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Report Title: *Peace River Wildlife Surveys – Baseline Inventory Surveys - 2006*
Project: Peace River Site C Hydro Project
Prepared By: Keystone Wildlife Research Ltd.
Prepared for: BC Hydro

NOTE TO READER:

This is a report on a study commissioned toward the development of engineering, environmental and technical work conducted to further define the potential Site C project.

For environmental studies, the focus is on the development of an environmental and socio-economic baseline around the area of the potential Site C Project. Baseline studies are generally a survey of existing conditions within a project study area.

This report and other information may be used for future planning work or an environmental assessment or regulatory applications related to the potential Site C Project.

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PEACE RIVER WILDLIFE SURVEYS –

Baseline Inventory Surveys - 2006

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i) information available at the time of preparation;

ii) data collected by Keystone Wildlife Research Ltd. and/or supplied by outside sources; and

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EXECUTIVE SUMMARY

BC Hydro is updating their environmental inventory data for the Peace River corridor in northeastern British Columbia. In 2005, a scope of study that identified plant and animal species at risk that could be adversely affected by water use planning and/or hydroelectric development was completed. These studies were conducted as baseline studies, commissioned by BC Hydro toward the development of an environmental baseline around the area of the potential Site C Project. Baseline studies are preliminary to and not intended to be environmental effects assessment studies. Baseline studies are generally a survey of existing conditions within a project study area. The current framework for an environmental assessment requires that ecological mapping and habitat assessment, supported by sufficient inventory data for resources of concern, be available.

A number of field studies were undertaken to collect baseline inventory data and identify habitat relationships for target flora and fauna that can be linked to the ecosystem units represented on the Terrestrial Ecosystem Map (TEM). Wildlife habitat ratings should be developed and used to identify habitat for priority species and quantify potential risks from hydroelectric development. Digital data is the preferred form for environmental assessments since it can provide both current and quantitative information.

Applying habitat ratings to the completed TEM will allow quantification of habitats present within the study area according to their suitability for the species. It will also assist in the identification of remaining data gaps and facilitate planning for future surveys where warranted.

This executive summary includes significant findings and future study needs for each species group. Activities identified for moderate and low priority species groups may be undertaken at any time prior to potential hydroelectric development within the Peace River Valley. The four listed species groups (songbirds, butterflies, bats and fisher) using habitats that may be affected by potential hydroelectric development have been assigned a high priority for immediate attention. A summary of prioritised species groups, findings and recommendations is presented in Table i-1.

Table i-1. Prioritised species groups, findings and recommendations.

PRIORITY At Risk Resources	Work Recommended in 2005 Scope of Study	Survey Results (2005-2006)	Findings and Implications	Future Needs
HIGH				
All Taxa	Terrestrial Ecosystem Mapping (TEM) of the River corridor and related transmission line at 1:20,000 scale.	Draft TEM has been completed. The severity of habitat impacts could not be adequately quantified using older small-scale (1:50,000) mapping.	Provides the basis for quantification of potential habitat losses due to potential hydroelectric development (Site C project) for species at risk.	Completed
	Digitize the existing 1:50,000 biophysical mapping adjacent to the corridor.	The biophysical mapping has been digitized.	Provides a Regional quantification of habitats for comparison.	
All Taxa	Field-truthing of ecosystem mapping in river corridor and along related transmission line.	25% visitation of mapped polygons in the river corridor and the related transmission line has been completed.	RISC standard polygon visitation level required to confirm accuracy of new TEM mapping.	Completed Dec 2006
Species at risk with mod-high estimated habitat impacts	Use TEM and habitat ratings to assess potential impacts of potential hydroelectric development (Site C project) on species at risk.	Habitat associations have been determined for a number of priority species / species groups.	Forty species identified where habitat loss from hydroelectric development could occur.	Wildlife habitat ratings should be developed and applied to the completed TEM.
Songbirds	Breeding bird surveys targeting warblers in the Peace River floodplain to determine relative abundance and estimate importance to the regional population.	Four of 8 rare species were detected in the riparian river corridor. Four other Red and Blue-listed species were found in upland habitats.	Four Red- and Blue-listed species are associated with riparian habitats. Two species appear to be uncommon in the study area.	Additional surveys focused on rare species required in May-June.

PRIORITY At Risk Resources	Work Recommended in 2005 Scope of Study	Survey Results (2005-2006)	Findings and Implications	Future Needs
Butterflies	Confirm occurrence and habitat use of listed species.	Twelve of 16 Blue listed butterflies were detected in 2006. The inventory was adequate to determine habitat associations and range for 8 taxa.	Red- and Blue-listed species are associated with riparian habitats. Inventory is inadequate for eight taxa.	Additional surveys to determine habitat associations and range are required for eight taxa.
Bats (including Northern Myotis)	Confirm species presence and habitat associations. Survey appropriate habitat during summer to confirm breeding and location of maternity roosts using radio-tagging. Identify winter hibernacula in the study area.	Six species of bats including 5 confirmed breeding and one Blue-listed species were captured. Radio-telemetry confirmed very high use of riparian, balsam poplar habitats for roosting and reproduction.	The Blue-listed northern myotis was confirmed breeding in the area, but only one maternity roost was located. Hibernacula considered unlikely due to terrain.	Measure relative activity and roost site preferences to support wildlife habitat ratings. This should provide additional information on the northern myotis. Investigate the potential for hibernacula in the study area.
Fisher (lynx, marten)	Confirm presence and the amount and quality of habitat.	Ten days of winter tracking completed in February, 2006. Remote camera photos also taken at 7 bait stations. No fishers were detected.	There is high quality habitat for fishers in the Peace River corridor. More intensive sampling is required to estimate numbers and distribution in the river corridor.	~90 hair-snagging stations should be used to detect and estimate numbers of fishers between January and March.
MODERATE				
Raptors – Herons (priority decreased: rare species not affected)	Identify nest sites adjacent to the river.	Nest surveys identified 17 active eagle nests in the river corridor, including 10 upstream of Moberly. No Broad-winged Hawk nests were found	Bald Eagles nest in poplar floodplain habitats. Broad-winged Hawks were sighted but their nest sites are likely in upland forests.	Continue to document the location and status of raptor nests in and adjacent to river.

PRIORITY At Risk Resources	Work Recommended in 2005 Scope of Study	Survey Results (2005-2006)	Findings and Implications	Future Needs
Rare Plants and Plant Communities (priority decreased: most found in upland habitats	Confirm occurrence, distribution and habitats of 56 rare plant taxa that may occur in the study area.	30 rare plants were found. Six of nine taxa that were expected in riparian habitats were found, but most were in upland (low risk) habitats. Four upland taxa were found only in riparian habitats.	Adjacent grassland habitats are the most productive sites for rare plants. Riparian associated taxa were not distributed as expected.	Additional surveys in valley bottom floodplain habitats should be completed to further document rare species.
Ungulates	Confirm expected population numbers and long-term trends.	Moose and deer populations are similar to 1991. The elk population has increased and heavily uses the river islands.	2006 surveys underestimated population sizes due to low snow depths.	Surveys should be repeated in normal (deeper) snow conditions to accurately estimate population numbers
LOW				
Waterfowl (risk rating decreased since no rare species are breeding in the area)	Complete surveys for waterfowl along the river floodplain to document seasonal use by rare species.	Five rare waterfowl species were recorded mainly in the fall. None were nesting.	The river may provide important fall migration habitat since the largest concentrations and rare species were recorded at this time.	Additional surveys should be completed to document seasonal trends and provide multi-year baseline data.
Harlequin Duck (risk rating decreased: no Harlequins observed and habitat marginal)	Determine use of river and tributaries for staging and nesting.	Surveys of Peace River and its major tributaries were completed in 2006. No harlequins were detected.	Harlequins are rarely present and unlikely to nest along the Peace River and lower tributaries	Waterfowl survey can document the presence of harlequins in the study area.
Amphibians	RISC standard surveys should be completed at the right time of year to determine use of breeding habitat in the study area.	Five target amphibian species were confirmed breeding during wetland searches and auditory surveys.	The SARA-listed western toad and other species were common and wide-spread. River back channels provide significant amphibian habitat.	Additional surveys focused on identifying potentially suitable habitat for western toads should be completed.

PRIORITY At Risk Resources	Work Recommended in 2005 Scope of Study	Survey Results (2005-2006)	Findings and Implications	Future Needs
Owls	Survey routes within the floodplain and upland areas were completed to determine species presence and relative abundance.	Five targeted species of owl were detected during surveys in 2006. Great Horned family groups were found in floodplain forests.	Nesting habitat is likely a limiting life requisite for owls. The balsam poplar floodplain may provide important nesting habitat for Great Horned and Great Gray Owls.	Call-playback surveys targeting balsam poplar floodplains should be completed to determine the use of these habitat types by nesting owls.
Beaver	Confirm expected population numbers and document trends.	Identified 67 active lodges resulting in a population estimate of 335 beavers between Hudson's Hope and Moberly River. 75 lodges were located downstream.	The population has remained stable since 1990	The inventory data should be updated prior to changes to water use and/or hydroelectric development.

Rare Plants

Fifty-six Red or Blue-listed plant taxa and five Red or Blue-listed ecological communities potentially occur in the Peace River area. Surveys in 2005 and 2006 have located 30 rare taxa within the study area.

Six of nine rare taxa that were expected in riparian habitats were located in the study area during surveys in 2005 or 2006. However, only one was actually found in a riparian habitat type. In addition, four taxa that were expected in wetland habitats were found only in riparian areas.

The 2005/2006 survey results suggest that steep, warm aspect slopes are the most productive sites in terms of both diversity and quantity of rare flora. Since this habitat will not be significantly affected by potential hydroelectric development, future surveys should focus on riparian habitats.

Additional surveys are required to obtain additional baseline data on potential rare taxa present in riparian habitats of the valley bottom. Ecosystem mapping and biophysical mapping should be used to identify areas with potential to support rare species.

Butterflies

Sixteen Blue-listed butterfly taxa potentially occur in the study area. Surveys in 2005 and 2006 have documented 12 of these taxa in the study area. The surveys provide sufficient inventory to determine habitat associations and range for 8 taxa.

Draft habitat suitability ratings have been completed for 14 of the Blue-listed butterfly taxa that were expected to occur in the study area. Additional surveys should be conducted to establish habitat relationships and determine the distribution and abundance of the listed taxa. Inventory for butterflies should be stratified by TEM habitat type, focussing on the river-associated habitats that are most likely to support each target butterfly taxon. The results of the surveys can be used to refine the existing habitat suitability rating for the identified butterfly species.

Owls

Six species of owls were documented during nocturnal surveys in April, May and June. The Northern Saw-whet Owl was detected the most frequently and was detected during

all surveys. Great Horned Owls and Barred Owls were also relatively abundant. The Short-eared Owl, the Boreal Owl and the Great Gray Owl were detected infrequently.

Since nesting habitat is typically the limiting life requisite for owls, the distribution and characteristics of this habitat need to be determined. Large stick nests in the area are predominantly associated with balsam poplar stands, because these trees have the size and configuration to support nest structures. Great Horned and Great Gray Owls both use large stick nests.

Since nesting habitat may be a limiting life requisite, additional call-playback surveys are required to determine the use of balsam poplar floodplains by nesting owls. Species-specific surveys should be conducted for Great Horned Owl, Great Gray Owl, and Boreal Owl. The additional baseline data will provide an indication of the use of this habitat type and the risks of potential hydroelectric development.

Amphibians

All five species of amphibians expected to occur in the study area were documented in 2005 or 2006. Auditory surveys and time-constrained searches of wetlands were completed. Western toads (*Bufo boreas*) were detected the most frequently during wetland searches and wood frogs were detected the most frequently during auditory surveys.

Six habitat types were surveyed including backchannels, shallow water, fens, bogs, marshes and swamps. Amphibians were observed the most frequently in fens, while backchannels typically contained the greatest numbers of individuals when amphibians were present.

Future work regarding amphibians should focus on completing baseline data collection. Waterbodies identified as potentially suitable toad breeding sites during field reconnaissance in 2005 and 2006 should be revisited to determine whether they are breeding sites for western toads. Additional, potentially suitable western toad breeding sites identified incidentally during other field surveys or on the TEM, should also be considered. Waterbodies identified in 2005 and 2006 should be resurveyed using auditory surveys and wetland searches to confirm breeding activity and determine relative abundance of amphibians.

Waterfowl / Shorebirds

Forty-two species were recorded during waterfowl surveys completed in the spring, summer and fall of 2006. Five of these were Blue-listed species, namely Surf Scoter, Sandhill Crane, Great Blue Heron, California Gull and Caspian Tern. These species are migratory and do not breed in the study area. Canada Goose and Mallard were the most common species of goose and duck, respectively, and were observed during all of the surveys.

Species abundance reached a peak in late September, when 6490 observations of 25 species of loons, ducks, geese, swans, gulls and coots were recorded during one boat survey. During these surveys, five species (Green-winged Teal, Mallard, Northern Shoveler, Northern Pintail, Ring-necked Duck and Trumpeter Swan; none of which are of conservation concern) were found to occur more frequently in backchannels. These species are also expected to breed in the area.

Additional waterfowl/shorebird surveys are required to generate multi-year baseline data on numbers, species, distribution, timing and habitat use of spring and fall migrants. The survey should focus on determining the species and breeding status of waterfowl using the study area. This data can be compared to observations of waterfowl from previous surveys to determine species distribution and abundance throughout the year.

Harlequin Ducks

Two systematic surveys for Harlequin Ducks were completed in 2006. No harlequins were detected.

The Peace River does not appear to provide suitable breeding habitat for Harlequin Ducks and surveys in 2005 and 2006 confirm this assumption. The potential presence of harlequins should be monitored during additional waterfowl surveys conducted along the river. If Harlequin Duck pairs and/or broods are observed using the Peace River during the breeding season, then surveys for brood-rearing areas and possible nesting sites should be considered.

Songbirds

Seventy-seven passerine species, including eight species at risk, were recorded during the 2005 or 2006 surveys. Four Red and Blue-listed species were detected in riparian habitats, including the Black-throated Green Warbler, Canada Warbler, Connecticut Warbler and Rusty Blackbird. Black-throated Green Warblers and Canada Warblers were relatively common in the study area. Analysis of the point locations for these species revealed that 50% and 22%, of the Black-Throated Green Warbler and Canada Warbler observations, respectively, were within riverine habitats. The Rusty Blackbird was uncommon in the study area and was associated with wetlands. The Connecticut Warbler was also uncommon in the study area and primarily found in upland forests. Other studies indicate that the Connecticut Warbler is associated with balsam poplar floodplains; however, data from 2005 and 2006 suggests that the floodplain habitats in the study area might not be used as much as previously suspected.

Additional surveys should be completed to gather additional baseline data on Red- and Blue-listed species including the Black-throated Green Warbler, Canada Warbler, Connecticut Warbler, Bay-breasted Warbler, Cape May Warbler, Barn Swallow, Nelson's Sharp-tailed Sparrow, LeConte's Sparrow, and Rusty Blackbird. Transects should be established in suitable habitat for these species and emphasis placed on documenting habitat associations of listed species in the Peace River corridor and along the related transmission line.

