ARCHAEOLOGICAL OVERVIEW ASSESSMENT

OF LANDSCAPE UNITS R06, R10, R11, R14, R15 AND R16,

COLUMBIA FOREST DISTRICT

prepared for Downie Street Sawmills Limited

by

Wayne T. Choquette

Archaeologist

March 31, 2007 Yahk, B.C.

Credits

Analysis of aerial photos, polygon mapping, database development and report preparation was done by consultant archaeologist Wayne Choquette. GIS mapping was carried out by Jose Galdamez of the Ktunaxa/Kinbasket Treaty Council. The contract was administered for Downie Street Sawmills Limited by Dieter Offermann.

Management Summary

The Provincial Forest lands encompassed within Landscape Units R06, R10, R11, R14, R15 and R16 of the Columbia Forest District were assessed for archaeological potential via aerial photograph analysis. A total of 156 landform-based polygons were identified as having potential to contain significant archaeological sites. The archaeological potential of the polygons was assessed via criteria derived from precontact land and resource use models developed for the upper Columbia River drainage. Numerical scoring of the criteria resulted in 9 polygons being assessed as having High archaeological potential and 147 polygons assessed as Medium.

Table of Contents

List of Tables

1. Introduction

This report accompanies the mapping of archaeological potential for Landscape Units R06, R10, R11, R14, R15 and R16 in the Columbia Forest District. It summarizes the background information that is the basis upon which the polygons were delineated and assessed, and describes the methodology employed. The report concludes with discussion and evaluation of the results and recommendations for future management.

The work was carried out for Downie Street Sawmills Limited with funding from the Forest Investment Account under contract # 4650005.

2. Study Area Environmental Background

Landscape Units R06, R10, R11, R14, R15 and R16 encompass much of the north end of the Columbia Mountains surounding the Big Bend of the Columbia River. At the north end of the study area, the Rocky Mountain Trench contains the eastern limb of the Columbia River, which follows the Selkirk Trench in a southward traverse of the study area.

2.1 Present Environment

The six LUs are within the Northern Columbia Mountains Ecosection of the Columbia Mountains and Highlands Ecoregion (Quesnel and Thiessen 1993). It is characterized by high serrated ridges and glacier-capped mountains dissected by deep narrow U-shaped valleys and trenches. The bedrock of LU R10 is dominated by a stock of Cretaceous granodiorite but most of the study area is underlain by upper Proterozoic to Palaeozoic metamorphosed sedimentary rocks, predominantly phyllite, schist and gneiss (Douglas et al 1969). Valley glacier moraines and shallow to deep colluvium and bedrock are the most common surficial deposits. Less extensive deposits of glaciofluvial drift and recent fluvial sediments occur at lower elevations.

This ecosection has the highest precipitation and the coldest temperatures in the Columbia Mountains and Highlands Ecoregion. Vegetation in the north half of the study area is represented by a sequence of biogeoclimatic zones ranging from low to middle elevation ICHvk1 (Mica Very Wet Cool Interior Cedar Hemlock variant) (Braumandl et al 1992) through the middle to high elevation ESSFvc (Very Wet Cold Engelmann Spruce – Subalpine Fir Subzone) to alpine tundra above timberline. In the central part of the study area at lower elevations is ICHwk1 (Wells Gray Wet Cool Interior Cedar Hemlock variant) and further south, southerly and westerly lower valley walls support ICHmw3 forests (Thompson Moist Warm Interior Cedar Hemlock variant). Seral stands include hybrid white spruce, western white pine and Douglas-fir at low elevations; spruce and subalpine fir are seral to mountain hemlock at middle to high elevations.

At low elevations, young seral stands and riparian areas are important habitat for moose, grizzly and black bear, elk, wolf and bald eagles. Upper elevation forests and alpine habitats are utilized by caribou, grizzly and black bear, mule deer and mountain goats. Except for a few kilometres downriver of Mica Dam and at the extreme south end of the study area, flanking erosional terraces and the floodplain and riparian ecozones of the Columbia River are now inundated by the Kinbasket and Revelstoke reservoirs.

2.2 Palaeoecology

The complex geological history of the study area can be traced back to the deposition of Precambrian sediments in a large shallow marine basin. Several episodes of mountain building took place over succeeding hundreds of millions of years. Some time before 70 million years ago, in the late Cretaceous, downfaulting created the Rocky Mountain Trench and other large valleys in mountainous northwestern North America.

