

**WILDLIFE INVENTORY
CRYSTAL MOUNTAIN
RESORT EXPANSION
WESTBANK, BC**

**Addendum
Expanded Study Area**

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EXECUTIVE SUMMARY

During the detailed “Master Plan” phase of the project, the study area was expanded to the south to include an area of approximately 110 hectares for residential and golf course development. It contains two wetlands, a mature forest and lies within the IDFdk2 biogeoclimatic zone.

During mid-August 2001, ENKON conducted additional field inventories to assess the potential impacts to environmental resources of the expanded area.

No red or blue listed vertebrate species were encountered during any of the August 21, 2001 surveys.

A total of 13 bird species (only passerines) were observed or heard on the project site, none of which were Red, Blue or Yellow listed. The loss of “core woodlot habitat” within the proposed development area will likely cause an increase in bird diversity (Riley and Mohr 1994) and a shift from forest dwelling birds to birds that prefer edge habitats.

In the July 2000 survey by ENKON a total of four bat species were encountered during the surveys, none of which were red or blue listed. These four bat species are also expected to use Wetlands 1 and 2. The adjacent mature forest community is primarily used for roosting while the wetlands provide feeding habitat during the late spring and summer.

No red or blue listed herpetofaunal species were encountered during any of the surveys. Two species (western toad and Pacific tree frog) of amphibians were found in Wetland 2.

No deer were observed within the area proposed for base area around the wetlands but scat and tracks were found around Wetland 2. The Telemark ski trails immediately south of the two wetlands provide deer travel corridors and good winter browse/thermal cover for moose.

Based on ENKON’s August 21, 2001 survey, the upland forest within the expanded study area may be considered moderate value wildlife habitat. The wetlands provide limited ecological value to the local fauna due to their ephemeral nature.

As part of the proposed development within the expanded study area, the following options should be considered:

1. If possible, retain one or both ephemeral wetlands, and a minimum 15m buffer measured from the high water mark. If possible, provide a minimum 15 m wide naturally vegetated movement corridor to the Jack Creek wetland; or

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2. If the wetlands cannot be retained, re-construct permanent wetlands (fed by the golf course irrigation system or stormwater) and associated minimum 15 m buffer within the expanded study area. To provide functional wildlife habitat, the wetland(s) should be a minimum size of approximately 0.6 acres (0.25 ha) and measure at least 50 m at one location perpendicular to its longitudinal axis; and
 3. Where possible, retain a minimum 15 m natural vegetative cover between and around the fairways to provide wildlife habitat and movement corridors

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1.0 INTRODUCTION

1.1 Background

Preliminary and final environmental assessment reports prepared by ENKON (2000) for the proposed expansion identified environmental resources, concerns and issues associated with the proposed development of the Crystal Mountain Ski Hill. Additionally, they provided conceptual mitigation measures and management plans to be used during the initial design and planning phase of the project to reduce or eliminate potential impacts of the proposed expansion on the environment. Guiding principles for sustainability including site design, building design and construction water management, energy management, and waste management/recycling were also provided.

During the detailed “Master Plan” phase of the project, the study area was expanded to the south to include an area of approximately 110 hectares for residential and golf course development (Figures 1 and 2). During mid-August 2001, ENKON conducted additional field inventories to assess the potential impacts to environmental resources of the expanded area.

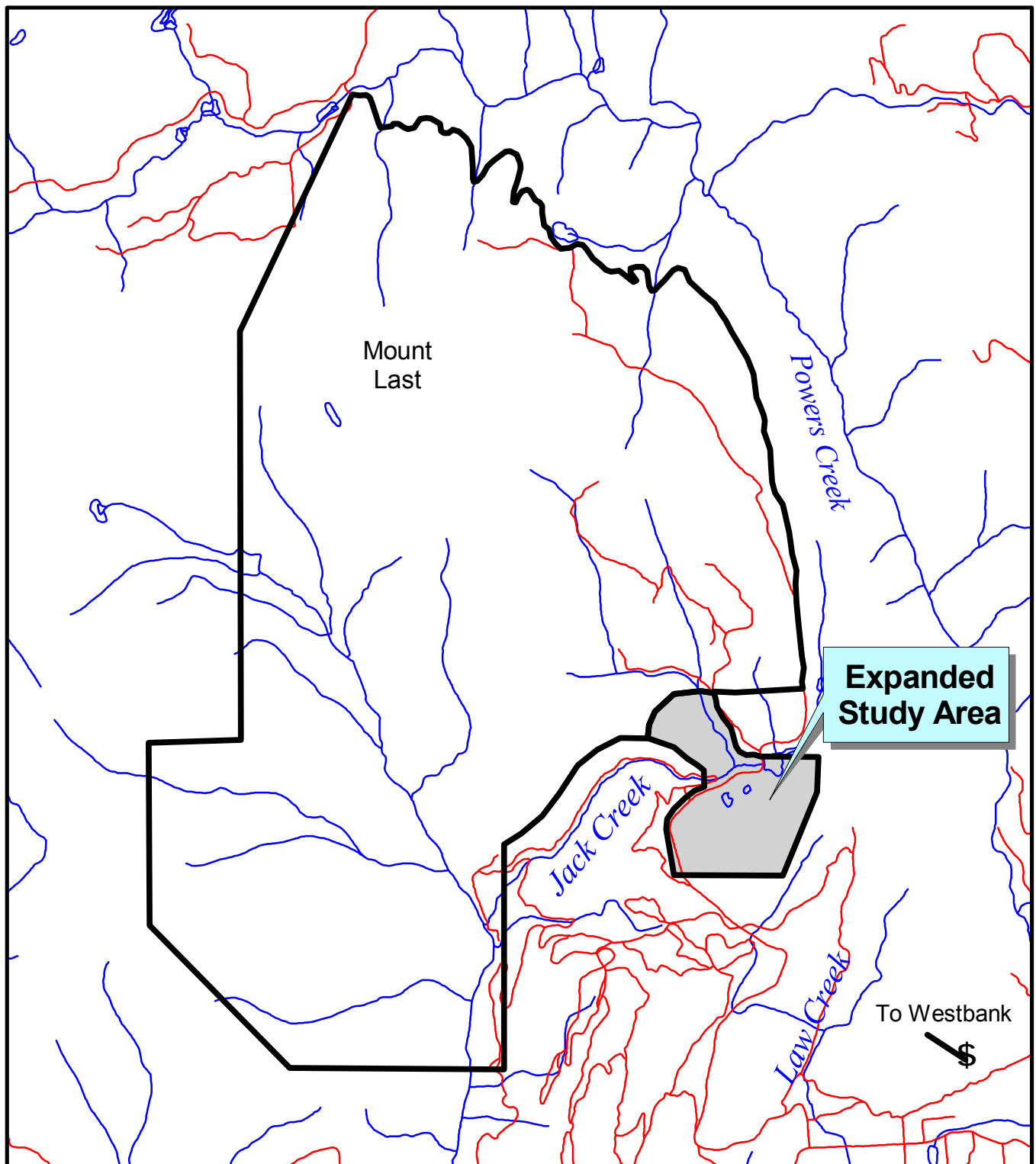
1.2 Prior Studies

ENKON (2000 and 2001) prepared three previous environmental reports including a preliminary environmental assessment dated June 2000, a wildlife inventory and management plan report dated October 2000 and a final environmental assessment report dated June 2001.