Beavers

An aerial census for beaver (*Castor canadensis*) was conducted to document lodge locations and estimate the population size upstream and downstream of the Moberly River. Beaver lodge and food cache counts along the Peace River were completed by Keystone on September 13 and 14, 2005. A helicopter was used to fly survey transects along the Peace River. Observers noted the presence of beaver caches and lodges and recorded their location using a GPS and a hardcopy map. The survey located 67 active and 60 inactive lodges between Moberly and Hudson Hope. The results of the 2005 survey show that the beaver population has remained relatively stable over the last 15 years.

The baseline inventory is adequate at this time. An additional survey should be completed to update numbers prior to hydroelectric development.

Ungulates

A stratified random block count completed in 1991 to estimate numbers of deer, elk and moose along the Peace River was repeated in 2006. The survey area was expanded to include areas downstream of the Moberly River, to quantify the regional population. Forty-seven blocks were defined in 2006, including 27 of the 29 blocks surveyed in 1991. Pre-stratification was completed on February 14, 2006 using a fixed-wing aircraft and block counts were completed February 15 to 18, 2006 using a Bell Jet Ranger helicopter with 3 observers. The numbers of moose (*Alces americanus*) counted were similar to those reported for 1991 in all strata. Numbers of mule deer (*Odocoileus hemionus*) seen were similar on north aspects and in the valley bottom and but substantially lower on south aspects than in 1991. Numbers of elk (*Cervus canadensis*) were greater on south aspects and in the valley bottom. Snow depths (estimated from the air) were 15-20 cm, well below average (50 cm). It would be advisable to repeat the census with more normal winter snow conditions to confirm the numbers of ungulates using each area.

Raptors / Herons

Nest surveys were completed in 2006 to document the number of nests in the study area. Seventeen active Bald Eagle nests were documented with adults on the nest or in the immediate vicinity. Twenty-two nests were inactive. No Broad-winged Hawk nests were located during the survey

Eagles appear to heavily use tall balsam poplars for nesting. The estimated linear nesting density in the study area is 10.6 active Bald Eagle nests per 100 km of river shoreline. Additional surveys to document the presence of alternative nesting sites outside of the main river corridor should be completed, and the river corridor should be re-surveyed to update nest location/activity data and provide trends for comparative purposes. Broad-winged Hawks were documented in the study area but do not appear to be associated with riparian habitats. Future work should include efforts to locate potential Broad-winged Hawk nest sites.

Fisher

Winter snow-tracking surveys were completed along the Peace River valley between Hudson's Hope and the British Columbia/Alberta border between February 18th and 26th 2006. Nineteen transects, totalling 41.4 km were completed, with the primary focus on habitat suitable for fisher (*Martes pennanti*) and marten (*Martes americana*). Fourteen large mustelid tracks (marten or fisher) were located, averaging about one track per 3 km surveyed. Seven camera stations were baited and monitored for over 30 days in suitable habitat where tracks had been observed, beginning on February 28. Marten were photographed at five of the seven stations. No fishers were photographed. Elk, red squirrels (*Tamiasciurus hudsonicus*) and Gray Jays also triggered the cameras. Black bears (*Ursus americanus*) began disturbing stations in early April and all stations were removed by May 25, 3006.

Information from fisher studies in the Kiskatinaw drainage indicates that fishers may be easily missed using standard survey techniques (few stations maintained over a long period). A follow-up furbearer study is recommended consisting of a large number of hair-snagging stations established and maintained from January to March 2009. This should adequately census the Peace corridor for fisher and confirm expected habitat associations.

Bats

Thirty-five bats of six species were captured in 2005 and 2006, including hoary bats (*Lasiurus cinereus*), little brown bats (*Myotis lucifugus*), long-legged myotis (*M. volans*), northern myotis (*M. septentrionalis*), silver-haired bats (*Lasionycteris noctivagans*), and big brown bats (*Eptesicus fuscus).* All species were confirmed to be reproducing except big brown bats.

Capture rates of 0.19 bats per net-night were lower than capture rates reported in other bat studies in northern B.C. (Vonhof *et al.* 1997; Crampton *et al.* 1997). Measures of relative activity indicate that balsam poplar stands, wetlands and slow-moving creeks have the highest levels of bat activity and that wetlands and creeks provide foraging habitat. Low foraging activity was observed on the Peace River and aspen forests had low activity overall.

Twelve bats of five species were radio-tagged and 22 roosting structures were identified from the 10 bats that could be relocated. The average distance between foraging (capture) and roosting sites was 730 m and roost-roost distances averaged 290 m. Of the roost structures identified, 64% were balsam poplar, 23% were aspen, 9% were steep cutbanks and 4% were buildings. Analysis of TEM habitat types showed that the valley bottom balsam poplar- horsetail habitats were used the most frequently and they were used the most in proportion to their availability. Cutbanks were also used as roost sites.

Additional studies are recommended to measure relative activity and roost site preferences of bats to support the draft habitat suitability ratings. This can be completed by detector surveys to determine relative activity in TEM habitat units. Concurrent mist-netting and radio-tagging in Peace River Corridor will continue to investigate species presence and roost selection. Future surveys can also provide additional information on the Blue-listed northern myotis. Methods to locate potential hibernacula in the study should also be investigated.

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1.0 INTRODUCTION

In 2005, a scope of study was prepared by Keystone Wildlife Research Ltd. (2005) to identify species at risk that could be adversely affected by potential hydroelectric development in the valley. Previous baseline studies in 1976 and 1993 focused on "consumptive" species, mainly ungulates, furbearers, bears and waterfowl, with little to no consideration of species at risk. Some additional work has been carried out by BC Hydro and others since 1993, but those studies were generally short-term or poorly timed and did not provide truly representative data.

This study was conducted as a baseline study, commissioned by BC Hydro toward the development of an environmental baseline around the area of the potential Site C Project. Baseline studies are preliminary to and not intended to be environmental effects assessment studies. Baseline studies are generally surveys of existing conditions within a project study area and are generally designed to support an environmental assessment, should it be required.

The Provincial standards for environmental assessment are now much more rigorous and comprehensive than in the past. Review agencies expect ecological mapping (RIC 1999) and habitat assessment (RIC 2000) supported by sufficient inventory to accurately predict and assess potential impacts to species and their habitat. Rare wildlife species, invertebrates, plants and plant communities have recently been added to the list of valued ecosystem components that must be considered.

A number of field studies were undertaken in 2005 and 2006 to fill information gaps for significant species that are known or expected to be present in the Peace River Corridor. The primary purpose of these studies was to identify habitat relationships for target flora and fauna. Specifically, habitat attributes for target taxa were determined and linked to the ecosystem units represented on the Terrestrial Ecosystem Map (TEM). Field sampling was then used:

- to confirm that expected habitat attributes needed by each species were in fact present and
- to document the presence of target taxa in predicted areas.

This report presents the baseline data, as well as the methodology and results of the field surveys undertaken in 2006 by Keystone Wildlife Research Ltd (Keystone). Detailed analysis of the data is not included within the scope of the current project, but is reserved for future work. Much of the future analysis will rely on the TEM map to identify the extent of suitable habitat (Keystone Wildlife Research Ltd. 2006a).

Common and scientific names of wildlife and plants used throughout the report are those listed by the BC Conservation Data Centre (2006). For most species and species groups, the common and scientific names are provided at the beginning of the section then the common name is used for all later references to that species. There are a few exceptions to this rule:

- Bird species have official common names, as assigned by the American Ornithological Union. Therefore, scientific names are not reported for bird species in this report.
- The names used for the butterfly species that are not of conservation concern are those that are scientifically correct, based on current scientific knowledge.
- Plants may have several different common names (or none) and common names used to describe a species in one area may refer to a different species in another area. Therefore, to avoid confusion, scientific names will be used in the text. Common names for plants are provided, where available, in summary tables.

2.0 STUDY AREA

The study area extends from the Peace Canyon Dam east to the Alberta border, encompassing the core Peace River corridor. The study area is within the Peace Forest District in the Northern Interior Forest Region and within wildlife Management Units (MUs) 7-31, 7-32, 7-33, 7-34 and 7-35.

Geographically, the core Peace River corridor refers to the entire river valley including the floodplain and the ascending slopes extending approximately 2 km on either side of the river (Figure 2.1; approximately 60,000 ha). The steep-sided Peace River Valley and its tributaries are major features on the predominantly plateau landscape. The area to

be assessed includes portions of 19 1:20,000 mapsheets and consists of a single subzone, the Boreal White and Black Spruce moist, warm Peace variant (BWBSmw1). All of the core study area lies within the Peace Lowlands (PEL) ecosection.

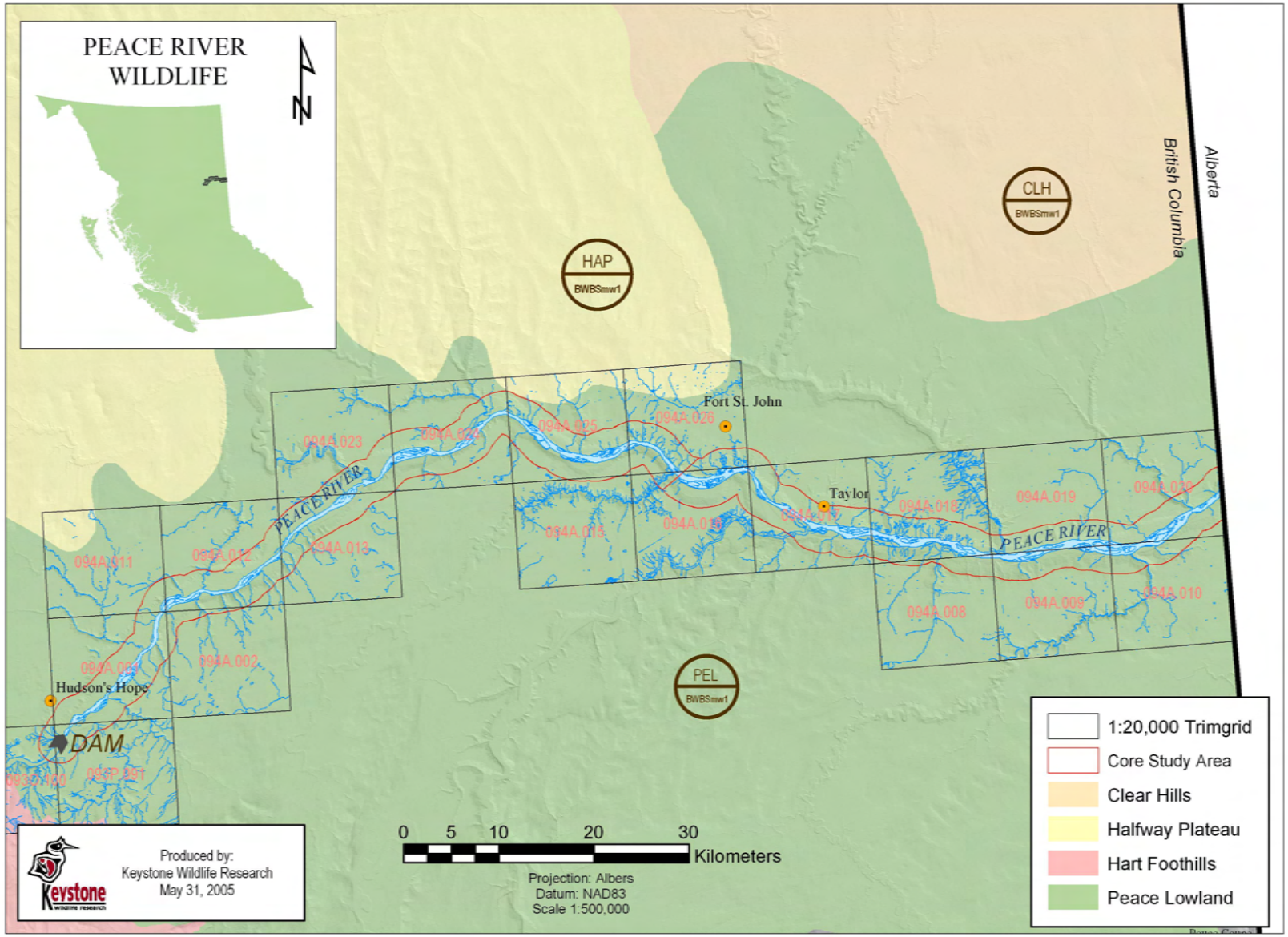

Figure 2.1. The study area, extending from Peace Canyon Dam to the Alberta Border.

3.0 RARE PLANT SURVEY

Rare plant surveys were not undertaken in historical baseline studies in the Peace River. Baseline inventory information is required on the distribution of rare plant species within the study area.

3.1 Introduction

Vegetative resources including rare plants and rare plant communities were identified in the 2005 scope of study (Keystone Wildlife Research Ltd. 2005) as a resource with significant baseline data gaps. The BC Conservation Data Centre identifies 51 Red or Blue-listed plant taxa and five Red or Blue-listed ecological communities that potentially occur in the BWBSmw1 in the Peace Forest District (Table 3.1, Table 3.2). Surveys are needed determine the occurrence, distribution and abundance of rare and sensitive species and their habitat associations within the study area.

Table 3.1. List of Red and Blue-listed plant taxa occurring, or potentially occurring in the BWBS zone in the Peace Forest District (CDC 2006 and Hawkes *et al.* 2006).

