APPENDIX D

TERRESTRIAL SURVEY RESULTS

GOLDBORO LNG

Appendix D-1
Habitat, Lichen and Wetland Survey
(September 2012)

Habitat, Wetland and Rare Lichen Survey, September 24-28th, 2012: Methods, Results and Photographs

Habitat, wetland and rare lichen surveys were carried out September 24th to 28th, 2012, by AMEC biologists Dr. Marion Sensen and Scott Burley, M.Sc.in the footprint of the Goldboro LNG plant. Dr. Sensen is a botanist with specialization in lichens, Mr. Burley is a botanist. Both have extensive training and experience in the identification, delineation and evaluation of wetlands.

1.0 PURPOSE

The Goldboro LNG Project footprint lies within the site of the former Keltic Petrochemicals and LNG Project site. The purpose of the site visit was to gather baseline habitat, wetland and rare lichen information, to compare the current condition on the site with the description presented in the Keltic Project EA (AMEC, 2006), and to identify the extent of change and/or requirements for new information:

- describe existing habitats and develop a habitat map;
- confirm, identify, and describe significant habitats including wetlands;
- delineate and functionally assess wetlands in the Project area;
- identify high potential habitats for rare vascular plant species;
- initiate a rare lichen survey and evaluated existing habitats for their potential to support rare lichen species
- identify and describe indications of previous disturbance; and
- record opportunistic wildlife sightings or signs.

Rare plant surveys were not carried out at that time due to the unsuitable phenology window, and no exhaustive plant inventory was attempted. However, opportunistic observations of rare or uncommon vascular plant species were to be recorded. Plant inventories and rare plant surveys were carried out for the Keltic Project (AMEC, 2006). Since several species of freshwater mussels are considered "rare" in Nova Scotia, any observations of freshwater mussels or mussel shells in streams or ponds were to be recorded.

2.0 METHODS

2.1 Preparation:

- Review of aerial photography (NSDNR and Google Earth)
- Assembly of maps of existing habitat using mapping available from NSDNR
  - Forest inventory maps (NSDNR, 1988-2000)
  - Topographical maps
  - Depth- to water-table mapping (NSDNR, 2012)
  - Maps depicting the results of habitat modeling for *Erioderma pedicellatum* (boreal felt lichen) (NSE)
- Review of the Keltic EA report (AMEC, 2006)
- Review NSDNR Wetlands Inventory and Significant Habitats Databases online

2.2 Field surveys:

All surveys were carried out concurrently.

2.3 Habitat and Vegetation:

Habitats present at the site were investigated by walking the project footprint. Dominant plant species in the various habitats were noted and used as a basis for the habitat descriptions. Tree diameter at breast height (dbh) was estimated. Progress was documented by GPS tracking. GPS points (LMK) are depicted in Figure 1. Habitats were documented with photos. Rare plant surveys were not carried out in September 2012 due to the unsuitable phenology window, and no exhaustive plant inventory was carried out. However, any observation of a plant species-at-risk or species of conservation concern which could still be identified with certainty was recorded with a GPS location and photo.

2.4 Lichen species-at-risk or of conservation concern

Surveys for lichen species- at- risk (including Boreal Felt Lichen), lichen species of conservation concern and indicator species were carried out whenever suitable habitat was encountered during the habitat and wetland surveys. The term “habitat” for lichens includes suitable host tree species, which may be scattered among less or not suitable host trees. Rare lichen species encompass ground-dwelling (terricolous), rock-dwelling (saxicolous) and tree- dwelling (arboreal) lichens, with one species occurring submerged in freshwater.

All suitable substrates (trees, rocks, ground, water courses) were surveyed. Based on previous experience and professional knowledge, the distribution of rare arboreal lichen species is generally correlated with the presence of larger/ older trees. Therefore, certain forest polygons, wetlands and streams were targeted for surveys, as well as any larger trees found among younger trees or shrubs. Particular attention was paid to any older trees of tree species which are known to be preferred substrate for rare lichens, independent of the surrounding habitat. Potential host trees within wetlands and at the edges of wetlands (Wetland # 1 to 10), each with a 10-20 m upland buffer, were targeted for lichen surveys. The size of the buffer depended on gradient, soil humidity and tree species present. In addition, habitat along the unnamed stream which is associated with wetlands # 1, #4 and # 10 was investigated. This stream is large enough to be included in topographic maps, though a field identified tributary originating in Wetland # 1 is not included in topographical maps. A field-identified and potentially ephemeral stream associated with Wetland # 5 was partially investigated, excluding the harvested and re-growing areas of dense, young forest.

2.4.1 Boreal Felt Lichen

In addition to looking for this lichen directly, the available habitat was evaluated concerning suitability as habitat for the boreal felt lichen (BFL) (*Erioderma pedicellatum*, NSDNR Red, NSESA/ COSEWIC/SARA Endangered). This lichen grows on bark of mature balsam fir (*Abies balsamea*) trees in cool, humid habitat. Wet coniferous forests, usually in or near wetlands, on north to east facing slopes near the coast are preferred. NSE Protect Areas Branch has prepared maps indicating polygons of potential BFL habitat in Nova Scotia based on a heuristic model (NSE, 2008). The maps indicate that there is no BFL habitat within the Project footprint.

There is one polygon of Category 2 (medium potential) habitat shown outside, but near the eastern corner of the project footprint. Nevertheless, the potential presence of BFL was considered throughout the surveys.

Wet forests on north to east facing slopes were not encountered, unless as the edge of a wetland. Forests dried up quickly with distance from a wetland. Boles and low branches of balsam fir trees in and near wetlands were investigated for BFL and other rare lichens. A large part of the category 2 habitat polygon mentioned above has been cut down to accommodate the SOEIP pipeline. The remainder received an initial cursory survey.

2.5 Wetland Identification, Delineation and Evaluation:

Aerial photography, the Keltic EA report and Depth-to-Watertable mapping were consulted in order to identify areas with high likelihood for presence of wetlands. The Keltic EA identified only one wetland in the Project footprint (AMEC, 2006). The NS Wetlands Vegetation and Classification Inventory shows no wetlands in the Project footprint (NSDNR, 2013). However, a marsh extending northwest from the northwestern end of Dung Cove Pond is hydrologically connected to the project footprint. The Nova Scotia Wetlands and Coastal Habitats Inventory (NSDNR, 2000), now superseded, classifies the marsh as deep marsh, and also shows “Marine Flat” habitat at Betty’s Cove shore. The current wetlands database online viewer only identifies the above mentioned marsh, located outside of the project footprint.

Any areas with high potential for the presence of wetlands as indicated in Depth-to-Watertable mapping and aerial photography were accessed by GPS navigation and investigated. However, any wetland encountered in the project footprint was recorded. Locations of wetlands detected in the field were marked with GPS. Wetlands were delineated according to the standard Reg IV US Army Corps of Engineers methods. Wetland data sheets were used to document delineation and wetland habitat information. Wetlands were photographed and classified applying the Canadian Wetland Classification System (1997).

2.6 Freshwater Mussels

Substrate in streams and at pond edges where encountered during the habitat and wetland surveys were observed in order to detect freshwater mussels or mussel shells, but deeper substrates were not investigated. Dung Cove Pond was apparently flooded due to heavy rains and its actual shoreline was not visible.

3.0 RESULTS

3.1 Habitat

The site survey has confirmed that terrestrial habitat conditions remain largely unaltered since the provincial EA of the Keltic Project in 2006, except for an increased height/mass of woody plants due to growth and regeneration after forest harvesting, and a limited area that may have been harvested since 2005, the last year when vegetation surveys were carried out for the

Keltic project. There have been no industrial developments since 2006, despite the Site's location in an industrial park

The field visit showed that the forestry map (NSDNR 2007/2012) is not accurate in depicting current site conditions; for example, an area coded as "old field" has now largely progressed to coniferous forest dominated by white spruce (*Picea glauca*), with the remainder dominated by ericaceous shrubs. A polygon of "rock barren" surrounding the ponds in the marine wetland near Red Head is actually not an "area covered by at least 50 % exposed rock outcrops and/or boulders", i.e. are rock fragments over 60 cm in diameter, but rather a layer of beach cobble interspersed with plants, including a few white spruce trees, and therefore does not fit the NSDNR forestry mapping definition. It does however, have less than 25% live tree cover.

Most of the site is covered by coniferous forest of various ages. In September 2012, ten habitat types and plant communities were identified, including two categories of wetlands. The description of habitat is based on the most frequent plant species observed, and tree size where applicable. Photos depicting habitat types are provided at the end of the report. Figure 1 depicts the geo-referenced survey locations. Photos of wetlands are provided in the separate wetland survey report.

Table 1: Habitat Types in the Project Footprint, Definitions and Summaries

Picture #	Type	Definition and Summaries
1,2,3,4	**Natural Stand: Coniferous Forest**	Forest stands composed of more than 75% coniferous (softwood) trees (NSDNR). In the Project footprint, the trees in these polygons are more mature than the trees in "young coniferous forest". Dominated by balsam fir, mature or nearing maturity, with tree diameters for balsam fir from about 15 cm dbh to 20 cm and occasionally 30 cm dbh; red maple and heartleaf birch are few and up to 20-30 cm dbh.
5,6,7,8,9, 10	**Young Coniferous Forest***	Areas of re-growth, most often following forestry activity, and other disturbance. Dominated by young trees (saplings) with occasional patches of shrubs (often mountain holly, witherod or alders). Older regenerating forest is dominated by young balsam fir with an estimated height of 6-10 m.
11,12	**Tall Shrubs***	At the Goldboro Project site, tall shrubs with an estimated height of around 2m, dominated by mountain holly (*Nemopanthus mucronatus*) and witherod (*Viburnum nudum*). NSDNR categorized this polygon as "brush", which is defined as any area containing less than 25% merchantable tree cover and contains non-merchantable woody plants consisting of at least 25% cover (NSDNR).
	Alder	"Alders 75% or greater cover- any forested area containing alders that compose 75% or more crown closure (NSDNR, code 39 in forest inventory map). Near the Goldboro Project site: a dense thicket of tall alders (*Alnus incana*).
13, 14	**Disturbed - Re-generating***	At the Project site, this category is represented by areas either dominated by raspberry with dead wood, or with patches of shrubs of about 1 m height, or by clear cuts** with indications of early stages of regeneration**, such as seedlings and small saplings of trees and shrubs. Dominated by small woody plants and herbaceous vegetation.
15, 16	**Riparian***	Habitat along watercourses. In the Project footprint, there is little such habitat. Long stretches of streams have no real floodplain, possibly due to the steep

Picture #	Type	Definition and Summaries
		gradient of the terrain.
17, 19	**Barren and Ericaceous Shrub Dominated Barren**	Any area of less than 25% live tree cover containing "ericaceous" vegetation with less than 50 % rock out crops and/ or boulder cover and less than 50% other woody plant cover. Area dry and firm in summer. Indicator plants: bearberry, rhodora, blueberry, huckleberry and lambkill (NSDNR). Ericaceous shrub dominated barren**: Ericaceous shrubs of up roughly 1m height, dominated by bayberry (*Myrica pensylvanica*). At the Project site, this habitat replaces former "old field". Rock outcrops or boulders not apparent, and ericaceous shrubs provide more than 50 % of the plant cover.
18	**White Spruce Forest***	Coniferous forest dominated by White Spruce. In the Project footprint: occupying former "old field".
	Freshwater Wetlands **	"Any wet area not identified as a lake, river or stream" (NSDNR). Encompasses the wetland classes: fen, marsh, swamp, and open water; definition extended to include wetland class bog.
18, 19, 20	**Marine wetlands***	Including estuarine flat, coastal saline pond, salt marsh, dune, etc.