The results of ENKON’s previous work identified a total of 41 bird species (passerines and raptors) that were observed or heard on the project site, none of which were Red, Blue or Yellow listed. Higher diversity, species numbers and composition of birds were associated with clearcut areas as compared to closed forests. The nocturnal bird transect point counts concluded that raptor species encountered were primarily correlated with the structural stages of deep forest of the MS zone and appeared to be heard in and around riparian zones of Jack and Powers Creeks.

A total of four bat species were encountered during the surveys, none of which were Red or Blue listed. Bats were associated with the Jack Creek wetland and adjacent forests.

No red or blue listed herpetofaunal species were encountered during any of the surveys. A total of 2 reptile species, three frog species were found or observed during the surveys.



— Surface Drainage
 — Road
 — Study Boundary

1 0 1 2 3
 Kilometres



Crystal Mountain Resort Expansion
Study Site Location

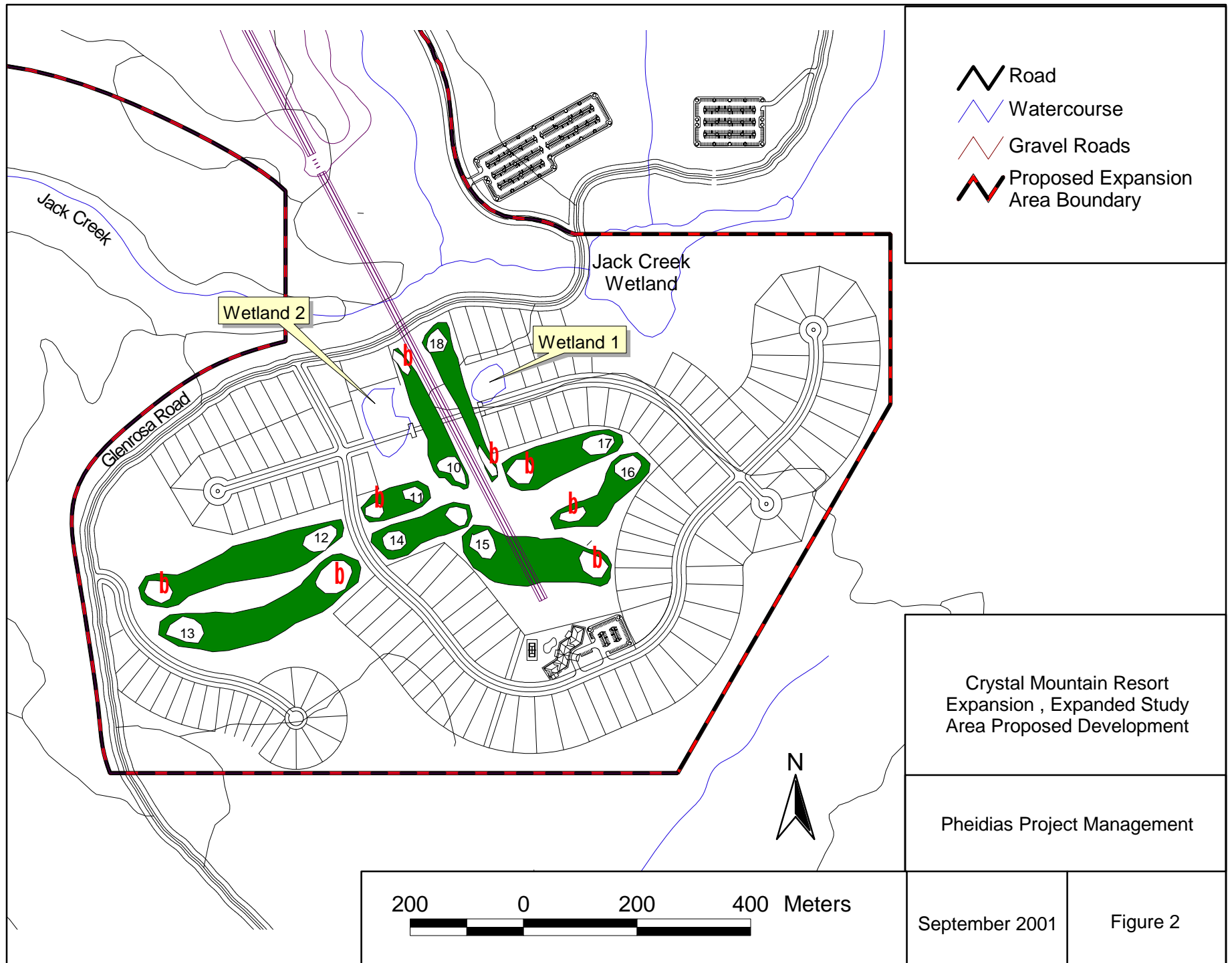
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Figure 1



ENKON Environmental Ltd.



Crystal Mountain Resort
Expansion , Expanded Study
Area Proposed Development

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Figure 2

Introduction

Herpetifaunal species were commonly found in the Jack Creek wetland, smaller wetlands throughout the site and rock outcrops.

No deer were observed within the area proposed for base area or ski run development, while four adult mule deer were observed immediately west of the Telemark ski area. Deer sign was noted at various locations throughout the study area.

ENKON prepared wildlife management recommendations that focused on maintaining bio-diversity. Primary management recommendations to protect important bird, bat and herpetifaunal habitat included the protection of a 15-30m riparian zone adjacent to Law, Powers and Jack Creek. The Jack Creek wetland and a number of other ephemeral wetlands/rock outcrops were also recommended for protection.