Scientific Name	English Name	BC Status
Alopecurus alpinus	alpine meadow-foxtail	Blue
Anemone canadensis[1]	Canada anemone	Blue
Anemone virginiana var. *cylindroidea*[2]	riverbank anemone	Red
Arabis lignifera[2]	woody-branched rockcress	Blue
Arabis sparsiflora[1]	sickle-pod rockcress	Red
Arnica chamissonis ssp. *incana*[2]	meadow arnica	Blue
Artemisia longifolia[1,2]	long-leaved mugwort	Red
Atriplex nuttallii[1,2]	Nuttall's orache	Red
Botrychium crenulatum[2]	dainty moonwort	Blue
Calamagrostis montanensis[1,2]	plains reedgrass	Red
Carex bicolour	two-coloured sedge	Blue
Carex scoparia	pointed broom sedge	Blue
Carex torreyi[2]	Torrey's sedge	Blue
Carex xerantica[1,2]	dry-land sedge	Red
Chrysosplenium iowense	Iowa golden-saxifrage	Blue
Cicuta virosa	European water-hemlock	Blue
Cirsium drummondii[2]	Drummond's thistle	Red
Draba cinerea	gray-leaved draba	Blue

Scientific Name	English Name	BC Status
Eleocharis elliptica[2]	elliptic spikerush	Blue
Epilobium saximontanum[2]	Rocky Mountain willowherb	Red
Galium labradoricum	northern bog bedstraw	Blue
Glyceria pulchella[1,2]	slender mannagrass	Blue
Gymnocarpium jessoense ssp. *parvulum*	Nahanni oak fern	Blue
Helianthus nuttallii var. *nuttalli*[1]	Nuttall's sunflower	Red
Helictotrichon hookeri[1,2]	spike-oat	Blue
Juncus confusus[2]	Colorado rush	Red
Juncus arcticus ssp. *alaskanus*	arctic rush	Blue
Lomatium foeniculaceum var. *foeniculaceum*[1]	fennel-leaved desert-parsley	Red
Luzula nivalis	arctic wood-rush	Blue
Luzula rufescens	rusty wood-rush	Blue
Oxytropis campestris var. *davisii*[1,2]	Davis' locoweed	Blue
Penstemon gracilis[1, 2]	slender penstemon	Red
Pinguicula villosa	hairy butterwort	Blue
Polemonium boreale	northern Jacob's-ladder	Blue
Polemonium occidentale ssp. *occidentale*	western Jacob's-ladder	Blue
Polygala senega[1]	Seneca-snakeroot	Red
Polypodium sibiricum	Siberian polypody	Red
Prenanthes racemosa ssp. *multiflora*	purple rattlesnake-root	Red
Pyrola elliptica	white wintergreen	Blue
Ranunculus cardiophyllus[1]	heart-leaved buttercup	Red
Ranunculus pedatifidus ssp. *affinis*[1]	birdfoot buttercup	Blue
Ranunculus rhomboideus	prairie buttercup	Red
Rosa arkansana var. *arkansana*	Arkansas rose	Blue
Rumex arcticus	arctic dock	Blue
Salix petiolaris	meadow willow	Blue
Salix serissima[1,2]	autumn willow	Blue
Sarracenia purpurea ssp. *gibbosa*	common pitcher-plant	Blue
Schizachyrium scoparium[2]	little bluestem	Red
Scolochloa festucacea	rivergrass	Red
Selaginella rupestris[2]	rock selaginella	Red
Senecio congestus	marsh fleabane	Blue
Senecio plattensis	plains butterweed	Blue
Silene drummondii var. *drummondii*[2]	Drummond's campion	Blue
Sphenopholis intermedia	slender wedgegrass	Blue
Stuckenia vaginata	sheathing pondweed	Blue
Utricularia ochroleuca	ochroleucous bladderwort	Red

1. previous CDC records exist for the study area
2. located in the study area by Hawkes *et al.* (2006), **bold** indicates taxon not previously recorded in the Peace River area.

Table 3.2. Red and Blue-listed ecological communities potentially occurring in the BWBSmw1 (CDC 2006).

Scientific Name	English Name	BC Status	BGC unit
Juncus arcticus - Puccinellia nuttalliana - Suaeda calceoliformis	arctic rush - Nuttall's alkaligrass - seablite	Red	BWBSmw1/00
Muhlenbergia richardsonis - Juncus arcticus - Poa secunda ssp. *juncifolia*	mat muhly - arctic rush - Nevada bluegrass	Red	BWBSmw1/00
Picea glauca / Ribes triste / Gymnocarpium dryopteris	white spruce / red swamp currant / oak fern	Blue	BWBSmw1/05
Picea glauca / Ribes triste / Mertensia paniculata	white spruce / red swamp currant / tall bluebells	Blue	BWBSmw1/06
Picea mariana / Arctostaphylos uva-ursi / Cladina spp.	black spruce / kinnikinnick / reindeer lichens	Blue	BWBSmw2/00

Existing information on rare plants and plant communities in the Peace River Corridor includes CDC occurrence records for rare taxa and plant inventories completed in 2005. Hawkes *et al.* (2006) completed inventory work for rare plants between July 20th and August 5th, 2005. They sampled 214 locations and identified 21 rare plant taxa, five of which had not previously been recorded in the Peace region and did not occur on the CDC tracking list. Compilation of the available information resulted in a list of 56 rare plant taxa that potentially occur in the Peace River area, 28 of which have been confirmed in the study area (Table 3.1).

Three of the 21 taxa documented by Hawkes *et al.* (2006) were found in the periphery but did not occur in the core river corridor, these included *B. crenulatum*, *G. pulchella*, and *S. serissima*. The habitat for those species was identified as wetland complexes on the plateau above the Peace River and is therefore not likely to occur in the river corridor. Hawkes *et al*. (2006) identified the grasslands and shrublands above the Peace and Beatton Rivers as having the most diverse rare plant communities.

3.2 Methods

A sampling plan was developed to target sites likely to contain one or more of the rare taxa listed on Table 3.1. To determine which ecosystem units were likely to provide habitat for rare taxa, previous occurrence records from Hawkes *et al.* (2006) and from the CDC were added to the draft TEM map and analysed. This process, in conjunction with a literature review of known habitat associations, produced a list of potential TEM

ecosystem units for each plant taxa. Priority habitats for rare plants were identified as: wetlands, grasslands, gravel bars and cutbanks. Plants not expected to occur in the study area were generally eliminated as target species. Specifically, taxa that are found at high elevation alpine sites were not targeted except those known to also occur on gravel bars.

The location of target habitats in the study area was determined on the TEM map and polygons prioritised for sampling. TEM polygons containing ecosystem units where multiple rare taxa might occur were given higher priority for sampling than polygons where only one or two taxa were expected. The accessibility of each sampling site was also considered.

Prior to fieldwork, the phenologic characteristics for each rare plant were summarised from plant guides and taxonomic keys (e.g. Klinkenberg 2006; Hitchcock and Cronquist 1974). *Rare Native Vascular Plants of British Columbia* was also used (Douglas *et al.* 2002).

The survey was conducted using repeat visits to the study area over several months during the spring and summer. These periodic visits were designed to ensure that plant phenology was taken into account (Klinkenberg and Penny 2006). Plants with different times of emergence and flowering can then be sampled in prime condition. It is essential to collect mature plant parts such as flowers or seeds to confirm species identification.

Searches for rare plants were conducted at target sites and opportunistically during other field surveys. Two surveyors searched a target site by completing a zigzagging traverse through the polygon or by selecting a compass bearing to bisect the polygon.

Standard ground inspection forms (GIF) and FS882 forms were filled out when a rare plant was located (BC MELP and BC MoF 1998). A CDC Field Survey Form was also completed for observations of the rare plants. Visual plots and notes were used to record data during other field surveys. Information recorded included location (UTM coordinates), other plant species (i.e. name, % cover), site and ecosystem. Rare plants found within the 400 m^2 GIF plot were recorded under the same plot number. Plants

found outside the GIF plot area were recorded under another plot number and another GIF form was completed if the habitat was different from the preceding plot.

Voucher specimens were collected according to ***Voucher Specimen Collection, Preparation, Identification and Storage Protocol: Plants & Fungi*** (RIC 1999a). Plants were collected as voucher specimens if the numbers found were sufficiently large, in the judgement of the botanist, that a sample could be collected without compromising the population (see Klinkenberg and Penny 2006; RIC 1999a). Rare plants were pressed as soon as possible to ensure a high quality voucher specimen. Plants were collected in flower or seed wherever possible.

Vouchers were not collected if the taxon had already been collected that day or if the taxon was easily recognized. Plants were not collected in Parks or other Protected Areas as per the conditions of the sampling permit issued by BC Parks. Specimens that could not be reliably keyed out in the field were sent to the UBC Herbarium for confirmation.

3.3 Results

Rare plant surveys took place between June 19th and September 16th, 2006, at 102 distinct locations (Figure 3.1a, b). Most survey sites were located within the Peace River corridor but observations were also made along the related transmission line corridor on the uplands south of the river. Twenty-four different ecosystem units were surveyed (Table 3.3).

Rare plants were located at 48 of the 102 sites sampled, in 12 different ecosystems. Habitats that contained the most rare taxa, as a function of the number of plots completed, were the Sedge Marsh and the Fuzzy-spiked wildrye - Wolf willow ecosystem units, confirming the assumption that wetlands and grasslands would be productive rare plant sites. Rare taxa were not found in twelve of the ecosystem units surveyed.

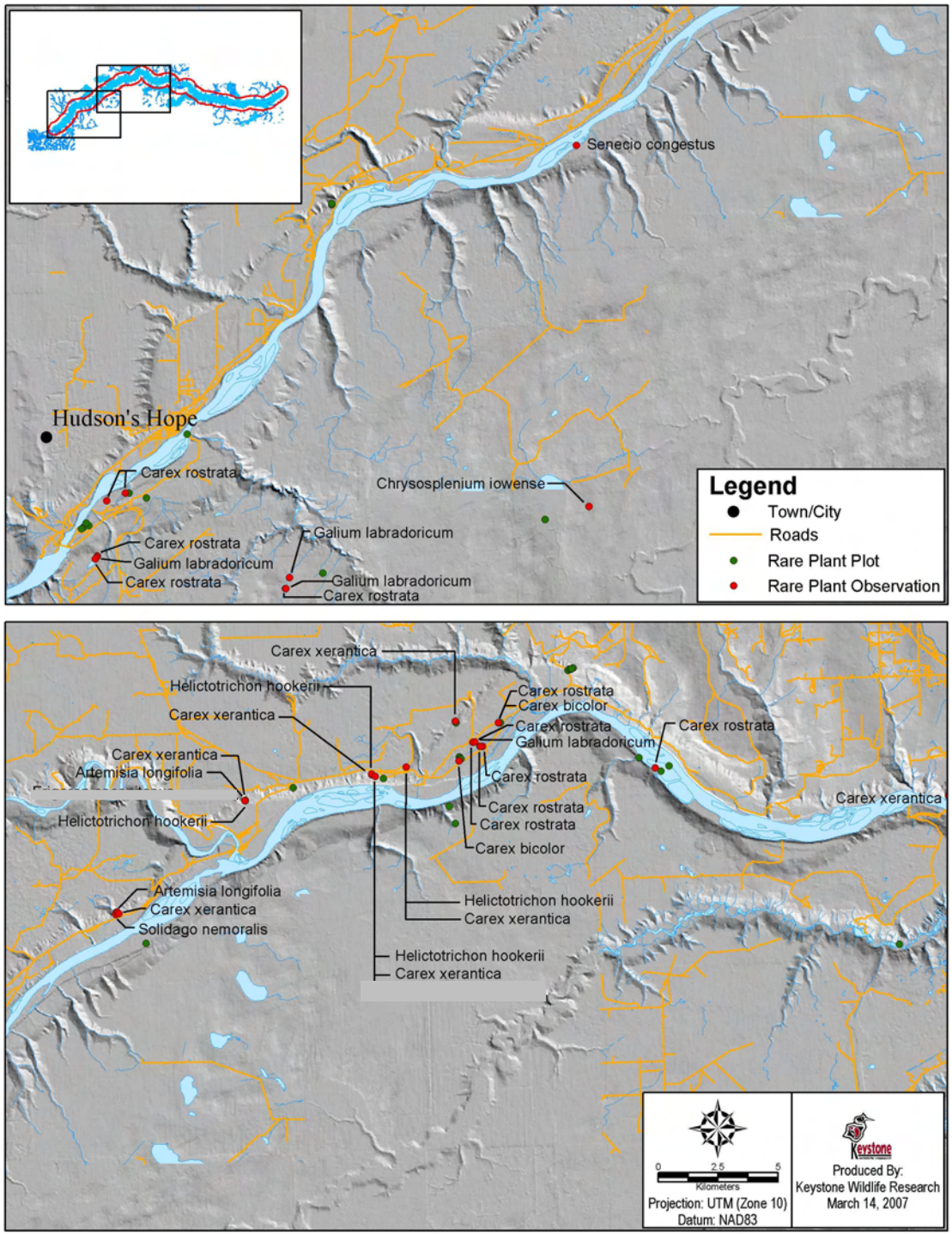

Figure 3.1a. Survey locations and significant observations of rare plants in the western portion of the study area.

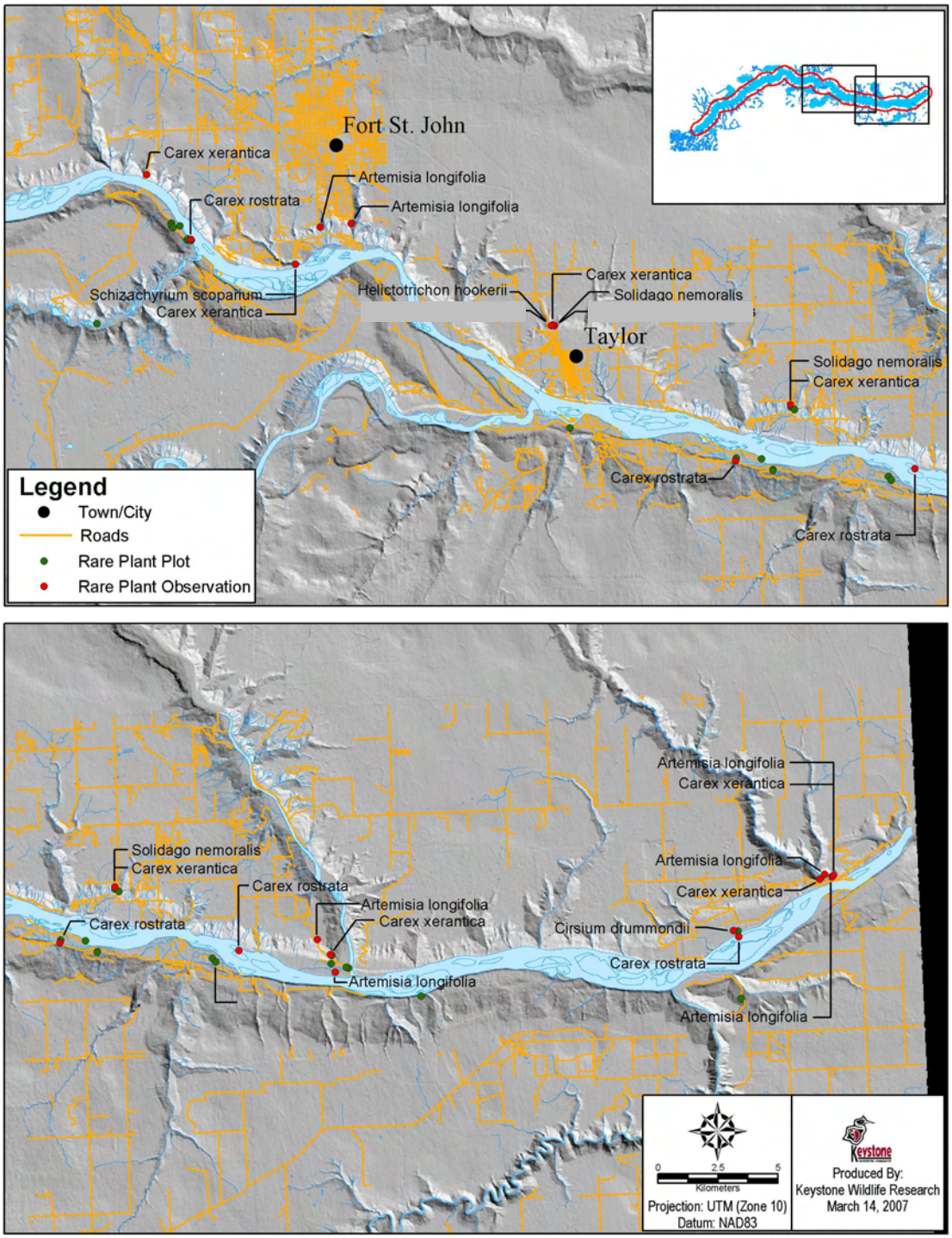

Figure 3.1b. Survey locations and significant observations of rare plants in the eastern portion of the study area.