- * Habitat type not used in the Forest Inventory
- ** Definition extended beyond Forest Inventory Map Definition (NSDNR, 2007/2012)
- Clear cuts are defined by NSDNR as "Any stand that has been completely cut and any residuals make up less than 25 % crown closure and with little or no indication of regeneration".
- NSDNR Forest Stand Maturity Classes defines "regenerating forest" as " trees less than 1m high and less than 20 years of age, and "young trees" as "trees less than 40 years and 6 m or less in height".
- dbh=diameter at breast height; dbh was estimated
- Old Field = "Any field that has an indication of merchantable tree species growing in with less than 25% crown closure and less than 1.0 meters of height" (NSDNR, 2007). In the Project footprint, this habitat type has been replaced due to re-colonization.
- "Mature" is used here in a biological- ecological sense, not in a forestry sense, and includes observation of factors such as standing dead trees and fallen coarse woody debris which may provide indications concerning the timing of disturbance.

3.2 Rare Lichen Surveys

No lichen species of conservation concern were found in September 2012. Few scattered hard wood trees occur. Older red maple trees found in more mature forests and in tall shrub dominated polygons did not carry any rare lichens, although several lungwort species (*Lobaria sp.)* were present on some of the red maples, as well as on some Mountain Ash (*Sorbus sp.)* trunks (Photo 23 and 24). Only one thallus of *Leptogium cyanescens*, a common species, was found on one Red Maple tree near Wetland #1.

The available habitat is not considered to have high potential for rare lichens due to tree species composition, tree age or microclimatic conditions. Based on previous experience and professional knowledge, rare lichens are most frequently found in mature hardwood or mixed wood forest on mature hardwood trees (except for boreal felt lichen). There is no such habitat in the project footprint. A tree species often favored by many rare lichen, Red Maple (*Acer rubrum*), occurred in very small numbers, with less than an estimated 2 % of trees present; forests were strongly dominated by coniferous trees. Much of the habitat consists of regenerating clear cuts of various ages. This type of habitat is not conducive to the growth of

rare lichens, due to the negative effects of clear cutting on tree age and microclimatic conditions. The negative effects often extend into the small islands of seed trees left in clear-cut areas, even if those trees have survived.

Most forest polygons in the project footprint contained trees that are young; many such polygons are dense and thus quite dark. Tree trunks in these polygons carried a sparse lichen flora of a few common species, dominated by *Parmelia squarrosa* (Photo # 1 and 2). The ground showed surprisingly few patches of sparse ground dwelling lichens of any kind, all of them in the *Cladina sp*. / *Cladonia sp*. (reindeer and pixie-cup lichens) groups. However, the ground cover and bole cover was similar even in the more mature forest parcels in the west of the property. There were few exposed rocks outside of the unnamed streams in the Project footprint, and no rare or other lichens on them, or on the rocks in and near streams.

Cursory surveys were carried out in the White Spruce dominated old field on Red Head. No rare lichens were found in the habitat type. Lighting conditions, microclimate and the host tree species (White Spruce) are not conducive to presence of rare lichens.

3.2.1 Boreal Felt Lichen:

Boreal felt lichen *(Erioderma pedicellatum)*, (BFL) grows on bark of mature balsam fir (*Abies balsamea*), preferably in wet coniferous forests, usually in or near wetlands, on north to east facing slopes near the coast are preferred. No boreal felt lichens were found. While balsam fir, the dominant forest trees species, is generally a suitable host species for Boreal Felt Lichen (BFL), the microclimatic conditions required by this species apparently were not met in the Project Footprint areas surveyed at this point, which includes Wetland # 1-10 and their edges and surrounding areas. Wet forests on north- to north east facing slopes were not encountered, unless when connected to a wetland. Forests dried up quickly with distance from a wetland. A large part of the of the polygon of predicted category 2 habitat (intermediate suitability) at the north east corner of the Goldboro Site has been cut down to accommodate the SOEIP pipeline. No BFL lichens or any other rare lichen species, were found in the remainder of this polygon near the Project boundary. Also, the remaining habitat is judged to be of low potential for the presence of BFL, due to tree size, absence of a sphagnum dominated wetlands, and the negative effects of the removal of a large part of the vegetation.

3.3 Wetlands

Depth-to-Watertable mapping available from NSDNR aided in the detection of several wetlands, while others were found in areas of low probability for the presence of wetlands (NSDNR, 2012). Seven freshwater wetlands were detected, evaluated and delineated in the Project footprint. Another two wetlands which were identified next to the Project boundaries are hydrologically connected to the project footprint. One of these has also been delineated. Based on topographical maps, there may be potential for another wetland in the project footprint, which will be confirmed during another field survey in 2013. However, on aerial photos this polygons appears to be a re-growing clear-cut. Details on the wetlands are provided in separate reports: wetland delineation reports with photos and the functional assessment report.

Most of the detected wetlands are freshwater wetland complexes consisting of several wetland classes and types: shallow open water, fen, bog, shallow marsh, shrub swamp, and wooded swamp. Therefore, both mineral wetlands and peatlands are present. Most wetlands are associated with streams or surface drainage features. Two wetlands, both sloped fens, are located adjacent to Highway 316.

The wetland labeled "wetland 1' in AMEC (2006) is actually described as a freshwater pond (Dung Cove Pond, Pond #6), indicating that it is not a wetland at all. Due to periods of heavy rainfall prior to the field visit in September 2012, Dung Cove Pond exhibited flooded conditions, indicated by non- aquatic vegetation below the surface. Therefore, it was not possible to determine if Dung Cove Pond actually is a pond, or if it is a shallow water wetland (depth of water less than 2 m). Further wetland surveys will be carried out in spring/early summer 2013.
Pond 4 and 5 (AMEC, 2006) are brackish to saline, and were identified as coastal saline wetlands.

3.4 Indications of previous disturbance

The entire site is dissected by logging roads of various ages. Clear- cuts and re-growing forest in the central, western and southern parts indicate fairly recent forest harvesting within the last few decades. Multi-trunked Red Maple and Mountain Ash trees which are found all over the Site may indicated potential harvesting further in the past (possibly as far back as 60-100 years). A cleared grassy area near the western Project boundary at Highway 316 used to be occupied by seasonal residence (AMEC, 2006). It has since been removed, but an old apple tree is left.
The western third of the Project Site contain numerous long- abandoned mine openings within the older forest. There are several mine tailings heaps.

3.5 Wildlife sightings and signs (September 2012):

- Bear droppings at the marine shoreline near Pond 6 (Dung Cove Pond)
- One monarch butterfly flying and feeding along Sable Road
- Odonates in most wetlands, as well as the ponds on Red Head
- One owl flying over the regenerating clearcut in the center of the property around noon on September 28th, 2012

3.6 Freshwater Mussels

Substrate in streams and at pond edges where encountered during the habitat and wetland surveys were observed in order to detect freshwater mussels or mussel shells, but deeper substrates were not investigated. No freshwater mussels were observed. However, Dung Cove Pond was apparently flooded due to heavy rains and its actual shoreline was not visible. Opportunistic observations will continue during future site visits.

4.0 REFERENCES:

AMEC, 2006. Keltic Petrochemicals and Liquefied Natural Gas Facility Environmental Assessment, Goldboro, Nova Scotia. Final Report (dated July 2006).

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NSE (Nova Scotia Environment), 2008: Boreal Felt Lichen Habitat Modeling.

CLIENT: GOLDBORO LNG	100 50 0 100 200 Metres	PROJECT: GOLDBORO LNG	DWN BY: TM	DATE: May 2013
	DATUM: NAD 83		CHK'D BY: MS	REV. NO:
AMEC Environment and Infrastructure A Division of AMEC Americas Ltd. 50 Troop Avenue, Unit 300 Dartmouth, N.S., B3B 1Z1 (P) 902-468-2848 (F) 602-468-1314	PROJECTION: UTM 20 North	TITLE: WETLAND, HABITAT AND LICHEN SURVEY SEPTEMBER 2012	SCALE: 1:10,000	FIGURE NO: 1
	PROJECT NO: TV121039			

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SOURCE: NBDNR Aerial Photography

Photo 1: Coniferous forest: open, mature (LMK 12-13). Sparse lichen vegetation.

Photo 2: Coniferous forest: open, mature (LMK5). Sparse lichen vegetation.

Photo 3: Coniferous forest with shrub layer (LMK 21).

Photo 4: Abandoned mine site in older coniferous forest.

Photo 5: Logging road with young coniferous forest (LMK31).

Photo 6: Opening in older regenerating coniferous forest (LMK31).

Photo 7: Dense regenerating (young) coniferous forest (LMK32).

Photo 8: Dense young regenerating forest (LMK16).

Photo 9: Tall shrub habitat in young coniferous forest (LMK 20).

Photo 10: Young coniferous forest near the coast.

Photo 11: Tall shrub habitat (LMK1).

Photo 12: Tall shrub habitat (LMK 15).

Photo 13: Disturbed re-generating habitat: re-growth dominated by black spruce and balsam fir saplings (LMK 8).

Photo 14: Disturbed re-generating habitat: dominated by raspberry; standing dead tree (LMK 29).

Photo 15: Riparian habitat (LMK11)

Photo 16: Riparian habitat (LMK24).

Photo 17: Barren: ericaceous shrubs occupying former old field habitat near Red Head

Photo 18: Beach at Betty's Cove looking west from barrier beach at /Dung Cove Pond, with white spruce forest on former "old field" habitat.

Photo 19: Red Head with brackish/ saline pond. Beach on western side of Red Head Peninsula, looking west.

Photo 20: Cobble Beach at Betty’s Cove, looking west.

Photo 21: Dung Cove Pond, looking NW.

Photo 22: View southwest from ridge (LMK 34).

Photo 23: Lichens: *Lobaria scrobiculata* and *Lobaria pulmonaria* (near LMK 14).

Photo 24: Lichens: *Lobaria scrobiculata* and *Lobaria pulmonaria* (near LMK 14).

