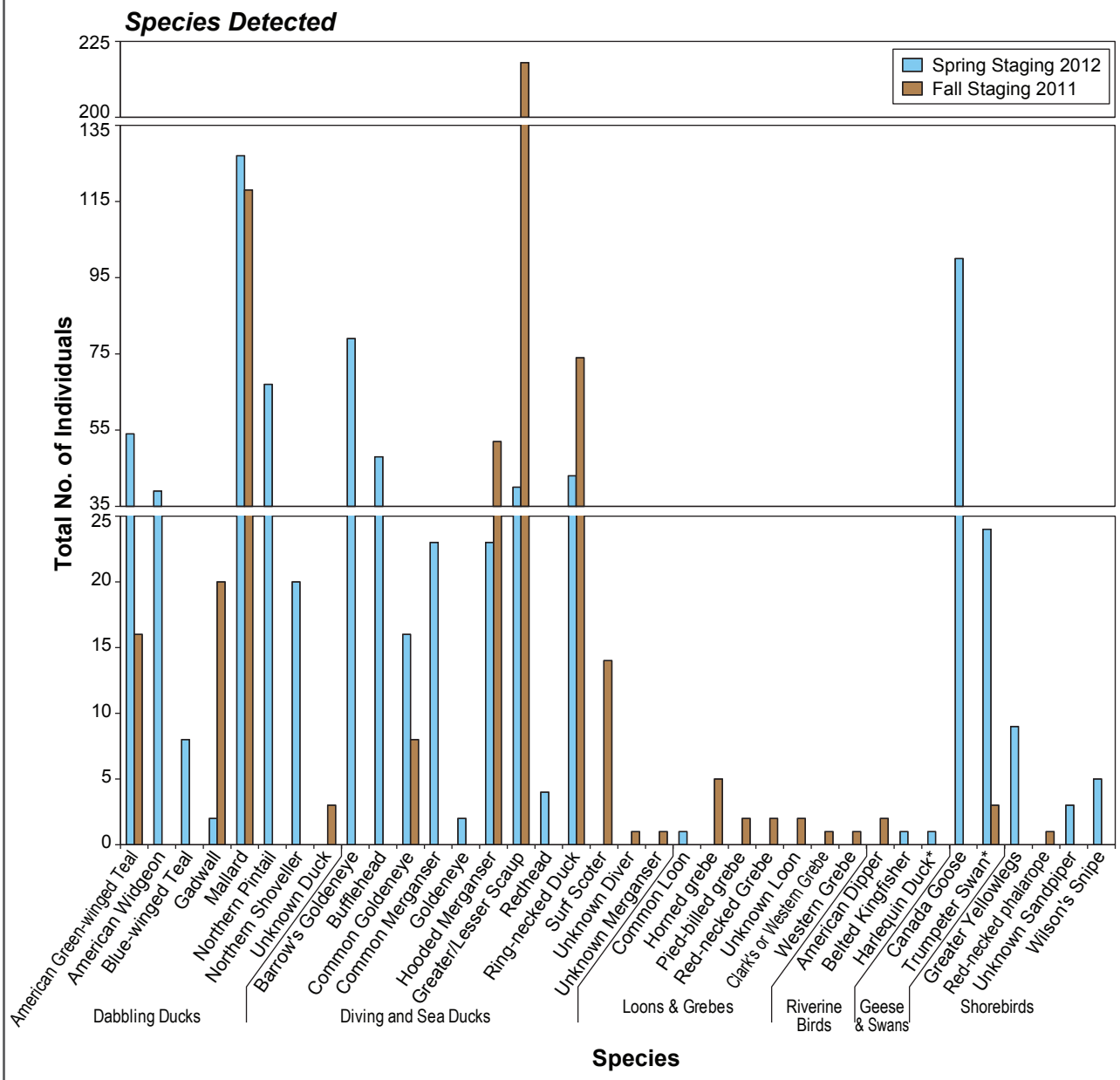
			Waterbird Survey												
			Spring Staging 2012			Pre-Incubation 2010			Brooding 2010			Fall Staging 2011			
Group	Species	Scientific Name	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Total
Dabbling Ducks	American Green-winged Teal	*Anas crecca*	35	19	-	3	2	-	23	5	1	16	-	-	104
	American Widgeon	*Anas americana*	38	1	-	12	-	-	3	-	-	-	-	-	54
	Blue-winged Teal	*Anas discors*	6	2	-	12	-	-	-	-	-	-	-	-	20
	Gadwall	*Anas strepera*	2	-	-	-	-	-	-	2	-	20	-	-	24
	Mallard	*Anas platyrhynchos*	101	26	-	51	6	2	36	2	-	113	5	3	345
	Northern Pintail	*Anas acuta*	63	4	-	-	-	-	-	-	-	-	-	-	67
	Northern Shoveller	*Anas clypeata*	11	9	-	6	-	-	-	-	-	-	-	-	26
	Unknown Duck		-	-	-	-	-	-	-	-	-	2	1	-	3
Diving and Sea Ducks	Barrow's Goldeneye	*Buchephala islandica*	63	16	-	24	4	1	1	10	-	-	-	-	119
	Bufflehead	*Bucephala albeola*	34	14	-	13	2	-	2	-	-	-	-	-	65
	Common Goldeneye	*Bucephala clangula*	13	3	-	-	-	-	2	-	1	-	8	4	31
	Common Merganser	*Mergus merganser*	17	6	-	9	1	-	8	-	-	-	-	-	41
	Goldeneye	*Bucephala islandica/ clangula*	2	-	-	-	-	-	-	-	-	-	-	-	2
	Hooded Merganser	*Lophodytes cucullatus*	23	-	-	1	-	2	-	-	-	45	7	4	82
	Lesser Scaup	*Aythya affinis*	-	-	-	-	-	-	-	7	-	144	74	6	231
	Redhead	*Aythya americana*	4	-	-	-	-	-	-	-	-	-	-	-	4
	Ring-necked Duck	*Aythya collaris*	39	4	-	75	17	7	15	-	-	47	27	-	231
	Surf Scoter*	*Melanitta perspicillata*	-	-	-	14	-	-	-	-	-	1	13	6	34
	Unknown Diver		-	-	-	-	-	-	27	-	-	-	1	43	71
	Unknown Merganser	*Lophodytes spp.*	-	-	-	-	-	-	-	-	-	1	-	-	1
	Unknown Scaup	*Aythya sp.*	32	8	-	-	-	-	-	-	-	-	-	-	40

(continued)

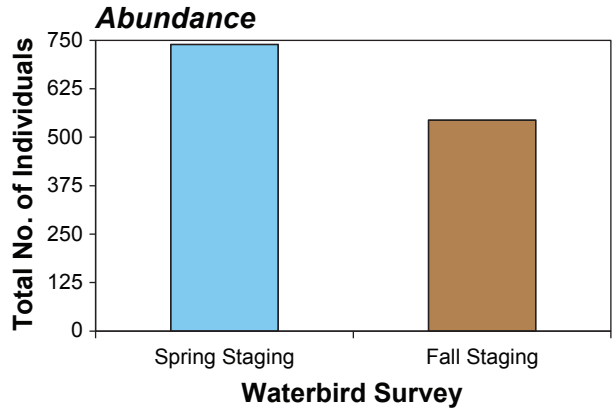
Table 4.3-2. Total Wetland Bird Observations, 2010 – 2012 (completed)

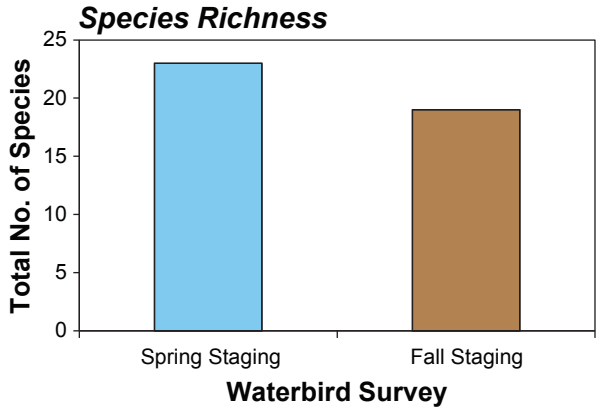
			Waterbird Survey												
			Spring Staging 2012			Pre-Incubation 2010			Brooding 2010			Fall Staging 2011			
Group	Species	Scientific Name	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Aerial	Ground	Inc.	Total
Loons and Grebes	Common Loon	*Gavia immer*	-	1	-	-	-	-	-	1	-	-	-	-	2
	Horned grebe*	*Podiceps auritus*	-	-	-	-	-	-	-	-	-	-	5	1	6
	Pacific Loon	*Gavia pacifica*	-	-	-	-	-	-	-	-	-	-	-	7	7
	Pied-billed grebe	*Podilymbus podiceps*	-	-	-	-	-	-	-	-	-	-	2	-	2
	Red-necked Grebe	*Podiceps grisegena*	-	-	-	-	-	-	-	-	-	-	2	-	2
	Unknown Loon	*Gavia sp.*	-	-	-	-	-	-	-	-	-	2	-	1	3
	Unknown Grebe* (Clark's or Western)	*Aechmophorus spp.*	-	-	-	-	-	-	-	-	-	1	-	12	13
	Western Grebe*	*Aechmophorus occidentalis*	-	-	-	-	-	-	-	-	-	1	-	-	1
Riverine Birds	American Dipper	*Cinclus mexicanus*	-	-	1	-	-	-	-	-	-	2	-	-	3
	Belted Kingfisher	*Megaceryle alcyon*	-	1	-	-	-	-	-	-	-	-	-	-	1
	Harlequin Duck*	*Histrionicus histrionicus*	1	-	-	-	-	2	-	-	-	-	-	-	3
Geese and Swans	Canada Goose	*Branta canadensis*	79	21	-	48	-	-	82	10	13	-	-	-	253
	Trumpeter Swan	*Cygnus buccinator*	20	4	-	2	-	-	2	6	-	3	-	2	39
Shorebirds	Greater Yellowlegs	*Tringa melanoleuca*	5	4	-	2	2	-	2	-	-	-	-	-	15
	Lesser Yellowlegs	*Tringa flavipes*	-	-	-	-	-	-	-	3	-	-	-	-	3
	Red-necked phalarope*	*Phalaropus lobatus*	-	-	-	-	-	-	-	-	-	-	1	-	1
	Solitary Sandpiper	*Tringa solitaria*	-	-	-	-	3	-	7	8	-	-	-	-	18
	Sora	*Porzana carolina*	-	-	-	-	-	-	-	1	-	-	-	-	1
	Spotted Sandpiper	*Actitis macularia*	-	-	-	-	5	3	-	9	2	-	-	-	19
	Unknown Sandpiper†		-	3	-	40	-	-	10	-	-	-	-	-	53
	Unknown Shorebird		-	-	-	44	-	-	-	-	-	-	-	1	45
	Wilson's Snipe	*Gallinago delicata*	-	5	-	-	1	3	-	-	-	-	-	-	9
TOTAL	**SPECIES**		**19**	**19**	**1**	**15**	**10**	**7**	**13**	**12**	**4**	**13**	**10**	**10**	**35**
	INDIVIDUALS		**588**	**151**	**1**	**356**	**43**	**20**	**220**	**64**	**17**	**398**	**146**	**90**	**2094**

**Species of conservation concern*
†Potentially Spotted or Solitary Sandpiper



*Note: *Species of conservation concern.*





hdMining | MURRAY RIVER COAL PROJECT

Wetland Bird Species with Species Abundance and Richness during Staging Surveys, 2011 and 2012

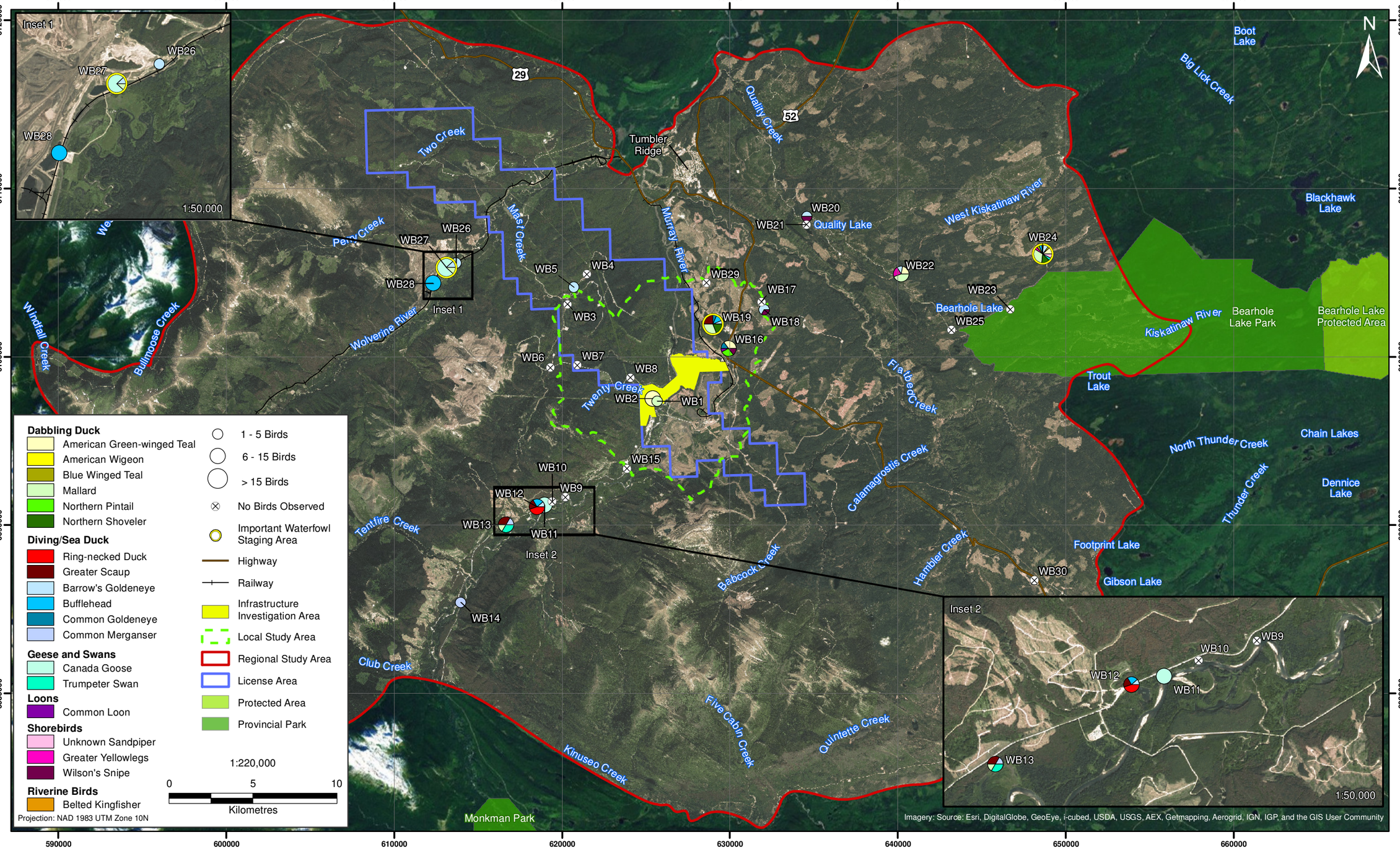
Figure 4.3-2

Rescan Engineers & Scientists

Plate 4.3-1. Breeding pair of Barrow's goldeneye, May 1, 2012.

Plate 4.3-2. Breeding pair of trumpeter swans, May 1, 2012.

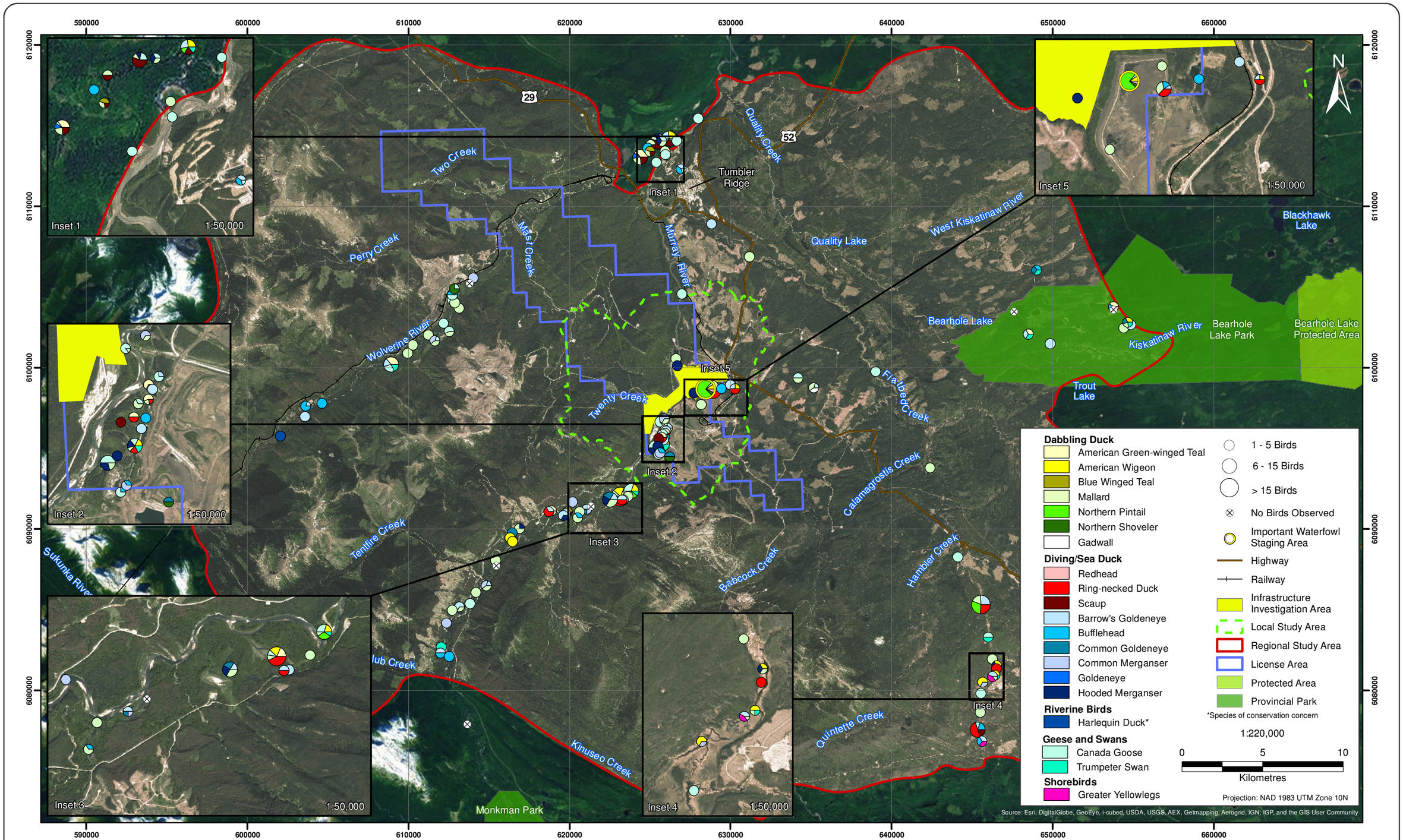
Wetland birds during both the ground and aerial surveys were detected primarily in pond (23%), river (22%), man-made waterbody (17%), and creek habitat (16%) (Figure 4.3-5). Due to the extent of ice cover on large lakes, very few wetland birds were observed on lake habitat (8%). Overall, dabbling ducks and diving ducks exploited the largest range of habitat types compared to the other wetland bird groups (Figure 4.3-5).



hd Mining | Rescan Engineers & Scientists | MURRAY RIVER COAL PROJECT

Figure 4.3-3

Location and Abundance of Wetland Birds during Spring Staging Ground Surveys, 2012

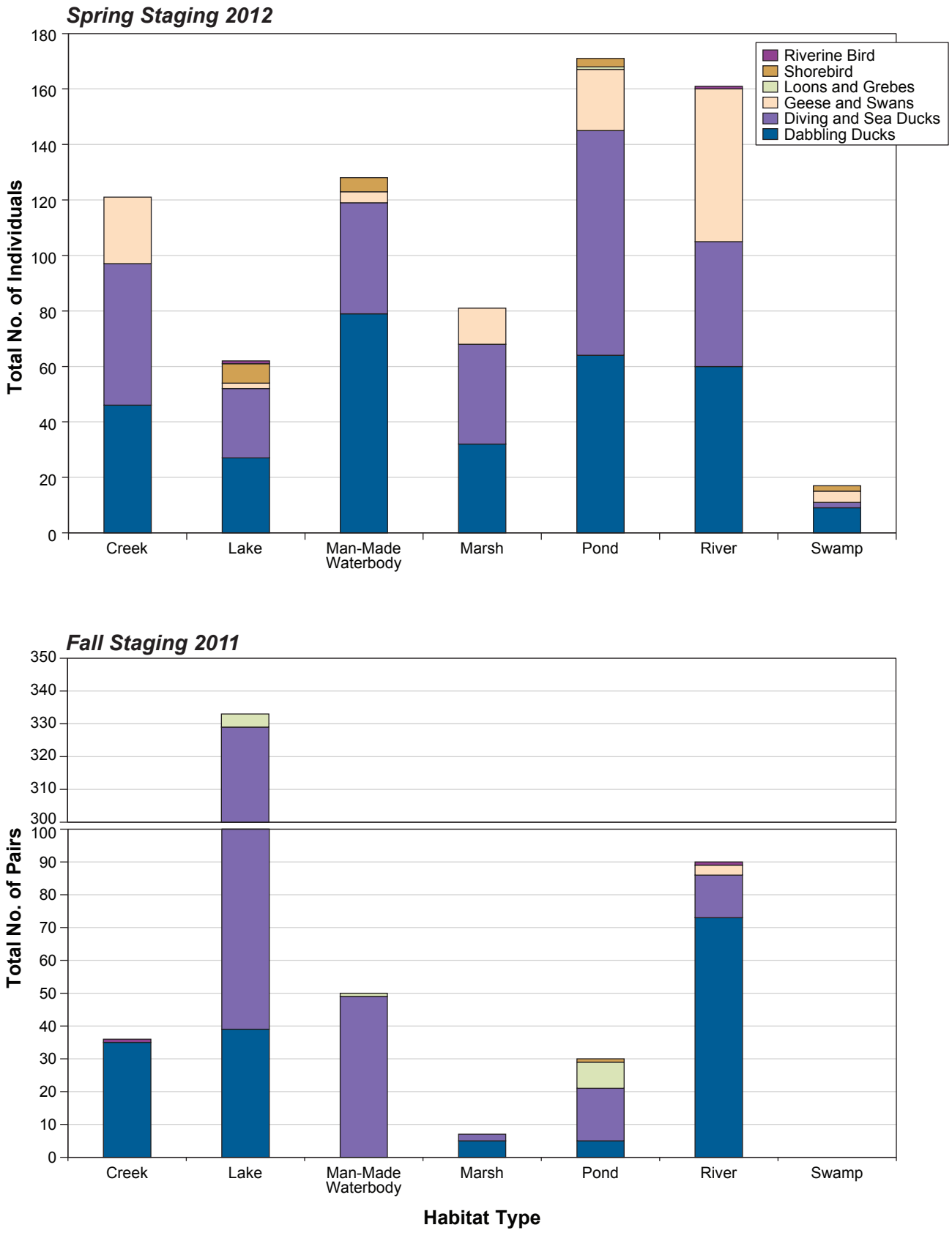


hd Mining | Rescan Engineers & Scientists

MURRAY RIVER COAL PROJECT

Figure 4.3-4

Location and Abundance of Wetland Birds during Spring Staging Aerial Surveys, 2012



MURRAY RIVER COAL PROJECT

Habitat Associations of Wetland Birds during Staging Surveys, 2011 and 2012

Figure 4.3-5

4.3.4.2 Fall Staging Survey

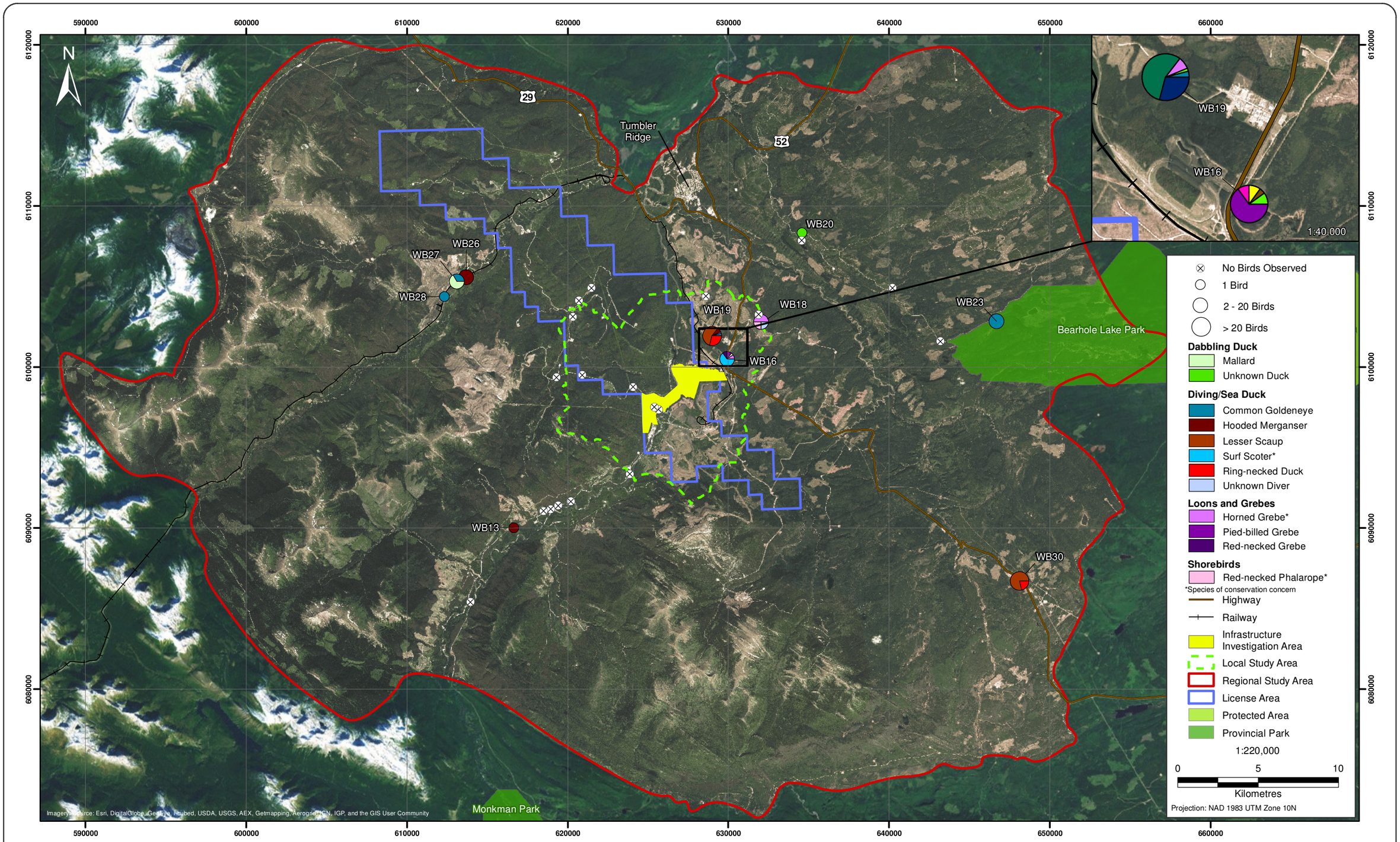
A total of 16 species and 634 individual birds were observed during aerial surveys, ground surveys, and incidentally during the fall staging period (Table 4.3-2; Appendix 4.3-4 to 4.3-7). Six additional wetland bird species were also detected but not identified to species (Table 4.3-2). Diving ducks were the most commonly observed wetland bird group observed, accounting for approximately 68% of bird observations, followed by dabbling ducks (25%). The five most abundant species observed were lesser scaup, mallard, ring-necked duck, surf scoter and hooded merganser (Figure 4.3-2). The largest concentrations of wetland birds were observed within the LSA near the Infrastructure Investigation Area during the ground surveys (Figure 4.3-6). During the aerial surveys, the highest abundance of birds was observed on or near Bearhole Lake in the northeast corner of the RSA and along the southern portion of Murray River within the RSA (Figure 4.3-7).

Wetland birds were detected at 11 of 30 sites during the ground surveys. During both aerial and ground surveys, wetland birds were observed primarily in lake (60%) and river habitat (17%) (Figure 4.3-5). Overall, dabbling ducks and diving and sea ducks exploited the widest range of habitat types compared to the other wetland bird groups.

4.3.4.3 Pre-incubation Survey

A total of 18 species and 419 individual birds were detected in the RSA during aerial surveys, ground surveys, and incidentally during the pre-incubation period (Table 4.3-2; Appendices 4.3-1 to 4.3-3; Figure 4.3-8; Plate 4.3-3). In late May, wetland birds were observed at 63 sites (approximately 70% of the wetlands surveyed). Detections of ring-necked ducks, mallard, and Canada geese comprised approximately half of all wetland bird detections (Figure 4.3-8). One species of conservation concern, a pair of harlequin ducks, was incidentally observed (Table 4.3-2). The largest concentrations of birds occurred along Murray River within the LSA adjacent to the Infrastructure Investigation Area (Figure 4.3-9).

Plate 4.3-3. A breeding pair of ring-necked ducks (left), May 19, 2010.

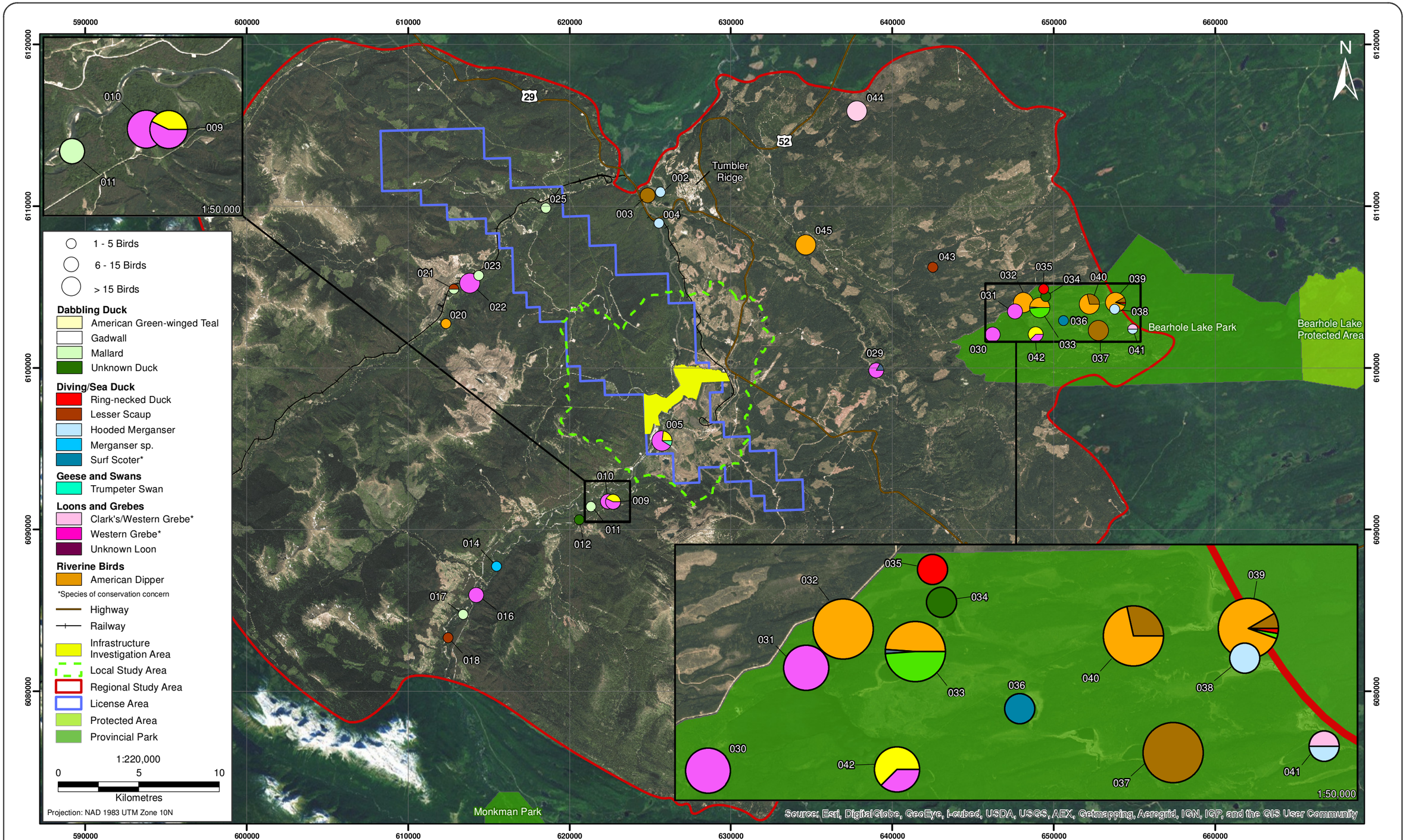


hd Mining Rescan™ Engineers & Scientists

MURRAY RIVER COAL PROJECT

Figure 4.3-6

Location and Abundance of Wetland Birds during Fall Staging Ground Surveys, 2011

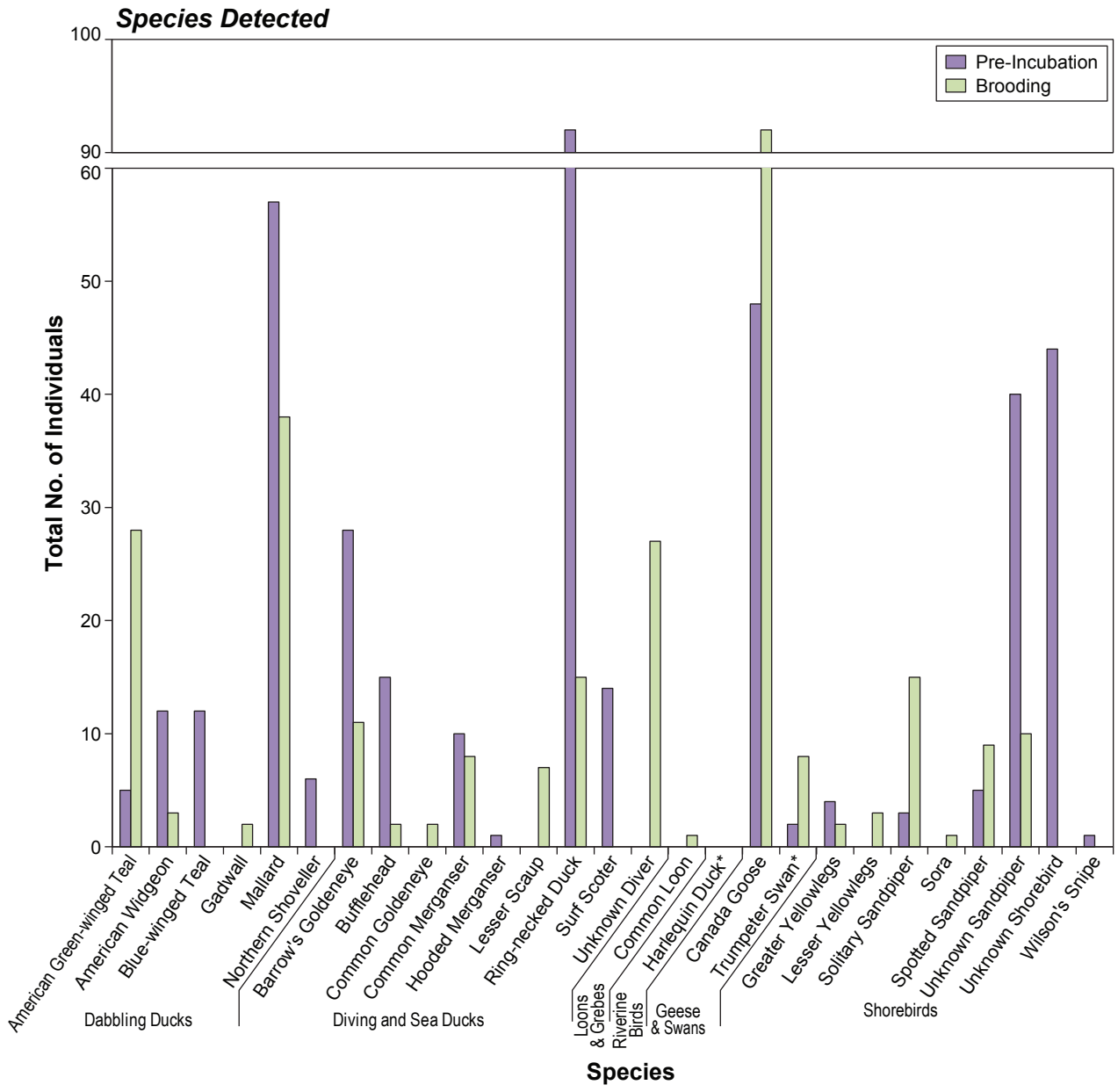


hdMining Rescan™ Engineers & Scientists

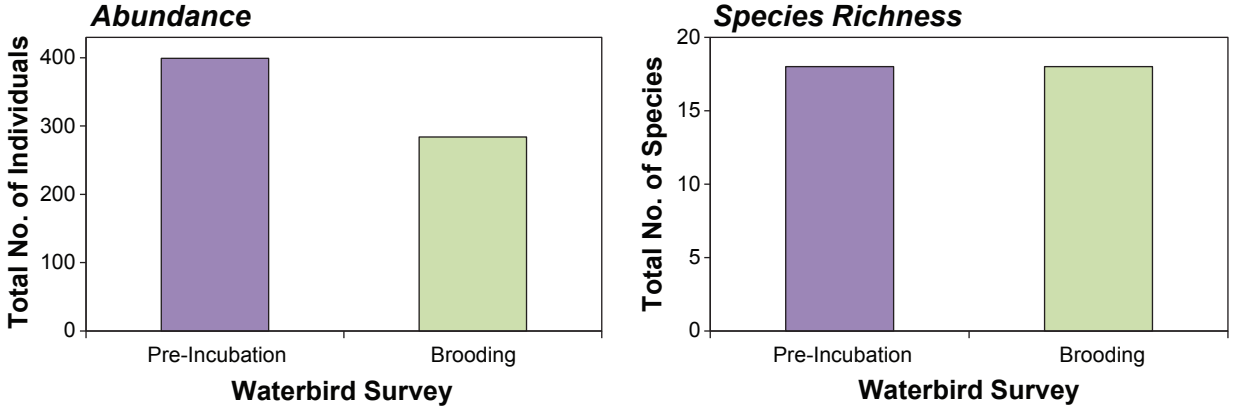
MURRAY RIVER COAL PROJECT

Figure 4.3-7

Location and Abundance of Wetland Birds during Fall Staging Aerial Surveys 2011



*Note: *Species of conservation concern.*



hd Mining | MURRAY RIVER COAL PROJECT

Wetland Bird Species with Species Abundance and Richness during Breeding Surveys, 2010

Figure 4.3-8

Rescan Engineers & Scientists

Wetland birds during ground and aerial surveys were detected primarily in pond (32%), river (21%), and man-made waterbody habitat (18%) (Figure 4.3-10). Diving ducks exploited the widest range of habitat types, followed by dabbling ducks and geese and swans; however, shorebirds were also common, observed in 50% of the habitat types (Figure 4.3-10).

A total of 40 breeding pairs of wetland birds were observed during ground and aerial surveys (Table 4.3-3). The numbers of breeding pairs are likely underestimated because it is difficult to discern pair behaviour and the numbers of pairs within large groups of birds. The majority of pairs detected were mallard, Barrow's goldeneye, and Canada goose. One Canada goose brood and trumpeter swan nest were also detected (Table 4.3-3 and Figure 4.3-9).

Table 4.3-3. Breeding Evidence Observed during Pre-Incubation Surveys, 2010

Group	Species	Pairs*	Brood Size	Brood Class
Dabbling Ducks	American Green-winged Teal	2		
	American Widgeon	3		
	Blue-winged Teal	2		
	Mallard	9		
Diving and Sea Ducks	Barrow's Goldeneye	7		
	Bufflehead	2		
	Ring-necked Duck	5		
Geese and Swans	Canada Goose	7	7	IB
	Trumpeter Swan	2	*No brood yet*	*Nest Found*
Shorebirds	Spotted Sandpiper	1		
Total		**40**	**1**	

**Pairs without broods*

4.3.4.4 Brooding Survey

A total of 18 species and 301 individual birds were detected in the RSA during aerial surveys, ground surveys, and incidentally during the brooding period (Table 4.3-2; Appendices 4.3-1 to 4.3-3; Figure 4.3-8). Wetland birds were observed at a total of 40 sites (approximately 38% of the wetlands surveyed). The most common species observed were Canada goose, mallard, and American green-winged teal (Figure 4.3-8). The largest concentrations of wetland birds occurred near the Infrastructure Investigation Area (Figure 4.3-11).

During the aerial and ground surveys, wetland birds were observed primarily in pond (69%) and man-made waterbody habitat (22%; Figure 4.3-10). No wetland birds were observed in marsh habitat. Diving ducks exploited the largest range of habitat types; however, within pond habitat, dabbling ducks and shorebirds comprised over 75% of the wetland birds observed.

A total of 41 broods from 13 species were observed at 26 locations within the RSA (Table 4.3-4; Figure 4.3-11). The species with the highest number of broods were Canada goose, American green-winged teal, and mallard. Overall, the average number of young per brood ranged from 3 to 9 for all 13 species; however, Canada goose, American green-winged teal, mallard, common merganser, and lesser scaup had broods of 6 or more. Average brood class was 19 to 55 days old (IIA or III) for dabbling ducks and diving ducks and 43 to 60 days old (III or fledged) for Canada geese. The majority of broods were detected in pond and man-made waterbody habitat (Plates 4.3-4 and 4.3-5). Small numbers of broods were also observed in lake, river and swamp habitat. Broods were observed primarily in the LSA adjacent to the Infrastructure Investigation Area (Figure 4.3-11).

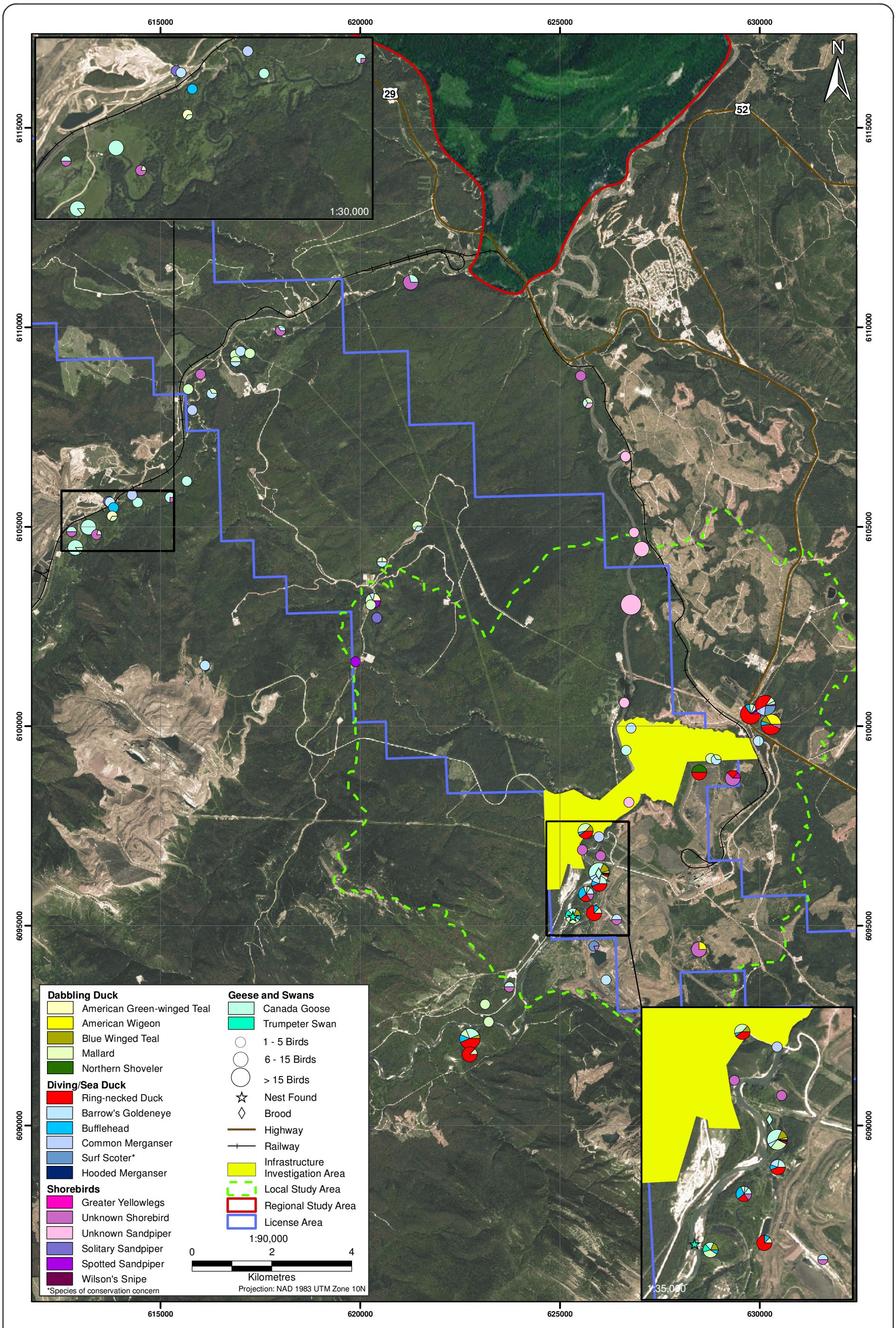


Figure 4.3-9

MURRAY RIVER COAL PROJECT

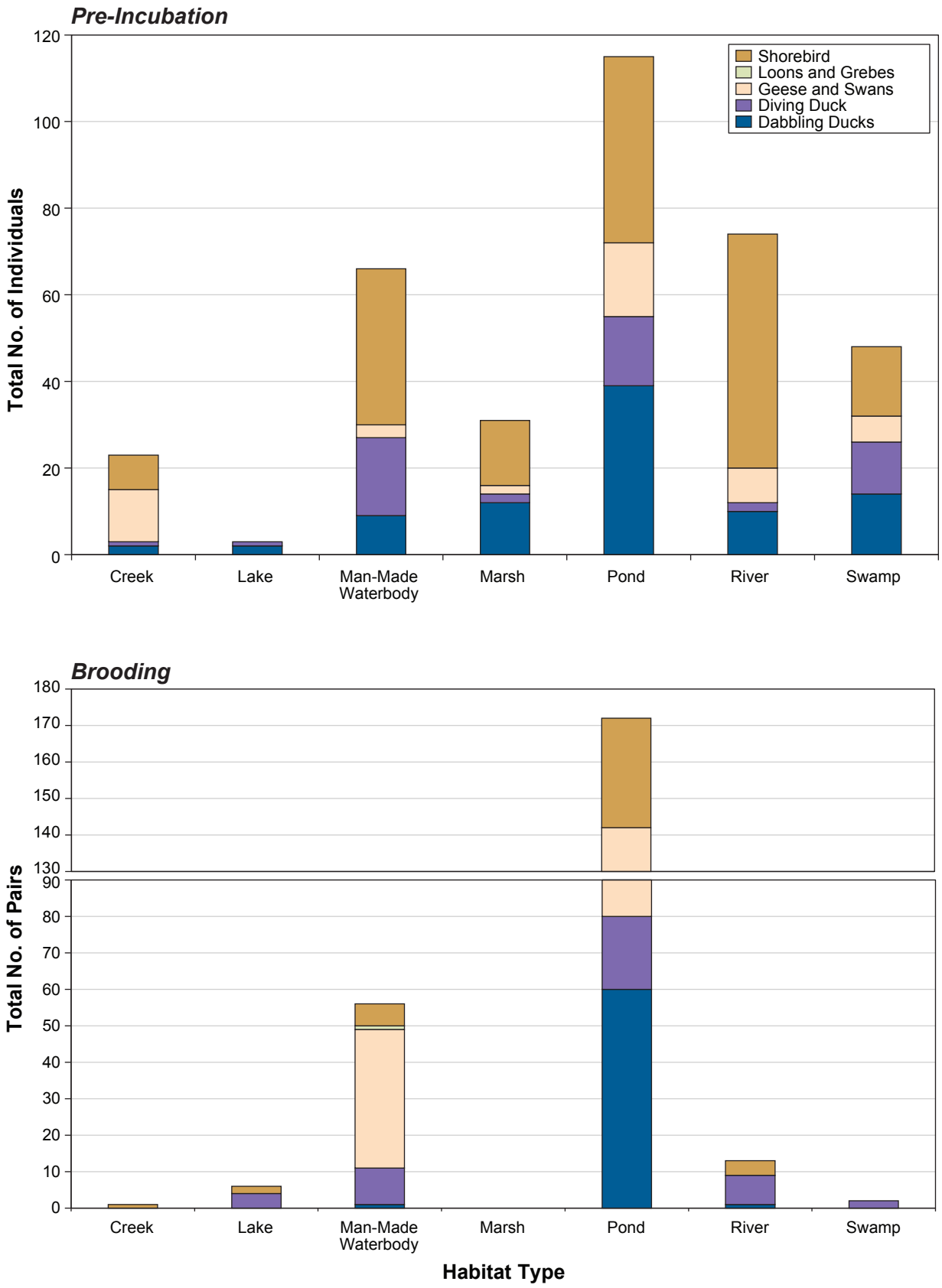
Location and Abundance of Wetland Birds during Pre-Incubation Surveys, 2010

Figure 4.3-9

Rescan Engineers & Scientists

Plate 4.3-4. An example of pond habitat that broods were detected in, July 20, 2010.

Plate 4.3-5. An example of man-made waterbody habitat that broods were detected in, July 23, 2010.



MURRAY RIVER COAL PROJECT

Habitat Associations of Wetland Birds during Breeding Surveys, 2010

Figure 4.3-10

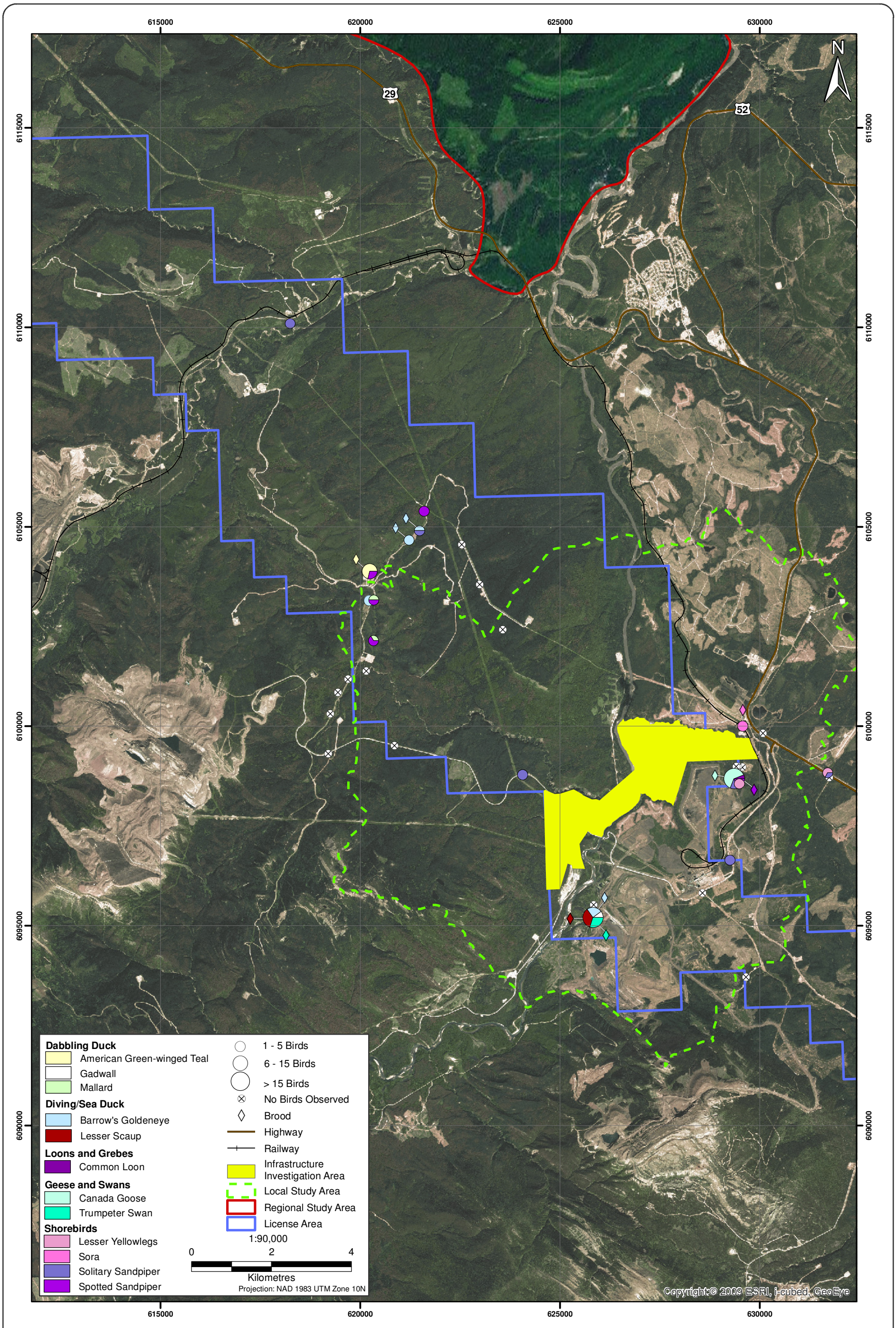


Figure 4.3-11

hdMining

MURRAY RIVER COAL PROJECT

Location and Abundance of Wetland Birds during Brooding Surveys, 2010

Figure 4.3-11

Rescan Engineers & Scientists

Table 4.3-4. Breeding Evidence Observed during Brooding Surveys, 2010

Group	Species	Pairs*	Brood Size†	Brood Class	Total No. Broods
Dabbling Ducks	American Green-winged Teal	-	1, 1	IIC, III	6
			4	IIA	
			5	IIB	
			6, 6	IIA, IIA	
	American Widgeon		3	IIC	1
	Gadwall	1	-	-	-
	Mallard		2	III	5
			3	IIB	
			4	III	
			7, 7	IIA, IIA	
Diving and Sea Ducks	Barrow's Goldeneye		1, 1, 1	IC, IIA, IIB	4
			4	IIB	
	Bufflehead		1	III	1
	Common Goldeneye		1	III	1
	Common Merganser		7	IIB	1
	Lesser Scaup		6	IIA	1
	Ring-necked Duck		3	IB	2
			5	IIA	
	Unknown Diver		1	IIB	5
			2, 2	IIB, IIC	
			3	IIA	
			5	IC	
Geese and Swans	Canada Goose		2	III	11
			3	IIB	
			4	IC	
			6	IIC	
			7	III	
			9, 9, 9, 9, 9	III, III, III, III, III	
			10	IIC	
	Trumpeter Swan*		4	IC	1
Shorebirds	Lesser Yellowlegs	1	-	-	-
	Solitary Sandpiper	2	-	-	-
	Sora		1	IIC	1
	Spotted Sandpiper	3	1	IA	1
Total		**7**			**41**

**Pairs without broods*
†Different broods of the same size are separated by a comma

4.3.4.5 Species of Conservation Concern

A total of five species of conservation concern were identified during wetland bird surveys: surf scoter (BC Blue listed), horned grebe (COSEWIC "Special Concern" species), red-necked phalarope (BC Blue listed and COSEWIC "Candidate" species), Western grebe (BC Red listed and COSEWIC "Candidate" species), and harlequin duck (provincially ranked as vulnerable during the non-breeding season). In addition, thirteen Western or Clark's grebes (BC Red listed) were observed on Bearhole Lake during the fall staging surveys; however, it was not possible to identify individuals to species (Figure 4.3-12).

Most of the species of conservation concern were detected within the LSA adjacent to the Infrastructure Investigation area (Figure 4.3-12); however, harlequin ducks were only detected along Wolverine River within the RSA.

4.3.4.6 Incidental Observations of Wetland Birds and Wildlife

During the spring staging ground and aerial surveys in 2012, seven species of raptors, 20 species of landbirds, eight species of mammals, and one species of amphibian were observed (Appendix 4.3-12). Three active raptor nests and one species of conservation concern, the rusty blackbird, (BC blue-listed, Schedule 1 of *SARA*) were also incidentally observed.