Management recommendations to protect important mule deer habitat were also prepared including:

1. Riparian corridors of 15-30 m average width adjacent to Jack, Law and Powers Creek were recommended to maintain the integrity of north-south and east-west movement corridors and also provide important shelter and forage habitat; and
2. Recommendations for the sizes of forested woodlots (minimum of >0.8-2.0 ha with a minimum width of 91 m (Nietfeld *et al.* 1985) between ski runs were provided to protect deer shelter and forage habitat;
3. Recommendations for maximum width (180 m) of ski run were also provided to allow deer to escape to shelter habitat; and
4. Low shrub areas west of the Nordic Ski trails adjacent to Jack Creek should be protected to provide mule and white-tailed deer foraging.

1.3 Objectives of this Study

The objectives of ENKON's August, 2001 environmental resource assessment included the following:

1. Confirm the presence/absence of red and/or blue listed wildlife species (i.e. raptors, waterbirds, passerines, amphibians, reptiles, small and large mammals) within the expanded study area; and
2. Assess the significance of two seasonal wetlands within the expanded area for fish and wildlife resources, particularly waterbirds, amphibians, reptiles and small mammals.

1.4 Expanded Study Area

The Crystal Mountain study site is located in the Central Okanagan Regional District of BC and is identified as a Resource Management Zone Type 4 (Natural Disturbance Type 4, fire; OSLRMP Draft #6).

The expanded study area is located north of the community of Glenrosa and southeast of the existing day lodge. It is approximately 110 hectares and contains two wetlands (Figure 3) and a mature forest. It lies within the IDFdk2 biogeoclimatic zone.

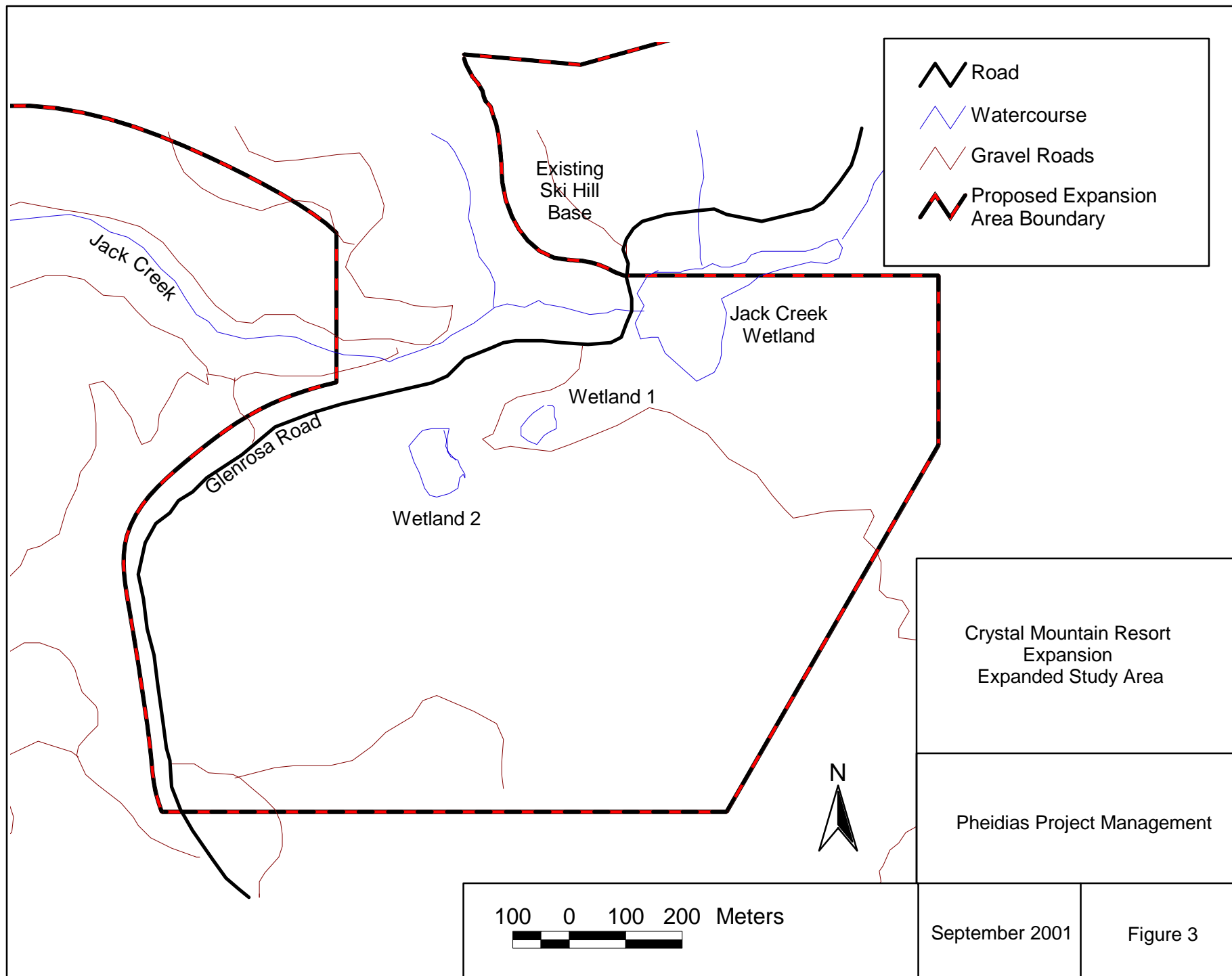
1.4.1 Upland Forest Community

The forest of the expanded study boundary is defined by a mature climax Douglas fir and lodgepole pine forest (Photograph 1). Lodgepole pine dominates the area on the dry southern exposures along the south and white spruce is most commonly present in the wetter areas surrounding two wetlands in the center of the site. Sections of the upland have topography which is undulating with moderate slopes that drain into the two interior wetlands and off the property to the headwaters of Law Creek to the south. Extensive Telemark Ski trails transect the area from the west to east.

1.4.2 Wetland Community

The two wetlands are located in the center of the expanded study area. Wetland 1 is approximately 2,800 m² and Wetland 2 is approximately 8,100 m² (Figure 2). Drainage to both wetlands is primarily from overland flows during rain events and snowpack melt. During August 2001 both wetlands were dry.

The perimeter of both wetlands have dead and decaying trees (Photograph 2), while the interior of both wetlands is comprised of *Carex* spp. (sedge), *Agrostis* spp. (grass), *Cyrtus* spp. (sedge), *Sium* spp. (celery), *Polygonum* spp. (pondweed), and *Plantago* spp. (water plantain).



