Southern Lakes
Terrestrial Environment Baseline Studies
2010 Terrestrial and Aquatic Mammal Surveys

(Photo: L. Turney)

Prepared for:

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and
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March 2012

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April 3, 2012

Hector Campbell
Director, Resource Planning & Regulatory Affairs
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Dear Hector:

Project No: 60146345 – Task 2.4.3 and 2.4.4

Regarding: Marsh Lake Fall-Winter Storage Concept – 2010 Terrestrial and Aquatic Mammal Surveys

Please find attached the above noted report prepared by Ardea Biological Consulting on behalf of AECOM.

We trust this report meets your current needs. If you have any questions regarding this report, or if we can be of further assistance, please do not hesitate to contact the undersigned.

Sincerely,
AECOM Canada Ltd.

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OM:om
Encl.
cc:

Executive Summary

Terrestrial baseline studies for terrestrial and aquatic mammals were completed in the Southern Lakes area during 2010. The purpose of this work was to determine the presence of aquatic and terrestrial mammal species and identify critical habitats used by mammals within the study area. These surveys were initiated in March 2010 and included aerial, boat, and ground-based surveys. Aerial surveys encompassed the Southern Lakes Study Area, while ground and boat based surveys focussed on wetland habitats in five main areas: Lewes Marsh/M'Clintock Bay, Monkey Creek wetland, 6-mile wetland, Tagish Narrows wetlands and Nares Lake.

Aerial surveys were conducted in monthly from March to July and in September and October 2010 to document seasonal wildlife use of the study area. We observed a total of 19 terrestrial and aquatic mammals species or found evidence of use by the species. Three of these species, woodland caribou, grizzly bear and wolverine are listed species within B.C., Yukon and Canada (COSEWIC 2010, Cannings and Jung 2010, BC CDC 2011). As well, the Dall's sheep are also listed in B.C. (BC CDC 2011). Wolverine sign was noted once during the 2010 surveys in a coniferous forest adjacent to Lewes Marsh, while Dall's sheep were observed in higher elevation slopes to the north of Nares Lake. Observations of woodland caribou and grizzly bear were more widespread within the study area, although the number of detections were limited in number.

Beaver, muskrat and moose were more commonly observed during both aerial and ground field surveys. Moose and evidence of moose were noted throughout the survey area. Willow habitats associated with many of the survey wetlands were noted to have relatively high levels use by moose. In particular, Lewes Marsh was identified as having a high level of use by moose. Evidence of muskrat and beaver were also noted numerous times throughout the surveys, but were most concentrated along Marsh Lake and within Lewes Marsh respectively.

Other species recorded during the 2010 field surveys included mountain goat, Stone's sheep, black bear, grey wolf, coyote, red fox, lynx, northern river otter, short-tailed weasel, porcupine, snowshoe hare, red squirrel and arctic ground squirrel. Many of these species were only noted a limited number of times.

Suggested Citation:

Macleod, A. and L. Turney. 2012. Southern Lakes Terrestrial Environment Baseline Studies - 2010 Terrestrial and Aquatic Mammal Surveys. Unpublished report prepared for AECOM Canada Ltd. and Yukon Energy Corporation by Ardea Biological Consulting Ltd., Smithers, BC. 15 pp. + appendices.

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Acknowledgements

This work was made possible with the support of the AECOM Whitehorse staff; Forest Pearson, Kathleen Woods and Kai Woloshyn; who supported our broad program of terrestrial studies within AECOM and with Yukon Energy Corporation. We would like to thank Cole Hodinski of Horizon Helicopters, who along with Patrick Stephens, Ben Drury and Paul Rossett, were excellent pilots providing safe and professional services during the aerial surveys. We would also like to thank Joel MacFabe, for his help boating us around during our field work and his great spotting of wildlife while on the water. Finally, the authors would like to thank the other members of the field team; Frank Doyle, Anne-Marie Roberts, Lis Rach, Patrick Williston, Graeme Turney and Gareth Doyle, for their excellent work on the wildlife studies, providing invaluable notes and observations during their work on this project.

Disclaimer

This report has been prepared by the authors under the direction of Ardea Biological Consulting Ltd. (Ardea) for Yukon Energy Corporation and AECOM Canada Ltd. (the Clients) to provide baseline ecological information for the Marsh Lake Water Storage Concept. The information contained in this report have been obtained and prepared in accordance with generally accepted biological survey standards and is intended for the exclusive use of the Clients. The information contained in this report is dependent on the conditions at the time and any recommendations or conclusions are based on the author's best judgement at the time of preparation. The Clients acknowledge that ecological conditions can change over time and that the conclusions and recommendations outlined in this report are time sensitive.

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INTRODUCTION

Yukon Energy Corporation (YEC) has engaged AECOM Canada Ltd. (AECOM) to assist with implementation of key energy development and enhancement projects as identified in YEC's 20-Year Resource Plan. One of the proposed projects is the Marsh Lake Storage Concept, which proposes to apply to the Yukon Water Board to increase the winter full supply level by 0.3 m and lower the low supply level by 0.1 m to increase winter flows downstream to the Whitehorse Rapids Generating Station. The concept would use the existing Lewes Dam control structure to release water from November to early May, which would be the same as the current release regime.

Ardea Biological Consulting Ltd. (Ardea) was contracted by AECOM to complete terrestrial baseline studies within Marsh Lake, Tagish Lake, Nares Lake and Bennett Lake, which comprise the Southern Lakes area. As part of the terrestrial baseline environment studies, terrestrial and aquatic mammal surveys were initiated in March 2010 and included aerial, boat and ground-based surveys. The main purpose of this work was to determine the presence of aquatic and terrestrial mammal species and identify critical habitats used by mammals within the study area. Surveys were team effort with surveys conducted by Laurence Turney (Ardea), Frank Doyle (Wildlife Dynamics Consulting), Anne Macleod (Sialia Biological Consulting), Lis Rach (TerraNiche Environmental Solutions) and Anne-Marie Roberts (A. Roberts Ecological Consulting). Technical assistance during the summer field program was provided by Gareth Doyle, Graeme Turney and Joel MacFabe.

This report provides the methodology and results of the 2010 surveys for terrestrial and aquatic mammals in the Southern Lakes Study Area.

STUDY AREA

The Southern Lakes Study Area for the 2010 field studies is situated within the Yukon River watershed and extends along the Yukon River south of Whitehorse, into Marsh Lake, Tagish Lake and Bennett Lake, but does not extend into Atlin Lake. It includes the rivers, lakes, shorelines and major adjacent wetlands bodies in both the Yukon and Northern British Columbia that are influenced by the fluctuating water levels found in these water bodies (Figure 1).

The Southern Lakes Study Area is located largely within the Yukon Southern Lakes Ecoregion; however, southern portions of the study area also overlap the Yukon-Stikine Highlands Ecoregion (YEWG 2004) and the Boreal Mountains and Plateaus Ecoregion of British Columbia (Demarchi 1995). The majority of the study area is located within the rain shadow of the St. Elias and Coast Mountains and is therefore a relatively dry region with precipitation averaging 200 to 325 mm annually (YEWG 2004). Mean annual temperatures are -1^{o} C to -2^{o} C across most of this area, with mean temperatures in July ranging from 12^{o} C to 14^{o} C and mean temperatures in January averaging about -21^{o} C (YEWG 2004). The south-western section of the study area around Carcross and Bennett Lake is within the Yukon Stikine Highlands Ecoregion and the southern portions of Tagish Lake, which is within the BC Boreal Mountain and Plateaus Ecoregion and is heavily influenced by Pacific maritime weather systems. This area receives moderate levels of precipitation and slightly cooler annual temperatures than the rest of the study area. Average annual rainfall reported for Atlin is 192.5 mm and average snowfall is 154.8 cm. Summer day temperatures average 13° C to 17° C and winter temperatures range between -10 °C and -20 °C (Environment Canada 2010).

The study area is characterized by broad glacial valleys with several large lakes and rivers traversing the valley floors. It lies in a sporadic discontinuous permafrost zone, where permafrost underlies less than 25% of the landscape. Soils tend to be alkaline and wetlands are