The succeeding Quaternary saw several advances of glacial ice. In general, older known glaciations in the eastern Cordillera were more extensive than younger ones (Clague 1989: 43). Although most of the stratigraphic record from earlier advances was destroyed by later glacial activity, deposits predating the last major advance have been identified in several localities including the Columbia-Wood-Canoe confluence area adjacent to LU R06. Sediments interpreted as overbank or floodbasin deposits of a large river were identified in a borrow pit at the mouth of the Wood River. These deposits contained abundant plant debris including pieces of wood identified as Populus balsamifera and Picea sp.; the latter dated 25,200 + 260 BP (GSC-1802) (Fulton and Achard 1985: 5). These data suggest that nonglacial conditions prevailed in the area 25,200 years ago and that the Rocky Mountain Trench here was occupied by a river with a floodplain level 75 m above modern river level (ibid.). Lacustrine sediments yielding wood dated between 25,200 and 21,500 years ago in this locality is interpreted to be related to ponding associated with the readvance of glacial ice ((ibid.: 10). This advance was characterized by the expansion of small glaciers originating in Columbia and Rocky Mountain cirques which then merged into a system of valley glaciers. Glacial till was deposited in the Rocky Mountain Trench at Wood River after 21,500 years ago (ibid.: 5). By 17,000 years ago, a large southerly flowing ice stream occupied the Rocky Mountain Trench (Clague et al 1980) and undoubtedly the Selkirk Trench as well.

Final deglaciation commenced about 15,000 years ago (Ryder 1981) and in the Jasper National Park vicinity to the east, glaciers had retreated to their present extents by 10,000 years ago (Kearney 1981). Parts of the upper Columbia River drainage became ice-free sooner than areas further west (Choquette 1996). A mechanism for this that has significant palaeoclimatic implications (see below) has been suggested by Clague (1989: 43): “the early retreat of mountain glaciers in some areas may have resulted from a reduction in precipitation in the eastern Cordillera due to growth of the Cordilleran Ice Sheet to the west. Ice covering the British Columbia interior may have depleted or diverted moist air masses that previously had flowed across the Rocky Mountains, making the air reaching that area rather dry. This, in turn, may have caused some local glaciers in the Rocky Mountains to retreat at a time when both the Cordilleran and Laurentide ice sheets were growing."

At the end of the latest glacial advance, the Rocky Mountain and Selkirk trenches were occupied by large proglacial lakes dammed by moraines and melting ice blocks; thick accumulations of clay, silt and fine sand accumulated in these lakes. One of these occupied the lower elevations in the Columbia-Wood-Canoe confluence area while the Selkirk Trench in the south half of the present study area contained an elevationally declining series of proglacial and early post-glacial lakes. Fulton and Achard identified lacustrine sediments as far north as Downie Creek, from a lake they inferred “owed its presence in part to the plug of glaciofluvial valley fill north of Revelstoke Dam and in part to isostatic tilting” (Fulton and Achard 1985: 7). However, the numerous prominent terraces at 595 m (1950 feet) a.m.s.l. in the Selkirk Trench are duplicated in other parts of the Columbia drainage including the Purcell Trench and Kootenay/Kootenai valleys, indicating the possibility of a geographically more extensive control over the hydrological baseline at this time (Choquette 1996). Surficial geology studies in the United States assume that southern BC was buried beneath ice, but the elevation of Richmond et al's (1965) "Great Terrace" at 1950 feet suggest that at least one stand of Glacial Lake Columbia, dammed at the Grand Coulee by the Okanagan ice lobe, may have extended up the Columbia River into the present study area. A radiocarbon date of 10,000 ± 160 BP (GSC 1753) was obtained from opposite La Forme Creek well below the top of lacustrine deposits graded to this lake (Fulton and Achard 1985: 6). When this lake drained, a smaller lake remained in its basin at an elevation of about 488 m (1600 feet) as noted by Fulton (1971). Fulton obtained radiocarbon dates of 10, 000 + 150 before present (GSC 1012) and 9990 + 150 before present (GSC 1059) from shoreline deposits at this elevation about 4 km downriver from the present Revelstoke damsite (Fulton 1971: 17). When the lakes drained, a series of terraces were carved by the Columbia River and its tributaries as they incised themselves into the valley fill until the local hydrological baseline became controlled by bedrock. That this had occurred before ca. 7000 years ago is indicated by the presence of Mazama tephra in floodplain overbank deposits within 3 m of the historic level of the Columbia River between Downie and La Forme creeks (Fulton and Achard 1985: 7).