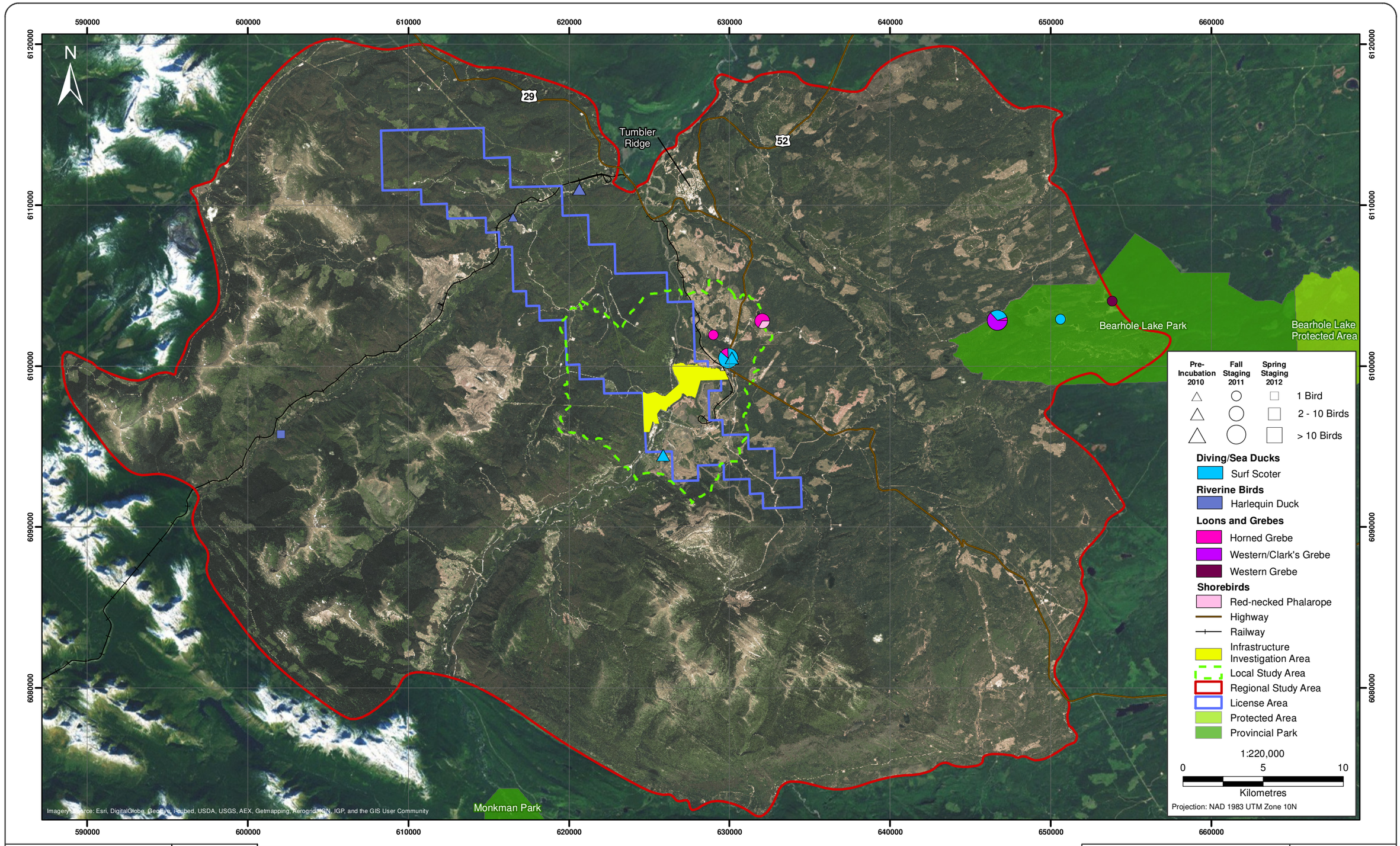
4.3.5 Discussion

A total of 35 species and 2,094 individuals were observed from six wetland bird groups during the waterbird surveys in 2010 – 2012. The most commonly observed species were mallard, lesser scaup, ring-necked duck, Canada goose, Barrow's goldeneye, hooded merganser, and American green-winged teal.

Five waterbird species of conservation concern were detected: surf scoter, horned grebe, Western grebe, red-necked phalarope, and harlequin duck. In addition, a sixth species of concern, Clark's grebe (BC Red listed) was potentially observed during the fall staging aerial surveys; however, it was not possible to confirm to species. Most of these species were observed during fall staging surveys within the LSA, suggesting the LSA provides important staging habitat for species of conservation concern.

The largest abundances of birds were observed during the staging periods (~1280 birds) compared to the breeding period (~680 birds), suggesting that available habitat in the RSA and LSA may be more suitable for staging than for breeding. The high abundance and species richness observed during the staging surveys provide substantive baseline data against which to measure environmental change, and suggests that the spring and fall staging periods may be effective times of the year to monitor potential mine-related effects to waterbirds. Staging areas are important to the overall life cycle of waterbirds because food and rest obtained in these areas provides energy necessary for survival during continued migration and essential nutrient reserves for successful reproduction upon arrival at breeding areas (Ankney and MacInnes 1978; Farmer and Parent 1997).

During fall staging surveys, high bird abundance was observed on lakes in Bearhole Lake Provincial Park (n = 231), along Murray River in the southwest portion of the RSA (n = 85), and near Quality Lake about 5 km southeast of Tumbler Ridge (n = 43). These high abundances indicate that several areas outside the LSA provide high quality fall staging habitat. Within the LSA, however, a sewage treatment cell (WB19) and large, shallow ponds (WB16 and WB18) adjacent to the LSA were also identified as potentially important fall staging habitats (Figure 4.3-6). Ten species and 72 individuals were counted at these sites, three of which were species of conservation concern (surf scoter, horned grebe, and red-necked phalarope). Waterbirds will often use sewage and man-made ponds during the staging or brooding period because benthic invertebrate density is up to five times greater in sewage ponds than in natural ponds (Belanger and Couture 1988). Areas identified as potentially important spring staging habitats within the LSA included the sewage treatment cell previously mentioned, a mine tailings pond located less than 2km east of Murray River, and swamp and marsh habitat along the east side of Murray River directly adjacent to the Infrastructure Investigation Area (Figure 4.3-3 and Figure 4.3-4).



hdMining Rescan™ Engineers & Scientists

MURRAY RIVER COAL PROJECT

Figure 4.3-12

Locations and Abundance of Wetland Bird Species of Conservation Concern, 2010 - 2012

Breeding evidence (broods, nest, or pairs) was confirmed for 20 species at 50 locations. The majority of broods belonged to Canada goose, American green-winged teal, and mallard. A total of 42 broods were detected, the majority of which were observed on pond or man-made waterbody habitats. Preferred brooding habitats are typically associated with calm, low flowing water bordered by dense shrub and tree cover with thick emergent vegetation. A number of ponds and man-made waterbodies within the LSA have these preferred characteristics, which may see continued activity during construction and operations and possibly used as indicators of project related effects. Broods were detected at a total of 13 sites within the LSA, two of which were adjacent to the Infrastructure Investigation Area. No broods of species of conservation concern were detected during breeding surveys; however, surf scoters were observed during the pre-incubation surveys so may potentially be breeding within the LSA.

Some species, such as goldeneye and bufflehead, nest in tree cavities that are naturally formed or excavated by woodpeckers. Cavity-nesting waterfowl require habitat with sufficiently old, large diameter trees, usually softened by fungal degradation, and generally within 800 m from water (Pierre, Bears, and Paszkowski 2001). Families will usually be seen in aquatic habitat in the general vicinity of nest sites until the young are capable of flight (50 to 60 days after hatching). Barrow's goldeneye broods were observed, but not capable of flight, confirming the presence of suitable nesting sites in old-growth trees or sufficiently large trees within the LSA adjacent to the Infrastructure Investigation Area.

The results of the breeding surveys are consistent with other studies previously done in the larger region. For example, Keystone Wildlife Research Ltd. conducted breeding bird surveys in 2002, 2004, and 2005 for the Brule Mine project, located 57 km south of Chetwynd (Western Canadian Coal 2005). They observed a total of five wetland bird species: Canada goose (*Branta canadensis*), common merganser (*Mergus merganser*), sora (*Porzana carolina*), spotted sandpiper (*Actitis macularius*), and Wilson's snipe (*Gallinago delicata*), all of which were observed during this inventory. Alpine Environmental Services conducted breeding bird surveys in June – July 2006 for the Roman Coal Mine project, located 30 km south of Tumbler Ridge. They observed 125 individuals of 13 wetland species: bufflehead, Canada goose, common goldeneye, common merganser, harlequin duck, hooded merganser, lesser yellowlegs (*Tringa flavipes*), mallard, ring-necked duck, solitary sandpiper, sora, spotted sandpiper (*Actitis macularia*), and Wilson's snipe (Peace River Coal Inc. 2010).

4.4 LANDBIRDS

4.4.1 Introduction

Bird species that breed in upland areas are referred to as landbirds (i.e., passerines, hummingbirds, swifts, woodpeckers, ptarmigan and grouse). Landbirds represent an abundant and diverse group that can be surveyed with relative ease (Hutto 1998). Generating baseline information on the distribution, habitat associations, and species composition of the landbird community is useful to measure the health of bird communities. Birds are also considered to be effective indicators of overall ecosystem function and health (Niemi and McDonald 2004). Birds perform important ecological roles (e.g., pollinators), and often respond rapidly to environmental change (Koch, Derver, and Martin 2011). For example, declines in the abundance of birds associated with riparian forests have been used to measure degradation of riparian sites (Rich 2002).

Landbirds and their nests are protected by the federal *Migratory Birds Convention Act* (1994c) and the provincial BC *Wildlife Act* (1996b). Additional conservation measures may be recommended for those species identified by COSEWIC, and are required for those listed under the federal *Species at Risk Act* (SARA (2002b)).

4.4.2 Objectives

The objectives of baseline surveys in the Project area for landbirds were to:

- document the distribution and estimate the relative abundance of landbird species;
- estimate species richness and diversity of the landbird community; and
- determine the presence and breeding activity of landbird species of conservation concern in the LSA.

4.4.3 Methods

4.4.3.1 Variable Radius Point Counts

Compared to other wildlife, the landbird community is easily surveyed because territorial males frequently sing to identify and defend their territories. In some species, both members of breeding pairs use sound to mark territory boundaries (e.g., drumming by woodpeckers). Bird species can be identified by trained observers according to the unique songs and other sounds that breeding pairs make to defend territories.

The Variable Radius Point Count (VRPC) is a common survey technique used to estimate species richness and relative abundance of forest birds (Ralph, Droege, and Sauer 1995). Observers stand quietly at survey stations (point counts) for a specified duration of time and identify all birds seen and heard. To keep track of birds as they move around, bird detections are recorded within 25 m distance bands (or radii), according to their approximate distance from the observer. Using mostly auditory cues, the number of nesting pairs of each species can be counted at each station as a measure of relative abundance, as well as the total number of species detected (species richness). VRPC surveys are conducted when male birds more actively defend territories, which is usually in the morning during the June nesting period.

Upland bird surveys were conducted from June 3 to 9, 2010 following standard VRPC inventory methods for songbirds (RIC 1999a). Surveys were conducted between sunrise (~4:30 a.m.), when birds are most active and sing most frequently, and continued until 10 am when bird activity declines. Point count stations were spaced at least 200 m apart. Surveys were not conducted when wind speeds exceeded approximately 30 km/h (5 on the Beaufort scale) or during rain or snow storms.

After a one to two minute settling time upon arrival at each point count station, observers recorded all birds seen and heard within 100 m for a survey period of five minutes. All bird observations were assigned to a 25 m radius interval (i.e., 0 to 25 m, 25 to 50 m, 50 to 75 m, and 75 to 100 m). Birds flying over the point count station and not landing and birds detected beyond 100 m were recorded as incidental detections but were not included in further analyses. Observers recorded species and the number of individuals. Observations of breeding behaviour, habitat descriptions, and weather were also recorded. Evidence of breeding activity included observations of nests, nest material carries, food carries, faecal sac carries, distraction displays, pair bonding, and copulation. Incidental observations of landbird species that were observed during travel between survey sites and those made during other wildlife field inventories were also recorded and geo-referenced.

4.4.3.2 Study Design

A total of 100 VRPCs were conducted from June 3 to 9, 2010. A total of 20 transects, each 800 m long, were surveyed by a team of two avian biologists (Figures 4.4-1; Appendix 4.4-1). Five point counts were conducted along each transect at 200 m intervals.

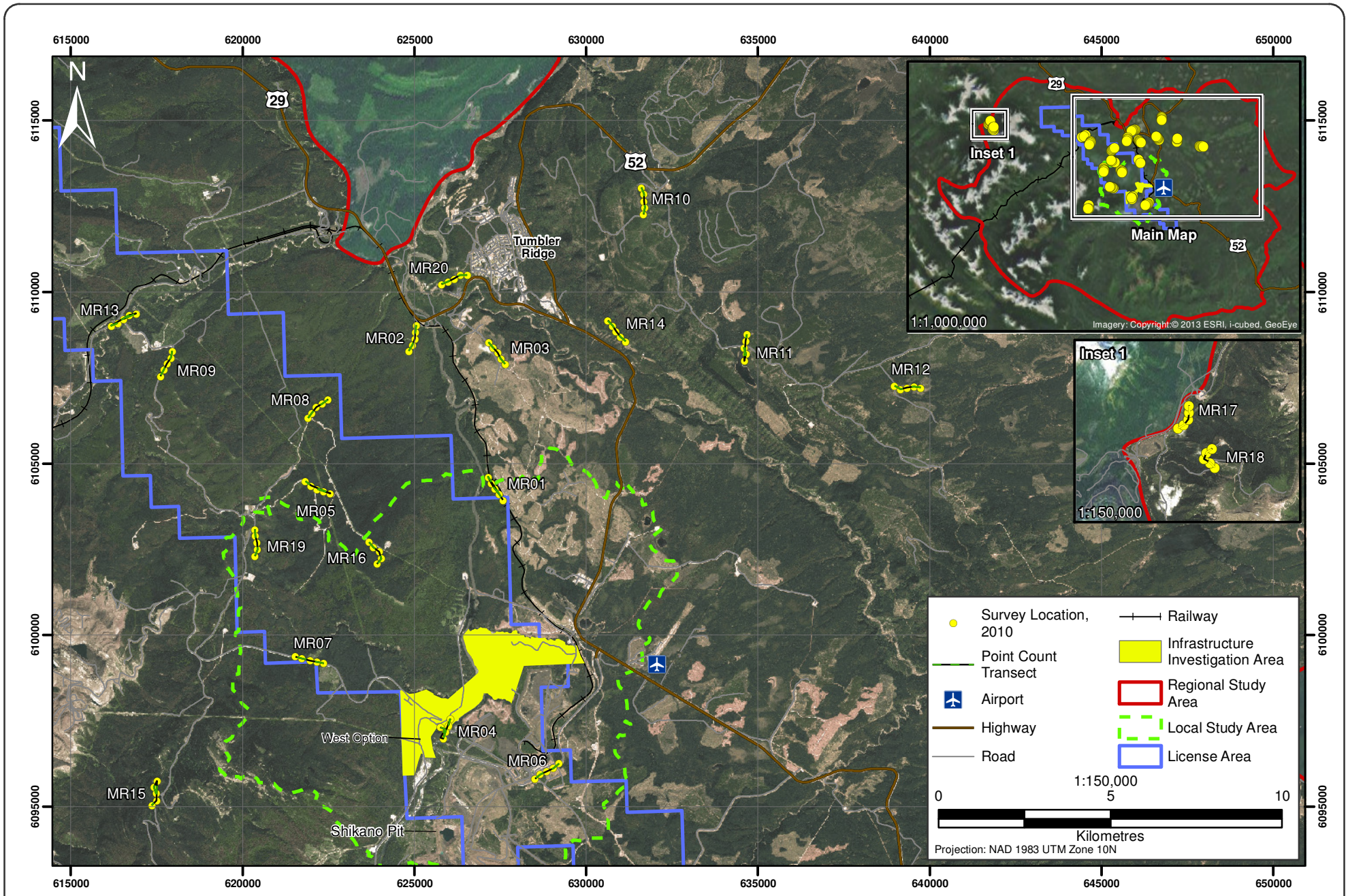


Figure 4.4-1

MURRAY RIVER COAL PROJECT

Landbirds Point Count Survey Locations, 2010

Figure 4.4-1

Rescan Engineers & Scientists

Five transects (25 point count stations) were located in the LSA, and 15 transects (75 point count stations) were located outside the LSA within the RSA. The team drove to a location close to their target transect and stopped at a distance that minimized the flushing of birds from the transect sites. The team then established a starting point of the transect using a handheld Garmin GPS 60 (advertised accuracy 3 to 15 m), and then proceeded for 800 metres along a compass bearing for that transect. Where obstructions (ridges, rivers, etc.) prevented travel along the bearing, a new bearing was taken from that point onward and the new direction of travel was recorded.

4.4.3.3 Data Analysis

The relative abundance of individual species was estimated as the total number of birds detected per species along each transect. The bird community can be described using three metrics - species richness, diversity, and equitability. Species richness was estimated for each transect as the total number of species observed across all point counts. A diversity index such as "Shannon's *H*" is a mathematical measure of species diversity in a community. The Shannon-Weiner index of diversity (*H*) was calculated using the equation:

$$H = -\sum_{i=1}^{s} p_i \ln p_i \qquad \text{or} \qquad H' = -\sum_{i=1}^{s} \frac{n_i}{N} \ln \frac{n_i}{N}$$

where ***S*** is the total number of species in a community (species richness) and p_i is the relative abundance of each species, calculated as the proportion of individuals of a given species (n_i) to the total number of individuals in the community (*N*).

This diversity index takes the relative abundance of different species into account, along with the number of species observed (Magurran 1988; Rosenzweig 1995). As such, diversity indices provide important information about rarity and commonness of species in a community.

Following the calculation of *H*, Shannon's equitability (E_H) was calculated by dividing *H* by H_{max} ($H_{max} = \ln S$). Equitability assumes a value between 0 and 1 with 1 being complete evenness (i.e., roughly equivalent numbers of birds belonging to each species recorded). The formula for Shannon's equitability is presented below.

$$E_H = \frac{H'}{H_{\max}} = \frac{H'}{\ln S}$$

Equitability is defined as the degree to which species are equally abundant (Reitz and Wing 1999) and also provides information about bird community composition. Areas with an even distribution of abundance among taxa have a higher diversity than samples with the same number of taxa, but with disproportionately high abundance of a few taxa. More taxonomic categories lead to greater diversity values when samples show the same degree of equitability in abundance (Reitz and Wing 1999).

4.4.3.4 Habitat Associations

To identify habitats that support a diverse bird community, average species diversity and equitability was compared among habitat types. Five general habitat categories were identified within the Murray River area: coniferous forest, deciduous forest, mixed coniferous/deciduous forest, riparian/wetland habitat, and disturbed habitat (Appendix 4.4-1). To compare these metrics among habitat types, the data were analysed using mixed-effects linear models with a normal error distribution. Transect location was entered as a random effect in the model and habitat type was entered as a fixed effect.

This allowed comparing the metrics across habitat types while considering the spatial proximity of point count locations along the same transect. Statistical effects of habitat type on each metric were assessed with F tests.

4.4.4 Results

4.4.4.1 Point Count Surveys

Overall, 60 species (685 individual birds) were observed during point count surveys (Figure 4.4-2; Table 4.4-1; Appendix 4.4-2). Including incidental observations, a total of 72 landbird species (1,048 individual birds) were identified (Appendices 4.4-2 and 4.4-3). The five most abundant species were yellow-rumped warbler, Swainson's thrush, warbling vireo, Wilson's warbler, and white-throated sparrow (Figure 4.4-2; Table 4.4-1). A colony of cliff swallows was observed near existing mine infrastructure. Only one individual was detected from 13 of the identified species: blue-headed vireo, brown creeper, downy woodpecker, golden-crowned sparrow, red-eyed vireo, Townsend's solitaire, violet-green swallow, white-crowned sparrow, winter wren, yellow-bellied flycatcher, blackpoll warbler, pileated woodpecker, and spruce grouse (Figure 4.4-2).

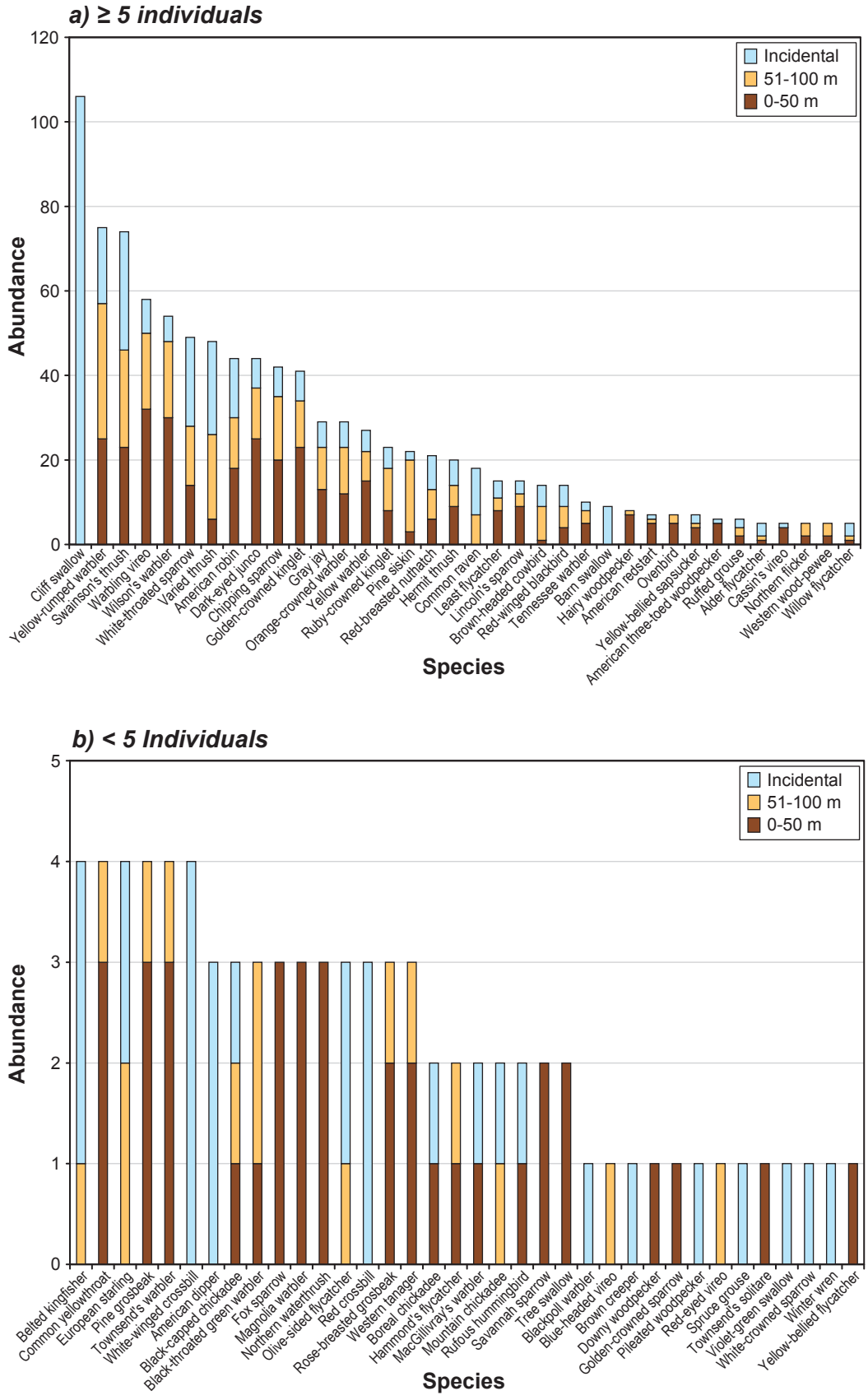
The highest species richness was observed along transects MR20, MR04, and MR14, where 20 or more species were detected (Figure 4.4-3a). The highest abundance was observed along transects MR20, MR14, and MR12, where 45 or more individual birds were observed (Figure 4.4-3a). Transect MR20, which had the highest species richness and abundance, was located just outside of the town of Tumbler Ridge. Transect MR04 was located at the Murray River Bridge adjacent to the Infrastructure Investigation Area on the west side of the river. Transects MR12 and MR14 were located to the east of Tumbler Ridge; MR14 was located on the west slope of the Tumbler Ridge landform and MR12 was located on the plateau to the east of the Tumbler Ridge landform (Figure 4.4-1).

Species diversity (using Shannon's *H* diversity index) varied per transect in the RSA. Transects MR04, MR14, MR20, and MR03 had the highest Shannon's *H*, with values greater than 2.7 (Figure 4.4-3b). All but one of the remaining transects had Shannon's *H* diversity values greater than 2.0. The equitability values of all sites were between 0.86 and 0.96 (Figure 4.4-3b), indicating that the majority of transects had relatively equal abundances of birds across detected species (i.e., one or two species did not make up most of the birds seen; rather the species were equally represented).

4.4.4.2 Habitat Associations

To gain a perspective of avian community composition and distribution in the area, species diversity and equitability were analyzed by habitat types (Plates 4.4-1 to 4.4-5). Given the amount of forestry activity in the region, each of the forested habitat categories (coniferous, deciduous, and mixed) were represented by different ages of forests (Plates 4.4-1 to 4.4-3). The disturbed habitat category included all regenerating clear cuts as well as other anthropogenic habitats (e.g., roads, existing buildings; Plate 4.4-5).

There were no significant differences in species diversity and equitability among habitat types (Table 4.4-2). Sample sizes per habitat type were uneven, particularly for deciduous forest, which was a relatively rare habitat type within the RSA. Therefore, analyses are interpreted with caution, as results may have been influenced by sampling effort.

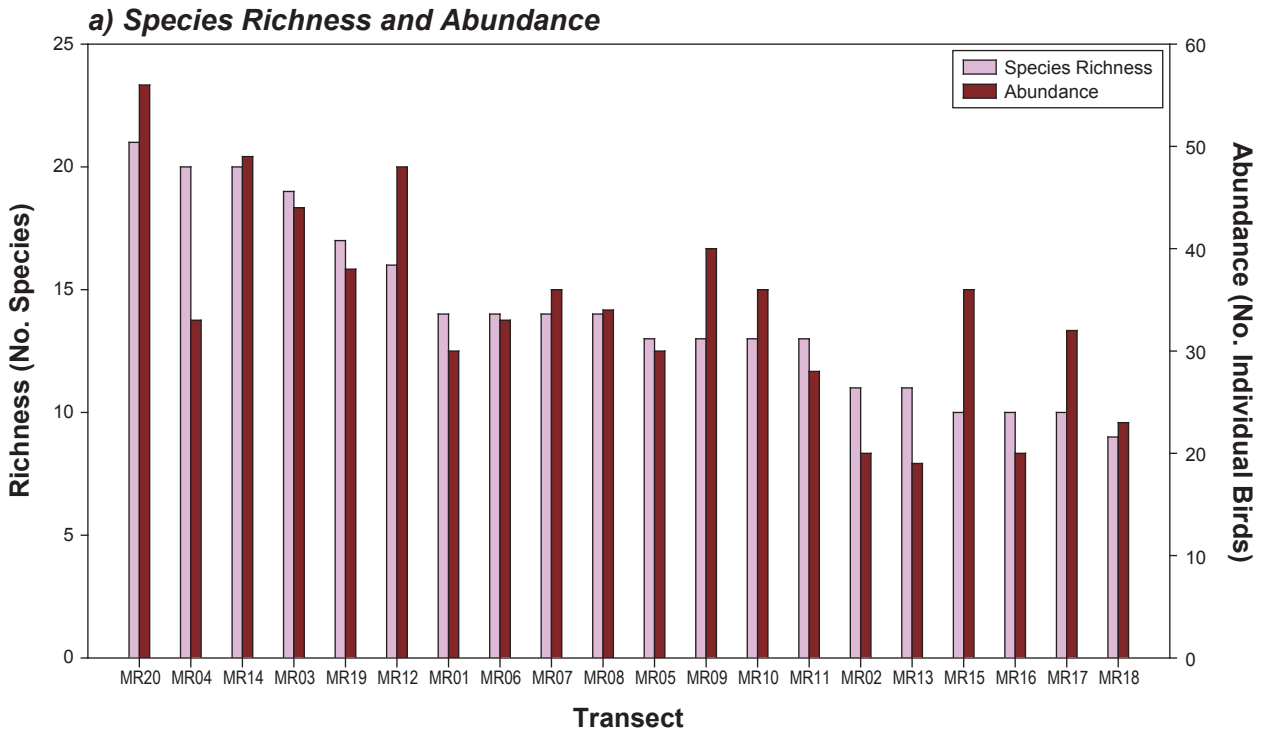


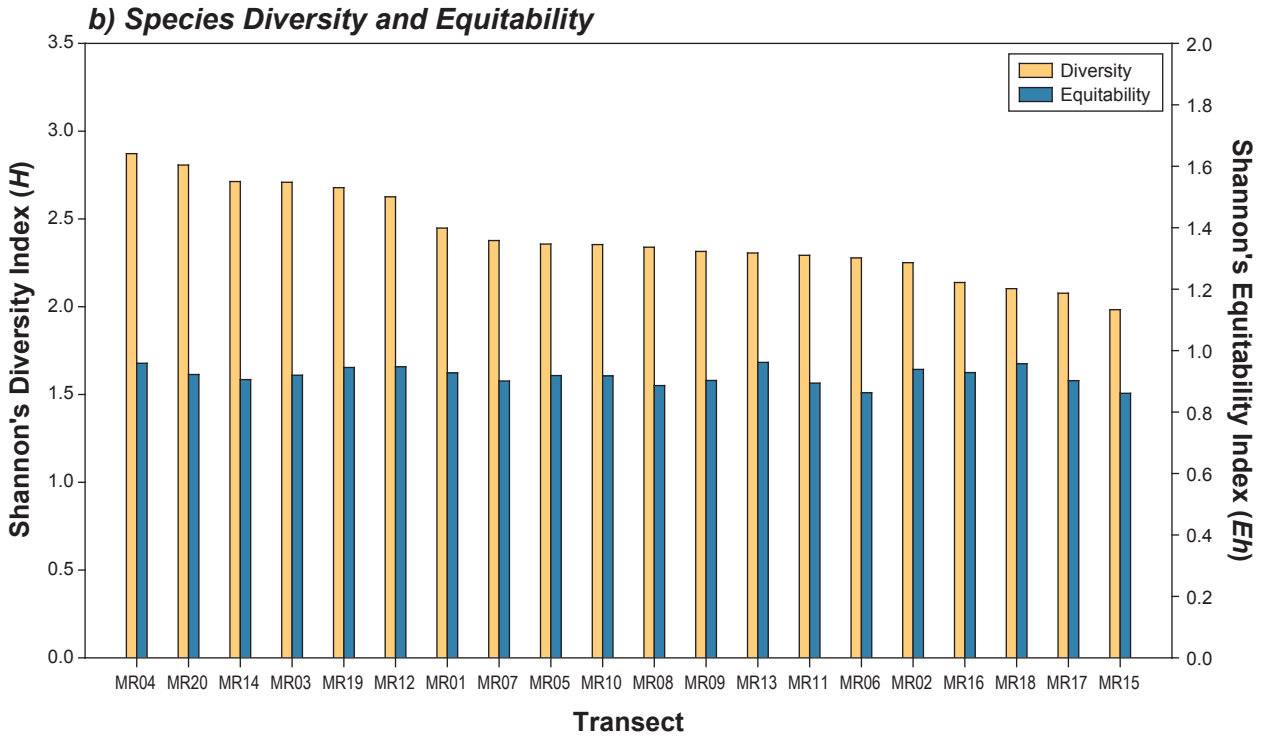
hd Mining | MURRAY RIVER COAL PROJECT

Landbird Species Detected during Point Count Surveys and Incidentally

Figure 4.4-2

Rescan™ Engineers & Scientists





hd Mining | MURRAY RIVER COAL PROJECT

Landbird Species Richness, Abundance, Diversity, and Equitability Observed along Transects during Point Count Surveys, 2010

Figure 4.4-3

Rescan™ Engineers & Scientists

Table 4.4-1. Landbird Species Observed during Point Count Surveys, 2010

Common Name	Scientific name	No. Observed	Incidental Obs.	Total Observed	Evidence of Breeding
Alder flycatcher	*Empidonax alnorum*	2	3	5	-
American dipper	*Cinclus mexicanus*	0	3	3	-
American redstart	*Setophaga ruticilla*	6	1	7	-
American robin	*Turdus migratorius*	30	14	44	Y
American three-toed woodpecker	*Picoides dorsalis*	5	1	6	-
Barn swallow	*Hirundo rustica*	0	9	9	Y
Belted kingfisher	*Megaceryle alcyon*	1	3	4	-
Black-capped chickadee	*Poecile atricapillus*	2	1	3	-
Blackpoll warbler	*Dendroica striata*	0	1	1	-
Black-throated green warbler	*Dendroica virens*	3	0	3	-
Blue-headed vireo	*Vireo solitarius*	1	0	1	-
Boreal chickadee	*Poecile hudsonica*	1	1	2	-
Brown creeper	*Certhia americana*	0	1	1	-
Brown-headed cowbird	*Molothrus ater*	9	5	14	-
Cassin's vireo	*Vireo cassinii*	4	1	5	-
Chipping sparrow	*Spizella passerina*	35	7	42	Y
Cliff swallow	*Petrochelidon pyrrhonota*	0	106	106	Y
Common raven	*Corvus corax*	7	11	18	Y
Common yellowthroat	*Geothlypis trichas*	4	0	4	-
Dark-eyed junco	*Junco hyemalis*	37	7	44	Y
Downy woodpecker	*Picoides pubescens*	1	0	1	-
European starling	*Sturnus vulgaris*	2	2	4	-
Fox sparrow	*Passerella iliaca*	3	0	3	-
Golden-crowned kinglet	*Regulus satrapa*	34	7	41	-
Golden-crowned sparrow	*Zonotrichia atricapilla*	1	0	1	-
Gray jay	*Perisoreus canadensis*	23	6	29	-
Hairy woodpecker	*Picoides villosus*	8	0	8	-
Hammond's flycatcher	*Empidonax hammondii*	2	0	2	-
Hermit thrush	*Catharus guttatus*	14	6	20	-
Least flycatcher	*Empidonax minimus*	11	4	15	-
Lincoln's sparrow	*Melospiza lincolnii*	12	3	15	-
MacGillivray's warbler	*Oporornis tolmiei*	1	1	2	-
Magnolia warbler	*Dendroica magnolia*	3	0	3	-
Mountain chickadee	*Poecile gambeli*	1	1	2	-
Northern flicker	*Colaptes auratus*	5	0	5	-
Northern waterthrush	*Seiurus noveboracensis*	3	0	3	-
Olive-sided flycatcher	*Contopus cooperi*	1	2	3	-
Orange-crowned warbler	*Vermivora celata*	23	6	29	-

(continued)

Table 4.4-1. Landbird Species Observed during Point Count Surveys, 2010 (completed)

Common Name	Scientific name	No. Observed	Incidental Obs.	Total Observed	Evidence of Breeding
Ovenbird	*Seiurus aurocapilla*	7	0	7	-
Pileated woodpecker	*Dryocopus pileatus*	0	1	1	-
Pine grosbeak	*Pinicola enucleator*	4	0	4	-
Pine siskin	*Carduelis pinus*	20	2	22	-
Red crossbill	*Loxia curvirostra*	0	3	3	-
Red-breasted nuthatch	*Sitta canadensis*	13	8	21	-
Red-eyed vireo	*Vireo olivaceus*	1	0	1	-
Red-winged blackbird	*Agelaius phoeniceus*	9	5	14	-
Rose-breasted grosbeak	*Pheucticus ludovicianus*	3	0	3	-
Ruby-crowned kinglet	*Regulus calendula*	18	5	23	-
Ruffed grouse	*Bonasa umbellus*	4	2	6	-
Rufous hummingbird	*Selasphorus rufus*	1	1	2	-
Savannah sparrow	*Passerculus sandwichensis*	2	0	2	-
Spruce grouse	*Falcipennis canadensis*	0	1	1	-
Swainson's thrush	*Catharus ustulatus*	46	28	74	-
Tennessee warbler	*Vermivora peregrina*	8	2	10	-
Townsend's solitaire	*Myadestes townsendi*	1	0	1	-
Townsend's warbler	*Dendroica townsendi*	4	0	4	-
Tree swallow	*Tachycineta bicolor*	2	0	2	Y
Varied thrush	*Ixoreus naevius*	26	22	48	-
Violet-green swallow	*Tachycineta thalassina*	0	1	1	-
Warbling vireo	*Vireo gilvus*	50	8	58	Y
Western tanager	*Piranga ludoviciana*	3	0	3	-
Western wood-pewee	*Contopus sordidulus*	5	0	5	-
White-crowned sparrow	*Zonotrichia leucophrys*	0	1	1	-
White-throated sparrow	*Zonotrichia albicollis*	28	21	49	-
White-winged crossbill	*Loxia leucoptera*	0	4	4	-
Willow flycatcher	*Empidonax traillii*	2	3	5	-
Wilson's warbler	*Wilsonia pusilla*	48	6	54	-
Winter wren	*Troglodytes troglodytes*	0	1	1	-
Yellow warbler	*Dendroica petechia*	22	5	27	-
Yellow-bellied flycatcher	*Empidonax flaviventris*	1	0	1	-
Yellow-bellied sapsucker	*Sphyrapicus varius*	5	2	7	Y
Yellow-rumped warbler	*Dendroica coronata*	57	18	75	-
Total		685	363	1,048	-

a) intermediate age coniferous forest (Transect MR05)

b) older growth coniferous forest (Transect MR01)

Plate 4.4-1. Examples of coniferous forests sampled during point count surveys.

a) intermediate age deciduous forest (Transect MR02)

b) older growth deciduous forest (Transect MR20)

Plate 4.4-2. Examples of deciduous forests sampled during point count surveys.

a) intermediate age mixed coniferous/deciduous forest (Transect MR02)

b) older growth mixed coniferous/deciduous forest (Transect MR14)

Plate 4.4-3. Examples of mixed forests sampled during point count surveys.

a) Riparian/wetland habitat along the Wolverine River (Transect MR13).

b) Riparian/wetland habitat adjacent to Murray River (Transect MR04).

Plate 4.4-4. Examples of riparian/wetland habitats sampled during point count surveys.

Table 4.4-2. Means and Standard Errors of Species Diversity and Equitability by Habitat Type

Habitat Type (No. Point Counts)	Diversity (Shannon's *H*)	Equitability (E_H)
Coniferous Forest (N=28)	1.34 (0.13)	0.96 (0.01)
Deciduous Forest (N=7)	1.85 (0.26)	0.97 (0.01)
Mixed Forest (N=23)	1.40 (0.15)	0.97 (0.01)
Riparian/Wetland (N=18)	1.47 (0.17)	0.97 (0.01)
Disturbed/Anthropogenic (N=24)	1.61 (0.14)	0.95 (0.01)

Despite the lack of statistically significant differences in bird community structure among habitat types, some species were only found in a single habitat type (Table 4.4-3). For example, eight species were recorded in coniferous forests or in riparian/wetland habitats that were not detected in any other habitat type. Detections of between one to four species were unique to one of the other habitat types (Table 4.4-3).

Table 4.4-3. Species Richness and Unique Species Detections by Habitat Type

Habitat Type	Species Richness	Species Only Detected in One Habitat Type
Coniferous Forest	33	blue-headed vireo, boreal chickadee, downy woodpecker, fox sparrow, golden-crowned sparrow, hermit thrush, pine grosbeak, and yellow-bellied flycatcher
Deciduous Forest	24	belted kingfisher, rose-breasted grosbeak
Mixed Forest	30	black-throated green warbler
Riparian/Wetland	31	common yellowthroat, Hammond's flycatcher, MacGillivray's warbler, magnolia warbler, northern waterthrush, red-winged blackbird, rufous hummingbird, tree swallow
Disturbed/Anthropogenic	33	European starling, olive-sided flycatcher, red-eyed vireo, savannah sparrow

a) first year clear cut with several retention patches[1] (in background) (Transect MR03)

b) regenerating clear cut (approx. 9 years) with large retention patch (in background) (Transect MR12)

c) regenerating clear cut (approx. 15-20 years) (Transect MR10)

d) grass/short shrub (maintained) habitat near existing mine infrastructure (Transect MR06)

Plate 4.4-5. Examples of disturbed/anthropogenic habitats sampled during point count surveys.

4.4.4.3 Evidence of Breeding

Evidence of breeding was recorded for nine species in 2010 (Table 4.4-1). An American robin eggshell was observed along Transect MR08, located just outside the northern edge of the LSA (Figure 4.4-1). A pair of warbling vireos was also observed along Transect MR08, displaying behaviours indicative of a nearby nest. A swallow colony was observed along Transect MR06 under the eaves of existing mine infrastructure in the southern portion of the LSA. The majority of individuals within this colony were cliff swallows (~100 individuals), and there were several barn swallows using this location for breeding as well. A copulation display by a pair of chipping sparrows was observed along Transect MR12 as well as a dark-eyed junco nest with four eggs (Plate 4.4-6). MR12 was located in the eastern RSA. Nestling common ravens were also heard to the south of Transect MR12 but the nest location was not confirmed

1 Retention patches, or reserves, are individual trees or groups of trees retained during harvest, or other forest management operations, to provide non-timber values such as wildlife habitat, aesthetics, and biodiversity BC MOF (1995). Biodiversity Guidebook. Victoria, BC, BC Ministry of Forests, Forest Practices Code Guidebooks.

to avoid disturbing the young. A pair of tree swallows flew out of a hollow tree stump in a swamp along Transect MR19 in the northern LSA. This stump had suitable microhabitat characteristics to support a nesting site for the pair. A tree cavity nest excavated by a yellow-bellied sapsucker, along with an adult and juvenile, were found along Transect MR01 on the eastern edge of the LSA.

Plate 4.4-6. Dark-eyed junco nest with four eggs observed along Transect MR12.

4.4.4.4 Species of Conservation Concern

Three species detected during point counts are of conservation concern: olive-sided flycatcher, barn swallow, and black-throated green warbler. All three species are listed as “Special Concern” on the BC Blue list. In addition, the barn swallow is considered “Threatened” by COSEWIC, and the olive-sided flycatcher is listed as “Threatened” on Schedule 1 of SARA, and “Near Threatened” on the 2010 IUCN Red List.

4.4.5 Discussion

A total of 72 landbird species were identified in the RSA during the 2010 baseline study. The most commonly observed species (including incidentals) were cliff swallow, yellow-rumped warbler, Swainson's thrush, warbling vireo, Wilson’s warbler, and white-throated sparrow. The most diverse species communities were observed along transects MR20, MR04, MR14, and MR03. Transect MR04 is located next to the Infrastructure Investigation Area; the remaining three transects are located outside the LSA within the RSA. Evidence of breeding was recorded within the LSA for the tree swallow, cliff swallow, barn swallow, and yellow-bellied sapsucker.

The majority of species recorded during point count surveys or incidentally in 2010 have also been detected in nearby areas over the course of a six year Breeding Bird Survey (BBS) within Tree Farm Licence (TFL) 48 (Westcam 2008). The number of species detected during this 2010 baseline study (72 species) is comparable to that recorded during the BBS in TFL 48 (95 species), particularly when survey effort is compared between these two inventories (one year vs. six years).

Songbird diversity and abundance is frequently correlated with vegetation structure (Whelan 2001; Peak and Thompson 2006). To test whether certain habitats supported a more diverse bird community, average species diversity and equitability were compared among five habitat types. There were no statistical differences among habitat types; however, the data suggest a pattern of lower species diversity in conifer forests compared to the other habitat types.

Several species were detected exclusively in only one of the five habitat types. Three of the eight species (pine grosbeak, boreal chickadee, golden-crowned sparrow) detected only in coniferous forests exhibit a preference for that habitat in BC (Campbell et al. 2001; Lab of Ornithology Cornell 2010). One of the two species recorded only in deciduous forests (rose-breasted grosbeak) are often found nesting in deciduous forests (Lab of Ornithology Cornell 2010). The black-throated green warbler was the only species detected exclusively in mixed wood forests, consistent with findings elsewhere in northeastern BC (Cooper, Enns, and Shepard 1997). Four of the eight species (common yellowthroat, red-winged blackbird, northern waterthrush, and tree swallow) detected only in riparian/wetland habitats are associated with water and riparian areas for breeding and foraging (Campbell et al. 2001; Lab of Ornithology Cornell 2010). The European starling, savannah sparrow, and olive-sided flycatcher were only recorded in disturbed habitats, and these species typically prefer modified, open, or transitional habitat (e.g., habitat edges). For example, European starlings in North America are rarely found in natural habitats and breed in or near urban areas (several individuals were observed along Transect MR06 by existing mine infrastructure) (Campbell et al. 2001; Lab of Ornithology Cornell 2010). Savannah sparrows are a grassland species, foraging and breeding in open meadows, pastures, and grasslands such as those surrounding existing mine infrastructure (Transect MR06; Plate 4.4-6) (Campbell et al. 2001). Olive-sided flycatchers are often associated with natural or modified forest openings (e.g., cutblocks) (Campbell et al. 1997).

Three species of conservation concern were observed in 2010: olive-sided flycatcher, barn swallow, and black-throated green warbler. Both barn swallow and olive-sided flycatcher were detected within the LSA, whereas the black-throated green warblers were only detected outside the LSA. Other species of conservation concern (bay-breasted warbler, Canada warbler, Cape May warbler, Connecticut warbler, and rusty blackbird) were detected during a roadside survey in TFL 48 (Westcam 2008) and also likely breed in the Murray River area.

In Canada, the olive-sided flycatcher population is estimated to have declined by 79% from 1968 to 2006, and 29% from 1996 to 2006; however, the cause of this decline remains uncertain (COSEWIC 2007). During surveys in 2010, three olive-sided flycatchers were found. These birds were primarily associated with edge habitats; two olive-sided flycatchers were detected within the LSA in retention patches or in snags that were left as wildlife trees in recent clear cuts. The remaining olive-sided flycatcher was observed along a transmission line right-of-way (ROW) near the northern edge of the RSA. Olive-sided flycatchers are generally found in open coniferous forests and in natural (e.g., wetlands, burned areas) or artificial edge habitats (e.g., clear cuts) (Campbell et al. 1997; COSEWIC 2007). The presence of snags is an important habitat feature for both foraging and breeding purposes. Olive-sided flycatcher nests are often placed in conifers, predominately Douglas fir (*Pseudotsuga menziesii*), but also white spruce (*Picea glauca*) and Engelmann spruce (*Picea engelmannii*) (Campbell et al. 1997; COSEWIC 2007).

Barn swallow populations in Canada underwent an average decline of 1.6% annually from 1966 to 1996 (Campbell et al. 1997). Within the province, coastal populations appear to be of greater concern, with declines averaging 3.6% per year from 1968 to 1993 whereas interior populations did not show any change during the same time period (Campbell et al. 1997). The causes of decline are not well known; however, the conversion of agricultural areas that provide swallows with nesting opportunities in barns and other structures to rural housing has been suggested as one potential source of decline in this

species (SCCP 2010). A total of nine barn swallows were observed during surveys in 2010, six of which were observed within a colony along Transect MR06 in the southern LSA. The remaining three individuals were observed incidentally on July 25 during waterfowl surveys within the LSA. Barn swallows have adapted to living in urban areas and place nests on vertical surfaces on artificial structures, such as under the eaves of buildings, in culverts, and under bridges. This species will also use natural landforms such as caves and cliff crevices for nesting (Campbell et al. 1997; Brown and Brown 1999).

Across their North American range, breeding bird survey data show a relatively stable population of black-throated green warblers (Morse and Poole 2005); however, there is evidence to suggest that warblers in northeastern BC, including black-throated green warbler, are in decline (Siddle 1992). Within the province, the range of black-throated green warblers is restricted to the boreal forest in the Peace Region and province wide population trends are lacking (BC MWLAP 2004c). The logging of late seral stage and old growth mixed wood forests has been identified as one of the primary threats to the long-term longevity of the species in the province (BC MWLAP 2004c). Three black-throated green warblers were detected during points count surveys in 2010, all of which were recorded along Transect MR14 in an older growth mixed forest along the Tumbler Ridge landform outside of the LSA. Black-throated green warblers appear to be highly dependent on mature to old-growth white spruce and mixed wood forests for breeding habitat in BC (Cooper, Enns, and Shepard 1997). Across their range, black-throated green warbler nests are often placed in conifers although deciduous trees may also be used, and mature trees are preferred over younger trees (Baicich and Harrison 1997).

5. Amphibian Community

Rescan™
Engineers and Scientists

5. Amphibian Community

5.1 OVERVIEW

Five amphibian species occur in the Peace region: the Columbia spotted frog (*Rana luteiventris*), the long-toed salamander (*Ambystoma macrodactylum*), the wood frog (*Lithobates sylvaticus*), the boreal chorus frog (*Pseudacris maculata*), and the western toad (*Anaxyrus boreas*). Four of these five species are not listed as species at risk at the provincial or federal levels. The Western toad is federally listed on Schedule 1 of SARA as a species of "Special Concern", due to rapid population declines in southern parts of range and its vulnerability to habitat deterioration (COSEWIC 2002a). Hence, survey effort of baseline field studies for amphibians focused on the western toad.

5.2 WESTERN TOADS

5.2.1 Introduction

Western toads are one of the few amphibian species to occupy alpine areas and can be found from sea level up to 3,660 m elevation (Wind and Dupuis 2002). They reach their highest densities at aquatic breeding sites where adults congregate during the spring to breed. Tadpoles remain in aquatic areas until mid to late summer when metamorphosis occurs, while adults spend the majority of their life cycle in terrestrial areas (BC Frogwatch 2006; CARCNET 2011). Therefore, like many aquatic-breeding amphibian species, the habitat requirements of western toads are biphasic (i.e., have two phases) (Trenham and Shaffer 2005).

The western toad is protected under the British Columbia *Wildlife Act* (1996b), which states that western toads cannot be killed, collected, or held in captivity without a permit. Western toads are also federally protected under SARA, and are listed as "Near Threatened" by the International Union for the Conservation of Nature Red List (IUCN) (IUCN; Hammerson, Santos-Barrera, and Muths 2004).

5.2.2 Objectives

Due to the conservation status of western toads and their potential sensitivity to development, a study was designed to assess the distribution and breeding status of western toads within the RSA. Specifically, the objectives of the western toad survey were to:

- conduct an aerial reconnaissance survey for ponds where western toads are likely to breed;
- survey ponds from the ground within the LSA and RSA to document evidence of western toad breeding; and
- record the presence and distribution of other amphibian species during surveys for western toads.

5.2.3 Methods

5.2.3.1 Aerial Survey

An aerial reconnaissance survey was conducted on July 18, 20, and 21, 2010 to identify potential breeding sites within the LSA and RSA. Breeding western toads require open water deep enough to prevent drying out prior to tadpole metamorphosis, but with sufficient shallow areas (<0.5 m) to support egg-laying. Breeding is supported in wetland areas that have limited tree canopy, relatively shallow water, and a low level of water flow (Pyare 2005).

Wetlands were geo-referenced with a Garmin GPSMAP 60Cx (advertised accuracy ± 10 m) and assigned a wetland type and size. Wetland type was classified into four categories: marsh, swamp, pond, and lake. Wetlands that were not classified were labelled as unclassified. Marsh habitat was classified on the basis of open water and ≥25% grass, sedges, and associated vegetation. Swamps were comprised of open water and ≥25% shrubs. Ponds were identified as naturally occurring water bodies with organic substrate and substantial emergent vegetation. Lakes were distinguished from ponds as deeper natural-occurring water bodies with predominantly non-organic substrate. Some wetlands were comprised of more than one wetland type, and so were classified as a "wetland complex". Habitat size was classified as small, medium, and large. Small survey sites had an area of ≤0.5 hectares (ha), medium survey sites had an area of >0.5 to <2 ha, and large survey sites had an area ≥2 ha. Each site was also rated for overall toad habitat quality as high, moderate, or poor.

5.2.3.2 Ground Survey

A subset of wetlands and ponds identified during the aerial reconnaissance survey were subsequently surveyed from the ground from July 22 to July 26, 2010. Where ground access permitted, survey locations were prioritized to those with high and moderate habitat ratings as assigned during the aerial survey.

Field methods for the detection of amphibian species were adapted from standard amphibian sampling techniques and western toad monitoring programs (Crump and Scott 1994; Leonard, Bury, and Olson 1997; Pyare 2005). Survey timing reflected the period when western toad breeding is easiest to observe, as toadlets often aggregate along margins of water bodies during the late summer (Plate 5.2-1). Observers searched shorelines, water bodies, and terrestrial habitat adjacent to the pond margin using the Visual Encounter Survey (VES) technique and net sweeps to locate evidence of breeding, such as the presence of tadpoles and emerging toadlets.

Plate 5.2-1. Western toad tadpole aggregation (left) and newly metamorphosed toadlet (right).

Amphibians were identified and classified into two broad life stages: juvenile (tadpole/larvae, metamorph/toadlet, or yearling) or adult (>2 years of age). Photographs were taken whenever possible. Amphibians were handled using powder-free latex gloves, and standard protocols were followed to sterilize field gear to minimize the transference of pathogens (i.e., chytrid fungus) and toxins (i.e., insect repellent, hand moisturizers). Observers also measured several biotic and abiotic environmental and habitat characteristics at each site where amphibians were observed. Such information will facilitate an understanding of species habitat associations that will ultimately inform mitigation and management strategies (Table 5.2-1).

Table 5.2-1. Abiotic and Biotic Site Characteristics

Characteristic	Description
Abiotic	
Location	UTM coordinates of site
Elevation	M above sea level
Observers	Person(s) who collected the data
Clouds	Clear and sunny, partially cloudy, or overcast
Rain	No rain, drizzle, or raining
Air Temperature	Measure air temperature
Water Temperature	Measure water temperature at a depth of 0.2 m, 0.5 m from shore
Size (m X m)	Length x width (as estimated with a rangefinder)
Water Flow	1=stagnant, 2=sluggish, 3=mobile, 4=dynamic, 5=very dynamic
Turbidity	Measure of the amount of sediment suspended in the water column (e.g., murkiness)
Biotic	
Wetland description	Brief description of wetland characteristics and type
% Canopy	Estimate of the % of water body edge with canopy cover > 10 m high
Canopy type	Forest, shrubs, open, etc.
Canopy open?	Wetland without surrounding canopy
Canopy set back?	Wetland with canopy, but canopy set back from pond at least the height of the canopy trees
Canopy dense, dark?	Canopy close to the wetland and casting a shadow on the water
Fish Present?	Yes, no, or unknown
Edge Type	Proportion of water body shoreline belonging to each type, which is characterized as the amount which is visible during ground or aerial surveys.
% mud	% muddy or silty materials (i.e., no vegetation)
% shrubs	% small shrubby vegetation (e.g., *Salix* spp.)
% gravel	% gravel/rocky materials (i.e., no vegetation)
% sphagnum/bog	% sphagnum or peat vegetation (i.e., loose shoreline)
% dense sedges/ aquatic vegetation	% in water aquatic vegetation (e.g., *Carex* spp., rushes, pond lilies)
Bank Slope	Proportion of water body edge with edge gradient, ranked on scale of 1 to 5
1 – mudflats	gradient < 10º
2 – gentle slope	gradient 10 to 30º
3 – moderate slope	gradient 30 to 50º
4 – steep slope	gradient 50 to 70º
5 – drop off	Drop off from aquatic vegetation or hard bank, gradient > 70º
Vegetation type	Proportion of area (water body edge, aquatic survey area) with vegetation in each type
Emergent	Proportion of edge with emergent vegetation
Floating	Proportion of aquatic survey area with floating vegetation *(i*.e., lilypads, duckweed)
Submerged	Proportion of aquatic survey area with submerged vegetation

5.2.4 Results

5.2.4.1 Aerial Survey

A total of 66 sites were flown and habitat characteristics were recorded for each site (Figure 5.2-1; Appendix 5.2-1). Most wetlands (73%) were located outside of the LSA and were classified as ponds. Of the 66 wetlands examined, 11 were classified as high quality toad breeding sites, 51 were classified as moderate, and 4 were rated as poor (Figure 5.2-1).

5.2.4.2 Ground Survey

Ground surveys for amphibian breeding activity were conducted at 36 sites (Figure 5.2-2). Location information was not available for five survey sites; therefore, these sites are not illustrated on Figure 5.2-2. Nineteen of the 31 survey sites for which coordinates were available were located within the LSA. Surveyors visited nine sites identified during the aerial reconnaissance survey, one of which was rated as high quality breeding habitat and the remaining eight were rated as moderate. The majority of the sites identified during the aerial reconnaissance survey were inaccessible from the ground and thus surveyors were required to select additional wetlands (n = 27) with good access.

The Columbia spotted frog, wood frog, western toad, and long-toed salamander were recorded at 10 separate locations during ground surveys, six of which were within the LSA (Figure 5.2-2; Table 5.2-2; Plate 5.2-2; Appendix 5.2-2). Columbia spotted frog and western toad were recorded at five sites each, and were the most frequently detected species during ground surveys. Western toad and Columbia spotted frog were recorded incidentally at two additional sites during waterfowl surveys in July, 2010 (Figure 5.2-2).