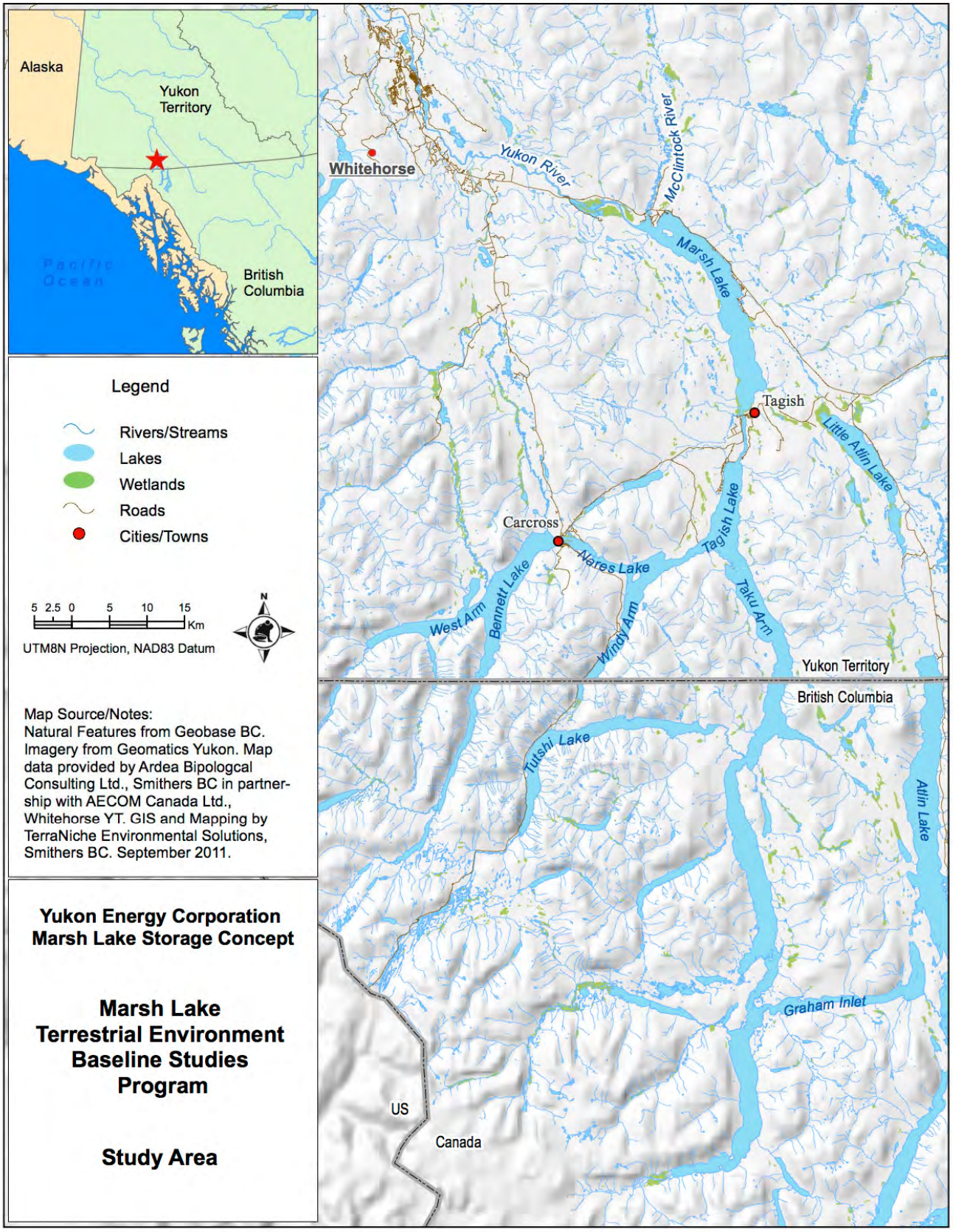

Figure 1. Southern Lakes study area.

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mainly fens (YEWG 2004). Vegetation within this area is dominated by coniferous forests of white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta*). Portions of the study area also encompass large wetlands dominated by willows and/or sedges.

METHODS

Baseline surveys for terrestrial and aquatic mammals conducted in the Southern Lakes Study Area in 2010 included aerial surveys, standardized ground plots, ground-based transects, boat transects and incidental observations. With the exception of the aerial surveys which encompassed the major lakes and wetlands within the study area, the ground and boat based field surveys focussed on five main wetland areas: Lewes Marsh and M'Clintock Bay, Monkey Creek wetlands, 6-mile wetlands, Tagish Narrows wetlands, and Nares Lake. These areas were selected because they contain a significant amount of wetland habitat which is expected to be one of the habitat types most affected by the proposed project.

Aerial Surveys

Aerial surveys of the Southern Lakes Study Area were conducted using a R-44 helicopter following standards outlined by the B.C. Resource Inventory Standards Committee for aerial surveys for ungulates and aquatic mammals (RIC 1998b and RIC 2002). The helicopter was flown at speeds of 60 to 90 km/h at a height of 75 to 100 m above the water. A minimum of two observers were present along with the pilot to search for wildlife or wildlife sign (e.g. tracks, lodges/dens, etc.) on or adjacent to the helicopter flight path. The helicopter flew along the shoreline of the lakes and over the major wetlands outlined above. Whenever animals were observed, their location was marked with a GPS and information was collected on the species, number, age group, sex, activity and habitat type. Surveys were conducted to minimize disturbance, therefore detailed counts of males vs. females were only obtained when disturbance could be minimized.

Ground and Water Based Surveys

A number of ground and water based survey techniques were used in conjunction with the aerial surveys to provide additional information on mammal use within the selected wetland complexes in Marsh and Tagish Lakes. These surveys were aimed at identifying habitat use (e.g. evidence of foraging, tracks, scat, etc.) and wildlife habitat features (e.g. dens, trails, etc.) that would not be possible to detect during the aerial surveys. The intent was to determine the extent of habitat use and identify critical habitat uses or areas, where possible, in these wetland areas.

Wildlife Habitat Assessments

Wildlife Habitat Assessment (WHA) plots consisted of 20 x 20 m plots in which data were collected on evidence of use by wildlife, habitat suitability ratings for focal species, and information on some of the local habitat attributes (particularly tree and coarse woody debris layers). The WHA plots were generally completed in conjunction with vegetation plots for the wetland vegetation community mapping and additional information on the vegetation and ecosystems present are available from the mapping and associated report. The focal species selected for the habitat suitability rating portion of the WHA plots were moose (*Alces alces*), woodland caribou (*Rangifer tarandus*), grizzly bear (*Ursus arctos*), and American marten (*Martes americanus*). The data collected on suitability can be used in conjunction with the wetland mapping to produce wildlife habitat suitability maps for the focal species in the future. Table 1 outlines the life requisites and the seasons that were assessed for each of the focal species. Survey methods for the WHA plots followed standardized methodologies outlined in the *British Columbia Wildlife Habitat Rating Standards* (RIC 1999) and the *Field Manual for*

Describing Terrestrial Ecosystems (MOELP and MOF 1998). Standardized wildlife habitat assessment forms (from the B.C. Provincial FS882 series) were used to record data.

Table 1. Species, life requisites and seasons for which suitability ratings were collected in the Southern Lakes Study Area, 2010.

Species Name	Latin Name	Life Requisites Assessed	Seasons Assessed
Moose	*Alces alces*	Living	Spring, Summer, Fall, Winter
Caribou	*Rangifer tarandus*	Living	Spring, Summer, Fall, Winter
Grizzly Bear	*Ursus arctos*	Living	Spring, Summer, Fall
American Marten	*Martes americanus*	Living	Spring, Winter

Ground and Boat Transects

Ground-based and boat transects consisted of reconnaissance-level wildlife encounter transects of unlimited width completed either by foot or by boat (canoe or zodiac) were undertaken using standardized methods (RIC 1998a). Two or more observers were present to search for evidence of wildlife along the transect. Whenever wildlife or wildlife sign was observed, their location was marked with a GPS and information was collected on the species, number, age group, sex, activity and habitat type.

Incidental Observations

Incidental observations of wildlife species were made while traveling to wetland areas by boat, car or by foot, or while conducting other dedicated assessments (e.g. wetland vegetation mapping). All incidental observations of any mammals encountered during other aspects of the fieldwork included recording the species observed, the number and sex of individuals, a UTM location, the date observed and any activity or behavioural information.

RESULTS

Aerial Surveys

We conducted seven flights within the Southern Lakes Study Area between March and October 2010 (Table 2 and Table 3). Marsh Lake, northern Tagish Lake and Nares Lake were surveyed in all survey periods to provide seasonal comparison data, while other portions of the Southern Lakes were surveyed during the majority of the survey periods when weather and time constraints allowed. Maps outlining the survey timing and a typical flight line for the aerial surveys within the Southern Lakes Study Area is outlined in Appendix A.

Table 2. Timing, observers and length of aerial terrestrial and aquatic mammal survey flights.

Survey Date	Observers	Start Time	End Time	Approximate Survey Length
24-Mar-10	L. Turney, F. Doyle	09:20	13:00	483 km
27-Apr-10	L. Turney, F. Doyle	09:25	15:00	543 km
14-May-10	L. Turney, F. Doyle, AM Roberts	08:42	14:55	494 km
8-Jun-10	L. Turney, L. Rach, AM Roberts	06:20	11:06	289 km
23-Jul-10	L. Turney, F. Doyle, AM Roberts	09:25	12:20	269 km
23-Sep-10	L. Turney, AM Roberts	11:55	16:18	369 km
18-Oct-10	L. Turney, F. Doyle	09:25	14:55	521 km

Table 3. Aerial terrestrial and aquatic mammal survey areas in 2010.