Table 3.3. Summary of the rare plants recorded in each ecosystem unit surveyed.

Ecosystem Unit	Ecosystem Unit Symbol	Number of sites surveyed	Number of Rare taxa recorded
Alder - Horsetail	AH	3	0
Spruce - Aspen - Step moss	AM	3	0
Aspen - Rose - Showy aster	AMap	1	0
Aspen - Dogwood	AMap-y	1	0
Spruce - Aspen - Soopolallie	AS	7	1
Paper birch - Red-osier dogwood	BD	1	0
Black Spruce - Labrador tea - Sphagnum	BT	3	2
Cutbank	CB	1	1
Cultivated field	CF	2	0
Gravel Bar	GB	4	1
Gravel Pit	GP	1	1
Spruce - Currant - Bluebells	SC	2	0
Aspen - Black twinberry	SCab	5	1
Sedge Fen	SE	10	9
Spruce - Horsetail	SH	3	0
Balsam Poplar - Cow parsnip	SHac	4	0
Balsam Poplar - Horsetail - Floodplain	Shac-a	1	0
Sedge Marsh	SM	2	3
Spruce - Fuzzy-spiked wildrye	SW	2	0
Aspen - Soopolallie	SWas	1	1
Tamarack – Sedge Fen	TS	5	4
Willow - Bluejoint Floodplain	WF	1	0
Willow – Sedge - Swamp	WS	2	2
Fuzzy-spiked wildrye - Wolf willow	WW	30	28
Not Classified	n/a	7	2
Total	**24**	**102**	**56**

Fifty-six observations of 11 different rare plant taxa were recorded in 2006 (Table 3.4). Species most commonly observed included *Carex rostrata* (15 observations) and *Carex xerantica* (13 observations). *Carex rostrata* was not listed by the CDC as potentially present in the Peace Forest District. Nine taxa were observed that were not recorded by Hawkes *et al.* (2006), including *Carex bicolor*, *Carex rostrata, Chrysosplenium iowense, Galium labradoricum*, *Senecio congestus* and *Solidago nemoralis.* In addition, *C. rostrata*, *S. scoparium* and *S. nemoralis* do not occur on the CDC tracking list. Voucher specimens were collected for 40 of the 56 observations and six specimens that were tentatively identified were sent to the herbarium to be confirmed. Three specimens were confirmed by the UBC Herbarium and three were determined to be other species. The remaining specimens will be held by Keystone for possible future examination.

Table 3.4. Rare plant taxa observed during the Peace River rare plant survey, summer 2006.

Plant Species	Habitat Unit	Number of rare taxa recorded	Voucher Specimen Collected
Artemisia longifolia			
Long-leaved mugwort	CB	1	no
	GP	1	no
	WW	7	yes
Carex bicolor	SM	1	yes
Two-coloured sedge	WS	1	yes
Carex rostrata	SE	8	yes
Swollen beaked sedge	SM	2	yes
	TS	2	yes
	WS	1	no
	Not classified	2	no
Carex xerantica			
Dry-land sedge	WW	13	yes
Chrysosplenium iowense			
Iowa golden-saxifrage	SWas	1	yes
Cirsium drummondii			
Drummond's thistle	SCab	1	yes
Galium labradoricum	BT	2	yes
Northern bog-bedstraw	SE	1	yes
	TS	2	yes
Helictotrichon hookerii	AS	1	yes
Spike-oat	WW	4	yes
Schizachyrium scoparium	WW	1	yes
Senecio congestus			
Marsh fleabane	GB	1	yes
Solidago nemoralis			
Field goldenrod	WW	3	yes*
Total		**56**	**40**

*specimen confirmed by UBC Herbarium

3.4 Recommendations

Rare plants that were considered high priority in the 2005 scope of study (Keystone Wildlife Research Ltd. 2005) included Red-listed species with occurrence records from the Peace River and with no known locations in the rest of the province. One of these high priority species (*A. longifolia*) has been documented during two years of rare plant surveys. This species was found on the steep, warm aspect slopes.

Nine of the 56 identified rare taxa are directly associated with riverine habitats (CDC 2006). Five of these taxa were located in upland habitats during the 2005 or 2006 surveys, and one (*J. confusus*) was found in a riparian habitat type. In addition, four taxa expected in wetlands were found only in riverine habitats. These included: *E. saximontanum*, *O. campestris* var. *davisii*, *J. confusus* and *S. congestus*. These results suggest that rare taxa may be more widely distributed than expected.

The steep, warm aspect slopes appear to be the most productive sites in the study area in terms of both diversity and number of rare flora. Since large amounts of this mostly upland habitat will not be directly affected by potential hydroelectric development, future surveys should focus on riverine habitats. Additional surveys are required to collect additional baseline data regarding rare taxa potentially present in floodplain habitats of the valley bottom. Ecosystem mapping and biophysical mapping should be used to identify areas with potential to support rare taxa.

4.0 BUTTERFLY SURVEY

A number of rare butterfly taxa have been identified in the Peace Region, mainly in grassland units along the river breaks. Additional surveys were conducted to establish habitat relationships and improve the limited inventory data collected to date.

4.1 Introduction

The 2005 scope of study (Keystone Wildlife Research Ltd. 2005) identifies butterflies as a resource of concern since they are strongly associated with specific vegetation and often have a restricted local distribution. These aspects of their life history make them particularly vulnerable to disturbance. As little information exists on population trends of other invertebrate taxa, butterflies can serve as an umbrella species group to represent the area's invertebrates.

Studies have been completed to identify species distribution, abundance and habitat use for butterflies in north-eastern B.C. Guppy and Shepard (2001) list 79 butterfly species that occur in the Peace Forest District (formerly Dawson Creek and Fort St. John Forest Districts), with four species represented by two subspecies arctic blue (*Plebejus glandon*); arctic skipper (*Carterocephalus palaemon*); common branded skipper (*Hesperia assiniboia*); clouded sulphur (*Colias philodice*)), for a total of 83 taxa. Since that publication, the bronze copper (*Lycaena hyllus*) and Mormon fritillary, *erinna* ssp. (*Speyeria mormonia erinna*) have been added to the list for area, for a total of 85 taxa. Nineteen of these taxa are provincially Blue-listed, although Mead's sulphur (*Colias meadii*), mountain or yellow-dotted alpine (*Erebia pawloskii*) and white-veined arctic *edwardsi* ssp.), are associated with alpine and subalpine habitats, which are not present in the study area. Therefore, 16 of the Blue-listed taxa are expected to occur in the Peace River Corridor.

The Conservation Data Centre is currently reviewing the conservation status of butterflies in B.C. This process may result in the elevation of several species to a higher conservation status as recommended by Guppy *et al.* (2003).

Shepard (2000) conducted inventories near the Peace River in 1997 and 1999. Additional useful information is provided by Kondla *et al.* (1994), Bird *et al.* (1995), and Layberry *et al.* (1998). The current status of species identification, photographs, distribution, habitat and biology up to 2000 are summarized in Guppy and Shepard (2001). Guppy *et al.* (2003) conducted extensive habitat-focussed inventory in the South Peace. They documented 13 of the Blue-listed taxa in the BWBSmw1 BEC variant (Table 4.1). Hawkes *et al.* (2006) completed an inventory to document occurrence and distribution of Blue-listed butterfly taxa in the Peace River between June 1st and July 24th, 2006. They sampled 64 sites, resulting in 264 observations representing 41 butterfly taxa. The presence of eight Blue-listed taxa was confirmed (Table 4.1).

The English names and scientific names of the Blue-listed butterflies correspond to those used by the Conservation Data Centre (Table 4.1), for consistency. The names used for the butterfly species that are not of conservation concern are those that are scientifically correct, based on current scientific knowledge.

Table 4.1. Summary of Blue-listed butterfly taxa documented in the Peace River Area.

English Name	Scientific Name	BC Status	Reported Hawkes *et al.* 2006	Reported Guppy *et al.* 2003
Alberta Arctic	*Oeneis alberta*	Blue		yes
Aphrodite Fritillary, *manitoba* ssp.	*Speyeria aphrodite manitoba*	Blue	yes	yes
Arctic Blue, *lacustris* ssp. [1]	*Plebejus glandon lacustris*	Blue		yes
Arctic Skipper, *mandan* ssp. [2]	*Carterocephalus palaemon mandan*	Blue	yes	yes
Baird's Swallowtail, *pikei* ssp. [3]	*Papilio machaon pikei*	Blue	yes	yes
Bronze Copper [4]	*Lycaena hyllus*	Blue	yes	
Checkered Skipper	*Pyrgus communis*	Blue		
Common Branded Skipper, *assiniboia* ssp. [5]	*Hesperia assiniboia*	Blue	yes	yes
Common Ringlet, *benjamini* ssp.	*Coenonympha tullia benjamini*	Blue	yes	
Common Woodnymph, *ino* ssp. [6]	*Cercyonis pegala nephele*	Blue	yes	yes
Coral Hairstreak, *titus* ssp.	*Satyrium titus titus*	Blue	yes	yes
Great Spangled Fritillary, *pseudocarpenteri* ssp.	*Speyeria cybele pseudocarpenteri*	Blue	yes	yes
Mead's Sulphur	*Colias meadii*	Blue		
Mountain Alpine	*Erebia pawloskii*	Blue		
Red-disked Alpine	*Erebia discoidalis*	Blue		yes
Striped Hairstreak	*Satyrium liparops*	Blue		yes
Tawny Crescent	*Phyciodes batesii*	Blue		yes
Uhler's Arctic	*Oeneis uhleri*	Blue		yes
White-veined Arctic, *edwardsi* ssp.	*Oeneis bore edwardsi*	Blue		

[1] The Latin name for *Plebejus glandon lacustris* has until recently been *Agriades glandon lacustris*.
[2] The CDC does not list an English name for this subspecies. "arctic skipper, *mandan* subspecies" is created here based on their common name for the species. The correct Latin name based on unpublished data (two "subspecies" flying together without interbreeding; mDNA data) is actually *Carterocephalus mandan*, with no generally accepted English name because it has only recently been recognized to be a full species; Mandan skipper has been used historically.
[3] The English name and scientific name listed by the CDC do not correspond. The possible combinations (depending on which book is used as a reference) are "Baird's swallowtail, *pikei* subspecies" (= *Papilio bairdii pikei*), "old-world swallowtail, *pikei* subspecies" (= *Papilio machaon pikei*), or "Pike's Swallowtail" for either version of the scientific name.
[4] The bronze copper is not listed from the Peace Forest District by the CDC. It was found for the first time in the Peace area in 2005 at two sites by Hawkes *et al.* (2006).
[5] The English name and scientific name listed by the CDC do not correspond. There is no generally accepted common name for *Hesperia assiniboia*, because it has only recently been recognized to be a full species (mDNA data), rather than a subspecies; Assiniboian skipper has been used historically.
[6] The English name and scientific name listed by the CDC do not correspond. The possible combinations (depending on which book is used as a reference) are "common woodnymph, *ino* subspecies" (= *Cercyonis pegala ino*) or "common woodnymph, *nephele* subspecies" (= *Cercyonis pegala nephele*).

The objectives of the 2006 butterfly survey were to:

- determine the range of the Blue-listed butterflies that are known from, or may occur in, the study area. The range was defined as the distance west of the Alberta border that each species occurs.

- identify TEM ecosystem units that are likely to be used for reproduction by Blue-listed butterflies.

4.2 Methods

The Resources Information Standards Committee's ***Inventory Methods for Terrestrial Arthropods*** (RIC 1998a) was used as the basis for the methods for this project. Data forms and methodology were modified to specifically address butterfly inventory by omitting non-applicable parts, however methods remained consistent with the RISC standards. This inventory focussed on presence/not detected data.

A sampling plan was developed to target sites likely to contain one or more of the rare taxa listed on Table 4.1. To determine which TEM ecosystem units were likely to contain rare taxa, previous occurrence records from Hawkes *et al.* (2006) and from the CDC were added to the draft TEM map and analysed. This process, in conjunction with a literature review of known habitat associations, produced a list of potential TEM ecosystem units for each butterfly taxon.

Sample sites were defined as the draft TEM polygons. Polygons were selected that were within the core area, had reasonable road access, and where the ecosystem unit was expected to contain habitat for one or more Blue-listed taxa (this varied depending on the time of year). An effort was also made to distribute surveys across the east-west axis of the core area. Within those constraints, polygon selection was arbitrary.

Sampling focussed on the habitats used by the butterfly taxa in flight during each of the three pre-determined sample periods. The habitats near the Peace River at the Clayhurst Bridge were periodically visited to confirm the flight periods of the Blue-listed butterflies. TEM polygons, other than those at the Clayhurst Bridge, were seldom revisited so as to maximize the number of polygons inventoried. Sampling was not done in provincial parks (Peace River Corridor Provincial Park, Taylor Landing Provincial Park) or protected areas (Kiskatinaw River Protected Area, Clayhurst Ecological Reserve) as BC Parks did not permit collection of specimens.

Each draft TEM habitat polygon was inventoried for butterflies by walking through the area to sample all the microhabitats within the polygon. The time spent in a given polygon was sufficient to ensure that all Blue-listed butterfly species using the polygon for breeding, on the date of inventory, were detected. The search time within a polygon varied from 15 to 120+ minutes, depending on the polygon size, microhabitat diversity, abundance and diversity of butterfly species, and butterfly activity level.

The Animal Observation Form – Terrestrial Arthropods – Butterflies, developed by Guppy *et al.* (2003) was used to record butterfly observation data. The habitat of each site was classified into TEM ecosystem units rather than listing the dominant plant species present. All butterfly species seen were recorded. Key data for all butterfly observations were entered into an Excel spreadsheet.

Butterflies were inventoried through sight observations and by netting. Netted butterflies were either released after identification or killed by pinching the thorax between thumb and forefinger, and then placed in a glassine envelope for temporary storage until permanent preparation as museum specimens. Only a fraction of the butterflies present at a site were collected as voucher specimens.

The butterflies were all identified by Crispin S. Guppy, an expert on the butterflies of BC and co-author of Butterflies of British Columbia (Guppy and Shepard 2001). Crescent butterflies (genus *Phyciodes*) were all identified from voucher specimens as sight observations are unreliable due to the great similarity of the species in this genus, and because there is an undocumented species flying in the study area.

A voucher collection of specimens has been incorporated into the research collection of Crispin S. Guppy. Those specimens, as with the remainder of his collection, are available for viewing or loan to other researchers. All prepared voucher specimens have data labels attached that are consistent with Royal British Columbia Museum (Victoria, BC) and RISC standards.

4.3 Results

The butterfly inventory occurred almost entirely in the core study area, with a few sites in the periphery. Each sample site corresponded to a single TEM polygon, to allow correlation of butterfly taxa with TEM ecosystem units. The three sampling periods, timed to coincide with the flight periods of Blue-listed taxa, were May 24th to June 1st, June 20th to 24th and July 20th to 24th.