Pollen studies (summarized in Choquette 1996) indicate that as early as 12,000 or more years ago, a pioneer community of grass, sage, cattails and scattered conifers occupied slopes and ridges amongst the expanses of bedrock, lingering glaciers and proglacial lakes. This community was probably adapted to the cold dry conditions resulting from the influence of the large glaciers still present on the British Columbia interior plateau and on the plains east of the mountain front (Clague 1989). This cold desert habitat gave way after about 10,500 years ago to coniferous forests as a warming climate permitted their invasion of the valley bottoms and lower mountainsides. Coniferous forest expanded in the region after 10,500 years ago when the climate warmed further; the presence of organic material including wood which provided the radiocarbon date of 10,000 ± 160 BP referred to above indicates that the study area was supporting vegetation by at least that time. However, the structure and species composition did not resemble that of modern forests until well after 5000 years ago. In much of southern BC, the period between 10,000 and 7,000 before present (known as the Hypsithermal or Altithermal) was characterized by drought and the highest forest fire frequency of the entire post-glacial period. However, these conditions do not seem to have been characteristic of the northernmost Columbia Mountains (Choquette and Keefer 2003) and pollen data from the Tonquin Valley in the Rockies a short distance to the north of the study area indicate cool conditions prior to ca. 8000 years ago, after which time upper treeline rose considerably and remained there until after the Mazama ashfall ca. 7000 years ago (Kearney and Luckman 1983). The pollen and macrofossils from the dated lacustrine sediments in the Selkirk Trench mentioned above have been interpreted to represent a climate similar to or wetter than at present (Fulton et al 1989: 264). This may reflect the influence of the huge lakes that existed here and in the Thompson and Okanagan drainages in early postglacial time.

After about 7000 years ago a major change in the regional climate occurred, characterized by a marked decline in continentality as the maritime westerlies began to exert a significant influence (Choquette 1987a). In response to the increased rainfall, vegetation zonation became longitudinal and forests on west-facing windward slopes became denser. By 5,000 years ago, a global cooling trend known as the Neoglacial

(Porter and Denton 1967) had begun to affect the region. Small glaciers began to grow in the high mountains, forest fire frequency declined, and forests expanded throughout the region. Cool, moist conditions apparently reached their maximum between 4000 and 2500 years ago (Baker 1983, Hallet and Walker 1999). This was accompanied by significant changes in vegetation composition as the maritime associations became established: cedar and hemlock pollen appears in core samples 5000 - 4000 years ago (eg. Hazell 1979) and becomes common after 3000 before present (Hebda 1995). The interval between ca. 6000 and 2500 years ago in the upper Columbia drainage was also characterized by high fluvial discharge, and the region may have supported generally more extensive aquatic ecosystems as well as more productive riparian communities. This was followed by a globally recognized but relatively brief warm and dry interval ca. 1500-500 years ago, when forest fire frequency increased while fluvial discharge notably decreased. The final episode in the region's palaeoclimate is known as the "Little Ice Age", the most severe glacial episode since the Pleistocene. Morainal positions indicate that during the last 400 years, glacial ice in the upper Columbia drainage area reached its greatest extent in more than 10,000 years.

There is no detailed information regarding terrestrial palaeoecology of the study area, but populations of large mammals of importance to precontact humans likely fluctuated with climate-induced changes in the vegetation mosaic, especially as mediated through the effects of wildfire. Aquatic resources undoubtedly fluctuated as well, especially considering the extent of Neoglaciation in the surrounding mountains. Data from pollen profiles, soil and sediment sequences, forest fire chronologies and glacial moraine positions have been synthesized into models of Holocene palaeoclimatology and palaeohydrology for the upper Columbia River drainage (Choquette 1985, 1987a) that are probably applicable to the neighbouring upper Fraser basin as well. These models cover the past 10,000 years and provide more detail than the larger scale climatic trends described previously; initially they have been used as a basis for predicting the Columbia River's past salmon carrying capacity. In composite, the models define a series of climatic cycles, each of about 2000 years duration, within each of which climatically induced variations in fluvial discharge and sediment load would have affected salmon carrying capacity either positively or negatively. The high sediment load related to dissection of the lacustrine valley fill and the subsequent disappearance of mountain glaciers during the early postglacial period undoubtedly reduced the quality and quantity of the Columbia River’s seasonal discharge while the effects, especially with regard to sediment input, of the more severe Neoglacial episodes ca. 2800 years ago and within the past four centuries probably affected salmon carrying capacity adversely. On the other hand, periods of high fluvial discharge and relative stability around 4000-3000 and 2000-1000 years ago probably fostered larger salmon runs. Archaeological evidence from elsewhere in the upper Columbia River basin suggests that during the early Neoglacial, the region may have supported generally more extensive aquatic communities including larger numbers of waterfowl and resident fish.