Survey Area	Survey Section	Mar. 24	Apr. 27	May 14	Jun. 08	Jul. 23	Sep. 23	Oct. 18
Yukon River	Yukon River	■		■	■			■
Lewes Marsh	Lewes Marsh	■	■	■	■		■	■
Lewes River	Yukon River - Lewes	■	■	■	■		■	■
M'Clintock	M'Clintock Bay	■		■	■	■	■	■
M'Clintock	M'Clintock River		■					
Marsh Lake	North Marsh Lake	■	■	■	■	■	■	■
Marsh Lake	North Marsh Lake East	■	■	■		■	■	■
Marsh Lake	North Marsh Lake West	■	■	■	■		■	■
Marsh Lake	Mid-Marsh Lake East	■	■	■	■	■	■	■
Marsh Lake	Mid-Marsh Lake West	■	■	■	■	■	■	■
Marsh Lake	South Marsh Lake	■	■	■	■	■	■	■
Tagish River	Tagish River	■	■	■	■	■	■	■
Tagish Lake	Tagish Lake - North	■	■	■		■	■	■
Tagish Lake	Taku Arm - North	■	■	■		■	■	■
Tagish Lake	Talaha Bay	■	■	■	■	■	■	■
Tagish Lake	Taku Arm - Middle	■	■	■				■
Tagish Lake	Taku Arm - Deep Bay	■	■	■				■
Graham Inlet	Graham Inlet	■		■				■
Tagish Lake	Taku Arm - South		■					
Tagish Lake	Tagish Lake - West	■	■	■	■	■	■	■
Tagish Lake	Windy Arm		■	■				
Nares Lake	Nares Lake	■	■	■	■	■	■	■
Bennett Lake	Bennett Lake	■	■		■			

We observed 10 mammal species during the 2010 aerial surveys: beaver, muskrat, river otter, moose, woodland caribou, Dall's sheep, Stone's sheep, mountain goat, coyote and grizzly bear (Appendix B).

Late Winter Survey

The March 24th aerial survey focussed on documenting animal distributions and habitat use in the Southern Lakes Study Area in late winter. The survey covered the Yukon River from Whitehorse south through Lewes Marsh, Marsh Lake, the Taku Arm of Tagish Lake to Graham Inlet, Graham Inlet, Nares Lake and the northern section of Bennett Lake. Seven moose were seen during the survey (five along Tagish Lake and two at Graham Inlet) in wetland and lakeshore habitats. Moose tracks were also noted in several areas with high densities of tracks noted in a wetland off Tagish Lake and along the shoreline of Graham Inlet. Caribou tracks were observed twice during the survey: two sets of tracks were noted in a spruce-pine forest at Talaha Bay on Tagish Lake, and numerous sets of caribou tracks were observed on both sides of the Yukon River approximately 3 to 3.5 km downstream of the highway bridge crossing the Yukon River downstream of Lewes Marsh.

The March survey also allowed documentation of late winter ice conditions within the Southern Lakes Study Area. On March 24th, the only large areas free of ice were the Yukon River from Whitehorse to Marsh Lake (including parts of Lewes Marsh), the Tagish River (from the Tagish Narrows through to the north end of Tagish Lake), and at Nares/Carcross. The remainder of the major lakes within the Southern Lakes area were completely covered in ice (Figure 2). We also

noted that along Graham Inlet, the ice had dropped approximately 1 to 1.5 m over the winter, creating a sloping shelf angled at less than 10 degrees.

Figure 2. Late winter conditions in the Southern Lakes Study Area on March 24, 2010, showing ice cover on Tagish Lake (Left) and open water at Carcross (Right).

Spring Surveys

During the aerial survey on April 27th, we surveyed the entire Southern Lakes Study Area from Lewes Marsh and Marsh Lake, down the Taku Arm of Tagish Lake to the Swanson River, along Graham Inlet, Nares Lake and all of Bennett Lake. This primary purpose of this early spring survey was to document the presence of muskrat through the location of their push-ups. Push-ups are mounds of vegetation on the ice, which muskrats have brought up from under the ice and create an area under the snow for resting and feeding in the winter.

We observed over 100 muskrat push-ups in 20 locations in the study area, with approximately 85% of the push-ups located along the shoreline of Marsh Lake. Seven beaver lodges and several dams were identified, and a high level of beaver sign was observed throughout Lewes Marsh. We also observed a river otter running along the ice at the south end of Marsh Lake. Eight moose were observed during the flight, seven in the Lewes Marsh area and one along Taku Arm of Tagish Lake; all observed moose were foraging in wetland habitats. We also observed more than 20 sets of ungulate tracks, likely caribou, crossing Tagish Lake about mid-way down Taku arm. Four mountain goats were seen on rocky outcrops above the southern-most section of Tagish Lake. Bear tracks were noted on the ice at Bennett Lake and on the beach along the north end of the Taku Arm of Tagish Lake.

On April 27th, the rivers in the Southern Lakes Study Area were mostly open, and many of the larger creeks had large open leads where they entered the lakes. Most of the larger lakes within the study area were still frozen over but the ice was getting noticeably thinner and openings were present along some shorelines and in shallower waters. Many of the smaller ponds and wetlands in upland areas adjacent to Marsh, Tagish and Bennett Lakes were free of ice and most of the snow had disappeared from the valley bottoms and the south and east-facing slopes (Figure 3).

The May 14th survey was conducted within along the Yukon River downstream of the control structure, Lewes Marsh, Marsh Lake, the Taku Arm of Tagish Lake to Graham Inlet, Graham Inlet, the northern section of the Windy Arm of Tagish Lake, and Nares Lake. Six beaver lodges were noted during the survey and eight beaver were observed swimming in lake and river habitats, most of these were in Lewes Marsh and along the Yukon River downstream of Lewes

Figure 3. Early spring ice conditions in the Southern Lakes Study Area on April 27, 2010, showing Lewes Marsh (Left) and Marsh Lake at 6-Mile wetland (Right).

Marsh. Surveyors observed a pair of coyotes running along the shoreline of Lewes Marsh and two grizzly bears foraging in open shrubby or herbaceous slopes on the west side of Taku arm of Tagish Lake. We observed four moose foraging in wetland habitats within Lewes Marsh, a single female caribou was seen walking along the shoreline of Nares Lakes, and a group of 2 adult females and 2 yearling caribou were travelling along the beach near Deep Bay on the Taku Arm of Tagish Lake. We observed a group of 8 adult Dall's sheep walking along an open hillslope on the north side of Nares Lake, and two groups of Stone's Sheep (one with 5 adults and one with 11 adults and 4 lambs) were seen on south-facing slopes above Graham Inlet. During a stop at Monkey Creek on Marsh Lake we observed a muskrat swimming in a small pond between the beach and the inland wetland as well as a muskrat den on the edge of the small pond.

By the May 14 survey in the Southern Lakes Study Area, the ice had melted from most of the rivers, creeks and wetlands, and from large sections of the lakes. The shoreline of most of the large lakes had melted and the remaining ice was floating free in middle of the lakes, often pushed to one end of the lake by winds. In general, the southern sections of the study area had more ice present on the lakes than the northern areas (Figure 4).

Figure 4. Spring ice conditions in the Southern Lakes Study Area on May 14, 2010, showing open water and ice pans north end of Marsh Lake (Left) and Nares Lake (Right).

The survey on June 8th encompassed Lewes Marsh, Marsh Lake, the Taku Arm of Tagish Lake down to Talaha Bay, Nares Lake, the north end of Bennett Lake, and Crag Lake. The only mammals we observed during this survey was beaver. With the exception of one beaver seen swimming in Talaha Bay of Tagish Lake, all beaver observations made during the June survey were in Lewes Marsh. There was no ice or snow remaining in the valleys by the June 8 survey.

Summer Survey

On the July 23rd aerial survey we assessed the area from Marsh Lake down to Talaha Bay on the Taku Arm of Tagish Lake, and then west to Nares Lake. We observed a single moose walking through wetland habitats along the southern end of Marsh Lake. An additional beaver lodge not noted during previous surveys was noted in a small inlet off Marsh Lake. We also located a mineral lick used by Dall's sheep on a slope... (location details removed).

Fall Surveys

The September 23rd aerial survey documented fall distributions and habitat use by mammals in Lewes Marsh, Marsh Lake, the Taku Arm of Tagish Lake, and Nares Lake. Other than beaver lodges previously noted in other surveys, the only mammals we observed during this survey were two moose seen walking through wetland habitats in Lewes Marsh.

The final aerial for 2010 occurred on October 18th and covered the Yukon River from Whitehorse south through Lewes Marsh, Marsh Lake, the Taku Arm of Tagish Lake to Graham Inlet, Graham Inlet, and Nares Lake. During this survey we observed a group of 34 Stone's sheep on rocky outcrops on the north side of Graham's Inlet. No other new mammal observations were made during this survey.

Ground and Water Based Surveys

Wildlife Habitat Assessments

We completed a total of 30 WHA plots within the Southern Lakes Study Area during July 2010. Most of these plots were conducted in wetland habitats; however, a few were located in terrestrial habitats adjacent to focal wetlands. The locations of the 2010 WHA plots are outlined in Appendix C. The WHA surveys documented evidence of use by several mammal species including arctic ground squirrel, beaver, grey wolf, grizzly bear, lynx, moose, porcupine, red fox, red squirrel, snowshoe hare, wolverine and woodland caribou. We assessed vegetation communities for habitat suitability and identified moderately-high value feeding habitat for moose and grizzly bear within some of the wetlands, high value habitat for marten in some forested habitats adjacent to some wetlands, but generally low to moderate habitats for caribou within the wetlands (Table 4).

Table 4. Summary of habitat suitability ratings for focal mammal species documented in WHA plots.

Species Name	Summary of Habitat Suitability Ratings
Woodland Caribou	Most of the WHA plots completed in 2010 rated caribou habitat as very low to moderate within wetland vegetation communities. Only one moderately-high value habitat was identified in a coniferous forest adjacent to Lewes Marsh due to a moderate amount of terrestrial and arboreal lichens. No high value habitats were located.
Moose	Suitability ratings collected for moose ranged from very low to moderately-high. Moderately-high value habitats identified for moose generally consisted of willow-dominated habitats in close proximity to mature forest.