Ninety sites were visited, resulting in 2011 observations representing 54 different taxa. Twelve of the 16 Blue-listed taxa that potentially occur in the core study area were observed, totalling 689 observations (Table 4.2; Figure 4.1a, b).

Table 4.2. Summary of the Blue-listed butterfly taxa observed in the Peace River in 2006.

Common Name	Scientific Name	Number of individuals observed
Aphrodite Fritillary, *manitoba* subspecies	*Speyeria aphrodite manitoba*	38
Arctic Blue, *lacustris* subspecies	*Plebejus glandon lacustris*	40
Arctic Skipper, *mandan* subspecies	*Carterocephalus palaemon mandan*	49
Baird's Swallowtail, *pikei* subspecies 3	*Papilio machaon pikei*	38
Common Branded Skipper, *assiniboia* subspecies	*Hesperia assiniboia*	24
Common Ringlet, *benjamini* subspecies	*Coenonympha tullia benjamini*	88
Common Woodnymph, *ino* subspecies	*Cercyonis pegala nephele*	42
Coral Hairstreak, *titus* subspecies	*Satyrium titus titus*	1
Great Spangled Fritillary, *pseudocarpenteri* subspecies	*Speyeria cybele pseudocarpenteri*	38
Striped Hairstreak	*Satyrium liparops*	7
Tawny Crescent	*Phyciodes batesii*	246
Uhler's Arctic	*Oeneis uhleri*	78
Total rare butterflies observed		**689**

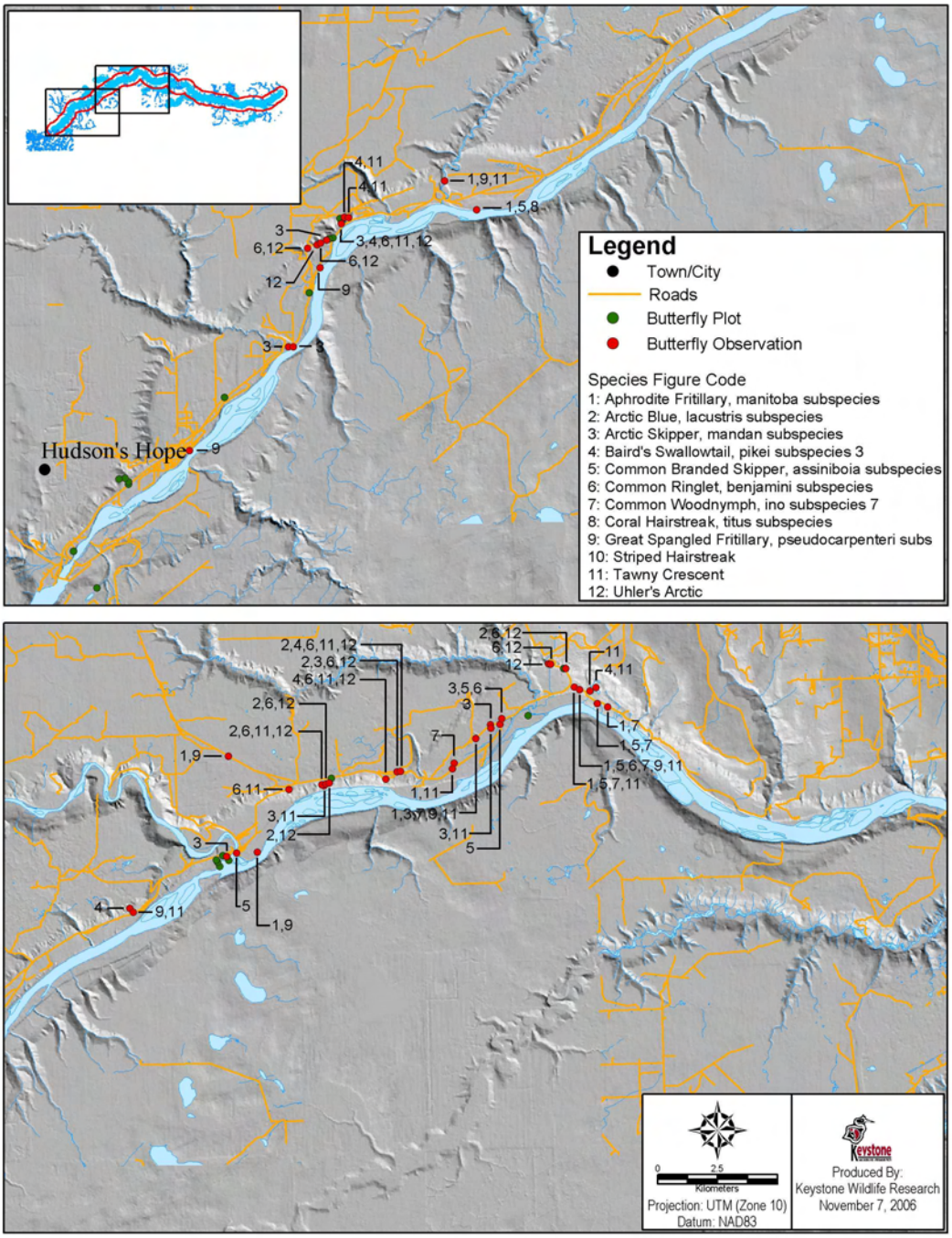

Figure 4.1a. Survey locations and significant observations for butterfly surveys completed in the western portion of the Peace corridor.

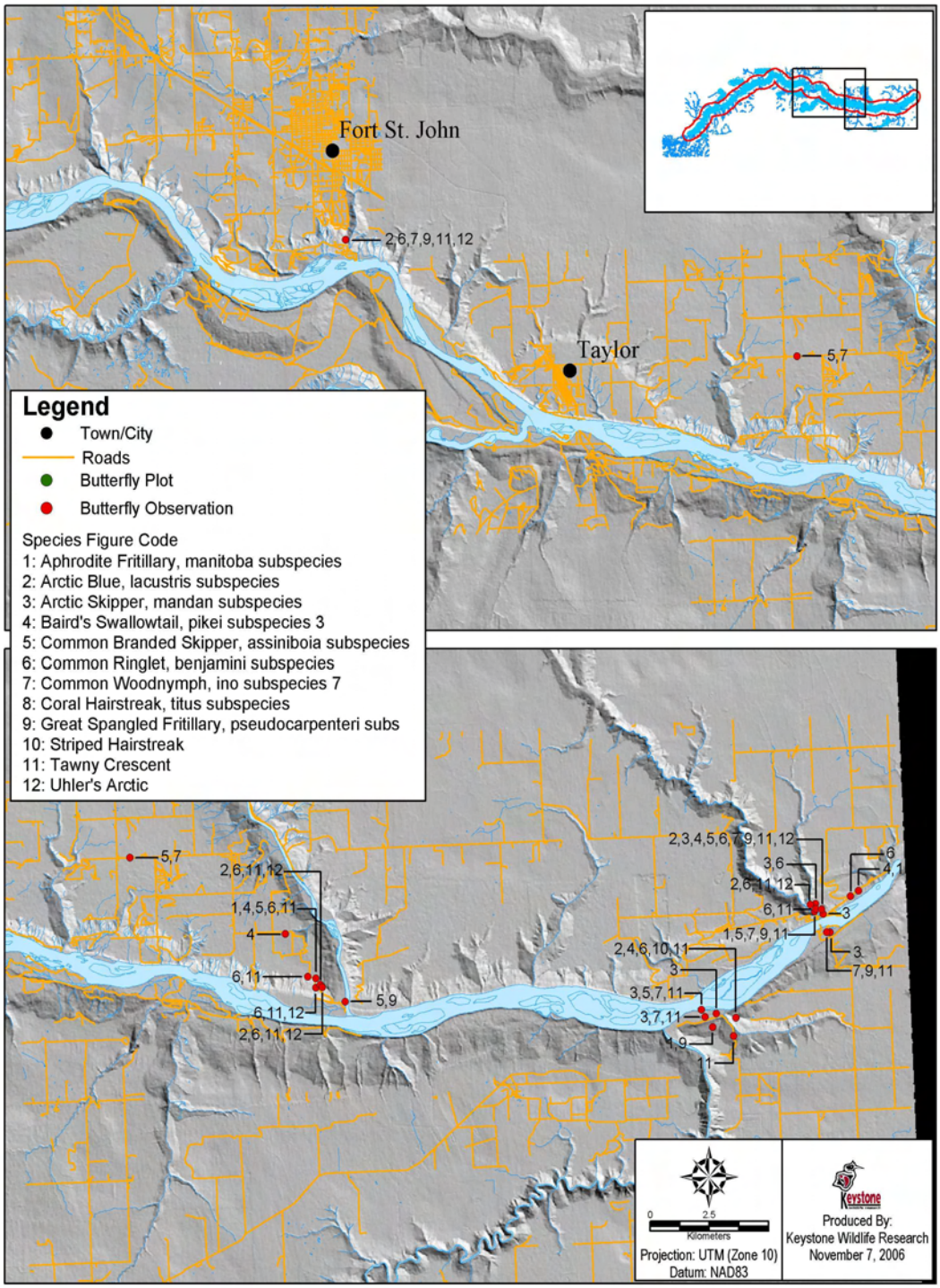

Figure 4.1b. Survey locations and significant observations for butterfly surveys completed in the eastern portion of the Peace corridor.

Sufficient information was gathered to meet the project objectives for ten of the Blue-listed taxa. Specifically:

- the western limit of the range for many species was confirmed to what was previously recorded (Guppy and Shepard 2001). In other cases, notably the great spangled fritillary (*pseudocarpenteri* subspecies; *Speyeria cybele pseudocarpenteri*), the range of the taxon has been extended considerably further west.

- the data provide a reasonable representation of the TEM ecosystem units used by these species. Of particular note, the habitat of the common branded skipper (*assiniboia* subspecies; *Hesperia assiniboia assiniboia)* has been shown to include not just the dry grass south-aspect slopes (WW ecosystem) as previously thought, but also sedge wetlands and river edges.

This inventory was inadequate to meet the project objectives for eight of the 16 Blue-listed species. The Alberta arctic (*Oeneis alberta*), bronze copper (*Lycaena hyllus*), checkered skipper (*Pyrgus communis*) and red-disked alpine (*Erebia discoidalis*) were not detected and the common branded skipper ssp. *assiniboia* (*Hesperia assiniboia*), common woodnymph ssp. *ino* (*Cercyonis pegala nephele*), coral hairstreak ssp. *titus* (*Satyrium titus titus*) and striped hairstreak (*Satyrium liparops*) were found but could not be adequately inventoried.

The data from this project, in combination with a 2003 butterfly inventory project for the forest company Louisiana Pacific Inc. in Dawson Creek and mDNA analysis through Guelph University in Ontario, has resulted in two significant scientific advances:

- The arctic skipper is actually two species, the arctic skipper (*Carterocephalus palaemon*) and the Mandan skipper (*Carterocephalus mandan*), both of which fly throughout the study area. The arctic skipper is not of conservation concern, and the Mandan skipper should remain Blue-listed.

- The pearl crescent is actually two species, the pearl crescent (*Phyciodes cocyta*) and the pasco crescent (*Phyciodes pascoensis*), both of which fly throughout the study area; neither is of conservation concern.
-

Data from voucher specimens collected by Guppy *et al.* (2003) has also shown that the lacustrine blue (*Agriades lacustris;* Plate 4.1), which occurs in the study area, is a separate species from the arctic blue (*Agriades glandon* = *A. rusticus*), which occurs in alpine areas near Tumbler Ridge. The lacustrine blue is Blue-listed, and the arctic blue is not of conservation concern.

Based on the available information, draft habitat suitability ratings have been completed for 14 of the Blue-listed butterfly taxa that were expected to occur in the study area. The four-class rating scheme was used as outlined in ***British Columbia Wildlife Habitat Ratings Standards*** (RIC 1999e).

Plate 4.1. Arctic Blue, *lacustris* subspecies (male). Cris Guppy photo.

4.4 Recommendations

Additional surveys should be conducted to establish habitat relationships and determine the distribution and abundance of the Blue-listed taxa for which existing inventory information is inadequate. Inventory efforts should be stratified to TEM habitat types, focussing on the river-associated habitats that are most likely to support each target butterfly species and which may be affected by potential hydroelectric development. The results of these surveys should be used to refine the existing habitat suitability rating for the identified butterfly species.

Additional inventory efforts should focus on the Alberta arctic (*Oeneis alberta*), bronze copper (*Lycaena hyllus*), checkered skipper (*Pyrgus communis*), red-disked alpine (*Erebia discoidalis*), common branded skipper ssp. *assiniboia* (*Hesperia assiniboia*), common woodnymph ssp. *ino* (*Cercyonis pegala nephele*), coral hairstreak ssp. *titus* (*Satyrium titus titus*) and striped hairstreak (*Satyrium liparops*).

5.0 OWL SURVEY

Owls have high regional significance and high spiritual value to First Nations. The Short-eared Owl is provincially Blue-listed, the Great Gray Owl is regionally important and the Great Horned Owl has spiritual significance to First Nations. Surveys were conducted to document species occurrence and habitat associations during the breeding season.

5.1 Introduction

The cumulative loss of mature and old forests through inundation and forestry has increased the value of the remaining owl habitat in northeastern B.C. The 2005 scope of study (Keystone Wildlife Research Ltd. 2005) identified nine owl species that could potentially occur in the study area. Species of particular concern include the Great Gray Owl, which is a regionally important wildlife species, the Great Horned Owl, which has spiritual values to First Nations and the Short-eared Owl, which is provincially Blue-listed and is a SARA species of concern.

Prior to 2005, incidental sightings have been the only records of owl species present in the area. Hawkes *et al.* (2006) completed nine call playback surveys between June 13th and July 23rd, 2005. They broadcast calls for Boreal Owls, Barred Owls, Great Gray Owls and Northern Saw-whet Owls at one or more stations. Responses were recorded from one Barred Owl and two Saw-whet Owls. They noted that the timing of their surveys was not optimal and owls would likely be more responsive in the spring.

The objective of the surveys in 2006 was to determine species composition for owls in the area. Species-specific surveys were conducted for Great Horned Owl, Great Gray Owl, Northern Saw-whet Owl, Boreal Owl, and Short-eared Owl.

5.2 Methods

Surveys were conducted according to methodology described in the RISC standards ***Inventory Methods for Raptors*** **(**RIC 2001). The methodology has recently been revised for seven owl species, including Great Horned Owl, Boreal Owl, and Northern Saw-whet Owl (Hausleitner 2006). These new standards state that each owl species

must be surveyed separately during a survey transect (i.e. only one species' call can be broadcast per transect per night). However, they maintain that all owl observations, regardless of species, should be recorded and plotted during all surveys.

Roadside visual surveys were conducted for Short-eared Owls as described in ***Inventory Methods for Raptors*** (RIC 2001). All surveys for Short-eared Owls were conducted pre-dusk prior to beginning species-specific nocturnal call-playback surveys.

Three owl transacts (labelled A, B and C) were established in the study area to sample a variety of adjacent ecosystem units along accessible survey routes (Figure 5.1a, b). Each transect was surveyed up to three times (April, May and June) for each target species, totalling 36 survey nights (1 species/night/transect).