3. Cultural Context

3.1 Ethnography

The fluctuating salmon carrying capacity of the upper Columbia River is postulated to have strongly affected the character and intensity of precontact human inhabitation in the study area. This may be especially true of the contact period, which was contemporary with the latter part of the Little Ice Age. There is a notable paucity of documentation of aboriginal presence here, undoubtedly a reflection of the rugged topography and heavy snowfall compared to areas to the west, east and south. Corelative to this, the study area at that time was at the edges of the territories of three distinctive cultural groups who inhabited those areas: the Secwepemc, Ktunaxa and Okanagan, respectively.

3.1.1 The Secwepemc

Speakers of the Secwepemc language, a division of the Salishan linguistic stock, occupied a large area of southern British Columbia centred on the Thompson and middle Fraser River drainages. Teit's 1909 and 1930 accounts of the Secwepemc and Ignace's 1998 work comprise the bulk of written data for that group.

Teit (1909: 523) described a group of "almost completely nomadic Indians who live nearly in the heart of the Rocky Mountains, around the head waters of North Thompson River, the Yellow Head Pass, and Jasper House" whom he named the Upper North Thompson band: “East and north [their hunting grounds] ... include... part of the Big Bend of the Columbia, part of the Rocky Mountain region”. Some of these people apparently were members of a group known as the Kinbaskets, who were named for Kenpesket, a North Thompson chief (ibid.: 460, 467). Social problems at Adams Lake resulted in Kenpesket's group resettling themselves near pre-dam Kinbasket Lake around 1840. They gradually moved southward where they eventually encountered the Ktunaxa whose numbers had been significantly reduced by disease. The two groups subsequently intermarried and their descendents are members of the present-day Shuswap Band of Invermere. Other descendents of this group reside in the Neskonlith community near Adams Lake (Bob Manuel 1996: personal communication). It is not impossible that similar groups could have 'hived off' the main Fraser-Thompson population centres in the precontact past as well and made their way into the uppermost parts of the Columbia drainage in response to fluctuations in salmon availability.

While their economy included exploitation of a diverse range of plant and animal resources, the Secwepemc settlement pattern was semi-nomadic with a strong riverine focus. Permanent settlements of semi-subterranean "pithouses" were occupied by groups of closely related families during the winter and early spring. These were situated close to the shores of the major rivers, usually on sandy, well-drained soil (Dawson 1892: 18). Associated with these winter villages were non-habitation features such as storage pits and sweat lodges. With the coming of spring, individual family units dispersed into the surrounding terrain in quest of ungulates, fish and plants. The time of maximum economic focus occurred during the summer and early fall when all groups would gather at fishing stations on the rivers for the annual salmon runs. Dawson (1892: 15) summarized the importance of the salmon resource as follows:

> Dried salmon ... constituted the sole winter staple. The right to occupy certain salmon fishing places, with the annual visit to these of the more remote families, and the congregation of large numbers of Indians at specially favourable places, largely influenced the life and customs of the Shuswaps.

According to Teit (1909: 328, 592-593), Secwepemc burial practices consisted of interment, generally near villages on the edges of terraces, in low side hills and sand knolls.

3.1.2 The Sinixt

At the time of European contact, the subsistence territory of the Secwepemc overlapped in the northern Selkirk Trench with that of the Okanagans, a Salish-speaking group who travelled eastward from the Okanagan Valley across the Monashee Mountains. However, the primary inhabitants of the Selkirk Trench at this time were another Okanagan group, the Sinixt or Lakes, a northward extension of Okanagan-speakers distributed along the main stem and tributaries of the middle Columbia River. The major ethnographic work on the Sinixt is by Bouchard and Kennedy (1985, 2000).

Historical records indicate that the Sinixt were focused on Kettle Falls during the contact period and even overwintered there. The major villages were along the Columbia River not far north of Kettle Falls at the southern edge of their subsistence territory. Prior to the middle of the 19th century, however, the Sinixt were centred further north in the Columbia Valley north of Castlegar. The ethnohistoric records indicate that their subsistence quest took them up the Columbia to the vicinity of its Big Bend but they apparently did not overwinter beyond Revelstoke.

The Sinixt's past land and resource use in the study area was characterized by intensive fishing, hunting, and gathering in spring, summer and fall by relatively small, mobile groups who inhabited small camps located adjacent to resource foci. In addition to extracting food resources, energies at this time were directed towards processing foodstuffs and storing them for the winter when fresh food was scarce. Food was cached in aboveground structures and underground in pits. Foodstuffs were later collected from the caches and transported by canoe and pack to the winter camps.

