Southern Lakes
Terrestrial Environment Baseline Studies
2010 Amphibian Surveys

(Photo: L. Rach)

Prepared for:

Yukon Energy Corporation
and
AECOM Canada Ltd.

Prepared by:

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March 2012

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March 23, 2012

Hector Campbell
Director, Resource Planning & Regulatory Affairs
Yukon Energy Corporation
2 Miles Canyon Road, Box 5920
Whitehorse, Yukon
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Dear Hector:

Project No: 60146345 – Task 2.4.5.4

Regarding: Marsh Lake Fall-Winter Storage Concept – Summary Report of 2010 Amphibian 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.

Forest Pearson
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OM:om
Encl.
cc:

EXECUTIVE SUMMARY

Amphibian surveys were completed within the Southern Lakes area in July 2010 and consisted of ground-based surveys for western toad, wood frog, spotted frog and long-toed salamander. The main purpose of this work was to determine the presence of amphibians and identify critical habitats used by amphibians, with the surveys carried out by Lis Rach (TerraNiche Environmental Solutions) and members of the Ardea team.

Representative wetland and shoreline habitats within Marsh, Tagish and Nares Lakes were surveyed from July 19 to 23, 2010 using area-based surveys that were systematically conducted depending on area size and complexity. All field assessments were conducted in accordance with accepted practices and standards. Surveys were concentrated in Lewes Marsh, Monkey Creek wetland and 6-Mile wetland on Marsh Lake; Tagish Narrows and Nares Lake. Within these wetlands, habitats assessed included streams, ponds, shallow water, backchannels, meadows and forested uplands.

Wood frogs were observed in all five assessment locations and breeding areas were identified based on observations of newly emerged froglets and juvenile forms within or near suitable bodies of water. Almost all of the areas where wood frogs were observed to be breeding were in areas where the large fluctuations in water levels of the adjacent lakes had less of an influence. These were primarily isolated ponds and backchannels, where upland water sources, and/or groundwater provided a steady water supply throughout the breeding season. Columbia spotted frog and western toads were not found during the surveys, although both have been found historically within the Southern Lakes study area. Spotted Frogs have previously been detected in the West arm of Bennett Lake (Mennell 1997) and Western toads have been located in Bennett Lake (Slough 2004) and Tagish Lake (Mennell and Slough 1998). The identification of wood frog breeding habitats and the lack of Columbia spotted frog and western toad observations provide important background information for determining the potential effects of the Marsh Lake Storage Concept.

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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.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. The authors and Ardea accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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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 baseline studies, boat and ground-based surveys amphibian surveys were carried out in July 2010. This field summary report focuses on the methodology and results of the 2010 surveys for amphibians in the Southern Lakes study area. Surveys and observations were carried out by Lis Rach (TerraNiche Environmental Solutions) with supplementary observations provided by the terrestrial studies team: Laurence Turney (Ardea), Frank Doyle (Wildlife Dynamics Consulting), Anne Macleod (Sialia Biological Consulting) 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.

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 mainly fens (YEWG 2004). Vegetation within this area is dominated by coniferous forests of