Call stations were typically 15 minutes long, and calls were broadcast for up to 1 minute at 5-minute intervals. The listening time at a call station was extended if ambient noise interfered with the surveyor's ability to detect owls. The standards recommend an inter-station distance for each owl species: 1000 m for Great Horned Owl, 800 m for Boreal and Great Gray Owls and 700 m for Northern Saw-whet Owls (RIC 2001). The inter-station distance for saw-whets was decreased to 500 m, since the male territorial call is only audible to the human ear at a distance up to 300 m through the forest (Cannings 1993). These distances were used unless specific circumstances indicated that the distance should be altered (e.g. if the same owl was heard at consecutive stations the distance would be increased).

Surveys for nocturnal owl species were conducted between ½ hour after dusk and ½ hour before sunrise. Owl surveys were not done within Protected Areas (Peace River Corridor Provincial Park, Taylor Landing Provincial Park, Clayhurst Ecological Reserve and Kiskatinaw River Protected Area) since a Parks research permit could not be obtained by the onset date of these surveys.

Surveys for Short-eared Owls were completed ½ hour before dusk until dark. The three established transects (A, B and C) were divided into ½ hour sections and each section was surveyed on successive nights until the entire transect was completed. Roadside

surveys were completed by driving at a low speed (not exceeding 40 km/hr) along a road with two observers scanning the countryside.

Information was recorded on RISC standard data forms modified for this project (Appendix 1). Specific information recorded at each station included: UTM location (NAD 83), start and stop time and weather conditions. When an owl was detected. the minimum information recorded included the species, count, distance and direction.

Ground-based nest searches were also performed during the day if an owl pair was located during a nocturnal survey. This involved searching the area of the detection for sign such as whitewash, prey pluckings and pellets.

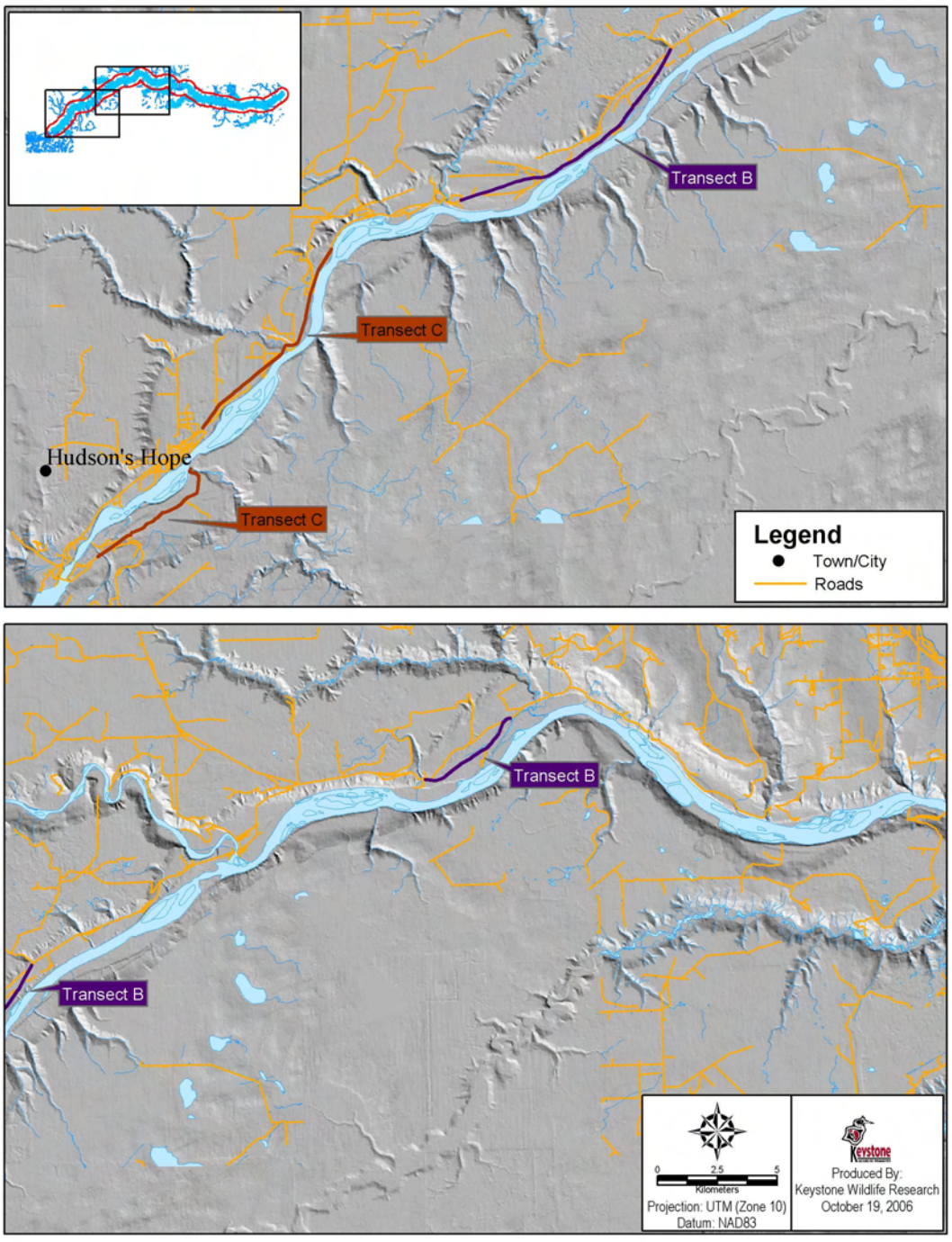

Figure 5.1a. Owl survey transect locations in the western portion of the Peace corridor.

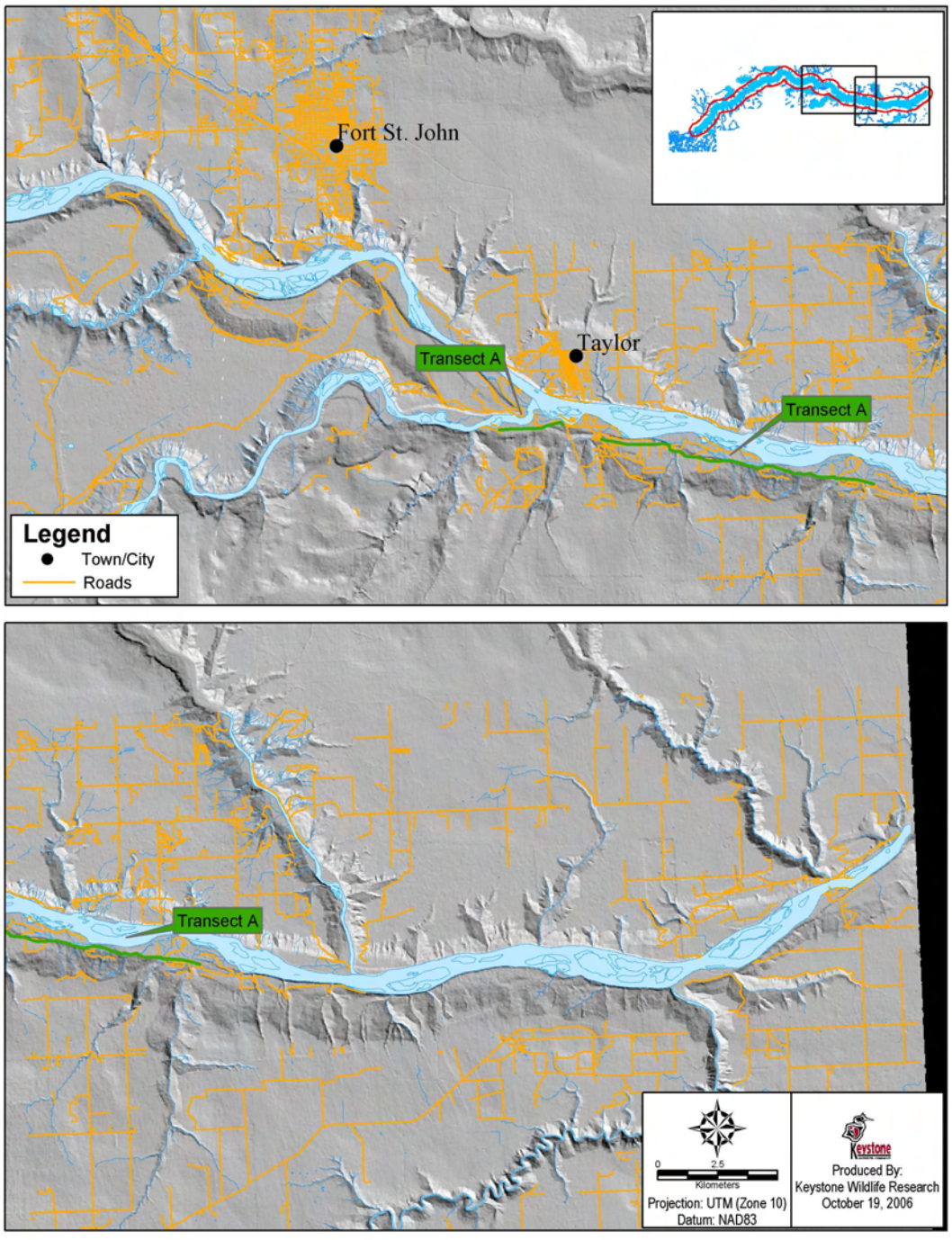

Figure 5.1b. Owl survey transect locations in the eastern portion of the Peace corridor.

5.3 Results

Surveys took place in three sample sessions; from April 19-27, May 23-31, and June 20-29, 2006. Total overall survey time was 129 hours and 21 minutes for all four species and over 500 km were surveyed (Table 5.1). Transect length and survey time varied between surveys depending on conditions (i.e. amount of light present or weather conditions) and owl species. Individual call-playback transects covered 8 to 16 km and took 2 to 4.5 hours to complete. Survey effort was the greatest for the Boreal Owl with 35 hrs and 31 minutes of survey time. Survey effort was the lowest for Short-eared Owl with 6 hours and 58 minutes of survey time, but this is expected since surveys for this crepuscular species are done for only 30 minutes per day at dusk.

The three transects were repeated three times for Great Gray Owl, Boreal Owl, Great Horned Owl, and Short-eared Owl. Approximately, 66% of the detections for Northern Saw-whet Owls occurred during call-playback surveys for other owl species. Since this species was frequently detected regardless of the owl call being broadcast, not all transects were repeated in the third sample session for this species. Specifically, June surveys were not repeated for saw-whets on two transects.

Inclement survey conditions (wind speed greater than 3 on the Beaufort scale) were experienced at 25 call stations (5% of total stations completed). Conditions usually improved over the course of the survey, and only one transect (Great Horned Owl on June 28) could not be completed because the conditions persisted.

Table 5.1. Summary the date, survey time and transect distance for species-specific owl surveys completed in 2006.

Species	Transect Label	Visit Dates	Survey Time (hh:mm)	Transect Length (km)
Boreal Owl	A	Apr 25, May 26, Jun 25	12:11	31.8
	B	Apr 27, May 23, Jun 26	12:41	36.8
	C	Apr 20, May 23, Jun 20	10:39	30.8
Boreal Owl Total			35:31	99.4
Great Gray Owl	A	Apr 19, May 29, Jun 27	10:48	34
	B	Apr 23, May 31, Jun 24	11:34	35.2
	C	Apr 21, May 24, Jun 21	11:44	38.2
Great Gray Owl Total			34:06	107.4
Great Horned Owl	A	Apr 22, May 24, Jun29	11:09	41
	B	Apr 20, May 25, Jun 29	10:14	43
	C	Apr 22, May 27	6:35	31
Great Horned Owl Total			27:58	115
Northern Saw-whet Owl	A	Apr 21, May 30	6:22	18.2
	B	Apr 19, May 27, Jun 28	10:29	24
	C	Apr 26, May 28	7:57	18.7
Northern Saw-whet Owl Total			24:48	60.9
Short-eared Owl*	A	Apr 19, 21, May 24, 26, 29, Jun 25	2:08	35.73
	B	Apr 19, 20, May 23, 25, 27, Jun 24, 26	2:21	47.73
	C	Apr 20, 21, May 23, 24, 27, Jun 20, 21	2:29	38.72
Short-eared Owl Total			6:58	122.18
Grand Total			129:21	504.88

*Visual survey

All of the targeted species were detected during surveys within the study area in 2006. In addition to target species, Barred Owls and four owls that could not be identified from their vocalizations were also detected for a total of 274 detections (Table 5.2). Northern Saw-whet Owls were detected the most frequently with 156 detections. Great Horned Owls and Barred Owls (Plate 5.1) were the next most common species recorded in the area with 57 and 51 detections, respectively. Short-eared Owls were detected only once. The most owl detections were recorded on Transect B.

Five Great Horned Owl pairs were detected in large balsam poplar stands located within the Peace River floodplain. Two Great Horned Owl family groups were also detected along the river during breeding bird surveys.

Table 5.2. Owl species observed during transects in the Peace River Corridor in 2006.

Transect Label	Survey Time	Boreal Owl	Great Gray Owl	Great Horned Owl	Northern Saw-whet Owl	Short-eared Owl	Northern Barred Owl	Unknown Owl	Total
A	April			3	40		2		45
	May		1	4	23		8		36
	June			10	5*		3		18
A Total			1	17	68		13		99
B	April			6	43		12		61
	May	2		12	11		12	2	39
	June			16	2		9	1	28
B Total		2		34	56		33	3	128
C	April		1	2	24		2		29
	May		1	4	8	1	1	1	16
	June			*	*		2		2
C Total			2	6	32	1	5	1	47
Total		2	3	57	156	1	51	4	274

*no species-specific survey completed for this species.

Most owl detections were the result of owls calling in response to a call playback broadcast or calling spontaneously prior to calls being broadcast. Visual observations of owls were made at 11 locations opportunistically or in response to broadcast calls. The Great Gray Owls were detected during surveys for Boreal Owls and Northern Saw-whet Owls, and did not respond to playbacks of their own call. Boreal Owls responded only to playback of their own calls.

Plate 5.1. Barred Owl roosting in a balsam poplar. L. Simpson photo.

Incidental Observations

One additional owl species was observed during the waterfowl survey in September 2006. Two call detections of Long-eared Owl were recorded on September 6 and 7 just south of the mouth of the Halfway River and about 8.6 km upstream of Taylor, respectively. Long-eared Owls are considered rare visitants in north-central BC (Prince George Naturalists Club 1996). Hawkes *et al.* (2006) also reported a single detection of the Northern Pygmy-owl in the river corridor in 2005.

5.4 Recommendations

Owls appear to be abundant in the study area based on 2006 data. Nesting habitat is typically a limiting life requisite for owls (Haywood and Verner 1994; Allan 1983). Nesting habitat associated with floodplains may be affected by potential hydroelectric

development and use of habitat in the study area for nesting may require further investigation.