2.0 METHODOLOGY

The key wildlife resources surveyed on August 21, 2001 included:

- 1) Raptors and Breeding Birds,
- 2) Herpetifaunal;
- 3) Small Mammals; and
- 3) Mule and White-tailed Deer

The inventory was conducted by an experienced Registered Professional Biologist in British Columbia.

2.1 Raptors and Breeding Birds

Study design followed the:

- Resource Inventory Committee's presence/not detected protocols of *'Standard Inventory Methodologies for Components of British Columbia's Biodiversity: Raptors (Version 1.1) Section 3.3.4, 3.3.6 and 3.3.7;*
- *"Standard Inventory Methodologies for Components of British Columbia's Biodiversity: Raptors (Version 1.1) Section 3.3.3".*
- Canadian Wildlife Service's (CWS) *"Forest Bird Monitoring Program (FBMP)";*and
- Environment Canada's (Env. Can.) *"Breeding Bird Survey (BBS)".*

Point counts, call playback surveys and foot surveys were used to identify raptors and passerines within the expanded study area. Single point counts were also placed around the perimeter and in the center of each wetland and all birds heard or seen were recorded.

Calls and songs of six target species (Northern Saw-whet Owl (NSWO), Northern Pygmy Owl (NOPO), Flammulated owl (FLAM) Blue-listed, Western Screech Owl (WESO) Red-listed, Barred Owl (BDOW); and Great-horned Owl (GHOW) potentially occurring in the expanded study area were played in the center of each wetland.

Foot (transect) surveys for nests were used to supplement point count and call playback surveys to verify any presence/not detected (but possible) occurrence of any breeding raptors or significant passerines from this summer, and to identify any nests which would be encountered on the site.

2.2 Herpetifauna

The reptile survey focused on identifying the presence/not-detected status of the following blue listed reptile species:

- Gopher Snake (*Pituophis catenifer deserticola*);
- Racer (*Coluber constrictor*); and
- Rubber Boa (*Charina bottae*)

The presence/not-detected inventory status of these reptiles on the study site followed methodologies outlined in “Standard Inventory Methodologies for Snakes Standards for Components of British Columbia’s Biodiversity No. 38: Snakes”(Version 2.0). Due to the timing of the survey, the methodology included only spot site inventory through transect encounters.

The wetlands were surveyed using linear transects (by foot) across each wetland. The following was performed in and along the perimeter of each of the wetlands:

- All rocks and objects which provide cover for snakes encountered during the transects were overturned; and
- All snake holes (potential dens) were recorded and locations immediately to these areas were intensively surveyed.

The amphibian and painted turtle surveys focused on identifying the presence/not-detected status of the following red and blue listed species:

1. Tiger Salamander; and
2. Northern Leopard Frog.

The presence/not-detected inventory status of these herpetifuauna on the study site followed methodologies outlined in “*Inventory Methods for Pond-breeding Amphibians and Painted Turtle Standards for Components of British Columbia's Biodiversity No. 37 (Version 2.0).*” Both the wetlands were surveyed. The survey methodologies followed RIC protocol and included:

1. Time-constrained searches; and
2. Systematic surveys.

2.3 Mule Deer, White-tailed Deer and Moose

The mule and white-tailed deer survey followed the MELP Inventory Branch for the Terrestrial Ecosystems Task Force Resource Inventory Committee (RIC) protocols for. “*Ground-based Inventory Methods for Selected Ungulates: Moose, Elk and Deer (Version 2.0, 1998)*”.

2.3.1 Ground Survey (Incidental sightings)

Most ungulate populations in the province exhibit some degree of seasonal movement between summer and winter ranges (Demarchi *et al.* 1983). These range shifts are largely a response to greater snow accumulations at higher elevations, forcing animals to lower elevation winter ranges where the snow depth is less.

These winter ranges are usually smaller than summer ranges thereby concentrating the ungulates into smaller groups and higher animal densities allowing easier ground-based sampling.

The method of incidental ground-based sampling used for the survey was structured using ***Transect Methodology*** (*Encounter Transects*) as outlined in '*Ground-based Inventory Methods for Selected Ungulates: Moose, Elk and Deer* ' - Section 3.4'.

The following criteria was used to assess deer use within the expanded study area:

- Track evidence;
- Evidence of browse;
- Scrapings;
- Scat presence; and
- Incidental observation.

3.0 RESULTS AND DISCUSSION

3.1 Red and Blue Listed Species

No red or blue-listed wildlife species defined in the Penticton Forest Districts Rare Vertebrate Tracking List (Appendix B) were recorded within the expanded study area.

3.2 Fish

Although no fish inventory was performed during the August 21, 2001 survey, there are no surface hydrological connections from the two wetlands to any fish bearing streams within or adjacent to the site.

3.3 Birds

A total of 13 bird species (all passerines) were encountered within the expanded study area during the August 21, 2001 survey (Table 3.1).

Table 3.1 Birds Observed or Heard During the August 21st, 2001 Survey, Crystal Mountain Expanded Study Area

Total No. Obs.	Species Name	At Wetland 1	At Wetland 2
14	Black-capped Chickadee	X	X
1	Harry Woodpecker	X	X
1	Northern Flicker	X	X
1	Swainson's Thrush		X
3	Pine Siskin		X
2	Winter Wren		X
4	American Robin	X	
2	Wilson's Warbler		X
12	Dark-eyed Junco	X	X
2	Purple Finch		X
2	Common Raven		X
1	Song Sparrow		X
1	Red-breasted Nuthatch	X	X

Results and Discussion

The mature, climax Douglas fir and lodgepole pine forest of the expanded study area primarily provides habitat for core forest dwelling bird species. ENKON (June 2001) determined that the higher diversity, species numbers and composition of birds were associated with edge habitat adjacent to clearcut areas as compared to closed forest habitats.

Both of the wetlands in the expanded area are likely to contain common breeders such as the Dark-eyed Junco, and cavity nesters like the Black-capped Chickadee, Downy Woodpecker and the Red-breasted Nuthatch. Downed woody debris around the perimeter of Wetland 2 is good for common breeding birds throughout Crystal Mountain like the Winter Wren, which is very abundant throughout the study area in both the IDF and MS zones of the study site.

3.4 Herpetifauna

A total of 2 amphibian species (western toad and Pacific tree frog) were observed during the August 21, 2001 survey (Table 3.2).