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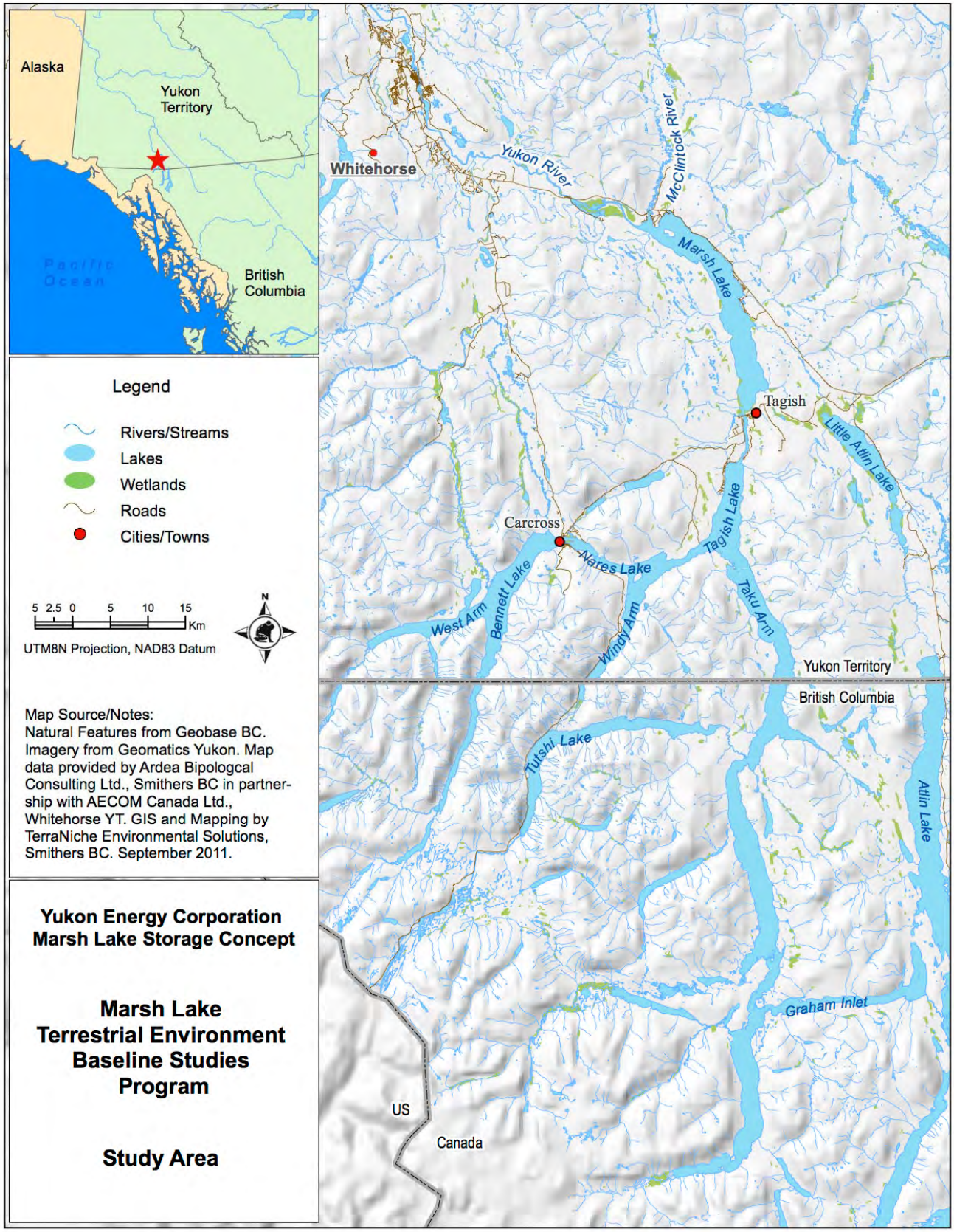

Figure 1. Southern Lakes study area.

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white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta*). Portions of the study area also encompass large wetlands dominated by willows and/or sedges.

SPECIES DISTRIBUTION, LIFE HISTORY AND CONSERVATION STATUS

Amphibians represent an important component of biodiversity. Significant range contractions have occurred in North America for many amphibian species with the greatest threat to amphibians within Canada being habitat loss. In particular, altering or draining wetlands for development has decreased the number of breeding sites, decreased the connectivity between habitats and severed corridors by increasing the distance between sites (Seburn and Seburn 2000). Amphibians are tied to moist environments and most species require standing water (e.g. ponds, marshes, and wet meadows) or running water (e.g. permanent creeks and small streams) to meet all of their life requirements (Davis 2002).

Amphibian species found in the Southern Lakes Study Area include the wood frog (*Lithobates sylvaticus*), the Columbia spotted frog (*Rana luteiventris*) (Corkran and Thoms 1996, Davis 2002) and the western toad (*Anaxyrus boreas*) (Slough and Mennell 2006). The long-toed salamander (*Ambystoma macrodactylum*) has not been identified in the study area (Slough and Mennell 2006), however, it has been detected south in the Stikine and Taku watersheds in north-western BC and south-eastern Alaska, including the Telegraph Creek area and the Taku and Nakina rivers (Slough and Mennell 2006).