Appendix D-2
Plant Inventory
(AMEC 2006)

Keltic Project Plant Inventory (AMEC, 2006) with 2013 Conservation Ranks							
Scientific Name	***Common Name***	***Site***	***Meadow Lake***	***ACCDC S-Rank (2013)***	***National N-Rank (2013)***	***SARA/ NSESA/ COSEWIC/ NSDNR General Status (2013)***	***Comments (2013 Nomenclature)***
Abies balsamea	Balsam-fir	X	X	S5	N5		
Acer rubrum	Red Maple	X	X	S5	NNR		
Achillea millefolium	Yarrow	X		S5	N5		
Acorus americanus	Sweetflag	X		S4	N5		
Aegopodium podagraria	Goutweed	X		SNA	NNA		
Agrostis canina	Velvet Bent Grass, Brown Bent		X	SNA	NNA		
Agrostis gigantea	Red Top	X		SNA	NNA		
Agrostis stolonifera	Creeping Bent Grass	X	X	S5	N5		
Alnus incana	Speckled Alder	X	X	S5	NNR		
Ambrosia artemisiifolia	Common Ragweed	X		S5	N5		
Amelanchier spp.	Serviceberry	X	X				
Amelanchier canadensis	Wild Pear	X		S4?	NNR		
Amelanchier cf. laevis	Smooth Serviceberry	X	X	S5	NNR		
Anaphalis margaritacea	Pearly Everlasting	X		S5	N3N5		
Andromeda glaucophylla	Bog-rosemary	X	X	S5	NNR		*Andromeda polifolia*
Anthoxanthum odoratum	Sweet Vernal Grass	X		SNA	NNA		
Aralia nudicaulis	Wild Sarsaparilla	X	X	S5	N5		
Arenaria lateriflora	Sandwort	X		SNA	NNA		*Arenaria serpyllifolia*
Arethusa bulbosa	Dragon's Mouth	X	X	S4	N4?		
Aronia melanocarpa	Black Chokeberry	X	X	S5	NNR		*Photinia melanocarpa*
Aster acuminata	Wood Aster	X		S5	NNR		*Oclemena acuminata*
Aster nemoralis	Bog Aster	X	X	S5	NNR		*Oclemena nemoralis*
Aster novi-belgii	New York Aster	X	X	S5	N3N5		*Symphyotrichum novi-belgii*
Aster radula	Aster	X	X	S5	NNR		*Eurybia radula*
Aster umbellatus	Tall White Aster	X	X	S5	NNR		*Doellingeria umbellata*
Atriplex cf. patula	Spreading Orach	X		SNA	NNR		
Betula alleghaniensis	Yellow Birch	X		S5	NNR		
Betula cordifolia	Canoe Birch		X	S5	NNR		*Betula papyrifera var. cordifolia*
Betula papyrifera	White Birch	X	X	S5	N5		
Bidens frondosa	Common Beggar's Ticks	X		S5	N5		
Brassica juncea	Chinese mustard	X		SNA	NNA		
Cakile edentula	Sea-rocket	X		S5	NNR		
Calamagrostis canadensis	Blue-joint	X	X	S5	N5		
Calamagrostis pickeringii	Reed Grass	X	X	S4S5	NNR		
Calopogon tuberosus	Grass-Pink		X	S4	NNR		
Calystegia sepium	Hedge-bindweed	X		S5	N5		

Carex brunnescens	Sedge	X	X	S5	NNR		
Carex canescens	Sedge	X		S5	NNR		
Carex cf. hormathodes	Sedge	X		S4S5	NNR		
Carex cf. lenticularis	Sedge		X	S4	NNR		
Carex cf. oligosperma	Sedge		X	S5	NNR		
Carex crinita	Sedge		X	S5	NNR		
Carex echinata	Sedge	X	X	S5	NNR		
Carex exilis	Sedge	X	X	S4	NNR		
Carex folliculata	Sedge	X	X	S5	NNR		
Carex lurida	Sedge		X	S5	NNR		
Carex michauxiana	Sedge		X	S4	NNR		
Carex nigra	Sedge	X		S5	N5		
Carex palacea	Sedge	X		S5	NNR		
Carex pallescens	Sedge	X		S5	N5		
Carex scoparia	Sedge		X	S5	NNR		
Carex stricta	Sedge	X	X	S5	NNR		
Carex trisperma	Sedge	X	X	S5	NNR		
Carum carvi	Caraway	X		SNA	NNA		
Centaurea nigra	Knapweed	X		SNA	NNA		
Chamaedaphne calyculata	Leather-leaf	X	X	S5	N5		
Chelone glabra	Turtlehead	X		S5	NNR		
Chenopodium album	Lambs Quarters	X		SNA	N1N3		
Chrysanthemum leucanthemum	Ox-eye Daisy	X		SNA	NNA		*Leucanthemum vulgare*
Circaea alpina	Small Enchanter's Nightshade	X		S5	NNR		
Cirsium vulgare	Bull thistle	X		SNA	NNA		
Coptis trifolia	Goldthread	X	X	S5	N5		
Cornus alternifolia	Alternate-leaved Dogwood	X		S5	NNR		
Cornus canadensis	Bunchberry	X	X	S5	N5		
Cornus sericea	Red Osier Dogwood	X		S5	NNR		
Cuscuta gronovii	Common Dodder	X		S4S5	NNR		
Danthonia spicata	Poverty Grass	X	X	S5	NNR		
Deschampsia flexuosa	Common Hairgrass	X		S5	N5		
Diphasiastrum complanatum	Crowfoot Clubmoss	X		S3S4	NNR		*Lycopodium complanatum*
Diphasiastrum digitatum	Running Pine	X	X	S5	NNR		*Lycopodium digitatum*
Drosera intermedia	Narrow-leaved Sundew		X	S5	NNR		
Drosera rotundifolia	Round-leaved Sundew	X	X	S5	N5		
Dryopteris campyloptera	Eastern Spreading Wood Fern	X		S5	NNR		
Drypoteris carthusiana	Spinulose Wood Fern	X		S5	NNR		
Dryopteris intermedia	Evergreen Wood Fern	X	X	S5	NNR		
Dulichium arundinaceum	Three-way Sedge		X	S5	NNR		
Echinocystis lobata	Wild Cucumber	X		SNA	N5		

Eleocharis acicularis	Spikerush	X		S5	NNR		
Eleocharis palustris	Spikerush	X		S5	NNR		
Elymus mollis	American Dune Grass	X		S5	NNR		*Leymus mollis*
Elymus repens	Witch-grass	X		SNA	NNA		
Elymus virginicus	Wild Rye Grass	X		S5	NNR		
Empetrum nigrum	Black Crowberry	X	X	S5	NNR		
Epigaea repens	Mayflower	X	X	S5	NNR		
Epilobium angustifolium	Fireweed	X		S5	NNR		*Chamerion angustifolium*
Epilobium leptophyllum	Bog Willow-herb	X		S5	NNR		
Equisetum sylvaticum	Wood-horsetail	X		S5	NNR		
Equisetum variegatum	Horsetail	X		S3	NNR		
Erigeron strigosus	Daisy Fleabane	X		S5	N5		
Eriophorum tenellum	Cotton-grass		X	S4S5	NNR		
Eriophorum vaginatum	Hare's Tail	X	X	S5	NNR		
Eriophorum virginicum	Tawny Cotton-grass		X	S5	N5		
Euphrasia officinalis	European Eyebright	X		SNA	NNA		*Euphrasia stricta*
Euthamia graminifolia	Narrow-leaved Goldenrod	X		S5	NNR		
Festuca ovina	Sheep Fescue		X	SNA	NNA		F. trachyphylla of Gleason and Cronquist (1991)
Festuca rubra	Red Fescue	X		SNA	NNR		
Fragaria virginiana	Strawberry	X	X	S5	NNR		
Galeopsis tretrahit	Hemp-nettle	X		SNA	NNA		
Galium mollugo	Cleavers	X		SNA	NNA		
Galium palustre	Marsh Bedstraw	X		S5	NNR		
Galium tinctorium	Small Bedstraw	X		S5	NNR		
Gaultheria hispidula	Creeping Snowberry	X	X	S5	NNR		
Gaultheria procumbems	Checkerberry	X	X	S5	N5		
Gaylussacia baccata	Huckleberry	X		S5	NNR		
Gaylussacia dumosa	Bog Huckleberry	X	X	S5	NNR		*Gaylussacia bigeloviana*
Glaux maritima	Sea-milkwort	X		S5	N5		
Glyceria borealis	Northern Manna-grass		X	S5	NNR		
Glyceria canadensis	Rattlesnake Grass	X	X	S5	N4N5		
Glyceria laxa (x laxa)	---	X		S4?	NNR		
Gymnocarpium dryopteris	Common Oak Fern	X		S5	N5		
Hesperis matronalis	Dame's Rocket	X		SNA	NNA		
Hippurus vulgaris	Mare's-tail	X		S4	N4N5		
Humulus lupulus	Hops	X		S4	N5		
Hypericum boreale	Northern St. John's-wort		X	S5	N5		
Hypericum ellipticum	Pale St. John's-wort		X	S5	NNR		
Hypericum perforatum	Common St. John's-wort	X		SNA	NNA		
Ilex verticillata	Winterberry	X		S5	NNR		
Impatiens capensis	Jewelweed	X		S5	N5		
Iris versicolor	Blue Flag	X		S5	N5		probably in all areas
Juncus acuminatus	Rush	X		S3S4	NNR		
Juncus articulatus	Rush	X		S5	NNR		

Juncus brevicaudatus	Short-tailed Rush	X		S5	N5		
Juncus canadensis	Rush	X	X	S5	N5		
Juncus effusus	Soft Rush	X		S5	N5		
Juncus filiformis	Rush	X	X	S5	NNR		
Juncus cf. pelocarpus	Rush	X		S5	N5		
Juncus tenuis	Path Rush	X		S5	NNR		
Juniperus communis	Common Juniper	X	X	S5	N5		
Kalmia angustifolia	Sheep Laurel	X	X	S5	NNR		
Kalmia polifolia	Bog Laurel	X	X	S5	NNR		
Larix laricina	Tamarack	X	X	S5	N5		
Lathyrus maritimus	Beach Pea	X		S5	NNR		*Lathyrus japonicus var. maritimus*
Ledum groenlandicum	Labrador Tea	X	X	S5	N5		
Ligusticum scothicum	Scotch Lovage	X		S5	NNR		
Limonium carolinianum	Sea Lavender	X		S5	NNR		
Linnaea borealis	Twinflower	X	X	S5	NNR		
Lolium perenne	Perennial Rye-grass	X		SNA	NNA		
Lonicera caerulea	Mountain Fly-honeysuckle	X	X	S4S5	NNR		*Lonicera villosa*
Lonicera canadensis	Fly-honeysuckle	X		S5	NNR		
Lupinus polyphyllus	Garden Lupine	X		SNA	N4		
Luzula multiflora	Common Woodrush	X		S5	N5		
Lycopodium clavatum	Running Clubmoss	X		S5	N5		
Lycopus uniflorus	Bugle-weed	X		S5	NNR		
Lysimachia terrestris	Loosestrife	X	X	S5	N5		
Lysimachia thyrsiflora	Water Loosestrife	X		S4	NNR		
Maianthemum canadense	Wild Lily-of-the-valley	X	X	S5	NNR		
Melampyrum lineare	Cow-wheat	X		S5	N5		
Mertensia maritima	Sea Lungwort	X		S5	NNR		
Mitchella repens	Partridge Berry	X		S5	NNR		
Monotropa uniflora	Indian Pipe	X		S5	N5		
Myrica gale	Sweet Gale	X	X	S5	NNR		
Myrica pensylvanica	Bayberry	X		S5	NNR		*Morella pensylvanica*
Nemopanthus mucronata	False Holly	X	X	S5	NNR		
Nuphar variegata	Cow-lily		X	S5	NNR		*Nuphar lutea*
Nymphaea adorata	Water-lily		X	S5	N5		
Oenothera biennis	Evening Primrose	X		S5	N5		
Onoclea sensibilis	Sensitive Fern		X	S5	NNR		
Osmunda cinnamomea	Cinnamon Fern	X	X	S5	NNR		
Phleum pratense	Timothy	X		SNA	NNA		
Picea glauca	White Spruce	X	X	S5	N5		
Picea mariana	Black Spruce	X	X	S5	N5		
Pinus strobus	White Pine	X		S5	N5		
Plantago lanceolata	Narrow-leaved Plantain	X		SNA	NNA		
Plantago major	Common Plaintain	X		SNA	NNA		
Plantago maritima	Seashore Plaintain	X		S5	NNR		