Table 3.2 Herpetifauna Encountered During the August 21, 2001 Survey, Crystal Mountain Expanded Study Area

Species	No.	Method	Total Time	Location.
Western Toad (<i>Bufo boreas</i>)	1	Foot search	3 hrs.	Around the perimeter of Wetland 2
Pacific Tree Frog (<i>Hyla regalis</i>)	2			

Wetlands 1 and 2 and the upland forest buffer immediately surrounding the wetlands do not provide any life cycle significance for any red or blue-listed species defined in the Pentiction Forest Districts Rare Vertebrate Tracking List. These two ephemeral wetlands may provide limited food and shelter for adult western toads and Pacific tree frogs during the late spring and summer seasons. Winter habitat for amphibians is non-existent.

No surveys were performed for painted turtles on August 21, 2001 as the wetlands were dry. The expanded study site is not likely to contain this species at any time of year because habitat requirements to support it are lacking.

3.5 Bats

Although no bat inventory was performed during the August 21, 2001 surveys, based on habitat requirements the wetlands likely provide habitat for the big brown bat, the California bat, the silver-haired bat and little brown bat. None are red-or blue-listed. The mature forest immediately surrounding the wetlands are the best habitat for bat foraging, while the mature forests also provide important roosting habitat.

3.6 Deer

No deer were observed within the expanded study area during the August 21, 2001 survey and only two deer signs (scat and browse) were located in Wetland 2 (Figure 4). Additionally, moose scat sign was recorded in Wetland 2 (Figure 4). No signs of any ungulate was observed anywhere else along the expanded study area during the four hour survey.

The expanded study area provides forage/shelter habitat during the spring and late fall migration periods. The mature forest provides limited food, but good thermal/security habitat during the winter.

Optimum habitat for deer has open water within 0.8 km of any point (Nietfeld *et al.*, 1985). Heaviest use of an area by deer occurs within 300m of water but water is less important in areas of succulent forage (Nietfeld *et al.*, 1985). Much of this habitat is lacking in the expanded study area other than in spring and early summer surrounding the two wetlands.

In spring, optimum habitat for fawning is an undisturbed forest environment with 50% canopy closure that has low shrubs or small trees from 0.6 to 1.8 m and food nearby (Stevens and Lofts, 1988). Although this habitat is present along the western side of the expanded study area, human disturbance (i.e. mountain bikes, all terrain vehicles and motorcycles) along the public trails limit the potential use in this area by deer during the spring and early summer.

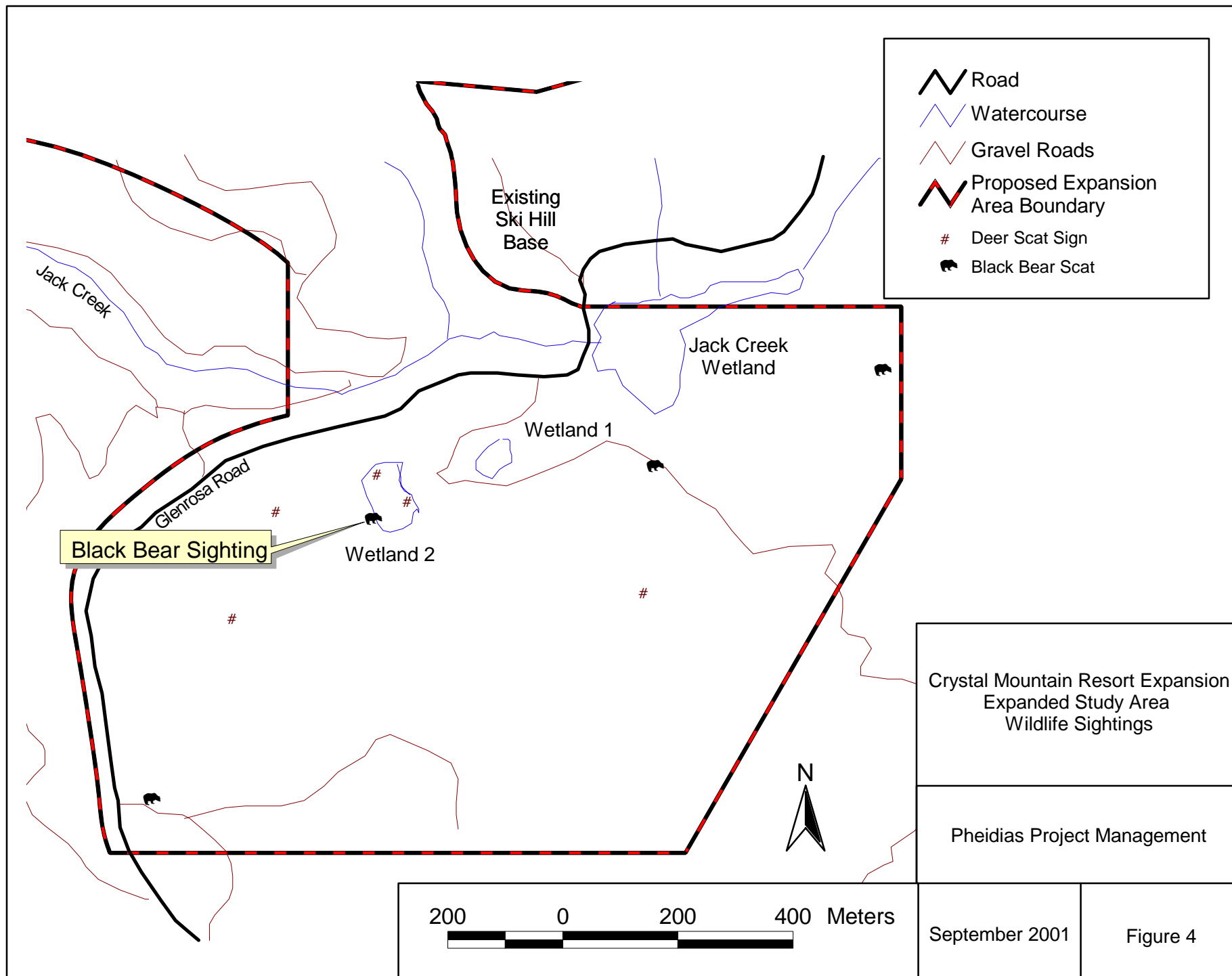
3.7 Incidental Wildlife Observations

3.7.1 Bears

During the survey a Black Bear was observed feeding on berries around the perimeter of Wetland 2 (Figure 4). Berry producing shrubs associated with the Telemark ski trails provide good forage during the summer-early fall. Scat was found in a number of locations along the Telemark Ski Trails. The wetlands also likely provide good early and late spring foraging for black bears.

3.7.2 Moose

Moose scat was observed in Wetland 2, suggesting that moose use the wetlands for forage and shelter during the spring, summer and fall. The mature forest adjacent to the wetlands provides thermal/security habitat.