Wood frogs live in habitats such as marshes, wet meadows, moist woodlands and brush; they breed in shallow pond edges, seasonal pools, flooded meadows and slow-moving parts of streams. They are small frogs with adults ranging up to 60 mm in length. Depending on local weather conditions, adults may emerge and begin breeding as early as March (range is March through June), as soon as temperatures rise above freezing during the day and before all pond ice has melted (Nussbaum *et al*. 1983). Wood Frogs are explosive breeders; while breeding over a few weeks in more southerly parts of their distribution, they only breed for a few days in the north (MacDonald 2003). Egg laying occurs 4 to 10 days after the first frogs appear and depending on temperature, they can hatch in 4 to 7.5 days. Eggs are laid together in masses attached to sedges and other submerged vegetation at, or near the surface of shallow water (BC Frogwatch 2010). Tadpoles live in the shallowest, warmest water available to them, predominately located at the edge of water bodies before they transform 45 to 80 days after the eggs are laid (Corkran and Thoms 1996). The wood frog exhibits a tolerance to freezing and dehydration during hibernation using special *cryoprotectant* chemicals, which allow up to 65 percent of the water in the wood frogs body to gradually crystallize into ice as body temperature drops to as low as -12^0 C (MacDonald 2003). It survives the winter by digging a resting chamber in leaf litter on the forest floor and hibernating for up to six months under the snow (MacDonald 2003). Wood frogs are widespread in the Yukon and are found farther north than any other amphibian in North America (at least as far north as Frog Lake, or Ney Khwi Vun, on the Old Crow Flats in the Yukon) (Slough and Mennell 2006). In British Columbia they are found in all but the Georgia Depression and Southern Interior Mountains Ecoprovinces at elevations from 400 to 1800 m (Corkran and Thoms 1996).

Columbia spotted frogs are considered habitat generalists and use various wetland habitats including lake edges, ponds, slow-moving streams and marshes. Spotted frogs require two types of water bodies; deep, warm bottomed lakes for over-wintering and shallow wetlands for the remainder of the year. This species may be particularly sensitive to population disturbance (Corkran and Thoms 1996, BC WLAP 2004) due to a relatively long developmental period before reaching sexual maturity. The Columbia spotted frog hibernates under water and unlike

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the wood frog, it cannot survive freezing, so the shallow ponds it inhabits must be covered with ice and a thick layer of snow. When the snow melts in the spring and floods pond edges, the Columbia spotted frog uses these areas as breeding sites (MacDonald 2003). Breeding occurs in late May in northwestern BC with aggregations of frogs gathering on the edges of shallow ponds. Tadpoles hatch in approximately 7 days are free swimming in 14-16 days, with metamorphosis occurring in August (Slough and Mennell 2006). Columbia spotted frogs have been observed in the West Arm of Bennett Lake (Mennell 1997) and documented along the mainland of Southeast Alaska at Salmon River, Unuk River, Stikine River, Pt. Agassiz, and Taku River (MacDonald 2003).

Western toads use three habitat types: breeding sites, terrestrial summer ranges, and winter hibernation sites. Preferred breeding sites are permanent or temporary water bodies with shallow, sandy bottoms. Breeding occurs in late April or early May at more northern latitudes (Pyare *et al.* 2005). Eggs hatch in three to twelve days, depending on water temperatures (Jones *et al.* 2005). The tadpoles feed and swim in synchronized schools until late July or early August (6 – 8 weeks later), when they metamorphose into toadlets, usually within three months of egg laying (Stebbins 1951). Toadlets spend the first period of their terrestrial life in the riparian zone adjacent to their nursery. Metamorph masses eventually disperse upland for their second phase of development where they forage, develop and disperse within forests and grasslands throughout the growing season (Corkran and Thoms 1996). They exhibit strong annual site fidelity, returning to their traditional breeding grounds from their over wintering grounds (Oldham 1965). They may roam up to 1600 m from breeding sites outside of breeding season, but they prefer damp conditions (Davis 2002). Western toads spend much of their time underground; although they are capable of digging their own burrows in loose soils, they generally shelter in small mammal burrows, beneath logs, and within rock crevices. These toads over-winter by hibernating in burrows below the frostline, sometimes up to 1.3 m underground. Western toads have been located in Bennett Lake (Slough 2004) and Tagish Lake (Mennell and Slough 1998) and are widespread in BC being found in all but the Taiga Plains Ecoprovince at elevations from sea level to 2250 m (Corkran and Thoms 1996).