Plantathera lacera	Ragged Orchid	X		S4S5	NNR		
Plantathera psycodes	Small Purple Fringed Orchid	X		S4	NNR		
Poa palustris	Fowl Meadow Grass	X		S5	N5		
Poa pratensis	Kentucky Bluegrass	X		S5	N5		
Polygonum aviculare	Prostrate Knotweed	X		S5	NNA		
Polygonum cilinode	Fringed Buckwheat	X		S5	NNR		
Polygonum convolvulus	Wild Buckwheat	X		SNA	NNA		
Polygonum persicaria	Ladie's Thumb	X		SNA	NNA		
Polygonum sagittatum	Tear-thumb	X		S5	N4N5		
Populus alba	White Poplar	X		SNA	NNA		
Populus grandidentata	Large-toothed Aspen		X	S5	NNR		
Populus tremuloides	Trembling Aspen	X		S5	NNR		
Potentilla anserina	Silverweed	X		S5	N4N5		*Argentina anserina*
Potentilla palustris	Marsh Cinquefoil	X		S5	NNR		*Comarum palustre*
Potentilla simplex	Cinquefoil	X	X	S5	N5		
Potentilla tridentata	Three-toothed Cinquefoil		X	S5	NNR		*Sibbaldiopsis tridentata*
Prunella vulgaris	Heal-all	X		S5	N5		
Prunus pensylvanica	Pin-cherry	X		S5	NNR		
Pteridium aquilinum	Bracken	X	X	S5	N5		
Quercus rubra	Red Oak		X	S5	NNR		north of ML, ATV trail
Ranunculus acris	Tall Buttercup	X		SNA	NNA		
Ranunculus cymbalaria	Seashore Buttercup	X		S5	NNR		
Ranunculus repens	Creeping Buttercup	X		SNA	NNA		
Rhinanthus crista-galli	Yellow Rattle	X		S5	N5		*Rhinanthus minor*
Rhododendron canadense	Rhodora	X	X	S5	NNR		
Rhynchospora alba	Beak-rush	X	X	S5	NNR		
Ribes glandulosum	Skunk Currant	X		S5	N5		
Rosa nitida	Swamp Rose	X		S4	N4N5		
Rosa virginiana	Common Wild Rose	X		S5	NNR		
Rubus allegheniensis	Common Blackberry	X		S5	N5		
Rubus chamaemorus	Bakeapple	X	X	S4	NNR		
Rubus cf. flagellaris	**Northern Dewberry**		**X**	**S1?**	**N4**	**NSDNR: Undeter.**	
Rubus cf. hispidus	Swamp-dewberry	X	X	S5	NNR		
Rubus idaeus	Red Raspberry	X		S5	N5		
Rubus pubescens	Dwarf Raspberry	X	X	S5	NNR		
Rumex acetosa	Sourdock	X		SNA	N4N5		
Rumex acetosella	Sheep-sorrel	X		SNA	NNA		
Rumex crispus	Curled Dock	X		SNA	NNA		
Rumex pallidus	Sea-beach Dock	X		S4?	NNR		
Salicornia europaea	Glasswort	X		S5	N3N5		*Salicornia maritima*
Salix bebbiana	Beaked Willow	X		S5	NNR		
Salix discolor	Pussy Willow	X		S5	NNR		
Salix pyrifolia	Bog Willow	X		S5	NNR		
Sambucus racemosa	Red-berried Elder	X		S5	N5		
Sarracenia purpurea	Pitcher-Plant	X	X	S5	N5		

Scirpus atrovirens	Bulrush	X		SNA	NNR		
Scirpus caespitosum	Deer Grass	X	X	S5	NNR		*Trichophorum caespitosum*
Scirpus cyperinus	Wool-grass	X	X	S5	NNR		
Scirpus subterminalis	Bulrush		X	S5	NNR		*Schoenoplectus subterminalis*
Scirpus validus	Softstem Bulrush	X		S5	N5		*Schoenoplectus tabernaemontani*
Scutellaria galacteria	Marsh-skullcap	X		S5	NNR		*Scutellaria galericulata*
Senecio jacobea	Tansy Ragwort	X		SNA	NNA		
Smilacina trifolia	Three-leaved False Solomon's Seal	X	X	S5	NNR		*Maianthemum trifolium*
Solidago canadensis	Canada Goldenrod	X		S5	N5		
Solidago puberula	Rough Goldenrod	X	X	S5	NNR		
Solidago rugosa	Rough Goldenrod	X		S5	N5		
Solidago sempervirens	Seaside Goldenrod	X		S5	N3N5		
Solidago uliginosa	Bog-goldenrod	X	X	S5	NNR		
Sonchus asper	Spiny Sow-thistle	X		SNA	NNA		
Sorbus americana	Mountain-ash	X	X	S5	NNR		
Sorbus decora	American Mountain-ash	X	X	S4	NNR		
Sparganium angustifolium	Bur-reed	X		S5	NNR		
Spiraea alba	Meadow-sweet	X	X	S5	N5		
Spiraea tomentosa	Steeplebush	X	X	S5	N5		
Stellaria graminea	Grass-leaved Stitchwort	X		SNA	NNA		
Sueda maritima	Sea-blite	X		S5	NNR		
Taraxacum officinale	Dandelion	X		SNA	N5		
Thalictrum pubescens	Meadow-rue	X	X	S5	NNR		
Thelypteris novaboracensis	New York Fern	X		S5	NNR		
Triadenum fraseri	Marsh St. John's-wort	X		S5	N5		
Triadenum virginicum	Marsh St. John's-wort	X		S5	NNR		
Trientalis borealis	Starflower	X	X	S5	NNR		
Trifolium campestre	Low Hop Clover	X		SNA	NNA		
Trifolium pratense	Red Clover	X		SNA	NNA		
Trifoilum repens	Creeping White Clover	X		SNA	NNA		
Triglochin maritima	Arrow-grass	X		S5	NNR		
Tussilago farfara	Coltsfoot	X		SNA	NNA		
Typha latifolia	Broad-leaved Cat-tail	X	X	S5	N5		
Utricularia cornuta	Horned Bladderwort	X	X	S5	NNR		
Vaccinium angustifolium	Lowbush Blueberry	X	X	S5	N5		
Vaccinium macrocarpon	Large Cranberry	X	X	S5	N4?		
Vaccinium myrtilloides	Velvet-leaf Blueberry	X	X	S5	N5		
Vaccinium oxycoccus	Small Cranberry	X	X	S5	N5		
Vaccinium vitis-idaea	Mountain Cranberry	X	X	S5	NNR		
Vallisneria americana	**Water Celery**	**X**	**X**	**S2**	**N5**	**NSDNR: Red**	
Veronica officinalis	Common Speedwell	X		S5	NNR		

Viburnum nudum	Witherod	X	X	S5	NNR		
Vicia cracca	Tufted Vetch	X		SNA	NNA		
Viola cucullata	Blue Violet	X		S5	NNR	probably in all areas	
Viola macloskeyi	Small White Violet	X	X	S5	NNR		
Notes:							
Meadow Lake - Lake basin up to the estimated water level of flooding due to potential impoundment for the Keltic Project (AMEC, 2006). There will be no flooding and impoundment for the Goldboro Project.							
"Site" refers to the Keltic main site area including the terminal area (AMEC, 2006). This includes the Goldboro LNG site and the neighbouring former Keltic Petrochemicals Site.							
This list is composed of those species observed and noted in the field, and while an attempt was made to record all vascular plant species this table does not represent an exhaustive list; e.g., if a species is not listed herein, it does not mean that it is absent from the area. Some plant species may have been inadvertently not observed or recorded, or the timing of field visits did not coincide with observable plant presence (AMEC, 2006).							
Nomenclature is largely in accordance with Zinck (1998) (AMEC, 2006). Nomenclature valid in 2013 is listed in the "comments" column.							

Appendix D-3
Habitat, Rare Vegetation and Wetland Survey
(June 2013)

Habitat, Wetland and Rare Plant Survey, June 17-21st, 2013: Methods, Results and Photographs

Habitat, wetland and rare plant surveys were carried out June 17th to 21st, 2013, by AMEC biologist Scott Burley, M.Sc. and field assistant Leah Darche, B.Sc. in the footprint of the proposed Goldboro LNG project. This includes the proposed:

- LNG facility footprint;
- Temporary work camp area;
- Water supply pipeline right-of-way (ROW); and
- Meadow Lake water intake structure location.

1.0 PURPOSE

The purpose of the June 2013 study was to:

- Confirm, identify and describe significant habitats within the Project footprint;
- Identify, delineate and functionally assess wetlands additional to those found during the September 2012 study; and
- Conduct, confirm presence/absence and identify areas of high potential habitats of rare plant species.

This information was used to compare the current condition on the site with the description presented in the Keltic Project EA (AMEC, 2006) as well as information gathered during the September 2012 study, and to identify the extent of change and/or requirements for new information.

2.0 METHODS

The following documents were reviewed prior to conducting the field surveys:

- Aerial photography (NSDNR and Google Earth)
- Maps of existing habitat
  - Forest inventory maps (NSDNR, 1988-2000)
  - Topographical maps
  - Depth- to-water-table mapping (NSDNR, 2012)
- Keltic EA report (AMEC, 2006)
- NSDNR Wetlands Inventory and Significant Habitats Databases online

2.1 Habitat and Vegetation

To supplement the September 2012 study and to encompass the entire Project footprint, additional habitat investigations were conducted by walking within the proposed water supply pipeline ROW. Dominant plant species in the various habitats were noted and used as a basis for the habitat descriptions. Habitats were documented with photos.

2.2 Wetland Identification, Delineation and Evaluation

A desktop review of aerial photography, the Keltic EA report (AMEC, 2006) and depth-to-water-table mapping (NSDNR, 2012) were consulted prior to field studies in order to identify areas

with high likelihood for presence of wetlands. The locations of wetlands detected in the field were marked with GPS. Wetlands were delineated according to the standard Reg IV US Army Corps of Engineers methods. Wetland data sheets were used to document delineation and wetland habitat information. Wetlands were photographed and classified applying the Canadian Wetland Classification System (1997). Functional Assessments were also conducted using the NovaWET methodology adopted by the Nova Scotia Department of Environment (NES) (see wetland field report, AMEC 2013, for more information).

2.3 Rare Plant Surveys

The plant surveys were carried out in accordance with standard methodologies. Survey methods consisted of optically controlled meanders through areas slated for direct disturbance (vegetation clearing) as well as the surrounding area. This method is considered to be the most efficient way for achieving maximum diversity of species found, but requires the knowledge of the types and locations of sub-habitats and microhabitats. Plant survey locations were documented by GPS tracking.