In latest precontact time, Sinixt 'pithouses' were replaced by rectangular pole frame mat lodges. Houses were of both single and multiple family occupancy. Besides the family dwellings, separate lodges were constructed in winter villages as secluded women's quarters. Men's retreats were generally upstream of the main camps where sweat lodges were constructed. Social organization was characterized by a main chief who presided over all the Sinixt people at any one time and subchiefs who headed the various local groups. Burials were not elaborate; interment was in gravel beds along the banks of rivers and in sandy knolls and ridges at the margins of higher terraces.

3.1.3 The Ktunaxa

The Ktunaxa comprised four geographically and linguistically distinct subdivisions centred on the Kootenay River. One band, however (the Qatmuk'nek), wintered at the Columbia River's headwaters in the Rocky Mountain Trench and travelled westward over the Purcell and Selkirk mountains for summer fishing in the Selkirk Trench. The major ethnographic works on the Ktunaxa are Schaeffer (1940) and Turney-High (1941); Smith (1984) and Brunton (1998) have compiled recent syntheses.

The Upper Ktunaxa followed a nomadic seasonal subsistence round which was determined by the location and scheduling of abundance and ripening of a broad range of animal and plant resources. Large ungulates, particularly deer and elk, were hunted singly with bows and traps and in communal hunts, mostly in the spring and fall. The latter provided the bulk of the meat that was dried and stored for winter consumption. From late spring through early fall, game, fish, waterfowl and plant foods such as roots and berries were acquired by task groups (for example, a group of women and children picking berries, accompanied by a few men who undertook casual hunting at the same time). Cooking by stone boiling was the preferred method of preparing food for immediate consumption, except for roots such as camas and bitterroot, which were baked in earth ovens. Foods not eaten directly were dried for winter storage; berries were important in this regard.

The main dwelling of the Upper Ktunaxa was the hide-covered tipi; there is some conjecture that prior to obtaining horses, a covering of mats also may have been used. Ktunaxa social organization was kinship-based and loosely organized into politically independent bands of related families. The hallmark of this social structure was its flexibility: band membership was voluntary and both size and composition varied from year to year. Chieftainship accrued to those with leadership qualities, although some tendancy towards hereditary chiefs is apparent in latest times. Disposal of the dead was by exposure in trees or on scaffolds; burial became more common after European contact.

3.2 Archaeology

3.2.1 Previous Investigations

There has been very little archaeological work conducted in the study area and most of it has been related to proposed hydroelectric projects. Parts of the Mica Dam pondage were surveyed in 1965 by Don Mitchell and John Sendey; Mitchell and Chris Turnbull made a brief reconnaissance in 1968 during which one precontact archaeological site was recorded (Mitchell and Turnbull 1968a). In 1972, Mike Robinson and Ken Martin surveyed the Canoe River from the Mica Dam site to the head of navigation 10 miles north of Howard Creek, plus the confluence of Columbia, Canoe and Wood rivers (Robinson and Martin 1972). No evidence was found of pre- or post-contact occupation; heavy disturbance by logging and construction activity may have been a contributing factor. Martin and Robinson felt that "some prehistoric sites must exist in the Canoe River trench, however, the oft changing river channels have probably isolated these sites in heavily forested areas" (ibid.: 2). The "extremely thorough reconnaissance" that would be required to find such sites did not follow, and the pondage filled the next year.

Parts of then-proposed High Revelstoke Reservoir were surveyed by Phil Murton and George Ferguson (1973), which resulted in the recording of five archaeological sites or potential sites, based in large part on information provided by informants. This was followed up in 1977 by a more focused investigation that included subsurface testing, but no precontact archaeological materials were located (Bussey 1979). Sections of the Revelstoke Reservoir shoreline were examined in 1994 during an archaeological overview assessment of emergency reservoir drawdown (Choquette 1995); sparse archaeological deposits were noted eroding from the left bank of the Columbia River just below Mica Dam and from the east shore of Revelstoke Reservoir north of Carnes Creek. As part of the Arrow-Mica Water Use Planning (WUP) process, the Mica Reservoir was briefly revisited in 2002. Reworking of the landscape by reservoir-related erosion, deflation and redeposition was found to be extensive but no precontact archaeological sites were found on the elevated landforms available for examination at the time (Choquette 2002). The two exposures of archaeological remains previously observed during the Revelstoke Reservoir emergency drawdown reconnaissance were revisited in 2006 as part of an assessment of the Revelstoke Unit 5 Project (Choquette 2006) but no additional cultural remains were observed.