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses amphibian species for their habitat loss potential and susceptibility to environmental changes (COSEWIC 2010). COSEWIC assigns status rankings as **Endangered**, **Threatened** or **Special Concern**. The Species at Risk Act (2003) provides for legal protection of wildlife species that are listed by COSEWIC. Species that have not been assessed yet but are suspected of being at some risk of extinction or extirpation are referred to as 'candidate wildlife species' (COSEWIC 2011). These species are identified as **High**, **Medium** or **Low** assessment priority by the Species Specialist Subcommittees (SSCs) or by the Aboriginal Traditional Knowledge (ATK) Subcommittee as candidates for detailed status assessment. In the Yukon, Environment Canada with the assistance of regional experts assesses the conservation ranking of all vertebrate species (Vertebrates of Conservation Concern) every 5 years (CESCC 2011). Species are ranked as: **At Risk**: Species for which a formal detailed assessment has identified as Endangered or threatened; **May be At Risk**: May be Endangered or threatened but for which no formal assessment has been completed; and **Sensitive**: Species that may require special attention or protection to prevent them from becoming at risk. The BC Conservation Data Centre (BC CDC 2011) ranks species as Red, Blue or Yellow-listed. The list contains species that are legally designated as endangered or threatened under the Wildlife Act, are extirpated from BC, are candidates for legal designation, considered a species of concern due to their declining status, or considered secure and not at risk. Amphibian species and their conservation status are listed in Table 1.

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Table 1. Conservation status of amphibian species expected to occur in the Southern Lakes Study Area.

Common Name	Scientific Name	COSEWIC Status	COSEWIC candidate Species	Yukon Vertebrates of Conservation Concern	BC Status
Western Toad	*Anaxyrus boreas*	Special Concern		Sensitive	Blue
Columbia Spotted Frog	*Rana luteiventris*		Medium	May be at risk	
Wood Frog	*Lithobates sylvaticus*		Low	Secure	
Long-toed Salamander	*Ambystoma macrodactylum*		Low		

In addition, the western toad is protected under the federal *Species at Risk Act* (SARA) as well the British Columbia *Wildlife Act*.

METHODS

Potential survey locations were selected based on a variety of semi-terrestrial and aquatic wetlands identified using aerial photographs and digital water information. Survey site selection was further refined through the selection of representative wetlands including lake and river edges, shallow water, fens, and wet meadows.

Area-based surveys survey methods were used to assess amphibian presence and habitat use within the various survey areas. In general, surveys consisted of walking a transect along the edge of the wetted portion of a wetland and adjacent upland areas that contained sufficient vegetation to provide suitable adult habitats such as forested or shrubby vegetation and accumulations of debris on the forest floor. Aquatic searches for tadpoles, juveniles and adults were conducted using a dip net to search through the mud and water at the bottom of ponds and around vegetation. Terrestrial searches for juvenile and adult amphibians were conducted by listening and watching for disturbed individuals while walking slowly through an area, by searching underneath medium to large coarse woody debris and boulders, and by looking in hollows and other spaces where amphibians may be found. Aquatic searches were also conducted by boat in order to efficiently cover aquatic reaches not reachable by ground. Boat searches consisted of paddling along pond and backchannel shorelines while looking for amphibians.

All field assessments were conducted in accordance with accepted practices and standards such as those outlined in peer reviewed literature and the *Inventory Methods for Pond Breeding Amphibians and Painted Turtle Ver. 2.0* (RIC 1998) and *Hygiene Protocols for Amphibians Fieldwork* (BC MOE 2008). Species, location and habitat data, including general wetland class (e.g. fen, bog or swamp), were collected onto field forms and entered into a database for review and analysis. Water temperature and pH were also collected in the areas sampled. Incidental observations of amphibians recorded by other members of the study team conducting baseline terrestrial environment studies within the Southern Lakes study area for aquatic birds, mammals, rare plants and wetland mapping were also entered into the database.