Great Gray and Great Horned Owls primarily use large stick nests created by other birds of prey, but they will also use broken-topped snags and artificial platforms (Bull and Duncan 1993; Houston *et al.* 1998). Competition for nesting sites between these species occurs, but Great Horned Owls typically claim the best nest sites since they nest earlier (Bull and Duncan 1993). Great Horned Owls are highly territorial and rarely tolerate another species of owl on their territory during the breeding season (Houston *et al*. 1998). In the Yukon, defended territories were 5.26-5.56 km^2 (Rohner 1997). Comparatively, Great Gray Owls will tolerate other owls and diurnal birds of prey within 500 m of a nest site (Bull and Duncan 1993).

Large stick nests in the area are predominantly associated with balsam poplar stands, since these trees have the size and configuration to support nest structures. These stands occur primarily along the Peace River. The Blue-listed Short-eared Owl nests on the ground in large patches of tall, dense, ungrazed grassland (Wiggins *et al.* 2006). The Boreal Owl and Northern Saw-whet Owl nest in existing woodpecker cavities in spruce, aspen, birch and cottonwood (Hayward and Hayward 1993; Cannings 1993). Therefore nesting habitat for these owls is unlikely to be restricted to the balsam poplar floodplain habitats.

Since nesting habitat may be a limiting life requisite, additional baseline surveys are required to determine the use of balsam poplar floodplains by nesting owls. This will give a better indication of the use of this habitat type and the potential effects of hydroelectric development. Species-specific surveys should be conducted for: Great Horned, Great Gray Owl, and Boreal Owl.

6.0 AMPHIBIAN SURVEY

Amphibian surveys were required since little baseline data has been collected within the study area for this species group and they are expected to be sensitive to hydroelectric development.

6.1 Introduction

According to Corkran and Thoms (1996), amphibian species expected to occur in the Boreal Plains ecoprovince include the long-toed salamander (*Ambystoma macrodactylum*), western toad (*Bufo boreas*), boreal chorus frog (*Pseudacris maculata*), Columbia spotted frog (*Rana luteiventris*) and wood frog (*Rana sylvatica*). These species are not provincially at risk but the western toad is listed under Schedule 1 of the Species at Risk Act as a species of special concern. The 2005 scope of study (Keystone Wildlife Research Ltd. 2005) indicated that there are significant data gaps for these species and surveys to determine relative abundance in the study area are required. Surveys should focus on the western toad since it is a species of special concern.

Amphibians have small home ranges, are highly philopatric, and have limited dispersal ability, making them sensitive to local environmental perturbations (Blaustein 1994; deMaynadier and Hunter 1995). All of the amphibians in the study area are aquatic breeders that use wetlands, ponds, and still-water off-channel habitats for breeding (Corkran and Thoms 1996; RISC 1998b).

Limited information exists on the distribution of amphibians in the study area and previous surveys in the area were completed in mid-summer (Fraker and Hawkes 2000), when many amphibians are not active near the surface and are therefore harder to detect (Corkran and Thoms 1996; RISC 1998b). Hawkes *et al.* (2006) completed time-constrained searches for metamorphosed juveniles and adult amphibians at 42 sites in the core area, between June 4th and July 24th. They targeted potential breeding sites including off channel habitats, ponds within the floodplain and wetlands within 2 kilometres of the core survey area. They completed 11.56 search hours and recorded

the long-toed salamander, the western toad and the wood frog (Table 6.1). No Columbia spotted frogs or boreal chorus frogs were detected.

Table 6.1. Numbers of amphibians recorded in the core area of the Peace River in 2005 (adapted from Hawkes *et al.* 2006)

Age Class	Long-toed Salamander	Western Toad	Wood Frog
Egg Masses		2	
Larvae	8	56*	2
Juveniles		1280*	5
Sub-adults			3
Adults		1	24
Unclassified		8	15
Total	8	1347	49

* Visually estimated

6.2 Methods

Amphibian surveys followed the protocols outlined in ***Inventory Methods for Pond-breeding Amphibians and Painted Turtles*** (RIC 1998b). Survey methods included auditory surveys and time-constrained searches for egg masses. Auditory surveys are recommended for vocal species such as the wood frog and chorus frog and indicate the presence of male frogs. Wetland searches for egg masses are recommended for all species present in the Peace River and can give a direct indication of the number of breeding females present in an area (RIC 1998b). Amphibians expected to lay eggs in the early spring include long-toed salamanders, boreal chorus frogs, Columbia spotted frogs and wood frogs (Corkran and Thoms 1996). Western toads are expected to start gathering at breeding sites in mid spring (Corkran and Thoms 1996). Due to the northern extent of the study area and annual weather patterns, breeding was believed to commence in late April, which coincides with the spring snowmelt.

Prior to surveys, TEM polygons containing wetlands were identified and highlighted on field maps. Polygons were either entirely composed of a wetland or a complex of several ecosystem units, one of which was a wetland. Polygons that were accessible from the road, and in some cases by boat, were searched for amphibians (Figure 6.1a, b). All wetlands and backchannels surveyed were given a unique identifier. Wetlands were typically labelled WA, WB…WZ and backchannels were labelled RB1, RB2…RB27.

Time-constrained Wetland Searches

Polygons identified on the TEM map were targeted for reconnaissance surveys (Figure 6.1a, b). River backchannels encountered during waterfowl surveys were also searched.

All wetlands were searched during the day, for a period not exceeding 2 hours. The presence of target taxa was recorded, as well as specific information including:

- Development stage
- Count (absolute or estimated number of egg masses, larvae or adults)
- Aggregate size (diameter or length x width of single egg mass)
- Length of captured amphibian (total length or snout-vent length)
- Distance to top of observation (water surface to the top of egg mass)
- Distance from shore to observation
- Water depth (minimum, maximum and depth at 1 metre from shore)
- Water drop (slope from pond edge to deeper water)
- Attachment substrate
- Bottom substrate (e.g., silt, sand, leaf litter)
- Macrohabitat (e.g., stream, log jam, general shoreline).

Ground inspection forms were filled out at each sample site. The wetland classification used was adapted from the wetland classes described in the wetlands of BC (MacKenzie and Moran 2004). This classification groups similar wetland associations (Table 6.2). Additional habitat attributes that were recorded at wetland sites included:

- Water temperature
- Water condition (turbidity)
- Description of dominant vegetation surrounding site
- Habitat type (Table 6.2)
- Estimated size of water body at time of sampling (surface area in ha or length x width)
- Percent open water (not occupied by emergent or surface vegetation) at time of sampling
- Exposure (percentage of water exposed to solar radiation)

- Duration of habitat (e.g., permanent, water most years, fills in heavy rain, fills from flooding, short duration) (Heyer *et al.* 1994). Habitat duration could be estimated from the micro-relief, drainage patterns and vegetation present in the water body.

General survey conditions including cloud cover, ambient air temperature, precipitation and wind speed were also recorded at each site. All codes used are described in Appendix 2. Information was recorded on RISC standard data forms modified for this project (Appendix 1). All amphibians encountered during other fieldwork were recorded and included as incidental observations. Observations were recorded as absolute counts (i.e. two adult toads observed) or as estimates when large numbers were observed.

Table 6.2. Wetland habitat classes developed for pond-breeding amphibian surveys.

Code	Name	Description
LA	Lake	a large inland body of standing water
Wb	Bog*	shrubby or treed, nutrient-poor peatlands with ericaceous shrubs and hummock-forming *sphagnum* species. Develop in basins.
Wf	Fen*	peatlands characterized by non-ericaceous shrubs, sedges, grasses, reeds and brown mosses. Develop in basins, lake margins, river floodplains and seepage slopes.
Wm	Marsh*	shallowly flooded mineral wetland dominated by emergent grass-like vegetation
Ws	Swamp*	forested, treed, or tall-shrub, mineral wetland dominated by trees or broadleaf shrubs
SW	Shallow Water*	aquatic wetlands dominated by rooted, submerged and floating aquatic plants. Associated with permanent still or slow-moving waterbodies.
DT	Ditch	a long narrow man-made excavation used for drainage
PD	Puddle	a small, temporary pool of usually muddy water
RB	River backchannel	a channel that is connected to the main river, but does not necessarily flow thru

*definitions developed from MacKenzie and Moran 2004.

Auditory Surveys

Auditory surveys for amphibians were completed during nocturnal owl surveys (Figure 5.1a, b) and during visits to suitable wetlands and backchannels during the day (Figure 6.1a, b). Nocturnal surveys started one half hour before dusk and continued until midnight. Since owl calls might affect the responsiveness of frogs, surveyors completed the frog survey before broadcasting for owls. Daytime surveys were completed at any time during the day. Listening stations in large wetlands and along owl transects were

situated 0.5 km apart. Stations were revisited several times during the breeding season, unless the habitat was unsuitable (e.g. cultivated fields) and no frogs were heard on the initial visit. Transect starting points were varied between visits to sample listening stations at different times. The location of each station was documented on the field map and recorded on the field form in UTM co-ordinates. Information was recorded on RISC standard data forms modified for this project (Appendix 1).

At each listening stop, observers listened for 3 minutes for free calling frogs. If no frogs were heard, then auditory recordings of frogs were broadcast to elicit a response. Observers listened for up to two minutes longer if ambient noise (from traffic, etc.) interfered with the ability to hear calls or if call-playback was completed. The total survey time per station was 3-5 minutes, since the number of detections of new species rapidly falls off after the first minute of listening time (Shirose *et al.* 1995). All species heard and seen were recorded, and the direction and distance to the calling frog were estimated. Weather conditions were also recorded at each listening station. Observations were recorded on standard data sheets, using the calling index recommended by Gartshore *et al.* (1992): 0 - nothing; 1 - individuals can be counted (no overlapping calls); 2 - calls of individuals are distinguishable, but some calls overlap; 3 - full chorus, or continuous calls, where individuals cannot be distinguished.

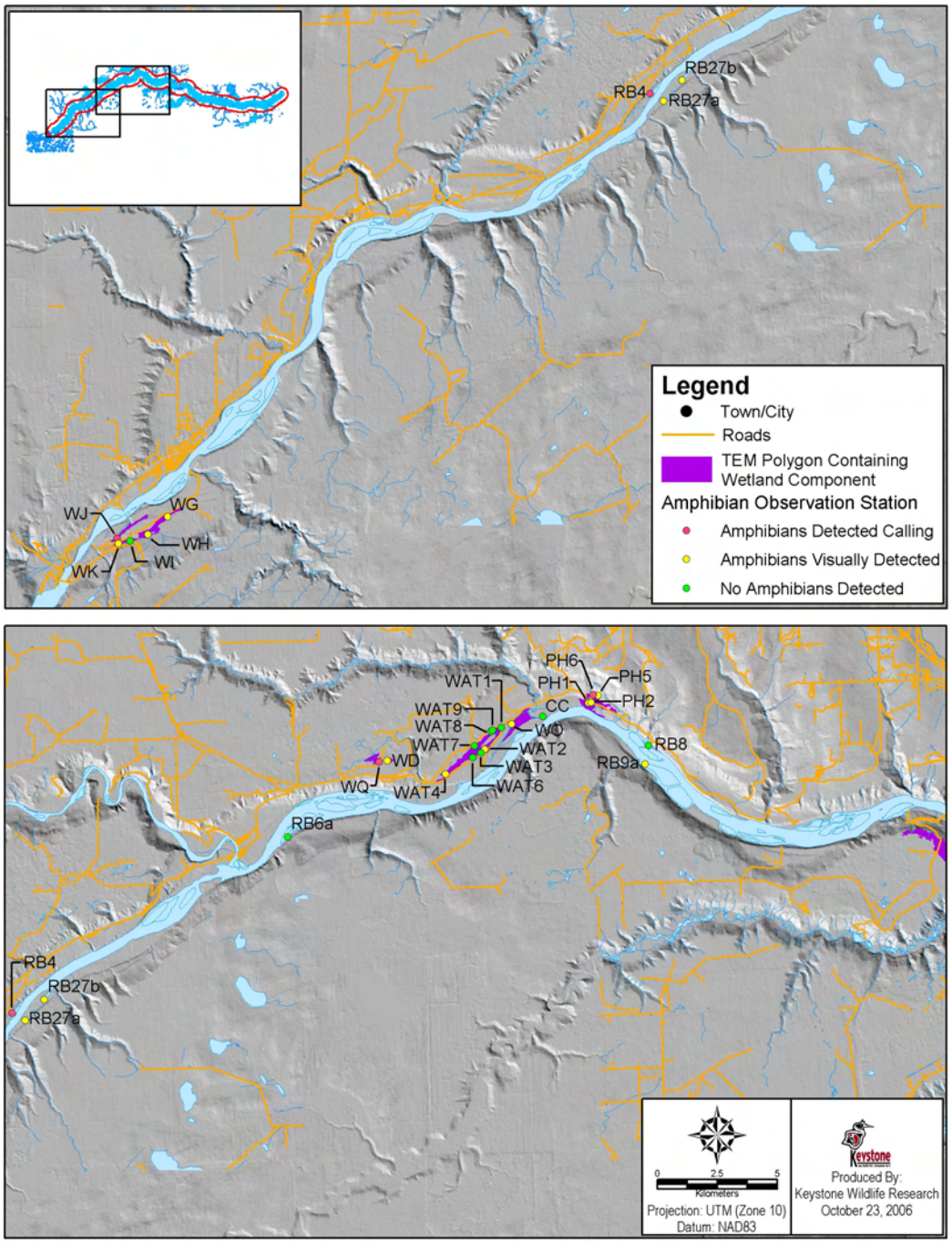

Figure 6.1a. Amphibian observation station locations (labelled) and detections in the western portion of the Peace corridor.