3.0 RESULTS

3.1 Habitat

The September 2012 and June 2013 site surveys have confirmed that terrestrial habitat conditions remain largely unaltered since the provincial EA of the Keltic Project in 2006. It should be noted that there is an increased height/mass of woody plants. This is due mainly to growth and regeneration after forest harvesting, the last of which may have occurred in a limited area in 2005. There have been no industrial developments since 2006, despite the Site's location in an industrial park.

In June 2013, habitat types were investigated within the water supply pipeline ROW. Eleven habitat types and plant communities were identified within this area, including one general wetland category which encompasses all wetland types encountered (see AMEC 2013 for more information), as shown in Table 1. The description of habitat is based on the most frequent plant species observed, and tree size where applicable.

Figure 1 depicts the geo-referenced survey locations. Photos depicting habitat types are provided at the end of the report. Photos of wetlands are provided in the separate wetland survey report.

Table 1: Habitat Types in the Water Supply Pipeline, Definitions and Summaries

Picture #	Type	Definition and Summaries
1, 2, 3	**Natural Stand: Coniferous Forest**	Forest stands composed of more than 75% coniferous (softwood) trees (NSDNR). The trees in these polygons are more mature than the trees in "young coniferous forest". Dominated by balsam fir, mature or nearing maturity, with tree diameters for balsam fir from about 15 cm dbh to 20 cm and occasionally 30 cm dbh; red maple and heartleaf birch are few and up to 20-30 cm dbh.
4, 5, 6, 15	**Natural Stand: Mixed Forest**	Forest stands composed mostly of balsam fir, white birch, red maple, and black spruce.

Picture #	Type	Definition and Summaries
7	**Young Coniferous Forest***	Areas of re-growth, most often following forestry activity, and other disturbance. Dominated by young trees (saplings) with occasional patches of shrubs (often mountain holly, witherod or alders). Older regenerating forest is dominated by young balsam fir with an estimated height of 6-10 m.
8, 9, 10	**Tall Shrubs***	At the Goldboro Project site, tall shrubs with an estimated height of around 2m, dominated by mountain holly (*Nemopanthus mucronatus*) and witherod (*Viburnum nudum*). NSDNR categorized this polygon as "brush", which is defined as any area containing less than 25% merchantable tree cover and contains non-merchantable woody plants consisting of at least 25% cover (NSDNR).
5	**Alder**	"Alders 75% or greater cover- any forested area containing alders that compose 75% or more crown closure (NSDNR, code 39 in forest inventory map). Near the Goldboro Project site: a dense thicket of tall alders (*Alnus incana*).
11	**Disturbed - Re-generating***	At the Project site, this category is represented by areas either dominated by raspberry with dead wood, or with patches of shrubs of about 1 m height, or by clear cuts** with indications of early stages of regeneration**, such as seedlings and small saplings of trees and shrubs. Dominated by small woody plants and herbaceous vegetation.
12	**Early Deciduous Forest**	Dominated with Red Maple in the canopy layer and mountain ash, witherod and alder in the ground layer. Habitat found along the Water Supply Pipeline near Meadow Lake.
13, 14	**Riparian***	Habitat along watercourses. In the Project footprint, there is little such habitat. Long stretches of streams have no real floodplain, possibly due to the steep gradient of the terrain.
16	**Wind Throw**	Fir and spruce species standing within an open habitat. Majority of trees pushed over leaving high amounts of coarse woody debris.
17-21	**Freshwater Wetlands ****	"Any wet area not identified as a lake, river or stream" (NSDNR). Encompasses the wetland classes: fen, marsh, swamp, and open water; definition extended to include wetland class bog.

- * Habitat type not used in the Forest Inventory
- ** Definition extended beyond Forest Inventory Map Definition (NSDNR, 2007/2012)
- Clear cuts are defined by NSDNR as "Any stand that has been completely cut and any residuals make up less than 25 % crown closure and with little or no indication of regeneration".
- NSDNR Forest Stand Maturity Classes defines "regenerating forest" as " trees less than 1m high and less than 20 years of age, and "young trees" as "trees less than 40 years and 6 m or less in height".
- dbh=diameter at breast height; dbh was estimated
- Old Field = "Any field that has an indication of merchantable tree species growing in with less than 25% crown closure and less than 1.0 meters of height" (NSDNR, 2007). In the Project footprint, this habitat type has been replaced due to re-colonization.
- "Mature" is used here in a biological- ecological sense, not in a forestry sense, and includes observation of factors such as standing dead trees and fallen coarse woody debris which may provide indications concerning the timing of disturbance.

3.2 Wetlands

In September 2012, ten freshwater wetlands were detected, evaluated, and delineated within the LNG Facility, including two wetlands next to the Project boundaries which are hydrologically connected to the Project footprint.

Three new wetlands were located on the LNG Facility in June 2013 which were evaluated and delineated. An additional fifteen wetlands were identified along the water supply pipeline ROW. It is uncertain how many of these wetlands will be impacted as the water supply pipeline routing has not yet been finalized. Upon finalization, those wetlands which will be impacted will be fully delineated (within the Project footprint) and functional assessments will be conducted.

Most of the potentially impacted wetlands are freshwater wetland complexes consisting of several wetland classes and types: shallow open water, fen, bog, shallow marsh, shrub swamp, and wooded swamp. Therefore, both mineral wetlands and peatlands are present. Most wetlands are associated with streams or surface drainage features. For further information regarding the methods and results of the wetland survey, see the wetland field survey report (AMEC, 2013).

3.3 Rare Plants

GPS points and tracks are depicted in Figure 1. No new rare plant species or high potential habitat were observed during the June 2013 survey.

4.0 REFERENCES

AMEC, 2006. Keltic Petrochemicals and Liquefied Natural Gas Facility Environmental Assessment, Goldboro, Nova Scotia. Final Report (dated July 2006).

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NSDNR (Nova Scotia Department of Natural Resources), 2013: Nova Scotia Wetlands Vegetation and Classification Inventory. Wetland and vegetation layers were last updated June 12, 2012. Online viewer available at: http://gis4.natr.gov.ns.ca/website/nssighabnew/viewer.htm; last accessed February 7 and 11, 2013.

NSDNR (Nova Scotia Department of Natural Resources), 2013: Significant Habitats. Significant Habitats Layer was last updated April 11, 2012. Online viewer available at: http://gis4.natr.gov.ns.ca/website/nssighabnew/viewer.htm; last accessed February 7 and 11, 2013

NSE (Nova Scotia Environment), 2008: Boreal Felt Lichen Habitat Modeling.

Meadow Lake

Gold Brook Lake

N

S

Gold Brook

SOEI GAS PLANT

WEBB'S COVE

DUNG COVE

CRANE LAKE

BETTY'S COVE BROOK

BETTY'S COVE

STORMONT BAY

LEGEND:

- GPS Location
- GPS Track Log
- Water Supply Pipeline (proposed)
- LNG Facility (proposed)

CLIENT: Pieridae Energy (Canada) Limited

0 300 600 Meters

DATUM: NAD 83

PROJECTION: UTM 20 North

PROJECT NO: TV121039

PROJECT: ENVIRONMENTAL ASSESSMENT

GOLDBORO LNG

TITLE: TERRESTRIAL SURVEY JUNE 2013 GPS LOCATIONS AND TRACKS

DWN BY: JT

DATE: Aug 2013

CHK'D BY: CL

REV. NO:

SCALE: 1:22,000

FIGURE NO: 1

AMEC Environment and Infrastructure
A Division of AMEC Americas Ltd.
Suite 1 - 495 Prospect Street
Fredericton, NB E3B 9M4
Tel. 506-458-1000 Fax 506-450-0829 Web www.amec.com

Path: G:\GIS\PROJECTS\TV121039_Phase3000\MXD\20130815_Terrestrial_SurveyFig_1.mxd User: jonathan.thornton Date: 16/08/2013

SOURCE: Bing Map Service - Aerial / SNSMR - Topographic Data

Photo 1: Coniferous forest: open, mature.

Photo 2: Coniferous forest with shrub layer.

Photo 3: Coniferous forest dominated by balsam fir.

Photo 4: Mixed Open Forest dominated by balsam fir, red maple, and white birch.

Photo 5: Mixed forest dominated by black spruce with an edge of alder habitat.

Photo 6: Mixed forest dominated by larch and balsam fir.

Photo 7: Dense regenerating (young) coniferous forest.

Photo 8: Tall shrub habitat dominated by wild raisin and red maple.

Photo 9: Tall shrub habitat within coniferous forest.

Photo 10: Clear cut regeneration, tall shrub habitat.

Photo 11: Disturbed re-generating habitat: re-growth dominated by balsam fir saplings.

Photo 12: Early deciduous forest, dominated by red maple.

Photo 13: Riparian habitat.

Photo 14: Riparian habitat.

Photo 15: Mixed Forest near Meadow Lake.

Photo 16: Open forest (wind throw) dominated by balsam fir.

Photo 17: Small pocket bog.

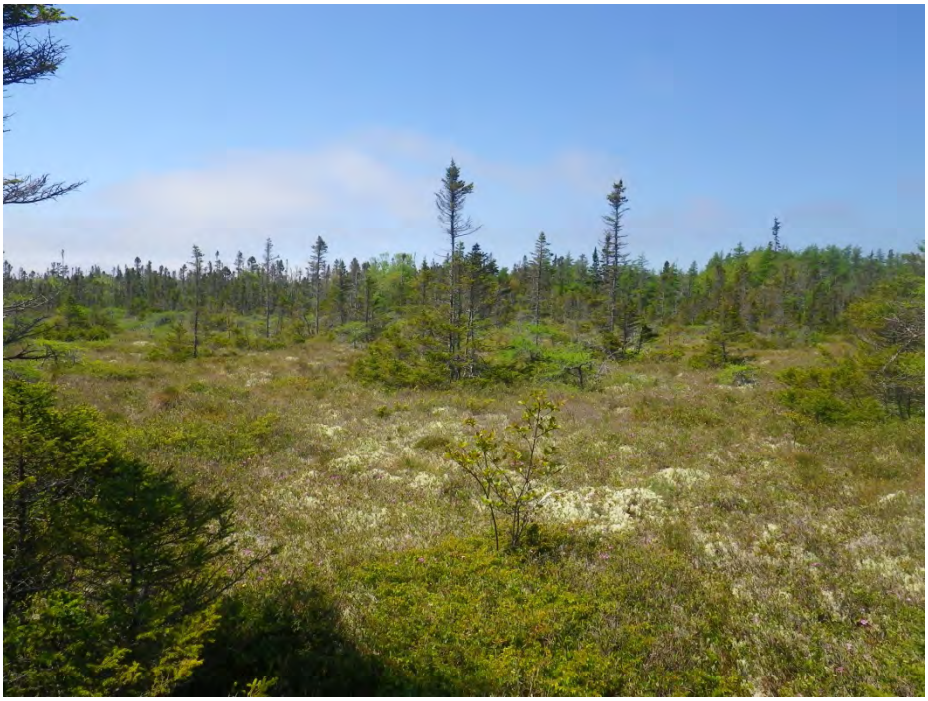


Photo 18: Raised bog dominated by black spruce.

Photo 19: Open, treed fen.

Photo 20: Wetland habitat.

Photo 21: Open, treed wetland near Meadow Lake.