While the Historic era resources of Mount Revelstoke and Glacier national parks have received considerable attention, there has been relatively little precontact archaeology conducted either in the parks or in their immediate vicinities. A "prehistoric archaeological site assessment" of the two parks was prepared Bussey and Alexander (1994). This work was essentially a literature review conducted from a synchronic perspective of the biogeography of this mountainous region, relying on modern ecological land classification schemes combined with what is essentially the direct historic approach to assess the archaeological potential of the two parks. The local and regional environmental and archaeological records were paid limited attention; instead, the evaluation of archaeological potential was based on models developed for the Fraser drainage. A palaeoecological and archaeological survey of several specific high elevation areas in these two parks was undertaken in 2003 (Choquette and Keefer 2003). No precontact archaeological remains were found during this survey, which included examination of high elevation habitats on Mount Revelstoke, directly east of LU R10.

Other recent archaeological investigations in the study area and its immediate vincity have included localized impact assessments of proposed mining in the Carnes Creek drainage (Bussey 1998), of recontour sites along BC Hydro transmission line 5L71 which crosses the northern Monashee Mountains through Pettipiece Pass and traverses along the east side of the Selkirk Trench (Choquette 2004), of the La Forme Creek Recreation Site (Wood 2006) and of forest industry developments (e.g. Campbell 2000, Mirau 2001, Larsson and Wood 2005). Two precontact sites have been recorded as a result of these assessments.

3.2.2 Precontact Culture History

The lack of data from the study area necessitates the extrapolation of a culture historical construct from adjacent, better studied localities. The following summary is based on more detailed discussions of regional culture history presented in Choquette (1984, 1987a and b, 1993 and 1996).

The archaeological record of the upper Columbia River drainage area includes evidence of two early postglacial cultures. The earliest cultural components identified at present have been found on terraces, beaches, dunes and glaciofluvial bars at or above the 595 m a.m.s.l. level of Glacial Lake Columbia, which had drained before 10,000 radiocarbon years ago. These archaeological components share a number of common characteristics in addition to their early landform and sediment associations. Microcrystalline stone was favoured in a technology primarily based on the production by percussion of large expanding flake blanks from large bifacial cores, edges of which were prepared by grinding. Large discoidal unifaces, large side scrapers, large stemmed weakly shouldered and lanceolate spearpoints and a variety of large marginally retouched flakes are typical tools. The name for this archaeological trait complex, the Goatfell Complex, derives from the predominance of tourmalinite and tourmaline chert from Goatfell Quarry in the southern Purcell Mountains. Evidence of the biface core technology and large stemmed spearpoints of tourmalinite, Kootenay Argillite and quartzite have been found in upland and high terrace contexts adjacent to Kootenay, Duncan, Arrow and Whatshan lakes to the south of the present study area, indicating that people were present in the central Columbia Mountains in early postglacial time, perhaps hunting in the steppe-tundra ecosystem in summer and wintering beside the huge early postglacial lakes. Initial occupation by Goatfell Complex people appears to have coincided with the northward shift in the mountain-steppe-lakeshore ecosystem out of what is now the Great Basin as the pluvial lakes there dried up at the end of the Pleistocene. At the present time, the Goatfell Complex is postulated to date between about 11,000 and 8000 years ago.

Cultural deposits of the second early archaeological manifestation have been found at Kettle Falls in cobble gravels, near Castlegar on a fluvial sand bar now situated on a high terrace more than 120 m above the present confluence of the Kootenay and Columbia rivers, and in the basal deposits at the uppermost falls on the lower Kootenay River. The settings of these sites indicate that this culture had a riverine focus and suggest that the Columbia River was still actively downcutting through the glaciolacustrine valley fill during this time period, named Shonitkwu and dated 9800 - 8800 years ago (Chance, Chance and Fagan 1977). The use of rhyolite as tool stock and certain distinctive Shonitkwu artifacts such as microblades radically differentiate Shonitkwu assemblages from Goatfell Complex implements and indicate the presence of a separate cultural group. The time slope on dated microblade assemblages indicates that this group arrived in the region from the north. The end of the Shonitkwu Period about 8800 years ago coincides with a marked decline in occupation at Kettle Falls, followed by a virtual hiatus around 7500 before present. Coupled with evidence of aeolian deposition in a previously alluvial setting, this suggests a failure in the anadromous fish runs that was probably caused by the effects of the Hypsithermal drought.

The pollen data indicate that the droughty climate of the Hypsithermal interval likely maintained open canopy forests and extensive high elevation grasslands, with their attendant high ungulate capability, in the southern Rockies and Purcells. Archaeological evidence also indicates that high elevations and the more northerly parts of the Rocky and Purcell mountains were very important to the early post-glacial inhabitants of the upper Columbia River basin. However, as discussed in Choquette and Keefer (2003) and summarized in Section 2.2 above, it does not appear that the mean location of the storm track shifted far enough to the northwest during this time period to have markedly decreased the available moisture in the northern Columbia Mountains. The negative results of the high elevation archaeological survey in Mount Revelstoke and Glacier national parks suggest that ungulate capability of the higher elevations there may not have been significantly higher during this time period. The degree to which this relates to the northern Monashee Mountains is not presently known.