Species Name	Summary of Habitat Suitability Ratings
American Marten	Most of the 2010 WHA plots were completed in wetland habitats – some of these areas provided good foraging opportunities for marten, but most did not provide the forest structure (i.e. large trees and coarse woody debris) required for reproductive dens and winter survival. Some high value marten habitat was identified in forested habitats adjacent to the wetlands.
Grizzly Bear	No high value habitats were identified for grizzly bear during the 2010 WHA surveys. However, a few moderately-high value habitats were documented for spring feeding – these generally consisted of wetland habitats with larger components of horsetails, sedges and other herbaceous plants.

Ground and Boat Transects

We completed 31 boat-based and 55 ground-based transects, which totalled approximately 62.3 km and 41.8 km respectively during the 2010 surveys within the focal wetlands in the study area (Appendix C). We observed evidence of muskrat, beaver, porcupine, snowshoe hare, short-tailed weasel, red fox, grey wolf, black bear, moose and caribou use of wetland and adjacent forested habitats. Beavers and their sign were the most common species observed with several beaver lodges and numerous trails and feeding areas identified (Table 5).

Table 5. Summary of wildlife sign and animals observed during ground and boat transects.

Species	# Sign	# Animals	Total
Beaver	45	5	50
Black Bear	1	1	
Caribou	5	5	
Grey Wolf	2	2	
Moose	16	3	19
Muskrat	10	5	15
Porcupine	1		1
Red Fox	1	1	
Short-tailed Weasel		6	6
Snowshoe Hare		2	2
Unspecified Bear	7	1	8
Unspecified Mustelid	3		3

Incidental Observations

Numerous incidental observations were made during the course of the 2010 fieldwork. These observations documented the presence and habitat use of several different wildlife species including: red squirrel, snowshoe hare, porcupine, beaver, muskrat, grey wolf, black bear, moose, and woodland caribou.

DISCUSSION

We documented 19 mammal species during the 2010 field surveys within the Southern Lakes Study Area (Table 6), with the majority of the species observed rather than inferred through sign.

Table 6. Terrestrial and aquatic mammals detected at within the Southern Lakes Study Area during the 2010 field surveys

Common Name	Scientific Name	Common Name	Scientific Name
Arctic Ground Squirrel	*Spermophilus parryii*	Northern River Otter	*Lutra canadensis*
Beaver	*Castor canadensis*	Porcupine	*Erethizon dorsatum*
Black Bear	*Ursus americanus*	Red Fox	*Vulpes vulpes*

Common Name	Scientific Name	Common Name	Scientific Name
Coyote	*Canis latrans*	Red Squirrel	*Tamiasciurus hudsonicus*
Grey Wolf	*Canis lupus*	Short-tailed Weasel (Ermine)	*Mustela erminea*
Grizzly Bear	*Ursus arctos*	Snowshoe Hare	*Lepus americanus*
Lynx	*Lynx canadensis*	Thinhorn Sheep	*Ovis dalli*
Moose	*Alces alces*	Wolverine	*Gulo gulo*
Mountain Goat	*Oreamnos americanus*	Woodland Caribou	*Rangifer tarandus*
Muskrat	*Ondatra zibethicus*		

Species of Concern

Of the species observed during the 2010 field surveys within the Southern Lakes Study Area, three are listed as species of conservation concern within the Yukon and/or Canada. All three, woodland caribou, grizzly bear and wolverine, have been listed by the Committee on the Status of Endangered Wildlife in Canada (COSWIC) as **Species of Special Concern** (COSEWIC 2010). At the territorial and provincial level, species experts have ranked these three species as **Sensitive** in the Yukon (Cannings and Jung 2010) and as **Blue** (Species of Concern) in B.C. (BC CDC 2011). Additionally, the Dall's subspecies of thinhorn sheep are also **Blue**-listed in B.C. (BC CDC 2011) (Table 7). In addition to the COSEWIC and provincial / territorial species listings, we also reviewed the Candidate Wildlife Species list for species that have not yet been assessed but are suspected of being at some risk. None of the species observed within the Southern Lakes Study Area are included on the COSEWIC Candidate Wildlife Species list (COSEWIC 2011).

Table 7. Status of Species of Conservation Concern Detected within the Southern Lakes Study Area.

Species	COSEWIC Status[1]	Yukon Ranking[2]	B.C. Ranking[3]
Dall's Sheep	--	--	Blue
Grizzly Bear	Special Concern	Sensitive	Blue
Wolverine	Special Concern	Sensitive	Blue
Woodland Caribou	Special Concern	Sensitive	Blue

Notes: [1] COSEWIC (2010); [2] Cannings and Jung (2010); [3] BC CDC (2011)

Ungulates

We documented moose, woodland caribou, mountain goats and both Dall's and Stone's thinhorn sheep during the 2010 surveys in the Southern Lakes Study Area (Appendix D).

Observations relating to mountain goats and thinhorn sheep were limited during the survey period. Mountain goats were only observed once when 4 goats were seen on cliff habitats above the southern end of Tagish Lake. Dall's Sheep were also only noted once when a group of 8 sheep were seen (location details removed) during the May aerial survey. Stone's Sheep were documented on the north slope of Graham Inlet during both the May and October aerial surveys: in May two groups of sheep totalling 16 adults and 4 lambs were observed, and in October a group of 34 sheep were recorded.

We noted woodland caribou several times during the 2010 surveys. The March aerial survey noted several sets of caribou tracks in a spruce-pine forest off Talaha Bay on Tagish Lake, and

numerous sets of caribou tracks on both sides of the Yukon River approximately 3 to 3.5 km downstream of the highway bridge crossing the Yukon River at Lewes Marsh. The April aerial survey observed numerous sets of ungulate tracks (more than 20 individuals), likely caribou, crossing Tagish Lake about mid-way down Taku arm. During the May aerial survey we noted a single female walking along the shoreline of Nares Lakes, and a group of 2 adult females and 2 yearlings travelling along the beach near Deep Bay in Tagish Lake. Additionally, during WHA plots and reconnaissance transects, caribou tracks were noted along the beach at Monkey Beach, caribou pellets were recorded in Lewes Marsh, and several piles of pellets were seen along with evidence of foraging on lichen in a coniferous forest adjacent to Lewes Marsh. Habitat suitability ratings collected during WHA plots rated the surveyed habitats for their value to caribou during the spring, summer, fall and winter seasons. Most of the plots rated caribou habitat as very low to moderate; however, the plots were mostly located in wetland habitats, which generally only provide high value forage for caribou in the spring when caribou will feed on sedges and other herbaceous plants. One moderately-high value habitat was identified during these surveys in a coniferous forest adjacent to Lewes Marsh that contained a moderate amount of terrestrial and arboreal lichens.

Moose were one of the most commonly documented species during the 2010 field surveys, with sign observed in nearly all of the focal wetlands and high amounts of moose sign noted in some areas. In particular, portions of Lewes Marsh showed evidence of heavy use by moose. Several of the aerial surveys observed moose foraging in Lewes Marsh, with 7 moose seen there during the April survey, 4 seen in May and 2 observed in September. A possible area where moose were crossing Taku Arm was noted just north of Graham Inlet. Habitat suitability ratings were collected for moose for the spring, summer, fall and winter seasons. The surveyed habitats ranged from very low to moderately-high, with moderately-high value habitats generally consisting of willow-dominated habitats in close proximity to mature forest.

Carnivores

Grizzly bear and their sign were detected several times during the 2010 surveys. We observed grizzly bears twice during the May aerial survey, with bears foraging and travelling along open, south-facing slopes above the Taku arm of Tagish Lake (Figure 5). Grizzly bear sign was noted during WHA plots conducted in wetland habitats within Lewes Marsh. Habitat suitability ratings collected during the WHA plots rated identified habitats as very low to moderately-high value for grizzly bears during the spring, summer and fall seasons. Moderately-high value habitats were identified only for spring feeding; these generally consisted of wetland habitats with larger components of horsetails, sedges and other herbaceous plants.

Figure 5. Grizzly bear on open slope above Tagish Lake.

Several other large and mid-sized carnivore species were detected during field surveys within the Southern Lakes Study Area, but most species were only detected once or twice. Wolverine was documented once when scat was found at a WHA plot located in a mature forest just above Lewes Marsh. Lynx was also documented only once when a WHA plot in mature forest adjacent to Lewes Marsh located scat. Tracks and scat from grey wolf were noted several times during surveys at Nares Lake and at Monkey Beach. Coyote was noted once when a pair of coyotes

were observed playing along the shoreline in Lewes Marsh during the May aerial survey. Red fox was detected once when tracks were noted during a WHA plot at Monkey Beach, and black bear was detected once when tracks were noted beside a small pond at 6-mile wetland.

Aquatic Mammals

Beaver, muskrat and northern river otter were all detected during field surveys in the Southern Lakes Study Area. River otter was only detected once when a single otter was observed running across the ice on Marsh Lake during the April aerial survey. Both muskrat and beaver were noted numerous times throughout the study period in various locations within study area, although most often in Marsh Lake.