Results and Discussion

3.7.3 Small Mammals

The wetlands and upland forests which have extensive coarse woody debris and brush piles are likely used by small mammals like common and vagrant shrews, montane, and meadow voles and red and northern flying squirrels. Several red squirrels were heard throughout the area but most were encountered around the two wetlands.

4.0 WILDLIFE MANAGEMENT RECOMMENDATIONS

4.1 General Guidelines

Based on ENKON's August 21, 2001 survey, the upland forest within the expanded study area may be considered moderate value wildlife habitat. The wetlands provide limited ecological value to the local fauna due to their ephemeral nature.

As part of the proposed development within the expanded study area, the following options should be considered:

1. If possible, retain one or both ephemeral wetlands, and a minimum 15m buffer measured from the high water mark. If possible, provide a minimum 15 m wide naturally vegetated movement corridor to the Jack Creek wetland; or
2. If the wetlands cannot be retained, re-construct permanent wetlands (fed by the golf course irrigation system or stormwater) and associated minimum 15 m buffer within the expanded study area. To provide functional wildlife habitat, the wetland(s) should be a minimum size of approximately 0.6 acres (0.25 ha) and measure at least 50 m at one location perpendicular to its longitudinal axis; and
3. Where possible, retain a minimum 15 m natural vegetative cover between and around the fairways to provide wildlife habitat and movement corridors.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The wildlife resources of the two wetlands were surveyed by ENKON Environmental Limited on August 21, 2001 using RIC protocols. No red or blue listed vertebrates were observed or expected to occur within the expanded study area.

A total of 13 bird species (only passerines) were observed or heard on the project site, none of which were Red, Blue or Yellow listed. The loss of “core woodlot habitat” within the proposed development area will likely cause an increase in bird diversity (Riley and Mohr 1994) and a shift from forest dwelling birds to birds that prefer edge habitats.

In the July 2000 survey by ENKON a total of four bat species were encountered during the surveys, none of which were Red or Blue listed. These four bats species are also expected to use Wetlands 1 and 2. The adjacent mature forest community is primarily used for roosting while the wetlands provide feeding habitat during the late spring and summer.

No red or blue listed herpetofaunal species were encountered during any of the surveys. Two species (western toad and Pacific tree frog) of amphibians were found in Wetland 2.

No deer were observed within the area proposed for base area around the wetlands but scat and tracks were found around Wetland 2. The Telemark ski trails immediately south of the two wetlands provide deer travel corridors and good winter browse/thermal cover for moose.

The wildlife management plan recommendations focused on maintenance of the existing bio-diversity and options for retention or re-creation of the two ephemeral wetlands.

6.0 REFERENCES

- Adams, A. W. 1978. *Migration*. In: Elk of North America – Ecology and Management. J.W. Thomas and D.E. Towell eds., Wildlife Management Institute, Washington, D.C. 698 p.
- Allen, A.W. 1982. Habitat Suitability Index Models: Marten. U.S.D.I. Fish and Wildlife Service. FWS/OBS-92/10.11. 9 pp.
- Armleder, H.M. 1981. Habitat relationships of mule deer in the interior Douglas-fir zone of central BC: problem analysis. Research Branch, Ministry of Forests. WHR-1. Victoria, BC. 44p.
- Armleder, H.M., M.J. Waterhouse, D.G. Keisker and R.J. Dawson. 1994. Winter habitat use by mule deer in the central interior of British Columbia. Can. J. Zool. 72: 1721-1725.
- Banfield, A.W.F. 1974. The Mammals of Canada. University of Toronto Press. Toronto, Ontario.
- B.C. Environment, 1995. *Forest Practices Code – Biodiversity Guidebook*. B.C. Ministry of Environment, Lands and Parks, Victoria. 99 p.
- Chambers, M.. Undated. Deer In British Columbia. Ministry of Environment Lands and Parks brochure, Q.P. #16922. 4 p.
- Black, H., R.J. Pederson, R.J., Scherzinger and J.W. Thomas. 1979. Deer and Elk. Pp 104-127 in *Wildlife Habitats in Managed Forests in the Blue Mountains of Oregon and Washington*. USDA.
- Blair, G. S. 1993. Species conservation plan for white-headed woodpecker. USDA For. Ser., Nez Perce National Forest, Idaho Dep. Fish and Game, Lewiston ID. pp. 1-14.
- Blower, D. 1988. *Wildlife Distribution Mapping, Big Game Series (Black-tailed Deer; Elk; Moose; Mountain Goat)*. Scale 1:2,000,000. Ministry of Environment, Lands and Parks, Victoria.
- Brown, W.S. and W.S. Parker. 1976. Movement ecology of Coluber constrictor near communal hibernacula. Copeia 1976(2):225-242.
- Campbell, C.A. 1991. Status Report on the Yellow-bellied racer, Coluber constrictor mormon, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

References

- Campbell, R. W., N. K. Dawe, I. McT.-Cowan, J. M. Cooper, G. W. Kaiser and M. C. McNall. 1990. *The Birds of British Columbia*, Vol's. 1 and 2. Royal B. C. Museum and Canadian Wildlife Service.
- Chilton, R. 1990. Fort Nelson and Area Average Winter Snowpack Mapping. Wildlife Working Report No. WR-49. Ministry of Environment, Fort St. John, BC. 7 pp. + map.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 1998. Internet web site: <http://www.cosewic.gc.ca/COSEWIC>. Canadian Wildlife Service, Environment Canada.
- Cowan, I. McT. and C.J. Guiguet, 1965. *The Mammals of British Columbia*. BC Provincial Museum, Victoria, Handbook No. 11, 414 p.
- Demarchi, D.A., B. Fuhr, B.A., Pendegast and A.C. Stewart. 1983. Wildlife capability classification for British Columbia: and ecological (biophysical) approach for ungulates. MOE Manual 4. B.C. Min. Env., Victoria, B.C.
- Enkon Environmental Limited 2001. Final Environmental Assessment Crystal Mountain Resort Expansion Westbank, BC.
- _____ 2000. Wildlife Inventory and Management Plan Crystal Mountain Resort Expansion Westbank, BC.
- _____ 1999. Mount Mackenzie Resort Expansion, Draft Report.
- Enns, K.A., E. Peterson and D. McLennan. 1993. Impacts of hardwood management on British Columbia wildlife: problem analysis. For. Can., B.C. Min. For., Victoria, B.C. FRDA Rep. No. 208.
- Eveland, T. (undated). Living with deer: A comprehensive guide. <http://www.fund.org/facts/livdeer.html>.
- Forsyth, A. 1985. *Mammals of the Canadian Wild*. Camden House Publishing Ltd. Camden East, Ontario.
- Gibbs, J.P. and S.M. Melvin. 1993. Call-response surveys for monitoring breeding waterbirds. J. Wildl. Manage. 57:27-34.
- Green, D. M. and R. W. Campbell, 1984. *The Amphibians of British Columbia*. Royal B.C. Museum Handbook No. 45. 100 p.
- Gregory, P. T. and R. W. Campbell. 1984. *The Reptiles of British Columbia*. Royal B. C. Museum Handbook No. 44. 102 p.