Table 5.2-2. Amphibians Observed during Ground Surveys, 2010

Species	Scientific Name	No. Observed				Total
		Adult	Juvenile	Larvae	Tadpole	
Columbia Spotted Frog	*Rana luteiventris*	7	6	-	127	140
Long-toed Salamander	*Ambystoma macrodactylum*	-	-	15	-	15
Western Toad	*Anaxyrus boreas*	-	1,092	-	2,600	3,192
Wood Frog	*Lithobates sylvaticus*	9	1	-	-	10
Total		16	1,099	15	2,727	3,857

Eight of the 10 sites identified during ground surveys contained juvenile life stages (e.g., tadpoles, larvae) and are considered to be breeding sites (Figure 5.2-2). One site under the transmission line ROW in the LSA contained juvenile life stages of western toad, Columbia spotted frog, and long-toed salamander, and one site in the northern portion of the LSA contained juvenile life stages of Columbia spotted frog and wood frog (Figure 5.2-2). Four sites contained juvenile life stages of only western toad, one of which was within the LSA, and two sites contained juvenile life stages of only Columbia spotted frog, with one of these sites in the LSA (Figure 5.2-2).

Western toad was the most abundant species detected during ground surveys (Figure 5.2-3; Table 5.2-2). Five breeding sites that contained western toad tadpoles and toadlets were found, two of which were located in the LSA (Figure 5.2-3). One large toadlet aggregation/recruitment site with over a thousand toadlets was detected within the eastern LSA (Figure 5.2-3; Plate 5.2-3). A potential toad breeding site was recorded incidentally in the LSA during waterfowl surveys in July, where one western toad toadlet and one adult were observed (Figure 5.2-3). A western toad adult was also observed incidentally in the west portion of the Infrastructure Investigation Area near the Murray River Bridge (Figure 5.2-3).

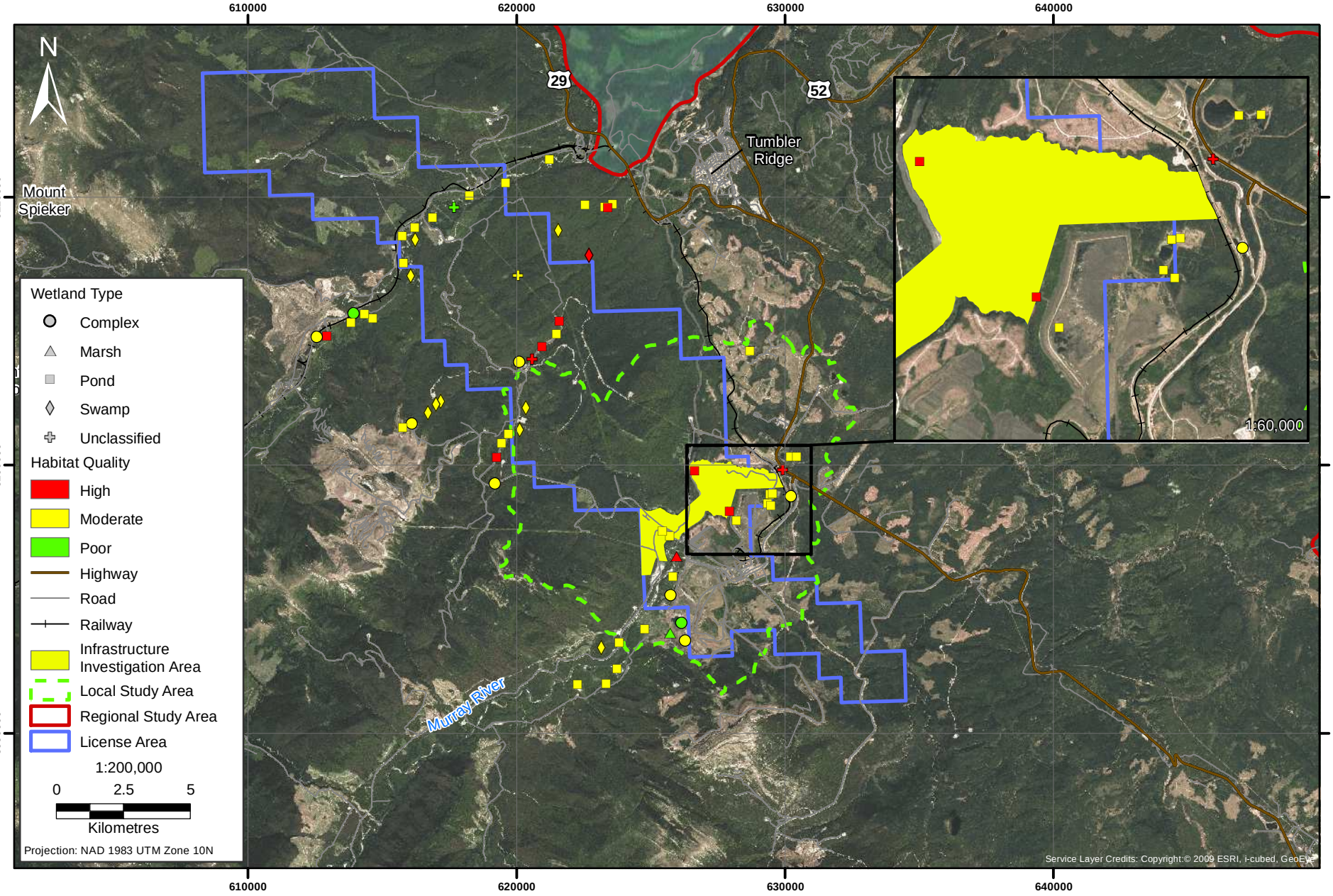


Figure 5.2-1

hcl Mining

MURRAY RIVER COAL PROJECT

Aerial Survey Locations for Evaluation of Potential Toad Breeding Sites, 2010

Figure 5.2-1

Rescan™ Engineers & Scientists

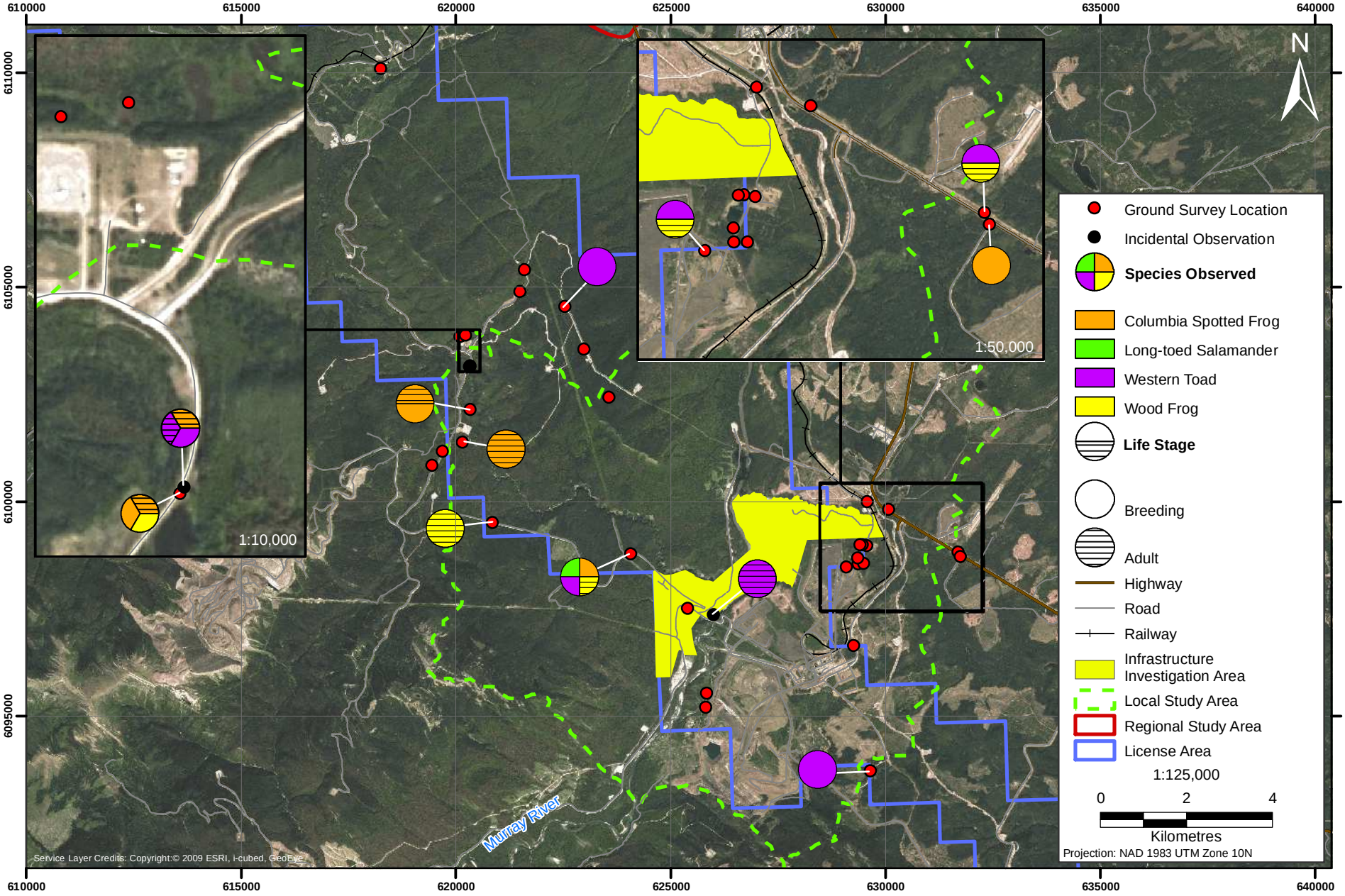


Figure 5.2-2

MURRAY RIVER COAL PROJECT

Ground Survey Locations and Detections of Amphibians, 2010

Figure 5.2-2

Rescan Engineers & Scientists

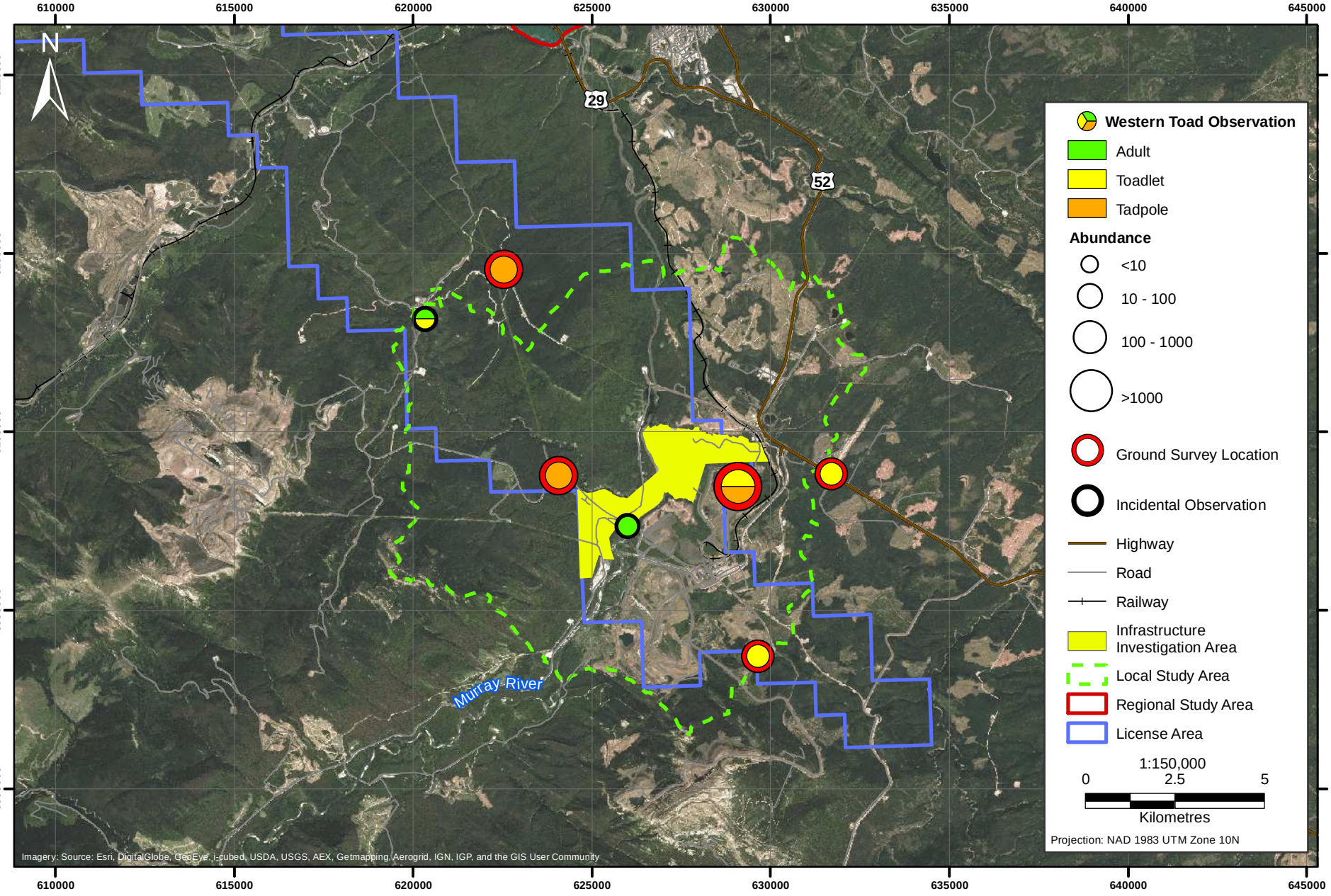


Figure 5.2-3

hd Mining

MURRAY RIVER COAL PROJECT

Western Toad Observations and Overall Abundance, 2010

Figure 5.2-3

Rescan™ Engineers & Scientists

a) Columbia Spotted Frog juvenile (likely yearling)

b) Wood Frog adult

c) Columbia Spotted Frog adult

d) Long-toed Salamander larvae and Columbia spotted frog tadpole

Plate 5.2-2. Amphibian species observed during ground surveys in July, 2010.

The majority of the 10 wetlands where amphibians were observed were small (~0.5 ha) in size with sluggish to very little water flow (Appendix 5.2-1). These 10 locations were located between 889 and 1,247 m elevation (average 1,045 ± 39 m Standard Error). Many wetlands had a gently sloped muddy or gravelly bank and a mix of emergent vegetation such as horsetails, sedges, and aqueous graminoids within the wetted area (Plate 5.2-4). All but one wetland were surrounded by an open, set-back forest canopy. Several wetlands appeared to have been created by beaver activity and three sites were roadside ditches (Appendix 5.2-1; Plate 5.2-4). Small fish were noted at one wetland.

5.2.5 Discussion

Four species of amphibians were detected at 10 survey sites during the 2010 field season: western toad, Columbia spotted frog, wood frog, and long-toed salamander. Eight sites were breeding sites (i.e., locations where amphibians in juvenile life stages were recorded). Four breeding sites were located in the LSA. One additional breeding site was detected incidentally in the LSA during other wildlife baseline surveys in July.

a) Western Toad tadpoles

b) Western Toad metamorphs (toadlet)

c) Western Toad toadlets

d) Western Toad toadlet

Plate 5.2-3. Large aggregation of western toad toadlets and tadpoles observed on the east side of the LSA.

Breeding evidence was most commonly observed for western toad (Table 5.2-2). Six locations (including the one site recorded incidentally) contained western toad tadpoles and/or toadlets, including two sites where over 500 individuals were counted (Figure 5.2-3). Three western toad breeding sites were located in the LSA. Columbia spotted frog tadpoles and juveniles were recorded at four locations, including one site where roughly one hundred tadpoles were counted. Three of the four Columbia spotted frog breeding sites were located in the LSA. Wood frog and long-toed salamander breeding was only detected at one site each; one wood frog juvenile was recorded at one location and 15 salamander larvae were detected at the other. Both of these sites were in the LSA.

Western toads are one of the few amphibian species to occupy alpine areas, occurring from sea level up to 3,660 m elevation (Wind and Dupuis 2002). Western toads require a variety of terrestrial and aquatic habitats to complete different stages of their life cycle: spring breeding, summer foraging, and winter hibernation. The onset of breeding is thought to be linked to the timing of snow pack melt (Pyare 2005) and the average daily minimum and maximum temperatures (Gyug 1996). Toads migrate over relatively long distances each spring from their winter terrestrial hibernation sites to aquatic breeding sites, and then to forested feeding sites during the summer. Movement corridors between these areas are necessary for their survival (COSEWIC 2002a). Toads are capable of travelling over five kilometres to breeding sites and occasional long distance excursions of up to 7.2 km have been noted (Davis 2002). Toadlets do not appear to move more than 200 m to 300 m from their natal site within the first year (Pyare 2006).

Plate 5.2-4. Examples of habitat where amphibians were observed.

Western toad breeding occurs in temporary ponds, including large puddles, roadside ditches, and irrigation ponds. One toad breeding site containing roughly 80 toadlets was located in a roadside ditch just to the south of the LSA (Plate 5.2-4); however, ephemeral water bodies such as these usually lack thermal and predatory cover for developing larvae. Thus, these habitats often function as "ecological sinks" when they dry up prior to tadpole metamorphosis, causing tadpole mortality (C. E. Stevens, Paszkowski, and Stringer 2006). Breeding in roadside ditches cannot be expected to occur on a regular basis because water levels likely vary on an annual basis.

References

Rescan™
Engineers and Scientists

References

1988. *Water Act: Water Regulation*, BC Reg 204/88.

1994a. *Canada Migratory Birds Convention Act*, RSC. C. 22. s. M-7.01.

1994b. *Migratory Birds Convention Act*, C. Chapter M-7.01, c. 22.

1994c. *Migratory Birds Convention Act*, C. 22.

1996a. *British Columbia Wildlife Act*, RSBC. C. 488. s. 1.1.

1996b. *Wildlife Act*, RSBC. C. 488.

2002a. *Species at Risk Act*, C. 29

2002b. *Species at Risk Act*, C. c.29, S-15.3.

2004a. *Forest and Range Practices Act*, SBC 2002. C. 69.

2004b. *Forest and Range Practices Act, SBC. C. 69, BC Reg 582/2004. Government Actions Regulation*.

Ankney, C. D. and C. D. MacInnes. 1978. Nutrient reserves and reproductive performance of female lesser snow geese. *Auk*, 95: 459-71.

Antoniuk, T. M. 1994. *Environmental Protection Strategies for Development of the Monkman/Grizzly Valley Gas Fields*. Prepared for Amoco Canada Petroleum Company Ltd., Norcen Energy Resources Limited, Ocelot Energy Inc., Petro-Canada Resources, Sceptre Resources Ltd., Shell Canada Ltd. and Talisman Energy Inc. by Salmo Consulting.: Calgary, AB.

APLIC. 2006. *Suggested practices for avian protection on power lines: The state of the art in 2006*. Edison Electric Institute, Avian Power Line Interaction Committee, and the California Energy Commission: Washington, DC and Sacramento, CA.

Ayotte, J. B. 2005. *1st BC Mountain Goat Workshop. Summary of current issues, management practices, and research needs*. Peace/Williston Fish and Wildlife Compensation Program Report No. 302: Prince George, BC.

Ayotte, J. B., K. L. Parker, and M. P. Gillingham. 2008. Use of Natural Licks by Four Species of Ungulates in Northern British Columbia. *Journal of Mammalogy*, 89 (4): 1041-50.

Baicich, P. J. and C. J. Harrison. 1997. *A guide to the nests, eggs, and nestlings of North American birds*. 2 ed. London, U.K: Academic Press.

BC CDC. 2010a. BC Species and Ecosystems Explorer: Search Criteria - Species "Bat" and Species Group "Mammal". *BC Ministry of Environment, Victoria, BC*:

BC CDC. 2010b. BC Species and Ecosystems Explorer: Search Criteria - Species "Myotis" and Species Group "Mammal". *BC Ministry of Environment, Victoria, BC*

BC Frogwatch. 2006. *Factsheet: Western Toad*. http://www.env.gov.bc.ca/wld/documents/westerntoad.pdf (accessed

BC ILMB. 2009. *Nass South Sustainable Resource Management Plan: Draft*. http://www.ilmb.gov.bc.ca/slrp/srmp/south/nass/index.html (accessed September, 2009).

BC MOE. 2004. Environmental Best Management Practices for Urban and Rural Land Development: Special Wildlife and Species at Risk.

BC MOE. 2005. *Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia*. BC MOE Ecosystem Standards and Planning Biodiversity Branch. http://www.env.gov.bc.ca/wld/BMP/bmpintro.html (accessed

BC MOE. 2006a. Develop with care: Environmental guidelines for urban and rural land development in British Columbia. *http://wwwenvgovbcca/wld/documents/bmp/devwithcare2006/develop_with_care_introhtml*:

BC MOE. 2006b. *Wildlife Guidelines for Backcountry Tourism/Commercial Recreation in British Columbia*. British Columbia Ministry of Environment Environmental Stewardship Division, Victoria, B.C. www.env.gov.bc.ca/wld/twg/documents/wildlife_guidelines_recreation_may06_v2.pdf (accessed

BC MOE. 2008. *Moose Management in the Peace Region*. Report prepared for the BC Ministry of Environment, Environmental Stewardship DIvision by Canadensis WIldlife Consulting: Fort St. John, BC.

BC MOF. 1997. *Species and Plant Community Accounts for Identified Wildlife Volume 1: Species #36 - Mountain Goat (Oreamnos americanus)*. British Columbia Ministry of Forests.

BC MSRM. 2002. Species Ranking in British Columbia.

BC MWLAP. 2004a. *Accounts and Measure for Managing Identified Wildlife; Northern Interior Forest Region*.

BC MWLAP. 2004b. *Best Management Practices for Amphibians and Reptiles in Urban and Rural Environments in British Columbia*. B.C. MWLAP Ecosystem Standards and Planning Biodiversity Branch, Nanaimo, B.C.

BC MWLAP. 2004c. *Black-throated Green Warbler Dendroica virens*. In Accounts and Measures for Managing Identified Wildlife - Accounts V 2004. Victoria, BC: Ministry of Water, Land and Air Protection. http://www.env.gov.bc.ca/wld/documents/identified/iwABPBX03100.pdf (accessed March, 2011).

BC MWLAP. 2004d. *Caribou Rangifer tarandus*. In Accounts and Measures for Managing Identified Wildlife – Accounts V 2004. Victoria, BC: Ministry of Water, Land and Air Protection. http://www.env.gov.bc.ca/wld/frpa/iwms/documents/Mammals/m_caribou.pdf (accessed March, 2011).

BC MWLAP. 2004e. *Peace Region Aerial Surveys, March 2004*. Ministry of Water, Land & Air Protection, Peace Region: Fort St John, BC.

BC MWLAP. 2004f. *Standards and best practices for instream works*. British Columbia Ministry of Water, Land and Air Protection, Ecosystems Standards and Planning, Biodiversity Branch.

BC Research. 1979. *Preliminary environmental study of the Sukunka Coal Project. Project No. 1696*. Prepared for Coalition Mining Ltd. by BC Research: Calgary, AB.

Belanger, L. and R. Couture. 1988. Use of man-made ponds by dabbling duck broods. *Journal of Wildlife Management*, 52 (4): 718-23.

Bellrose, F. C. 1980. *The Ducks, Geese and Swans of North America*. Philadelphia, PA: Stackpole Books.

Blood, D. A. 2000a. *Elk in British Columbia, Ecology, Conservation and Management*. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

Blood, D. A. 2000b. *Moose in British Columbia, ecology, conservation and management*. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

Blood, D. A. 2000c. *Mountain goat in British Columbia: Ecology, Conservation and Management*. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

Blood, D. A. 2000d. *Mule and Black-tailed Deer in British Columbia: Ecology, Conservation and Management*. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

Blood, D. A. 2000e. *White-tailed Deer in British Columbia: Ecology, Conservation and Management*. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

Bowyer, R. T., V. V. Ballenberghe, and J. G. Kie. 2003. Moose. In *Wild Mammal of North America; Biology, Management and Conservation*. Eds. G. A. Feldhamer, B. Thompson, and J. Chapman. 931-64. Baltimore, Marylan: Johns Hopkins University Press.

Brown, C. R. and M. B. Brown. 1999. *Barn Swallow (Hirundo rustica). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology*. http://bna.birds.cornell.edu/bna/species/452 (accessed March, 2011).

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, M. C. E. McNall, and G. E. J. Smith. 1997. *The Birds of British Columbia. Volume III Passerines: Flycatchers through Vireos*. . Vancouver, BC: UBC Press.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, A. C. Stewart, and M. C. E. McNall. 2001. *Birds of British Columbia. Volume IV Passerines: Wood Warblers through Old World Sparrows*. Vancouver: UBC Press.

Cooper, J. M., K. A. Enns, and M. G. Shepard. 1997. *Status of the Black-throated Green Warbler in British Columbia*. BC Ministry of Environment, Lands and Parks, Wildlife Branch: Victoria, BC.

COSEWIC. 2002a. *COSEWIC assessment and status report on the western toad Bufo boreas in Canada*. . Ottawa.

COSEWIC. 2002b. *COSEWIC assessment and update status report on the woodland caribou Rangifer tarandus caribou in Canada*. Committee on the Status of Endangered Wildlife in Canada: Ottawa, ON.

COSEWIC. 2007. COSEWIC assessment and status report on the olive-sided flycatcher *Contopus cooperi* in Canada. *Committee on the Status of Endangered Wildlife in Canada*, Ottawa, vii + 25 pp. http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_olivesided_flycatcher_0808_e.pdf

COSEWIC. 2012. *Emergency Assessment Concludes that Three Bat Species are Endangered in Canada*. http://www.cosewic.gc.ca/eng/sct7/Bat_Emergency_Assessment_Press_Release_e.cfm (accessed September 2013).

Couturier, S. and C. Barrette. 1988. The behaviour of moose at natural mineral springs in Quebec. p522-28. On file with BC Geological Survey, Ministry of Energy, Mines, and Petroleum Resources.

Cross, S. P. 1988. Riparian systems and small mammals and bats. In *Riparian Management: riparian wildlife and forestry interactions*. Ed. K. J. Raedeke. 93-112. Seattle, WA: Univeristy of Washington Institute for Forestry Resources Contribution No. 57.

Crump, M. L. and N. J. Scott. 1994. Visual encounter surveys. In *Measuring and monitoring biological diversity: standard methods for amphibians*. Eds. W. R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster. 84-91. Washington, DC: Smithsonian Institute Press.

Davis, T. M. 2002. British Columbia Ministry of Water, Land and Air Protection, Government of British Columbia, Victoria, B.C., Research Priorities for the Management of the Western Toad, *Bufo boreas*, in British Columbia. Wildlife Working Report No. WR-106.

Demarchi, D. A. 1986. *Biophysical Resources of the East Kootenay Area Wildlife*. British Columbia Ministry of Environment, Lands and Parks. Ministry of Environment Technical Report: Victoria, BC.

Demarchi, M. W., S. R. Johnson, and G. F. Searing. 2000. Distribution and Abundance of Mountain Goats, Oreamnos americanus, in Westcentral British Columbia. *Can Field Nat*, 114 (2): 301-06.

Doyle, F. I. and T. Mahon. 2001. *Inventory of the northern goshawk in the Kispiox Forest District. Annual Report 2000*. BC Ministry of Environment, Lands and Parks: Smithers, BC.

Ehlers, T., S. Bennett, and P. Corbett. 1998. *TFL #14 Ungulate Winter Range Inventory: Year 2 1996/1997*. Crestbrook Forest Industries Ltd. Unpublished report.: Parson, BC.

Elliott, J. E., L. K. Wilson, K. M. Langelier, P. Mineau, and P. H. Sinclair. 1997. Secondary poisoning of birds of prey by the organophosphorus insecticide, phorate. *Ecotoxicology*, 6 (4): 219-31.

Farmer, A. H. and A. H. Parent. 1997. Effects of the landscape on shorebird movements at spring migration stopovers. *The Condor*, 99 (3): 698-707.

Fenton, M. B. and G. P. Bell. 1981. Recognition of species of insectivorous bats by their echolocation calls. *Journal of Mammalogy*, 62 (2): 233-43.

Finavera. 2011. *Tumbler Ridge Wind Energy Project: Application for an Environmental Assessment Certificate. Section 5.10: Bats*. Finavera Wind Energy Inc.: Vancouver, BC.

Fox, J. L. 1978. Weather as a Determinant Factor in Summer Mountain Goat Activity and Habitat Use. M.Sc. thesis diss., University of Alaska.

Fox, J. L. 1983. Constraints on winter habitat selection by the mountain goat (Oreamnos americanus) in Alaska. Ph.D diss., University of Washington, Seattle.

GeoBC. 2011. *iMapBC: BCs Natural Resource Mapping Tool. Service provided by GeoBC, BC Minisitry of Natural Reserouce Operations*. http://webmaps.gov.bc.ca/imfx/imf.jsp?site=imapbc (accessed March, 2011).

Geowest. 2000. *Wildlife Habitat Suitability Interpretations for Terrestrial Ecosystems: Canfor T.F.L. # 048*. Prepared for Canadian Forest Products Ltd. Chetwynd Woodlands Department by Geowest Environmental Consultants Ltd. Draft: Chetwynd, BC.

Gollop, J. B. and W. H. Marshall. 1954. A guide for aging duck broods in the field. 14 pp. http://www.npwrc.usgs.gov/resource/birds/ageduck/index.htm (accessed November, 2010).

Goulet, L. A. and D. J. Haddow. 1985. *An inventory of wildlife resources on the Liard River, northern British Columbia: a report of the 1978, 1980, and 1981 field studies*. BC Hydro. Report No. Ess-30:

Grindal, S. D., J. L. Morissette, and R. M. Brigham. 1999. Concentration of bat activity in riparian habitats over an elevational gradient. *Canadian Journal of Zoology*, 77: 972-77.

Gross, J. E., M. C. Kneeland, D. F. Reed, and R. M. Reich. 2002. GIS-based habitat models for mountain goats. *J Mammal*, 83 (1): 218-28.

Gyug, L. 1996. Part IV Amphibians. In *Timber harvesting effects on wildlife and vegetation in the Okanagan Highlands of British Columbia*.Penticton, BC: BC Ministry of Environment.

Hammerson, G., G. Santos-Barrera, and E. Muths. 2004. *Bufo boreas. IUCN Red List of Threatened Species*. World Conservation Union. www.iucnredlist.org

Harper, F. E. 1988. *Regional wildlife plan for the Peace Subregion, Northern Region*. BC Ministry of Environment and Parks, Wildlife Branch: Fort St. John, BC.

Hatler, D. F. 1990. *Wildlife distribution and habitat use in the northern Williston Reservoir area, British Columbia, winter 1990*. Peace/Williston Fish and Wildlife Compensation Program Report No. 3: Smithers, BC.

Hatter, I. 1998. *Moose Conservation and Harvest Management in Central and Northern British Columbia*. Unpubublished British Columbia Environment Wildlife Working Report (draft for stakeholder discussion): Victoria, BC.

Horn, H. L., P. Arcese, K. Brunt, A. Burger, H. Davis, F. Doyle, K. Dunsworth, P. Friele, S. Gordon, Hamilton, G. MacHutchon, T. Mahon, E. McClaren, V. Michelfelder, B. Pollard, G. Sutherland, S. Taylor, and L. Waterhouse. 2009. Part 3: Knowledge base for focal species and their habitats in Coastal BC. . *Report 3 of the EBM working group focal species project Integrated Land Management Bureau, Nanaimo, BC*

Hutto, R. L. 1998. Using landbirds as an indicator species group. In *Avian Conservation: Research and Management*. Eds. J. M. Marzluff and R. Sallabankcs. 75-91. Covelo, California: Island Press.

Jones, E. S. 2008. *Seasonal habitat use and selection by woodland caribou herds in the South Peace region, central British Columbia*. Prepared for British Columbia Ministry of Environment. Habitat Conservation Trust Fund Project No. 7-325: Fort St John, BC.

Klaus, G. and B. Schmid. 1998. Geophagy at natural licks and mammal ecology: a review. *Mammalia*, 62: 481-97.

Koch, A. J., M. C. Derver, and K. Martin. 2011. The efficacy of common species as indicators; avian responses to disturbance in British Columbia, Canada. *Biodiversity and Conservation*, 20: 3555-75.

Lab of Ornithology Cornell. 2010. *The Birds of North American Online*. http://bna.birds.cornell.edu/bna (accessed March, 2010).

Lauson, C. 2006. *Bat survey of Nahanni National Park and surrounding areas NWT*. Report for Parks Canada: Fort Simpson, NWT.

Leonard, W. P., R. B. Bury, and D. H. Olson. 1997. *Standard methods for inventory and monitoring of pond breeding amphibians in the Pacific Northwest*. 4. Society for Northwest Vertebrate Biology, Northwest Fauna.

Lofroth, E. C. 1993. Scale dependent analyses of habitat selection by marten in the sub-boreal spruce biogeoclimatic zone, British Columbia. M. Sc. diss., Simon Fraser University, 109 pp.

MacHutchon, A. G. 2001. *British Columbia Environmental Assessment Guidelines for Grizzly Bears and Black Bears*. Prepared by the BC Ministry of Environment, Lands and Parks Regional Operations and Environmental Assessment Section: Victoria, BC.

Madison, E., K. Oelrich, T. Rodhouse, and L. Garrett. 2003. *Report for subagreement No. 20 to cooperative agreement CA9000-95-018. Mammal Inventories, City of Rocks National Reserve*. University of Idaho and National Park Service Columbia Cascades Support Office.: Moscow, Idaho.

Magurran, A. E. 1988. *Ecological Diversity and its Measurement*. Princeton, NJ.: Princeton University Press.

McCaffrey, M., T. Rodhouse, and L. Garrett. 2003. *Report for subagreement No. 20 to cooperative agreement CA9000-95-018. 2003 vertebrate inventory Lake Roosevelt National Recreation Area.* . University of Idaho and National Park Service Columbia Cascades Support Office.: Moscow, Idaho.

Milko, R. 1998a. *Migratory birds environmental assessment guideline*. Canadian Wildlife Service, Environment Canada: Ottawa.

Milko, R. 1998b. *Wetlands Environmental Assessment Guideline*. Biodiversity Protection Branch, Environment Canada (Canadian Wildlife Service): Ottawa, Ontario.

Ministry of Environment. *In prep. Science Update for the South Pease Northern Caribou (rangifer tarandus caribou pop. 15) in British Columbia.* . Victoria, BC. 14 p.

Morgantini, L. E. and W. B. Russell. 1983. *An assessment of three selected elk winter ranges in the Rocky Mountain Region*. Alberta Fish and Wildlife Division by Wildland Resource Consultants Ltd: Edmonton, AB.

Morse, D. H. and A. F. Poole. 2005. *Black-throated Green Warbler (Dendroica virens), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology*. http://bna.birds.cornell.edu/bna/species/055 (accessed March, 2011).

Mountain Goat Management Team. 2010. *Management Plan for the Mountain Goat (Oreamnos americanus) in British Columbia*. Prepared for the B.C. Ministry of Environment: Victoria, BC.

Nagorsen, D. W. and R. M. Brigham. 1995. *Bats of British Columbia. Royal BC Museum Handbook*. Vancouver, B.C.: UBC Press

Niemi, G. J. and M. E. McDonald. 2004. Application of ecological indicators. *Annual Review of Ecology, Evolution, and Systematics*, 35: 89-111.

O'Farrell, M. J., B. W. Miller, and W. L. Gannon. 1999. Qualitative identification of free-flying bats using the Anabat detector. *Journal of Mammalogy*, 80 (1): 11-23.

Ormsbee, P. C. 1996. Characteristics, Use, and Distribution of Day Roosts Selected by Female Myotis volans (Long-legged Myotis) in Forested Habitat of the Central Oregon Cascades. In *Bats and Forests Symposium, October 19-21, 1995*. Ed. R. M. R. B. a. R. M. Brigham. 124-31. Victoria, BC: Research Branch, BC Ministry of Forests.

Peace River Coal Inc. 2010. *Roman Coal Mine Project. Environmental Assessment Report*. Prepared for BC Environmental Assessment Office, Victoria, BC: Vancouver, BC.

Peak, R. G. and F. R. Thompson. 2006. Factors affecting avian species richness and density in riparian areas. *Journal of Wildlife Management*, 70 (1): 173-79.

Pierre, J. P., H. Bears, and C. A. Paszkowski. 2001. Effects of forest harvesting on nest predation in cavity-nesting waterfowl. *Auk*, 118 (224): 230.

Pyare, S. 2005. *Establishment of a large-scale monitoring program for the western toad (Bufo boreas) in Southeast Alaska*. Alaska Department of Fish and Game: Juneau, Alaska.

Ralph, C. J., S. Droege, and J. R. Sauer. 1995. Managing and monitoring birds using point counts: standards and applications. In *Monitoring Bird Populations by Point Counts*. Eds. C. J. Ralph, J. R. Sauer, and S. Droege. 161-68. Albany, California: Pacific Southwest Research Station.

Rea, R. V., D. P. Hodder, and K. N. Child. 2004. Considerations for natural mineral licks used by moose in land use planning and development. p161-67. On file with BC Geological Survey, Ministry of Energy, Mines, and Petroleum Resources.

Reitz, E. J. and E. S. Wing. 1999. *Zooarchaeology*. Cambridge, UK: University of Cambridge Press.

RIC. 1998. *Inventory Methods for Bats. Standards for Components of British Columbia's Biodiversity No. 20*. Prepared by Ministry of Environment, Lands and Parks, Resources Inventory Branch for the Terrestrial Ecosystem Task Force, Resources Information Committee (RIC): Victoria, BC.

RIC. 1999a. *Inventory Methods for Forest and Grassland Songbirds. Standards for Components of British Columbia's Biodiversity No.15. Version 2*. Prepared by Ministry of Environment, Lands and Parks, Resources Inventory Branch for Terrestrial Ecosystem Task Force, Resources Inventory Committee (RIC): Victoria, BC.

RIC. 1999b. *Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot and Sandhill Crane. Standards for Components of British Columbia's Biodiversity No. 18*. Prepared by Ministry of Environment, Lands and Parks, Resources Inventory Branch for Terrestrial Ecosystem Task Force, Resources Inventory Committee (RIC): Victoria, BC.

RIC. 2001. *Inventory Methods for Raptors: Standards for Components of British Columbia's Biodiversity No. 11. Version 2.0*. Prepared by Ministry of Environment, Lands and Parks Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee (RIC): Victoria, BC.

RIC. 2002. *Aerial-based Inventory Methods for Selected Ungulates: Bison, Mountain Goat, Mountain Sheep, Moose, Elk, Deer & Caribou. Standards for Components of British Columbia's Biodiversity No. 32*. Prepared by Ministry of Environment, Lands and Parks, Resources Inventory Branch for Terrestrial Ecosystem Task Force, Resources Inventory Committee (RIC): Victoria, BC.

Rich, T. D. 2002. Using breeding land birds in the assessment of western riparian systems. *Wildlife Society Bulletin*, 30: 1128-39.

Robertson, G. J. and R. I. Goudie. 1999. *Harlequin Duck (Histrionicus histrionicus)*. A. Poole, ed. In The Birds of North America Online. Ithaca: Cornell Lab of Ornithology. http://bna.birds.cornell.edu/bna/species/466

Rosenzweig, M. L. 1995. *Species Diversity in Space and Time*. Cambridge, UK: Cambridge University Press.

Rowe, M. 2008. *Murray River Moose Population Assessment*. BC Ministry of Environment Technical Report: Fort St John, BC.

RTEC. 2006a. *Galore Creek Small Mammals, Bats and Herpetiles Baseline Study 2005. March, 2006*. Prepared for NovaGold Canada Inc. by Rescan Tahltan Environmental Consultants.

RTEC. 2006b. *Galore Creek Wildlife Habitat Rating and Enhanced Habitat Suitability Models for Six Focal Species, 2004-2005*. Prepared for NovaGold Canada Inc by Rescan Tahltan Environmental Consultants. March 2006.

RTEC. 2008. *Schaft Creek Bat Inventory 2007*. Report Prepared for Copper Fox Metals, Inc. by Rescan Tahltan Environmental Consultants. March, 2008

Sasse, D. B. and P. J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (Myotis septentrionalis) in the White Mountain National Forest. In *Bats and Forests Symposium, October 19-21, 1995*. Ed. R. M. R. B. a. R. M. Brigham. 91-101. Victoria, BC: Research Branch, BC Ministry of Forests.

SCCP. 2010. *British Columbia's Coast Region: Species and Ecosystems of Conservation Concern: Barn Swallow (Hirundo rustica)*. Prepared by Pamela Zevit of Adamah Consultants for the South

Coast Conservation Program (SCCP) in partnership with: International Forest Products (Interfor), Capacity Forestry (CapFor) and the BC Ministry of Environment (BC MoE), E-Flora and E-Fauna the Electronic Atlas of the Flora and Fauna of BC, Species at Risk and Local Government: A Primer for BC. http://www.geog.ubc.ca/biodiversity/factsheets/pdf/Hirundo_rustica.pdf. (accessed March, 2011).

Schoen, J. W. and M. D. Kirchoff. 1982. *Habitat Use by Mountain Goats in Southeast Alaska*. Unpublished Report for the Alaska Department of Fish and Game: Juneau, Alaska.

Seip, D. and E. Jones. 2013. *Population Status of Caribou Herds in the Central Mountain Designatable Unit within British Columbia, 2013*. BC Ministry of Forests: Prince George, BC.

Seip, D. R. 2002. *Ecological relationships between threatened caribou herds and their habitat in the Central Rocky Mountains ecoregion*. BC Ministry of Forests: Prince George, BC.

Shackleton, D. 1999. *Hoofed Mammals of British Columbia*. The mammals of British Columbia Vol. 3. Vancouver, B.C.: UBC Press.

Sherburne, S. S. and J. A. Bissonette. 1992. Subnivean Access Point Choice by American Marten Martes-Americana Homeothermic Considerations or Prey Driven? *Bulletin of the Ecological Society of America*, 73 (2 SUPPL): 342-43.

Siddle, C. 1992. *The declining populations of warblers in northeastern British Columbia*. Paper presented at Community action for endangered species: a public symposium on BC's threatened and endangered species and their habitat Sept 28-29, 1991, Vancouver, BC: Federation of BC Naturalists and Northwest Wildlife Preservation Society.

Simmons, J. A., M. B. Fenton, and M. J. O'Farrell. 1979. Echolocation and pursuit of prey by bats. *Science*, 203 (4375): 16-21.

Steenhof, K., M. N. Kochert, L. B. Carpenter, and R. N. Lehman. 1999. Long-term Prairie Falcon population changes in relation to prey abundance, weather, land uses and habitat conditions. p28-41. On file with BC Geological Survey, Ministry of Energy, Mines, and Petroleum Resources.

Stevens, C. E., C. A. Paszkowski, and D. Stringer. 2006. Occurrence of the Western toad and its use of 'borrow pits' in west-central Alberta. p107-17. On file with BC Geological Survey, Ministry of Energy, Mines, and Petroleum Resources.

Stevens, V. and S. Lofts. 1988. *Wildlife Habitat Handbooks for the Southern Interior Ecoprovince Vol 1:Species Notes for Mammals*. British Columbia Ministry of Environment/British Columbia Ministry of Forests. Wildlife Report No. R-15: Victoria, BC.

Sweanor, P. Y. and F. Sandegren. 1989. Winter-Range Philopatry of Seasonally Migratory Moose. *Journal of Applied Ecology*, 26: 25-33.

Trenham, P. C. and H. B. Shaffer. 2005. Amphibian upland habitat use and its consequences for population viability. *Ecological Applications*, 15 (4): 1158-68.

Vonhof, M. J. and L. C. Wilkinson. 1999. *Roosting habitat requirements of the northern long-eared bat (Myotis septentrionalis) in the boreal mixed wood forest of northeastern British Columbia: year 2*. . Prepared for the BC Ministry of Environment, Lands, and Parks.: Victoria, BC.

Wallmo, O. C. and W. L. Regelin. 1981. Rocky Mountain and Intermountain Habitats. In *Mule and Black-Tailed Deer of North America*. Ed. O. C. Wallmo. 387-98. Lincoln, NE: University of Nebraska Press.

Westcam. 2008. *Monitoring Birds in TFL48 for Sustainable Forestry: Six-year Summary, Occurrence of "Listed" Species, and Pre-treatment Herbicide Application Summary*. Prepared for Canadian Forest Products Ltd. by Westcam Consulting Services: Chetwynd, BC.

Western Canadian Coal. 2005. *Brule Mine Project - Application for an Environmental Assessment (EA) Certificate*. Vancouver, BC.

Western Canadian Coal. 2007. *Application for an Environmental Assessment Certificate for the Hermann Mine Project*

Whelan, C. J. 2001. Foliage structure influences foraging of insectivorous forest birds: An experimental study. *Ecology*, 82 (1): 219-31.

Wind, E. I. and L. A. Dupuis. 2002. *COSEWIC Status Report on the Western Toad Bufo boreas in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario.

Woods. 2003. *Ungulate Winter Range Species Accounts Specific to the Peace River Region 2003*. Prepared for British Columbia Ministry of Water, Land, and Air Protection, Ecosystems Section by Woods Environmental Consulting: Fort St John, BC.

Woods. 2004. *Potential Wildlife Habtiat Areas (WHA) for Woodland Caribou: Dawson Creek TSA*. Prepared for British Columbia Ministry of Water, Land, and Air Protection, Ecosystems Section by Woods Environmental Consulting: Fort St. John, BC.

WSP. 2009. *Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia*. Wetland Stewardship Partnership. http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html (accessed May 2010).

Personal Communication

Seip, D. 2013. Wildlife Biologist, BC Ministry of Forests, Prince George. Personal Communication: February 6, 2013.

Appendix 3.2-1

Mountain Goat and Northern Caribou Summer Aerial Survey Details, 2010

Rescan™
Engineers and Scientists

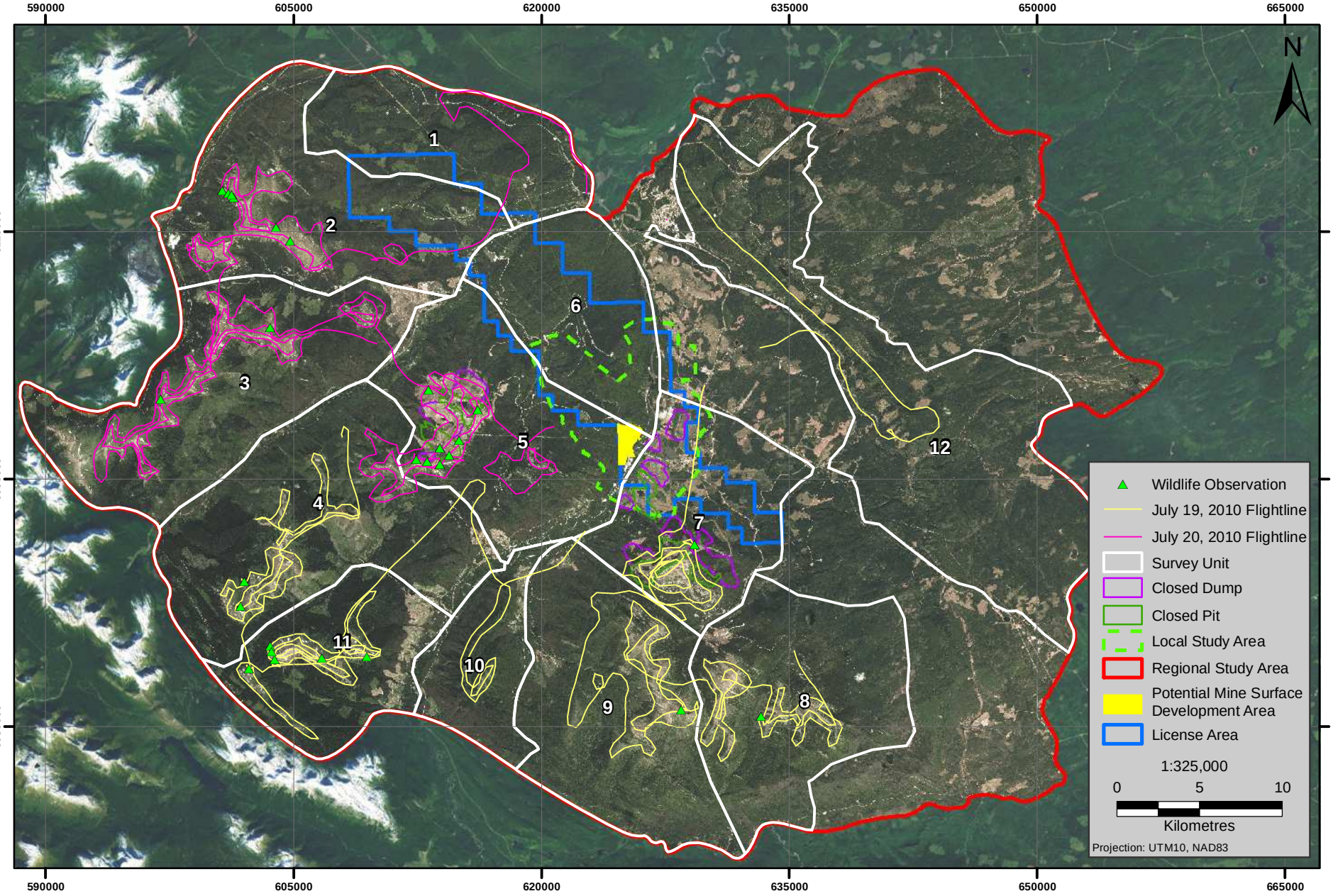
Appendix 3.2-1. Mountain Goat and Northern Caribou Summer Aerial Survey Details, 2010

Date	Survey Unit	Temp (oc)	Cloud Cover (%)	Wind	Lighting	Start Time	Fuel Stop	Fuel Re-Start	End time	Elapsed Time (min)
19-Jul-10	7	15	25	light	sunny	09:33:00			10:02:00	29
19-Jul-10	9	10	50	none	mixed	10:05:00			10:50:00	45
19-Jul-10	8	10	15	light W	bright	10:50:00			11:25:00	35
19-Jul-10	10	16	60	none	mixed	12:03:00			12:15:00	12
19-Jul-10	11	10	80	light SW	mixed	12:23:00			13:12:00	49
19-Jul-10	4	12	70	light W	mixed	13:12:00			13:58:00	46
19-Jul-10	12	20	50	10 Kn SW	bright	14:20:00			14:36:00	16
20-Jul-10	6	no suitable habitat for goat - all forested - not surveyed								
20-Jul-10	5	16	5	light-variable	bright	09:24:00			10:15:00	51
20-Jul-10	3	15	20	none	bright	10:17:00	10:38:00	11:12:00	11:59:00	68
20-Jul-10	2	13	65	calm	mixed	11:59:00			12:48:00	49
20-Jul-10	1	17	40	none	bright	12:49:00			12:58:00	9

Appendix 3.2-2

Aerial Survey Flightlines, Summer 2010

Rescan™
Engineers and Scientists



Appendix 3.2-2

hdMining

MURRAY RIVER PROJECT

Aerial Survey Flightlines, Summer 2010

Appendix 3.2-2

Rescan™ Engineers & Scientists

Appendix 3.2-3

Mountain Goat and Northern Caribou Raw Observation Data, Summer 2010

Rescan™
Engineers and Scientists

Appendix 3.2-3. Mountain Goat and Northern Caribou Raw Observation Data, Summer 2010

Survey			UTM			No. Mountain Goats			No. Northern Caribou								Topographic Features			
Unit	Date	Time	Zone	Easting	Northing	Adults	Kids	Total	Bulls	Cows	Calves	Total	Activity	HSR	% Cover	Photo(s)	Elevation (m)	Slope (°)	Apect (°)	Comment(s)
7	19-Jul-10	09:46	10	629259	6091050	38	8	46					Rn	2	0	114-3348	1,518	19	3	Heavily used area
9	19-Jul-10	10:24	10	628418	6081024	6	1	7					Sd	1	0	114-3450	1,909	26	226	1 billy
8	19-Jul-10	11:21	10	633254	6080609				1			1	Rn	3	20	114-3451	1,535	21	7	Facing west
10	19-Jul-10																			none observed
11	19-Jul-10	12:29	10	603565	6084874	3	1	4					Rn	2	30		1,574	25	320	1 juvenile, 1 yearling
11	19-Jul-10	12:31	10	603844	6084070	1		1					Rn	2	30	114-3459	1,655	38	186	
11	19-Jul-10	12:37	10	606706	6084174					1		1	Sd	2	0		1,782	17	48	yearling
11	19-Jul-10	12:40	10	603643	6084546	13	3	16					Rn	2	0	114-3460	1,787	34	287	
11	19-Jul-10	12:52	10	609421	6084251	2		2						1	0		1,357	37	183	
11	19-Jul-10	13:12	10	602285	6083536				1			1		1	0	114-3461	1,663	17	17	yearling
11	19-Jul-10			602285	6083536					shed caribou antler										
4	19-Jul-10	13:22	10	602001	6088786				1			1	Rn	1	0		1,523	7	261	
4	19-Jul-10			603074	6092563					shed caribou antler										
4	19-Jul-10	13:33	10	601796	6087310	1		1					Sd	1	0	114-3463 to 3465	1,890	44	334	
12	19-Jul-10																			none observed
6	20-Jul-10																			not suitable for goats - all forested - not surveyed
5	20-Jul-10	09:39	10	613144	6100452	1		1					Sd	4	0	115-3472	1,245	16	300	
5	20-Jul-10	09:52	10	614399	6096482	13	5	18					Sd	4	0	115-3473	1,603	1	45	In coal mine.
5	20-Jul-10	09:57	10	616117	6099237	2	2	4					Rn	4	0		1,631	33	232	
5	20-Jul-10	10:01	10	613826	6096930	1	1	2					Rn	4	0		1,495	20	11	
5	20-Jul-10	10:03	10	613054	6096102	12	2	14					Rn	4	0		1,766	23	14	
5	20-Jul-10	10:04	10	613834	6095905	1		1					Rn	4	0	115-3476	1,801	23	181	Old Wolverine mine area.
5	20-Jul-10	10:05	10	612410	6096237	3		3					Rn	2	0	115-3477	1,747	32	333	Old Wolverine mine area.
5	20-Jul-10	10:12	10	614993	6097403	1		1					Sd	4	0		1,714	14	104	
3	20-Jul-10	11:16	10	603576	6104224				1			1		1	0	115-3479	1,807	16	113	Reeser Mtn - alpine (NE)
3	20-Jul-10	11:49	10	596941	6099871	4		4					Sd	2	0		1,892	35	265	
2	20-Jul-10	12:22	10	603924	6110306	1		1					Rn	1	0		1,774	31	346	
2	20-Jul-10	12:30	10	600687	6112496	1		1					Rn	2	25	115-3480	1,651	27	253	
2	20-Jul-10	12:32	10	601033	6112334	2		2					Sd	1	0	115-3481	1,758	41	190	
2	20-Jul-10	12:32	10	601361	6112106	6		6					Sd	1	0	115-3482	1,771	47	228	2 juvenlines.
2	20-Jul-10	12:38	10	601238	6112271	1	1	2					Sd	1	0		1,777	46	215	
2	20-Jul-10			602567	6112243					shed caribou antler										
2	20-Jul-10	12:41	10	604796	6109458	1		1					Rn	4			1,890	7	209	yearling
1	20-Jul-10															115-3485				Limited escape terrain for goat habitat in SU. No alpine. None observed

Rn= running, Sd = standing

Appendix 3.2-4

Incidental Observations of Ungulates Recorded during the 2010 Wildlife Baseline Program

Rescan™
Engineers and Scientists

Appendix 3.2-4. Incidental Observations of Ungulates Recorded during the 2010 Wildlife Baseline Program

Date	Species	Easting	Northing	Adult	Young	Total	Comments
18-May-10	Ungulate Spp.	626232	6098416				mineral lick/den; heavily used wildlife area; heavily used trails
18-May-10	Moose	615795	6107923	1		1	
18-May-10	Moose	622741	6092171	1		1	
18-May-10	Moose	622743	6091773	1		1	
19-May-10	Ungulate Spp.	625967	6097305				along Murray river. Moose browse and pellets along beach. Some deer pellets and possibly elk and caribou.
19-May-10	Moose	620278	6103017				moose drop antler and lots of browse/pellets used heavily due to mild winter condictions
19-May-10	Ungulate Spp.	626056	6097584				heavy browse of willow suggestive of winter use at rivers edge - moose, deer, caribou and elk.
20-May-10	Mule Deer	626245	6096859	2		2	observed off Murray River FSR 1 km above bridge
20-May-10	White-tailed Deer	625967	6097305	1		1	just past Murray River bridge
20-May-10	White-tailed Deer	630657	6103521	4		4	on Hwy heading south ~9 km from Tumbler Ridge - 1 buck, 3 does
3-Jun-10	Moose	627375	6104048				
5-Jun-10	White-tailed Deer	638285	6105851	1		1	
6-Jun-10	Rocky Mountain Elk	624625	6109904	6		6	group of elk crossing road just outside of Tumbler Ridge
6-Jun-10	Moose	616319	6108998	1		1	in riparian area along Wolverine River
18-Jul-10	Rocky Mountain Elk	628119	6095645	1		1	4-5 pt bull elk observed at Quintette Mine site
18-Jul-10	Moose	614625	6105494	1	2	3	cow with twins
18-Jul-10	Moose	626221	6105967	1	1	2	cow and calf
19-Jul-10	Deer Spp.	601796	6087310	1		1	deer spp. in SU 4
19-Jul-10	Deer Spp.	628418	6081024	1		1	deer spp. in SU 9
19-Jul-10	Rocky Mountain Elk	607708	6093288	1		1	in SU 4
19-Jul-10	Rocky Mountain Elk	616444	6089194	5		5	crossing Murray river south of open mine, SU 10
19-Jul-10	Moose	640729	6098560	1		1	bull moose along Tumbler Ridge (landform) in SU 12
19-Jul-10	White-tailed Deer	628400	6087900	1		1	south side of Mt. Babcock: whitetail doe
19-Jul-10	White-tailed Deer	629323	6109140	1		1	on Hwy out of Tumbler Ridge
20-Jul-10	Deer Spp.	603924	6110306	2		2	deer spp. observed in SU 2
20-Jul-10	Rocky Mountain Elk	612266	6095208	1		1	cow elk in SU 5
20-Jul-10	Mule Deer	614993	6097403	1		1	
21-Jul-10	Moose	614324	6105670				lots of moose browse

Appendix 3.2-5

EDI Inc. Winter Wildlife Track Baseline Survey, 2013

Rescan™
Engineers and Scientists

Murray River Project - Winter Wildlife Track Transects 2013

PREPARED FOR:

HD MINING INTERNATIONAL LTD.
SUITE 433-595 BURRARD ST.
VANCOUVER, BC
V7X 1J1

PREPARED BY:

EDI ENVIRONMENTAL DYNAMICS INC.
301 GEORGE STREET
PRINCE GEORGE, BC V2L 1R4
250.562.5412

EDI Contact:

RANDY MORRIS, MRM, PAG
604.633.1891

EDI PROJECT NO.:

PROJECT # 13-P-0108
DATE MAY 1, 2013

2012 ENVIRONMENTAL EMPLOYER OF THE YEAR

EDI ENVIRONMENTAL DYNAMICS INC.