Muskrat were observed primarily in Marsh Lake, with 86 push-ups observed in 17 locations along the shoreline of Marsh Lake during the April aerial survey. Push-ups in Marsh Lake appeared to be associated with shallow beach habitats, where it is assumed muskrat are able to access under-ice vegetation. A small number of push-ups were also observed in Nares Lake and in a wetland complex/bay on the east side of Taku Arm in Tagish Lake. Ground and boat surveys conducted in May, June and July also found evidence of muskrat including tracks, dens and tunnels in Lewes Marsh and Monkey Beach wetland (Appendix D). Figure 6 provides examples of muskrat habitat observed at Monkey Beach on Marsh Lake.

Figure 6. Muskrat habitat at Marsh Lake, showing muskrat at Monkey Beach (Left) and habitat near muskrat den at Monkey Beach (Right).

We located a total of 18 beaver lodges in the Southern Lakes Study Area (Appendix D) during the 2010 field work, with 5 identified as active, 3 as inactive and 10 unknown. Beaver lodges, dams and other beaver sign were found across the study area, but were particularly concentrated in Lewes Marsh. Beavers within the study area have adapted to the large fluctuations (range = 3.64 m, average = 2.25 m) on a yearly basis using two strategies. One strategy is to create a series of beaver lodges that have different entrance and interior platform elevations. The beavers then move from lodge to lodge as the water levels change, which could account for the large number of beaver lodges observed where we were unable to determine occupancy. An alternate strategy is to construct linear lodges that extend tens of meters from the high water mark to the low water mark. Figure 7 provides an example of each of these structures found within the study area.

Figure 7. Beaver lodges within the Southern Lakes Study Area. A linear type built upon a beach on Tagish Lake (Left) and a typical, round structure at Tagish Narrows (Right).

Small and Medium-Sized Mammals

Small and medium-sized mammals observed within the Southern Lakes Study Area included arctic ground squirrel, red squirrel, snowshoe hare, porcupine and short-tailed weasel. Most of these species were detected several times throughout the survey period, but none appeared to be abundant within the surveyed areas. It should be noted however, that the field surveys focussed on wetland habitats, which are not extensively used by most of these species.

American marten was selected as one of the focal species for which habitat suitability ratings were collected during the 2010 WHA plots due to its importance for trappers. Most of the WHA plots were completed in wetland habitats; some of these provided good foraging opportunities for marten, but most did not provide the forest structure (i.e. large trees and coarse woody debris) required for reproductive dens and winter survival. Therefore, habitat suitability ratings collected for marten were generally not very high, although some high value marten habitat was identified in forested habitats adjacent to the wetlands. Evidence of marten was not detected during any of 2010 field surveys.

Wildlife Features

Wildlife features such as mineral licks or extensive wildlife trails are important for wildlife as they are places that wildlife will use on a regular basis. We documented numerous wildlife trails within the wetland areas of the Southern Lakes Study Area, but few extended for more than 100 m or so and many appeared to be short segments that avoided deep water channels or ponds, rather than extensive travel corridors. As outlined in the Ungulate section, we did note evidence of both caribou and moose crossing the ice of Taku Arm of Tagish Lake (Appendix D). A mineral lick used by Dall's sheep near (location details removed) and appeared to be well-used (Figure 8).

CONCLUSIONS AND RECOMMENDATIONS

A total of 19 terrestrial and aquatic mammal species were documented during the 2010 surve Three of these species, woodland caribou, grizzly bear and wolverine are listed species within ys. B.C., Yukon and Canada (COSEWIC 2010, Cannings and Jung 2010, BC CDC 2011). As well, the Dall's sheep are also listed in B.C. (BC CDC 2011). Wolverine sign was noted once during the 2010 surveys in a coniferous forest adjacent to Lewes Marsh, while Dall's sheep were observed in higher elevation slopes to the north of Nares Lake. Observations of woodland

Figure 8. Mineral lick observed to be used by Dall's sheep near (photos and location details removed).

caribou and grizzly bear were more widespread within the study area, although the number of detections were limited in number.

Beaver, muskrat and moose were more commonly observed during both aerial and ground field surveys. Moose and evidence of moose were noted throughout the survey area. Willow habitats associated with many of the survey wetlands were noted to have relatively high levels use by moose. In particular, Lewes Marsh was identified as having a high level of use by moose. Evidence of muskrat and beaver were also noted numerous times throughout the surveys, but were most concentrated along Marsh Lake and within Lewes Marsh respectively.

Other species recorded during the 2010 field surveys included mountain goat, Stone's sheep, black bear, grey wolf, coyote, red fox, lynx, northern river otter, short-tailed weasel, porcupine, snowshoe hare, red squirrel and arctic ground squirrel. Many of these species were only noted a limited number of times.

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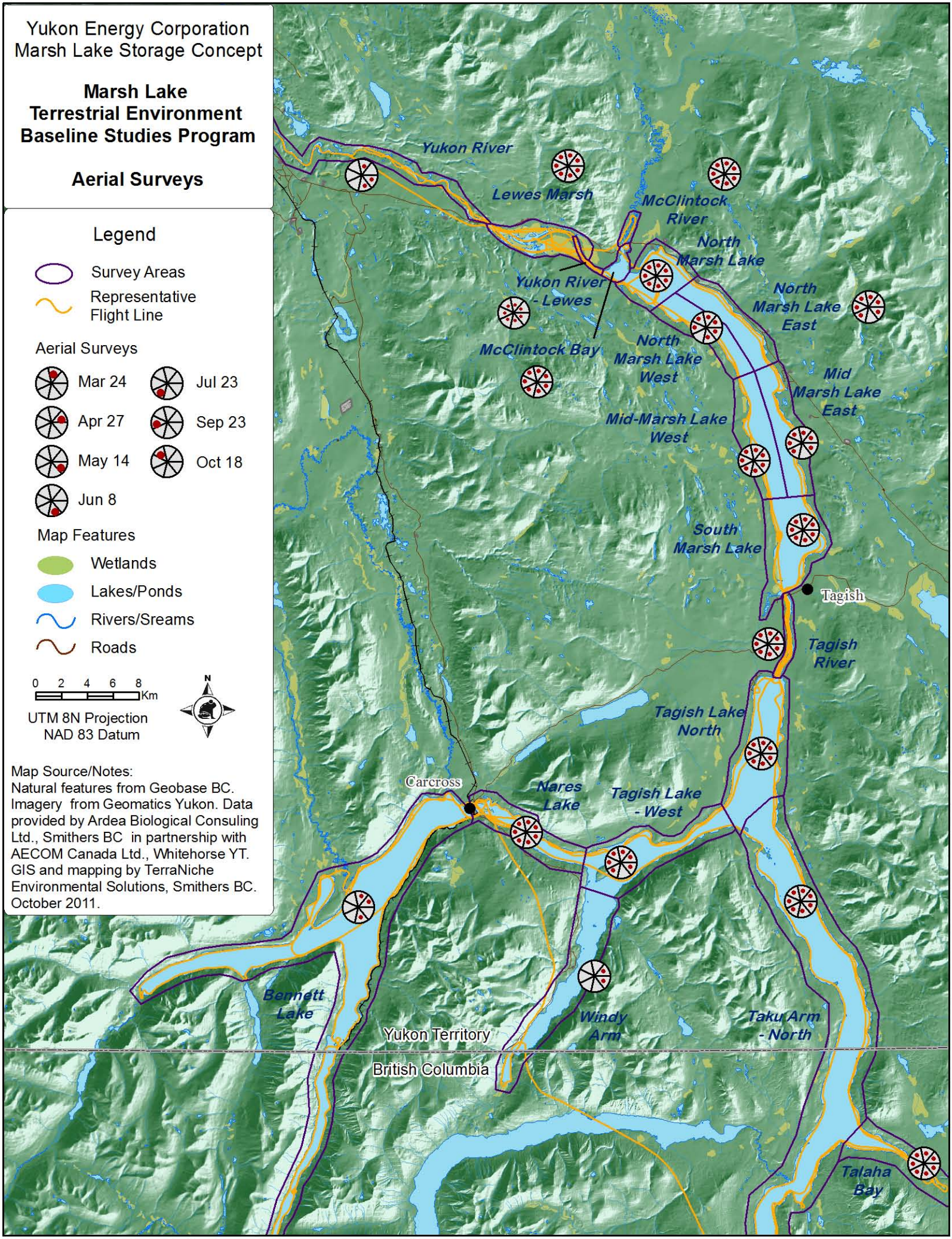
APPENDIX A: TIMING AND EXTENT OF AERIAL SURVEYS IN 2010


Yukon Energy Corporation
Marsh Lake Storage Concept
Marsh Lake
Terrestrial Environment
Baseline Studies Program
Aerial Surveys
Legend
Survey Areas
Representative Flight Line
Aerial Surveys
Mar 24
Apr 27
May 14
Jun 8
Jul 23
Sep 23
Oct 18
Map Features
Wetlands
Lakes/Ponds
Rivers/Sreams
Roads
0 2 4 6 8 Km
UTM 8N Projection
NAD 83 Datum
N
Map Source/Notes:
Natural features from Geobase BC.
Imagery from Geomatics Yukon. Data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT.
GIS and mapping by TerraNiche Environmental Solutions, Smithers BC.
October 2011.
Yukon River
Lewes Marsh
McClintock River
North Marsh Lake
Yukon River - Lewes
McClintock Bay
North Marsh Lake West
North Marsh Lake East
Mid Marsh Lake East
Mid-Marsh Lake West
South Marsh Lake
Tagish
Tagish River
Tagish Lake North
Carcross
Nares Lake
Tagish Lake - West
Bennett Lake
Windy Arm
Taku Arm - North
Yukon Territory
British Columbia
Talaha Bay

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Aerial Surveys

Legend

- Survey Areas
- Representative Flight Line

Aerial Surveys

- Mar 24
- Apr 27
- May 14
- Jun 8
- Jul 23
- Sep 23
- Oct 18

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Sreams
- Roads

0 2 4 6 8 Km

UTM 8N Projection
NAD 83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. October 2011.