On the other hand, the present study area was situated near the heads of large lakes at least during the initial part of the Hypsithermal drought interval, possibly a very strategic location. In general, the lack of intensive archaeological investigations limits what can be inferred with regard to the middle Holocene human history of this part of the Columbia Valley. Artifacts from local collections indicate that humans were still present in the region between the end of Goatfell and Shonitkwu occupation and the beginning of the succeeding and well documented Ksunku Period and Deer Park Phase (see below), but little is known of their activities. The focus of excavation in the Arrow Reservoir on pithouses may also be responsible for the dearth of documented evidence between

6000 and 3500 years ago, as occupation may have been in open camps whose deposits were not extensively sampled. In addition, the recent findings of the Arrow-Mica WUP archaeological survey (Choquette 2002) indicate that such occupations also may have been on landforms situated above those sampled by the Arrow Reservoir salvage project.

The Columbia River's anadromous salmon resource is a primary consideration as a factor in predicting archaeological site distributions, especially during the last 5000 years. In both the Fraser and Columbia drainages, the salmon resource was responsible for the support of substantial human populatons with a distinctive culture and semi-sedentary lifestyle. Unfortunately, the virtual lack of systematic archaeological survey in the Columbia River's big bend within the areas now inundated by the reservoirs does not allow any definitive statements to be made regarding past human use of this resource here. Nevertheless, the intensity of human inhabitation of the study area vicinity was undoubtedly related to the salmon carrying capacity of the Columbia River (as noted in Section 2.2 above and set out in detail in Choquette 1985). The presence of salmon fishers most likely would have been tied to periodic episodes of high salmon carrying capacity.

That the Columbia River's salmon runs had reached significant proportions is indicated by intensive re-utilization of the Kettle Falls fishery between about 4300 and 3400 years ago (Chance and Chance 1985). This archaeological manifestation was named Ksunku by David Chance and is considered to have been a distinct culture as compared to the Shonitkwu. Although the ethnographic record indicates that Kettle Falls was the second most important aboriginal fishery in the entire Columbia drainage, Ksunku period occupations there were followed by an occupational hiatus. This second hiatus, and the period of relatively low use that followed it, coincide in time with the Deer Park Phase (Turnbull 1977) of the Arrow Lakes and lower Kootenay River. The abundance and character of the Deer Park Phase archaeological evidence (especially the pithouses) indicate high human population density along the Columbia River north of Kettle Falls during the time period between about 3500 and 2500 years ago. This suggests that failure of the salmon runs was not responsible for the abandonment of Kettle Falls as a fishery during this period. Instead, it is postulated that high fluvial discharge was responsible for the upriver shift in the focus of the salmon fishery, both because the water volumes at Kettle Falls may have made the contemporary fishing technology unusable there and also because it contributed to larger salmon runs in the upper portions of the Columbia River drainage (Choquette 1985).

Following the period of high population density in the Canadian portion of the Selkirk Trench that is represented by the Deer Park Phase, significant changes again occurred in the human settlement pattern. Sites yielding evidence of occupation dating within the last two thousand years are less common in the Arrow Lakes and lower Kootenay River localities. During this same time period, the intensity of human use of the Kettle Falls fishery reached unprecedented proportions, and the lower falls became the major fishery for the first time. Ecological factors relating to palaeohydrology and salmon carrying capacity again seem to have played a major role in influencing human settlement dynamics in this portion of the upper Columbia River drainage, reflected by somewhat of a southerly shift in the focus of human inhabitation in the Arrow Lakes portion of the Selkirk Trench at least. Interestingly, there is a similar downriver shift in occupational focus on the Thompson River over the same time span, there subsumed by the Shuswap, Thompson and Kamloops phases of Richards and Rousseau (1987). An even more severe population decline and southerly shift has been alluded to previously in Section 3.1.2 with regard to the ethnohistorically documented changes in Sinixt settlement pattern.

3.3 Contact Era History

David Thompson crossed the Athabasca Pass in 1811 and overwintered at the confluence of the Columbia, Canoe and Wood rivers (Spry 1963, Hopwood 1971) at a place later known as Boat Encampment. A fur trade route (the Columbia Trail) was subsequently established connecting Jasper House with Forts Colvile, Okanagan, Walla Walla and Vancouver. The fur traders established a supply depot at Boat Encampment, which was also known as the Athabasca portage. Boat Encampment served as a major fur trade transfer point for some 50 years.