PRINCE GEORGE • VANCOUVER • NANAIMO • GRANDE PRAIRIE • WHITEHORSE

www.edynamics.com

This page is intentionally blank.

AUTHORSHIP

This report was prepared by the EDI Environmental Dynamics Inc. EDI staff who contributed to this project include:

Sarah Racicot, B.Sc., A.Ag. ..... Primary Author

Cathy Mackay, M.Sc., R.P.Bio., P.Ag. ..... Senior Review

This page is intentionally blank.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

This page is intentionally blank.

1 INTRODUCTION

EDI is responsible for completing a Wildlife Habitat Ratings (WHR) study among a number of other components of baseline work for the Murray River Project (MRP). Focal species for that study are: woodland caribou, Black-throated Green Warbler, mountain goat, moose, grizzly bear, fisher and elk. To supplement data of the WHR study, a snow-track survey for ungulates and furbearers was conducted. White-tailed deer, mule deer and American marten were selected as focal species; however, the study was designed to capture data for all species to support the WHR study. The objectives of the current study were as follows:

- Provide baseline habitat use data for the focal species (i.e. deer and American marten) within the study area;
- Collect wildlife habitat utilization data in a manner that can be used to support wildlife habitat modeling (i.e. the WHR study); and
- Establish a standardized and replicable system for monitoring wildlife abundance and habitat utilization over multiple years.

The study area for this work was identified as the Local Study Area (LSA) of the Project. The LSA was used because its extent encompasses the potential impacts to deer and marten populations caused by the proposed mine development. The Regional Study Area (RSA) of the Project is much larger than the potential impact area.

In order to compare habitat use across the study area for deer and marten, it was stratified according to two variables known to influence winter habitat selection for each species. Comparing measures of species detection and relative abundance between these strata allowed potential high quality habitat qualities to be identified.

Collecting habitat use data for deer and American marten provides information on species that were not included in the WHR study. This has the benefit of collecting baseline data for these species should they be identified as potential Valued Components identified by the Project's Working Group. However, all tracks were identified and recorded allowing all detections, in addition to those of deer and American marten, to contribute to previous WHR work.

The study was designed to be repeatable so that potential effects over the life cycle of the Project may be detected and quantified. Therefore this study provided the study design and initial values for a monitoring program should it be found necessary. The study is easily adjustable to a larger study area.

2 METHODOLOGY

2.1 STUDY DESIGN

2.1.1 Study Area and Species Selection

The 12,093 ha LSA of the Project was selected as the study area for winter wildlife transects (Figures 1 and 2). In order to determine the appropriate size of this study area, we included area around the proposed infrastructure where potential effects could occur. This study area was chosen over the much larger RSA (230,000 ha) because the objective of this study is to monitor potential impacts to deer and marten and these effects would be contained within the smaller area. Potential effects include: sensory disturbance, habitat loss or alteration, increased predation and increased hunting pressures. For example, a study by Sawyer and colleagues (2006) suggested that indirect habitat losses may extend up to 2.7 to 3.7 km from a well pad during development of a natural gas field as was demonstrated by lower predicted probabilities of use by mule deer. A 2.7 km buffer around the infrastructure investigation area is nearly entirely contained within the LSA polygon (93%). American marten usually do not cross large open areas, but may cross forestry roads and smaller clearings (Buskirk 1984 and Buskirk and Ruggerio 1994 in Jacques Whitford Axys 2010). If present, marten will be displaced from the areas of the Project Site due to forest removal.

The focal species selected for this study were the two deer species and American marten. These species were chosen because a review of various stages of the WHR study by stakeholders indicated that they were species of interest, but were not captured in the WHR study. These species are important socioeconomically, marten as a furbearer important to local trappers and deer as subsistence and recreational hunting species. Both white-tailed deer and mule deer were chosen and considered jointly as both reside within the study area and their tracks are very difficult, if not impossible, to distinguish.

2.1.2 Stratification

The LSA was stratified into six and seven strata for deer and marten respectively. Strata were created from variables known to influence habitat selection. Telfer (1978 in Geowest 2000) found that mule deer select for winter habitats with lower elevations, climax forests with dense crown closures, gentle to moderate slopes with warm aspect and lower snow depths. Preferred white-tailed deer winter habitats are similar and are usually below 1000 m in deep snowpack zones (U.S. Forest Service 1998 in Ministry of Environment 2001). Since both white-tailed and mule deer are known to select for warm aspects and low elevations in winter, aspect (warm, neutral or cool) and elevation (high <1000 m, low >1000 m) were chosen as variables for stratification for deer (Figure 1). Marten are known to mainly inhabit old-growth coniferous and mixed forests (Snyder and Bissonette 1987). However, use of young deciduous and deciduous forests has also been documented in northeastern British Columbia (Poole *et al.* 2004). Therefore forest type (coniferous, broadleaf or mixed) and forest age (young or mature) were variables used for stratification for marten (Figure 2). As marten strata were based on forest characteristics, non-forested areas were separated into a seventh stratum (no rating). The "No rating" category applied to herb-dominated or shrubby areas

(structural stages 2a, 2b, 3a, 3b) or non-forested map codes (e.g. waterbodies, urban areas or disturbance such as railways, mines and reclaimed areas). Comparing measures of detection and relative abundance between these strata allowed potential high quality habitat qualities to be identified. A description of each stratum is provided in Table 1. The data sources for each variable are outlined below:

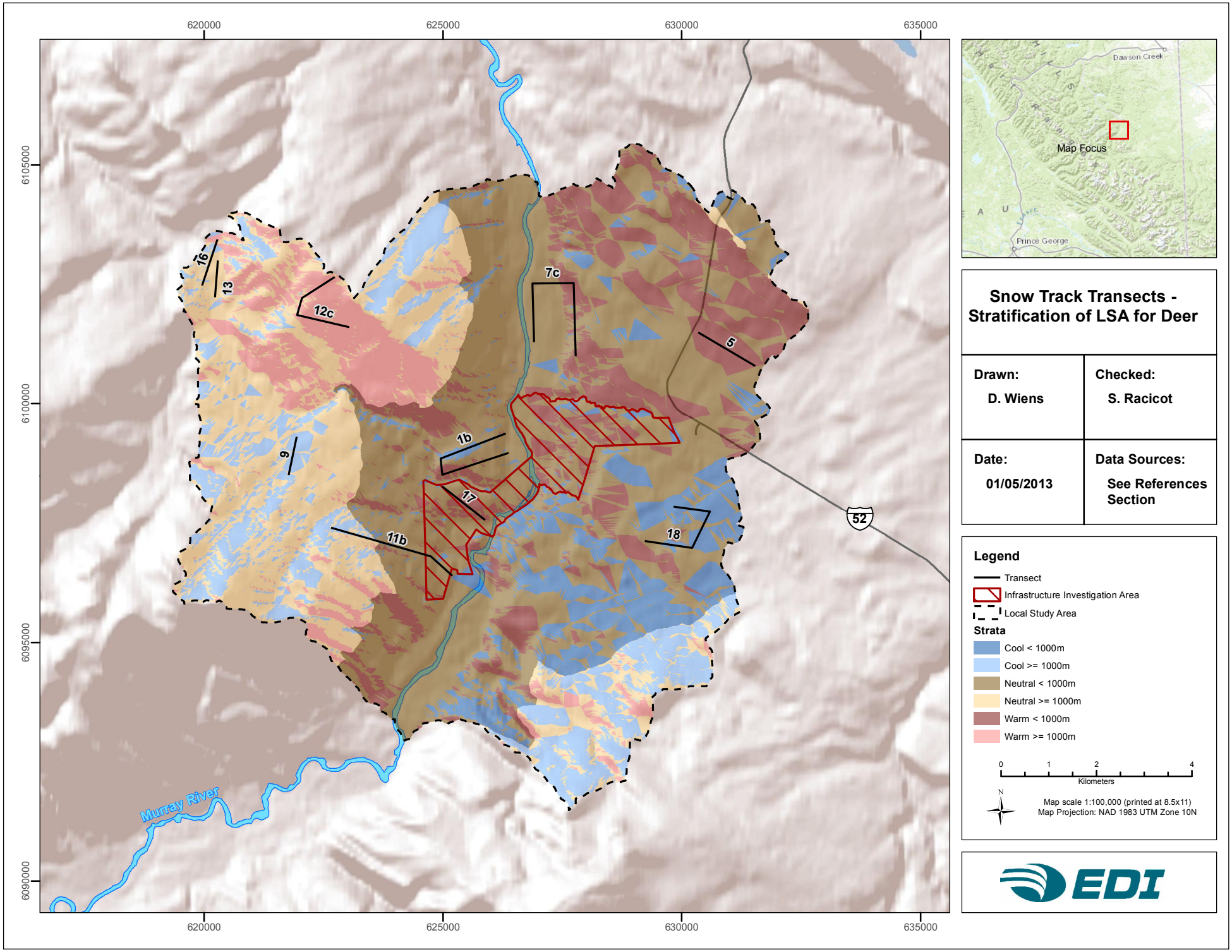
- Aspect and elevation – In a previously completed WHR study (EDI 2012) a triangulated irregular network (TIN) was created using ET GeoWizards. This produced a dataset of elevation, slope and aspect for the entire LSA. Aspect and elevation were taken from this dataset.

- Forest type and forest age (i.e. structural stage) – variable "Stand_M1" and "Struct_S1" respectively from a Terrestrial Ecosystem Mapping (TEM) project produced by Rescan (2013). Note that the TEM data was polygon-based but consisted of up to three deciles per polygon. This meant that within each polygon every variable could have up to three values. Decile 1 indicated the percentage of area within the polygon that is the primary site series/modifier/structural stage ecosystem map unit. Decile 2 indicated the second most common ecosystem map unit and decile 3 indicated the third most common ecosystem map unit. The value from the primary decile was used here.

Table 1. Stratification of LSA for 2013 snow track surveys.

	American Marten		Deer	
Variable	Forest Age*	Forest Type*	Aspect	Elevation
Strata and Definition	Mature – Structural stages 6 & 7	Broadleaf - ≥75% of forest canopy is deciduous species	Warm - 136° to 270°	High – greater than or equal to 1000 m
	Young – Structural Stages 4 & 5	Coniferous - ≥75% of forest canopy is coniferous species	Neutral - 45° to 135°, 271° to 315°	Low – less than 1000 m
		Mixed – neither deciduous or coniferous trees are ≥75% of forest canopy	Cool - 0° to 44°, 316° to 360°	

*from first decile in TEM data



Snow Track Transects - Stratification of LSA for Deer

Drawn:	Checked:
D. Wiens	S. Racicot
Date:	**Data Sources:**
01/05/2013	See References Section

Legend

- Transect
- Infrastructure Investigation Area
- Local Study Area

Strata

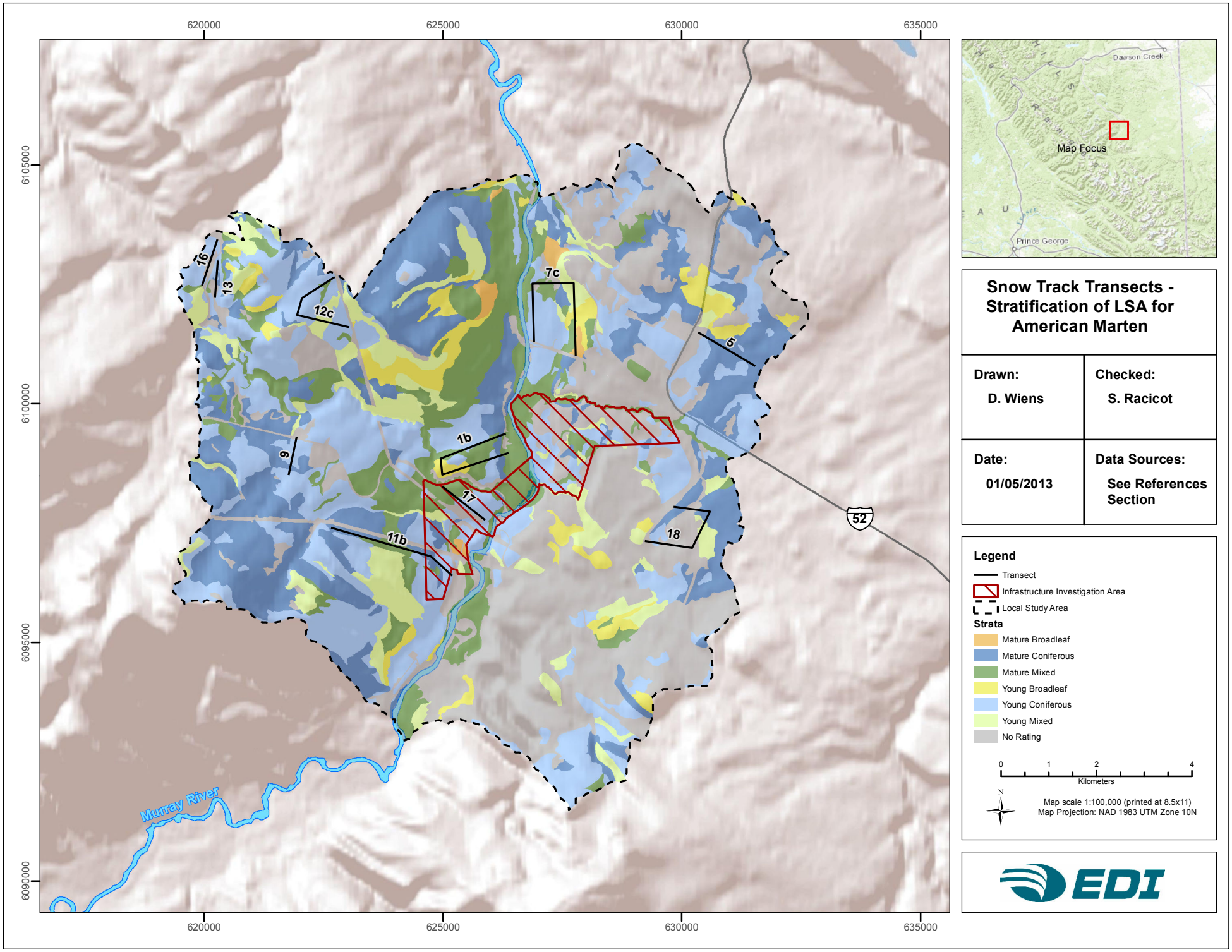
- Cool < 1000m
- Cool >= 1000m
- Neutral < 1000m
- Neutral >= 1000m
- Warm < 1000m
- Warm >= 1000m

0 1 2 4
Kilometers

N

Map scale 1:100,000 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 10N

EDI



Snow Track Transects - Stratification of LSA for American Marten

Drawn:	Checked:
D. Wiens	S. Racicot
Date:	**Data Sources:**
01/05/2013	See References Section

Legend

- Transect
- Infrastructure Investigation Area
- Local Study Area

Strata

- Mature Broadleaf
- Mature Coniferous
- Mature Mixed
- Young Broadleaf
- Young Coniferous
- Young Mixed
- No Rating

0 1 2 4
Kilometers

N

Map scale 1:100,000 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 10N

EDI

2.2 DATA COLLECTION

Transects were planned prior to fieldwork, following stratification of the study area (Figures 1 and 2). More transects were planned than were traversed to allow flexibility during fieldwork. Study design was consistent with RISC standard "Ground-based Inventory Methods for Ungulate Snow-track Surveys" (D'Eon *et al.* 2006). Following this standard, two sampling sessions should have been completed as planned between January and March 2013. However, approval of the study occurred in later winter, allowing only one session to be completed during appropriate winter conditions. This study should be repeated next winter to provide more data.

Transects were traversed on snowshoes and snowmobiles were used opportunistically for access to transect start points. Data collected included:

- Present date and date of last snowfall
- Transect start time, waypoint and temperature and weather conditions (e.g. precipitation and wind that may interfere with data collection)
- Transect end time, waypoint and temperature
- At the start of each transect and at each detected track leading forest species and structural stage was recorded.
- At each track a waypoint, habitat data and snow depth was recorded.
- A note on snowshoe hare and red squirrel: there were many observations of tracks which were often in groups. Recorded number of crossings of the transect line rather than trying to estimate the number of individuals.

3 RESULTS

3.1 FIELDWORK

Fieldwork was completed March 19 to March 24, 2013. Snowfall on March 20, 2013 prevented surveys on that day. Ten transects were completed with a cumulative transect distance of approximately 19.7 km. Figures 1 and 2 show the transects completed in relation to deer and marten strata. Table 2 provides information about each transect. All collected field data is presented in Appendix A.

Table 2. Completed transect information.

Date	Transect	Transect Length (km)	Start, End Temperatures (°C)	Time since snowfall (6 hr increments)	Snow Depth Average, Std Dev, (# Measurements) (cm)
March 19, 2013	5	1.4	-1, -1	42	89, 17 (16)
March 20, 2013	No transects – Snow day	-	-	-	-
March 21, 2013	7C	3.6	-14, -5	12	42, 15 (27)
	17	1.1	-5, -5	18	42, 21 (10)
March 22, 2013	12C	2.3	-10, -6	36	95, 19 (6)
	16	1.0	-6, -5	36	98, 11 (7)
	13	0.8	-5, -5	42	106, 16 (4)
March 23, 2013	11B	2.8	-17, -5	60	75, 28 (24)
	9	0.8	-1, -1	66	79, 21 (6)
March 24, 2013	1B	3.3	-18, -3	84	66, 17 (41)
	18	2.6	0, 2	84	81, 22 (16)

3.2 STRATIFICATION

Under the deer stratification, the LSA consists mainly of neutral aspect area less than 1000 m in elevation (39% of the LSA), followed by neutral aspect area greater than or equal to 1000 m elevation (19%) and warm aspect area less than 1000 m in elevation (15%) (Table 3). Correspondingly, the majority of the transects fell within the Neutral < 1000 m (33%) stratum. Transect segments within Neutral ≥ 1000 and Warm < 1000 were also correspondingly high. Overall the proportion of transects within each stratum matched closely with the portion of the stratum within the LSA, although proportions were not exact.

Under the marten stratification, the LSA consists mainly of No Rating (non-forested) category (31% of the LSA), followed by Young Coniferous (24%) and Mature Coniferous (20%) (Table 3). The majority of transects fell within the Young Coniferous stratum (33%) and Mature Coniferous (20%). Only 14% of transect fell within the No Rating stratum, likely due to knowledge that non-forested areas were not likely to exhibit much, if any, habitat use by marten.

Table 3. Areas of strata and lengths of transects within LSA (including proportions).

Stratum	Area within LSA (ha)	Proportion of strata within LSA	Length of transect segments (km)	Proportion of transect segment length to total transect
DEER				
Warm >= 1000	914	8%	2.2	11%
Warm < 1000	1772	15%	4.1	21%
Neutral >= 1000	2308	19%	1.9	10%
Neutral < 1000	4701	39%	6.6	33%
Cool >= 1000	1257	10%	1.8	9%
Cool < 1000	1141	9%	3.2	16%
AMERICAN MARTEN				
Mature Broadleaf	66	1%	0.3	2%
Mature Coniferous	2452	20%	3.9	20%
Mature Mixed	1477	12%	3.6	18%
Young Broadleaf	463	4%	1.3	7%
Young Coniferous	2952	24%	6.6	33%
Young Mixed	930	8%	1.4	7%
No Rating	3753	31%	2.7	14%

3.3 SPECIES DETECTION & RELATIVE ABUNDANCE

3.3.1 All Species

Species detected by their tracks in snow in this study included:

- coyote,
- deer spp.,
- mice and voles,
- grouse spp.,
- snowshoe hare,
- lynx,
- American marten,
- moose,
- red squirrel,
- weasel spp., and
- wolf.

3.3.2 Deer

Deer were detected in two strata: Warm < 1000 and Neutral < 1000 (Table 4). A measure of relative abundance (number of tracks/day/kilometer transect traversed) indicated that observed relative abundance from this study was higher in the Warm < 1000 than the Neutral < 1000.

Table 4. Deer spp. detected/not detected

Stratum	Detected / Not Detected	Relative Abundance (tracks / day / km)
Warm >= 1000	×	
Warm < 1000	✓	4.94
Neutral >= 1000	×	
Neutral < 1000	✓	0.42
Cool >= 1000	×	
Cool < 1000	×	

3.3.3 American Marten

American marten were detected in three strata: Mature Coniferous, Mature Mixed and Young Coniferous (Table 5). Observed relative abundance from this study was highest in Mature Coniferous, followed by Young Coniferous and Mature Mixed.

Table 5. American marten detected/not detected

Stratum	Detected / Not Detected	Relative Abundance (tracks / day / km)
Mature Broadleaf	×	
Mature Coniferous	✓	1.23
Mature Mixed	✓	0.30
Young Broadleaf	×	
Young Coniferous	✓	0.49
Young Mixed	×	
No rating	×	

3.3.4 Medium- to Large- Carnivores

Lynx, coyote and wolf are predatory species that were detected within this study. Although strata were designed for deer spp. and American marten, detections of these predators were compared against these strata to look for trends (Table 6). Within deer strata, detections of these predators were within Warm and Neutral <1000 and Neutral ≥ 1000 which generally matched those strata in which deer tracks were detected (exception being Neutral ≥ 1000). Within American marten strata, these predators were detected in all strata except Young Broadleaf and Young Mixed. This did not closely match detections of marten since marten was not detected in Mature Broadleaf or No Rating.

Table 6. Detection of predators within the LSA.

	Detected / Not Detected		
Stratum (for Deer)	**LYNX**	**COYOTE**	**WOLF**
Warm >= 1000			
Warm < 1000	✓	✓	✓
Neutral >= 1000		✓	
Neutral < 1000		✓	✓
Cool >= 1000			
Cool < 1000			
Stratum (for American Marten)			
Mature Broadleaf			✓
Mature Coniferous	✓	✓	✓
Mature Mixed		✓	
Young Broadleaf			
Young Coniferous		✓	✓
Young Mixed			
No Rating	✓	✓	✓

3.3.5 Prey Species

Prey species detected in this study included grouse spp., snowshoe hare, mouse spp., red squirrel, vole spp. and weasel spp. These prey species were detected in all strata of the LSA with the exception of Mature Broadleaf of the marten strata (Table 7).

Table 7. Detection of prey species within the LSA.

Stratum (for Deer)	Prey Species
Warm >= 1000	✓
Warm < 1000	✓
Neutral >= 1000	✓
Neutral < 1000	✓
Cool >= 1000	✓
Cool < 1000	✓
Stratum (for American Marten)	
Mature Broadleaf	
Mature Coniferous	✓
Mature Mixed	✓
Young Broadleaf	✓
Young Coniferous	✓
Young Mixed	✓
No Rating	✓

3.3.6 Other Ungulates

Moose was the only other ungulate detected in this study. Moose was detected in four deer strata: Warm < 1000, Neutral ≥ 1000, Neutral < 1000 and Cool < 1000 (Table 8). This represents a wider range than deer, which were detected only in Warm < 1000 and Neutral < 1000. Within marten strata, moose were detected in Mature Mixed, Young Broadleaf and No Rating.

Table 8. Detection of moose within the LSA.

Stratum (for Deer)	Prey Species
Warm >= 1000	
Warm < 1000	✓
Neutral >= 1000	✓
Neutral < 1000	✓
Cool >= 1000	
Cool < 1000	✓
Stratum (for American Marten)	
Mature Broadleaf	
Mature Coniferous	
Mature Mixed	✓
Young Broadleaf	✓
Young Coniferous	
Young Mixed	
No Rating	✓

4 DISCUSSION

4.1 STRATIFICATION

The provincial Resources Information Standards Committee's Species Inventory Fundamentals (MELP 1998) outlines three advantages usually provided by stratifying a study area:

- produces a smaller confidence interval than produced by a simple random sample (i.e. increased reliability),
- reduces cost per observation, and
- enables parameter estimates to be calculated for each subgroup.

The Murray River Project's LSA was stratified by this study into two systems, one for deer and another for American marten. This allowed measures of detection and abundance for the focal species and other detected species to be compared between the strata. It also allowed proportion of strata within the LSA and proportion of transects within strata to be analyzed. The proportions of strata within the LSA were not evenly distributed, and this allowed transect effort to match this distribution or certain strata to be surveyed less if warranted. For example, in the marten stratification, No Rating strata was surveyed proportionally less than the available strata due to the knowledge of its lower habitat importance. An additional benefit of stratification is that it can be easily changed or modified as necessary when completing future studies in the study area of the MRP.

4.2 SPECIES DETECTION & RELATIVE ABUNDANCE

In this study, the observed relative abundance of deer was highest in warm aspects at low elevations followed by neutral aspects in this elevation range. This corresponds with general knowledge that deer prefer winter habitats on south-facing slopes of low elevation where snow depth is expected to be limited. For marten, relative abundance was highest in mature coniferous forest, followed by young coniferous and mature mixed forest. This again corresponds with known habitat preference for American marten. As might be expected, detection of predators (including lynx, coyote and wolf) occurred within deer strata where deer were detected. The exception being these predators were detected in neutral areas above 1000 m where deer were not detected. This likely reflects the availability of multiple prey species. Detection of predators within marten strata did not present a perceptible pattern. Prey species were detected in all strata of the LSA with the exception of mature broadleaf forest. This high amount of detection was likely due to compiling a large range of prey species (grouse spp., snowshoe hare, mouse spp., red squirrel, vole spp. and weasel spp) which each have unique habitat requirements. The exception of no detections in mature broadleaf forest was probably due to the low proportion of this marten stratum within the LSA (1%). Moose, the only other ungulate species detected in this study, was detected in a higher number of deer strata than deer (warm and cool aspects below 1000 m and neutral aspects above and below 1000 m) and is likely due to tolerance of deeper snow conditions.

This study has provided initial relative abundance values of the focal species, deer and marten, within the Murray River Project's LSA. Abundance values were associated with habitat strata devised from variables known to influence habitat selection. This data provides initial values that link well into future effects assessment and monitoring efforts. However, it is recommended this study be repeated next winter to increase baseline data and reliability of calculated values. The study has been designed and recorded such that it can be easily repeated for this purpose or for monitoring. Additionally, habitat strata can be modified as the intent of the study changes or evolves. As the stratification is easily applied to new areas, this program could also be expanded to the RSA should it be required.

5 REFERENCES

5.1 LITERATURE CITED

D'Eon, R.G., S.F. Wilson, and D. Hamilton. 2006. Ground-based Inventory Methods for Ungulate Snow-track Surveys: Standards for Components of British Columbia's Biodiversity No. 33a. Prepared for Ministry of Environnment, Ecosystems Branch for the Resources Inventory Committee.

Environmental Dynamics Inc. (EDI). 2012. Murray River Project – Wildlife Habitat Ratings for Local Study Area. Prepared for HD Mining International, 62 pp + appendices.

GEOWEST Environmental Consultants Ltd. 2000. Terrestrial Ecosystem Mapping with Wildlife Interpretations for Weyerhaeuser TFL 15, Volume I: Terrestrial Ecosystem Mapping with Expanded Legends for Terrestrial Ecosystem Units. Prepared for Weyerhaeuser Canada Ltd.

Jacques Whitford Axys. 2010. Technical Data Report: Wildlife Habitat Modelling: Approach, Methods and Species Accounts. Prepared for Enbridge Northern Gateway Project.

Ministry of Environment. 2001. BC Wildlife Habitat Ratings Standards Species Accounts, White-tailed Deer.

Ministry of Environment, Land and Parks (MELP). 1998. Species Inventory Fundamentals: Standards for Components of British Columbia's Biodiversity No. 1.

Poole, K.G., A.D. Porter, A. de Vries, C. Maundrell, S.D. Grindal, and C.C. St. Clair. 2004. Suitability of a young deciduous-dominated forest for American marten and the effects of forest removal. Can. J. Zool. 82: 423 – 435.

Rescan Environmental Services Ltd. 2013. Terrestrial Ecosystem Mapping. Received March 4, 2013. Prepared for HD Mining International Ltd. by Rescan Environmental Services Ltd.: Vancouver, British Columbia.

Sawyer, H., R.M. Nielson, F. Lindzey, and L. L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70(2):396–403.

Snyder, J.E. and J.A. Bissonette. 1987. Marten use of clear-cuttings and residual forest stands in western Newfoundland. Can. J.Zool. 65: 169 – 174.

5.2 SPATIAL DATA

1:50,000 CanVec topographic data from Government of Canada, Natural Resources Canada, Earth Sciences Sector, Centre for Topographic Information. Geogratis website (http://geogratis.cgdi.gc.ca).

1:20,000 TRIM positional files from the Land and Resource Data Warehouse (http://lrdw.ca). Copyright belongs to Her Majesty the Queen in Right of the Province of British Columbia.

National Road Network data from Government of Canada, Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information - Sherbrooke. Geobase website (http://www.geobase.ca/geobase/en/data/nrn/index.html).

National Hydro Network data from Government of Canada, Natural Resources Canada, Earth Sciences Sector, Geomatics Canada, Centre for Topographic Information - Sherbrooke. Geobase website (http://www.geobase.ca/geobase/en/data/nhn/index.html).

Basemaps:

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster N L, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community. Copyright: © 2013 Esri.

Disclaimer:
Maps presented in this document are a geographical representation of known features. Although the data collected and presented herein has been obtained with the utmost attention to quality, this document is not an official land survey and should not be considered for spatial calculation. EDI Environmental Dynamics Inc. does not accept any liability for errors, omissions or inaccuracies in the data.

APPENDIX A FIELD DATA

date	date_lastsnow	hrs_since_snow	transect_no	start_wypt	start_time	start_temp	start_wx	start_snow depth	track_wypt	deer_strata	marten_strata	track_ID	track_habtype	track_sp1	track_sp2	track_sp3	track_STS	track_snow depth	track_photos	end_wypt	end_time	end_temp	comments
19-Mar-13	17-Mar-13	42	5		1356	-1	clear, light wind	29		Warm < 1000	No_Rating	moose	disturbed				2	66	2208, 2209	18	1535	-1	
		42	5							Warm < 1000	No_Rating	moose	disturbed				2	40					
		42	5							Warm < 1000	No_Rating	hare	disturbed				3b	81	2210				multiple tracks to 630462 6101488
		42	5							Warm < 1000	No_Rating	lynx	forest	Pl	Sb	Lx	5	86	2211, 2212, 2213, 2214				
		42	5							Warm < 1000	No_Rating	hare	forest	Pl	Sb	Lx	5	86					multiple tracks
		42	5							Warm < 1000	No_Rating	lynx	forest	Lt	Sb		5	98	2215, 2216				
		42	5							Warm < 1000	No_Rating	hare	forest	Lt	Sb		5	98					multiple tracks
		42	5							Warm < 1000	Mature_Coniferous	hare	forest	Lt	Sb		5	98					
		42	5						9	Warm < 1000	Mature_Coniferous	hare	forest	Lt	Sb		5	98					
		42	5						10	Warm < 1000	Mature_Coniferous	lynx	forest	Sb	Lt		6	80					
		42	5						10	Warm < 1000	Mature_Coniferous	hare	forest	Sb	Lt		6	80					multiple tracks
		42	5						12	Warm < 1000	Mature_Coniferous	hare											
		42	5						12	Warm < 1000	Mature_Coniferous	hare											
		42	5						13	Warm < 1000	Mature_Coniferous		forest	Sb			6						forest type change
		42	5						14	Warm < 1000	Mature_Coniferous	marten	forest	Sb	Lt		6	105	2215, 2216				
		42	5						15	Warm < 1000	Mature_Coniferous	marten	forest	Sb	Lt		6	105					
		42	5						15	Warm < 1000	Mature_Coniferous	marten	forest	Sb	Lt		6	105					
		42	5						16	Warm < 1000	Young_Coniferous	marten	forest	Sb	Lt		6	99					
		42	5						17	Warm < 1000	Mature_Coniferous	marten	forest	Sb	Lt		6	95					
21-Mar-13	20-Mar-13	12	7C	22	1004	-14	clear, no wind	43	23	Warm < 1000	Mature_Broadleaf	deer	forest	Sx	At	Pl	6	35		38	1345	-5	
		12	7C						23	Warm < 1000	Mature_Broadleaf	deer	forest	Sx	At	Pl	6	35					
		12	7C						24	Neutral < 1000	Mature_Broadleaf	wolf	forest	Sx	At	Pl	6	25	2221, 2222, 2223				
		12	7C						24	Neutral < 1000	Mature_Broadleaf	wolf	forest	Sx	At	Pl	6	25	2221, 2222, 2223				
		12	7C						25	Warm < 1000	Young_Mixed	squirrel	forest	Sx			7	61					
		12	7C						26	Warm < 1000	Young_Mixed	deer	forest	At			5	35	2224, 2225				wildlife trail, likely 3+ deer
		12	7C						26	Warm < 1000	Young_Mixed	deer	forest	At			5	35	2224, 2225				wildlife trail, likely 3+ deer
		12	7C						26	Warm < 1000	Young_Mixed	deer	forest	At			5	35	2224, 2225				wildlife trail, likely 3+ deer
		12	7C						27	Warm < 1000	Young_Mixed	mouse	forest	At			5	39					
		12	7C						28	Warm < 1000	Young_Mixed	deer	forest	At			5	40					
		12	7C						28	Warm < 1000	Young_Mixed	deer	forest	At			5	40					
		12	7C						29	Warm < 1000	Mature_Coniferous	deer	forest	At			5	41					wildlife trail, likely 3+ deer
		12	7C						29	Warm < 1000	Mature_Coniferous	deer	forest	At			5	41					wildlife trail, likely 3+ deer
		12	7C						29	Warm < 1000	Mature_Coniferous	deer	forest	At			5	41					wildlife trail, likely 3+ deer
		12	7C						29	Warm < 1000	Mature_Coniferous	mouse	forest	At			5	41					
		12	7C						30	Neutral < 1000	No_Rating	vole	wetland				3	63					
		12	7C						31	Neutral < 1000	No_Rating	mouse	meadow				2	53					
		12	7C						32	Neutral < 1000	Mature_Mixed	coyote	forest	Sx	At		5	25	2226, 2227				
		12	7C						32	Neutral < 1000	Mature_Mixed	coyote	forest	Sx	At		5	25	2226, 2227				
		12	7C						32	Neutral < 1000	Mature_Mixed	coyote	forest	Sx	At		5	25	2226, 2227				
		12	7C						32	Neutral < 1000	Mature_Mixed	coyote	forest	Sx	At		5	25	2226, 2227				
		12	7C						33	Neutral < 1000	No_Rating	vole	wetland				3	90	2228, 2229, 2230				
		12	7C						34	Neutral < 1000	Young_Coniferous	hare	forest	Sx	At	Pl (dea	5	65					
		12	7C						34	Neutral < 1000	Young_Coniferous	hare											
		12	7C						34	Neutral < 1000	Young_Coniferous	hare											
		12	7C						34	Neutral < 1000	Young_Coniferous	hare											
		12	7C						34	Neutral < 1000	Young_Coniferous	hare											
		12	7C						35	Neutral < 1000	Young_Coniferous	grouse	forest	Sx	At	Pl (dea	5	50					
		12	7C						36	Neutral < 1000	Young_Coniferous	hare	forest	Sx	At	Pl (dea	5	50					
		12	7C						36	Neutral < 1000	Young_Coniferous	squirrel	forest	Sx	At	Pl (dea	5	50					
		12	7C						37	Neutral < 1000	Young_Coniferous	marten	forest	Pl	Sx		5	51					
21-Mar-13	20-Mar-13	18	17	39	1515	-5		32	40	Neutral < 1000	Mature_Mixed	coyote	forest	At	Sx		6	30		52	1634	-5	
		18	17						41	Neutral < 1000	Mature_Mixed	deer	disturbed				2		2231, 2232				kill site
		18	17						41	Neutral < 1000	Mature_Mixed	coyote	disturbed				2						
		18	17						44	Warm < 1000	Young_Coniferous	hare	forest	Pl	Sx		5	92					
		18	17						44	Warm < 1000	Young_Coniferous	hare											
		18	17						44	Warm < 1000	Young_Coniferous	hare											
		18	17						45	Warm < 1000	Young_Coniferous	squirrel	forest	Pl	Sx		5	42					
		18	17						46	Warm < 1000	Young_Coniferous	wolf	forest	Pl	Sx		5	37					
		18	17						47	Warm < 1000	Young_Coniferous	coyote	forest	At			6	63					
		18	17						48	Warm < 1000	Young_Coniferous	hare	forest	Sx	At	Bp	5	23					
		18	17						48	Warm < 1000	Young_Coniferous	hare											
		18	17						48	Warm < 1000	Young_Coniferous	hare											
		18	17						48	Warm < 1000	Young_Coniferous	hare											
		18	17						49	Neutral < 1000	Young_Coniferous	wolf	forest	Pl			4	29					
		18	17						49	Neutral < 1000	Young_Coniferous	wolf	forest	Pl			4	29					
		18	17						50	Neutral < 1000	Young_Coniferous	wolf	forest	Pl			4	30					
		18	17						51	Warm < 1000	Young_Coniferous	wolf	forest	Pl			4	42					
22-Mar-13	20-Mar-13	36	12C	53	943	-10		103	54	Warm >= 1000	Young_Coniferous	hare	forest	Pl			5	110		59	1140	-6	
		36	12C						54	Warm >= 1000	Young_Coniferous	hare	forest	Pl			5	110					

		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						54	Warm >= 1000	Young_Coniferous	hare											
		36	12C						55	Neutral >= 1000	Young_Coniferous	marten	forest					79					
		36	12C						56	Warm >= 1000	Young_Coniferous	grouse	forest	Bp			5	97	2235				
		36	12C						57	Warm >= 1000	Young_Coniferous	weasel	forest	Pl			5	65					maybe mink?
		36	12C						58	Warm >= 1000	Young_Coniferous	weasel	forest	Bp	willow		6	110	2238				maybe mink?
22-Mar-13	20-Mar-13	36	16	60	1245	-6		113	61	Warm >= 1000	Young_Coniferous	hare	forest	Pl			4	88		68	1340	-5	
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						61	Warm >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare	forest	Pl	Sb	Bp	6	115					
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						63	Cool >= 1000	Young_Coniferous	hare											
		36	16						65	Neutral >= 1000	No_Rating	hare	forest	Pl	Sb	Bp	6	102					
		36	16						65	Neutral >= 1000	No_Rating	hare	forest	Pl	Sb	Bp	6	102					
		36	16						65	Neutral >= 1000	No_Rating	hare	forest	Pl	Sb	Bp	6	102					
		36	16						65	Neutral >= 1000	No_Rating	hare	forest	Pl	Sb	Bp	6	102					
		36	16						65	Neutral >= 1000	No_Rating	hare											
		36	16						65	Neutral >= 1000	No_Rating	hare											
		36	16						66	Neutral >= 1000	Young_Coniferous	grouse	forest	Pl	Sx		6	80					
22-Mar-13	20-Mar-13	42	13	69	1403	-5		93	69	Neutral >= 1000	No_Rating	moose	forest	Sb	Lt		5	93	2242, 2243	72	1440	-5	
		42	13						70	Neutral >= 1000	No_Rating	coyote	forest	Sb	Lt		5	129					
		42	13						71	Neutral >= 1000	Young_Coniferous	hare	forest	Pl			3a	101					
		42	13						71	Neutral >= 1000	Young_Coniferous	hare	forest	Pl			3a	101					
23-Mar-13	20-Mar-13	60	11b	73	916	-17		109	74	Cool >= 1000	Mature_Coniferous	marten	forest	Pl	Bl		6	121	2253	97	1139	-5	
		60	11b						75	Cool >= 1000	Mature_Coniferous	squirrel	forest	Pl	Bl		6	132					
		60	11b						76	Cool >= 1000	Mature_Coniferous	marten	forest	Pl	Bl		6	101					
		60	11b						77	Neutral >= 1000	Mature_Coniferous	squirrel	forest	Pl	Bl		6	105					
		60	11b						78	Cool >= 1000	Mature_Coniferous	marten	forest	Pl	Bl		6	120	2254				
		60	11b						79	Cool >= 1000	Mature_Coniferous	marten	forest	Pl	Bl		6	95					
		60	11b						80	Neutral < 1000	No_Rating	squirrel	forest	Sx	Bp	Pl	7	109	2255				
		60	11b						81	Neutral < 1000	No_Rating	squirrel	forest	Sx	Bp	Pl	7	92					
		60	11b						82	Neutral < 1000	No_Rating	squirrel	forest	Sx	Bp	Pl	7	47					
		60	11b						82	Neutral < 1000	No_Rating	wolf	forest	Sx	Bp	Pl	7	47					
		60	11b						83	Neutral < 1000	Mature_Mixed	marten	forest	Sx	Bp	Pl	7	60					
		60	11b						84	Neutral < 1000	Mature_Mixed	marten	forest	Sx	Bp	Pl	7	76					
		60	11b						85	Neutral < 1000	Mature_Coniferous	wolf	forest	Sx	Bl		6	60					
		60	11b						87	Neutral < 1000	Mature_Coniferous	squirrel	forest	Sx	Bl		6	54					
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare	forest	Sx	Pl		6	51	2256				
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						88	Neutral < 1000	Mature_Coniferous	squirrel											
		60	11b						89	Neutral < 1000	Mature_Coniferous	wolf	forest	Sx	Pl		6	44					
		60	11b						89	Neutral < 1000	Mature_Coniferous	squirrel											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											

		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						89	Neutral < 1000	Mature_Coniferous	hare											
		60	11b						90	Neutral < 1000	Mature_Coniferous	squirrel											
		60	11b						92	Neutral < 1000	Mature_Mixed	hare	forest	Bp	At		6	55					
		60	11b						92	Neutral < 1000	Mature_Mixed	squirrel	forest	Bp	At		6	55					
		60	11b						92	Neutral < 1000	Mature_Mixed	squirrel											
		60	11b						92	Neutral < 1000	Mature_Mixed	squirrel											
		60	11b						92	Neutral < 1000	Mature_Mixed	squirrel											
		60	11b						93	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl		5	83					
		60	11b						94	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl		5	64					
		60	11b						95	Neutral < 1000	Young_Coniferous	wolf	forest	Sx	Pl		5	57					
		60	11b						95	Neutral < 1000	Young_Coniferous	wolf	forest	Sx	Pl		5	57					
		60	11b						96	Neutral < 1000	Young_Coniferous	squirrel	forest	Pl			5	52					
		60	11b						96	Neutral < 1000	Young_Coniferous	hare	forest	Pl			5	52					
		60	11b						97	Neutral < 1000	Young_Coniferous	hare	forest	Pl			5						
		60	11b						97	Neutral < 1000	Young_Coniferous	hare	forest	Pl			5						
23-Mar-13	20-Mar-13	66	9	99	1415	-1		106	100	Cool >= 1000	Young_Coniferous	squirrel	forest	Sx	Bl		6	105		104	1440	-1	
		66	9						100	Cool >= 1000	Young_Coniferous	hare	forest	Sx	Bl		6	105					
		66	9						100	Cool >= 1000	Young_Coniferous	squirrel											
		66	9						100	Cool >= 1000	Young_Coniferous	squirrel											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						100	Cool >= 1000	Young_Coniferous	hare											
		66	9						102	Cool >= 1000	Young_Coniferous	squirrel	forest	Sx	Pl		6	62					
		66	9						102	Cool >= 1000	Young_Coniferous	squirrel	forest	Sx	Pl		6	62					
		66	9						102	Cool >= 1000	Young_Coniferous	hare	forest	Sx	Pl		6	62					
		66	9						104	Cool >= 1000	Young_Coniferous	squirrel	forest	Pl			5	80	2264				
24-Mar-13	20-Mar-13	84	1b	105	826	-18	clear, no wind	55	105	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	Bp		6	55	2265	136	1209	-3	
		84	1b						105	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	Bp		6	55					
		84	1b						105	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	Bp		6	55					
		84	1b						105	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	Bp		6	55					
		84	1b						106	Neutral < 1000	Mature_Coniferous	coyote	forest	Sx	Bp		6	22					
		84	1b						106	Neutral < 1000	Mature_Coniferous	hare	forest	Sx	Bp		6	22					
		84	1b						107	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	Bp		6	30					
		84	1b						108	Neutral < 1000	Mature_Mixed	marten	forest	Bp			6	81					
		84	1b						109	Neutral < 1000	Mature_Coniferous	marten	forest	Bp			6	42					
		84	1b						110	Neutral < 1000	Young_Coniferous	grouse	forest	Bp			6	50					
		84	1b						111	Neutral < 1000	Young_Coniferous	hare	forest	Pl	Bp		6	80	2266				
		84	1b						112	Neutral < 1000	Young_Coniferous	coyote	forest	Pl	Sx		5	70					
		84	1b						113	Neutral < 1000	Young_Coniferous	hare	forest	Pl	Sx		5	83					
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						113	Neutral < 1000	Young_Coniferous	hare											
		84	1b						114	Neutral < 1000	Young_Coniferous	squirrel	forest	Pl	Sx		5	90					
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6	71	2267				
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	hare	forest	Sx	Pl	At	6						
		84	1b						115	Neutral < 1000	Young_Coniferous	squirrel	forest	Sx	Pl	At	6						
		84	1b						116	Neutral < 1000	Young_Coniferous	mouse	forest	Sx	Pl	At	6	65					
		84	1b						116	Neutral < 1000	Young_Coniferous	squirrel	forest	Sx	Pl	At	6	65					
		84	1b						117	Cool < 1000	Young_Coniferous	mouse	forest	Sx	Pl	At	6	77					
		84	1b						117	Cool < 1000	Young_Coniferous	squirrel	forest	Sx	Pl	At	6	77					
		84	1b						118	Cool < 1000	Mature_Mixed	grouse	forest	Pl	At		6	61					
		84	1b						120	Cool < 1000	Mature_Mixed	moose	forest	At	Pl	alder	6	99					

		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6	81	2268				
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6		2269				
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						121	Neutral < 1000	Young_Broadleaf	moose	forest	At	Pl	alder	6						
		84	1b						123	Warm < 1000	Young_Broadleaf	weasel	forest	At	Pl		6	80	2270, 2271, 2272, 2273, 2274				maybe long-tailed weasel?
		84	1b						124	Neutral < 1000	Young_Broadleaf	hare	forest	Pl			5	50					
		84	1b						125	Warm < 1000	Young_Broadleaf	grouse	forest	At	Pl		5	47					
		84	1b						125	Warm < 1000	Young_Broadleaf	hare											
		84	1b						125	Warm < 1000	Young_Broadleaf	hare											
		84	1b						125	Warm < 1000	Young_Broadleaf	hare											
		84	1b						125	Warm < 1000	Young_Broadleaf	hare											
		84	1b						126	Neutral < 1000	Young_Broadleaf	deer	forest	Pl	Sx		6	71	2275, 2276				
		84	1b						126	Neutral < 1000	Young_Broadleaf	deer	forest	Pl	Sx		6	71					
		84	1b						126	Neutral < 1000	Young_Broadleaf	deer	forest	Pl	Sx		6	71					
		84	1b						126	Neutral < 1000	Young_Broadleaf	deer	forest	Pl	Sx		6	71					
		84	1b						127	Neutral < 1000	Young_Broadleaf	squirrel	forest	Pl	Sx		6	74					
		84	1b						127	Neutral < 1000	Young_Broadleaf	hare	forest	Pl	Sx		6	74					
		84	1b						128	Warm < 1000	Young_Broadleaf	hare	forest	Pl	Sx		6	56					
		84	1b						129	Neutral < 1000	Young_Broadleaf	deer	forest	At	Pl		6	46					
		84	1b						130	Warm < 1000	Young_Broadleaf	mouse	forest	At	Pl		6	72					
		84	1b						130	Warm < 1000	Young_Broadleaf	mouse	forest	At	Pl		6	72					
		84	1b						130	Warm < 1000	Young_Broadleaf	mouse	forest	At	Pl		6	72					
		84	1b						130	Warm < 1000	Young_Broadleaf	mouse	forest	At	Pl		6	72					
		84	1b						131	Warm < 1000	Mature_Mixed	squirrel	forest	Sx	At		5	66					
		84	1b						132	Neutral < 1000	Mature_Mixed	coyote	forest	Sx	At		6	82					
		84	1b						132	Neutral < 1000	Mature_Mixed	squirrel	forest	Sx	At		6	82					
		84	1b						133	Neutral < 1000	Young_Coniferous	squirrel	forest	Sx	At	Bp	7	95	2277				
24-Mar-13	20-Mar-13	84	18	137	1243	0		46	138	Neutral < 1000	No_Rating	wolf	forest	willow	Pl	Sx	3a	75	2278	159	1453	2	
		84	18						139	Neutral < 1000	No_Rating	hare	disturbed	willow	Pl	Sx	2	40					
		84	18						139	Neutral < 1000	No_Rating	hare	disturbed	willow	Pl	Sx	3a						
		84	18						139	Neutral < 1000	No_Rating	hare	disturbed	willow	Pl	Sx	3a						
		84	18						139	Neutral < 1000	No_Rating	hare	disturbed	willow	Pl	Sx	3a						
		84	18						139	Neutral < 1000	No_Rating	hare	disturbed	willow	Pl	Sx	3a						
		84	18						141	Neutral < 1000	No_Rating	coyote	disturbed				3a	83					
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	willow	Sx		3a	97					
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a	93	2281				
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	squirrel	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	squirrel	disturbed	Pl	Sx		3a						
		84	18						142	Neutral < 1000	No_Rating	squirrel	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a	110					
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						143	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						146	Neutral < 1000	No_Rating	coyote	disturbed	Pl	Sx		3a	100					
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a	100					
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						

		84	18						146	Neutral < 1000	No_Rating	hare	disturbed	Pl	Sx		3a						
		84	18						147	Neutral < 1000	No_Rating	coyote	disturbed	Pl	Sx		3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						147	Neutral < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	squirrel	disturbed	Pl			3a	77					
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a	77					
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						148	Cool < 1000	No_Rating	hare	disturbed	Pl			3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						150	Cool < 1000	Young_Mixed	hare	disturbed	Pl	Sx		3a						
		84	18						152	Cool < 1000	Mature_Coniferous	marten	forest	Sb			5	77	2282				
		84	18						154	Cool < 1000	Mature_Coniferous	squirrel	forest	Pl	Sb		5	71					
		84	18						155	Cool < 1000	Mature_Coniferous	squirrel	forest	Bp	At		3b	87					
		84	18						155	Cool < 1000	Mature_Coniferous	hare	forest	Bp	At		3b						
		84	18						155	Cool < 1000	Mature_Coniferous	hare	forest	Bp	At		3b						
		84	18						155	Cool < 1000	Mature_Coniferous	hare	forest	Bp	At		3b						
		84	18						156	Cool < 1000	No_Rating	moose	forest	Bp	At		3b	115					
		84	18						156	Cool < 1000	No_Rating	hare	forest	Bp	At		3b						
		84	18						156	Cool < 1000	No_Rating	hare	forest	Bp	At		3b						
		84	18						158	Cool < 1000	Mature_Coniferous	marten	forest	Sb	Sx	Pl	6	59					
		84	18						159	Cool < 1000	Mature_Coniferous	squirrel	forest	Sx	Bp		6	36					

Appendix 3.3-1

Echolocation Call Survey Location Details, 2010

Rescan™
Engineers and Scientists

Appendix 3.3-1. Echolocation Call Survey Location Details, 2010

Survey Location	Zone	Easting	Northing	Detector	Band	Start					End				
						Date	Time	Temp (°C)	CC (%)	Wind (km/hr)	Date	Time	Temp (°C)	CC (%)	Wind (km/hr)
Location 1	10V	625998	6097363	Anabat	broad/ handheld	18-Jul-10	21:30:00	17	15	calm	18-Jul-10	23:30:00	12	clear	calm
Location 2	10V	627828	6096102	Anabat	broad/ handheld	19-Jul-10	21:30:00	10	40	5-10km/hr	19-Jul-10	23:30:00	9	10	5-10km/hr
Location 3	10V	626330	6109796	Anabat	broad/ handheld	20-Jul-10	21:30:00	18	10	calm	20-Jul-10	23:45:00	15	15	calm

Survey Location	Precip	Lunar Phase	Moonrise	Moonset	Sunrise	Sunset	Photos	Comment(s)
Location 1	zero	3/4	14:54:00	23:36:00	04:48:00	21:31:00	113-3445 - 47	Calibrate @ 21:13. Heavy rain & thunderstorms from 11:30 to 14:30 this evening. At bridge access over Murrary River. Elevation: 748. Riparian Sx & cottonwood SS 5/6 at edge of Murray River. Open canopy to thick riparian vegetation. lots of mosquitoes.
Location 2	zero	3/4	16:17:00		04:50:00	21:30:00	114-3467 - 70	Elevation 905 m. Site at Quinttette Mine - open area near conveyor belt by wetland. Grass & SS 3 Aspen/Poplar & willow (70% grass, 30% shrub) A lot less bat activity than expected. Good insects, slope <10%, creek beside site too.
Location 3	zero	7/8	17:35:00	00:00:00	04:50:00	21:29:00	115-3486 - 89	Located on edge of Flatbed Creek, beside bridge. Mostly open next to larger deciduous trees (poplar & aspen). Grassy area with scattered rocks. Many moths out.