APPENDIX B: TERRESTRIAL AND AQUATIC MAMMAL OBSERVATIONS FROM 2010 AERIAL SURVEYS

Survey Date	Waypoint	Species	Observation Type	Activity Type	Number	General Area	Habitat	Comments
03/24/10	4	Woodland Caribou	Sign	Tracks	Abundant	Yukon River	Pine Forest	Tracks abundant on both sides of the river
03/24/10	19	Moose	Visual	Resting	1	Tagish Lake	Wetland	
03/24/10	20	Woodland Caribou	Sign	Tracks	Abundant	Tagish Lake	Beach	
03/24/10	21	Moose	Visual	Resting	1	Tagish Lake	Wetland	
03/24/10	23	Moose	Sign	Tracks	1	Tagish Lake	Lake Ice	Across Tagish Lake
03/24/10	24	Moose	Sign	Tracks	Abundant	Graham Inlet	Lake Ice	High density of tracks
03/24/10	25	Moose	Visual	Resting	2	Graham Inlet	Wetland	
03/24/10	29	Moose	Visual	Resting	3	Tagish Lake	Wetland	
03/24/10	31	Moose	Sign	Tracks	Abundant	Tagish Lake	Wetland	Tracks abundant at ground-water spring-wetland complex
03/24/10	35	Moose	Sign	Tracks	1	Mill Haven Bay	Lake Ice	
04/27/10	43	Moose	Visual	Feeding	6	Lewes Marsh	Wetland	
04/27/10	44	Moose	Visual	Feeding	1	Lewes Marsh	Wetland	
04/27/10	45	Beaver	Sign	Feeding	Abundant	Lewes Marsh	Wetland	Heavy beaver feeding sign throughout Lewes Marsh
04/27/10	46	Muskrat	Sign	Pushup	3	Marsh Lake	River Ice	
04/27/10	47	Muskrat	Sign	Pushup	2	Marsh Lake	River Ice	
04/27/10	48	Muskrat	Sign	Pushup	2	Marsh Lake	Lake Ice	
04/27/10	49	Muskrat	Sign	Pushup	3	Marsh Lake	Lake Ice	
04/27/10	50	Muskrat	Sign	Pushup	2	Marsh Lake	Lake Ice	
04/27/10	51	Muskrat	Sign	Pushup	6	Marsh Lake	Lake Ice	
04/27/10	52	Muskrat	Sign	Pushup	4	Marsh Lake	Lake Ice	
04/27/10	53	Muskrat	Sign	Pushup	3	Marsh Lake	Lake Ice	
04/27/10	54	River Otter	Visual	Running	1	Marsh Lake	Lake Ice	Running in middle of lake on ice
04/27/10	55	Muskrat	Sign	Pushup	3	Marsh Lake	Wetland	
04/27/10	61	Beaver	Sign	Lodge	1	Talaha Bay	Wetland	Beaver dams and lodge

Survey Date	Waypoint	Species	Observation Type	Activity Type	Number	General Area	Habitat	Comments
04/27/10	63	Unspecified Bear	Sign	Tracks	2	Tagish Lake	Lake	Bear tracks on lake
04/27/10	64	Beaver	Sign	Lodge	1	Tagish Lake	Beach	Beaver lodge on gravel shore
04/27/10	65	Unspecified Ungulate	Sign	Tracks	>20	Tagish Lake	Lake Ice	Numerous ungulate tracks across lake; probably caribou
04/27/10	67	Muskrat	Sign	Pushup	6	Tagish Lake	Wetland	
04/27/10	68	Moose	Visual	Feeding	1	Tagish Lake	Wetland	
04/27/10	74	Beaver	Sign	Lodge	1	Tagish Lake	Wetland	Beaver dams and lodge
04/27/10	75	Mountain Goat	Visual	Living	3	Tagish Lake	Cliff	
04/27/10	76	Mountain Goat	Visual	Living	1	Tagish Lake	Cliff	
04/27/10	82	Beaver	Sign	Lodge	1	Tagish Lake	Wetland	Beaver lodge on gravel shore
04/27/10	83b	Beaver	Sign	Dam	2	Tagish Lake	Stream	Dams on stream leading to lake
04/27/10	84	Muskrat	Sign	Pushup	8	Nares Lake	Stream	
04/27/10	85	Muskrat	Sign	Pushup	2	Nares Lake	Lake	
04/27/10	91	Unspecified Bear	Sign	Tracks	1	Bennett Lake	Lake	
04/27/10	104b	Beaver	Sign	Lodge	1	Tagish River	River	Beaver lodge on island
04/27/10	106	Muskrat	Sign	Pushup	12	Marsh Lake	Lake Ice	
04/27/10	107	Muskrat	Sign	Pushup	4	Marsh Lake	Lake Ice	
04/27/10	108	Beaver	Sign	Lodge	1	Marsh Lake	Stream	Beaver lodge and dam; appear abandoned
04/27/10	109	Muskrat	Sign	Pushup	17	Marsh Lake	Lake Ice	
04/27/10	110	Muskrat	Sign	Pushup	4	Marsh Lake	Lake Ice	
04/27/10	111	Muskrat	Sign	Pushup	2	Marsh Lake	Lake Ice	
04/27/10	112	Muskrat	Sign	Pushup	4	Marsh Lake	Lake Ice	
04/27/10	116	Muskrat	Sign	Pushup	3	Marsh Lake	Lake Ice	
04/27/10	117	Muskrat	Sign	Pushup	12	Marsh Lake	Lake Ice	
05/14/10	168	Beaver	Visual	Swimming	3	Yukon River	River	Beaver lodge nearby
05/14/10	171	Beaver	Visual	Swimming	1	Yukon River	River	Beaver lodge nearby

Survey Date	Waypoint	Species	Observation Type	Activity Type	Number	General Area	Habitat	Comments
05/14/10	176	Coyote	Visual	Walking/ Running	2	Lewes Marsh	Wetland	Appeared to be playing along shoreline
05/14/10	176	Beaver	Sign	Lodge	1	Lewes Marsh	Lake	Old lodge
05/14/10	177	Beaver	Visual	Swimming	3	Lewes Marsh	Lake	
05/14/10	178	Beaver	Visual	Swimming	1	Lewes Marsh	Lake	
05/14/10	182	Moose	Visual	Feeding	4	Lewes Marsh	Wetland	
05/14/10	196	Muskrat	Visual	Swimming	1	Marsh Lake	Pond	Monkey Creek
05/14/10	196	Muskrat	Sign	Den	1	Marsh Lake	Pond	Monkey Creek
05/14/10	203	Beaver	Visual	Swimming	1	Tagish Narrows	Lake	Beaver lodge nearby
05/14/10	204	Beaver	Sign	Lodge	1	Tagish Narrows	Shore	
05/14/10	212	Woodland Caribou	Visual	Walking	1	Nares Lake	Shore	Single female caribou
05/14/10	218	Dall's Sheep	Visual	Walking	8	Nares Lake	Non-forested slope	On open mid-lower slope
05/14/10	221	Grizzly Bear	Visual	Feeding	1	Taku Arm	Non-forested slope.	On south-facing slope. As get to BC border more ice on lake.
05/14/10	225	Beaver	Sign	Lodge	1	Atlin Lake	Shore	
05/14/10	231	Beaver	Sign	Lodge	1	Atlin Lake	Lake	
05/14/10	235	Stone's Sheep	Visual	Walking	5	Graham Inlet	Non-forested slope	
05/14/10	236	Stone's Sheep	Visual	Walking	15	Graham Inlet	Non-forested slope	At least 4 lambs in group; lower to upper slope
05/14/10	241	Woodland Caribou	Visual	Walking	4	Windy Arm	Shore	2 adults and 2 yearlings.
05/14/10	242	Grizzly Bear	Visual	Feeding	1	Windy Arm	Non-forested slope	Bear is in herbaceous opening
06/08/10	83	Beaver	Visual	Swimming	1	Lewes Marsh	River	Active lodge nearby
06/08/10	86	Beaver	Visual	Swimming	1	Lewes Marsh	Pond	
06/08/10	89	Beaver	Visual	Swimming	1	Lewes Marsh	Pond	
06/08/10	99	Beaver	Visual	Swimming	1	Lewes Marsh	River	
06/08/10	138	Beaver	Visual	Swimming	1	Talaha Bay	Lake	

Survey Date	Waypoint	Species	Observation Type	Activity Type	Number	General Area	Habitat	Comments
07/23/10	72	Moose	Visual	Walking	1	Marsh Lake	Wetland	
07/23/10	XXX	Ungulate	Feature	Mineral Lick	1	xxx	Non-forested slope	
07/23/10	134	Beaver	Sign	Lodge	1	Marsh Lake	River	
09/23/10	193	Beaver	Sign	Lodge	1	Lewes Marsh	Pond	
09/23/10	195	Moose	Visual	Walking	2	Lewes Marsh	Wetland	
10/18/10	71	Stone's Sheep	Visual	Walking	34	Graham Inlet	Rocky slope	

APPENDIX C: LOCATION OF GROUND SURVEYS AND WHA PLOTS IN 2010

1. Lewes Marsh / McClintock Bay

0 500 1,000 1,500 M

2. Monkey Creek

0 250 500 M

3. Tagish Narrows / 6-Mile

0 500 1,000 M

4. Nares Lake

0 250 500 M

0 2 4 6 8 Km

UTM8N Projection, NAD83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Mammal data from Sialia Biological Consulting, Smithers BC. All other data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. March 2012.