References

- Harmoning, A. K. 1976. White-tailed Deer Dispersion and Habitat Utilisation in Central North Dakota. North Dakota Fish and Game Dept., Proj. No. W-67-R-13, 14 and 15. Unpub. Rpt. 37p.
- Hoyer, R.F. 1974. Description of a rubber boa (*Charina bottae*) population from western Oregon. *Herpetologica* 30(3):275-283.
- Loveless, C.M. 1967. Ecological characteristics of a mule deer winter range. Tech. Bull. No. 20, Colo. Game, Fish and Parks Dep., Denver. 124p.
- Lowell K. Halls, 1984, *White-Tailed Deer Ecology and Management*, Wildlife Management Institute, Stackpole Books, Harrisburg, Penn.
- Ministry of Environment Lands and Parks Nelson Forest District 1996. Impact of Harvesting on Habitat Use by Foraging Bats; Scott Grindal. Extension Note 028.
- Ministry of Environment Lands and Parks Nelson Forest District 1996. Bats and Trees; M.J. Vonhof and R.M.R. Barklay. Extension Note 027.
- Ministry of Environment Lands and Parks Nelson Forest District 1996. Impacts of Spring and Summer Logging on Cavity-Nesting Vertebrates; Christoph Steeger and Marlene Machmer. Extension Note 025.
- Ministry of Environment Lands and Parks Nelson Forest District 1996. Bat Research in the West Arm Demonstration Forest; Juliet Craig. Extension Note No. 13.
- Ministry of Environment, Lands and Parks (MELP). 1997. B.C. Conservation Data Centre: Rare Vertebrate Animal Tracking List. Internet web site: <http://www.env.gov.bc.ca/wld/cdc/atrkprov.htm>
- Ministry of Environment, Lands and Parks (MELP). 1997. Aerial Based Inventory Techniques for Selected Ungulates. Resources Inventory Committee Publication, Version 1.1.
- Ministry of Environment, Lands and Parks (MELP). 1998. Ground-based Inventory Methods for Selected Ungulates: Moose, Elk and Deer. Standards for Components of British Columbia's Biodiversity No. 33. Resources Inventory Branch Publication, Version 2.0.
- Nagorsen, D. 1990. The Mammals of British Columbia. Royal British Columbia Museum Memoir No. 4. Royal British Columbia Museum and Wildlife Branch, Victoria.
- Nietfeld, M., Wilk, J., Woolnough, K. 1985. Wildlife Habitat Requirement Summaries for Selected Wildlife Species in Alberta. Wildlife Resource Inventory Unit, Edmonton Alberta. Alberta Energy and Natural Resources Fish and Wildlife Division. 15p.

References

- Parker, W.S. and W.S. Brown. 1980. Comparative ecology of two colubrid snakes in northern Utah. Milwaukee Public Museum, Milwaukee, WI. Publ. Biol. and Geol. No. 7.
- Pauley, G.R., J.M. Peek and P. Zager. 1993. Predicting white-tailed deer habitat use in northern Idaho. J. Wildl. Manage. 57(4): 904-913.
- Prescott, W.H. 1974. Interrelationships of moose and deer of the genus *Odocoileus*. Can. Natur. 101:493-504.
- Rahme, A.H. 1991. Visual Cover and Site Selection by Mule Deer. M.Sc. Thesis, Simon Fraser University, Burnaby, BC.
- Resource Analysis Branch. 1968a. Aerial Survey. Mapsheet 94/F Ware. Aerial wildlife survey flown Jan. 25, 1968. BC Ministry of the Environment.
- Resource Analysis Branch. 1968b. Aerial Survey. Mapsheet 94/G Trutch. Aerial wildlife survey flown February, 1968. BC Ministry of the Environment.
- Resource Analysis Branch. 1969a. Aerial Survey. Mapsheet 94/F Ware. Aerial wildlife survey flown Jan. 22-23, 1969. BC Ministry of the Environment.
- Resource Analysis Branch. 1969b. Aerial Survey. Mapsheet 94/G Trutch. Aerial wildlife survey flown Jan. 17-21, 1969. BC Ministry of the Environment.
- Riley, John, L. and Pat Mohr, 1994. The natural heritage of southern Ontario's settled landscapes: A review of Conservation and restoration ecology for land-use and landscape planning. Ont. Min. Nat. Res. 77pp.
- Shewchuk, C.H. and H.L. Waye. 1995. Status Report for the Gopher Snake in British Columbia. B.C. Min. Environ., Lands and Parks, Victoria, B.C. Draft Report.
- Shewchuk, C.H. and P.T. Gregory. [1994]. Methods for sampling snakes in British Columbia. B.C. Min. Environ., Lands and Parks, Victoria, B.C.
- Smith, C. A. 1977. The Habitat patterns and associated movements of white-tailed deer in southern British Columbia. M.Sc. Thesis, Univ. of British Columbia, Vancouver. 139pp.
- Stevens, V. and Lofts, S. 1988. Wildlife Habitat Handbooks for the Southern Interior Ecoprovince, Vol. 1 Species Notes for Mammals. Wildlife Habitat Research WHR-28 Wildlife Report No. R-15. Wildlife Branch Ministry of Environment Victoria, BC. 174 p.
- Swift, S. M. 1980. Activity patterns of Pipistrelle bats (*Pipistrellus pipistrellus*) in north east Scotland. Journal of Zoology of London, 190:285-295.