Appendix 3.3-2

Echolocation Call Survey Detections, 2010

Rescan™
Engineers and Scientists

Appendix 3.3-2. Echolocation Call Survey Detections, 2010

Survey Location	Date	Obs #	Start time	End time	Freq KHz	Detection		Species	Comments / Reference Recording
						Pass	Buzz		
Location 1	18-Jul-10	1	10:10	10:10	unk	✓		M-MYXX	good short pass
Location 1	18-Jul-10	2	10:15	10:15	unk	✓		M-MYXX	good solid pass
Location 1	18-Jul-10	3	10:17	10:17	unk	✓		M-MYXX	good solid pass
Location 1	18-Jul-10	4	10:17	10:17	unk	✓		M-MYXX	good pass
Location 1	18-Jul-10	5	10:18	10:18	unk	✓		M-MYXX	good short pass
Location 1	18-Jul-10	6	10:19	10:19	unk	✓		M-MYXX	short pass
Location 1	18-Jul-10	7	10:29	10:29	unk	✓		M-MYXX	weak, short pass
Location 1	18-Jul-10	8	10:35	10:35	unk	✓		M-MYXX	very weak pass, no sequence file likely
Location 1	18-Jul-10	9	10:45	10:45	unk	✓		M-MYXX	long but weak pass
Location 1	18-Jul-10	10	10:53	10:53	unk	✓		M-MYXX	short weak pass
Location 1	18-Jul-10	11	11:05	11:05	unk	✓		M-MYXX	good pass
Location 1	18-Jul-10	12	11:09	11:09	unk	✓		M-MYXX	good pass
Location 2	19-Jul-10	1	22:19	22:19	unk	✓		M-MYXX	short pass, likely a MYLU
Location 2	19-Jul-10	2	23:10	23:10	unk	✓		M-MYXX	short, weak pass, likely no sequence file
Location 2	19-Jul-10	3	23:10	23:10	unk	✓		M-MYXX	short, weak pass
Location 2	19-Jul-10	4	23:13	23:13	unk	✓		M-MYXX	medium pass, likely a MYLU
Location 3	20-Jul-10	1	10:10	10:10	unk	✓		M-MYXX	short pass, good strength, likely MYLU
Location 3	20-Jul-10	2	10:22	10:22	unk		✓	M-MYXX	good solid detection
Location 3	20-Jul-10	3	10:22	10:22	unk	✓		M-MYXX	
Location 3	20-Jul-10	4	10:24	10:24	unk	✓		M-MYXX	
Location 3	20-Jul-10	5	10:30	10:30	unk	✓		M-MYXX	
Location 3	20-Jul-10	6	10:32	10:32	unk	✓		M-MYXX	short pass
Location 3	20-Jul-10	7	10:36	10:36	unk		✓	M-MYXX	
Location 3	20-Jul-10	8	10:37	10:37	unk	✓	✓	M-MYXX	good strong pass
Location 3	20-Jul-10	9	10:37	10:37	unk	✓		M-MYXX	
Location 3	20-Jul-10	10	10:40	10:40	unk	✓	✓	M-?	larger than Myotis
Location 3	20-Jul-10	11	10:45	10:45	unk	✓	✓	M-?	feeding buzz, 2 larger bats observed
Location 3	20-Jul-10	12	10:49	10:49	unk	✓		M-MYXX	good pass
Location 3	20-Jul-10	13	10:50	10:50	unk	✓		M-MYXX	good pass, observed
Location 3	20-Jul-10	14	10:51	10:51	unk	✓		M-MYXX	short pass, Myotis
Location 3	20-Jul-10	15	10:55	10:55	unk	✓		M-?	lower frequency pass
Location 3	20-Jul-10	16	10:56	10:56	unk	✓		M-MYXX	
Location 3	20-Jul-10	17	10:57	10:57	unk	✓		M-MYXX	short pass
Location 3	20-Jul-10	18	10:59	10:59	unk	✓		M-?	
Location 3	20-Jul-10	19	10:59	10:59	unk	✓		M-MYXX	short pass
Location 3	20-Jul-10	20	10:59	10:59	unk	✓		M-MYXX	
Location 3	20-Jul-10	21	11:03	11:03	unk	✓		M-MYXX	
Location 3	20-Jul-10	22	11:03	11:03	unk	✓		M-?	larger bat
Location 3	20-Jul-10	23	11:03	11:04	unk		✓	M-MYXX	
Location 3	20-Jul-10	24	11:05	11:05	unk	✓		M-MYXX	short pass
Location 3	20-Jul-10	25	11:05	11:05	unk	✓	✓	M-MYXX	
Location 3	20-Jul-10	26	11:07	11:07	unk	✓		M-MYXX	
Location 3	20-Jul-10	27	11:12	11:12	unk	✓		M-MYXX	very short pass
Location 3	20-Jul-10	28	11:12	11:12	unk	✓		M-?	possibly Sliver Haired or Hoary
Location 3	20-Jul-10	29	11:13	11:13	unk	✓		M-?	possibly Sliver Haired or Hoary
Location 3	20-Jul-10	30	11:17	11:17	unk	✓	✓	M-MYXX	pass & feeding pass
Location 3	20-Jul-10	31	11:18	11:18	unk	✓		M-?	low frequency, possibly Hoary
Location 3	20-Jul-10	32	11:19	11:19	unk	✓		M-?	possibly Hoary bat
Location 3	20-Jul-10	33	11:20	11:20	unk	✓		M-MYXX	Myotis
Location 3	20-Jul-10	34	11:21	11:21	unk	✓		M-MYXX	
Location 3	20-Jul-10	35	11:22	11:22	unk	✓		M-?	
Location 3	20-Jul-10	36	11:23	11:23	unk	✓		M-MYXX	Possibly Hoary or Silver Haired, low frequency
Location 3	20-Jul-10	37	11:31	11:31	unk	✓		M-MYXX	
Location 3	20-Jul-10	38	11:37	11:37	unk		✓	M-MYXX	
Location 3	20-Jul-10	39	11:39	11:39	unk	✓	✓	M-?	larger bat, long pass
Location 3	20-Jul-10	40	11:41	11:41	unk	✓		M-MYXX	Myotis
Location 3	20-Jul-10	41	11:42	11:42	unk		✓	M-?	
Location 3	20-Jul-10	42	11:43	11:43	unk	✓		M-?	low frequency

Appendix 3.4-1

Observations of Incidental Mammals during the 2010 Wildlife Baseline Program

Rescan™
Engineers and Scientists

Appendix 3.4-1. Observations of Incidental Mammals During the 2010 Wildlife Baseline Program

Date	Survey	Easting	Northing	Common Name	Scientific Name	No. Animals Observed	Sign Observed	Comment(s)
18-May-10	Waterfowl	615237	6105735	Grizzly Bear	*Ursus arctos*	0	Seasonal Habitat	high value grizzly bear spring habtiat
19-May-10	Waterfowl	625273	6097492	American Marten	*Martes americana*	0	Seasonal Habitat	possible marten winter habitat
19-May-10	Waterfowl	620413	6102719	Red Squirrel	*Tamiasciurus hudsonicus*	0	Midden	
19-May-10	Waterfowl	629261	6097266	Grizzly Bear	*Ursus arctos*	1		first year individual
3-Jun-10	Terrestrial Breeding Birds	627329	6104427	North American Deermouse	*Peromyscus maniculatus*	1	Carcass	dead deermouse seen on train tracks
3-Jun-10	Terrestrial Breeding Birds	627422	6104273	North American Deermouse	*Peromyscus maniculatus*	1	Carcass	dead female deermouse on railroad tracks, no visible signs of trauma
5-Jun-10	Terrestrial Breeding Birds	621957	6106429	American Marten	*Martes americana*	0	Scat	marten scat along overgrown road; Breeding Bird Trasect MR08
5-Jun-10	Terrestrial Breeding Birds	631686	6112697	Snowshoe hare	*Lepus americanus*	1		ran across road, alogn MR 10, in regenerating clearcut ~15-20 yrs old
7-Jun-10	Terrestrial Breeding Birds	630554	6108841	Red Fox	*Vulpes vulpes*	0	Skull	at toe of slope, transition between mature apsen forest and clearcut
7-Jun-10	Terrestrial Breeding Birds	624060	6102210	Red Squirrel	*Tamiasciurus hudsonicus*	0	Midden	huge squirrel midden in coniferous forest along Breeding Bird Transect MR16
7-Jun-10	Terrestrial Breeding Birds	627341	6104268	Red Squirrel	*Tamiasciurus hudsonicus*	0	Midden	squirrel midden in coniferous forest along Breeding Bird Trasect MR01
19-Jul-10	Ungulates	627631	6088577	Hoary Marmot	*Marmota caligata*	0	Burrow	colony on Babckock Mountain in ungulate survey unit 7
19-Jul-10	Ungulates			Hoary Marmot	*Marmota caligata*	0	Burrow	colony observed on NE side of Quintette Mountain, ungulate survey unit 8
19-Jul-10	Ungulates			Hoary Marmot	*Marmota caligata*	0	Burrow	colony in ungulate survey unit 11
19-Jul-10	Ungulates			Hoary Marmot	*Marmota caligata*	0	Burrow	two colonies obseved in ungulate survey unit 4
19-Jul-10	Ungulates			American Black Bear	*Ursus americanus*	1		in ungulate survey unit 4
19-Jul-10	Ungulates	603074	6092563	Grizzly Bear	*Ursus arctos*	0	Den	grizzly bear digging possible den but likley digging for marmots
19-Jul-10	Ungulates			American Black Bear	*Ursus americanus*	1		in ungulate survey unit 12
20-Jul-10	Ungulates			Hoary Marmot	*Marmota caligata*	1		in ungulate survey unit 5
20-Jul-10	Ungulates	615411	6097234	Grizzly Bear	*Ursus arctos*	1		
20-Jul-10	Ungulates			American Black Bear	*Ursus americanus*	1		on the southeast side of Reesor Moutain, ungulate survey unit 3
20-Jul-10	Ungulates			Hoary Marmot	*Marmota caligata*	0	Burrow	colony in ungulate survey unit 3
25-Jul-10	Amphibians	617812	6108461	American Black Bear	*Ursus americanus*	3		Female and two cubs. ~250 m E of Shell Station.
26-Jul-10	Waterfowl	629675	6099406	American Black Bear	*Ursus americanus*	1		Walking along trail

Appendix 4.2-1
Standwatch Survey Data

Rescan™
Engineers and Scientists

Appendix 4.2-1. Standwatch Survey Data

WPT	Easting	Northing	Elevation (m)	Site Description	Date	Start Time	Start Cloud Cover (%)	Start Wind Scale	Start Temp	End Time	End Cloud Cover (%)	End Wind Scale
MR-SW1	622082.57	6103104.53	1313	higher elevation pine/fir/spruce forest, standwatch is at pipeline/communications tower facility, good visibility for western study area	4-Jun-10	10:30	20	~1-3	13	11:40	same	
SW2	630476.95	6111110.18	1176	looking over a regenerating clearcut surrounded by mature pine/spruce/fir forest	5-Jun-10	12:32	65	~1-3	19	13:30	same	
SW2	628643.81	6113710.37	1134	overlooking Tumbler Ridge at the radio tower, surrounded by a few regenerating cutblocks and coniferous forest,	6-Jun-10	14:00	0	~1-3	19	15:00	same	

WPT	End Temp	Observation #	Time	Species	Common Name	Scientific Name	Visual/Call	Activity	Sex	Age Class	Comments
MR-SW1		none observed									
SW2		1	12:47	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	V	soaring	U	U	high flying individual, could not identify sex or age
SW2		none observed									

Appendix 4.2-2

Incidental Observations of Raptors, 2010

Rescan™
Engineers and Scientists

Appendix 4.2-2. Incidental Observations of Raptors, 2010

Date	Survey Type	Waypoint ID	Easting	Northing	Species Code	Common Name	Scientific Name	No. Observed	Age Class	Behaviour	Sign Observed	Distance	Direction
20-May-10		016	619145.2983	6112105.401	B-OSPR	Osprey	*Pandion haliaetus*	0	Unknown		Nest		
23-Jul-10		MR015	625398.0351	6097516.443	B-BAEA	Bald Eagle	*Haliaeetus leucocephalus*	1	Unknown	Fly-over		<10m	
23-Jul-10		MRI01	629653.9332	6099681.152	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	Unknown	Perched		<10m	NE
25-Jul-10		MRI02	617613.2055	6105980.11	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	Adult	Flying		<10m	S
3-Jun-10	Upland Birds	AMKE	628775.8699	6106610.255	B-AMKE	American Kestrel	*Falco sparverius*	1	Unknown	Perched		50-100m	N
3-Jun-10	Upland Birds	RTHA	629213.6089	6096762.385	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	Unknown	Fly-over		50-100m	E
4-Jun-10	Upland Birds	RTHA2	625570.5984	6097646.112	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	Adult	Fly-over		<10m	SE
5-Jun-10	Upland Birds	NOHAMALE	646057.6026	6110769.675	B-NOHA	Northern Harrier	*Circus cyaneus*	1	Adult	Fly-over		10-50m	E
5-Jun-10	Upland Birds	RTHA3	646932.6026	6110635.753	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1	Adult	Food Carry		<10m	
5-Jun-10	Upland Birds	AMKE2	626444.5059	6096480.906	B-AMKE	American Kestrel	*Falco sparverius*	1	Juvenile	Fly-over		<10m	S
6-Jun-10	Upland Birds	OSRYNEST	619157.9682	6112117.248	B-OSPR	Osprey	*Pandion haliaetus*				Tree Nest	50-100m	S
7-Jun-10	Upland Birds	PLUCK	630790.7529	6108990.426	B-UNRA	Unknown Raptor					Hair/Body Part	<10m	
7-Jun-10	Upland Birds	BDOW	627678.1593	6110898.345	B-BDOW	Barred Owl	*Strix varia*	1	Unknown	Perched		50-100m	
8-Jun-10	Upland Birds	OSPR	609359.9939	6119934.777	B-OSPR	Osprey	*Pandion haliaetus*					<10m	
9-Jun-10	Upland Birds	PLUCK-POST	620386.689	6102846.033	B-UNRA	Unknown Raptor					Hair/Body Part	<10m	
9-Jun-10	Upland Birds	NOGO	626445.8954	6110401.152	B-NOGO	Northern Goshawk	*Accipiter gentilis*	1	Adult	Fly-over		<10m	N
9-Jun-10	Upland Birds	MERL2	627731.4597	6110616.061	B-MERL	Merlin	*Falco columbarius*	2	Adult	Nest Building Activity		10-50m	E
3-Jun-10	Upland Bird	MR1-1	627472.3792	6104115.646	B-NOGO	Northern Goshawk	*Accipiter gentilis*	1					
8-Jun-10	Upland Bird	MR19-1	609555.717	6119797.267	B-OSPR	Osprey	*Pandion haliaetus*	1					
18-May-10	Waterbird Aerial	030	625325.6463	6095245.135	B-BAEA	Bald Eagle	*Haliaeetus leucocephalus*	1					
18-Jul-10	Waterbird Aerial	023	625728.6494	6095607.652	B-BAEA	Bald Eagle	*Haliaeetus leucocephalus*	1		Nest Found			
18-May-10	Waterbird Aerial	004	625690.6352	6108097.716	B-OSPR	Osprey	*Pandion haliaetus*	1		Flying			
18-May-10	Waterbird Aerial	028	625649.4861	6095792.57	B-OSPR	Osprey	*Pandion haliaetus*	2		Nest Found			
18-Jul-10	Waterbird Aerial	016	625617.9558	6096670.906	B-OSPR	Osprey	*Pandion haliaetus*	1					
18-Jul-10	Waterbird Aerial	021	625622.1882	6095561.722	B-OSPR	Osprey	*Pandion haliaetus*	1					
18-Jul-10	Waterbird Aerial	059	621631.1908	6111415.749	B-OSPR	Osprey	*Pandion haliaetus*	1		Flying			
18-May-10	Waterbird Aerial	076	621636.5129	6105985.578	B-RTHA	Red-tailed Hawk	*Buteo jamaicensis*	1					
18-May-10	Waterbird Aerial	027	625677.4053	6095623.712	B-UNRA	Unknown Raptor		0		Nest Found			

Appendix 4.2-2. Incidental Observations of Raptors, 2010

Date	Habitat Type	Size of Habitat	Habitat Description	Comments
20-May-10				osprey nest on powerline
23-Jul-10	Lake			Circled wetland a couple times and flew away.
23-Jul-10	Coniferous Forest		On side of road. In tree on steep slope. Trees fairly sparse.	
25-Jul-10	Mixed Forest			Flying over roads and forest.
3-Jun-10	Clear Cut	Large>2ha		perched on snag
3-Jun-10	Clear Cut	Large>2ha		flying over stands of forest and several small clear cuts in the area
4-Jun-10	Forest	Large>2ha		flying over road towards Murray River
5-Jun-10	Clear Cut	Large>2ha		flying over a regenerating forest, probably 9-10 years old
5-Jun-10	Clear Cut	Large>2ha		in regenerating (9-10yr old)forest
5-Jun-10	Anthropogenic/Non-vegetated			perched and flew from powerline - flying over tailings area or something of the like, overgrown with grasses
6-Jun-10	Anthropogenic/Non-vegetated	Medium 0.5-2ha		osprey nest on power pole
7-Jun-10	Forest	Large>2ha		feathers from perhaps a varied thrush or larger bird observed, likely a plucking post from a goshawk, in decidous forest along MR 14
7-Jun-10	Anthropogenic/Non-vegetated	Large>2ha		observed near the parking lot for the lodge, perched in a tree
8-Jun-10	Anthropogenic/Non-vegetated	Medium 0.5-2ha		
9-Jun-10	Forest	Large>2ha		another pluck post observed - maybe a sharpie or a goshawk
9-Jun-10	Forest	Large>2ha		adult flew over in mature decidous forest - whoosh what a rush!
9-Jun-10	Forest	Medium 0.5-2ha		pair of merlins building nest in small tree patch across from gas station in Tumbler ridge - looks like building in pine tree. Wpt not physical location of nest tree.
3-Jun-10	Forest			Calling in spruce tree right above point count, called twice and then flew off roughly eastward into clearcut
8-Jun-10	Forest			perched on powerpole with fish
18-May-10	Swamp	Large>2ha		
18-Jul-10				Nest occupied.
18-May-10	River	Large>2ha		
18-May-10	Swamp	Medium 0.5-2ha		Female on nest.
18-Jul-10	Other			On telephone line.
18-Jul-10	Pond	Large>2ha	Wetland complex.	
18-Jul-10				
18-May-10	Pond	Small <0.5ha		
18-May-10	Swamp	Medium 0.5-2ha		Raptor nest (not occupied).

Appendix 4.3-1

Wetland Bird Survey Habitat Data, 2010

Rescan™
Engineers and Scientists

Appendix 4.3-1. Wetland Bird Survey Habitat Data, 2010

Survey Period	Site Name	Easting	Northing	Survey Date	Survey Type	Habitat Type	Habitat Size	Comments	Photos
Pre-breeding	W001	630090	6100369	5/19/2010	Ground	Pond	Large	-	-
Pre-breeding	W003	630276	6100042	5/18/2010	Aerial	Marsh	Medium	-	-
Pre-breeding	W004	629338	6098730	5/18/2010	Aerial	Man-made Waterbody	Large	-	108-3316
Pre-breeding	W008	626773	6099951	5/18/2010	Aerial	Swamp	Large	-	108-3315
Pre-breeding	W010	620308	6103126	5/19/2010	Ground	Swamp	Large	-	-
Pre-breeding	W011	625632	6097369	5/18/2010	Aerial	Pond	Medium	-	-
Pre-breeding	W013	625558	6096897	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W015	625835	6095535	5/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Pre-breeding	W016	625975	6096054	5/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Pre-breeding	W017	626019	6096272	5/18/2010	Aerial	Pond	Large	-	-
Pre-breeding	W018	626149	6093638	5/18/2010	Aerial	Man-made Waterbody	Unknown	-	-
Pre-breeding	W019	628417	6094304	5/18/2010	Aerial	Man-made Waterbody	Large	-	108-3326
Pre-breeding	W020	625845	6094487	5/18/2010	Aerial	Man-made Waterbody	Large	-	108-3327
Pre-breeding	W021	626418	6095152	5/18/2010	Aerial	Man-made Waterbody	Unknown	-	-
Pre-breeding	W024	616106	6101493	5/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Pre-breeding	W025	616286	6108341	5/18/2010	Aerial	Swamp	Small	-	-
Pre-breeding	W027	613793	6105266	5/18/2010	Aerial	Pond	Small	-	-
Pre-breeding	W028	612779	6104878	5/18/2010	Aerial	Marsh	Medium	-	-
Pre-breeding	W032	620561	6104052	5/18/2010	Aerial	Pond	Large	-	-
Pre-breeding	W033	621423	6105018	5/18/2010	Aerial	Lake	Small	-	108-3332
Pre-breeding	W040	623732	6093466	5/18/2010	Aerial	Pond	Large	-	-
Pre-breeding	W081	616870	6109307	5/20/2010	Ground	River	Large	-	-
Pre-breeding	W110	625514	6108778	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W111	625691	6108098	5/18/2010	Aerial	River	Large	-	108-3313
Pre-breeding	W112	626637	6106756	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W113	626851	6104854	5/19/2010	Aerial	River	Large	-	-
Pre-breeding	W114	627040	6104438	5/19/2010	Aerial	River	Large	-	-
Pre-breeding	W115	626774	6103049	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W116	626607	6100592	5/18/2010	Aerial	River	Large	-	108-3314
Pre-breeding	W117	629962	6099625	5/18/2010	Aerial	Creek	Large	-	-
Pre-breeding	W118	628776	6099187	5/18/2010	Aerial	Pond	Medium	-	-
Pre-breeding	W119	628909	6099156	5/18/2010	Aerial	Pond	Medium	-	-
Pre-breeding	W120	628487	6098836	5/18/2010	Aerial	Man-made Waterbody	Small	-	-
Pre-breeding	W121	626652	6099393	5/18/2010	Aerial	Pond	Medium	-	-
Pre-breeding	W122	626722	6098090	5/18/2010	Aerial	River	Large	-	108-3317
Pre-breeding	W123	626015	6096749	5/18/2010	Aerial	Creek	Unknown	-	-
Pre-breeding	W124	625649	6095793	5/18/2010	Aerial	Swamp	Medium	-	-
Pre-breeding	W125	625326	6095245	5/18/2010	Aerial	Pond	Unknown	-	108-3323 & 24
Pre-breeding	W126	623123	6093027	5/18/2010	Aerial	Swamp	Medium	-	108-3325
Pre-breeding	W127	623216	6092590	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W128	622741	6092171	5/18/2010	Aerial	Swamp	Large	-	-
Pre-breeding	W129	622743	6091773	5/18/2010	Aerial	Pond	Large	-	-

Appendix 4.3-1. Wetland Bird Survey Habitat Data, 2010

Survey Period	Site Name	Easting	Northing	Survey Date	Survey Type	Habitat Type	Habitat Size	Comments	Photos
Pre-breeding	W130	621259	6111121	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W131	618005	6109912	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W132	617240	6109343	5/18/2010	Aerial	Swamp	Medium	-	108-3329
Pre-breeding	W133	616881	6109136	5/18/2010	Aerial	Swamp	Small	-	-
Pre-breeding	W134	616002	6108816	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W135	615691	6108449	5/18/2010	Aerial	River	Large	-	-
Pre-breeding	W136	615795	6107923	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W137	615655	6106142	5/18/2010	Aerial	River	Medium	-	-
Pre-breeding	W138	615237	6105735	5/18/2010	Aerial	River	Medium	-	-
Pre-breeding	W139	614430	6105610	5/18/2010	Aerial	River	Medium	-	-
Pre-breeding	W140	614295	6105797	5/18/2010	Aerial	Pond	Small	-	-
Pre-breeding	W141	613736	6105618	5/18/2010	Aerial	Pond	Medium	-	108-3330
Pre-breeding	W142	613830	6105480	5/18/2010	Aerial	Pond	Small	-	-
Pre-breeding	W143	613403	6104800	5/18/2010	Aerial	Creek	Small	-	-
Pre-breeding	W144	613196	6104990	5/18/2010	Aerial	Creek	Small	-	108-3331
Pre-breeding	W145	612874	6104480	5/18/2010	Aerial	Creek	Small	-	-
Pre-breeding	W146	617008	6109395	5/20/2010	Ground	River	Large	-	-
Pre-breeding	W147	625972	6097225	5/19/2010	Ground	River	Large	-	-
Pre-breeding	W148	619877	6101619	5/19/2010	Ground	Creek	Large	-	-
Pre-breeding	W149	620413	6102719	5/19/2010	Ground	Pond	Large	-	-
Pre-breeding	W150	613697	6105634	5/20/2010	Ground	Man-made Waterbody	Small	-	-
Pre-breeding	W151	630182	6101241	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W152	624853	6110390	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W154	626056	6097584	5/19/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W155	619447	6100721	5/19/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W157	620041	6101592	5/19/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W160	620397	6102579	5/19/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W161	616510	6109301	5/20/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W162	616582	6109282	5/20/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W163	616808	6097229	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W164	615987	6108945	5/20/2010	Ground	Unknown	Unknown	-	-
Pre-breeding	W174	626295	6087964	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W176	625755	6093565	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W178	624976	6111713	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W179	612269	6112077	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W186	619726	6103571	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W188	615850	6103209	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W196	612751	6103957	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W198	620947	6109196	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W200	621330	6108747	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W201	622748	6109117	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W203	623128	6109723	5/18/2010	Aerial	Unknown	Unknown	-	-

Appendix 4.3-1. Wetland Bird Survey Habitat Data, 2010

Survey Period	Site Name	Easting	Northing	Survey Date	Survey Type	Habitat Type	Habitat Size	Comments	Photos
Pre-breeding	W205	623299	6108664	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W207	622590	6107822	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W210	620971	6101880	5/18/2010	Aerial	Unknown	Unknown	-	-
Pre-breeding	W212	625180	6107977	5/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W001	630090	6100369	7/18/2010	Aerial	Pond	Large	-	113-3426
Breeding	W002	630093	6099949	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W004	629338	6098730	7/26/2010	Ground	Man-made Waterbody	Large	-	0011-14
Breeding	W005	629345	6098607	7/18/2010	Aerial	Pond	Small	-	-
Breeding	W006	629488	6098554	7/26/2010	Ground	Pond	Medium	-	0018-19
Breeding	W007	629563	6098977	7/26/2010	Ground	Unknown	Unknown	-	-
Breeding	W009	629070	6098425	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W010	620308	6103126	7/25/2010	Ground	Swamp	Medium	-	008
Breeding	W011	625632	6097369	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W012	625394	6097516	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W014	625672	6095235	7/24/2010	Ground	Pond	Large	-	6156-57
Breeding	W015	625835	6095535	7/24/2010	Ground	Man-made Waterbody	Medium	-	6153-55
Breeding	W016	625975	6096054	7/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Breeding	W017	626019	6096272	7/18/2010	Aerial	Pond	Large	-	-
Breeding	W019	628417	6094304	7/18/2010	Aerial	Man-made Waterbody	Large	-	-
Breeding	W022	620150	6101382	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W023	620351	6102165	7/22/2010	Ground	Swamp	Small	-	6113-14; 6105-08
Breeding	W024	616106	6101493	7/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Breeding	W026	618250	6110092	7/25/2010	Ground	Creek	Small	-	0001-2
Breeding	W029	613938	6105675	7/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Breeding	W030	612799	6105129	7/18/2010	Aerial	Man-made Waterbody	Small	-	-
Breeding	W031	620231	6103883	7/24/2010	Ground	Pond	Small	-	4299-4300
Breeding	W032	620561	6104052	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W033	621423	6105018	7/24/2010	Ground	Lake	Large	Riparian shrubs up from shoreline.	6158 - JLY 9295-98
Breeding	W034	621596	6105391	7/21/2010	Ground	Pond	Small	-	116-3495
Breeding	W035	624066	6098778	7/23/2010	Ground	Pond	Small	-	6142-43
Breeding	W036	620855	6099516	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W037	620335	6103166	7/21/2010	Ground	Pond	Medium	-	116-3496 to 3504
Breeding	W038	630077	6099822	7/26/2010	Ground	Unknown	Unknown	-	-
Breeding	W042	621222	6104665	7/21/2010	Ground	Lake	Small	-	-
Breeding	W047	625570	6094850	7/18/2010	Aerial	Swamp	Large	-	-
Breeding	W048	625378	6095092	7/18/2010	Aerial	Pond	Large	-	-
Breeding	W049	625622	6095562	7/18/2010	Aerial	Pond	Large	-	-
Breeding	W050	625806	6095870	7/18/2010	Aerial	Pond	Small	-	-
Breeding	W051	625729	6095608	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W052	626025	6096579	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W057	623192	6091951	7/18/2010	Aerial	Pond	Large	-	-
Breeding	W058	622790	6091607	7/18/2010	Aerial	Pond	Large	-	-

Appendix 4.3-1. Wetland Bird Survey Habitat Data, 2010

Survey Period	Site Name	Easting	Northing	Survey Date	Survey Type	Habitat Type	Habitat Size	Comments	Photos
Breeding	W063	619693	6101176	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W064	619443	6100849	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W065	619249	6100316	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W066	619198	6099321	7/23/2010	Ground	Unknown	Unknown	-	-
Breeding	W071	628940	6102105	7/18/2010	Aerial	Man-made Waterbody	Medium	-	-
Breeding	W072	628684	6104275	7/18/2010	Aerial	Pond	Medium	-	-
Breeding	W075	623575	6109766	7/18/2010	Aerial	River	Medium	-	-
Breeding	W079	617730	6109946	7/18/2010	Aerial	River	Medium	-	-
Breeding	W096	628565	6095828	7/25/2010	Ground	Unknown	Unknown	-	-
Breeding	W097	622981	6103555	7/24/2010	Ground	Creek	Unknown	-	-
Breeding	W098	629651	6093717	7/25/2010	Ground	Unknown	Unknown	-	-
Breeding	W099	629574	6099997	7/26/2010	Ground	Pond	Unknown	-	4357
Breeding	W100	629455	6098992	7/26/2010	Ground	Unknown	Unknown	-	-
Breeding	W101	629405	6098989	7/26/2010	Ground	Unknown	Unknown	-	-
Breeding	W102	631695	6098829	7/26/2010	Ground	Pond	Small	-	4374-79
Breeding	W103	631742	6098716	7/26/2010	Ground	Unknown	Unknown	-	-
Breeding	W104	629256	6096639	7/23/2010	Ground	Pond	Large	-	-
Breeding	W105	623560	6102431	7/24/2010	Ground	Swamp	Unknown	-	-
Breeding	W106	622532	6104555	7/22/2010	Ground	Unknown	Unknown	-	-
Breeding	W153	629897	6099853	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W156	629529	6098970	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W158	628176	6097969	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W159	627919	6098307	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W165	625943	6096603	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W166	623815	6093400	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W167	623167	6093216	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W168	623742	6092402	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W169	623332	6091857	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W170	622272	6091833	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W171	624776	6093898	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W172	625499	6093740	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W173	625704	6093739	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W175	626281	6093466	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W177	620116	6101350	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W180	617174	6102407	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W181	616994	6102305	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W182	616701	6101997	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W183	615746	6101435	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W184	616225	6108455	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W185	626221	6105967	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W187	623281	6109660	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W189	621216	6111430	7/18/2010	Aerial	Unknown	Unknown	-	-

Appendix 4.3-1. Wetland Bird Survey Habitat Data, 2010

Survey Period	Site Name	Easting	Northing	Survey Date	Survey Type	Habitat Type	Habitat Size	Comments	Photos
Breeding	W190	619581	6110540	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W191	616870	6109260	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W192	616204	6108905	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W193	615729	6108571	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W194	615782	6107564	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W195	616048	6107109	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W197	614625	6105494	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W199	614324	6105670	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W202	613826	6105345	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W204	612928	6104837	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W206	612557	6104794	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W208	620105	6103856	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W209	620946	6104444	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W211	621478	6104918	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W213	622709	6107852	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W214	626622	6099825	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W215	630227	6098852	7/18/2010	Aerial	Unknown	Unknown	-	-
Breeding	W216	621546	6108795	7/20/2010	Aerial	Unknown	Unknown	-	-
Breeding	W217	620043	6107115	7/20/2010	Aerial	Unknown	Unknown	-	-
Breeding	W218	622549	6109726	7/20/2010	Aerial	Unknown	Unknown	-	-
Breeding	W219	623392	6109636	7/20/2010	Aerial	Unknown	Unknown	-	-
Breeding	W220	624056	6098789	7/21/2010	Ground	Unknown	Unknown	-	-
Breeding	W221	620879	6099516	7/21/2010	Ground	Unknown	Unknown	-	-

Appendix 4.3-2

Wetland Bird Survey Observation Data, 2010

Rescan™
Engineers and Scientists

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Pre-breeding	W001	Barrow's Goldeneye	No		2	0	0	0	2	-	
Pre-breeding	W001	Bufflehead	No		2	0	0	0	2	-	
Pre-breeding	W001	Greater Yellowlegs	No		0	0	1	0	1	-	
Pre-breeding	W001	Greater Yellowlegs	No		0	0	1	0	1	-	
Pre-breeding	W001	Mallard	No		0	1	0	0	1	-	
Pre-breeding	W001	Mallard	No		0	1	0	0	1	-	
Pre-breeding	W001	Ring-necked Duck	No		16	1	0	0	17	-	
Pre-breeding	W001	Wilson's Snipe	No		0	0	1	0	1	-	
Pre-breeding	W001	Barrow's Goldeneye	Yes		1	0	0	0	1	-	
Pre-breeding	W001	Canada Goose	Yes		0	0	1	0	1	-	
Pre-breeding	W001	Canada Goose	Yes		0	0	1	0	1	-	
Pre-breeding	W001	Common Merganser	Yes		6	0	0	0	6	-	
Pre-breeding	W001	Greater Yellowlegs	Yes		0	0	1	0	1	-	
Pre-breeding	W001	Mallard	Yes		1	0	0	0	1	-	
Pre-breeding	W001	Mallard	Yes		3	0	0	0	3	-	
Pre-breeding	W001	Ring-necked Duck	Yes		0	0	2	0	2	-	
Pre-breeding	W001	Ring-necked Duck	Yes		0	0	2	0	2	-	
Pre-breeding	W001	Ring-necked Duck	Yes		0	0	12	0	12	-	
Pre-breeding	W001	Surf Scoter	Yes		10	0	0	0	10	-	
Pre-breeding	W001	Wilson's Snipe	Yes		0	0	1	0	1	-	
Pre-breeding	W003	American Wigeon	No	Pair	1	1	0	0	2	-	
Pre-breeding	W003	American Wigeon	No	Pair	1	1	0	0	2	-	
Pre-breeding	W003	American Wigeon	No		2	0	0	0	2	-	
Pre-breeding	W003	American Wigeon	No		2	1	0	0	3	-	
Pre-breeding	W003	Blue-winged Teal	No		3	0	0	0	3	-	
Pre-breeding	W003	Bufflehead	No		0	0	2	0	2	-	
Pre-breeding	W003	Ring-necked Duck	No		1	0	0	0	1	-	
Pre-breeding	W003	Ring-necked Duck	No	Pair	1	1	0	0	2	-	
Pre-breeding	W003	Ring-necked Duck	No		6	0	0	0	6	-	
Pre-breeding	W003	Ring-necked Duck	No		0	0	1	0	1	-	
Pre-breeding	W003	Ring-necked Duck	No		0	0	1	0	1	-	
Pre-breeding	W003	Unknown Shorebird	No		0	0	2	0	2	-	
Pre-breeding	W004	Greater Yellowlegs	No		0	0	1	0	1	-	
Pre-breeding	W004	Ring-necked Duck	No	Pair	1	1	0	0	2	-	
Pre-breeding	W004	Unknown Shorebird	No		0	0	5	0	5	-	
Pre-breeding	W008	Barrow's Goldeneye	No		0	1	0	0	1	-	
Pre-breeding	W010	Barrow's Goldeneye	No		1	0	0	0	1	-	
Pre-breeding	W010	Green-winged Teal	No	Pair	1	1	0	0	2	-	
Pre-breeding	W010	Mallard	No		2	0	0	0	2	-	
Pre-breeding	W010	Spotted Sandpiper	No	Pair	1	1	0	0	2	-	
Pre-breeding	W010	Spotted Sandpiper	No		0	0	2	0	2	-	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Pre-breeding	W010	Mallard	Yes		0	1	0	0	1	-	
Pre-breeding	W010	Spotted Sandpiper	Yes		0	0	3	0	3	-	
Pre-breeding	W011	Blue-winged Teal	No	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W011	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Mallard	No		3	1	0	0	4	-	
Pre-breeding	W011	Ring-necked Duck	No	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Ring-necked Duck	No	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Ring-necked Duck	No	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Hooded Merganser	Yes	Pair	1	1	0	0	2	-	
Pre-breeding	W011	Mallard	Yes		1	0	0	0	1	-	
Pre-breeding	W011	Ring-necked Duck	Yes		5	2	0	0	7	-	
Pre-breeding	W011	Wilson's Snipe	Yes		0	0	2	0	2	-	
Pre-breeding	W013	Unknown Shorebird	No		0	0	4	0	4	-	
Pre-breeding	W015	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W015	Mallard	No		0	1	0	0	1	-	
Pre-breeding	W015	Ring-necked Duck	No	Pair	3	3	0	0	6	-	
Pre-breeding	W016	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W016	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W016	Canada Goose	No	Pair	1	1	0	0	2	-	
Pre-breeding	W016	Ring-necked Duck	No	Pair	2	2	0	0	4	-	
Pre-breeding	W017	American Wigeon	No		0	0	1	0	1	-	
Pre-breeding	W017	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W017	Blue-winged Teal	No		4	0	0	0	4	-	
Pre-breeding	W017	Canada Goose	No	Pair	2	2	0	7	11	Ib	
Pre-breeding	W017	Hooded Merganser	No		1	0	0	0	1	-	
Pre-breeding	W017	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W017	Mallard	No		6	1	0	0	7	-	
Pre-breeding	W017	Ring-necked Duck	No		1	0	0	0	1	-	
Pre-breeding	W018	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W019	American Wigeon	No	Pair	1	1	0	0	2	-	
Pre-breeding	W019	Unknown Shorebird	No		0	0	6	0	6	-	
Pre-breeding	W020	Surf Scoter	No	Pair	2	2	0	0	4	-	
Pre-breeding	W020	Unknown Shorebird	No		0	0	1	0	1	-	
Pre-breeding	W021	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W021	Unknown Shorebird	No		0	0	2	0	2	-	
Pre-breeding	W024	Barrow's Goldeneye	No	Pair	2	2	0	0	4	-	
Pre-breeding	W025	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W025	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W027	Green-winged Teal	No	Pair	1	1	0	0	2	-	
Pre-breeding	W027	Mallard	No		0	1	0	0	1	-	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Pre-breeding	W028	Canada Goose	No	Pair	1	1	0	0	2	-	
Pre-breeding	W028	Unknown Shorebird	No		0	0	2	0	2	-	
Pre-breeding	W032	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W032	Green-winged Teal	No		0	0	1	0	1	-	
Pre-breeding	W032	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W033	Barrow's Goldeneye	No		1	0	0	0	1	-	
Pre-breeding	W033	Mallard	No		2	0	0	0	2	-	
Pre-breeding	W040	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W040	Unknown Shorebird	No		0	0	1	0	1	-	
Pre-breeding	W081	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W110	Unknown Shorebird	No		0	0	1	0	1	-	
Pre-breeding	W111	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W111	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W111	Unknown Sandpiper	No		0	0	1	0	1	-	
Pre-breeding	W112	Unknown Sandpiper	No	Flying	0	0	4	0	4	-	
Pre-breeding	W113	Unknown Sandpiper	No		0	0	4	0	4	-	
Pre-breeding	W114	Unknown Sandpiper	No		0	0	6	0	6	-	
Pre-breeding	W115	Unknown Sandpiper	No		0	0	18	0	18	-	
Pre-breeding	W116	Unknown Sandpiper	No		0	0	5	0	5	-	
Pre-breeding	W117	Barrow's Goldeneye	No		0	0	1	0	1	-	
Pre-breeding	W118	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W119	Barrow's Goldeneye	No	Pair	1	1	0	0	2	-	
Pre-breeding	W119	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W120	Northern Shoveler	No		0	0	6	0	6	-	
Pre-breeding	W120	Ring-necked Duck	No		5	1	0	0	6	-	
Pre-breeding	W121	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W122	Unknown Sandpiper	No		0	0	2	0	2	-	
Pre-breeding	W123	Unknown Shorebird	No		0	0	3	0	3	-	
Pre-breeding	W124	Barrow's Goldeneye	No		1	0	0	0	1	-	
Pre-breeding	W124	Bufflehead	No		0	1	0	0	1	-	
Pre-breeding	W124	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W124	Bufflehead	No	Pair	1	1	0	0	2	-	
Pre-breeding	W124	Canada Goose	No	Pair	1	1	0	0	2	-	
Pre-breeding	W124	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W124	Ring-necked Duck	No		1	2	0	0	3	-	
Pre-breeding	W124	Unknown Shorebird	No		0	0	2	0	2	-	
Pre-breeding	W125	Blue-winged Teal	No	Pair	1	1	0	0	2	-	
Pre-breeding	W125	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W125	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W125	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W125	Mallard	No	Pair	1	1	0	0	2	-	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Pre-breeding	W125	Mallard	No		2	0	0	0	2	-	
Pre-breeding	W125	Trumpeter Swan	No	Nest Found	1	1	0	0	2	-	Pair.
Pre-breeding	W126	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W127	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W127	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W128	Blue-winged Teal	No		0	1	0	0	1	-	
Pre-breeding	W128	Bufflehead	No	Pair	1	1	0	0	2	-	
Pre-breeding	W128	Canada Goose	No	Pair	1	1	0	0	2	-	
Pre-breeding	W128	Canada Goose	No	Pair	1	1	0	0	2	-	
Pre-breeding	W128	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W128	Ring-necked Duck	No		1	2	0	0	3	-	
Pre-breeding	W128	Ring-necked Duck	No	Pair	2	2	0	0	4	-	
Pre-breeding	W129	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W129	Ring-necked Duck	No		2	1	0	0	3	-	
Pre-breeding	W129	Ring-necked Duck	No		9	1	0	0	10	-	
Pre-breeding	W130	Canada Goose	No		0	0	2	0	2	-	
Pre-breeding	W130	Unknown Shorebird	No		0	0	5	0	5	-	
Pre-breeding	W131	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W131	Unknown Shorebird	No		0	0	2	0	2	-	
Pre-breeding	W132	Mallard	No	Pair	1	1	0	0	2	-	
Pre-breeding	W133	Barrow's Goldeneye	No		1	0	0	0	1	-	
Pre-breeding	W133	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W134	Unknown Shorebird	No		0	0	3	0	3	-	
Pre-breeding	W135	Mallard	No		3	1	0	0	4	-	
Pre-breeding	W136	Common Merganser	No		2	0	0	0	2	-	
Pre-breeding	W137	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W138	Canada Goose	No		0	0	3	0	3	-	
Pre-breeding	W138	Unknown Shorebird	No		0	0	1	0	1	-	
Pre-breeding	W139	Canada Goose	No		0	0	1	0	1	-	
Pre-breeding	W140	Common Merganser	No		1	0	0	0	1	-	
Pre-breeding	W141	Barrow's Goldeneye	No		0	0	1	0	1	-	
Pre-breeding	W142	Bufflehead	No		1	0	0	0	1	-	
Pre-breeding	W143	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W143	Unknown Shorebird	No		0	0	4	0	4	-	
Pre-breeding	W144	Canada Goose	No		0	0	6	0	6	-	
Pre-breeding	W145	Canada Goose	No		0	0	6	0	6	-	
Pre-breeding	W145	Mallard	No		1	0	0	0	1	-	
Pre-breeding	W146	Barrow's Goldeneye	No		0	1	0	0	1	-	
Pre-breeding	W147	Common Merganser	No		0	1	0	0	1	-	
Pre-breeding	W148	Spotted Sandpiper	No		0	0	1	0	1	-	
Pre-breeding	W149	Solitary Sandpiper	No		0	0	2	0	2	-	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Pre-breeding	W150	Solitary Sandpiper	No		0	0	1	0	1	-	
Breeding	W001	Canada Goose	No		0	1	0	2	3	III	
Breeding	W001	Unknown Diver	No		0	0	0	3	3	IIa	
Breeding	W001	Unknown Diver	Yes		0	0	0	5	5	IIb	
Breeding	W002	Greater Yellowlegs	No		0	0	1	0	1	-	
Breeding	W002	Green-winged Teal	No		0	1	0	0	1	-	
Breeding	W002	Mallard	No		0	1	0	7	8	III	
Breeding	W004	Canada Goose	No		0	0	0	6	6	IIc	
Breeding	W004	Canada Goose	No	Territorial	0	0	1	0	1	-	Acting protective/territorial.
Breeding	W004	Canada Goose	No		0	0	3	0	3	-	Flew away.
Breeding	W004	Common Loon	No		0	0	1	0	1	-	
Breeding	W004	Solitary Sandpiper	No	Pair	0	0	2	0	2	-	
Breeding	W004	Spotted Sandpiper	No	Pair	0	0	2	1	3	Ia	Young between IA and IB.
Breeding	W004	Greater Yellowlegs	Yes		0	0	1	0	1	-	
Breeding	W005	Unknown Sandpiper	No		0	0	1	0	1	-	
Breeding	W005	No birds present.	Yes		0	0	0	0	0	-	
Breeding	W006	Lesser Yellowlegs	No		0	0	1	0	1	-	
Breeding	W007	No birds present.	No		0	0	0	0	0	-	
Breeding	W009	Canada Goose	No		0	4	0	47	51	III	Also IIC.
Breeding	W009	Canada Goose	Yes		0	0	1	0	1	-	Sneaking through emergent veg up little hill.
Breeding	W010	Barrow's Goldeneye	No		0	1	0	0	1	-	
Breeding	W011	Mallard	No		0	1	0	7	8	IIa	
Breeding	W011	No birds present.	Yes		0	0	0	0	0	-	
Breeding	W012	Ring-necked Duck	No		0	0	6	3	9	Ib	
Breeding	W012	No birds present.	Yes		0	0	0	0	0	-	
Breeding	W014	Barrow's Goldeneye	No		0	1	0	4	5	Ib	Young between IB and IC.
Breeding	W014	Gadwall	No	Pair	1	1	0	0	2	-	
Breeding	W014	Lesser Scaup	No		0	1	0	6	7	IIa	
Breeding	W014	Trumpeter Swan	No		0	0	2	4	6	Ic	
Breeding	W014	Mallard	Yes		0	1	0	7	8	III	
Breeding	W014	No birds present.	Yes		0	0	0	0	0	-	
Breeding	W014	Unknown Diver	Yes		0	0	0	8	8	Ib	
Breeding	W015	No birds present.	No		0	0	0	0	0	-	
Breeding	W016	Canada Goose	No		0	1	0	4	5	Ic	
Breeding	W017	Unknown Sandpiper	No		0	0	1	0	1	-	
Breeding	W019	Unknown Diver	No		0	0	0	5	5	Ic	
Breeding	W022	No birds present.	No		0	0	0	0	0	-	
Breeding	W023	Mallard	No		0	1	0	0	1	-	
Breeding	W023	Spotted Sandpiper	No	Pair	0	0	2	0	2	-	
Breeding	W023	Green-winged Teal	Yes	Other	0	0	0	1	1	III	Wounded.
Breeding	W023	Solitary Sandpiper	Yes		0	0	5	0	5	-	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Breeding	W023	Unknown Sandpiper	Yes		0	0	4	0	4	-	
Breeding	W024	Bufflehead	No		0	1	0	1	2	III	
Breeding	W024	Common Goldeneye	No		0	1	0	1	2	III	
Breeding	W026	Solitary Sandpiper	No		0	0	1	0	1	-	
Breeding	W029	Canada Goose	No		0	1	0	3	4	IIb	
Breeding	W029	Spotted Sandpiper	Yes		0	1	0	1	2	-	
Breeding	W030	Canada Goose	No		0	1	0	7	8	III	
Breeding	W030	Canada Goose	Yes		0	0	12	0	12	-	
Breeding	W031	Green-winged Teal	No		0	1	0	4	5	IIa	Young along. Female was acting protective.
Breeding	W031	Spotted Sandpiper	No	Pair	0	0	2	0	2	-	
Breeding	W032	Mallard	No		0	1	0	4	5	III	
Breeding	W032	Common Goldeneye	Yes		0	1	0	0	1	-	
Breeding	W033	Barrow's Goldeneye	No		0	1	0	1	2	Ic	
Breeding	W033	Solitary Sandpiper	No	Pair	0	0	2	0	2	-	
Breeding	W034	Spotted Sandpiper	No		0	0	1	0	1	-	
Breeding	W034	No birds present.	Yes		0	0	0	0	0	-	
Breeding	W035	Solitary Sandpiper	No		0	0	1	0	1	-	
Breeding	W036	No birds present.	No		0	0	0	0	0	-	
Breeding	W037	Mallard	No		0	1	0	0	1	-	
Breeding	W037	Spotted Sandpiper	No		0	0	1	0	1	-	
Breeding	W038	No birds present.	No		0	0	0	0	0	-	
Breeding	W042	Barrow's Goldeneye	No		0	1	0	1	2	IIb	
Breeding	W047	Unknown Diver	No	Flying	0	0	1	0	1	-	
Breeding	W048	Green-winged Teal	No		0	1	0	6	7	IIa	
Breeding	W048	Green-winged Teal	No		0	1	0	6	7	Ib	
Breeding	W048	Green-winged Teal	No		0	1	0	5	6	IIb	
Breeding	W049	Green-winged Teal	No		0	0	1	0	1	-	
Breeding	W049	Mallard	No		0	1	0	2	3	III	
Breeding	W049	Ring-necked Duck	No		0	1	0	5	6	IIa	
Breeding	W050	American Wigeon	No		0	0	0	3	3	IIc	
Breeding	W051	Unknown Sandpiper	No		0	0	1	0	1	-	
Breeding	W052	Canada Goose	No		0	1	0	10	11	IIc	
Breeding	W057	Trumpeter Swan	No		0	0	2	0	2	-	
Breeding	W058	Unknown Diver	No		0	0	0	2	2	IIc	
Breeding	W063	No birds present.	No		0	0	0	0	0	-	
Breeding	W064	No birds present.	No		0	0	0	0	0	-	
Breeding	W065	No birds present.	No		0	0	0	0	0	-	
Breeding	W066	No birds present.	No		0	0	0	0	0	-	
Breeding	W071	Barrow's Goldeneye	No		0	0	0	1	1	IIa	
Breeding	W071	Green-winged Teal	No		0	0	0	1	1	IIc	
Breeding	W072	Mallard	No		0	0	0	3	3	IIb	

Appendix 4.3-2. Wetland Bird Survey Observation Data, 2010

					Number Observed						
Survey Period	Site Name	Species Name	Incidental?	Behaviour	Males	Females	Unknown	Brood	Total	Brood Age	Comments
Breeding	W072	Unknown Diver	No		0	0	0	1	1	IIb	
Breeding	W072	Unknown Diver	No		0	0	0	2	2	IIb	
Breeding	W072	Unknown Sandpiper	No		0	0	1	0	1	-	
Breeding	W075	Common Merganser	No		0	1	0	7	8	IIb	
Breeding	W075	Unknown Sandpiper	No		0	0	2	0	2	-	
Breeding	W079	Mallard	No	Flying	0	0	1	0	1	-	
Breeding	W079	Solitary Sandpiper	No		0	0	2	0	2	-	
Breeding	W096	No birds present.	No		0	0	0	0	0	-	
Breeding	W097	No birds present.	No		0	0	0	0	0	-	
Breeding	W098	No birds present.	No		0	0	0	0	0	-	
Breeding	W099	Sora	No	Foraging	0	0	0	1	1	IIc	
Breeding	W100	No birds present.	No		0	0	0	0	0	-	
Breeding	W101	No birds present.	No		0	0	0	0	0	-	
Breeding	W102	Lesser Yellowlegs	No	Pair	0	0	2	0	2	-	
Breeding	W102	Solitary Sandpiper	No		0	0	1	0	1	-	
Breeding	W103	No birds present.	No		0	0	0	0	0	-	
Breeding	W104	Solitary Sandpiper	No		0	0	1	0	1	-	
Breeding	W105	No birds present.	No		0	0	0	0	0	-	
Breeding	W106	No birds present.	No		0	0	0	0	0	-	

Appendix 4.3-3

Incidental Wetland Bird Data, 2010

Rescan™
Engineers and Scientists

Appendix 4.3-3. Incidental Wetland Bird Data, 2010

Survey Period	Survey Date	Survey Type	Waypoint Name	Easting	Northing	Species Name	Number	Behaviour	Habitat Type	Habitat Size	Comments
Pre-breeding	5/18/2010	Aerial	045	620630	6111021	Harlequin Duck	2	Pair	River	Large	Photos - 108-3328
Breeding	6/3/2010	Ground	RNDU3-RWBL	625635	6097412	Ring-necked Duck	3	Foraging	Wetland	Medium	Shallow open water marsh.
Breeding	6/4/2010	Ground	MR3-4	627519	6108056	Wilson's Snipe	1		Clear Cut	Unknown	-
Breeding	6/4/2010	Ground	MR3-5	627651	6107902	Wilson's Snipe	1		Clear Cut	Unknown	-
Breeding	6/4/2010	Ground	MR4-1	625991	6097358	Barrow's Goldeneye	1		Water/Riparian	Unknown	-
Breeding	6/4/2010	Ground	MR4-5	625757	6097316	Wilson's Snipe	2		Water/Riparian	Unknown	-
Breeding	6/5/2010	Ground	COLO2	620276	6103095	Common Loon	2	Pair	Wetland	Small	In small wetland along road. Foraging.
Breeding	6/5/2010	Ground	MALL	643175	6101600	Mallard	1	Foraging	Swamp	Medium	One male in swamp beside road.
Breeding	6/6/2010	Ground	BWTE6MALL5	634631	6108097	Blue-winged Teal	6	Pair	Lake	Large	3 pairs observed, foraging.
Breeding	6/6/2010	Ground	BWTE6MALL5	634631	6108097	Mallard	5		Lake	Large	5 males foraging.
Breeding	6/6/2010	Ground	HADUMALE	616519	6109263	Harlequin Duck	1	Foraging	Water/Riparian	Medium	Male floating down Wolverine River.
Breeding	6/6/2010	Ground	MR11-1	634597	6108384	Mallard	1		Forest	Unknown	-
Breeding	6/6/2010	Ground	MR11-1	634597	6108384	Wilson's Snipe	1		Forest	Unknown	-
Breeding	6/6/2010	Ground	MR11-1	634597	6108384	Wilson's Snipe	1		Forest	Unknown	-
Breeding	6/6/2010	Ground	MR11-2	634654	6108193	Sora	1		Forest	Unknown	-
Breeding	6/6/2010	Ground	MR11-3	634600	6108000	Sora	2		Forest	Unknown	-
Breeding	6/6/2010	Ground	MR11-5	634686	6108775	Common Loon	1		Lake	Unknown	-
Breeding	6/6/2010	Ground	MR12-1	638980	6107273	Wilson's Snipe	1		Clear Cut	Unknown	-
Breeding	6/7/2010	Ground	BAGO3FEM	620292	6103114	Barrow's Goldeneye	3		Swamp	Large	Female foraging.
Breeding	6/7/2010	Ground	BAGOFEM	626005	6097363	Barrow's Goldeneye	1		Water/Riparian	Medium	Female floating down Murray River. Foraging
Breeding	6/7/2010	Ground	BAGOMALE	621144	6104571	Barrow's Goldeneye	1		Swamp	Large	Lone male in swamp shallow open water complex.
Breeding	6/7/2010	Ground	SPSAMALL4	620292	6103114	Mallard	4	Pair	Water/Riparian	Large	Foraging
Breeding	6/7/2010	Ground	SPSAMALL4	620292	6103114	Solitary Sandpiper	1		Swamp	Large	Foraging
Breeding	6/8/2010	Ground	BAGQPAIR	596313	6110901	Barrow's Goldeneye	2	Pair	Water/Riparian	Medium	Foraging on settling ponds.
Breeding	6/8/2010	Ground	MR19-1	609556	6119797	Spotted Sandpiper	1		Forest	Unknown	-
Breeding	6/9/2010	Ground	MR20-1	620356	6103096	Mallard	1		Water/Riparian	Unknown	-
Breeding	6/9/2010	Ground	MR20-2	620369	6102891	Solitary Sandpiper	2		Water/Riparian	Unknown	-
Breeding	6/9/2010	Ground	MR20-3	620421	6102693	Solitary Sandpiper	1		Water/Riparian	Unknown	-
Breeding	6/9/2010	Ground	MR20-4	620427	6102496	Green-winged Teal	1		Water/Riparian	Unknown	-
Breeding	6/9/2010	Ground	MR20-5	620353	6102302	Solitary Sandpiper	1		Water/Riparian	Unknown	-

Appendix 4.3-4

Wetland Bird Fall Staging Ground Survey Location and Habitat Information, 2011

Rescan™
Engineers and Scientists

Appendix 4.3-4. Wetland Bird Fall Staging Ground Survey Location and Habitat Information, 2011