Legend

- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads
- Focal Wetlands
- WHA Plots
- Boat Transect
- Foot Transect

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Aquatic and Terrestrial Mammal Ground Survey Locations

APPENDIX D: UNGULATE OBSERVATIONS IN 2010

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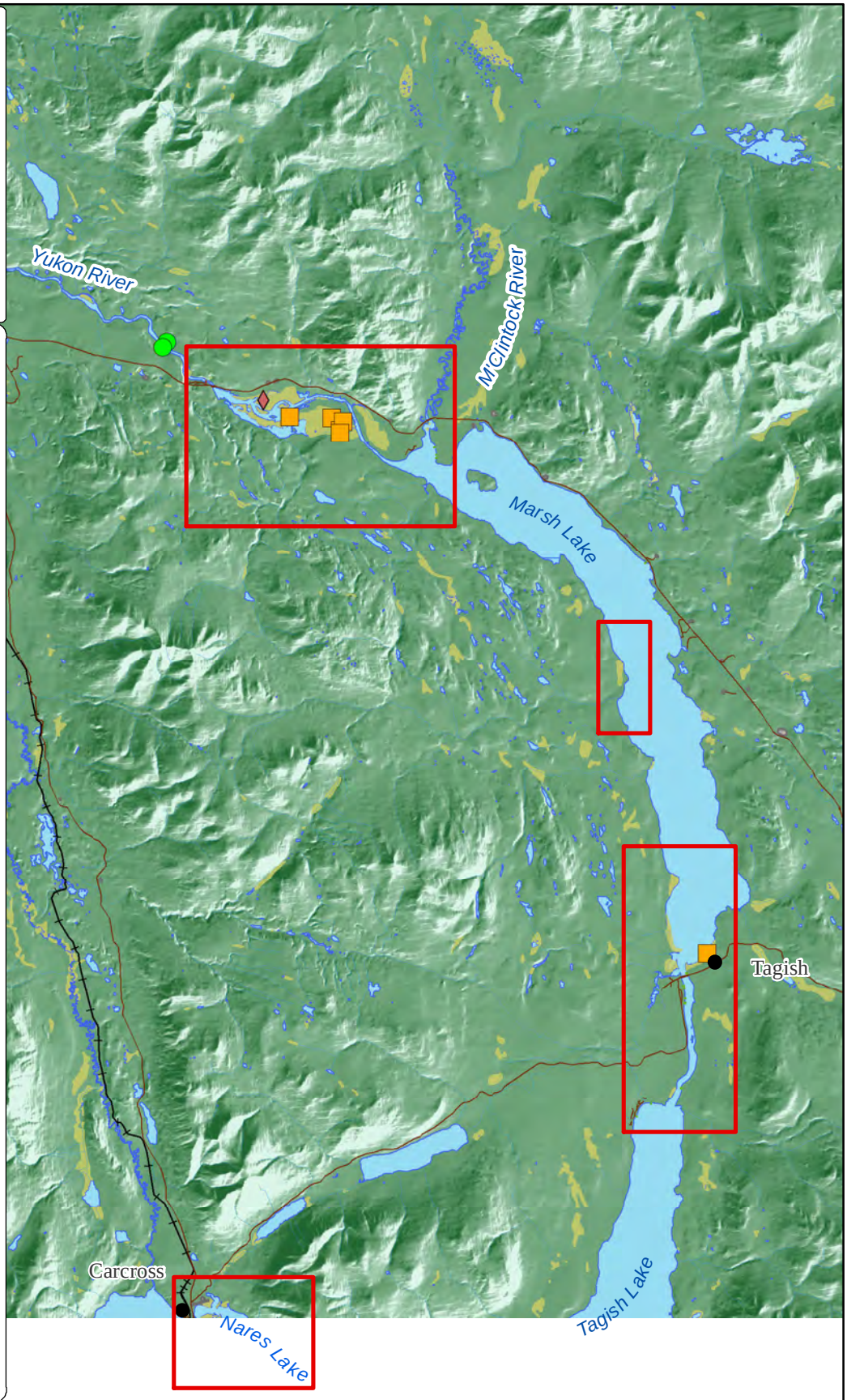
Ungulate
Observations



Legend

- Focal Wetlands

Observations

- Caribou Tracks
- Caribou
- Coyote
- Mineral Lick
- Dall's Thinhorn Sheep
- Grizzly Bear
- Moose
- Moose Tracks
- Mountain Goat
- Stone's Sheep

Ungulate Movements

- Caribou
- Moose

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads

0 2 4 6 8 10 Km

UTM 8N Projection
NAD 83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Wildlife data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. September 2011.

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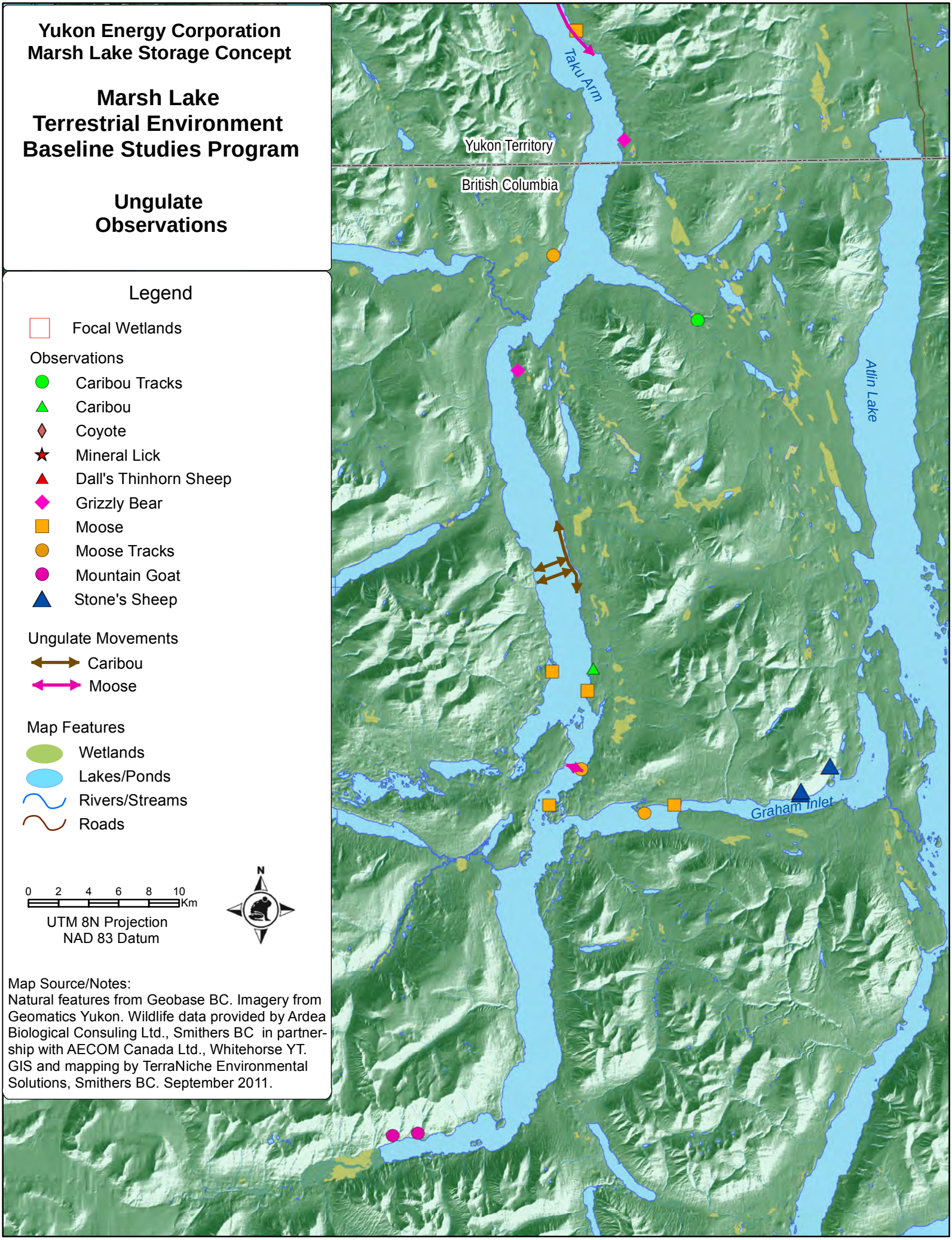
Ungulate
Observations



Legend

- Focal Wetlands

Observations

- Caribou Tracks
- Caribou
- Coyote
- Mineral Lick
- Dall's Thinhorn Sheep
- Grizzly Bear
- Moose
- Moose Tracks
- Mountain Goat
- Stone's Sheep

Ungulate Movements

- Caribou
- Moose

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads

0 2 4 6 8 10 Km

UTM 8N Projection
NAD 83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Wildlife data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. September 2011.