Appendix D-4
Avian Survey Results
(July 2013)

Avian Surveys
July 2013: Methods, Results and Photographs

Breeding bird surveys with a focus on avian species at risk were carried out on 02 and 03 July 2013 by AMEC biologist Maureen Cameron-MacMillan, M.Sc. and experienced birder Laura Saunders in the footprint of the proposed Goldboro LNG project.

Surveys were conducted in the proposed LNG facility footprint and temporary work camp area, as well as the water supply pipeline right-of-way (ROW) and Meadow Lake water intake structure location.

1.0 AVIAN SURVEY

1.1 Purpose

The purpose of the July 2013 avian study was to:

- Supplement earlier bird survey work conducted in the LNG facility footprint for the Keltic and Maple projects using standard, quantifiable survey methods and representing a greater variety of habitat types in the Project area;
- Provide information on avian species presence and distribution along the water supply pipeline and at the Meadow Lake intake structure; and
- Perform targeted surveys for avian species at risk identified as having potential to occur in the study area.

1.2 Methods

In preparation for the field surveys, a review of available information on avian species presence in the study area was conducted, including Maritimes Breeding Bird Atlas (MBBA) data and the results of field surveys conducted for the Keltic EA and Maple LNG project in 2004, 2005 and 2008. AMEC habitat mapping was consulted for information on the habitat types present in the Project area.

All surveys were conducted by experienced observers, each with over ten years of birding experience in eastern Nova Scotia including participation in the MBBA and Cape Breton Nocturnal Owl Survey.

1.2.1 Point Count Surveys

For the breeding bird surveys, point counts were the primary method of data gathering. Each point count consists of a ten minute period of silent listening, during which all birds observed within 100 m of the observer were recorded. Additional species seen or heard outside of the ten minute listening period or more than 100 m from the observer, as well as any incidental non-avian observations, were noted separately.

Surveys began at dawn and continued until late morning, when bird activity was perceived to drop off. Species were identified visually or by their unique vocalizations. Bird activity and evidence of reproductive behaviour was noted, and the status of each species was recorded as “possible”, “probable”, or “confirmed” breeding based on criteria from Bird Studies Canada and

the MBBA. Examples of such behavioural cues for breeding, and codes used to record this breeding evidence, are shown in Table 1.

Table 1. Breeding Evidence Codes Used in MBBA Surveys

Level of Certainty	Code	Definition
No Evidence	X	Species observed in the survey area outside of suitable breeding habitat.
Possible	S	Individual singing in suitable nesting habitat during the breeding season.
	H	Individual observed in suitable nesting habitat during breeding season.
Probable	A	Agitated behaviour or alarm call of an adult in suitable nesting habitat.
	P	Presence of a pair in suitable nesting habitat during the breeding season.
Confirmed	NY	Nest with young.
	FY	Presence of recently fledged young.
	CF	Adult carrying food for young.

Point count locations were positioned 300 to 500 metres apart, and covered all major habitat types in the Project area.

1.2.2 Scanning for Coastal Species

The coastal portion of the Project area was traversed on foot and the area scanned for presence of waterfowl, shorebirds and other marine-associated species. A pair of 10X42 binoculars and a spotting scope equipped with a 20X - 60X zoom lens were used to scan the harbour.

1.2.3 Surveys for Avian Species at Risk

Surveys for diurnal species at risk were conducted as part of the point count surveys. In areas of suitable habitat where potential presence of an avian SAR is suspected, playback of territorial calls was used if deemed appropriate (i.e., for species that are known to be responsive to playback such as the Canada Warbler).

For SAR that are nocturnal/crepuscular, namely the Common Nighthawk and Short-eared Owl, surveys were conducted shortly before sunset. Point count surveys were conducted in fixed locations in areas of appropriate habitat within the survey area; both of these species tend to prefer open habitats such as cutovers. Survey locations were visited in daylight prior to conducting the survey, ensuring that appropriate and accessible survey locations were selected. The playback protocol consisted of a series of vocalizations, each followed by a one minute silent listening period; if a response was heard, observers estimated and recorded approximate distance and direction of the bird.

1.3 Results

1.3.1 Point Count Surveys

A total of eleven point count surveys were conducted in the LNG facility footprint and temporary work camp area, and an additional 14 were conducted along the water supply pipeline ROW and at the Meadow Lake water intake structure location. Figure 1 depicts the point count survey locations, along with the 2008 survey transects. A list of species observed during the surveys is provided in Table 2.

Thirty-eight species were observed in the LNG facility footprint and temporary work camp area, of which thirty-two were considered possible breeders. Two species, the American Redstart and Magnolia Warbler, were considered probable breeders; two others (Blackpoll Warbler and Yellow-rumped Warbler) were confirmed breeders. Along the pipeline ROW, thirty-one species were observed, including two confirmed breeders (Northern Harrier and Hairy Woodpecker), one probable breeder (Swamp Sparrow) and twenty-seven possible breeders (Table 2).

Table 2. Species Observed during July Avian Surveys at Goldboro Project Site

Common Name	Scientific Name	Highest Breeding Evidence[1]		
		LNG Facility	Pipeline	Coast
Alder Flycatcher	*Empidonax alnorum*	S	S	
American Crow	*Corvus brachyrhynchos*	H		
American Goldfinch	*Spinus tristis*	S		
American Redstart	*Setophaga ruticilla*	P	S	
American Robin	*Turdus migratorius*	S	S	
Bald Eagle	*Haliaetus leucocephalus*			X
Black-and-white Warbler	*Mniotilta varia*		S	
Black-capped Chickadee	*Parus atricapillus*	S	S	
Blackpoll Warbler	*Dendroica striata*	CF		
Black-throated Green Warbler	*Dendroica virens*	S		
Blue Jay	*Cyanocitta cristata*	S	S	
Blue-headed Vireo	*Vireo solitarius*	S	S	
Boreal Chickadee	*Parus hudsonicus*	S		
Cape May Warbler	*Dendroica tigrina*	S		
Chestnut-sided Warbler	*Dendroica pensylvanica*		S	
Chipping Sparrow	*Spizella passerina*		S	
Common Eider	*Somateria mollissima*			X
Common Loon	*Gavia immer*		X	H
Common Raven	*Corvus corax*	X		
Common Tern	*Sterna hirundo*			X
Common Yellowthroat	*Geothlypis trichas*	S	S	
Dark-eyed Junco	*Junco hyemalis*	S	S	
Double-crested Cormorant	*Phalacrocorax auritus*			X
Fox Sparrow	*Passerella iliaca*		S	
Gray Jay	*Perisoreus canadensis*	S		
Great Black-backed Gull	*Larus marinus*			X
Hairy Woodpecker	*Picoides villosus*	S	NY	

Common Name	Scientific Name	Highest Breeding Evidence[1]		
		LNG Facility	Pipeline	Coast
Hermit Thrush	*Catharus guttatus*	S	S	
Herring Gull	*Larus argentatus*	X		X
Kildeer	*Charadrius vociferus*			H
Least Flycatcher	*Empidonax minimus*	S	S	
Magnolia Warbler	*Dendroica magnolia*	A	S	
Mourning Warbler	*Oporornis philadelphia*	S		
Nashville Warbler	*Vermivora ruficapilla*	S	S	
Northern Flicker	*Colaptes auratus*	S		
Northern Harrier	*Circus cyaneus*	H	CF	
Olive-sided Flycatcher	*Contopus cooperi*		S	
Osprey	*Pandion haliaetus*	H	H	
Palm Warbler	*Dendroica palmarum*		S	
Purple Finch	*Carpodacus purpureus*	S	S	
Red-breasted Merganser	*Mergus serrator*			X
Red-eyed Vireo	*Vireo olivaceus*	S	S	
Ruby-crowned Kinglet	*Regulus calendula*	S	S	
Song Sparrow	*Melospiza melodia*	S	S	
Spotted Sandpiper	*Actitis macularia*			H
Swainson's Thrush	*Catharus ustulatus*	S		
Swamp Sparrow	*Melospiza georgiana*	S	A	
Tennessee Warbler	*Oreothlypis peregrina*	S		
White-throated Sparrow	*Zonotrichia albicollis*	S	S	
Wilson's Warbler	*Wilsonia pusilla*	S	S	
Winter Wren	*Troglodytes troglodytes*	S		
Yellow Warbler	*Dendroica petechia*		S	
Yellow-bellied Flycatcher	*Empidonax flaviventris*	S	S	
Yellow-rumped Warbler	*Dendroica coronata*	CF		

Note: 1. Breeding evidence codes are described in Table 1.

1.3.2 Scanning for Coastal Species

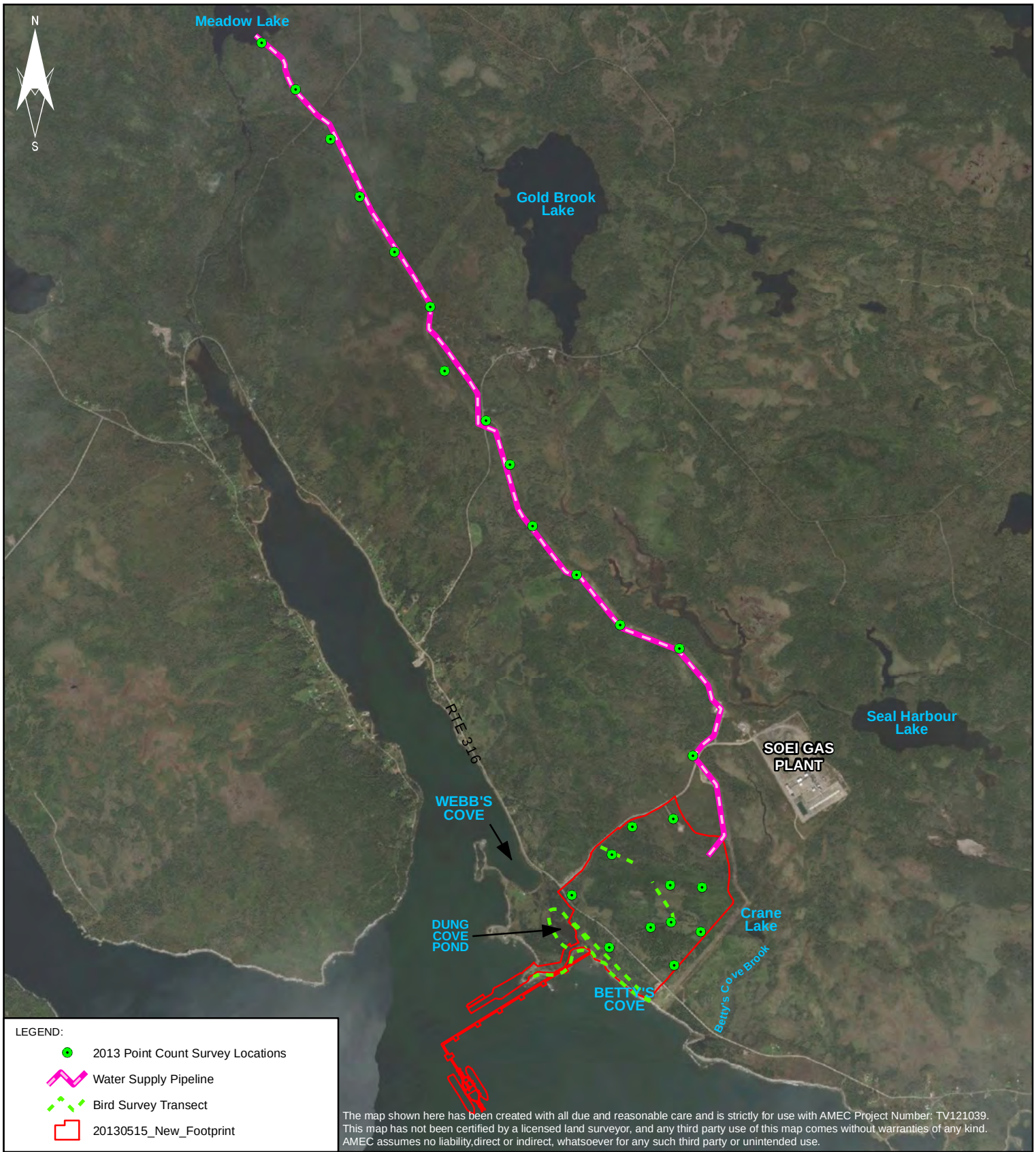
Ten species were observed along the coast and in the waters offshore (Table 2). Killdeer, Spotted Sandpiper and Common Loon are considered possible breeders in the Project area. The remaining seven species, Red-breasted Merganser, Common Eider, Herring Gull, Great Black-backed Gull, Common Tern, Bald Eagle and Double-crested Cormorant were not observed in suitable breeding habitat and are considered unlikely to be nesting in the Project footprint.