Survey Date	Station	Easting	Northing	Start Time	End Time	Total No. Birds	Temperature	Cloud Cover	Wind	Lighting	Habitat Type	Size	Wetland Surveyed (%)	Emergent Vegetation (%)	Riparian Shrubs/Trees (%)
4-Oct-11	WB1	625649	6097372	9:01		0	5	100	0	flat	OT	Medium	95	100	50
4-Oct-11	WB2	625393	6097531	9:10		0	5	100	0	flat	PO	Medium	100	100	70
4-Oct-11	WB3	620314	6103140	9:49		0	5	100	0	flat	SW	Large	70	5	80
4-Oct-11	WB4	621475	6104917	9:59		0	5	100	0	flat	PO	Large	100	0	15
4-Oct-11	WB5	620690	6104144	10:05		0	5	100	0	flat	PO	Medium	100	20	100
4-Oct-11	WB6	619295	6099376	10:13		0	6	100	0	flat	SW	Small	90	0	20
4-Oct-11	WB7	620893	6099523	10:24		0	6	100	0	flat	SW	Small	90	0	0
4-Oct-11	WB8	624063	6098783	10:32		0	6	100	0	flat	SW	Small	95	0	15
4-Oct-11	WB9	620189	6091686	11:03		0	6	90	0	flat	RI	Large	90	0	90
4-Oct-11	WB10	619401	6091415	11:20		0	7	90	0	flat	RI	Large	90	0	90
4-Oct-11	WB11	618933	6091203	11:31		0	7	90	0	flat	RI	Large	90	0	90
4-Oct-11	WB12	618490	6091089	11:39		0	7	90	0	flat	LK	Large	100	90	35
4-Oct-11	WB13	616647	6090013	12:25	12:45	1	7	90	0	flat	SOW	Large	80	100	20
4-Oct-11	WB14	613950	6085412	13:14		0	8	90	0	flat	RI	Large	90	0	90
4-Oct-11	WB15	623855	6093380	13:42		0	8	80	0	flat	CR	Medium	90	50	50
4-Oct-11	WB16	629918	6100502	14:12	14:32	20	10	100	7	flat	PO	Large	100	100	10
4-Oct-11	WB17	631869	6103283	14:51		0	10	80	5	flat	PO	Large	100	100	8
4-Oct-11	WB18	632039	6102803	15:09	15:29	6	10	50	5	bright/flat	PO	Large	90	100	10
4-Oct-11	WB19	628974	6101936	15:50	16:10	48	12	50	0	bright	OT	Large	100	100	0
5-Oct-11	WB20	634583	6108346	8:30		1	1	100	0	flat	LK	Large	100	100	20
5-Oct-11	WB21	634558	6107867	8:50		0	2	100	0	flat	LK	Large	80	100	20
5-Oct-11	WB22	640194	6104920	9:33		0	2	100	0	flat	SW	Medium	100	80	20
5-Oct-11	WB23	646673	6102841	10:10	10:30	72	3	25	0	bright/flat	LK	Large	80	20	40
5-Oct-11	WB24	648629	6106113	11:25	11:45	11	5	50	0	bright	LK	Large	100	90	0
5-Oct-11	WB25	643179	6101613	12:25		0	6	80	2	flat	LK	Medium	100	90	40
5-Oct-11	WB26	613674	6105574	14:57	15:07	2	12	85	2	flat	OT	Medium	100	10	20
5-Oct-11	WB27	613099	6105310	15:07	15:22	6	12	85	2	flat	PO	Large	100	80	10
5-Oct-11	WB28	612318	6104377	15:22	15:42	1	12	85	2	flat	LK	Medium	100	80	0
5-Oct-11	WB29	628596	6104417	16:45		0	12	85	2	flat	LK	Medium	100	85	25
6-Oct-11	WB30	648121	6086724	14:00	14:20	65	14	5	7	flat	LK	Medium	100	85	5

Appendix 4.3-4. Wetland Bird Fall Staging Ground Survey Location and Habitat Information, 2011

Survey Date	Habitat Description
4-Oct-11	beaver pond/swamp/ marsh complex, beaver lodge in middle, lots of sedges and grasses and some cattails, one snag and a few willows
4-Oct-11	sedges and lots of willows and a few snags. Veg bottom.
4-Oct-11	lots of snags, v. Little aquatic veg, CWD
4-Oct-11	little aquatic veg, no snags, very muddy
4-Oct-11	beaver pond, lots of willow around edges, some emerg veg like sedges
4-Oct-11	treed swamp, lots of dead standing snags
4-Oct-11	treed swamp on side of road
4-Oct-11	treed swamp, lots of standing snags in water, CWD
4-Oct-11	slow bend/oxbow of Murray River, lots of horsetail on sandy shore, cottonwood/aspen floodplain forest
4-Oct-11	low eddy of Murray River
4-Oct-11	slow eddy of Murray River
4-Oct-11	lots of reeds and sedges, beaver activity
4-Oct-11	large swamp, SOW complex, lots of sedges and grasses and small open water areas, mint, a few treed patches
4-Oct-11	bridge crossing at Murray River
4-Oct-11	terraced beaver dams on a creek, lots of emergent veg in water (horsetail) and willows as well
4-Oct-11	pond/lake, lots of sedges and grasses on shore, beaver lodge
4-Oct-11	lake/pond, pond lily, sedges, grasses with snags, wide area of grasses around edge
4-Oct-11	lake/pond, pond lily, sedges, small amount of cattails, mossy grassy shoreline
4-Oct-11	2 treatment cells/settling ponds, manmade, lots of cattails around edges
5-Oct-11	Quality Lake, mixed conif/decid old growth, snags in water, sedges/grasses, 5 m shoreline, veg bottom, deep
5-Oct-11	Quality Lake, same as before
5-Oct-11	shallow swamp/pond with beaver activity, small-med, snags and veg in water, CWD in and around, grasses and sedges around edges
5-Oct-11	Bearhole Lake. Rocky/sandy, grasses and sedges on edges, some willow, conifer dom. Around edge.
5-Oct-11	east side very marshy with sedges, lots of standing snags, aspen at edge but surrounded by conifers, sandy bottom, small outflow to east with lots of grasses/sedges
5-Oct-11	CWD and snags in the water; grass/sedge islands and shorelines; conifer dom forest edge; moose tracks
5-Oct-11	roadside catchment pond; very little aquatic veg; some willows and aspens on shore
5-Oct-11	large settling pond beside train tracks; mostly grasses around shoreline; some willow shrubs
5-Oct-11	settling pond/lake; CWD and snags in the water; rocky, sandy substrate; minimal veg around shore; grass, sedge, and some forbs, CWD on shoreline
5-Oct-11	mixed decid-con forest, ~5m grass and sedge shoreline, aquatic veg prevalent (boggy shore); some snags around edges
6-Oct-11	abundant snags around shore; dense grass shoreline

Appendix 4.3-5

Wetland Bird Observations, Fall Staging Ground Surveys, 2011

Rescan™
Engineers and Scientists

Appendix 4.3-5. Wetland Bird Observations, Fall Staging Ground Surveys, 2011

Survey Date	Station	Group No.	Common Name	Scientific Name	Species Code	No. Drakes	No. Hens	No. Unknowns	Total Birds	Incidental	Comments
4-Oct-11	WB13	1	Hooded Merganser	*Lophodytes cucullatus*	HOME	0	1	0	1		flushed
4-Oct-11	WB16	1	Pied-billed Grebe	*Podilymbus podiceps*	PBGR	0	0	2	2		
4-Oct-11	WB16	2	Mallard	*Anas platyrhynchos*	MALL	0	0	1	1		
4-Oct-11	WB16	3	Horned Grebe	*Podiceps auritus*	HOGR	0	0	2	2		
4-Oct-11	WB16	4	Surf Scoter	*Melanitta perspicillata*	SUSC	0	0	13	13		
4-Oct-11	WB16	5	Red-necked Grebe	*Podiceps grisegena*	RNGR	0	0	2	2		
4-Oct-11	WB18	1	Horned Grebe	*Podiceps auritus*	HOGR	0	0	2	2		
4-Oct-11	WB18	2	Ring-necked Pheasant	*Phasianus colchicus*	RNPH	0	0	1	1		
4-Oct-11	WB18	3	Unknown Duck		UNKN	0	0	1	1		flew into cattails, most likely LESC, unknown scaup or RNDU
4-Oct-11	WB19	1	Ring-necked Duck	*Aythya collaris*	RNDU	0	0	14	14		mixed with LESC, on cell 1
4-Oct-11	WB19	1	Lesser Scaup	*Aythya affinis*	LESC	0	0	26	26		on cell 1
4-Oct-11	WB19	2	Common Goldeneye	*Bucephala clangula*	COGO	0	2	0	2		on cell 1
4-Oct-11	WB19	3	Horned Grebe	*Podiceps auritus*	HOGR	0	0	1	1		on cell 1
4-Oct-11	WB19	4	Hooded Merganser	*Lophodytes cucullatus*	HOME	0	2	0	2		on cell 1
4-Oct-11	WB19	5	Hooded Merganser	*Lophodytes cucullatus*	HOME	0	2	0	2		on cell 2
4-Oct-11	WB19	6	Lesser Scaup	*Aythya affinis*	LESC	0	0	1	1		on cell 2
5-Oct-11	WB20	1	Unknown Duck	*Aythya spp.*	UNKN	0	0	1	1		flushed off lake, couldn't get positive ID
5-Oct-11	WB23	1	Common Goldeneye	*Bucephala clangula*	COGO	1	2	0	3	Yes	
5-Oct-11	WB23	2	Grebe spp.	*Aechmophorus sp.*	GREB	0	0	7	7	Yes	unknown grebe - clarks or western, > 200m
5-Oct-11	WB23	3	Unknown Diver	*Aythya spp.*	UNKN	0	0	43	43	Yes	unknown divers, likely mix of RNDU and LESC, too far even with scope, > 200m
5-Oct-11	WB23	4	Common Goldeneye	*Bucephala clangula*	COGO	0	4	0	4		> 200m
5-Oct-11	WB23	4	Lesser Scaup	*Aythya affinis*	LESC	0	4	0	4	Yes	> 200m
5-Oct-11	WB23	4	Surf Scoter	*Melanitta perspicillata*	SUSC	0	0	6	6	Yes	> 200m
5-Oct-11	WB23	4	Horned Grebe	*Podiceps auritus*	HOGR	0	0	1	1	Yes	> 200m
5-Oct-11	WB23	4	Surf Scoter	*Melanitta perspicillata*	SUSC	0	0	6	6	Yes	> 200m
5-Oct-11	WB23	4	Horned Grebe	*Podiceps auritus*	HOGR	0	0	1	1	Yes	> 200m
5-Oct-11	WB23	5	Unknown Grebe	*Aechmophorus sp.*	GREB	0	0	5	5	Yes	> 200m, unknown grebe, either clarks or western grebe
5-Oct-11	WB23	5	Unknown Loon	*Gavia spp.*	LOON	0	0	1	1	Yes	> 200m, unknown loon
5-Oct-11	WB23	6	Unknown Shorebird		UNKN	0	0	1	1	Yes	unknown shorebird flyover
5-Oct-11	WB24	1	Pacific Loon	*Gavia pacifica*	PALO	0	0	7	7	Yes	potentially a family group, >200m
5-Oct-11	WB24	2	Hooded Merganser	*Lophodytes cucullatus*	HOME	1	3	0	4		> 200m
5-Oct-11	WB26	1	Hooded Merganser	*Lophodytes cucullatus*	HOME	0	2	0	2		
5-Oct-11	WB27	1	Mallard	*Anas platyrhynchos*	MALL	0	4	0	4		
5-Oct-11	WB27	2	Common Goldeneye	*Bucephala clangula*	COGO	0	2	0	2		
5-Oct-11	WB28	1	Common Goldeneye	*Bucephala clangula*	COGO	0	1	0	1		
6-Oct-11	WB30	1	Lesser Scaup	*Aythya affinis*	LESC	0	0	47	47		mixed sexes
6-Oct-11	WB30	1	Ring-necked Duck	*Aythya collaris*	RNDU	10	3	0	13		mixed sexes
6-Oct-11	WB30	2	Mallard	*Anas platyrhynchos*	MALL	0	3	0	3	Yes	
6-Oct-11	WB30	3	Lesser Scaup	*Aythya affinis*	LESC	0	0	2	2	Yes	

Appendix 4.3-6

Wetland Bird Fall Staging Aerial Survey Location and Habitat Information, 2011

Rescan™
Engineers and Scientists

Appendix 4.3-6. Wetland Bird Fall Staging Aerial Survey Location and Habitat Information, 2011

UID	Date	Survey Type	Survey Strata	Start/End Time	Easting	Northing	Temp. (°C)	Cloud Cover (%)	Wind (km/hr)	Lighting
ALAL	6-Oct-11	Fall Staging	Murray River	8:51	6106708	626172	7	50	2	Bright/flat
001	6-Oct-11	Fall Staging	Murray River		6113265	625908	7	50	2	Bright/flat
001	6-Oct-11	Fall Staging	Murray River		6113265	625908	7	50	2	Bright/flat
002	6-Oct-11	Fall Staging	Murray River		6110875	625622	7	50	2	Bright/flat
003	6-Oct-11	Fall Staging	Murray River		6110663	624832	7	50	2	Bright/flat
004	6-Oct-11	Fall Staging	Murray River		6108945	625532	7	50	2	Bright/flat
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	7	50	2	Bright/flat
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	7	50	2	Bright/flat
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	7	50	2	Bright/flat
006	6-Oct-11	Fall Staging	Murray River		6090542	625952	7	50	2	Bright/flat
007	6-Oct-11	Fall Staging	Murray River		6093035	626945	7	50	2	Bright/flat
008	6-Oct-11	Fall Staging	Murray River		6094369	627500	7	50	2	Bright/flat
009	6-Oct-11	Fall Staging	Murray River		6091714	622682	7	50	2	Bright/flat
009	6-Oct-11	Fall Staging	Murray River		6091715	622683	7	50	2	Bright/flat
010	6-Oct-11	Fall Staging	Murray River		6091719	622365	7	50	2	Bright/flat
011	6-Oct-11	Fall Staging	Murray River		6091411	621320	7	50	2	Bright/flat
012	6-Oct-11	Fall Staging	Murray River		6090595	620592	7	50	2	Bright/flat
013	6-Oct-11	Fall Staging	Murray River		6091703	620368	7	50	2	Bright/flat
014	6-Oct-11	Fall Staging	Murray River		6087724	615467	7	50	2	Bright/flat
015	6-Oct-11	Fall Staging	Murray River		6086159	614303	7	50	2	Bright/flat
016	6-Oct-11	Fall Staging	Murray River		6085953	614209	7	50	2	Bright/flat
017	6-Oct-11	Fall Staging	Murray River		6084750	613406	7	50	2	Bright/flat
018	6-Oct-11	Fall Staging	Murray River	10:06	6083306	612462	7	50	2	Bright/flat
019	6-Oct-11	Fall Staging	Wolverine River	10:22	6101591	610901	7	50	2	Bright/flat
020	6-Oct-11	Fall Staging	Wolverine River		6102732	612336	7	50	2	Bright/flat
021	6-Oct-11	Fall Staging	Wolverine River		6104865	612827	7	50	2	Bright/flat
021	6-Oct-11	Fall Staging	Wolverine River		6104865	612827	7	50	2	Bright/flat
022	6-Oct-11	Fall Staging	Wolverine River		6105234	613806	7	50	2	Bright/flat
023	6-Oct-11	Fall Staging	Wolverine River		6105710	614371	7	50	2	Bright/flat
024	6-Oct-11	Fall Staging	Wolverine River		6105540	614621	7	50	2	Bright/flat
025	6-Oct-11	Fall Staging	Wolverine River	11:03	6109892	618523	9	30	2	Bright/flat
026	6-Oct-11	Fall Staging	Flatbed Creek	11:04	6106667	631002	9	30	2	Bright/flat
027	6-Oct-11	Fall Staging	Flatbed Creek		6104870	635585	9	30	2	Bright/flat
028	6-Oct-11	Fall Staging	Flatbed Creek		6103896	636539	9	30	2	Bright/flat
029	6-Oct-11	Fall Staging	Flatbed Creek		6099856	638999	9	30	2	Bright/flat
029	6-Oct-11	Fall Staging	Flatbed Creek	12:14	6099856	638999	9	30	2	Bright/flat
030	6-Oct-11	Fall Staging	Bearhole Lake	12:17	6102041	646211	9	30	2	Bright/flat
031	6-Oct-11	Fall Staging	Bearhole Lake		6103485	647598	9	30	2	Bright/flat
032	6-Oct-11	Fall Staging	Bearhole Lake		6104032	648119	9	30	2	Bright/flat
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	9	30	2	Bright/flat
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	9	30	2	Bright/flat

Appendix 4.3-6. Wetland Bird Fall Staging Aerial Survey Location and Habitat Information, 2011

UID	Date	Survey Type	Survey Strata	Start/End Time	Easting	Northing	Temp. (˚C)	Cloud Cover (%)	Wind (km/hr)	Lighting
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	9	30	2	Bright/flat
034	6-Oct-11	Fall Staging	Bearhole Lake		6104412	649505	9	30	2	Bright/flat
035	6-Oct-11	Fall Staging	Bearhole Lake		6104871	649376	9	30	2	Bright/flat
036	6-Oct-11	Fall Staging	Bearhole Lake		6102911	650606	9	30	2	Bright/flat
037	6-Oct-11	Fall Staging	Bearhole Lake		6102294	652766	9	30	2	Bright/flat
038	6-Oct-11	Fall Staging	Bearhole Lake		6103621	653775	9	30	2	Bright/flat
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	9	30	2	Bright/flat
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	9	30	2	Bright/flat
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	9	30	2	Bright/flat
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	9	30	2	Bright/flat
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	9	30	2	Bright/flat
040	6-Oct-11	Fall Staging	Bearhole Lake		6103937	652208	9	30	2	Bright/flat
040	6-Oct-11	Fall Staging	Bearhole Lake		6103937	652208	9	30	2	Bright/flat
041	6-Oct-11	Fall Staging	Bearhole Lake		6102386	654891	9	30	2	Bright/flat
041	6-Oct-11	Fall Staging	Bearhole Lake		6102386	654891	9	30	2	Bright/flat
042	6-Oct-11	Fall Staging	Bearhole Lake		6102060	648877	9	30	2	Bright/flat
042	6-Oct-11	Fall Staging	Bearhole Lake		6102060	648877	9	30	2	Bright/flat
042	6-Oct-11	Fall Staging	Bearhole Lake	12:58	6102060	648877	9	30	2	Bright/flat
043	6-Oct-11	Fall Staging	Quality Lake	13:01	6106218	642507	13	10	2	Bright/flat
044	6-Oct-11	Fall Staging	Quality Lake		6115882	637807	13	10	2	Bright/flat
045	6-Oct-11	Fall Staging	Quality Lake	13:07	6107602	634637	13	10	2	Bright/flat

Appendix 4.3-7

Wetland Bird Observations, Fall Staging Aerial Surveys, 2011

Rescan™
Engineers and Scientists

Appendix 4.3-7. Wetland Bird Observations, Fall Staging Aerial Surveys, 2011

UID	Date	Survey Type	Survey Strata	Start/End Time	Easting	Northing	Group No.	Incidental	Species	Scientific Name	Code	Distance from Observer	No. Drakes	No. Hens	No. Unknown	Total Birds	Behaviour	Habitat Type	Comments
ALAL	6-Oct-11	Fall Staging	Murray River	8:51	6106708	626172	1		Moose	*Alces americanus*	ALAM	< 400 m			2	2		RI-L	
001	6-Oct-11	Fall Staging	Murray River		6113265	625908	1		Moose	*Alces americanus*	ALAM	< 400 m		1	1	2		RI-L	Cow and calf
001	6-Oct-11	Fall Staging	Murray River		6113265	625908	2		Northern Harrier	*Circus cyaneus*	NOHA	< 400 m		1		1	F/O	RI-L	
002	6-Oct-11	Fall Staging	Murray River		6110875	625622	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m		1		1		RI-L	along shoreline
003	6-Oct-11	Fall Staging	Murray River		6110663	624832	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m			6	6		RI-L	
004	6-Oct-11	Fall Staging	Murray River		6108945	625532	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m		4		4		RI-L	
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	1		Trumpeter Swan	*Cygnus buccinator*	TRSW	< 400 m			3	3		RI-L	2 adults and 1 juvenile
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	2		American Green-winged Teal	*Anas carolinensis*	AGTE	< 400 m			8	8		RI-L	
005	6-Oct-11	Fall Staging	Murray River		6095482	625717	3		Mallard	*Anas platyrhynchos*	MALL	< 400 m			24	24		RI-L	
006	6-Oct-11	Fall Staging	Murray River		6090542	625952	1		Mountain Goat	*Oreamnos americanus*	ORAM	< 400 m			45	45		OT	40 adults and 5 kids on the exposed ridge line
007	6-Oct-11	Fall Staging	Murray River		6093035	626945	1		Mountain Goat	*Oreamnos americanus*	ORAM	< 400 m			7	7		OT	ridge
008	6-Oct-11	Fall Staging	Murray River		6094369	627500	1		Bobcat or Lynx	*Lynx spp.*	FELI	< 400 m			1	1		OT	on the road
009	6-Oct-11	Fall Staging	Murray River		6091714	622682	1		American Green-winged Teal	*Anas carolinensis*	AGTE	< 400 m			3	3		CR-L	
009	6-Oct-11	Fall Staging	Murray River		6091715	622683	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m			4	4		CR-L	
010	6-Oct-11	Fall Staging	Murray River		6091719	622365	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m	4	11		15		CR-L	
011	6-Oct-11	Fall Staging	Murray River		6091411	621320	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		4		4		RI-L	
012	6-Oct-11	Fall Staging	Murray River		6090595	620592	1		Unknown Duck		UNDU	< 400 m			1	1		RI-L	unidentified dabbler
013	6-Oct-11	Fall Staging	Murray River		6091703	620368	1		Beaver	*Castor canadensis*	CACA	< 400 m			1	1		RI-L	
014	6-Oct-11	Fall Staging	Murray River		6087724	615467	1		Merganser sp.	*Lophodytes spp.*	MERG	< 400 m			1	1		RI-L	
015	6-Oct-11	Fall Staging	Murray River		6086159	614303	1		Moose	*Alces americanus*	ALAL	< 400 m	1			1		RI-L	bull
016	6-Oct-11	Fall Staging	Murray River		6085953	614209	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		6		6		RI-L	
017	6-Oct-11	Fall Staging	Murray River		6084750	613406	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		2		2		RI-L	
018	6-Oct-11	Fall Staging	Murray River	10:06	6083306	612462	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m		1		1		RI-L	marshy side channels
TRSW2	6-Oct-11	Fall Staging	Murray River	10:07	6077906	613646	1	Yes	Trumpeter Swan	*Cygnus buccinator*	TRSW	< 400 m			2	2		RI-L	incidental
019	6-Oct-11	Fall Staging	Wolverine River	10:22	6101591	610901	1		Mule Deer	*Odocoileus hemionus*	ODHE	< 400 m		2		2		RI-M	
020	6-Oct-11	Fall Staging	Wolverine River		6102732	612336	1		American Dipper	*Cinclus mexicanus*	AMDI	< 400 m			1	1		RI-L	
021	6-Oct-11	Fall Staging	Wolverine River		6104865	612827	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		1		1		MA-M	
021	6-Oct-11	Fall Staging	Wolverine River		6104865	612827	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			1	1		MA-M	
022	6-Oct-11	Fall Staging	Wolverine River		6105234	613806	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m	3	23		26		RI-M	
023	6-Oct-11	Fall Staging	Wolverine River		6105710	614371	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m	1	3		4		MA-M	
024	6-Oct-11	Fall Staging	Wolverine River		6105540	614621	1		Moose	*Alces americanus*	ALAL	< 400 m		1	1	2		MA-M	Cow and calf
025	6-Oct-11	Fall Staging	Wolverine River	11:03	6109892	618523	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		2		2		RI-M	backwash
026	6-Oct-11	Fall Staging	Flatbed Creek	11:04	6106667	631002	1		Beaver	*Castor canadensis*	CACA	< 400 m			3	3		CR-L	hauling logs
027	6-Oct-11	Fall Staging	Flatbed Creek		6104870	635585	1		Elk	*Cervus canadensis*	CEEL	< 400 m		2		2		CR-L	both does
028	6-Oct-11	Fall Staging	Flatbed Creek		6103896	636539	1		Elk	*Cervus canadensis*	CEEL	< 400 m	1			1		CR-L	buck
029	6-Oct-11	Fall Staging	Flatbed Creek		6099856	638999	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		5		5		CR-L	
029	6-Oct-11	Fall Staging	Flatbed Creek	12:14	6099856	638999	1		American Dipper	*Cinclus mexicanus*	AMDI	< 400 m			1	1		CR-L	
030	6-Oct-11	Fall Staging	Bearhole Lake	12:17	6102041	646211	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m			8	8		CR-S	
031	6-Oct-11	Fall Staging	Bearhole Lake		6103485	647598	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m			9	9		LK-L	
032	6-Oct-11	Fall Staging	Bearhole Lake		6104032	648119	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			24	24		LK-L	
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			44	44		LK-L	mixed flock with the RNDU
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	1		Ring-necked Duck	*Aythya collaris*	RNDU	< 400 m			44	44		LK-L	mixed flock with the LESC
033	6-Oct-11	Fall Staging	Bearhole Lake		6103715	649134	2		Loon sp.	*Gavia spp.*	LOON	< 400 m			2	2		LK-L	
034	6-Oct-11	Fall Staging	Bearhole Lake		6104412	649505	1		Unknown Duck		UNDU	< 400 m			1	1		LK-L	
035	6-Oct-11	Fall Staging	Bearhole Lake		6104871	649376	1		Ring-necked Duck	*Aythya collaris*	RNDU	< 400 m	1	1		2		LK-M	
036	6-Oct-11	Fall Staging	Bearhole Lake		6102911	650606	1		Surf Scoter	*Melanitta perspicillata*	SUSC	< 400 m			1	1		LK-M	
037	6-Oct-11	Fall Staging	Bearhole Lake		6102294	652766	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m	10	10		20		LK-L	
038	6-Oct-11	Fall Staging	Bearhole Lake		6103621	653775	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m	1	1		2		LK-L	
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			26	26		LK-L	
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	2		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m			3	3		LK-L	
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	1		Ring-necked Duck	*Aythya collaris*	RNDU	< 400 m	1			1		LK-L	

Appendix 4.3-7. Wetland Bird Observations, Fall Staging Aerial Surveys, 2011

UID	Date	Survey Type	Survey Strata	Start/End Time	Easting	Northing	Group No.	Incidental	Species	Scientific Name	Code	Distance from Observer	No. Drakes	No. Hens	No. Unknown	Total Birds	Behaviour	Habitat Type	Comments
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	3		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			5	5		LK-L	
039	6-Oct-11	Fall Staging	Bearhole Lake		6104042	653823	4		Western Grebe	*Aechmophorus occidentalis*	WEGR	< 400 m			1	1		LK-L	
040	6-Oct-11	Fall Staging	Bearhole Lake		6103937	652208	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m	5	3		8		LK-L	
040	6-Oct-11	Fall Staging	Bearhole Lake		6103937	652208	2		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			20	20		LK-L	
041	6-Oct-11	Fall Staging	Bearhole Lake		6102386	654891	1		Hooded Merganser	*Lophodytes cucullatus*	HOME	< 400 m	1			1		LK-L	
041	6-Oct-11	Fall Staging	Bearhole Lake		6102386	654891	2		Grebe sp.	*Aechmophorus spp.*	GREB	< 400 m			1	1		LK-L	Western or Clark's Grebe
042	6-Oct-11	Fall Staging	Bearhole Lake		6102060	648877	1		Mallard	*Anas platyrhynchos*	MALL	< 400 m		3		3		LK-L	
042	6-Oct-11	Fall Staging	Bearhole Lake		6102060	648877	1		American Green-winged Teal	*Anas carolinensis*	AGTE	< 400 m			5	5		LK-L	
042	6-Oct-11	Fall Staging	Bearhole Lake	12:58	6102060	648877	1		Bald Eagle	*Haliaeetus leucocephalus*	BAEA	< 400 m			1	1		LK-L	
043	6-Oct-11	Fall Staging	Quality Lake	13:01	6106218	642507	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m	1	4		5		LK-M	
044	6-Oct-11	Fall Staging	Quality Lake		6115882	637807	1		Gadwall	*Anas strepera*	GADW	< 400 m			20	20		LK-L	mostly females, possibly NOPI as well
045	6-Oct-11	Fall Staging	Quality Lake	13:07	6107602	634637	1		Lesser Scaup	*Aythya affinis*	LESC	< 400 m			18	18		LK-L	

Appendix 4.3-8

Spring Staging Ground Survey Location and Habitat Information, 2012

Rescan™
Engineers and Scientists

Appendix 4.3-8. Spring Staging Ground Survey Location and Habitat Information, 2012

SurveyDate	Station	Easting	Northing	Start Time	End Time	Total No. Birds	Temperature	CloudCover	Wind	Lighting	Habitat Type	Size	Wetland Surveyed (%)	Emergent Vegetation (%)	Riparian Shrubs/Trees (%)
1-May-2012	WB17	631869	6103283	8:23	8:28	0	4	95	Calm	Variable	PO	Large	100	100	8
1-May-2012	WB18	632039	6102803	8:47	8:57	6	4	95	Calm	Variable	PO	Large	90	100	10
1-May-2012	WB19	628974	6101936	9:35	9:49	24	4	95	Calm	Variable	OT	Large	100	100	0
1-May-2012	WB16	629918	6100502	10:14	10:29	19	4	95	Calm	Variable	PO	Large	100	100	10
1-May-2012	WB14	613950	6085412	13:08	13:15	10	5	50	Calm	Variable	RI	Large	90	0	90
1-May-2012	WB13	616647	6090013	13:33	13:45	11	5	50	Calm	Variable	SOW	Large	80	100	20
1-May-2012	WB12	618490	6091089	13:59	14:10	18	5	50	Calm	Variable	LK	Large	100	90	35
1-May-2012	WB11	618933	6091203	14:16	14:26	16	5	50	Calm	Variable	RI	Large	90	0	90
1-May-2012	WB10	619401	6091415	14:28	14:35	0	5	50	Calm	Variable	RI	Large	90	0	90
1-May-2012	WB9	620189	6091686	14:59	15:07	0	5	50	Calm	Variable	RI	Large	90	0	90
1-May-2012	WB15	623855	6093380	15:19	15:29	0	5	50	Calm	Variable	CR	Medium	90	50	50
1-May-2012	WB4	621475	6104917	16:03	16:07	0	5	50	Calm	Bright	PO	Large	100	0	15
1-May-2012	WB5	620690	6104144	16:10	16:15	2	5	50	Calm	Bright	PO	Medium	100	20	100
1-May-2012	WB3	620314	6103140	16:15	16:20	0	5	50	Calm	Bright	SW	Large	70	5	80
1-May-2012	WB6	619295	6099376	16:25	16:27	0	5	50	Calm	Bright	SW	Small	90	0	20
1-May-2012	WB7	620893	6099523	16:28	16:33	0	5	50	Calm	Bright	SW	Small	90	0	0
1-May-2012	WB8	624063	6098783	16:34	16:39	0	5	50	Calm	Bright	SW	Small	95	0	15
1-May-2012	WB2	625393	6097531	16:40	16:58	7	5	50	Calm	Bright	PO	Medium	100	100	70
1-May-2012	WB1	625649	6097372	17:00	17:15	1	5	50	Calm	Bright	OT	Medium	95	100	50
1-May-2012	WB30	648121	6086724	17:55	18:10	0	6	45	Calm	Variable	LK	Medium	100	85	5
2-May-2012	WB29	628596	6104417	8:45	8:55	0	6	45	Calm	Variable	LK	Medium	100	85	25
3-May-2012	WB20	634583	6108346	8:50	9:00	8	5	50	Calm	Bright	LK	Large	100	100	20
3-May-2012	WB21	634558	6107867	8:50	9:00	0	8	30	Calm	Bright	LK	Large	80	100	20
3-May-2012	WB22	640194	6104920	9:30	9:45	12	6	45	Calm	Variable	SW	Medium	100	80	20
3-May-2012	WB25	643179	6101613	10:15	10:20	0	6	45	Calm	Variable	LK	Medium	100	90	40
3-May-2012	WB23	646673	6102841	10:30	10:35	0	0		Calm		LK	Large	80	20	40
3-May-2012	WB24	648629	6106113	11:00	11:10	55	6	45	Calm	Variable	LK	Large	100	90	0
3-May-2012	WB26	613674	6105574	15:40	15:44	4	6	45	Calm	Variable	OT	Medium	100	10	20
3-May-2012	WB27	613099	6105310	15:45	15:55	32	6	45	Calm	Variable	PO	Large	100	80	10
3-May-2012	WB28	612318	6104377	16:02	16:10	16	6	45	Calm	Variable	LK	Medium	100	80	0

Appendix 4.3-8. Spring Staging Ground Survey Location and Habitat Information, 2012

SurveyDate	Station	Habitat Description	Comments
1-May-2012	WB17	lake/pond, pond lily, sedges, grasses with snags, wide area of grasses around edge	90% of lake ice covered ; RCKI, DEJU, VATH, AMRO
1-May-2012	WB18	lake/pond, pond lily, sedges, small amount of cattails, mossy grassy shoreline	90% of lake ice covered
1-May-2012	WB19	2 treatment cells/settling ponds, manmade, lots of cattails around edges	75% of lake ice covered; RWBL
1-May-2012	WB16	pond/lake, lots of sedges and grasses on shore, beaver lodge	RUBL (s) in trees by lake (in ~25m)
1-May-2012	WB14	bridge crossing at Murray River	
1-May-2012	WB13	large swamp, SOW complex, lots of sedges and grasses and small open water areas, mint, a few treed patches	no ice cover, lots of MYWA, lots of moose tracks, OCWA, RUBL (s)
1-May-2012	WB12	lots of reeds and sedges, beaver activity	
1-May-2012	WB11	slow eddy of Murray River	
1-May-2012	WB10	low eddy of Murray River	BOCH, GCKI, RCKI, no waterfowl, no ice
1-May-2012	WB9	slow bend/oxbow of Murray River, lots of horsetail on sandy shore, cottonwood/aspen floodplain forest	no ice cover
1-May-2012	WB15	terraced beaver dams on a creek, lots of emergent veg in water (horsetail) and willows as well	
1-May-2012	WB4	little aquatic veg, no snags, very muddy	98% ice cover on lake
1-May-2012	WB5	beaver pond, lots of willow around edges, some emerg veg like sedges	95% ice cover on pond
1-May-2012	WB3	lots of snags, v. Little aquatic veg, CWD	98% ice cover on lake
1-May-2012	WB6	treed swamp, lots of dead standing snags	98% ice cover and snow on lake
1-May-2012	WB7	treed swamp on side of road	98% ice cover and snow on lake
1-May-2012	WB8	treed swamp, lots of standing snags in water, CWD	80% ice and snow cover on lake
1-May-2012	WB2	sedges and lots of willows and a few snags. Veg bottom.	beaver activitty and observation
1-May-2012	WB1	beaver pond/swamp/ marsh complex, beaver lodge in middle, lots of sedges and grasses and some cattails, one snag and a few willows	90% ice covered
1-May-2012	WB30	abundant snags around shore; dense grass shoreline	
2-May-2012	WB29	mixed decid-con forest, ~5m grass and sedge shoreline, aquatic veg prevalent (boggy shore); some snags around edges	95% ice covered; checked during aerial survey due to lack of access
3-May-2012	WB20	Quality Lake, mixed conif/decid old growth, snags in water, sedges/grasses, 5 m shoreline, veg bottom, deep	95% ice covered; YRWA, RCKI, VATH, WTSP
3-May-2012	WB21	Quality Lake, same as before	surveyed at same time as WB20; same lake with 95% ice cover
3-May-2012	WB22	shallow swamp/pond with beaver activity, small-med, snags and veg in water, CWD in and around, grasses and sedges around edges	WPT 134 - RTHA harrassed by 2 COHA
3-May-2012	WB25	CWD and snags in the water; grass/sedge islands and shorelines; conifer dom forest edge; moose tracks	98% ice covered
3-May-2012	WB23	Bearhole Lake. Rocky/sandy, grasses and sedges on edges, some willow, conifer dom. Around edge.	98% ice covered
3-May-2012	WB24	east side very marshy with sedges, lots of standing snags, aspen at edge but surrounded by conifers, sandy bottom, small outflow to east with lots of grasses/sedges	80% ice cover; HETH, RWBL, CORA
3-May-2012	WB26	roadside catchment pond; very little aquatic veg; some willows and aspens on shore	
3-May-2012	WB27	large settling pond beside train tracks; mostly grasses around shoreline; some willow shrubs	
3-May-2012	WB28	settling pond/lake; CWD and snags in the water; rocky, sandy substrate; minimal veg around shore; grass, sedge, and some forbs, CWD on shoreline	

Appendix 4.3-9

Wetland Bird Raw Observation Data, Spring Staging Ground Surveys, 2012

Rescan™
Engineers and Scientists

Appendix 4.3-9. Wetland Bird Raw Observation Data, Spring Staging Ground Surveys, 2012

SurveyDate	Station	Group No.	CommonName	ScientificName	Species Code	No. Drakes	No. Hens	No. Unknowns	Total Birds	Incidental	Comments
1-May-12	WB1	2	Mallard	*Anas platyrhynchos*	MALL	1	0	0	1		
1-May-12	WB2	1	American Green-winged Teal	*Anas crecca*	AGWT	5	2	0	7		also observed at WB1
1-May-12	WB2	2	Barred Owl	*Strix varia*	BDOW	0	0	1	1	Yes	wood frogs also calling
1-May-12	WB5	1	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	0	0	1		
1-May-12	WB11	1	Canada Goose	*Branta canadensis*	CAGO	0	0	8	8		flock / group
1-May-12	WB12	1	Greater Scaup	*Aythya marila*	GRSC	1	1	0	2		
1-May-12	WB12	1	Bufflehead	*Bucephala albeola*	BUFF	1	1	0	2		
1-May-12	WB12	1	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	0	0	1		SOGR, ALFL, RTHA
1-May-12	WB12	1	Ring-necked Duck	*Aythya collaris*	RNDU	4	0	0	4		
1-May-12	WB13	1	Trumpeter Swan	*Cygnus buccinator*	TRUS	1	1	0	2		
1-May-12	WB13	1	Mallard	*Anas platyrhynchos*	MALL	1	0	0	1		
1-May-12	WB13	2	Greater Scaup	*Aythya marila*	GRSC	1	1	0	2		
1-May-12	WB13	2	Common Merganser	*Mergus merganser*	COME	0	1	0	1		
1-May-12	WB14	1	Common Merganser	*Mergus merganser*	COME	4	1	0	5		3 males flew off together
1-May-12	WB16	1	Common Loon	*Gavia immer*	COLO	0	0	1	1		
1-May-12	WB16	1	Northern Pintail	*Anas acuta*	NOPI	2	2	0	4		
1-May-12	WB16	1	American Green-winged Teal	*Anas crecca*	AGWT	3	2	0	5		
1-May-12	WB16	1	Common Goldeneye	*Bucephala clangula*	COGO	2	0	0	2		
1-May-12	WB16	1	Wilson's Snipe	*Gallinago delicata*	WISN	0	0	2	2		one calling (possibly flying around overhead) and one by shore
1-May-12	WB18	1	Wilson's Snipe	*Gallinago delicata*	WISN	0	0	1	1	Yes	
1-May-12	WB18	1	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
1-May-12	WB19	1	Northern Shoveler	*Anas clypeata*	NOSL	2	1	0	3		
1-May-12	WB19	1	Greater Scaup	*Aythya marila*	GRSC	2	2	0	4		
1-May-12	WB19	1	Common Goldeneye	*Bucephala clangula*	COGO	1	0	0	1		
1-May-12	WB19	1	Bufflehead	*Bucephala albeola*	BUFF	1	1	0	2		
1-May-12	WB19	1	Mallard	*Anas platyrhynchos*	MALL	2	2	0	4		one pair flew overhead
1-May-12	WB19	2	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	0	0	1		second sewage pond obs
1-May-12	WB19	2	Mallard	*Anas platyrhynchos*	MALL	1	0	0	1		second sewage pond obs
3-May-12	WB20	1	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
3-May-12	WB20	2	Wilson's Snipe	*Gallinago delicata*	WISN	0	0	2	2	Yes	heard calling in the area
3-May-12	WB22	1	Mallard	*Anas platyrhynchos*	MALL	3	1	0	4		
3-May-12	WB22	1	Greater Yellowlegs	*Tringa melanoleuca*	GRYE	0	0	2	2		exhibiting nest defense behaviour
3-May-12	WB22	2	Barrow's Goldeneye	*Bucephala islandica*	BAGO	0	1	0	1		
3-May-12	WB22	3	American Green-winged Teal	*Anas crecca*	AGWT	1	1	0	2		
3-May-12	WB24	1	Trumpeter Swan	*Cygnus buccinator*	TRUS	1	1	0	2		
3-May-12	WB24	1	Belted Kingfisher	*Ceryle alcyon*	BEKI	0	0	1	1		in tree snag
3-May-12	WB24	2	Mallard	*Anas platyrhynchos*	MALL	1	1	0	2		PA
3-May-12	WB24	3	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
3-May-12	WB24	3	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
3-May-12	WB24	4	Greater Yellowlegs	*Tringa melanoleuca*	GRYE	0	0	2	2		one on ice and one flying over, heard calling
3-May-12	WB24	5	Mallard	*Anas platyrhynchos*	MALL	5	4	0	9		flock
3-May-12	WB24	5	Bufflehead	*Bucephala albeola*	BUFF	1	1	0	2		
3-May-12	WB24	6	Northern Shoveler	*Anas clypeata*	NOSL	5	1	0	6		
3-May-12	WB24	6	American Green-winged Teal	*Anas crecca*	AGWT	2	3	0	5		
3-May-12	WB24	6	Mallard	*Anas platyrhynchos*	MALL	1	0	0	1		
3-May-12	WB24	6	Blue-winged Teal	*Anas discors*	BWTE	1	1	0	2		
3-May-12	WB24	7	American Wigeon	*Anas americana*	AMWI	1	0	0	1		
3-May-12	WB24	7	Mallard	*Anas platyrhynchos*	MALL	1	0	0	1		
3-May-12	WB24	7	Northern Harrier	*Circus cyaneus*	NOHA	1	0	0	1		possible nest on hummock in grassy marsh area with snags
3-May-12	WB24	7	Unknown Shorebird		UNKN	0	0	3	3		unknown sandpiper/shorebird, elk poo
3-May-12	WB26	1	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
3-May-12	WB27	1	Canada Goose	*Branta canadensis*	CAGO	6	6	1	13		
3-May-12	WB27	2	Mallard	*Anas platyrhynchos*	MALL	1	1	0	2		
3-May-12	WB27	2	Barrow's Goldeneye	*Bucephala islandica*	BAGO	1	1	0	2		
3-May-12	WB28	1	Bufflehead	*Bucephala albeola*	BUFF	4	4	0	8		

Appendix 4.3-10

Spring Staging Aerial Survey Location and Habitat Information, 2012

Rescan™
Engineers and Scientists

Appendix 4.3-10. Spring Staging Aerial Survey Location and Habitat Information, 2012

UID	Date	Survey Type	Survey Strata	Start Time	End Time	Easting	Northing	Temp. (°C)	Cloud Cover (%)	Wind	Lighting
002	2-May-12	Spring Staging	Murray River	8:45	10:45	627975	6115449	8	30	Calm	Bright/Hazy
003	2-May-12	Spring Staging	Murray River			626642	6114064	8	30	Calm	Bright/Hazy
004	2-May-12	Spring Staging	Murray River			626168	6114210	8	30	Calm	Bright/Hazy
005	2-May-12	Spring Staging	Murray River			625707	6114052	8	30	Calm	Bright/Hazy
006	2-May-12	Spring Staging	Murray River			625485	6114029	8	30	Calm	Bright/Hazy
007	2-May-12	Spring Staging	Murray River			625031	6113811	8	30	Calm	Bright/Hazy
008	2-May-12	Spring Staging	Murray River			624839	6113607	8	30	Calm	Bright/Hazy
009	2-May-12	Spring Staging	Murray River			624983	6113419	8	30	Calm	Bright/Hazy
010	2-May-12	Spring Staging	Murray River			624390	6113075	8	30	Calm	Bright/Hazy
012	2-May-12	Spring Staging	Murray River			625920	6113441	8	30	Calm	Bright/Hazy
013	2-May-12	Spring Staging	Murray River			625944	6113222	8	30	Calm	Bright/Hazy
015	2-May-12	Spring Staging	Murray River			625377	6112743	8	30	Calm	Bright/Hazy
016	2-May-12	Spring Staging	Murray River			626960	6104569	8	30	Calm	Bright/Hazy
017	2-May-12	Spring Staging	Murray River			626601	6100575	8	30	Calm	Bright/Hazy
018	2-May-12	Spring Staging	Murray River			626689	6100135	8	30	Calm	Bright/Hazy
020	2-May-12	Spring Staging	Murray River			625597	6096653	8	30	Calm	Bright/Hazy
021	2-May-12	Spring Staging	Murray River			625878	6096830	8	30	Calm	Bright/Hazy
023	2-May-12	Spring Staging	Murray River			626068	6096258	8	30	Calm	Bright/Hazy
024	2-May-12	Spring Staging	Murray River			625922	6096142	8	30	Calm	Bright/Hazy
025	2-May-12	Spring Staging	Murray River			625977	6096079	8	30	Calm	Bright/Hazy
026	2-May-12	Spring Staging	Murray River			625921	6095936	8	30	Calm	Bright/Hazy
027	2-May-12	Spring Staging	Murray River			625881	6095671	8	30	Calm	Bright/Hazy
028	2-May-12	Spring Staging	Murray River			625821	6095523	8	30	Calm	Bright/Hazy
029	2-May-12	Spring Staging	Murray River			625776	6095874	8	30	Calm	Bright/Hazy
030	2-May-12	Spring Staging	Murray River			625715	6095685	8	30	Calm	Bright/Hazy
032	2-May-12	Spring Staging	Murray River			625529	6095612	8	30	Calm	Bright/Hazy
033	2-May-12	Spring Staging	Murray River			625728	6095278	8	30	Calm	Bright/Hazy
034	2-May-12	Spring Staging	Murray River			625480	6095138	8	30	Calm	Bright/Hazy
035	2-May-12	Spring Staging	Murray River			625345	6095038	8	30	Calm	Bright/Hazy
036	2-May-12	Spring Staging	Murray River			625528	6094626	8	30	Calm	Bright/Hazy
037	2-May-12	Spring Staging	Murray River			625612	6094723	8	30	Calm	Bright/Hazy
039	2-May-12	Spring Staging	Murray River			623822	6092352	8	30	Calm	Bright/Hazy
040	2-May-12	Spring Staging	Murray River			623625	6092023	8	30	Calm	Bright/Hazy
041	2-May-12	Spring Staging	Murray River			623332	6091814	8	30	Calm	Bright/Hazy
042	2-May-12	Spring Staging	Murray River			623257	6091805	8	30	Calm	Bright/Hazy
043	2-May-12	Spring Staging	Murray River			623156	6092005	8	30	Calm	Bright/Hazy
044	2-May-12	Spring Staging	Murray River			622496	6091822	8	30	Calm	Bright/Hazy
045	2-May-12	Spring Staging	Murray River			621057	6091228	8	30	Calm	Bright/Hazy
046	2-May-12	Spring Staging	Murray River			620619	6091070	8	30	Calm	Bright/Hazy
047	2-May-12	Spring Staging	Murray River			620499	6090698	8	30	Calm	Bright/Hazy
048	2-May-12	Spring Staging	Murray River			619863	6091051	8	30	Calm	Bright/Hazy
049	2-May-12	Spring Staging	Murray River			619742	6090931	8	30	Calm	Bright/Hazy
050	2-May-12	Spring Staging	Murray River			619610	6090835	8	30	Calm	Bright/Hazy
051	2-May-12	Spring Staging	Murray River			620179	6091678	8	30	Calm	Bright/Hazy
052	2-May-12	Spring Staging	Murray River			618876	6091126	8	30	Calm	Bright/Hazy
053	2-May-12	Spring Staging	Murray River			618708	6091074	8	30	Calm	Bright/Hazy
054	2-May-12	Spring Staging	Murray River			616894	6090034	8	30	Calm	Bright/Hazy
055	2-May-12	Spring Staging	Murray River			616436	6089775	8	30	Calm	Bright/Hazy
056	2-May-12	Spring Staging	Murray River			616299	6089455	8	30	Calm	Bright/Hazy
057	2-May-12	Spring Staging	Murray River			616451	6089224	8	30	Calm	Bright/Hazy
058	2-May-12	Spring Staging	Murray River			615400	6088068	8	30	Calm	Bright/Hazy
059	2-May-12	Spring Staging	Murray River			614825	6086502	8	30	Calm	Bright/Hazy
061	2-May-12	Spring Staging	Murray River			614176	6086086	8	30	Calm	Bright/Hazy
062	2-May-12	Spring Staging	Murray River			613817	6085380	8	30	Calm	Bright/Hazy
063	2-May-12	Spring Staging	Murray River			613161	6085181	8	30	Calm	Bright/Hazy
064	2-May-12	Spring Staging	Murray River			612716	6084971	8	30	Calm	Bright/Hazy
065	2-May-12	Spring Staging	Murray River			612360	6084185	8	30	Calm	Bright/Hazy
066	2-May-12	Spring Staging	Murray River			612033	6082690	8	30	Calm	Bright/Hazy
067	2-May-12	Spring Staging	Murray River			611986	6082317	8	30	Calm	Bright/Hazy
068	2-May-12	Spring Staging	Murray River			612530	6082103	8	30	Calm	Bright/Hazy

Appendix 4.3-10. Spring Staging Aerial Survey Location and Habitat Information, 2012

UID	Date	Survey Type	Survey Strata	Start Time	End Time	Easting	Northing	Temp. (°C)	Cloud Cover (%)	Wind	Lighting
070	2-May-12	Spring Staging	Wolverine River	11:15	11:50	602045	6095768	10	30	Low-20km/h	Bright/Hazy
071	2-May-12	Spring Staging	Wolverine River			603575	6096977	10	30	Low-20km/h	Bright/Hazy
072	2-May-12	Spring Staging	Wolverine River			603624	6097633	10	30	Low-20km/h	Bright/Hazy
073	2-May-12	Spring Staging	Wolverine River			604628	6097795	10	30	Low-20km/h	Bright/Hazy
074	2-May-12	Spring Staging	Wolverine River			608922	6100210	10	30	Low-20km/h	Bright/Hazy
075	2-May-12	Spring Staging	Wolverine River			609944	6100910	10	30	Low-20km/h	Bright/Hazy
076	2-May-12	Spring Staging	Wolverine River			610267	6101413	10	30	Low-20km/h	Bright/Hazy
077	2-May-12	Spring Staging	Wolverine River			611228	6102028	10	30	Low-20km/h	Bright/Hazy
078	2-May-12	Spring Staging	Wolverine River			611630	6101671	10	30	Low-20km/h	Bright/Hazy
079	2-May-12	Spring Staging	Wolverine River			612527	6102243	10	30	Low-20km/h	Bright/Hazy
080	2-May-12	Spring Staging	Wolverine River			612175	6102754	10	30	Low-20km/h	Bright/Hazy
081	2-May-12	Spring Staging	Wolverine River			613145	6103690	10	30	Low-20km/h	Bright/Hazy
082	2-May-12	Spring Staging	Wolverine River			612714	6104204	10	30	Low-20km/h	Bright/Hazy
083	2-May-12	Spring Staging	Wolverine River			612867	6104032	10	30	Low-20km/h	Bright/Hazy
084	2-May-12	Spring Staging	Wolverine River			612720	6104507	10	30	Low-20km/h	Bright/Hazy
085	2-May-12	Spring Staging	Wolverine River			612845	6104888	10	30	Low-20km/h	Bright/Hazy
086	2-May-12	Spring Staging	Wolverine River			614009	6105563	10	30	Low-20km/h	Bright/Hazy
088	2-May-12	Spring Staging	Tumbler Ridge Sewage Lagoons	12:50	13:00	626914	6112334	15	30	Low-20km/h	Variable
089	2-May-12	Spring Staging	Flatbed Creek & Headwaters	13:15	14:00	628804	6108922	15	30	Low-20km/h	Variable
090	2-May-12	Spring Staging	Flatbed Creek & Headwaters			631185	6106881	15	30	Low-20km/h	Variable
091	2-May-12	Spring Staging	Flatbed Creek & Headwaters			639010	6099771	15	30	Low-20km/h	Variable
093	2-May-12	Spring Staging	Flatbed Creek & Headwaters			642387	6093788	15	30	Low-20km/h	Variable
094	2-May-12	Spring Staging	Flatbed Creek & Headwaters			644112	6088277	15	30	Low-20km/h	Variable
095	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645542	6085326	15	30	Low-20km/h	Variable
096	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645997	6083298	15	30	Low-20km/h	Variable
097	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646253	6081947	15	30	Low-20km/h	Variable
098	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646519	6081527	15	30	Low-20km/h	Variable
099	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646500	6081336	15	30	Low-20km/h	Variable
100	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646412	6080941	15	30	Low-20km/h	Variable
101	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646263	6080855	15	30	Low-20km/h	Variable
102	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645655	6080504	15	30	Low-20km/h	Variable
103	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645545	6079812	15	30	Low-20km/h	Variable
104	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645511	6078638	15	30	Low-20km/h	Variable
105	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645347	6077548	15	30	Low-20km/h	Variable
106	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645616	6076850	15	30	Low-20km/h	Variable
107	2-May-12	Spring Staging	Bearhole Lake	14:05	14:25	648492	6102074	15	80	Low-20km/h	Flat
108	2-May-12	Spring Staging	Bearhole Lake			649852	6101493	15	80	Low-20km/h	Flat
109	2-May-12	Spring Staging	Bearhole Lake			654403	6102454	15	80	Low-20km/h	Flat
110	2-May-12	Spring Staging	Bearhole Lake			654848	6102661	15	80	Low-20km/h	Flat
111	2-May-12	Spring Staging	Bearhole Lake			654654	6102812	15	80	Low-20km/h	Flat
112	2-May-12	Spring Staging	Bearhole Lake			653773	6103779	15	80	Low-20km/h	Flat
113	2-May-12	Spring Staging	Bearhole Lake			649005	6106054	15	80	Low-20km/h	Flat
114	2-May-12	Spring Staging	Bearhole Lake			634187	6099373	15	80	Low-20km/h	Flat
115	2-May-12	Spring Staging	Quality Lake	14:30	14:32	635167	6098766	15	80	Low-20km/h	Flat
116	2-May-12	Spring Staging	Murray River - Flatbed Creek	14:45	15:00	626435	6100162	15	90	Low-20km/h	Flat
117	2-May-12	Spring Staging	Murray River - Flatbed Creek			625359	6097568	15	90	Low-20km/h	Flat
118	2-May-12	Spring Staging	Murray River - Flatbed Creek			625958	6096424	15	90	Low-20km/h	Flat
119	2-May-12	Spring Staging	Murray River - Flatbed Creek			625812	6096009	15	90	Low-20km/h	Flat
120	2-May-12	Spring Staging	Murray River - Flatbed Creek			625394	6095517	15	90	Low-20km/h	Flat
121	2-May-12	Spring Staging	Murray River - Flatbed Creek			625344	6095019	15	90	Low-20km/h	Flat
122	2-May-12	Spring Staging	Murray River - Flatbed Creek			625442	6094367	15	90	Low-20km/h	Flat
123	2-May-12	Spring Staging	Murray River - Tailings Ponds	14:45	15:00	626205	6094486	15	90	Low-20km/h	Flat
125	2-May-12	Spring Staging	Murray River - Tailings Ponds			627710	6098439	15	90	Low-20km/h	Flat
126	2-May-12	Spring Staging	Murray River - Tailings Ponds			628167	6097718	15	90	Low-20km/h	Flat
127	2-May-12	Spring Staging	Murray River - Tailings Ponds			628444	6098680	15	90	Low-20km/h	Flat
129	2-May-12	Spring Staging	Murray River - Tailings Ponds			628906	6098892	15	90	Low-20km/h	Flat
130	2-May-12	Spring Staging	Murray River - Tailings Ponds			628927	6098570	15	90	Low-20km/h	Flat
131	2-May-12	Spring Staging	Murray River - Tailings Ponds			629424	6098710	15	90	Low-20km/h	Flat
132	2-May-12	Spring Staging	Murray River - Tailings Ponds			629995	6098950	15	90	Low-20km/h	Flat
133	2-May-12	Spring Staging	Murray River - Tailings Ponds			630284	6098699	15	90	Low-20km/h	Flat

Appendix 4.3-11

Habitat and Wetland Bird Raw Observation Data, Spring Staging Aerial Surveys, 2012

Rescan™
Engineers and Scientists

Appendix 4.3-11. Habitat and Wetland Bird Raw Observation Data, Spring Staging Aerial Surveys, 2012