APPENDIX E: AQUATIC MAMMAL OBSERVATIONS IN 2010

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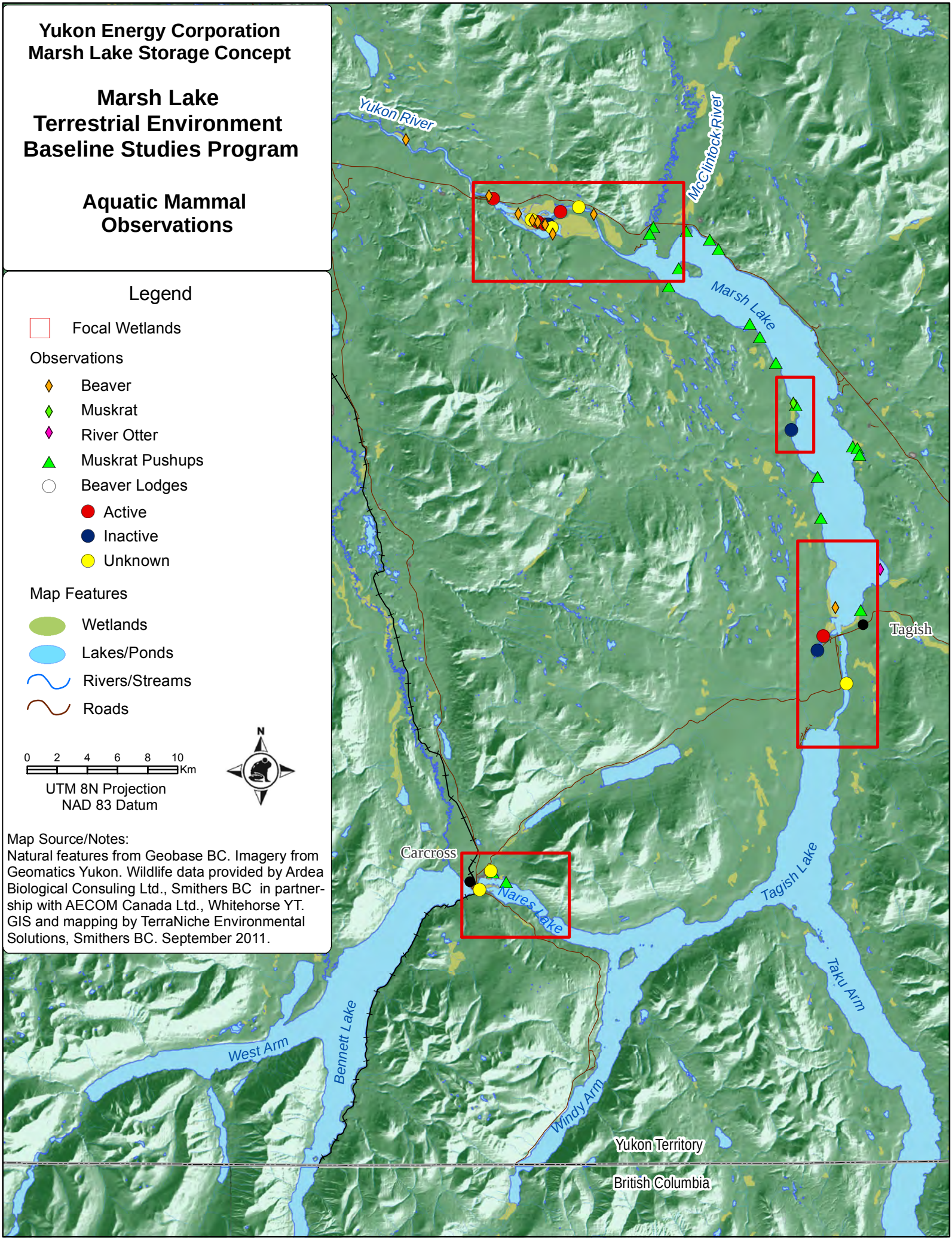
Marsh Lake Terrestrial Environment Baseline Studies Program

Aquatic Mammal Observations



Legend

- Focal Wetlands

Observations

- Beaver
- Muskrat
- River Otter
- Muskrat Pushups
- Beaver Lodges
  - Active
  - Inactive
  - Unknown

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads

0 2 4 6 8 10 Km

UTM 8N Projection
NAD 83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Wildlife data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. September 2011.

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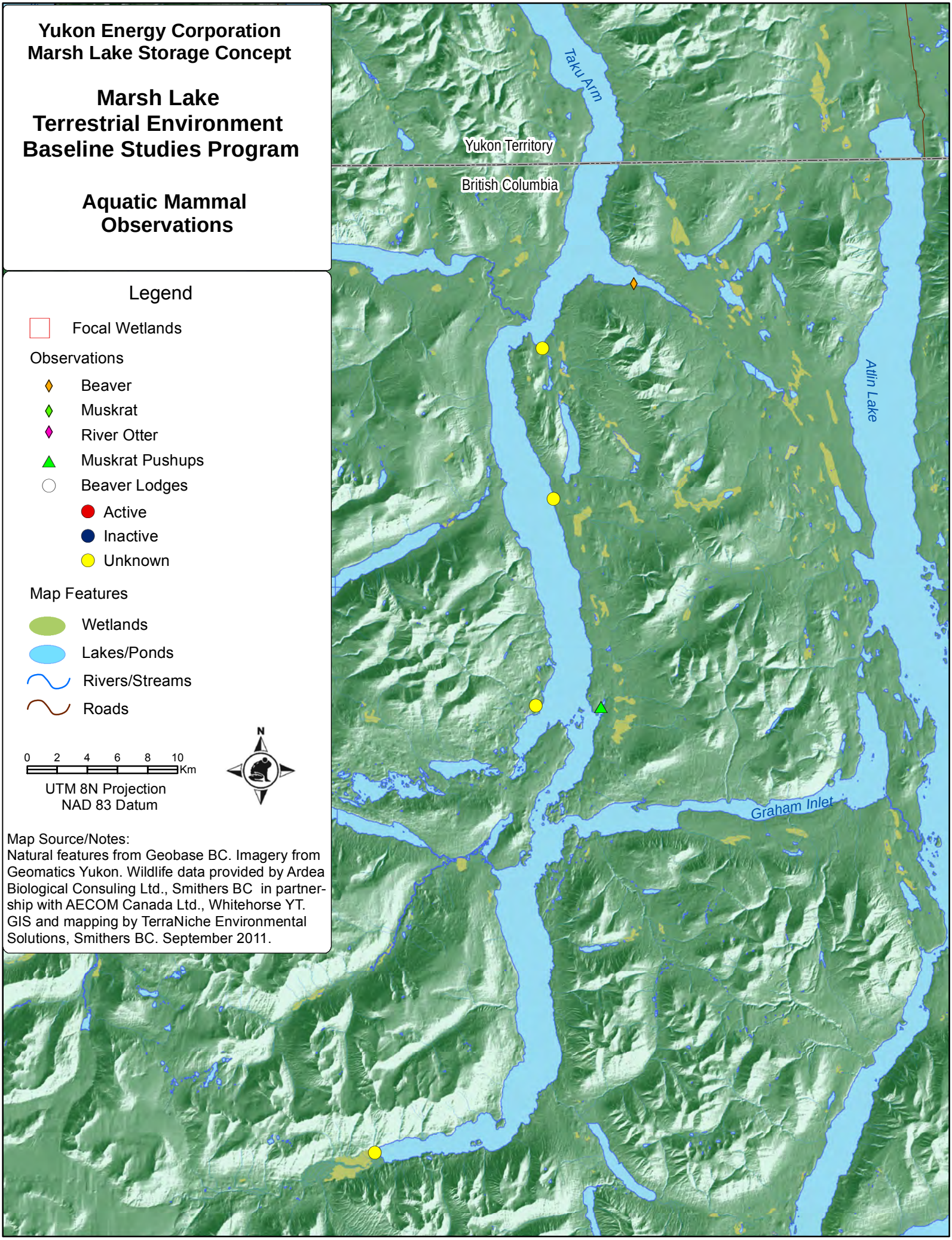
Terrestrial Environment
Baseline Studies Program

Aquatic Mammal
Observations



Legend

- Focal Wetlands

Observations

- Beaver
- Muskrat
- River Otter
- Muskrat Pushups
- Beaver Lodges
  - Active
  - Inactive
  - Unknown

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Streams
- Roads

0 2 4 6 8 10 Km

UTM 8N Projection
NAD 83 Datum

N

Map Source/Notes:
Natural features from Geobase BC. Imagery from Geomatics Yukon. Wildlife data provided by Ardea Biological Consuling Ltd., Smithers BC in partnership with AECOM Canada Ltd., Whitehorse YT. GIS and mapping by TerraNiche Environmental Solutions, Smithers BC. September 2011.