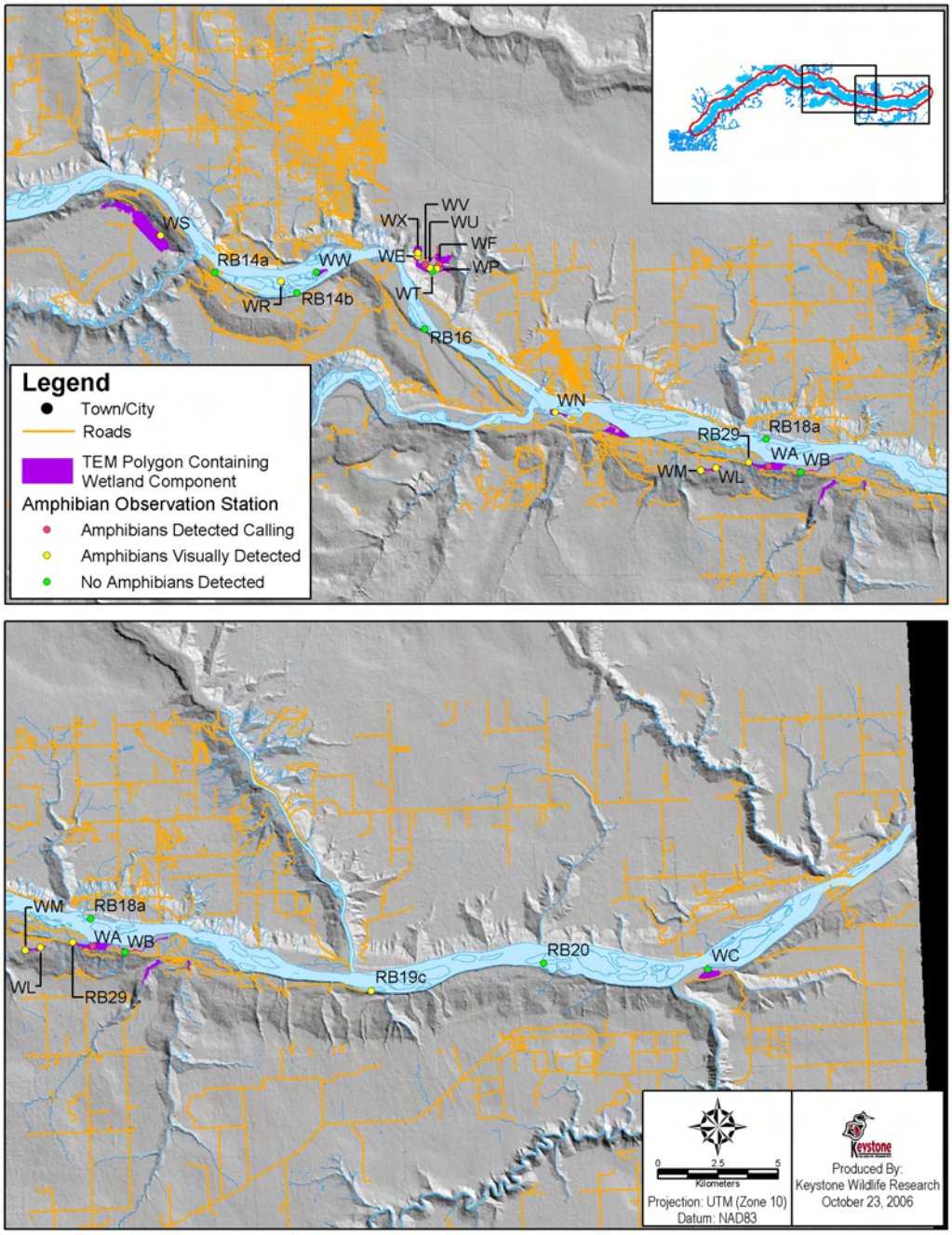

Figure 6.1b. Amphibian observation station locations (labelled) and detections in the eastern portion of the Peace corridor.

6.3 Results

The unpredictability of the weather in the Peace River valley was a significant limiting factor, since amphibians respond strongly to local changes in weather and temperature. The condition of wetlands encountered in April varied from frozen habitat to prime breeding conditions, with ambient temperatures ranging from 10°C to 24°C and water temperatures ranging from below 0°C to 19°C. Weather conditions were generally favourable for this search methodology, with no hard rain. Wind speed was over 3 on the Beaufort scale during only one survey (RISC 1998b).

Wetland Surveys

Sixty-three surveys were conducted between April 23rd and June 21st, totalling 19.17 hours of survey time. Survey sites included 34 wetlands and 16 distinct river back channels (Figure 6.1a, b). Of these sites, 12 were found to be unsuitable and seven were suitable but no amphibians were observed. Thirty-one sites contained at least one species in some developmental stage. Some survey sites that were visited in April, but did not result in amphibian detections, were revisited in June since the habitat appeared suitable.

Six of the nine habitat types identified in Table 6.2 were surveyed in 2006 (Table 6.3). Fens appeared to be the most productive sites, with amphibians found at 64% of the sites surveyed (n=11). In addition, these sites supported four of the five species expected to occur in the area.

Table 6.3. Number of surveys and observations in each habitat type sampled in 2006.

Habitat Type	Number of Sites Surveyed	Total species detected (max. 5)	Percent of sites surveyed with amphibians	Average number of detections* at sites with amphibians
River Backchannel	16	3	50%	4.00
Shallow Water	7	3	57%	1.25
Bog	4	1	25%	n/a
Fen	11	4	64%	2.43
Marsh	9	2	56%	2.00
Swamp	3	1	33%	n/a
Total	50		52%	2.81

*1 detection is one species of one life stage at one location.

All five amphibian species expected to be present in the study area were detected during surveys, including western toad, Columbia spotted frog, wood frog, boreal chorus frog and long-toed salamander (Table 6.4; Plate 6.1). Wood frogs were detected the most frequently and salamanders were only recorded once.

Table 6.4. Number of amphibians detected in specified habitat types during 2006 wetland surveys.

Habitat Type	Development Stage	Long-toed Salamander	Western Toad	Boreal Chorus Frog	Columbia Spotted Frog	Wood Frog	Total
River Backchannel	Adult		1 (75)	1		9	86
	Egg Mass		1	8		4 (20)*	33
	Tadpole		30 (700)*				736
Shallow Water	Adult		1	1		3	5
Bog	Adult			1			1
Fen	Adult	1	1	10		10	22
	Egg Mass					7 (83)*	90
Marsh	Adult				1	8	9
	Egg Mass				16	0 (30)*	46
	Tadpole					0 (100)*	100
Swamp	Adult				11		11
	Egg Mass				14		14
Total (incl. estimates)		1	815	21	42	274	1153

*number in () was estimated in the field

Western toads were observed in all life stages at two wetland sites and six river backchannel sites. In late April, approximately 75 adults were found in amplexus in a backchannel (Plate 6.1). This backchannel was approximately 600 m^2 in size with emergent vegetation around the edges. It had high solar exposure, resulting in a water temperature of 12^oC, and was relatively deep (1.5 m at 1 metre from shore). A female toad was also observed laying eggs in this same backchannel. Tadpoles were observed at 4 distinct sites in late May and June.

Wood frogs were recorded at four backchannel sites and eleven wetlands. Adults were recorded at twelve sites, egg masses were observed at five sites in late April and tadpoles were seen at one site in early June. Egg masses were 2 to 10 cm in diameter

and were typically attached to sedges (*Carex* spp.), but were also found attached to a small branch and a herb (Plate 6.1). The sites containing eggs typically had high solar exposure with water temperatures between 9 and 15^{o}C. Four sites had significant submerged vegetation covering 60 to 90% of the water surface area.

Spotted frogs were observed at two wetland sites in late April. Adults and egg masses were recorded at both sites and at one site, 4 adults were observed in amplexus (Plate 6.1). Both wetlands were small, with submerged vegetation only on the periphery. The ponds had high solar exposure with water temperatures between 10 and 13^{o}C. Egg masses were 5 to 10 cm in diameter and were found at the water surface to 35 cm below, attached to grasses and small branches.

Plate 6.1. Amphibians photographed in the study area. (Left to right, and down: wood frog, long-toed salamander larvae, western toads in amplexus, spotted frog, wood frog egg mass. Photos: L. Andrusiak, C. DiCorrado, L. Law).

Boreal chorus frogs were recorded at four distinct sites. Adults were observed at all four sites and eight egg masses were observed in a backchannel site in late May. The eggs were found in a long, narrow backchannel, with some submerged vegetation at the periphery. The channel was partially shaded with a water temperature of 7^{o}C and had been dammed by beavers. The egg masses were attached to submerged sedges, 6 to 7 cm below the water surface.

One long-toed salamander adult was detected in late April in an old beaver pond. No long-toed salamander eggs were detected during spring surveys in 2006. This salamander is the one of the first amphibians to breed, laying eggs during periods of warm weather in the late winter to early spring. Eggs hatch within two weeks if the temperature remains favourable, providing a very brief window to detect salamander eggs (Corkran and Thoms 1996; RISC 1998b). The weather was unseasonably warm in early April, which may have provided a window for the salamander eggs to hatch.

Auditory Surveys

Fifty-one auditory frog surveys were completed between May 19th and April 31st, totalling 10.26 hours of survey time. Surveys included three road transects with up to 17 listening stations, 25 wetlands and 2 backchannels. Boreal chorus frogs, wood frogs and Columbia spotted frogs were detected vocalising and several western toads were visually detected.

Wood frogs were recorded the most frequently, with 190 detections at 19 different sites (Table 6.5). Chorus frogs were detected the second most frequently with 121 detections at 16 different sites. If the wetland itself was not visited (nocturnal survey detection) then the distance and direction of the calls was analysed spatially to determine where the frog call originated. Five different habitat types were identified from this analysis and over 60% of the detections were found to occur in wetlands.

Table 6.5. Summary of amphibian detections for each habitat type surveyed during auditory frog surveys.

Habitat Type	Western Toad	Boreal Chorus Frog	Columbia Spotted Frog	Wood Frog	Total detections per habitat type
Backchannel		16		64	**80**
Cultivated field	1	11		12	**24**
Moist forest		9		2	**11**
Road	2				**2**
Wetland		85	6	112	**203**
Total species detections	**3**	**121**	**6**	**190**	**320**

Incidental Observations

Forty-three incidental observations of amphibians were recorded during other surveys in the Peace River corridor in 2005 and 2006 (Table 6.6). Most notable was the detection of long-toed salamander larvae, observed in a puddle during TEM field truthing in September 2005.

Table 6.6. Amphibian observations recorded during other wildlife surveys in the study area in 2005 and 2006.

Common Name	Total number observed
Long-toed Salamander	5
Western Toad	2864
Boreal Chorus Frog	4
Columbia Spotted Frog	1
Wood Frog	32
Total observations	2906

6.4 Recommendations

Wetland habitat types appear to support the majority of the breeding amphibian populations in the study area. Fens in particular seem to support a high diversity of amphibian fauna. Backchannels also provide suitable habitat, and three of the five amphibian species were documented in this habitat type. Since wetlands are not common in the study area, backchannels likely provide important breeding habitat for amphibians.

Western toads are abundant in the area and were commonly encountered during amphibian surveys and as incidental observations during surveys focusing on other species groups.

Future work regarding amphibians should focus on completing baseline data collection. Waterbodies identified as potentially suitable toad breeding sites during field reconnaissance in 2005 and 2006 should be revisited to determine whether they are breeding sites for western toads. Additional, potentially suitable western toad breeding sites identified incidentally during other field surveys or on the TEM should also be considered. Waterbodies identified in 2005 and 2006 should be resurveyed using auditory surveys and wetland searches to confirm breeding activity and determine relative abundance of amphibians. Survey methods should include time-constrained searches for egg masses and auditory surveys.

7.0 WATERFOWL / SHOREBIRD SURVEYS

Waterbird surveys were undertaken to update inventory data and assess the importance of the river corridor for migrants.

7.1 Introduction

Twenty-one species of waterfowl have been recorded on the river (Blood 1979; Campbell *et al.* 1990; Fraker and Hawkes 1999; Prowse *et al.* 2002; Thurber 1976; Wiacek *et al.* 1998). Generally, these species use the Peace River corridor during migration, at sites adjacent to agricultural fields and productive wetlands. Blood (1979) noted that early migrating swans make considerable use of the river in spring when surrounding lakes are still frozen. It is unknown what proportion of these migrants breed in the area, although small portions of the local and regional populations are known to breed in the Peace River floodplain (Thurber 1976; Blood 1979; Wiacek *et al.,* 1998; Robertson and Hawkes 2000). Most of the breeding pairs on the landscape are likely to nest in the wetlands north and south of the river corridor (Paul Pryor, CWS Edmonton, pers. comm.).

Shorebirds reported in the area include Killdeer, Spotted Sandpiper, Solitary Sandpiper, Greater Yellowlegs, Lesser Yellowlegs and Wilson's (formerly Common) Snipe. Shorebirds were reported in the study area by Thurber (1976), Robertson (1999) and Robertson and Hawkes (2000). Thurber (1976) estimated 11,000 shorebirds migrate through the area in May.

Hawkes *et al.* (2006) completed aerial and boat surveys on the Peace River between June 15th and July 24th of 2005. They recorded 14 species of waterfowl and 18 species of water-associated birds. The species and abundance of each species reported during those surveys is likely representative of the resident bird population in the study area.

The main objective of the 2006 waterfowl/shorebird surveys was to document the numbers, species, distribution, timing and habitat use of spring and fall migrants. This data can be compared to observations of waterfowl from previous surveys to determine species distribution and abundance throughout the year.

7.2 Methods

Boat, helicopter and ground transects were completed to survey waterfowl species present in the study area. All surveys were carried out according to the provincial standard methods described in ***Inventory Methods for Waterfowl and Allied Species: Loons, Grebes, Swans, Geese, Ducks, American Coot and Sandhill Crane*** (RIC 1999b). All species observed during surveys were recorded, including waterfowl, water-associated birds, raptors and songbirds.

Since Hawkes *et al.* (2006) completed multiple waterfowl surveys in June and July of 2005, surveys in 2006 were planned outside of this time period so that the species lists could be compared, and migrant species identified. Surveys were completed in April, May, August and September.

Information was recorded on RISC standard data forms modified for this project (Appendix 1). Specific information recorded at each station included: UTM location (NAD 83), start and stop time and weather conditions. Habitat was stratified into three

habitat types: river, backchannels and wetlands. These data were recorded to determine the relative use of the habitats available in the Peace River Valley.

Aerial Surveys

Helicopter surveys were designed to survey for Harlequin Ducks but this methodology is also consistent with aerial surveys for waterfowl. Low-level aerial surveys were completed in April and August, and covered the entire extent of the Peace River Corridor, from the Peace Canyon Dam to the Alberta border (Figure 7.1a, b).

The survey transects were unlimited width and observations were recorded in 5 to 10 km transect segments (depending on the number of observations). Due to the width of the Peace River, transects were flown in both directions, concentrating on either the north or south side of the river. The flight track and species observations were monitored to avoid recounting the same birds. Backchannels and tributaries were also surveyed. Since accurate identification of species, age class and sex is more difficult from the air, helicopter surveys were augmented with boat and ground transects.

Boat Transect Surveys

Boat surveys were completed in April and September to identify migrants that use the Peace River. The survey methodology followed RIC (1999b) standards, and the number, species and sex (when possible) of all birds observed was recorded.

The river was sampled from Hudson's Hope to Clayhurst in one km transect segments, as determined by a portable GPS unit (Figure 7.1a, b). A fixed-width encounter transect was completed and observations were recorded as occurring within three distinct zones: 0-150 m from the boat, 150 to 300 metres from the boat and greater than 300 metres from the boat. Each survey involved two observers scanning the river in opposite directions.

The survey boat was allowed to drift downstream on the main river and in side channels, with the current in order to avoid alarming wildlife with engine noise. The surveyors followed the main channel of the Peace River on the initial survey (survey route 1) but

moved into smaller side channels (when possible) on subsequent surveys (survey route 2), since these areas had higher densities of waterfowl based on aerial surveys.

Ground Surveys

Observation stations were completed at backchannels and in wetlands (Figure 7.1a, b). These sites were identified from the TEM map prior to surveys and they coincide with wetlands and backchannels surveyed during other species-specific surveys (e.g., amphibian surveys). Sites were accessed by boat during boat transects or on foot if they were accessible from a road.

The number of separate observation stations was determined by the size of the area and the visibility. Observation stations were placed at vantage points where a sample independent from the previous station could be obtained. The percentage of the wetland surveyed was recorded for each wetland. Each wetland or backchannel was surveyed one or more times depending on the site's accessibility and the suitability of the habitat.

Waterfowl and shorebird species were also observed during surveys targeting other species groups, as well as during the TEM field-truthing. Those incidental observations were recorded and have been used in the generation of the species list.