RESULTS

The Southern Lakes Study Area was assessed for amphibian species from July 19 to July 23, 2010 within Lewes Marsh, Monkey Creek wetlands and 6-Mile wetlands on Marsh Lake; Tagish Narrows and Nares Lake (Appendix A). Within these wetlands, habitats assessed included streams, ponds, shallow water, backchannels, meadows and forested uplands.

Wood frogs were observed in all five assessment locations and all of the assessment areas were determined to contain breeding areas (Table 2, Appendix A). Breeding habitat was determined based on the identification of newly emerged froglets and juvenile forms within or near backchannel and ponds in upland areas (Figure 2 and Figure 3).

Table 2. 2010 amphibian survey results.

Wetland ID	Survey Area Name	Identified Species	Age Class[1]	Breeding Areas Identified
1a	Lewes Marsh	Wood Frog	4 to 6	Yes
1b	M'Clintock Bay/River	Wood Frog	5 to 6	Yes
2	Monkey Creek Wetland	Wood Frog	4 to 6	Yes
3	6-Mile Wetland	Wood Frog	4 to 6	Yes
4	Tagish Narrows/Tagish Lake	Wood Frog	4 to 6	Yes
5	Nares Lake	Wood Frog	4 to 6	Yes

[1]Age Class: 1: Egg, 2: Tadpole, 3: Tadpole with legbuds, 4: Froglet/Toadlet, 5: Juvenile, 6: Adult.

Figure 2. Froglet observed at 6-Mile wetland, Marsh Lake (July 20, 2010).

Figure 3. Froglets observed at Monkey Beach wetland, Marsh Lake (July 23, 2010).

Wood frogs were identified in several shallow warm water areas and meadows of Lewes Marsh, located adjacent to the main river flow, in the backchannels and creek outlets. Numerous newly emerged wood frogs were observed in the shallow ponds of a graminoid fen located near the confluence of an unnamed creek and the Yukon River several kilometres downstream of Marsh

Lake. Wood frogs were also identified in a small marsh situated in the upper extent of M'Clintock Bay, near the M'Clintock River outflow.

The upland wetland complex located north of the mouth of Monkey Creek contained an extensive willow/sedge fen with ponds and meandering channels on the south side of the wetland and a forested bog with numerous pit ponds on the north side. Numerous juvenile and adult wood frogs were observed throughout the wetland and newly emerged froglets were identified in the fringes of the bog pit ponds.

Many wood frogs were observed at the 6-Mile wetland complex located approximately 4 km north of the Tagish Narrows Bridge on Marsh Lake. Adult and juvenile frogs were found throughout this extensive sedge fen area. Newly emerged froglets were also identified in the exposed mud of the shallow, nearly dry ponds.

Juvenile wood frogs were identified on the creek bank at the upper extents of Tagish Creek west of Tagish Narrows. Juvenile and newly emerged wood frogs were also identified in a small marsh situated near the confluence of Tagish and Austin's Creek.

Nares Lake consists of a lake/marsh/fen complex with Nares Narrows on the south side of the lake and a large bay on the north. A newly emerged wood frog was observed in a sedge meadow near the bay opening.

CONCLUSIONS AND RECOMMENDATIONS

Overall, wood frogs were found throughout the surveyed areas within suitable wetland and pond habitats. The habitats surveyed included the lake and river edges, river backchannels, as well as complex upland habitats containing slow-moving streams and isolated ponds, providing ideal breeding and rearing habitat for wood frogs. Almost all of the areas where wood frogs were observed to be breeding were in areas where large fluctuations in water levels of the adjacent lakes had less of an influence. These were primarily isolated ponds and backchannels, where upland water sources, and/or groundwater provided a steady water supply throughout the breeding season. Although a large effort was put into locating tadpoles, only juvenile and adult wood frogs were found. Based on survey results of finding froglets and juveniles in late July, it can be assumed that the wood frogs laid their eggs mid to late April. Conducting surveys earlier would likely have found tadpoles; however, the occurrence of froglets also confirms breeding in the area.