UID	Date	Survey Type	Survey Strata	Start Time	End Time	Easting	Northing	Species	Code	No. Drakes	No. Hens	No. Unknown	No. Pairs	Total Birds	Habitat Type	Comments
002	2-May-12	Spring Staging	Murray River	8:45	10:45	627975	6115449	Canada Goose	CAGO			1		1	RI	
003	2-May-12	Spring Staging	Murray River			626642	6114064	Canada Goose	CAGO				1	2	RI	
004	2-May-12	Spring Staging	Murray River			626168	6114210	Trumpeter Swan	TRUS				1	2	RI	back channel of river
005	2-May-12	Spring Staging	Murray River			625707	6114052	Canada Goose	CAGO			1		1	RI	
006	2-May-12	Spring Staging	Murray River			625485	6114029	Scaup	SCAUP	6			2	10	CR	side channel of river
007	2-May-12	Spring Staging	Murray River			625031	6113811	Mallard	MALL				1	2	CR	
008	2-May-12	Spring Staging	Murray River			624839	6113607	Bufflehead	BUFF				1	2	CR	
009	2-May-12	Spring Staging	Murray River			624983	6113419	Mallard	MALL				1	2	CR	
010	2-May-12	Spring Staging	Murray River			624390	6113075	Mallard	MALL	4				4	CR	
012	2-May-12	Spring Staging	Murray River			625920	6113441	Mallard	MALL				1	2	RI	
013	2-May-12	Spring Staging	Murray River			625944	6113222	Canada Goose	CAGO				1	2	RI	Nesting in old raptor nest on top of white spruce
015	2-May-12	Spring Staging	Murray River			625377	6112743	Canada Goose	CAGO			1		1	RI	
016	2-May-12	Spring Staging	Murray River			626960	6104569	Canada Goose	CAGO			1		1	RI	
017	2-May-12	Spring Staging	Murray River			626601	6100575	Mallard	MALL	1			1	3	RI	
018	2-May-12	Spring Staging	Murray River			626689	6100135	Hooded Merganser	HOME				1	2	MA	MW 24
020	2-May-12	Spring Staging	Murray River			625597	6096653	Canada Goose	CAGO			6		6	RI	
021	2-May-12	Spring Staging	Murray River			625878	6096830	Common Merganser	COME				1	2	RI	
023	2-May-12	Spring Staging	Murray River			626068	6096258	Canada Goose	CAGO				1	2	RI	Probable nest on mid-river island
024	2-May-12	Spring Staging	Murray River			625922	6096142	Barrow's Goldeneye	BAGO				1	2	RI	
025	2-May-12	Spring Staging	Murray River			625977	6096079	Barrow's Goldeneye	BAGO		1		1	3	RI	
026	2-May-12	Spring Staging	Murray River			625921	6095936	American Green-winged Teal	AGWT	3	2			5	RI	
027	2-May-12	Spring Staging	Murray River			625881	6095671	Bufflehead	BUFF				1	2	CR	
028	2-May-12	Spring Staging	Murray River			625821	6095523	Barrow's Goldeneye	BAGO				1	2	CR	
029	2-May-12	Spring Staging	Murray River			625776	6095874	Mallard	MALL				1	2	CR	
030	2-May-12	Spring Staging	Murray River			625715	6095685	Ring-necked Duck	RNDU				1	2	CR	
032	2-May-12	Spring Staging	Murray River			625529	6095612	Scaup	SCAUP			7		7	CR	flock
033	2-May-12	Spring Staging	Murray River			625728	6095278	Trumpeter Swan	TRUS				1	2	CR	
034	2-May-12	Spring Staging	Murray River			625480	6095138	Hooded Merganser	HOME	3	1			4	RI	
035	2-May-12	Spring Staging	Murray River			625345	6095038	Hooded Merganser	HOME	1				1	RI	
036	2-May-12	Spring Staging	Murray River			625528	6094626	Canada Goose	CAGO			3		3	RI	
037	2-May-12	Spring Staging	Murray River			625612	6094723	Bufflehead	BUFF	1				1	RI	
039	2-May-12	Spring Staging	Murray River			623822	6092352	Canada Goose	CAGO			6		6	RI	
040	2-May-12	Spring Staging	Murray River			623625	6092023	Mallard	MALL				1	2	PO	WPT 041 to 051 - ponds connected to river
041	2-May-12	Spring Staging	Murray River			623332	6091814	Barrow's Goldeneye	BAGO				1	2	PO	
042	2-May-12	Spring Staging	Murray River			623257	6091805	Barrow's Goldeneye	BAGO				1	2	PO	
043	2-May-12	Spring Staging	Murray River			623156	6092005	Canada Goose	CAGO				1	2	PO	
044	2-May-12	Spring Staging	Murray River			622496	6091822	Mallard	MALL				2	4	PO	
045	2-May-12	Spring Staging	Murray River			621057	6091228	Common Merganser	COME	1				1	PO	
046	2-May-12	Spring Staging	Murray River			620619	6091070	Mallard	MALL	3	1			4	PO	
047	2-May-12	Spring Staging	Murray River			620499	6090698	Bufflehead	BUFF	1				1	PO	
048	2-May-12	Spring Staging	Murray River			619863	6091051	Blue-winged Teal	BWTE				1	2	PO	
049	2-May-12	Spring Staging	Murray River			619742	6090931	Barrow's Goldeneye	BAGO				1	2	PO	
050	2-May-12	Spring Staging	Murray River			619610	6090835	Barrow's Goldeneye	BAGO				1	2	PO	
051	2-May-12	Spring Staging	Murray River			620179	6091678	Common Merganser	COME	2				2	PO	
052	2-May-12	Spring Staging	Murray River			618876	6091126	Mallard	MALL	1				1	CR	
053	2-May-12	Spring Staging	Murray River			618708	6091074	Ring-necked Duck	RNDU	2				2	PO	
054	2-May-12	Spring Staging	Murray River			616894	6090034	Hooded Merganser	HOME	1				1	RI	
055	2-May-12	Spring Staging	Murray River			616436	6089775	Common Goldeneye	COGO	1				1	RI	
056	2-May-12	Spring Staging	Murray River			616299	6089455	American Wigeon	AMWI				1	2	RI	
057	2-May-12	Spring Staging	Murray River			616451	6089224	American Wigeon	AMWI	1				1	RI	
058	2-May-12	Spring Staging	Murray River			615400	6088068	Mallard	MALL				1	2	RI	
059	2-May-12	Spring Staging	Murray River			614825	6086502	Mallard	MALL				1	2	RI	
061	2-May-12	Spring Staging	Murray River			614176	6086086	Mallard	MALL	2				2	RI	
062	2-May-12	Spring Staging	Murray River			613817	6085380	Canada Goose	CAGO				1	2	RI	
063	2-May-12	Spring Staging	Murray River			613161	6085181	Barrow's Goldeneye	BAGO				1	2	PO	
064	2-May-12	Spring Staging	Murray River			612716	6084971	Mallard	MALL				1	2	RI	
065	2-May-12	Spring Staging	Murray River			612360	6084185	Common Merganser	COME				1	2	RI	
066	2-May-12	Spring Staging	Murray River			612033	6082690	Trumpeter Swan	TRUS				1	2	CR	
067	2-May-12	Spring Staging	Murray River			611986	6082317	Bufflehead	BUFF				1	2	PO	
068	2-May-12	Spring Staging	Murray River			612530	6082103	Bufflehead	BUFF	1				1	PO	
070	2-May-12	Spring Staging	Wolverine River	11:15	11:50	602045	6095768	Harlequin Duck	HADU		1			1	RI	potential sighting; Wolverine is fast flowing, good for HADU but not much else

Appendix 4.3-11. Habitat and Wetland Bird Raw Observation Data, Spring Staging Aerial Surveys, 2012

UID	Date	Survey Type	Survey Strata	Start Time	End Time	Easting	Northing	Species	Code	No. Drakes	No. Hens	No. Unknown	No. Pairs	Total Birds	Habitat Type	Comments
071	2-May-12	Spring Staging	Wolverine River			603575	6096977	Barrow's Goldeneye	BAGO				1	2	PO	
072	2-May-12	Spring Staging	Wolverine River			603624	6097633	Barrow's Goldeneye	BAGO	1				1	PO	
073	2-May-12	Spring Staging	Wolverine River			604628	6097795	Bufflehead	BUFF				1	2	PO	Wolverine downriver is quieter so more habitat for waterbirds; slower moving
074	2-May-12	Spring Staging	Wolverine River			608922	6100210	Trumpeter Swan	TRUS				1	2	CR	
075	2-May-12	Spring Staging	Wolverine River			609944	6100910	Mallard	MALL	1				1	RI	
076	2-May-12	Spring Staging	Wolverine River			610267	6101413	Mallard	MALL	1				1	RI	
077	2-May-12	Spring Staging	Wolverine River			611228	6102028	Mallard	MALL	2				2	RI	
078	2-May-12	Spring Staging	Wolverine River			611630	6101671	Canada Goose	CAGO			1		1	CR	
079	2-May-12	Spring Staging	Wolverine River			612527	6102243	Mallard	MALL	3				3	SW	connected to main river
080	2-May-12	Spring Staging	Wolverine River			612175	6102754	Canada Goose	CAGO				2	4	RI	
081	2-May-12	Spring Staging	Wolverine River			613145	6103690	Mallard	MALL				1	2	PO	side pond connected to river
082	2-May-12	Spring Staging	Wolverine River			612714	6104204	Canada Goose	CAGO				1	2	PO	side pond connected to river
083	2-May-12	Spring Staging	Wolverine River			612867	6104032	Mallard	MALL				2	4	MA	
084	2-May-12	Spring Staging	Wolverine River			612720	6104507	Canada Goose	CAGO				1	2	CR	
085	2-May-12	Spring Staging	Wolverine River			612845	6104888	Canada Goose	CAGO			1		1	CR	
086	2-May-12	Spring Staging	Wolverine River			614009	6105563	Common Merganser	COME				1	2	CR	
088	2-May-12	Spring Staging	Tumbler Ridge Sewage Lagoons	12:50	13:00	626914	6112334	Canada Goose	CAGO			1		1	MW	
089	2-May-12	Spring Staging	Flatbed Creek & Headwaters	13:15	14:00	628804	6108922	Barrow's Goldeneye	BAGO				2	4	MA	Flatbed too fast flowing for waterbirds and too much sediment for HADU at this time of year
090	2-May-12	Spring Staging	Flatbed Creek & Headwaters			631185	6106881	Mallard	MALL				1	2	CR	
091	2-May-12	Spring Staging	Flatbed Creek & Headwaters			639010	6099771	Canada Goose	CAGO				1	2	RI	
093	2-May-12	Spring Staging	Flatbed Creek & Headwaters			642387	6093788	Mallard	MALL	1				1	RI	
094	2-May-12	Spring Staging	Flatbed Creek & Headwaters			644112	6088277	Canada Goose	CAGO			1		1	CR	
095	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645542	6085326	Barrow's Goldeneye	BAGO				2	4	PO	a lot of side channels still frozen
096	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645997	6083298	Trumpeter Swan	TRUS				1	2	MA	
097	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646253	6081947	Mallard	MALL	2				2	MA	
098	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646519	6081527	American Wigeon	AMWI				1	2	MA	
099	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646500	6081336	Ring-necked Duck	RNDU	1				1	MA	
100	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646412	6080941	Trumpeter Swan	TRUS				1	2	MA	
101	2-May-12	Spring Staging	Flatbed Creek & Headwaters			646263	6080855	Barrow's Goldeneye	BAGO	2	1			3	MA	
102	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645655	6080504	Common Merganser	COME				1	2	MA	
103	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645545	6079812	Canada Goose	CAGO			2		2	MA	
104	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645511	6078638	Mallard	MALL	1				1	MA	
105	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645347	6077548	Scaup	SCAUP	2				2	MA	
106	2-May-12	Spring Staging	Flatbed Creek & Headwaters			645616	6076850	Barrow's Goldeneye	BAGO				1	2	MA	
107	2-May-12	Spring Staging	Bearhole Lake	14:05	14:25	648492	6102074	Trumpeter Swan	TRUS				1	2	CR	
108	2-May-12	Spring Staging	Bearhole Lake			649852	6101493	Barrow's Goldeneye	BAGO				1	2	RI	Kiskatinaw River
109	2-May-12	Spring Staging	Bearhole Lake			654403	6102454	Mallard	MALL				1	2	PO	95% ice cover, open edge
110	2-May-12	Spring Staging	Bearhole Lake			654848	6102661	Barrow's Goldeneye	BAGO				1	2	MA	
111	2-May-12	Spring Staging	Bearhole Lake			654654	6102812	Trumpeter Swan	TRUS				1	2	MA	
112	2-May-12	Spring Staging	Bearhole Lake			653773	6103779	American Green-winged Teal	AGWT				1	2	MA	
113	2-May-12	Spring Staging	Bearhole Lake			649005	6106054	Trumpeter Swan	TRUS				1	2	PO	
114	2-May-12	Spring Staging	Bearhole Lake			634187	6099373	Mallard	MALL				1	2	PO	
115	2-May-12	Spring Staging	Quality Lake	14:30	14:32	635167	6098766	Mallard	MALL				1	2	PO	
116	2-May-12	Spring Staging	Murray River - Flatbed Creek	14:45	15:00	626435	6100162		-					0	RI	Photo log of river in the MSDA, 893
117	2-May-12	Spring Staging	Murray River - Flatbed Creek			625359	6097568		-					0	RI	894, 4992
118	2-May-12	Spring Staging	Murray River - Flatbed Creek			625958	6096424		-					0	RI	4993
119	2-May-12	Spring Staging	Murray River - Flatbed Creek			625812	6096009		-					0	RI	4994
120	2-May-12	Spring Staging	Murray River - Flatbed Creek			625394	6095517		-					0	RI	4995
121	2-May-12	Spring Staging	Murray River - Flatbed Creek			625344	6095019		-					0	RI	4996
122	2-May-12	Spring Staging	Murray River - Flatbed Creek			625442	6094367		-					0	RI	4997
123	2-May-12	Spring Staging	Murray River - Tailings Ponds	14:45	15:00	626205	6094486	Northern Shoveller	NSHO				2	4	MW	Tailings pond
125	2-May-12	Spring Staging	Murray River - Tailings Ponds			627710	6098439	Hooded Merganser	HOME				1	2	MW	waste ponds east of Murray River
126	2-May-12	Spring Staging	Murray River - Tailings Ponds			628167	6097718	Mallard	MALL	1				1	MW	
127	2-May-12	Spring Staging	Murray River - Tailings Ponds			628444	6098680	Canada Goose	CAGO			3		3	MW	
129	2-May-12	Spring Staging	Murray River - Tailings Ponds			628906	6098892	Mallard	MALL				1	2	MW	
130	2-May-12	Spring Staging	Murray River - Tailings Ponds			628927	6098570	Mallard	MALL				2	4	MW	
131	2-May-12	Spring Staging	Murray River - Tailings Ponds			629424	6098710	Bufflehead	BUFF				1	2	MW	
132	2-May-12	Spring Staging	Murray River - Tailings Ponds			629995	6098950	Barrow's Goldeneye	BAGO	1				1	MW	natural pond?
133	2-May-12	Spring Staging	Murray River - Tailings Ponds			630284	6098699	Ring-necked Duck	RNDU	3	1			4	MW	natural pond?

Appendix 4.3-12

Wildlife Observed Incidentally During Spring Staging Wetland Bird Survey, 2012

Rescan™
Engineers and Scientists

Appendix 4.3-12. Wildlife Observed Incidentally During Spring Staging Wetland Bird Survey, 2012

Group	Common Name	Scientific Name
Raptors	Bald Eagle[1]	*Haliaeetus leucocephalus*
	Barred Owl	*Strix varia*
	Cooper's Hawk	*Accipiter cooperii*
	Golden Eagle	*Aquila chrysaetos*
	Northern Harrier	*Circus cyaneus*
	Osprey[2]	*Pandion haliaetus*
	Red-tailed Hawk	*Buteo jamaicensis*
Landbirds	American Crow	*Corvus brachyrhynchos*
	American Robin	*Turdus migratorius*
	Common Raven	*Corvus corax*
	Black-capped Chickadee	*Poecile atricapillus*
	Boreal Chickadee	*Poecile hudsonica*
	Dark-eyed Junco	*Junco hyemalis*
	Golden-crowned Kinglet	*Regulus satrapa*
	Golden-crowned Sparrow	*Zonotrichia atricapilla*
	Hammond's Flycatcher	*Empidonax hammondii*
	Hermit Thrush	*Catharus guttatus*
	Orange-crowned Warbler	*Vermivora celata*
	Red-winged Blackbird	*Agelaius phoeniceus*
	Ruby-Crowned Kinglet	*Regulus calendula*
	Red-breasted Nuthatch	*Sitta canadensis*
	Rusty Blackbird[3]	*Euphagus carolinus*
	Varied Thrush	*Ixoreus naevius*
	White-throated Sparrow	*Zonotrichia albicollis*
	Yellow-rumped Warbler (Myrtle)	*Setophaga coronata*
	Northern Flicker	*Colaptes auratus*
	Ruffed Grouse	*Bonasa umbellus*
Mammals	American Beaver	*Castor canadensis*
	American Black Bear	*Ursus americanus*
	Moose	*Alces alces*
	Mountain Goat	*Oreamnos americanus*
	Mule Deer	*Odocoileus hemionus*
	Elk	*Cervus canadensis*
	White-tailed Deer	*Odocoileus virginianus*
	Wolf	*Canis lupus*
Amphibian	Wood Frog	*Rana sylvatica*

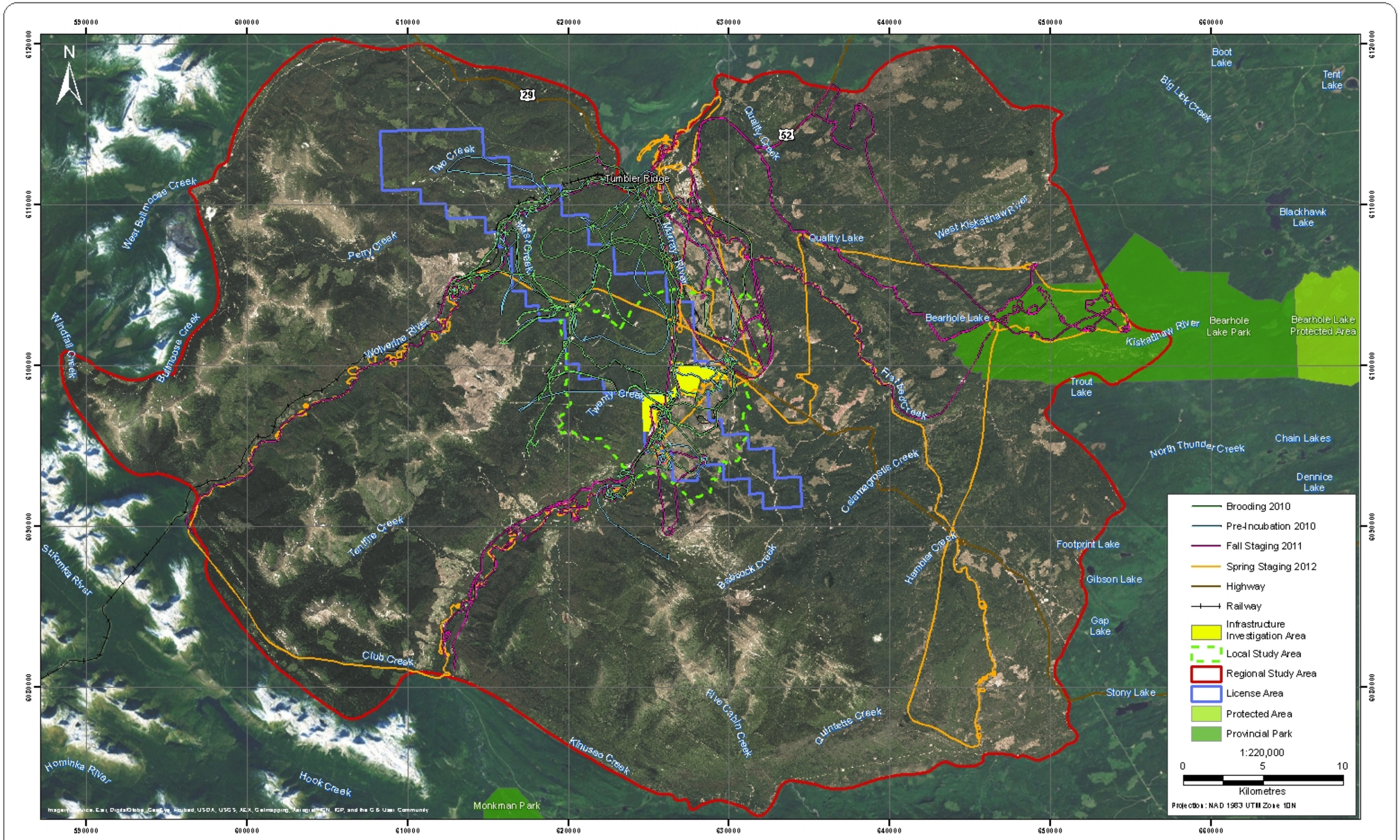
[1] *One active nest observed.*
[2] Two active nests observed.
[3] Species of Conservation Concern.

Appendix 4.3-13

Wetland Bird Aerial Survey Effort, 2010 - 2012

Rescan™
Engineers and Scientists

PROJECT # 0194106-0003 GIS # AM R-23-069 VERSION # TO. 10 July 10 2013



hd Mining | Rescan Engineers & Scientists | MURRAY RIVER COAL PROJECT

Appendix 4.3-13

Wetland Bird Aerial Survey Effort, 2010 - 2012

Appendix 4.3-14

EDI Inc. Waterfowl Staging Surveys – Baseline Data Summary

Rescan™
Engineers and Scientists

EDI WATERFOWL STAGING SURVEYS – BASELINE DATA SUMMARY

PREPARED FOR:

CANADIAN DEHUA INTERNATIONAL MINES GROUP INC.

1411 - 409 GRANVILLE STREET
VANCOUVER, BC
V6C 1T2

PREPARED BY:

EDI ENVIRONMENTAL DYNAMICS INC.

SUITE 201 – 1110 6TH AVENUE
PRINCE GEORGE, BC
V2L 3M6

EDI CONTACT:

Randy Morris, M.R.M., A.Ag.

(604) 633-1891

EDI PROJECT NO.:

10–V–0427
JUNE 2011

2011 ENVIRONMENTAL EMPLOYER OF THE YEAR

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

Environmental Dynamics Inc. (EDI) is responsible for conducting baseline studies including waterfowl staging surveys for the proposed Murray River project on behalf of Canadian Dehua. As per the Spring Staging 2011 Waterfowl Survey Workplan, a spring staging survey was conducted on May 13, 2011. Information gained during this survey in conjunction with data collected during 2010 fall staging survey allows for the compilation of a species list for water dependant birds during staging and migration. This report is intended to briefly outline the findings from the waterfowl surveys completed to date.

2 OBJECTIVES

Waterfowl staging surveys were completed in the fall 2010 and spring 2011 with the intent of identifying and enumerating water dependant bird species at the survey locations and describing their observed behaviour. The fall staging survey was used to identify species migrating through the area. The spring staging survey documented both those birds that were breeding in the area and those that were continuing their northward migration. Outlined below are the procedures that were used by EDI to document spring waterfowl species use of wetland and river systems within the project-site area.

3 SAMPLING OVERVIEW

Eight waterbodies were selected for the surveys in close proximity to, or within, the proposed project site. Survey sites were selected within the Murray River corridor (primarily along the Murray Forest Service Road) at waterbodies considered to be good waterfowl habitat, with vantage points for viewing and reasonable access for surveyors. Both wetland and riverine habitats were chosen in order to capture potential waterfowl diversity associated with preferred habitat selection.

The surveys were conducted on-the-ground using key vantage points for each section of open water. Observation sites were selected with the objective of maximizing identifications of waterfowl and compiling a species list. All birds observed were counted and identified to species. Attempts were also made to determine the social status of birds observed, such as whether they were flocked indicating pre-breeding, or if they were a breeding pair.

Data was collected and recorded according to the *Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot and Sandhill Crane* (Ministry of Environment, Lands and Parks 1999). Necessary equipment included binoculars and regional bird checklists. The fall survey was completed by one observer over one day, and the spring survey was completed by two observers over one day.

Waterfowl survey data for the fall and spring staging surveys was compiled to provide a species list, and can be found as Attachment 2 - *Field Data*. Survey areas were observed for a time frame suitable to adequately observe the entire wetland or river as required. Most sites were observed for thirty minutes.

4 SITE CONDITIONS

The fall waterfowl staging survey was completed on October 14 and 15, 2010. The spring waterfowl survey repeated assessments at the same locations on May 13, 2011. Both the fall and spring assessments were completed under ice-free conditions. The fall survey occurred on a day with clear skies and an ambient temperature of approximately 10°C. Spring surveys were completed on a clear day with slight cloud cover (i.e. approx. 5%), and temperatures ranging from 13°C to 17°C. Winds were light, and no precipitation was encountered. Attachment 1 – *Field Maps* contains copies of the maps utilized by field crews.

5 OBSERVATIONS

During the fall survey a total of 12 individuals were observed over the seven sites, while during the spring survey, a total of 35 individual waterfowl were observed. All of the target waterbodies were easily visible from the selected vantage points. Species observed from the fall survey are identified in Table 1, while those from the spring survey are identified in Table 2.

Table 1. Waterfowl observations during the fall waterfowl staging surveys.

Site Number:	Waterbody Type (Wetland, River, Lake)	Species Identified*	Total waterfowl
1	River	None Observed	0
2	Wetland	Mallard	2
3	Wetland	Mallard	10
4	Wetland	None Observed	0
5	Marsh/side channel	None Observed	0
6	Wetland	None Observed	0
7	River	None Observed	0

*UC = Unclassified Waterfowl

As expected, behaviour differed across the fall and spring seasons. Species observed in the fall were migrating south, and were present in mixed flocks. Species observed during the spring survey displayed a range of migrant or breeding behaviour depending on the species. Some individuals, identified as migrants, may have been staging, but unless the observed waterfowl demonstrated behaviour indicative of breeding, it was not possible to differentiate if the birds were migrants or breeders.

Table 2. Waterfowl observations during the spring waterfowl staging surveys.

Site Number:	Waterbody Type (Wetland, River, Lake)	Species Identified*	Total waterfowl
1	River	Canada Goose	2
2	Wetland	Mallard, Green-winged Teal, UC	9
3	Wetland	Mallard, Green-winged Teal	10
4	Wetland	None Observed	0
5	Marsh/side channel	None Observed	0
6	Wetland	Lesser Scaup, UC	3
7	River	None Observed	0

*UC = Unclassified Waterfowl

At the time of the spring survey, Mallards were observed in mixed flocks, and were not exhibiting territorial or nesting behaviour. Likely these flocks were migrants. In contrast, the green-winged teals observed were paired. No courtship displays were observed, but the pairs remained close to shore. One lone male lesser scaup was observed in a large wetland (Site 6) and appeared to be defending the area.

Much of the behaviour corresponds with expected timelines identified in the Ministry of Environment, Lands and Parks (1999) standards. However, Mallards breeding patterns appeared to be slightly delayed based on this survey. If this is true for the wider population, it is likely a function of the prolonged winter and late start to spring this year.

Due to the variation in breeding behaviour amongst species and the variety of species observed, the survey was well-timed to maximize observations. The previous surveys conducted by Rescan in the summer months should provide more information on waterfowl breeding within the project area allowing for possible comparisons among seasons.

Appendix A. Field Map

620000

630000

6100000

6090000

1

2

3

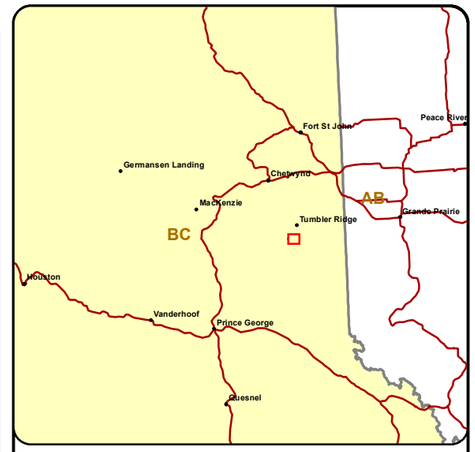
4

5

6

7

N



Legend

Survey_Points

Contours (20m interval)

- Index
- Intermediate
- Trail
- Abandoned Pit
- Cutline or Seismic Line
- Gravel or Sand Pit
- Pipeline
- Tailing Pond
- Transmission Line
- Underground Mine
- Railway
- Rough Road
- Gravel Road 2 Lane; Gravel Road 1 Lane
- Cutblocks
- River/Stream
- Lake/Wetland

GeneralStudyAreas

- Local Study Area
- Potential Mine Surface Facilities Area
- Project Site

0 0.25 0.5 1 1.5 2

Kilometers

Scale:1:50,000

DEHUA - MURRAY RIVER

Figure 1. Waterfowl Survey (Spring)

Drawn: D. Weber	Datum/Projection: NAD 1983 UTM Zone 10N
Checked: S. Atherton	EDI Project No.: 10-V-0427
Date: 4/27/2011	Data Sources: Refer to References Section

ENVIRONMENTAL DYNAMICS INC.

Path: J:\PROJECTS\2010\VC 2010\10-VC-0427 Dehua Murray River\GIS\Waterfowl\GIS\Mapping\Waterfowl_Survey_11x17_dw.mxd

Appendix B. Photos

Photo 1: Riverine habitat at Site 1

Photo 2: Wetland habitat at Site 2

Photo 3: Migrating Mallards during fall 2010 survey at Site 3

Photo 4: Wetland habitat at Site 6

Appendix C. Field Data

Date	Site	Start Time	End time	Location			Species	Total	Age Class			Sex		Location Description	Comments
				Zone	Easting	Northing			Adult	Juvenile	Unclassified	Male	Female		
14-Oct-10	1			10	625986	6097277	NO							First Bridge on Murray FSR	Photo 1211 (US) & 1212 (DS)
14-Oct-10	2			10	625653	6097380	MALL	2	2			1	1	Wetland at 9km	Photo 1213
14-Oct-10	3			10	625375	6097547	MALL	10						Wetland site	Photo 1214 (ducks) & 1215 (wetland)
14-Oct-10	4			10	624292	6094168	NO							Small access road 13.2 km	Photo 1216 (US)
14-Oct-10	5			10	620022	6091701	NO							19.1 km close access to Murray	
14-Oct-10	6			10	618491	6091088	NO							21km Wetland	Photo 1217
14-Oct-10	7			10	618486	6090260	NO							1 km on Barbour Rd. Bridge over Murray	Photo 1218 (Bridge) & 1219 (D/S)
13-May-11	1	12:25	12:55	10	625989	6097305	CAGO	2	2					First Bridge on Murray FSR	Fly bys.
13-May-11	2	11:50	12:15	10	625649	6097381	MALL	6	6			5	1	Wetland at 9km	One staging lone male, one mixed flock of 3 adults foraging, and one male group foraging (2 adult males, flew at our approach)
13-May-11	2	11:50	12:15	10	625649	6097381	UC	1	1					Wetland at 9km	Fly through, left from close to group of three mallards
13-May-11	2	11:50	12:15	10	625649	6097381	GWTE	2	2			1	1	Wetland at 9km	Paired.
13-May-11	3	11:08	11:38	10	625410	6097532	MALL	8	8			7	1	Wetland site	Flock of 7 Mallards (1 female), likely migratory based on the grouping and lack of territorial behaviour. Clustered to the middle of the wetland. Some foraging. The whole group left shortly after our arrival except one male who remained, moved to the grass, and began to quack. Left @11:20. One lone male also flew in the wetland and landed 11:30.
13-May-11	3	11:08	11:38	10	625410	6097532	GWTE	2	2			1	1	Wetland site	Pair arrived and left together. Stayed close together. Possibly a breeding pair.
13-May-11	4	10:40	11:00	10	624313	6094188	NO							Small access road 13.2 km	

13-May-11	5	10:19	10:35	10	620018	6091574	NO							19.1 km near Murray River	
13-May-11	6	9:35	10:35	10	618472	6091082	LESC	1	1			1		21km Wetland	Landed solo, toured the wetland, and began to forage.
13-May-11	6	9:35	10:35	10	618472	6091082	UC				1			21km Wetland	Fly through. No colours on primaries, possible female scaup. Solo.
13-May-11	6	9:35	10:35	10	618472	6091082	COGO	1	1				1	21km Wetland	Could not distinguish common or Barrow's classification from distance. Scaup flew at it until convinced it was a separate species. Goldeneye spent most of its time in the grasses/sedges along the wetland edge.
13-May-11	7	8:52	9:22	10	618484	6090260	NO							1 km on Barbour Rd. Bridge over Murray	High flow velocities, may not have been an ideal staging area.

Appendix 4.4-1

Terrestrial Breeding Bird Point Count Survey Details, June 2010

Rescan™
Engineers and Scientists

Appendix 4.4-1. Terrestrial Breeding Bird Point Count Survey Details, June 2010

Date	Time	Temp. (°)	Wind (1-5)	Cloud Cover (%)	Transect - Point Count Station	Easting	Northing	Habitat Type	Notes
3-Jun-10	05:50:00	10	2	100	MR01-1	627472	6104116	Mixed Forest	some trembling aspen mixed in, soopolallie in the understory
3-Jun-10	06:24:00	10	2	100	MR01-2	627341	6104268	Coniferous Forest	fir/spruce/pine forest with labrador tea and alder in the understory, some fairy slipper as well.
3-Jun-10	06:44:00	10	4	100	MR01-3	627235	6104436	Mixed Forest	mix of spruce, fir, aspen, and alder (alder is somewhat smaller more like a shrub, but nothing really in understory)
3-Jun-10	06:58:00	10	3	100	MR01-4	627145	6104622	Mixed Forest	predominately aspen with some alder in under. Odd fir tree. Prickly rose and some fairyslipper on floor.
3-Jun-10	07:31:00	11	3	100	MR01-5	627580	6103946	Coniferous Forest	spruce and fir with small apsen poles mixed, a few lodgepoles, prickly rose and bunchberry on floor.
3-Jun-10	08:42:00	11	3	100	MR02-1	625056	6109039	Mixed Forest	roughly 60-40 mix of decidous to coniferous, alder, aspen, pine, fir, and spuce. High-bush cranberry, rose, and willow in understory
3-Jun-10	08:58:00	11	3	60	MR02-2	625025	6108843	Deciduous Forest	mostly aspen and poplar, dogwood in understory (some browse by moose), fireweek, prickly rose, and cranberry. The odd lodgepole mixed in.
3-Jun-10	09:17:00	13	3	50	MR02-3	625014	6108637	Deciduous Forest	apsen with a few dead lodgepole pines mixed in, dogwood, rose, milkvetch, gooseberry, fireweed in understory and floor.
3-Jun-10	09:42:00	13	3	50	MR02-4	624935	6108454	Mixed Forest	pine, fir, aspen, open understory, soopolallie, fairyslipper
3-Jun-10	10:06:00	13	3	50	MR02-5	624834	6108283	Mixed Forest	pine, apsen, fir with willow, vetch, maple, rose, fireweed and arnica in the understory and floor
3-Jun-10	04:45:00	20	1	0	MR03-1	627166	6108542	Disturbed/Anthropogenic	leave patch ~4ha, apsen, spruce, planted pine, and some alder in understory
4-Jun-10	05:01:00	2	1	0	MR03-2	627291	6108385	Disturbed/Anthropogenic	adjacent to leave patch, spruce, regenerating pine, dogwood, alder, and prickly rose.
4-Jun-10	05:15:00	3	1	0	MR03-3	627425	6108235	Disturbed/Anthropogenic	located primiarly in clear cut but several retention areas within 50 to 100m from point.
4-Jun-10	05:40:00	5	1	0	MR03-4	627519	6108056	Disturbed/Anthropogenic	no leave patches in count, 95% pine and poplar and apsen.
4-Jun-10	05:55:00	5	1	0	MR03-5	627651	6107902	Disturbed/Anthropogenic	point located in 2yr old cut with 9yr old regenerating pine 40m away. Area has been treated to kill poplar and aspen.
4-Jun-10	06:49:00	7	1	0	MR04-1	625991	6097358	Riparian/Wetland	large cottonwoods and spruce, alders and willow
4-Jun-10	07:14:00	7	1	0	MR04-2	626048	6097552	Riparian/Wetland	no large cottonwoods within 50m, but similar to previous point.
4-Jun-10	07:42:00	7	1	0	MR04-3	625900	6097174	Riparian/Wetland	large spruce with willow/alder understory
4-Jun-10	07:55:00	7	1	0	MR04-4	625846	6096978	Riparian/Wetland	riparian area but mostly coniferous species
4-Jun-10	08:13:00	9	1	0	MR04-5	625757	6097316	Riparian/Wetland	a fair amount of blowdown on the upward slope above wetland
4-Jun-10	08:52:00	120	0	0	MR05-1	622166	6104262	Coniferous Forest	small open meadow at point
4-Jun-10	09:06:00	120	1	0	MR05-2	622361	6104195	Coniferous Forest	point adjacent to a powerline, short shrub growing
4-Jun-10	09:30:00	12	1	0	MR05-3	622552	6104133	Coniferous Forest	fir/pine/spruce. Stunted blueberry in understory, labrador tea
4-Jun-10	09:55:00	12	1	0	MR05-4	621991	6104363	Coniferous Forest	point in forest adjacent recently constructed road (right-of-way ~30m)
4-Jun-10	10:08:00	130	0	0	MR05-5	621832	6104486	Disturbed/Anthropogenic	point conducted on road adjacent to forest
5-Jun-10	04:46:00	8	3	10	MR06-1	629207	6096254	Disturbed/Anthropogenic	road occupies large portion of count, surrounded by patches of mixed forest aspen/spruce/fir
5-Jun-10	04:55:00	8	3	10	MR06-2	629044	6096124	Disturbed/Anthropogenic	mixed forest along road verge
5-Jun-10	05:03:00	8	4	10	MR06-3	628858	6096031	Disturbed/Anthropogenic	mixed forest along road verge
5-Jun-10	05:11:00	8	3	10	MR06-4	628667	6095946	Disturbed/Anthropogenic	tree patch along road

Appendix 4.4-1. Terrestrial Breeding Bird Point Count Survey Details, June 2010

Date	Time	Temp. (°)	Wind (1-5)	Cloud Cover (%)	Transect - Point Count Station	Easting	Northing	Habitat Type	Notes
5-Jun-10	05:45:00	6	3	5	MR06-5	628511	6095813	Disturbed/Anthropogenic	point mostly composed of planted grasses along road with a small patche of willows and cottonwoods
5-Jun-10	05:45:00	6	2	5	MR07-1	622366	6099181	Disturbed/Anthropogenic	conifer forest with road running through, small clear cuts on side of road
5-Jun-10	05:56:00	6	3	5	MR07-2	622169	6099212	Coniferous Forest	willow shrub along road verge
5-Jun-10	06:05:00	60	2	5	MR07-3	621973	6099259	Disturbed/Anthropogenic	similar to last point, larger clearcut to north
5-Jun-10	06:16:00	6	3	5	MR07-4	621731	6099321	Coniferous Forest	small riparin zone along stream at far end of count
5-Jun-10	06:29:00	6	2	5	MR07-5	621532	6099364	Coniferous Forest	along road (10% nov-vegetated)
5-Jun-10	07:01:00	6	3	5	MR08-1	621906	6106326	Mixed Forest	regenerating clearcut surrounded by older forest, mostly pine with aspen
5-Jun-10	07:13:00	6	2	5	MR08-2	622025	6106488	Mixed Forest	
5-Jun-10	07:33:00	7	2	5	MR08-3	622151	6106653	Mixed Forest	willow and young cottonwood = short shrub
5-Jun-10	07:35:00	8	2	5	MR08-4	622324	6106753	Mixed Forest	10 m high aspen, lower willow
5-Jun-10	07:48:00	8	2	5	MR08-5	622484	6106879	Mixed Forest	
5-Jun-10	08:30:00	8	2	0	MR09-1	617959	6108281	Mixed Forest	along road, surrounded by mixed apsen/spruce forest
5-Jun-10	08:39:00	8	3	0	MR09-2	617916	6108084	Mixed Forest	below road is mostly mixed forest, up of road is mainly deciduous, road ROW is pretty wide
5-Jun-10	08:49:00	10	2	0	MR09-3	617798	6107919	Mixed Forest	
5-Jun-10	09:03:00	10	2	0	MR09-4	617707	6107738	Mixed Forest	
5-Jun-10	09:11:00	10	2	0	MR09-5	617612	6107556	Mixed Forest	
6-Jun-10	04:22:00	2	1	0	MR10-1	631613	6113053	Disturbed/Anthropogenic	regenerating clearcut - at least 20 years, forest growing back quite well. Point along gravel road, some pine and fir trees mixed in with aspens
6-Jun-10	04:32:00	2	1	0	MR10-2	631679	6112863	Disturbed/Anthropogenic	
6-Jun-10	04:40:00	2	1	0	MR10-3	631683	6112659	Disturbed/Anthropogenic	
6-Jun-10	04:47:00	3	1	0	MR10-4	631716	6112462	Disturbed/Anthropogenic	pine trees ~15 yrs old
6-Jun-10	04:55:00	4	1	0	MR10-5	631671	6112265	Disturbed/Anthropogenic	pine/aspen mix but primarly decidous
6-Jun-10	05:20:00	4	1	0	MR11-1	634597	6108384	Riparian/Wetland	larger wetland, lots of snags along shoreline, some emergent reeds/grasses
6-Jun-10	05:31:00	4	1	0	MR11-2	634654	6108193	Riparian/Wetland	some larch, little open water at point but mostly covered with wet grasses
6-Jun-10	05:48:00	4	0	0	MR11-3	634600	6108000	Riparian/Wetland	mature spruce/larch around waterbody, grassy shore with snags
6-Jun-10	06:12:00	5	0	0	MR11-4	634642	6108578	Coniferous Forest	mature black or white spruce with some smaller younger trees
6-Jun-10	06:21:00	6	0	0	MR11-5	634686	6108775	Disturbed/Anthropogenic	regenerating clearcut, ~17 yr old pines, cottonwoods with 5 larger snags
6-Jun-10	06:49:00	7	1	0	MR12-1	638980	6107273	Disturbed/Anthropogenic	along gravel road, just entering into clear cut area, some coniferous forest (mature spruce) to rear of point
6-Jun-10	07:04:00	7	1	0	MR12-2	639152	6107169	Disturbed/Anthropogenic	deciduous forest is treepatch that is located between two clear cut areas, mostly mature aspens with some pine mixed in.
6-Jun-10	07:15:00	7	1	0	MR12-3	639345	6107225	Disturbed/Anthropogenic	in retention stand between two cuts, more mixed forest now aspen/pine/spruce/fir
6-Jun-10	07:29:00	6	2	0	MR12-4	639546	6107248	Disturbed/Anthropogenic	in middle of retention patch
6-Jun-10	07:40:00	8	1	0	MR12-5	639743	6107216	Disturbed/Anthropogenic	mostly pine
6-Jun-10	08:57:00	10	1	0	MR13-1	616365	6109102	Riparian/Wetland	mostly youn alder/cottonwood with a patch of mature cottonwood and spruce
6-Jun-10	09:15:00	10	1	0	MR13-2	616182	6109021	Riparian/Wetland	some young fir, mature spruce and cottonwood
6-Jun-10	09:35:00	10	1	0	MR13-3	616697	6109328	Riparian/Wetland	
6-Jun-10	09:48:00	10	1	0	MR13-4	616898	6109373	Riparian/Wetland	mostly red alder with a spruce understory

Appendix 4.4-1. Terrestrial Breeding Bird Point Count Survey Details, June 2010

Date	Time	Temp. (°)	Wind (1-5)	Cloud Cover (%)	Transect - Point Count Station	Easting	Northing	Habitat Type	Notes
6-Jun-10	10:04:00	11	1	0	MR13-5	616532	6109212	Riparian/Wetland	50% conifer/50% cottonwood aspen
7-Jun-10	04:20:00	7	1	95	MR14-1	631153	6108572	Mixed Forest	mature aspen/fir forest on slope
7-Jun-10	04:35:00	7	1	95	MR14-2	630995	6108693	Mixed Forest	mature aspen/fir multi-layered understory, soopolallie
7-Jun-10	04:51:00	7	1	95	MR14-3	630875	6108854	Mixed Forest	apsen/fir multi-layered, understory young aspen + rose, as few trees >70cm dbh
7-Jun-10	05:08:00	8	1	95	MR14-4	630768	6109023	Mixed Forest	70% coniferous, 30 deciduous, many large 60 cm dbh plus spruce
7-Jun-10	05:23:00	7	1	95	MR14-5	630629	6109171	Mixed Forest	60% coniferous/40% deciduous. Similar to previous but with more large dbh cottonwoods and aspens
7-Jun-10	06:33:00	4	3	100	MR15-1	617488	6095382	Coniferous Forest	~1573 m, parkland forest
7-Jun-10	06:44:00	4	3	100	MR15-2	617420	6095569	Coniferous Forest	parland forest, stunted forest
7-Jun-10	06:54:00	3	3	100	MR15-3	617515	6095745	Coniferous Forest	more open, crowberry, lichen and patchy fir
7-Jun-10	07:25:00	3	3	100	MR15-4	617494	6095181	Coniferous Forest	parkland forest alongside road
7-Jun-10	07:35:00	4	3	100	MR15-5	617352	6095039	Coniferous Forest	along road, visibility ~150m
7-Jun-10	08:38:00	6	1	100	MR16-1	623683	6102709	Coniferous Forest	high stem density, few shrubs, 4-5 aspens
7-Jun-10	08:51:00	6	2	100	MR16-2	623809	6102553	Coniferous Forest	
7-Jun-10	09:04:00	6	1	100	MR16-3	623977	6102429	Coniferous Forest	90% pine forest
7-Jun-10	09:18:00	6	1	100	MR16-4	624042	6102231	Coniferous Forest	mostly spruce, 3-4 pines mixed in
7-Jun-10	09:36:00	7	1	100	MR16-5	623917	6102070	Coniferous Forest	70% spruce, 20% fir, 10% pine
8-Jun-10	04:54:00	7	1	100	MR17-1	598019	6111548	Coniferous Forest	spruce/fir forest with few willows, popular
8-Jun-10	05:11:00	7	1	100	MR17-2	598194	6111649	Coniferous Forest	spruce/fir, relatively large amount of coarse woody debris
8-Jun-10	05:31:00	7	1	100	MR17-3	598313	6111814	Coniferous Forest	spruce/fir, very similar to pt 2. morning star in the understory
8-Jun-10	05:47:00	7	1	100	MR17-4	598342	6112015	Mixed Forest	80% coniferous forest, 20% deciduous
8-Jun-10	06:01:00	7	1	100	MR17-5	598338	6112215	Mixed Forest	w/ 3-4 large cottonwoods, much more understory of alder and young cottonwood
8-Jun-10	07:14:00	6	2	100	MR18-1	599093	6110406	Coniferous Forest	higher elevation forest ~1460, along road
8-Jun-10	07:23:00	6	1	100	MR18-2	598954	6110548	Coniferous Forest	
7-Jun-10	07:32:00	6	1	100	MR18-3	598777	6110653	Coniferous Forest	
8-Jun-10	07:39:00	6	1	100	MR18-4	598845	6110846	Coniferous Forest	
8-Jun-10	07:46:00	7	1	100	MR18-5	599012	6110962	Coniferous Forest	
9-Jun-10	04:38:00	0	1	100	MR19-1	620356	6103096	Riparian/Wetland	conifer forest on slope above swamp, some decidous trees mixed in
9-Jun-10	04:54:00	0	1	100	MR19-2	620369	6102891	Riparian/Wetland	a lot of willow at waters edge, less visible water at point but it is running
9-Jun-10	05:12:00	0	1	100	MR19-3	620421	6102693	Riparian/Wetland	quite a bit of open water here, lots of snags in water, slope on both sides of the swamp
9-Jun-10	05:25:00	0	1	100	MR19-4	620427	6102496	Riparian/Wetland	
9-Jun-10	05:39:00	0	0	100	MR19-5	620353	6102302	Riparian/Wetland	
9-Jun-10	07:02:00	2	1	100	MR20-1	626536	6110497	Deciduous Forest	all aspen, mature forest, a few firs mixed in, milk vetch, fireweed, rose and willow in undetstory
9-Jun-10	07:21:00	2	1	100	MR20-2	626333	6110496	Deciduous Forest	relatively open mature forest
9-Jun-10	07:37:00	2	1	100	MR20-3	626156	6110397	Deciduous Forest	
9-Jun-10	07:48:00	3	0	100	MR20-4	625981	6110305	Deciduous Forest	fairly open, ribes spp in understory and rose
9-Jun-10	08:05:00	3	0	100	MR20-5	625793	6110235	Deciduous Forest	aspen forest is coming to an end, abuts river and transitions to cottonwoods and a rocky backwash

Appendix 4.4-2

Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Rescan™
Engineers and Scientists