1.3.3 Surveys for Avian Species at Risk

Survey locations are depicted in Figure 1. Only one avian SAR, the Olive-sided Flycatcher, was observed during the surveys: two individuals were heard near the intersection of the pipeline ROW with Goldbrook Road.

1.3.4 Incidental Non-avian Observations

Two butterfly species, the Eastern tiger swallowtail (*Papilio glaucus*) and northern crescent (*Phyciodes cocyta*), were observed during the surveys. At Dung Cove pond, green frogs (*Rana clamitans*) were heard and tadpoles (likely green frog, but possibly other species as well) were extremely abundant. American toad (*Bufo americanus*) and wood frog (*Rana sylvatica*) were also observed in the Project area. Evidence of white-tailed deer (*Odocoileus virginianus*) and porcupine (*Erethizon dorsatum*) was noted.



CLIENT: GOLDBORO LNG

SCALE: 400 200 0 400 800 1,200 Metres
1:40,000

PROJECT: GOLDBORO LNG

DWN BY: JT

CHK'D BY: MC

DATE: July 2013

REV. NO:

FIGURE NO: 1

AMEC Environment and Infrastructure
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Suite 1 - 495 Prospect Street
Fredericton, NB E3B 9M4
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www.amec.com

DATUM: NAD 83

PROJECTION: UTM Zone 20 North

PROJECT NO: TV121039.3000

TITLE: TRANSECT LOCATIONS FOR 2008/ 2013 SUMMER AND AUTUMN BIRD SURVEYS FOR PROPOSED MAPLE LNG FACILITY

Path: G:\GIS\PROJECTS\TV121039_Phase3000\MXD\20130731_2013BirdSurvey_Fig1.mxd User: jonathan.thornton

SOURCE: NS Environment, 2008/ESRI Map-Aerial/SNSMR - Topographic Data

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Appendix D-5
AMO Survey Summary Table

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
4.0	to water: 1.5	Y	Spruce and fir trees, moss	Young coniferous forest	Animal Use	soil	16 m	Water is cloudy/chalky. Small channel ~15m east of waypoint 014.
4.0	to water: 1.5	Y	Spruce and fir trees, moss	Young coniferous forest	Ruby-crowned Kinglet, Dark-eyed Junco, American Crow	soil	16 m	Opposite end of previous trench
~35.0	12.0	Y	Lots of dead trees	Young clearcut re-growth	Ruby-crowned Kinglet, Dark-eyed Junco, American Crow	soil	20 m	One long trench. Household debris/garbage in AMO.
~20.0	4.0	N	Young fir trees, alder, raspberry, moss	Young clearcut re-growth	None observed	soil	19 m	2 shallow trenches.
4.0	5.0	Y	Young fir trees, alder, raspberry, moss	Young clearcut re-growth	Wood frog heard	soil	18 m	Deep depression. Rock piles around.
4.0	to water: 1.0	Y	Fir trees	Coniferous forest	Fresh deer scat, vole	soil	22 m	* Three AMOs in total, information recorded for the largest. One is a shallow depression and not flooded.
7.0	to water: 1.5	Y	Fir trees	Coniferous forest	Hare scat	soil	20 m	* 4 AMOs and 2 short trenches within 15m, all flooded. Information recorded for largest. AMOs near the edge of a clearcut.
4.0	to water: 2.0	Y	Dense fir trees	Coniferous forest	Red squirrel	soil	22 m	High mound of waste rock; water flowing from AMO into small wetland.
6.0	to water: 1.5	Y	Fir trees, moss	Coniferous forest	None observed	soil	21 m	---
4.0 - 7.0	to water: 1.5	Y	Alder, spruce and fir trees, moss	Coniferous forest	Hare and porcupine scat	soil	28 m	* Four AMOs clustered within 20m, all flooded.
6.0	to water: 1.0	Y	Fir trees, moss	Coniferous forest	None observed	soil	22 m	Overhanging dead trees, big rocks.
6.0	to water: 1.0	Y	Alder, spruce and fir trees, moss	Coniferous forest	None observed	soil	32 m	Old rock pile covered in moss.
4.0	2.0	N	Fir trees, moss	Coniferous forest	Deer scat; frog in AMO	soil	35 m	Porcupine observed in tree.
4.0	2.0	N	Fir trees, moss	Coniferous forest	Porcupine scat and fir cuttings	soil	39 m	Heavily grown in with young fir.
5.0	to water: 1.0	Y	Young fir trees, alder, raspberry, moss	Young clearcut re-growth	Porcupine scat	soil	19 m	* 2 identical AMOs. Rock ridges froming a trench north of the AMOs.
3.0	3.0	N	Fir trees, raspberry, grass	Clearing in coniferous forest	Frog eggs,	soil	16 m	This is closer to provided 077 waypoint.
3.0	2.5	N	Fir trees, moss	Mixed forest adjacent to clearing	None observed	soil	23 m	Some samller crevices (unknown depth).

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
8.0	3.5	N	Fir trees, alder	Mixed forest	Porcupine den	soil	16 m	AMO is more of a trench, only 1m wide. 2 small holes ~3" in diameter in bottom (depth unknown).
15.0	to water: 1.0	Y	Fir trees, moss	Coniferous forest	None observed	soil	18 m	AMO is more of a trench, only 1m wide. Debris in bottom of trench, large rock around.
6.0	6.0	N	Fir trees, alder	Coniferous forest	Red squirrel	rock	37 m	Some samller crevices (unknown depth). Waste rock around entrance.
4.0	~25.0	N	Fir and spruce trees, alder and grass	Coniferous forest and alder shrub	American Crow.	rock	45 m	High bat potential. Lots of debris and household garbage around entrance.
3.0	to water: 1.0	Y	Cherry trees, grass	Clearing, adjacent to small pond	Ruffed Grouse	rock	34 m	---
2.5	to water: 3.0	Y	Cherry trees, grass	Shrub/clearing	None observed	soil	40 m	May have been backfilled but subsided.
5.0	2.0	N	Fir trees	Coniferous forest	Coyote scat	soil	15 m	Shallow depression
na	na	na	na	na	None observed	na		AMO was likely backfilled during construction of the main road.
na	na	na	na	na	Na	na		AMO appears to be filled in. Lots of waste rock in the area.
na	na	na	na	na	Na	na	28 m	AMO appears to be filled in. Lots of waste rock in the area.
8.0	?	N	Spruce trees, alder, grass	Coniferous forest	Na	?	29 m	Located along forest edge/old trail. AMO is filled with automotive debris.
5.0	1.0	N	Spruce trees, alder	Coniferous forest	None observed	rock	31 m	Lots of debris nearby (automotive). Concrete structure nearby.
5.0	4.0	N	Fir and cherry trees, moss	Mixed forest (pred. coniferous)	Hare scat, Winter Wren	soil	27 m	---
5.0	to water: 2.5	Y	Young hardwood trees and grass	Young hardwood	None observed	soil	40 m	"Danger" sign fallen into AMO.
4.0	to water: 1.5	Y	Birch trees and alder, some grass	Shrub/mixed forest	Porcupine den nearby	soil	43 m	A second similar AMO within 10m.
5.0	to water: 1.5	Y	Birch trees and alder, some grass	Shrub/mixed forest	Deer browse	soil	44 m	Waste rock pile, caution sign.
4.0	to water: 3.0	Y	Young hardwood trees and grass	Young hardwood	None observed	soil	44 m	Large rocks in the bottom.
5.0	to water: 1.0	Y	Fir and birch trees, moss	Mixed forest	deer scat	soil	46 m	---

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
8.0	to water: 1.5	Y	Fir and birch trees, moss	Mixed forest	Hare scat	soil	45 m	---
5.0	to water: 1.0	Y	Fir and birch trees, moss	Mixed forest	Hare scat	soil	30 m	Access from old grown-in road.
3.0	to water: 5.0	Y	Fir trees, alder	Mixed forest (pred. coniferous)	None observed	rock	48 m	Lots of cobble and waste rock.
5.0	~20.0	N	Fir trees, alder	Coniferous forest	Hare scat	rock	34 m	High bat potential. Lots of cover around entrance (i.e. fir trees). Ring of waste rock ~2m high surrounds entrance.
8.0	to water: 2.0	Y	Fir trees, alder	Coniferous forest	None observed	rock	33 m	Horseshoe shaped ring of waste rock around shallow pond. Some garbage around AMO.
10.0	8.0	N	Spruce trees, alder	Coniferous forest	None observed	rock	28 m	Abandoned truck in AMO. May be rock crevices at bottom, difficult to see. Waste rock around AMO.
7.0	2.0	N	Spruce trees	Open coniferous forest	None observed	rock	26 m	Second shallow grassy depression ~12m to west.
8.0	2.0	N	Coniferous trees, moss, grass	Open coniferous forest, adjacent to old trail	Winter Wren and Common Loon heard. Deer and Hare scat	soil	24 m	---
na	na	na	na	na	Northern Flicker	na		Appears to be on a residential property. Not checked.
na	na	na	na	na	Na	na	4 m	AMO was likely backfilled during construction of the main road.
na	na	na	na	na	Na	na	22 m	Located in someone's backyard. No evident AMO. Waste rock located at waypoint 065.
4.0	1.5	N	Fir trees	Coniferous forest	Na	unknown	30 m	Dense fir tree growth.
na	na	N	Cherry trees, grass	Shrub/clearing	Porcupine browse	unknown	48 m	Backfilled. Lots of waste rock in clearing.
2.5	0.5	N	Alder, moss	Alder clearing	Spruce Grouse	unknown	35 m	Filled with cobble. Waste rock piles.
na	na	na	Alders, some grass and moss	Alder thicket	None observed	na	44 m	Small depression with boulders scattered within a 10m radius.
na	na	na	Alders, some grass and moss	Alder thicket	None observed	na	43 m	Small depression with boulders scattered within a 10m radius.
7.0	to water: 1.5	Y	Coniferous trees, moss, grass	Open coniferous forest	None observed	rock	5 m	Rock wall to north. Adjacent to highway.