Columbia spotted frogs have been found in the Southern Lake study area in the West Arm of Bennett Lake (Mennell 1997) and it was expected that they could be found in Nares and possibly Marsh Lakes. The lack of observations during these surveys suggests that although present in the southern portion of the Southern Lakes, they may not be abundant in other wetlands of the study area. The Columbia spotted frog has a localized distribution across its range, rather than continuous (Corkran and Thoms 1996, Seburn and Seburn 2000, MacDonald 2003). While many areas in the Southern Lakes study area appear to be ideal spotted frog breeding habitat, the shorter growing season and fluctuating water levels may limit reproductive success. It may be that successful reproduction can only occur in mild temperature years when open water conditions are extended, allowing for froglets to completely metamorphosis prior to over-wintering. Breeding sites for spotted frogs are also occasionally compromised by falling water levels, leaving egg masses landlocked and stranded (Slough and Mennell 2006, Slough *et al.* 2002). It is also possible that breeding does not occur annually in peripheral populations and that the shorter season causes tadpoles to overwinter in ponds. Spotted frog metamorphs have been observed in late May in, which is too early for those eggs laid in the same year, and tadpoles have been observed in mid-September (Slough and Mennell 2006).

Although Western toads were not observed during our surveys, they have been found within the Southern Lakes area previously in Bennett Lake (Slough 2004), Tagish Lake (Mennell and Slough 1998) and the Atlin River (Rach 2011). Western toads aggregate for breeding at shallow ponds, lake edges and other warm waters, including man-made environments; and will use the same areas year to year (Wind and Dupuis 2002). The use of the same areas for breeding, along with the species' tendency to aggregate as breeding adults, tadpoles and toadlets makes them distinctive and noticeable. Given these factors, the limited number of previous and our lack of observations of western toad in the Southern Lakes area suggests that western toads are very limited in their distribution within the area.

Amphibian surveys were conducted in the Southern Lakes area during the potential amphibian breeding and rearing season. A range of habitats and sites were visited in July, a time when amphibians could have been detected in terrestrial or aquatic habitats and when tadpoles and newly emerged froglets and toadlets were expected to be present in aquatic habitats (Corkran and Thoms 1996, Carstenson *et al*. 2003, MacDonald 2003). Supported by survey findings, it can be concluded that the surveys occurred within the breeding season for amphibians in the Southern Lakes area. The combination of survey timing and intensity, in the range of habitats assessed, demonstrates that the sampling was sufficient to detect amphibian breeding habitats within the wetlands surveyed.

The identification of wood frog breeding habitats and the lack of Columbia spotted frog and western toad observations provide important background information for determining the potential effects of the Marsh Lake Storage Concept. Additional surveys could refine and/or provide information on additional wood frog breeding habitat areas, and could even identify locations for Columbia spotted frog and western toads within the Southern Lakes study area. This additional information would not likely affect the procedures and habitats considered in the effects assessment however, as the information collected was sufficient to identify the breeding habitat conditions and attributes for the assessment of effects.

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APPENDIX A: MAP OF AMPHIBIAN SURVEY AREAS AND OBSERVATIONS

1. Lewes Marsh / McClintock Bay

1

2. Monkey Creek

2

3. Tagish Narrows / 6-Mile

3

4. Nares Lake

4

0 2 4 6 8 Km

UTM 8N Projection NAD 83 Datum

N

Map Source/Notes:
Imagery from Geomatics Yukon. Natural features from Geobase BC. Amphibian data from Lis Rach, TerraNiche Environmental Solutions, 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. September 2011.

Legend

Observations

- Wood Frog
- Breeding Area

Survey Locations

- Focal Wetlands
- Amphibian Survey Transects
- Other Survey Transects

Map Features

- Wetlands
- Lakes/Ponds
- Rivers/Creeks
- Roads

Yukon Energy Corporation
Marsh Lake Storage Concept

Marsh Lake Terrestrial Environment Baseline Studies Program

Amphibian Survey Locations and Results