References

- Telfer, E. S. 1970. Winter Habitat selection by moose and white-tailed deer. *J. Wildl. Manage.* 34(3):553-559.
- Thomas, J. W. 1979. Wildlife Habitats in Managed Forests in the Blue Mountains of Oregon and Washington. US Dept. of Agr. Forest Service. Agr. Handbook 553.
- Thomas, D. W., and LaVal, R. K. 1988. Survey and census methods. In kuunz, Thomas H., ed. Ecological and behavioural methods for the study of bats. Washington, D.C. Smithsonian Institution Press. Pp. 77-89.
- Wallmo, O. C. 1978. Mule and Black-tailed Deer distribution and Habitats. Pp 387-398 *In* O.C. Wallmo (Ed). Mule and black-tailed deer in North America. Wild. Manage. Instit. Univ. of Nebraska Press.
- Wallmo, O.C. and W.L. Regelin. 1978. Rocky Mountain and Intermountain Habitats. Part 1. Food Habits and Nutrition. Pp 387-398 *In* O.C. Wallmo (Ed). Mule and black-tailed deer in North America. Wild. Manage. Instit. Univ. of Nebraska Press.
- Wildlife Branch. 1995. Aerial Survey. Mapsheet 94/G Trutch. Aerial wildlife survey flown Feb. 21-23, 25 and 26 1995. Ministry of the Environment, Lands and Parks.
- Wishart, W. 1979. Regional Management of White-tailed Deer and their Habitat. Unpubl. Report. Alta. Fish and Wildlife Div., Edmonton.
- Wishart, W.D. 1984. Western Canada. Pp 475-487 *In* L.K. Halls (Ed.). White-tailed deer management. Ecology and Management. Stackpole books, Harrisburg. Pa. USFWS. 475-486p

APPENDICES

APPENDIX A

Photographs



Photograph 1 - Mature Forest Surrounding the Wetlands



Photograph 2 – Dead Trees and Woody Debris Surrounding the Wetlands

APPENDIX B

Pentiction Forest District Rare Vertebrate Tracking List

**BC Conservation Data Centre's Rare Vertebrate Animal Tracking List Penticton Forest District Species
List and their likely occurrence in the project area (April 26, 1999)**

Species	Latin Name	BC Status	COSEWIC Status
Birds			Based on April 1999 status
Lark Sparrow	<i>Chondestes grammacus</i>	Red	Not at Risk
*Western Screech-Owl	<i>Otus kennicottii macfarlanei</i>	Red	Indeterminate
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Red	Threatened
Brewer's Sparrow, Breweri	<i>Spizella breweri breweri</i>	Red	Not at Risk
Burrowing Owl	<i>Athene cunicularia</i>	Red	Endangered
Ferruginous Hawk	<i>Buteo regalis</i>	Red	Vulnerable
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	Red	Not at Risk
Prairie Falcon	<i>Falco mexicanus</i>	Red	Not at Risk
Sage Grouse	<i>Centrocercus urophasianus</i>	Red	Extirpated
Sage Thrasher	<i>Oreoscoptes montanus</i>	Red	Endangered
Swainson's Hawk	<i>Buteo swainsoni</i>	Red	Not at Risk
Upland Sandpiper	<i>Bartramia longicauda</i>	Red	Not at Risk
White-Headed Woodpecker	<i>Picoides albolarvatus</i>	Red	Threatened
Yellow-Breasted Chat	<i>Icteria virens</i>	Red	Threatened
Long-Billed Curlew	<i>Numenius americanus</i>	Blue	Vulnerable
American Avocet	<i>Recurvirostra americana</i>	Blue	Not at Risk
American Bittern	<i>Botaurus lentiginosus</i>	Blue	Not at Risk
Barn Owl	<i>Tyto alba</i>	Blue	Endangered
Bobolink	<i>Dolichonyx oryzivorus</i>	Blue	Not at Risk
California Gull	<i>Larus californicus</i>	Blue	Not at Risk
Canyon Wren	<i>Catherpes mexicanus</i>	Blue	Not at Risk
Flammulated Owl	<i>Otus flammeolus</i>	Blue	Vulnerable
Gray Flycatcher	<i>Empidonax wrightii</i>	Blue	Not at Risk
Great Blue Heron	<i>ardea herodias</i>	Blue	Vulnerable
Lewis's Woodpecker	<i>Melanerpes lewis</i>	Blue	Vulnerable
Sandhill Crane	<i>Grus canadensis</i>	Blue	Not at Risk
Sharp-Tailed Grouse	<i>Tympanuchus phasianellus</i>	Blue	Not at Risk
Short-eared owl	<i>Asio flammeus</i>	Blue	Vulnerable
White-Throated Swift	<i>Aeronautes saxatalis</i>	Blue	Not at Risk
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	Blue	Not at Risk
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Yellow	Not at Risk
Redhead	<i>Aythya americana</i>	Yellow	Not at Risk
Ring-Billed Gull	<i>Larus delawarensis</i>	Yellow	Not at Risk
Rough-Legged Hawk	<i>Buteo lagopus</i>	Yellow	Not at Risk
Mammals			
Pallid Bat	<i>Antrozous pallidus</i>	Red	Vulnerable
California Bighorn Sheep	<i>Ovis canadensis californiana</i>	Blue	Not at Risk
Fisher	<i>Martes pennanti</i>	Blue	Not at Risk
Fringed Myotis	<i>Myotis thysanodes</i>	Blue	Vulnerable
Great Basin Pocket Mouse	<i>Perognathus parvus</i>	Blue	Not at Risk
Northern Long-Eared Myotis	<i>Myotis septentrionalis</i>	Blue	Not at Risk
Nuttall's Cottontail	<i>Sylvilagus nuttallii</i>	Blue	Vulnerable
Spotted Bat	<i>Euderma maculatum</i>	Blue	Vulnerable
Townsend's Big-Eared Bat	<i>Corynorhinus townsendii</i>	Blue	Not at Risk
Western Harvest Mouse	<i>Reithrodontomys megalotis</i>	Blue	Vulnerable
Western Small-Footed Myotis	<i>Myotis ciliolabrum</i>	Blue	Not at Risk
Reptiles			
Night Snake	<i>Hypsiglena torquata</i>	Red	Not at Risk
Gopher Snake, Deserticola	<i>Pituophis catenifer</i>	Blue	Not at Risk
Painted Turtle	<i>Chrysemys picta</i>	Blue	Not at Risk
Racer	<i>Coluber constrictor</i>	Blue	Not at Risk
Rubber Boa	<i>Charina bottae</i>	Blue	Not at Risk
Western Rattlesnake	<i>Crotalus viridis</i>	Blue	Not at Risk
Amphibians			
Tiger Salamander	<i>Ambystoma tigrinum</i>	Red	Not at Risk
Tailed Frog	<i>Ascaphus truei</i>	Red	Not at Risk
Northern Leopard Frog	<i>Rana pipiens</i>	Red	Endangered
Great Basin Spadefoot	<i>Spea intermontana</i>	Blue	Vulnerable