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
15.0	8.0	N	Spruce trees, moss	Open coniferous forest	None observed	soil	22 m	A second smaller, shallower AMO ~8m away. Waste rock scattered nearby.
15.0	1.5	N	Fir trees, raspberry, moss	Open coniferous forest, lots of deadfall	Deer scat, likely porcupine den in bottom. Song Sparrow, Winter Wren, Dark-eyed Junco.	soil	26 m	AMO is a trench. Waste rock pile to north.
7.0	3.5	Y	Fir trees	Regenerating clearcut/young coniferous forest	Deer scat, Dark-eyed Junco	soil	41 m	Some standing water in bottom of AMO. Newly grown in with fir trees.
6.0	to water: 2.0	Y	Fir trees, moss	Regenerating clearcut/young coniferous forest	Winter Wren. Deer browse (some large - moose?), moose scat	soil	39 m	Lots of deadfall over AMO.
6.0	to water: 1.0	Y	Fir trees, alder	Coniferous forest	Lots of deer sign, peepers	soil	44 m	Some waste rock nearby.
6.0	to water: 1.0	Y	Fir trees, alder	Coniferous forest	Deer and Hare scat, peepers heard	soil	45 m	---
6.0	to water: 1.5	Y	Fir trees, alder	Coniferous forest	Deer and Hare scat, peepers heard	soil	31 m	Difficult access. A second similar AMO nearby.
12.0	2.5	N	Young fir trees, grasses	Regenerating clearcut/young coniferous forest	Hare scat, peepers heard	soil	27 m	Looks like 2 AMOs connected. Lots of deadfall in and around AMOs.
10.0	1.5	Y	Grass, rose, raspberry cane	Grass/low shrub clearing	Heavy deer use. Winter Wren.	rock	7 m	Square opening, looks like a foundation.
5.0	to water: 2.0	Y	Fir trees, moss	Coniferous forest	None observed	soil	44 m	(similar to above; same cluster of openings)
4.0 - 6.0	to water: 2.0	Y	Fir trees, moss	Coniferous forest	Porcupine and deer scat	soil	44 m	* 3 AMOs within 15m. Another 4 smaller flooded AMOs to the north.
6.0	to water: 2.0	Y	Fir trees, moss	Coniferous forest	Porcupine and deer scat	soil	41 m	Another 2 similar flooded AMOs within 15m.
4.0	to water: 1.0 (looks deep)	Y	Fir trees, moss; small wetland to northeast	Coniferous forest	None observed	soil	41 m	---
4.0	to water: 2.0	Y	Fir trees, moss	Coniferous forest	Deer scat	rock	43 m	Flagging tape on tree.
6.0	to water: 2.0	Y	Fir trees, moss, algae in water	Coniferous forest	Deer and porcupine scat; game trails observed	soil	41 m	---
5.0	4.0	N	Fir trees, moss	Coniferous forest	None observed	rock	50 m	NSDNR "Danger" sign noted. Crevice between rocks at bottom of AMO (1 m * 25 cm) extends somewhat deeper, approx 2 m.

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
8.0	5.0	N	Fir trees, moss	Coniferous forest	Porcupine den under a boulder in bottom of AMO	soil/rock	50 m	Drill rod stuck in side of AMO but does not appear to be more than 1m deep.
7.0	4.0	N	Alder, fir and birch trees	Cobbles, mixed woods	Game trails nearby	rock	48 m	Cobbles around opening, a second similar AMO nearby.
4.0	3.0	Y	Fir trees; wetland ~50m away	Coniferous forest	Some rock crevices; older deer browse	rock	50 m	Large rusted pipe nearby.
5.0	4.5	Y	Fir trees; moss	Coniferous forest	None observed	soil/rock	46 m	---
3.0	to water: 1.5	Y	Fir and spruce trees	Coniferous forest edge/coast	Porcupine scat	soil	6 m	Waste rock around, debris in bottom of AMO, eroding.
5.0	to water: 1.0	Y	Fir trees; moss	Coniferous forest	None observed	soil	43 m	Flagged, no surrounding waste rock pile.
6.0	3.5	N	Fir and birch trees, moss	Mixed woods, boulders, cobble	Hare scat; aquatic insects in water	soil	43 m	Small opening in bottom (~0.5m wide depth unknown). Other AMOs to the northeast that are flooded.
4.0	3.0	N	Fir trees, moss	Coniferous forest	Porcupine scat	soil	43 m	Shallow pit
5.0	to water: 2.0	Y	Alder, spruce and fir trees, moss	Coniferous forest	None observed	soil	30 m	Old rock pile covered in moss.
3.0	2.5	N	Young fir trees, raspberry, grass	Clearing in coniferous forest	Deer scat	soil	19 m	---
15.0	to water: 2.0	Y	Spruce stand, rushes, algae in water	Clearing in coniferous forest	None observed	soil	16 m	Wetland nearby.
12.0	to water: 1.5	Y	Fir trees, moss	Coniferous forest adjacent to wetland	Frog eggs	soil	13 m	AMO is more of a trench, only 2m wide.
5.0	3.0	N	Birch trees and alder	Shrub/mixed forest	None observed	rock	44 m	Small crevices in rock.
3.0	to water: 1.0	Y	Young hardwood trees and grass	Young hardwood	Winter deer fur and Hare scat	soil	41 m	---
1.5	to water: 0.5	Y	Fir and birch trees, moss	Mixed forest	Deer and porcupine scat	soil	27 m	Access from old grown-in road.
3.0	1.0	N	Fir trees	Coniferous forest	None observed	unknown	46 m	A shallow depression along road.
1.0	1.0	N	Alder, grasses	Shrub/clearing	None observed	unknown	34 m	Shallow depression in waste rock.
2.0	to water: 0.5	Y	Fir trees, moss	Regenerating clearcut/young coniferous forest	None observed	soil	40 m	Lots of deadfall.
8.0	to water: 2.0	Y	Young hardwood trees and grass	Young hardwood	Deer scat, peepers	soil	34 m	AMO is more of a trench, 2m wide. Large birch fallen into AMO. 2 similar smaller AMOs within 20m.
5.0 - 6.0	3.0 - 5.0	Y	Fir and birch trees, moss *	Mixed woods *	Hare scat; deer browse	soil	44 m	* 5 AMOs within a 20m radius, all have similar dimensions and within same habitat.

Appendix D-5: Summary of Survey Results for Potential Bat Hibernacula at Abandoned Mine Openings (AMO)

Width (m)	Depth (m)	Flooded?	Vegetation	Habitat	Animal Use	Wall type	Elevaation	Notes
6.0	to water: 1.5	Y	Fir and birch trees, moss	Mixed forest (pred. coniferous)	None observed	soil	41 m	5 AMOs within immediate area. Information recorded for largest.

APPENDIX D-6
Bat Surveys
(September 2013)

Photo D6-1: Anabat SD2 unit deployed near AMO, before concealment in brush

Photo D6-2: Anabat Roost Logger deployed at entrance to AMO

Table D6-1: Summary of Anabat SD2 and Roost Logger data recorded at AMO ISH-05-026 from Aug 27 to September 16, 2013

Date	Total # of Ultrasonic Events Recorded		Myotis spp. Calls		Suspected Myotis Calls		Suspected other Bat Species Calls		Unknown Sounds		Non-bat Sound Events ("Junk")		Temperature (ºC)		Comments
	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Min	Max	
27-Aug	174	112	20	5	2	1			9		143	106	17.3	**	
28-Aug	85	2	35	1	10		2		14		24	1	16.5	21.8	
29-Aug	4045	73			11	3					4034	70	16	18.3	heavy rain
30-Aug	53	2	27	1	7				4		15	1	13	20.3	
31-Aug	76	3	49	1	17	1			3		7	1	10.5	23.3	
1-Sep	80	5	26	3	6	1	7		7		34	1	17	20	
2-Sep	28	2	18		8						2	2	16.5	19.5	
3-Sep	19	21	6	1	3	3			1	1	9	16	17.3	20.3	
4-Sep	58	0	37		4		5		1		11	0	17	20.8	
5-Sep	36	0	18		4				6		8	0	11.8	26	
6-Sep	37	5	9	4	6				11		11	1	7.8	24.5	
7-Sep	12	1	4	1	5				1		2	0	4.5	23.3	
8-Sep	75	7	20	6	27		1		3		24	1	11.8	18.8	
9-Sep	20	0	5		8				2		5	0	7.5	21.3	
10-Sep	41	2	9	2	17		1		4		10	0	7.8	23	
11-Sep	40	6	6	4	7	1			1		26	1	13.8	16.5	
12-Sep	37	6	4	5	17						16	1	15.3	21.5	
13-Sep	509	51	1	6	6	17			1	1	501	27	15.8	20.3	heavy rain
14-Sep	18	9	2	3	5	1				2	11	3	15.8	19.5	
15-Sep	97	4	68	1	26		2			3	1	0	9.8	21	

*The two *Myotis* species, *M. lucifugus* and *M. septentrionalis* cannot be distinguished reliably using acoustic methods, and it is standard practice to lump them together.

**Recorded by Roost Logger

***Data discarded due to artifical highs encountered in vehicle during transport to site

Table D6-2: Summary of Anabat SD2 and Roost Logger data recorded at AMO ISH-05-002 from Aug 27 to September 16, 2013

Date	Total # of Ultrasonic Events Recorded		*Myotis* spp. Calls		Suspected *Myotis* Calls		Suspected other Bat Species Calls		Unknown Sounds		Non-bat Sound Events ("Junk")		Temperature (ºC)		Comments
	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Anabat SD2	Roost Logger	Min	Max	
27-Aug	32	152	18	1	5				4		5	151	17.3	**	
28-Aug	31	1	23		2						5	1	16.5	21.8	
29-Aug	858	22	2		2	1			1	2	853	19	16	18.3	heavy rain
30-Aug	19		6								13	0	13	20.3	
31-Aug	27	4	21	4	2				2		2	0	10.5	23.3	
1-Sep	37	3	28	1					1	2	8	0	17	20	
2-Sep	5		4						1			0	16.5	19.5	
3-Sep	15	1	8		1				1	1	4	0	17.3	20.3	
4-Sep	20		11								9	0	17	20.8	
5-Sep	13	3	10						3			3	11.8	26	
6-Sep	11		3						1		7	0	7.8	24.5	
7-Sep	36		14		1						21	0	4.5	23.3	
8-Sep	9	2	7	1						1	2	0	11.8	18.8	
9-Sep	13	1	11								2	1	7.5	21.3	
10-Sep	97		15		4				10		68	0	7.8	23	
11-Sep	11		6		2						3	0	13.8	16.5	
12-Sep	20		6								14	0	15.3	21.5	
13-Sep	91	1	3		1						87	1	15.8	20.3	heavy rain
14-Sep	155		4		1						150	0	15.8	19.5	
15-Sep	37	1	15	1							22	0	9.8	21	

*The two *Myotis* species, *M. lucifugus* and *M. septentrionalis* cannot be distinguished reliably using acoustic methods, and it is standard practice to lump them together.

**Recorded by Roost Logger

***Data discarded due to artificial highs encountered in vehicle during transport to site