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
3-Jun-10	MR01-1	Yellow-bellied Sapsucker	*Sphyrapicus varius*	2	0	0	0	Nest found	juvenile foraging (seen first) and adult
3-Jun-10	MR01-1	Least Flycatcher	*Empidonax minimus*	1	0	0	0		
3-Jun-10	MR01-1	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
3-Jun-10	MR01-1	Dark-eyed Junco	*Junco hyemalis*	2	0	0	0		
3-Jun-10	MR01-1	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
3-Jun-10	MR01-1	American Robin	*Turdus migratorius*	1	0	0	0		
3-Jun-10	MR01-1	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
3-Jun-10	MR01-1	Red-breasted Nuthatch	*Sitta canadensis*	1	0	0	0		
3-Jun-10	MR01-1	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
3-Jun-10	MR01-1	Red Crossbill	*Loxia curvirostra*	0	0	1	0		
3-Jun-10	MR01-2	American Robin	*Turdus migratorius*	2	0	0	0		
3-Jun-10	MR01-2	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
3-Jun-10	MR01-2	Chipping Sparrow	*Spizella passerina*	0	0	1	0		
3-Jun-10	MR01-2	Common Raven	*Corvus corax*	0	0	1	0		
3-Jun-10	MR01-2	Yellow-bellied Sapsucker	*Sphyrapicus varius*	0	1	0	0		
3-Jun-10	MR01-2	Blue-headed Vireo	*Vireo solitarius*	0	1	0	0		
3-Jun-10	MR01-2	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
3-Jun-10	MR01-2	Mountain Chickadee	*Poecile gambeli*	0	0	1	0		
3-Jun-10	MR01-2	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
3-Jun-10	MR01-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
3-Jun-10	MR01-3	Warbling Vireo	*Vireo gilvus*	0	0	1	0		
3-Jun-10	MR01-3	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
3-Jun-10	MR01-3	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
3-Jun-10	MR01-3	American Robin	*Turdus migratorius*	0	0	1	0		
3-Jun-10	MR01-4	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
3-Jun-10	MR01-4	Red-breasted Nuthatch	*Sitta canadensis*	0	1	1	0		
3-Jun-10	MR01-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
3-Jun-10	MR01-5	Ovenbird	*Seiurus aurocapilla*	0	1	0	0		
3-Jun-10	MR01-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
3-Jun-10	MR01-5	Red-breasted Nuthatch	*Sitta canadensis*	3	0	0	0		
3-Jun-10	MR01-5	Northern Flicker	*Colaptes auratus*	0	1	0	0		
3-Jun-10	MR01-5	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
3-Jun-10	MR01-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
3-Jun-10	MR01-5	White-crowned Sparrow	*Zonotrichia leucophrys*	0	0	1	0		
3-Jun-10	MR01-5	Gray Jay	*Perisoreus canadensis*	0	0	2	0		
3-Jun-10	MR01-5	Golden-crowned Kinglet	*Regulus satrapa*	0	0	1	0		
3-Jun-10	MR02-1	Warbling Vireo	*Vireo gilvus*	2	0	0	0		
3-Jun-10	MR02-1	Alder Flycatcher	*Empidonax alnorum*	0	1	0	0		
3-Jun-10	MR02-1	Ovenbird	*Seiurus aurocapilla*	1	0	0	0		
3-Jun-10	MR02-1	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
3-Jun-10	MR02-1	Common Raven	*Corvus corax*	0	3	0	0		
3-Jun-10	MR02-1	Chipping Sparrow	*Spizella passerina*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
3-Jun-10	MR02-2	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
3-Jun-10	MR02-2	Townsend's Solitaire	*Myadestes townsendi*	1	0	0	0		
3-Jun-10	MR02-2	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
3-Jun-10	MR02-2	Gray Jay	*Perisoreus canadensis*	1	0	0	0		
3-Jun-10	MR02-2	Warbling Vireo	*Vireo gilvus*	0	0	1	0		
3-Jun-10	MR02-3	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
3-Jun-10	MR02-3	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
3-Jun-10	MR02-3	Orange-crowned Warbler	*Vermivora celata*	0	2	0	0		
3-Jun-10	MR02-3	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
3-Jun-10	MR02-3	American Robin	*Turdus migratorius*	0	0	0	2		
3-Jun-10	MR02-4	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
3-Jun-10	MR02-4	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
3-Jun-10	MR02-5	Ovenbird	*Seiurus aurocapilla*	1	0	0	0		
3-Jun-10	MR02-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
4-Jun-10	MR03-1	White-throated Sparrow	*Zonotrichia albicollis*	0	1	1	0		
4-Jun-10	MR03-1	American Robin	*Turdus migratorius*	2	0	0	0		
4-Jun-10	MR03-1	Red-breasted Nuthatch	*Sitta canadensis*	1	0	0	0		
4-Jun-10	MR03-1	Lincoln's Sparrow	*Melospiza lincolnii*	0	1	0	0		
4-Jun-10	MR03-1	Swainson's Thrush	*Catharus ustulatus*	0	0	3	0		
4-Jun-10	MR03-1	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
4-Jun-10	MR03-1	Mountain Chickadee	*Poecile gambeli*	0	1	0	0		
4-Jun-10	MR03-1	Tennessee Warbler	*Vermivora peregrina*	0	1	0	0		
4-Jun-10	MR03-1	Warbling Vireo	*Vireo gilvus*	0	0	2	0		
4-Jun-10	MR03-2	Western Wood-Pewee	*Contopus sordidulus*	1	0	0	0		
4-Jun-10	MR03-2	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
4-Jun-10	MR03-2	American Robin	*Turdus migratorius*	1	0	0	0		
4-Jun-10	MR03-2	Varied Thrush	*Ixoreus naevius*	0	2	0	0		
4-Jun-10	MR03-2	Lincoln's Sparrow	*Melospiza lincolnii*	0	1	0	0		
4-Jun-10	MR03-2	Dark-eyed Junco	*Junco hyemalis*	1	1	0	0		
4-Jun-10	MR03-2	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		
4-Jun-10	MR03-2	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
4-Jun-10	MR03-2	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
4-Jun-10	MR03-2	White-throated Sparrow	*Zonotrichia albicollis*	0	1	0	0		
4-Jun-10	MR03-2	Common Raven	*Corvus corax*	0	0	1	0		
4-Jun-10	MR03-2	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
4-Jun-10	MR03-3	American Robin	*Turdus migratorius*	1	2	0	0		
4-Jun-10	MR03-3	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
4-Jun-10	MR03-3	Ruffed Grouse	*Bonasa umbellus*	0	1	0	0		
4-Jun-10	MR03-3	White-throated Sparrow	*Zonotrichia albicollis*	0	2	0	0		
4-Jun-10	MR03-3	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
4-Jun-10	MR03-3	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
4-Jun-10	MR03-3	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
4-Jun-10	MR03-3	Olive-sided Flycatcher	*Contopus cooperi*	0	1	0	0		bird was calling from retention area (~2ha) to the south east
4-Jun-10	MR03-4	Ruffed Grouse	*Bonasa umbellus*	1	0	0	0		
4-Jun-10	MR03-4	White-throated Sparrow	*Zonotrichia albicollis*	2	0	0	0		
4-Jun-10	MR03-4	Warbling Vireo	*Vireo gilvus*	2	0	0	0		
4-Jun-10	MR03-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	1	0		
4-Jun-10	MR03-4	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
4-Jun-10	MR03-4	Swainson's Thrush	*Catharus ustulatus*	0	0	2	0		
4-Jun-10	MR03-5	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
4-Jun-10	MR03-5	Orange-crowned Warbler	*Vermivora celata*	2	0	0	0		
4-Jun-10	MR03-5	Lincoln's Sparrow	*Melospiza lincolnii*	0	0	1	0		
4-Jun-10	MR03-5	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
4-Jun-10	MR03-5	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
4-Jun-10	MR03-5	American Robin	*Turdus migratorius*	0	1	0	0		
4-Jun-10	MR04-1	White-throated Sparrow	*Zonotrichia albicollis*	1	1	1	0		
4-Jun-10	MR04-1	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
4-Jun-10	MR04-1	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
4-Jun-10	MR04-1	Brown-headed Cowbird	*Molothrus ater*	1	1	0	0		
4-Jun-10	MR04-1	MacGillivray's Warbler	*Oporornis tolmiei*	1	0	1	0		
4-Jun-10	MR04-1	Tennessee Warbler	*Vermivora peregrina*	1	0	0	0		
4-Jun-10	MR04-1	Rufous Hummingbird	*Selasphorus rufus*	1	0	0	0		
4-Jun-10	MR04-1	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
4-Jun-10	MR04-2	Magnolia Warbler	*Dendroica magnolia*	2	0	0	0		
4-Jun-10	MR04-2	Tennessee Warbler	*Vermivora peregrina*	1	0	1	0		
4-Jun-10	MR04-2	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
4-Jun-10	MR04-2	Yellow Warbler	*Dendroica petechia*	0	0	1	0		
4-Jun-10	MR04-2	Alder Flycatcher	*Empidonax alnorum*	1	0	0	0		
4-Jun-10	MR04-2	Ruffed Grouse	*Bonasa umbellus*	0	1	0	0		
4-Jun-10	MR04-3	Magnolia Warbler	*Dendroica magnolia*	1	0	0	0		
4-Jun-10	MR04-3	Yellow Warbler	*Dendroica petechia*	1	0	1	0		
4-Jun-10	MR04-3	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
4-Jun-10	MR04-3	Golden-crowned Kinglet	*Regulus satrapa*	1	0	1	0		
4-Jun-10	MR04-3	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
4-Jun-10	MR04-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
4-Jun-10	MR04-3	American Redstart	*Setophaga ruticilla*	1	0	0	0		
4-Jun-10	MR04-4	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
4-Jun-10	MR04-4	American Redstart	*Setophaga ruticilla*	1	1	0	0		
4-Jun-10	MR04-5	Common Yellowthroat	*Geothlypis trichas*	2	0	0	0		
4-Jun-10	MR04-5	Red-winged Blackbird	*Agelaius phoeniceus*	0	1	0	0		
4-Jun-10	MR04-5	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
4-Jun-10	MR04-5	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
4-Jun-10	MR04-5	Brown-headed Cowbird	*Molothrus ater*	0	1	0	0		
4-Jun-10	MR04-5	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
4-Jun-10	MR04-5	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
4-Jun-10	MR04-5	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
4-Jun-10	MR05-1	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
4-Jun-10	MR05-1	Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	0		
4-Jun-10	MR05-1	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
4-Jun-10	MR05-1	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
4-Jun-10	MR05-1	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
4-Jun-10	MR05-2	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
4-Jun-10	MR05-2	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
4-Jun-10	MR05-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
4-Jun-10	MR05-2	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
4-Jun-10	MR05-2	Boreal Chickadee	*Poecile hudsonica*	1	0	0	0		
4-Jun-10	MR05-2	Gray Jay	*Perisoreus canadensis*	3	0	0	0		
4-Jun-10	MR05-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
4-Jun-10	MR05-3	Gray Jay	*Perisoreus canadensis*	1	0	0	0		
4-Jun-10	MR05-3	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
4-Jun-10	MR05-3	American Three-toed Woodpecker	*Picoides dorsalis*	1	0	0	0		
4-Jun-10	MR05-3	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
4-Jun-10	MR05-3	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
4-Jun-10	MR05-4	Varied Thrush	*Ixoreus naevius*	1	0	0	0		
4-Jun-10	MR05-4	American Robin	*Turdus migratorius*	0	1	0	0		
4-Jun-10	MR05-5	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
4-Jun-10	MR05-5	Varied Thrush	*Ixoreus naevius*	2	0	0	0		
4-Jun-10	MR05-5	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
4-Jun-10	MR05-5	Chipping Sparrow	*Spizella passerina*	2	0	0	0		
4-Jun-10	MR05-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
5-Jun-10	MR06-1	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
5-Jun-10	MR06-1	White-throated Sparrow	*Zonotrichia albicollis*	0	1	1	0		
5-Jun-10	MR06-1	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
5-Jun-10	MR06-1	Lincoln's Sparrow	*Melospiza lincolnii*	0	0	1	0		
5-Jun-10	MR06-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
5-Jun-10	MR06-1	Brown-headed Cowbird	*Molothrus ater*	0	1	0	0		
5-Jun-10	MR06-1	Gray Jay	*Perisoreus canadensis*	0	2	0	0		
5-Jun-10	MR06-1	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
5-Jun-10	MR06-2	Cliff Swallow	*Petrochelidon pyrrhonota*	0	0	6	0		near buildings foraging
5-Jun-10	MR06-2	Common Raven	*Corvus corax*	0	0	1	1		
5-Jun-10	MR06-2	Lincoln's Sparrow	*Melospiza lincolnii*	0	1	0	0		
5-Jun-10	MR06-3	Red-eyed Vireo	*Vireo olivaceus*	0	1	0	0		
5-Jun-10	MR06-3	American Robin	*Turdus migratorius*	0	1	3	0		
5-Jun-10	MR06-3	Dark-eyed Junco	*Junco hyemalis*	0	0	2	0		
5-Jun-10	MR06-3	European Starling	*Sturnus vulgaris*	0	0	0	1		
5-Jun-10	MR06-3	Brown-headed Cowbird	*Molothrus ater*	0	0	1	0		
5-Jun-10	MR06-3	American Robin	*Turdus migratorius*	0	0	1	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
5-Jun-10	MR06-4	Brown-headed Cowbird	*Molothrus ater*	0	0	1	3		
5-Jun-10	MR06-4	European Starling	*Sturnus vulgaris*	0	1	1	0		
5-Jun-10	MR06-4	Least Flycatcher	*Empidonax minimus*	0	1	1	0		
5-Jun-10	MR06-4	Pine Siskin	*Carduelis pinus*	0	1	0	0		
5-Jun-10	MR06-5	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
5-Jun-10	MR06-5	Pine Siskin	*Carduelis pinus*	0	10	0	0		flock
5-Jun-10	MR06-5	Savannah Sparrow	*Passerculus sandwichensis*	2	0	0	0		
5-Jun-10	MR06-5	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
5-Jun-10	MR06-5	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
5-Jun-10	MR06-5	Brown-headed Cowbird	*Molothrus ater*	0	3	0	0		
5-Jun-10	MR06-5	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
5-Jun-10	MR06-5	European Starling	*Sturnus vulgaris*	0	1	0	0		
5-Jun-10	MR06-5	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
5-Jun-10	MR07-1	Northern Flicker	*Colaptes auratus*	0	1	0	0		
5-Jun-10	MR07-1	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
5-Jun-10	MR07-1	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
5-Jun-10	MR07-1	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
5-Jun-10	MR07-1	American Robin	*Turdus migratorius*	1	0	0	0		
5-Jun-10	MR07-1	Yellow-rumped Warbler	*Dendroica coronata*	0	2	0	0		
5-Jun-10	MR07-1	Willow Flycatcher	*Empidonax traillii*	0	0	1	0		
5-Jun-10	MR07-1	Dark-eyed Junco	*Junco hyemalis*	0	1	0	1		
5-Jun-10	MR07-1	White-winged Crossbill	*Loxia leucoptera*	0	0	0	3		
5-Jun-10	MR07-1	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
5-Jun-10	MR07-1	Olive-sided Flycatcher	*Contopus cooperi*	0	0	1	0		calling from snag in cutblock area to south
5-Jun-10	MR07-1	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
5-Jun-10	MR07-2	Yellow-rumped Warbler	*Dendroica coronata*	1	1	0	0		
5-Jun-10	MR07-2	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
5-Jun-10	MR07-2	Red-breasted Nuthatch	*Sitta canadensis*	1	0	0	0		
5-Jun-10	MR07-2	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
5-Jun-10	MR07-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
5-Jun-10	MR07-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
5-Jun-10	MR07-3	Willow Flycatcher	*Empidonax traillii*	1	0	0	0		
5-Jun-10	MR07-3	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
5-Jun-10	MR07-3	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
5-Jun-10	MR07-3	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
5-Jun-10	MR07-3	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
5-Jun-10	MR07-3	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
5-Jun-10	MR07-3	American Robin	*Turdus migratorius*	0	1	0	0		
5-Jun-10	MR07-3	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
5-Jun-10	MR07-4	Chipping Sparrow	*Spizella passerina*	3	0	0	0		
5-Jun-10	MR07-4	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
5-Jun-10	MR07-4	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
5-Jun-10	MR07-4	Yellow-bellied Flycatcher	*Empidonax flaviventris*	1	0	0	0		
5-Jun-10	MR07-4	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
5-Jun-10	MR07-5	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
5-Jun-10	MR07-5	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
5-Jun-10	MR07-5	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
5-Jun-10	MR07-5	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
5-Jun-10	MR07-5	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
5-Jun-10	MR07-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
5-Jun-10	MR08-1	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
5-Jun-10	MR08-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
5-Jun-10	MR08-1	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
5-Jun-10	MR08-1	Wilson's Warbler	*Wilsonia pusilla*	1	2	0	0		
5-Jun-10	MR08-1	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
5-Jun-10	MR08-1	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
5-Jun-10	MR08-1	Yellow-rumped Warbler	*Dendroica coronata*	0	1	1	0		
5-Jun-10	MR08-1	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
5-Jun-10	MR08-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
5-Jun-10	MR08-2	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
5-Jun-10	MR08-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
5-Jun-10	MR08-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
5-Jun-10	MR08-2	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
5-Jun-10	MR08-2	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
5-Jun-10	MR08-2	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
5-Jun-10	MR08-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
5-Jun-10	MR08-2	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
5-Jun-10	MR08-2	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
5-Jun-10	MR08-2	American Robin	*Turdus migratorius*	1	0	0	0		
5-Jun-10	MR08-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
5-Jun-10	MR08-3	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
5-Jun-10	MR08-3	Warbling Vireo	*Vireo gilvus*	2	0	0	0	Pair	
5-Jun-10	MR08-3	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
5-Jun-10	MR08-3	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
5-Jun-10	MR08-4	Tennessee Warbler	*Vermivora peregrina*	1	0	0	0		
5-Jun-10	MR08-4	American Robin	*Turdus migratorius*	1	0	0	0		
5-Jun-10	MR08-4	Yellow-rumped Warbler	*Dendroica coronata*	2	0	0	0		
5-Jun-10	MR08-4	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
5-Jun-10	MR08-4	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
5-Jun-10	MR08-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
5-Jun-10	MR08-5	Warbling Vireo	*Vireo gilvus*	1	1	0	0		
5-Jun-10	MR08-5	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
5-Jun-10	MR08-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
5-Jun-10	MR09-1	Swainson's Thrush	*Catharus ustulatus*	0	1	0	2		
5-Jun-10	MR09-1	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
5-Jun-10	MR09-1	Warbling Vireo	*Vireo gilvus*	1	1	0	0		
5-Jun-10	MR09-1	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
5-Jun-10	MR09-1	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
5-Jun-10	MR09-2	Swainson's Thrush	*Catharus ustulatus*	3	0	0	0		
5-Jun-10	MR09-2	Wilson's Warbler	*Wilsonia pusilla*	2	1	0	0		
5-Jun-10	MR09-2	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
5-Jun-10	MR09-2	Golden-crowned Kinglet	*Regulus satrapa*	0	2	0	0		
5-Jun-10	MR09-2	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
5-Jun-10	MR09-2	Yellow-bellied Sapsucker	*Sphyrapicus varius*	1	0	0	0		
5-Jun-10	MR09-2	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
5-Jun-10	MR09-2	Black-capped Chickadee	*Poecile atricapillus*	1	0	0	0		
5-Jun-10	MR09-2	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
5-Jun-10	MR09-3	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
5-Jun-10	MR09-3	Warbling Vireo	*Vireo gilvus*	2	0	0	0		
5-Jun-10	MR09-3	American Robin	*Turdus migratorius*	1	0	0	0		
5-Jun-10	MR09-3	White-throated Sparrow	*Zonotrichia albicollis*	0	1	0	0		
5-Jun-10	MR09-3	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
5-Jun-10	MR09-3	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
5-Jun-10	MR09-3	American Robin	*Turdus migratorius*	1	0	0	0		
5-Jun-10	MR09-4	Common Raven	*Corvus corax*	0	0	0	1		
5-Jun-10	MR09-4	Warbling Vireo	*Vireo gilvus*	0	2	0	0		
5-Jun-10	MR09-4	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
5-Jun-10	MR09-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
5-Jun-10	MR09-4	American Robin	*Turdus migratorius*	0	1	0	0		
5-Jun-10	MR09-5	Ovenbird	*Seiurus aurocapilla*	1	0	0	0		
5-Jun-10	MR09-5	White-throated Sparrow	*Zonotrichia albicollis*	0	1	0	0		
5-Jun-10	MR09-5	Yellow Warbler	*Dendroica petechia*	2	0	0	0		
5-Jun-10	MR09-5	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
5-Jun-10	MR09-5	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
5-Jun-10	MR09-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR10-1	Dark-eyed Junco	*Junco hyemalis*	1	1	0	0		
6-Jun-10	MR10-1	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
6-Jun-10	MR10-1	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
6-Jun-10	MR10-1	Varied Thrush	*Ixoreus naevius*	0	0	2	0		
6-Jun-10	MR10-1	Wilson's Warbler	*Wilsonia pusilla*	0	0	1	0		
6-Jun-10	MR10-1	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
6-Jun-10	MR10-1	White-throated Sparrow	*Zonotrichia albicollis*	0	1	1	0		
6-Jun-10	MR10-1	American Robin	*Turdus migratorius*	1	0	0	0		
6-Jun-10	MR10-1	Tennessee Warbler	*Vermivora peregrina*	0	0	1	0		
6-Jun-10	MR10-1	American Robin	*Turdus migratorius*	0	0	1	0		
6-Jun-10	MR10-2	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
6-Jun-10	MR10-2	Cassin's Vireo	*Vireo cassinii*	1	0	0	0		
6-Jun-10	MR10-2	Chipping Sparrow	*Spizella passerina*	0	1	1	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
6-Jun-10	MR10-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
6-Jun-10	MR10-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
6-Jun-10	MR10-2	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
6-Jun-10	MR10-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
6-Jun-10	MR10-2	Gray Jay	*Perisoreus canadensis*	0	0	1	0		
6-Jun-10	MR10-2	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
6-Jun-10	MR10-2	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
6-Jun-10	MR10-3	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
6-Jun-10	MR10-3	Cassin's Vireo	*Vireo cassinii*	1	0	0	0		
6-Jun-10	MR10-3	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
6-Jun-10	MR10-3	Warbling Vireo	*Vireo gilvus*	1	1	0	0		
6-Jun-10	MR10-3	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
6-Jun-10	MR10-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR10-3	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
6-Jun-10	MR10-3	American Robin	*Turdus migratorius*	1	0	0	0		
6-Jun-10	MR10-3	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
6-Jun-10	MR10-4	Cassin's Vireo	*Vireo cassinii*	1	0	0	0		
6-Jun-10	MR10-4	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
6-Jun-10	MR10-4	Gray Jay	*Perisoreus canadensis*	0	0	2	0		
6-Jun-10	MR10-4	Least Flycatcher	*Empidonax minimus*	1	0	0	0		
6-Jun-10	MR10-4	Orange-crowned Warbler	*Vermivora celata*	0	0	1	0		
6-Jun-10	MR10-4	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
6-Jun-10	MR10-5	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
6-Jun-10	MR10-5	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
6-Jun-10	MR10-5	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
6-Jun-10	MR10-5	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
6-Jun-10	MR10-5	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
6-Jun-10	MR10-5	Varied Thrush	*Ixoreus naevius*	1	0	0	0		
6-Jun-10	MR10-5	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
6-Jun-10	MR10-5	Gray Jay	*Perisoreus canadensis*	1	0	0	0		
6-Jun-10	MR11-1	Gray Jay	*Perisoreus canadensis*	0	2	0	0		
6-Jun-10	MR11-1	Red-winged Blackbird	*Agelaius phoeniceus*	2	0	0	0		
6-Jun-10	MR11-1	Tennessee Warbler	*Vermivora peregrina*	0	1	0	0		
6-Jun-10	MR11-1	Common Yellowthroat	*Geothlypis trichas*	0	1	0	0		
6-Jun-10	MR11-2	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
6-Jun-10	MR11-2	Red-winged Blackbird	*Agelaius phoeniceus*	2	2	0	0		
6-Jun-10	MR11-2	Common Yellowthroat	*Geothlypis trichas*	1	0	0	0		
6-Jun-10	MR11-2	Violet-green Swallow	*Tachycineta thalassina*	0	0	0	1		out foraging on lake
6-Jun-10	MR11-2	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
6-Jun-10	MR11-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
6-Jun-10	MR11-2	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
6-Jun-10	MR11-3	Red-winged Blackbird	*Agelaius phoeniceus*	0	2	0	0		
6-Jun-10	MR11-3	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
6-Jun-10	MR11-3	Ruby-crowned Kinglet	*Regulus calendula*	0	0	1	0		
6-Jun-10	MR11-3	Chipping Sparrow	*Spizella passerina*	0	1	1	0		
6-Jun-10	MR11-3	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
6-Jun-10	MR11-3	Chipping Sparrow	*Spizella passerina*	2	0	0	0		
6-Jun-10	MR11-4	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
6-Jun-10	MR11-4	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
6-Jun-10	MR11-4	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
6-Jun-10	MR11-5	Western Wood-Pewee	*Contopus sordidulus*	1	0	0	0		
6-Jun-10	MR11-5	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
6-Jun-10	MR11-5	Red Crossbill	*Loxia curvirostra*	0	0	0	2		
6-Jun-10	MR11-5	American Robin	*Turdus migratorius*	0	1	0	0		
6-Jun-10	MR11-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
6-Jun-10	MR11-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR12-1	Yellow-rumped Warbler	*Dendroica coronata*	2	1	0	0		
6-Jun-10	MR12-1	American Robin	*Turdus migratorius*	0	1	0	0		
6-Jun-10	MR12-1	Willow Flycatcher	*Empidonax traillii*	0	0	1	0		
6-Jun-10	MR12-1	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
6-Jun-10	MR12-1	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
6-Jun-10	MR12-1	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
6-Jun-10	MR12-1	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
6-Jun-10	MR12-1	Pine Siskin	*Carduelis pinus*	0	2	0	0		
6-Jun-10	MR12-1	Hairy Woodpecker	*Picoides villosus*	0	1	0	0		
6-Jun-10	MR12-1	Common Raven	*Corvus corax*	0	0	0	1		
6-Jun-10	MR12-2	Hairy Woodpecker	*Picoides villosus*	1	0	0	0		
6-Jun-10	MR12-2	Northern Flicker	*Colaptes auratus*	1	0	0	0		
6-Jun-10	MR12-2	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
6-Jun-10	MR12-2	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
6-Jun-10	MR12-2	Western Wood-Pewee	*Contopus sordidulus*	0	1	0	0		
6-Jun-10	MR12-2	American Three-toed Woodpecker	*Picoides dorsalis*	2	0	0	0		
6-Jun-10	MR12-2	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
6-Jun-10	MR12-2	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
6-Jun-10	MR12-2	American Robin	*Turdus migratorius*	1	0	0	0		
6-Jun-10	MR12-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
6-Jun-10	MR12-3	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
6-Jun-10	MR12-3	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
6-Jun-10	MR12-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
6-Jun-10	MR12-3	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
6-Jun-10	MR12-3	Hairy Woodpecker	*Picoides villosus*	2	0	0	0		territorial calling
6-Jun-10	MR12-3	Western Wood-Pewee	*Contopus sordidulus*	0	1	0	0		
6-Jun-10	MR12-3	Chipping Sparrow	*Spizella passerina*	2	0	0	0	Copulation display	
6-Jun-10	MR12-4	Gray Jay	*Perisoreus canadensis*	6	0	0	0		imitating northern goshawk
6-Jun-10	MR12-4	Warbling Vireo	*Vireo gilvus*	1	0	0	0		chased off gray jay
6-Jun-10	MR12-4	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
6-Jun-10	MR12-4	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
6-Jun-10	MR12-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
6-Jun-10	MR12-4	Common Raven	*Corvus corax*	0	0	1	0		giving call indicative a "near nest call"
6-Jun-10	MR12-4	Northern Flicker	*Colaptes auratus*	1	0	0	0		
6-Jun-10	MR12-4	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
6-Jun-10	MR12-5	White-throated Sparrow	*Zonotrichia albicollis*	0	1	0	0		
6-Jun-10	MR12-5	Common Raven	*Corvus corax*	0	3	0	0		nestling/fledglings
6-Jun-10	MR12-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR12-5	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
6-Jun-10	MR12-5	Gray Jay	*Perisoreus canadensis*	0	0	1	0		
6-Jun-10	MR12-5	Boreal Chickadee	*Poecile hudsonica*	0	0	1	0		
6-Jun-10	MR12-5	Ruby-crowned Kinglet	*Regulus calendula*	0	0	1	0		
6-Jun-10	MR12-5	American Robin	*Turdus migratorius*	0	1	0	0		
6-Jun-10	MR12-5	Chipping Sparrow	*Spizella passerina*	1	0	0	0	Material carry	
6-Jun-10	MR13-1	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
6-Jun-10	MR13-1	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
6-Jun-10	MR13-1	Least Flycatcher	*Empidonax minimus*	0	0	1	0		
6-Jun-10	MR13-1	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
6-Jun-10	MR13-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
6-Jun-10	MR13-1	Golden-crowned Kinglet	*Regulus satrapa*	0	0	1	0		
6-Jun-10	MR13-2	Hammond's Flycatcher	*Empidonax hammondii*	1	0	0	0		
6-Jun-10	MR13-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
6-Jun-10	MR13-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
6-Jun-10	MR13-2	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
6-Jun-10	MR13-2	Yellow-rumped Warbler	*Dendroica coronata*	0	1	1	0		
6-Jun-10	MR13-2	Wilson's Warbler	*Wilsonia pusilla*	0	0	1	0		
6-Jun-10	MR13-2	Willow Flycatcher	*Empidonax traillii*	0	1	0	0		
6-Jun-10	MR13-3	American Redstart	*Setophaga ruticilla*	2	0	0	0		
6-Jun-10	MR13-3	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
6-Jun-10	MR13-3	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
6-Jun-10	MR13-3	Hammond's Flycatcher	*Empidonax hammondii*	0	1	0	0		
6-Jun-10	MR13-3	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
6-Jun-10	MR13-3	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
6-Jun-10	MR13-3	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
6-Jun-10	MR13-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR13-3	Willow Flycatcher	*Empidonax traillii*	0	0	1	0		
6-Jun-10	MR13-3	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
6-Jun-10	MR13-3	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
6-Jun-10	MR13-4	Warbling Vireo	*Vireo gilvus*	0	0	2	0		
6-Jun-10	MR13-4	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
6-Jun-10	MR13-4	American Redstart	*Setophaga ruticilla*	0	0	1	0		
6-Jun-10	MR13-4	Yellow Warbler	*Dendroica petechia*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
6-Jun-10	MR13-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
6-Jun-10	MR13-5	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
6-Jun-10	MR13-5	Yellow Warbler	*Dendroica petechia*	0	0	1	0		
6-Jun-10	MR13-5	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
6-Jun-10	MR13-5	Common Raven	*Corvus corax*	0	0	1	0		
6-Jun-10	MR13-5	Orange-crowned Warbler	*Vermivora celata*	0	0	1	0		
7-Jun-10	MR14-1	Warbling Vireo	*Vireo gilvus*	2	0	0	0		
7-Jun-10	MR14-1	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
7-Jun-10	MR14-1	Tennessee Warbler	*Vermivora peregrina*	1	0	0	0		
7-Jun-10	MR14-1	Hairy Woodpecker	*Picoides villosus*	1	0	0	0		
7-Jun-10	MR14-1	Chipping Sparrow	*Spizella passerina*	1	2	0	0		
7-Jun-10	MR14-1	White-throated Sparrow	*Zonotrichia albicollis*	0	2	1	0		
7-Jun-10	MR14-1	Orange-crowned Warbler	*Vermivora celata*	0	1	0	0		
7-Jun-10	MR14-1	Orange-crowned Warbler	*Vermivora celata*	0	0	1	0		
7-Jun-10	MR14-1	American Robin	*Turdus migratorius*	0	0	1	0		
7-Jun-10	MR14-2	Warbling Vireo	*Vireo gilvus*	2	1	0	0		
7-Jun-10	MR14-2	Hairy Woodpecker	*Picoides villosus*	2	0	0	0		
7-Jun-10	MR14-2	White-throated Sparrow	*Zonotrichia albicollis*	0	1	1	0		
7-Jun-10	MR14-2	Western Tanager	*Piranga ludoviciana*	1	0	0	0		
7-Jun-10	MR14-2	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
7-Jun-10	MR14-2	Black-throated Green Warbler	*Dendroica nigrescens*	0	1	0	0		
7-Jun-10	MR14-3	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
7-Jun-10	MR14-3	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
7-Jun-10	MR14-3	Black-throated Green Warbler	*Dendroica nigrescens*	1	0	0	0		
7-Jun-10	MR14-3	Yellow-bellied Sapsucker	*Sphyrapicus varius*	1	0	0	0		
7-Jun-10	MR14-3	Western Tanager	*Piranga ludoviciana*	1	0	0	0		
7-Jun-10	MR14-3	White-throated Sparrow	*Zonotrichia albicollis*	0	1	0	0		
7-Jun-10	MR14-3	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
7-Jun-10	MR14-3	Ruffed Grouse	*Bonasa umbellus*	1	0	0	0		
7-Jun-10	MR14-3	American Three-toed Woodpecker	*Picoides dorsalis*	1	0	0	0		
7-Jun-10	MR14-4	American Three-toed Woodpecker	*Picoides dorsalis*	1	0	0	0		
7-Jun-10	MR14-4	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
7-Jun-10	MR14-4	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
7-Jun-10	MR14-4	Swainson's Thrush	*Catharus ustulatus*	0	2	0	0		
7-Jun-10	MR14-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
7-Jun-10	MR14-4	Common Raven	*Corvus corax*	0	0	1	0		
7-Jun-10	MR14-4	Golden-crowned Kinglet	*Regulus satrapa*	0	2	0	0		
7-Jun-10	MR14-4	Townsend's Warbler	*Dendroica townsendi*	1	0	0	0		
7-Jun-10	MR14-5	Golden-crowned Kinglet	*Regulus satrapa*	2	0	0	0		
7-Jun-10	MR14-5	Swainson's Thrush	*Catharus ustulatus*	1	1	0	0		
7-Jun-10	MR14-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
7-Jun-10	MR14-5	American Three-toed Woodpecker	*Picoides dorsalis*	0	0	1	0		
7-Jun-10	MR14-5	Black-throated Green Warbler	*Dendroica nigrescens*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
7-Jun-10	MR14-5	Hairy Woodpecker	*Picoides villosus*	1	0	0	0		
7-Jun-10	MR14-5	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
7-Jun-10	MR14-5	Western Tanager	*Piranga ludoviciana*	0	1	0	0		
7-Jun-10	MR14-5	Cassin's Vireo	*Vireo cassinii*	1	0	0	0		
7-Jun-10	MR14-5	Gray Jay	*Perisoreus canadensis*	1	0	0	0		
7-Jun-10	MR14-5	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
7-Jun-10	MR14-5	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
7-Jun-10	MR14-5	Red-breasted Nuthatch	*Sitta canadensis*	0	0	1	0		
7-Jun-10	MR15-1	Fox Sparrow	*Passerella iliaca*	1	0	0	0		
7-Jun-10	MR15-1	Yellow-rumped Warbler	*Dendroica coronata*	1	1	0	0		
7-Jun-10	MR15-1	Hermit Thrush	*Catharus guttatus*	2	1	0	0		
7-Jun-10	MR15-1	Golden-crowned Kinglet	*Regulus satrapa*	0	0	1	0		
7-Jun-10	MR15-1	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
7-Jun-10	MR15-1	Varied Thrush	*Ixoreus naevius*	1	1	2	0		
7-Jun-10	MR15-2	Hermit Thrush	*Catharus guttatus*	1	0	0	0		
7-Jun-10	MR15-2	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
7-Jun-10	MR15-2	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
7-Jun-10	MR15-2	Fox Sparrow	*Passerella iliaca*	1	0	0	0		
7-Jun-10	MR15-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
7-Jun-10	MR15-3	Varied Thrush	*Ixoreus naevius*	1	0	0	0		
7-Jun-10	MR15-3	Hermit Thrush	*Catharus guttatus*	1	1	0	0		
7-Jun-10	MR15-3	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
7-Jun-10	MR15-3	Golden-crowned Sparrow	*Zonotrichia atricapilla*	1	0	0	0		
7-Jun-10	MR15-4	Hermit Thrush	*Catharus guttatus*	1	1	0	0		
7-Jun-10	MR15-4	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
7-Jun-10	MR15-4	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
7-Jun-10	MR15-4	American Robin	*Turdus migratorius*	0	1	0	0		
7-Jun-10	MR15-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
7-Jun-10	MR15-4	Fox Sparrow	*Passerella iliaca*	1	0	0	0		
7-Jun-10	MR15-4	Pine Grosbeak	*Pinicola enucleator*	1	0	0	0		
7-Jun-10	MR15-5	American Robin	*Turdus migratorius*	1	0	0	0		
7-Jun-10	MR15-5	Yellow-rumped Warbler	*Dendroica coronata*	1	2	0	0		
7-Jun-10	MR15-5	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
7-Jun-10	MR15-5	Hermit Thrush	*Catharus guttatus*	1	1	0	0		
7-Jun-10	MR15-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
7-Jun-10	MR15-5	Dark-eyed Junco	*Junco hyemalis*	3	0	0	0		
7-Jun-10	MR16-1	Gray Jay	*Perisoreus canadensis*	0	1	0	0		
7-Jun-10	MR16-1	Yellow-rumped Warbler	*Dendroica coronata*	1	1	0	0		
7-Jun-10	MR16-1	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
7-Jun-10	MR16-1	Common Raven	*Corvus corax*	0	0	1	0		
7-Jun-10	MR16-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
7-Jun-10	MR16-1	American Robin	*Turdus migratorius*	0	0	1	0		
7-Jun-10	MR16-1	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
7-Jun-10	MR16-2	Golden-crowned Kinglet	*Regulus satrapa*	2	0	0	0		
7-Jun-10	MR16-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
7-Jun-10	MR16-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
7-Jun-10	MR16-2	Common Raven	*Corvus corax*	0	1	0	0		
7-Jun-10	MR16-3	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
7-Jun-10	MR16-3	Dark-eyed Junco	*Junco hyemalis*	2	0	0	0		
7-Jun-10	MR16-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
7-Jun-10	MR16-4	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
7-Jun-10	MR16-4	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
7-Jun-10	MR16-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
7-Jun-10	MR16-4	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
7-Jun-10	MR16-4	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
7-Jun-10	MR16-5	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
7-Jun-10	MR16-5	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
7-Jun-10	MR16-5	Downy Woodpecker	*Picoides pubescens*	1	0	0	0		
8-Jun-10	MR17-1	Townsend's Warbler	*Dendroica townsendi*	1	1	0	0		
8-Jun-10	MR17-1	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
8-Jun-10	MR17-1	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
8-Jun-10	MR17-1	Wilson's Warbler	*Wilsonia pusilla*	0	0	1	0		
8-Jun-10	MR17-1	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
8-Jun-10	MR17-1	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
8-Jun-10	MR17-1	American Robin	*Turdus migratorius*	0	0	1	0		
8-Jun-10	MR17-1	Varied Thrush	*Ixoreus naevius*	0	2	1	0		
8-Jun-10	MR17-1	Lincoln's Sparrow	*Melospiza lincolnii*	0	0	1	0		
8-Jun-10	MR17-1	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
8-Jun-10	MR17-1	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
8-Jun-10	MR17-2	Golden-crowned Kinglet	*Regulus satrapa*	4	1	0	0		
8-Jun-10	MR17-2	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
8-Jun-10	MR17-2	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
8-Jun-10	MR17-2	Varied Thrush	*Ixoreus naevius*	0	1	1	0		
8-Jun-10	MR17-2	Black-capped Chickadee	*Poecile atricapillus*	0	1	0	0		
8-Jun-10	MR17-2	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
8-Jun-10	MR17-2	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
8-Jun-10	MR17-3	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
8-Jun-10	MR17-3	Varied Thrush	*Ixoreus naevius*	0	1	2	0		
8-Jun-10	MR17-3	Winter Wren	*Troglodytes troglodytes*	0	0	1	0		
8-Jun-10	MR17-3	Chipping Sparrow	*Spizella passerina*	0	0	1	0		
8-Jun-10	MR17-3	Hermit Thrush	*Catharus guttatus*	0	0	1	0		
8-Jun-10	MR17-3	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
8-Jun-10	MR17-4	Golden-crowned Kinglet	*Regulus satrapa*	2	0	0	0		
8-Jun-10	MR17-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
8-Jun-10	MR17-4	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
8-Jun-10	MR17-4	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
8-Jun-10	MR17-4	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
8-Jun-10	MR17-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
8-Jun-10	MR17-5	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
8-Jun-10	MR17-5	Pine Siskin	*Carduelis pinus*	0	2	0	0		
8-Jun-10	MR17-5	Varied Thrush	*Ixoreus naevius*	0	0	1	0		
8-Jun-10	MR18-1	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
8-Jun-10	MR18-1	Hermit Thrush	*Catharus guttatus*	0	0	3	0		
8-Jun-10	MR18-1	Golden-crowned Kinglet	*Regulus satrapa*	0	1	1	0		
8-Jun-10	MR18-1	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
8-Jun-10	MR18-1	Wilson's Warbler	*Wilsonia pusilla*	0	1	0	0		
8-Jun-10	MR18-1	Dark-eyed Junco	*Junco hyemalis*	0	0	1	0		
8-Jun-10	MR18-2	Hermit Thrush	*Catharus guttatus*	1	1	2	0		
8-Jun-10	MR18-2	Ruby-crowned Kinglet	*Regulus calendula*	1	0	0	0		
8-Jun-10	MR18-2	Pine Siskin	*Carduelis pinus*	1	0	0	0		
8-Jun-10	MR18-2	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
8-Jun-10	MR18-2	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
8-Jun-10	MR18-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
8-Jun-10	MR18-3	Hermit Thrush	*Catharus guttatus*	1	0	0	0		
8-Jun-10	MR18-3	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
8-Jun-10	MR18-4	Dark-eyed Junco	*Junco hyemalis*	1	0	0	0		
8-Jun-10	MR18-4	Pine Grosbeak	*Pinicola enucleator*	1	1	0	0		
8-Jun-10	MR18-4	Hermit Thrush	*Catharus guttatus*	1	0	0	0		
8-Jun-10	MR18-4	Varied Thrush	*Ixoreus naevius*	0	1	1	0		
8-Jun-10	MR18-4	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
8-Jun-10	MR18-4	Golden-crowned Kinglet	*Regulus satrapa*	0	1	0	0		
8-Jun-10	MR18-4	Common Raven	*Corvus corax*	0	0	0	1		
8-Jun-10	MR18-5	Pine Grosbeak	*Pinicola enucleator*	1	0	0	0		
8-Jun-10	MR18-5	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		
8-Jun-10	MR18-5	Dark-eyed Junco	*Junco hyemalis*	0	0	1	0		
8-Jun-10	MR18-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
8-Jun-10	MR18-5	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
8-Jun-10	MR18-5	Varied Thrush	*Ixoreus naevius*	0	0	2	0		
9-Jun-10	MR19-1	Orange-crowned Warbler	*Vermivora celata*	1	0	0	0		
9-Jun-10	MR19-1	Warbling Vireo	*Vireo gilvus*	0	1	1	0		
9-Jun-10	MR19-1	Wilson's Warbler	*Wilsonia pusilla*	1	1	0	0		
9-Jun-10	MR19-1	Swainson's Thrush	*Catharus ustulatus*	0	0	2	0		
9-Jun-10	MR19-1	Ruby-crowned Kinglet	*Regulus calendula*	0	0	1	0		
9-Jun-10	MR19-1	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
9-Jun-10	MR19-1	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
9-Jun-10	MR19-1	Red-breasted Nuthatch	*Sitta canadensis*	0	1	0	0		
9-Jun-10	MR19-1	Chipping Sparrow	*Spizella passerina*	0	0	1	0		
9-Jun-10	MR19-2	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
9-Jun-10	MR19-2	Wilson's Warbler	*Wilsonia pusilla*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
9-Jun-10	MR19-2	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
9-Jun-10	MR19-2	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		
9-Jun-10	MR19-2	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
9-Jun-10	MR19-2	Dark-eyed Junco	*Junco hyemalis*	0	0	1	0		
9-Jun-10	MR19-3	Swainson's Thrush	*Catharus ustulatus*	0	1	0	0		
9-Jun-10	MR19-3	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
9-Jun-10	MR19-3	Wilson's Warbler	*Wilsonia pusilla*	0	0	1	0		
9-Jun-10	MR19-3	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
9-Jun-10	MR19-3	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
9-Jun-10	MR19-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
9-Jun-10	MR19-3	Ruby-crowned Kinglet	*Regulus calendula*	1	0	1	0		
9-Jun-10	MR19-4	Yellow-rumped Warbler	*Dendroica coronata*	2	0	0	0		
9-Jun-10	MR19-4	Dark-eyed Junco	*Junco hyemalis*	2	1	0	0		
9-Jun-10	MR19-4	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		
9-Jun-10	MR19-4	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
9-Jun-10	MR19-4	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
9-Jun-10	MR19-4	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
9-Jun-10	MR19-5	Northern Waterthrush	*Seiurus noveboracensis*	1	0	0	0		
9-Jun-10	MR19-5	Swainson's Thrush	*Catharus ustulatus*	1	0	0	0		
9-Jun-10	MR19-5	Wilson's Warbler	*Wilsonia pusilla*	2	0	0	0		
9-Jun-10	MR19-5	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
9-Jun-10	MR19-5	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
9-Jun-10	MR19-5	Varied Thrush	*Ixoreus naevius*	0	1	0	0		
9-Jun-10	MR19-5	Pine Siskin	*Carduelis pinus*	0	1	0	0		
9-Jun-10	MR19-5	Chipping Sparrow	*Spizella passerina*	1	0	0	0		
9-Jun-10	MR19-5	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
9-Jun-10	MR19-5	Ruby-crowned Kinglet	*Regulus calendula*	0	1	0	0		
9-Jun-10	MR19-5	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
9-Jun-10	MR19-5	Tree Swallow	*Tachycineta bicolor*	2	0	0	0	Nest found	came out of snag ~2m tall, nesting just above water
9-Jun-10	MR20-1	Tennessee Warbler	*Vermivora peregrina*	1	0	0	0		
9-Jun-10	MR20-1	American Robin	*Turdus migratorius*	0	0	2	0		
9-Jun-10	MR20-1	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
9-Jun-10	MR20-1	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
9-Jun-10	MR20-1	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
9-Jun-10	MR20-1	Western Wood-Pewee	*Contopus sordidulus*	0	1	0	0		
9-Jun-10	MR20-1	Northern Flicker	*Colaptes auratus*	0	1	0	0		
9-Jun-10	MR20-1	Pine Siskin	*Carduelis pinus*	2	0	0	0		
9-Jun-10	MR20-1	Chipping Sparrow	*Spizella passerina*	2	0	0	0		
9-Jun-10	MR20-1	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
9-Jun-10	MR20-1	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
9-Jun-10	MR20-2	Least Flycatcher	*Empidonax minimus*	3	0	0	0		
9-Jun-10	MR20-2	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		

Appendix 4.4-2. Terrestrial Breeding Bird Species Observed during Point Count Surveys, June 2010

Date	Point Count	Common Name	Scientific Name	0-50 m	50-100 m	>100 m	Flyover	Breeding_Behaviour	Bird_Notes
9-Jun-10	MR20-2	Warbling Vireo	*Vireo gilvus*	1	1	0	0		
9-Jun-10	MR20-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
9-Jun-10	MR20-2	Lincoln's Sparrow	*Melospiza lincolnii*	1	0	0	0		
9-Jun-10	MR20-2	Chipping Sparrow	*Spizella passerina*	0	1	0	0		
9-Jun-10	MR20-2	Orange-crowned Warbler	*Vermivora celata*	0	1	1	0		
9-Jun-10	MR20-2	Golden-crowned Kinglet	*Regulus satrapa*	1	0	0	0		
9-Jun-10	MR20-2	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
9-Jun-10	MR20-2	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
9-Jun-10	MR20-3	Least Flycatcher	*Empidonax minimus*	1	1	1	0		
9-Jun-10	MR20-3	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
9-Jun-10	MR20-3	American Robin	*Turdus migratorius*	2	0	0	0		
9-Jun-10	MR20-3	Ovenbird	*Seiurus aurocapilla*	2	0	0	0		
9-Jun-10	MR20-3	White-throated Sparrow	*Zonotrichia albicollis*	1	0	0	0		
9-Jun-10	MR20-3	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
9-Jun-10	MR20-3	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	1	0	0	0		
9-Jun-10	MR20-3	Yellow-rumped Warbler	*Dendroica coronata*	0	1	0	0		
9-Jun-10	MR20-3	Brown-headed Cowbird	*Molothrus ater*	0	1	0	0		
9-Jun-10	MR20-3	White-winged Crossbill	*Loxia leucoptera*	0	0	1	0		
9-Jun-10	MR20-4	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
9-Jun-10	MR20-4	Warbling Vireo	*Vireo gilvus*	1	0	0	0		
9-Jun-10	MR20-4	Swainson's Thrush	*Catharus ustulatus*	0	1	1	0		
9-Jun-10	MR20-4	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
9-Jun-10	MR20-4	Least Flycatcher	*Empidonax minimus*	1	0	0	0		
9-Jun-10	MR20-4	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	1	0	0	0		
9-Jun-10	MR20-4	American Redstart	*Setophaga ruticilla*	1	0	0	0		
9-Jun-10	MR20-4	Yellow-rumped Warbler	*Dendroica coronata*	1	0	0	0		
9-Jun-10	MR20-4	Yellow Warbler	*Dendroica petechia*	0	1	0	0		
9-Jun-10	MR20-4	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
9-Jun-10	MR20-5	Yellow Warbler	*Dendroica petechia*	1	0	0	0		
9-Jun-10	MR20-5	Pine Siskin	*Carduelis pinus*	0	1	0	0		
9-Jun-10	MR20-5	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	0	1	0	0		
9-Jun-10	MR20-5	American Robin	*Turdus migratorius*	0	1	0	0		
9-Jun-10	MR20-5	Belted Kingfisher	*Megaceryle alcyon*	0	1	0	0		
9-Jun-10	MR20-5	Least Flycatcher	*Empidonax minimus*	1	1	0	0		
9-Jun-10	MR20-5	Yellow-rumped Warbler	*Dendroica coronata*	0	0	1	0		
9-Jun-10	MR20-5	White-throated Sparrow	*Zonotrichia albicollis*	0	0	1	0		
9-Jun-10	MR20-5	Warbling Vireo	*Vireo gilvus*	0	1	0	0		
9-Jun-10	MR20-5	Yellow-bellied Sapsucker	*Sphyrapicus varius*	0	0	1	0		
9-Jun-10	MR20-5	Swainson's Thrush	*Catharus ustulatus*	0	0	1	0		
9-Jun-10	MR20-5	Tennessee Warbler	*Vermivora peregrina*	0	1	0	0		
9-Jun-10	MR20-5	Ovenbird	*Seiurus aurocapilla*	0	1	0	0		
9-Jun-10	MR20-5	Orange-crowned Warbler	*Vermivora celata*	0	0	1	0		
9-Jun-10	MR20-5	Dark-eyed Junco	*Junco hyemalis*	0	1	0	0		
9-Jun-10	MR20-5	Brown-headed Cowbird	*Molothrus ater*	0	1	0	0		

Appendix 4.4-3

Incidental Observations of Terrestrial Breeding Bird Species, 2010

Rescan™
Engineers and Scientists

Appendix 4.4-3. Incidental Observations of Terrestrial Breeding Bird Species, 2010

Date	Easting	Northing	Common Name	Scientific Name	No. Observed	Comment(s)
18-May-10	626773	6099951	Red-winged Blackbird	*Agelaius phoeniceus*	1	
18-May-10	622741	6092171	Red-winged Blackbird	*Agelaius phoeniceus*	1	
18-May-10	624626	6088888	American Dipper	*Cinclus mexicanus*	1	
18-May-10	616815	6112305	American Dipper	*Cinclus mexicanus*	2	
18-May-10	623732	6093466	Belted Kingfisher	*Megaceryle alcyon*	1	
19-May-10	619877	6101619	Yellow-rumped Warbler	*Dendroica coronata*	1	
19-May-10	620321	6103145	Ruffed Grouse	*Bonasa umbellus*	1	
19-May-10	625967	6097305	Yellow Warbler	*Dendroica petechia*	1	along Murray River
19-May-10	626056	6097584	Ruffed Grouse	*Bonasa umbellus*	1	
19-May-10	629789	6100491	Red-winged Blackbird	*Agelaius phoeniceus*	1	
19-May-10	625646	6097394	Red-winged Blackbird	*Agelaius phoeniceus*	1	
20-May-10	616870	6109307	Belted Kingfisher	*Megaceryle alcyon*	1	off channel, small beaver pond associated with river
3-Jun-10	625635	6097412	Red-winged Blackbird	*Agelaius phoeniceus*	1	mixed SOW - marsh
3-Jun-10	624895	6108343	Spruce Grouse	*Falcipennis canadensis*	1	along MR2. Male.
4-Jun-10	628427	6096153	Cliff Swallow	*Petrochelidon pyrrhonota*	100	large colony of cliff swallows underneath existing mine infastructure, many flying in and out of nests, foraging
4-Jun-10	628404	6096145	Barn Swallow	*Hirundo rustica*	6	a few barn swallows foraging in with cliff swallows, probably nesting in the same area under existing mine infastructure
5-Jun-10	622389	6106797	American Robin	*Turdus migratorius*		robin shell observed along overgrown road (along MR8), lots of tall alder and willow around, likely nesting in a nearby area.
6-Jun-10	639706	6107223	Dark-eyed Junco	*Junco hyemalis*	1	nest with 4 eggs - female flushed off nest
6-Jun-10	619170	6112150	Olive-sided Flycatcher	*Contopus cooperi*	1	singing from edge of powerline ROW or within forest beside ROW.
7-Jun-10	630629	6109171	Brown Creeper	*Certhia americana*	1	
8-Jun-10	609556	6119797	Yellow Warbler	*Dendroica petechia*	1	
8-Jun-10	609556	6119797	Red-breasted Nuthatch	*Sitta canadensis*	1	
8-Jun-10	609556	6119797	Alder Flycatcher	*Empidonax alnorum*	3	
8-Jun-10	609556	6119797	Wilson's Warbler	*Wilsonia pusilla*	1	
8-Jun-10	609556	6119797	American Robin	*Turdus migratorius*	1	
8-Jun-10	609556	6119797	Chipping Sparrow	*Spizella passerina*	1	
8-Jun-10	609556	6119797	Yellow-rumped Warbler	*Dendroica coronata*	1	
8-Jun-10	609556	6119797	Orange-crowned Warbler	*Vermivora celata*	1	
8-Jun-10	609556	6119797	Pine Siskin	*Carduelis pinus*	2	
8-Jun-10	609556	6119797	Wilson's Warbler	*Wilsonia pusilla*	1	
8-Jun-10	609556	6119797	Ruby-crowned Kinglet	*Regulus calendula*	1	
8-Jun-10	609556	6119797	Warbling Vireo	*Vireo gilvus*	1	
8-Jun-10	609556	6119797	Golden-crowned Kinglet	*Regulus satrapa*	2	
8-Jun-10	609750	6119818	Swainson's Thrush	*Catharus ustulatus*	1	
8-Jun-10	609750	6119818	Cassin's Vireo	*Vireo cassinii*	1	
8-Jun-10	609750	6119818	Black-capped Chickadee	*Poecile atricapillus*	1	
8-Jun-10	609750	6119818	Least Flycatcher	*Empidonax minimus*	1	
8-Jun-10	609750	6119818	Yellow-rumped Warbler	*Dendroica coronata*	1	
8-Jun-10	609895	6119766	Yellow-rumped Warbler	*Dendroica coronata*	1	
9-Jun-10	626543	6110329	Pileated Woodpecker	*Dryocopus pileatus*	1	adult flew over highway to Tumbler Ridge
18-Jul-10	617651	6109638	Belted Kingfisher	*Megaceryle alcyon*	1	
23-Jul-10	620150	6101382	Rufous Hummingbird	*Selasphorus rufus*	1	
25-Jul-10	620327	6103154	Chipping Sparrow	*Spizella passerina*	1	around shore of wetland.
25-Jul-10	620327	6103154	Barn Swallow	*Hirundo rustica*	3	around shore of wetland.
25-Jul-10	620327	6103154	Blackpoll Warbler	*Dendroica striata*	1	around shore of wetland.
26-Jul-10	629574	6099997	Yellow-bellied Sapsucker	*Sphyrapicus varius*	1	

Appendix 5.2-1

Habitat Information Recorded at Wetlands Surveyed in 2010

Rescan™
Engineers and Scientists

Appendix 5.2-1. Habitat Information Recorded at Wetlands Surveyed in 2010

Date	Waypoint	Northing	Easting	Air Temp	Water Temp	Water pH	Weather	Wind	Water Colour	Flow	Wetland Size	Wetland Width (m)	Wetland Length (m)	Wetland Description	Landuse/Surrounding Habitat
26-Jul-10	MR011	6098473	629090	21	21	9	Clear	Calm	clear	0	Medium	70	150	old gravel pit away from abandoned forestry road	alpine field
23-Jul-10	MR042	6101383	620149			0					Small	15	40	forest pond	
23-Jul-10	MR043					0						0	0		
23-Jul-10	MR044					0						0	0		
22-Jul-10	MR047	6102146	620329	15	20	8	Overcast	Calm	clear	1	Large			wetland	forestry
25-Jul-10	MR062	6110092	618250			0						0	0		
24-Jul-10	MR077					0			brown	1		0	0	beaver pond	forest
24-Jul-10	MR081	6104903	621483			0					Large	0	0	beaver pond	forest
24-Jul-10	MR082	6105410	621592			0			clear			0	0		
23-Jul-10	MR091	6098779	624065	20	19	7	Clear		grey	1	Small	30	100	beaver pond	roadside; forest in back
23-Jul-10	MR092	6099516	620855			0			stained	1	Large	0	0	beaver pond	
24-Jul-10	MR094	6103555	622981			0						0	0		
25-Jul-10	MR096	6103154	620327			0	Clear				Large	0	0	large beaver pond in stream	
25-Jul-10	MR097	6093715	629645	29	27	8	Clear			1	Small	6	12	roadside gravel pit	forest road; forest in back
26-Jul-10	MR098	6099822	630077			0						0	0	beaver pond	
26-Jul-10	MR099	6099997	629574			0	Clear		brown	1	Large	0	0	beaver pond	road on one side, rail line on another side, forest
26-Jul-10	MR102	6098829	631694	19	23	9	Partly Cloudy	Light		1	Large	12	30	mudflats off to side of beaver pond	highway; forest in back
26-Jul-10	MR103	6098717	631741	19		0			brown		Small	6	6		roadside
25-Jul-10	MR105	6095528	625842			0	Clear	Strong	clear		Large	0	0	man made reservoirs	riparian wetlands surrounding area
24-Jul-10	MR107	6102431	623560			0						0	0		
22-Jul-10	MR108	6104555	622531	15	19	7	Overcast	Calm	grey	1	Small	15	40	gravel pit off forestry road	gravel pit; forest in back

Appendix 5.2-1. Habitat Information Recorded at Wetlands Surveyed in 2010

Date	Notes	Shoreline Canopy (%)	Canopy	Shallow Muddy Bank	Fish Present	Emergent Veg (%)	Emergent Veg Type	Bank Substrate and Slope
26-Jul-10	elevation=896 m. In placesawa from where toadlets found, bank slope ~45 degrees	0	open and sunny		none	50	sedge	40% gravel, 10% sphagnum, 60% aquatic vegetation; gently sloping ~10-15 degrees
23-Jul-10	tanins in water, closed canopy, dense veg around pond		dense, dark		no	100		
23-Jul-10	good rocky riverside habitat for toads; surveyed the surrounding terrestrial area for adults but none observed							
23-Jul-10	riverine habitat; a few small pools between beaver dams were checked as well							
22-Jul-10	pond where juveniles found: 15 m x 5 m; time of day = morning	0	open and sunny			80	grasses	mud and grasses
25-Jul-10	Shallow oxbow of river (ditch-like); river plants in water; mudflats							
24-Jul-10	Excellent terrestrial habiat but no amphibians found	0	open and sunny	yes		0		banks substrate mud and downed trees; steep in most places
24-Jul-10	two beaver ponds observed here	30	set back	yes		20	grasses	grasses and some open mud
24-Jul-10	Channel with lots of grassy overhanging banks and small pools; clear pools with muddy bottoms; looks okay for toads but no amphibians observed							
23-Jul-10	Lots of dead depris in water and dead pine on shore; shoreline very muddy; slope drops off steeply about 30cm into pond; elevation=908; m (point originall called MR088)	10	open and sunny	yes	none	0	na	90% mud, <1% shrubs, 2% gravel, 50% grasses/sedges; moderate slope ~45 degrees
23-Jul-10	(point originally called MR087); photos from Tracey's camera. No veg in pond substrate, very large, tanin stained beaver pond							steep bank
24-Jul-10	small stream under bridge; lots of neighboring steeps; rocky bottom							
25-Jul-10	Fish observed on other side of culvert; grasses/sedges and dead trees along edges, gentle sloping in many places, steep drop-offs in other places; very deep in middle,	15	open and sunny		yes	60	grasses	
25-Jul-10	pool with toadlets was adjacent and connected to larger pool without any amphibians (~8x18 m); dipnetted larger pool. elevation=1129 m	0	open and sunny		none	80	horsetail	40% gravel, 60% sedges/grasses; slope ~60 deg on one side and ~25-35 deg on side with toadlets
26-Jul-10								
26-Jul-10	pond chocked with veg	30	canopy set back	yes		50	grasses	grasses; gentle slope
26-Jul-10	two pools and one channel; elevation =900 m	0	open and sunny	yes	none	70	horsetails	30% mud; 70% aquatic vegetation, 50% mudflats, 50% 10-15 degree slope
26-Jul-10		0		yes	none			
25-Jul-10	riverine vegetation in water; rocky/gravel shores that look good for toads but none observed; deep pools; (point originally called MR090)	0	open and sunny	no		0		gravel, some grasses
24-Jul-10	high elevation bog; very overgrown (closed canopy); very little water (point originally recorded as MR093)							
22-Jul-10	elevation =1242 m; (Point originally called MR086). Water depth around 50m	0	open and sunny		no	0	na	gravel; moderate slope 45 degrees

Appendix 5.2-2

Observations of Amphibians, 2010

Rescan™
Engineers and Scientists

Appendix 5.2-2. Observations of Amphibians, 2010

Date	Waypoint	Northing	Easting	Time	Species	No. Observed	Age Class	Calling	Comments
26-Jul-10	MR011	6098473	629091	15:04	Western toad	1000	Juvenile		toadlets found in two places where the pond had receeded due to drying. Photos of toads - 0020-28 (TJL)
26-Jul-10	MR011	6098473	629091	15:00	Western toad	2000	Tadpole		toad tadpoles found throughout pond but concentrated in one spot
26-Jul-10	MR011	6098473	629091	15:00	Wood frog	6	Adult		
23-Jul-10	MR042	6101382	620150	10:39	Columbia spotted frog	1	Adult		
23-Jul-10	MR043								no amphibians observed
23-Jul-10	MR044								no amphibians observed
22-Jul-10	MR047	6102146	620329	16:13	Columbia spotted frog	1	Adult	No	grassy puddle beside larger pond, photos of frog - 6109 - 12 (TJL)
22-Jul-10	MR047	6102146	620329	16:13	Columbia spotted frog	5	Juvenile	No	grassy shallow ponds beside larger pond
25-Jul-10	MR062	6110092	618250	10:26					no amphibians observed
24-Jul-10	MR077								no amphibians observed
24-Jul-10	MR081	6104903	621483	12:44					no amphibians found
24-Jul-10	MR082	6105410	621592	13:37					no amphibians observed
23-Jul-10	MR091	6098778	624066	14:16	Long-toed salamander	15	Larvae		density of tadpoles ~20 per square metre of pond surface; tadpoles still at early stage (no limb buds), photos of toad and salamander - 6140-41 (TJL)
23-Jul-10	MR091	6098778	624066	14:16	Columbia spotted frog	12	Tadpole		
23-Jul-10	MR091	6098778	624066	14:16	Western toad	100	Tadpole		
23-Jul-10	MR092	6099516	620855	13:30	Wood frog	1	Adult	No	
24-Jul-10	MR094	6103555	622981	15:40					no amphibians observed
25-Jul-10	MR096	6103154	620327	13:15	Wood frog	1	Juvenile	No	
25-Jul-10	MR096	6103154	620327	13:15	Columbia spotted frog	5	Adult	No	
25-Jul-10	MR096	6103154	620327	13:15	Columbia spotted frog	1	Juvenile	No	
25-Jul-10	MR096	6103154	620327	13:15	Columbia spotted frog	100	Tadpole		tadpoles found in several pockets (not found along entire
25-Jul-10	MR097	6093717	629651	16:57	Western toad	80	Juvenile		recently metamorphosed toads (some still hadn't reabsorbed tail)
26-Jul-10	MR098	6099822	630077	10:48					no amphibians observed
26-Jul-10	MR099	6099997	629574	11:13					no amphibians observed
26-Jul-10	MR102	6098829	631695	15:45	Western toad	12	Juvenile		toadlets found between one pool and the channel ~ 1-5 m away from water edge of the pool closest to the highway; no toadlets observed in water
26-Jul-10	MR102	6098829	631695	15:45	Wood frog	2	Adult		
26-Jul-10	MR103	6098716	631742	17:28	Columbia spotted frog	15	Tadpole		hind limbs well developed
24-Jul-10	MR105	6095528	625842	10:46					no amphibians observed
22-Jul-10	MR108	6104555	622532	17:19	Western toad	500	Tadpole		number of tadpoles not counted but >>500 (30 individuals counted in 40 s.); tadpoles large with hindlimbs but no arm buds yet; tadpoles found along entire periphery of pond (large population)