Native camps were encountered by Sir George Simpson and Edward Ermatinger, in 1824 and 1827 respectively. Only Simpson provided an identification ("a lodge of Indians part of the Kettle Fall tribe") and the locations are not specifically identified but were apparently along the Columbia River in the immediate vicinity of the present study area (Bouchard and Kennedy 1985). In 1838, a party of twenty-six people, including a group of Oblate missionaries, were descending the Columbia River when their boat was wrecked in Death Rapids in the south half of the present study area, where twelve people lost their lives. In 1846, Paul Kane met a band of Shuswap under a chief known as Capote Blanc at Boat Encampment where they were hunting moose and beaver, and in 1847 he met up with the Sinixt in the southern part of the study area (Kane 1974: 106, 235, 229).

4. Study Methodology

This study comprises an assessment of the archaeological potential of Provincial Forest lands in Landscape Units R06, R10, R11, R14, R15 and R16. The assessment takes the form of polygons drafted onto 1:20,000 scale TRIM contour maps, accompanied by a database containing the criteria upon which the definition of the polygons is based and the scoring that supports the ranking of the polygons into Medium or High archaeological potential.

The individual polygons consist of landforms or landscapes identified via stereoscopic analysis of aerial photos. The criteria for polygon definition were derived from the geological and palaeoenvironmental background information summarized in Section 2 above. These criteria are linked with the prediction of potential occurrance of archaeological sites through traits used to define the regional archaeological record (Section 3.2.2), especially in terms of settlement pattern, subsistence base and palaeoenvironmental context as extrapolated from the soil and sediment associations of the cultural deposits. In their various combinations as identified in the databases, these traits represent models of past human land and resource use applied to the landforms and landscapes identified during the air photo analysis. The result is a set of GIS compatible polygons that reflect the potential of various parts of the LUs to contain archaeological deposits and features.

The criteria by which the polygons are assessed represent a bridge between the terrain units and the human land and resource use models. To achieve objectivity in defining the archaeological potential of the polygons and to promote broader apprehension of the process amongst resource managers, each criterion is numerically scored relative to its contribution to the delineation and evaluation of the polygon in question. A four part scoring system has been used: "0" indicates that the criterion in question has not contributed to the definition of a given polygon, "1" indicates a minor contribution, "2" a more significant contribution, and "3" indicates that the criterion is a major determinant of the polygon's assessment or definition.

Each criterion is described below with specific reference to the biogeography and archaeology of the six LUs. The criteria are subdivided into two categories that reflect the regional perspective (macrosite criteria) and the local perspective (microsite criteria). The distinction between the two is discussed in more detail in Section 6 below.

4.1 Macrosite Criteria

The following attributes are considered to be the primary dimensions of archaeological potential within the regional context.

4.1.1 Known Sites

Where the level of previous investigation has been sufficient to support it, the distribution of known sites can provide a relatively reliable measure of the intensity of precontact human utilization within the given study area in which they occur and also some indication of the types of past human activities that might have taken place.

For example, focused occupation, particularly that of a winter settlement or base camp characterized by a significant duration and continuity of human presence, would have had a range of other activities associated with it. Besides those related to procurement and processing of subsistence resources, such ancillary activities would have included a range of social and ceremonial practices that could be represented as archaeological sites. Thus the vicinity of a habitation focus would be characterized by a higher site density than would other parts of the landscape even if they were characterized by similar topography.

Precontact site ElQm-1 is adjacent to pre-dam Kinbasket Lake in the Rocky Mountain Trench south of LU R06. A single flake of unidentified lithic material was observed in a disturbed area; the site is interpreted to be a possible camp (Mitchell and Turnbull 1968b).

Most of the archaeological sites recorded during the original Revelstoke Reservoir survey were based on informants' reports but a revisit in 1977 (Bussey 1979) did not suggest that any were archaeological resources (Bussey 1998: 5). Regardless, these sites are now inundated by the reservoir. Similarly, nothing further was observed in 2006 at the two locations where precontact archaeological deposits had been identified in reservoir shoreline sloughage during the 1994 emergency drawdown assessment reconnaissance (Choquette 1995, 2006). Both of the latter locations are near LUs that are the subject of the present study.

The only definite precontact archaeological sites actually within the present study area are EgQn-5 and 6, two lithic scatters on boulder-filled terraces above the left bank of the

Columbia River at the extreme south end of LU R10 (Campbell 2000). Almost all equivalent landforms to the north are inundated by Revelstoke and Kinbasket reservoirs.

A score of 3 for this criterion represents the presence in a polygon of one or more known archaeological sites while a score of 2 is assigned to polygons adjacent to known sites. A score of 1 reflects the location of a polygon between, but at some distance from, known site occurrances. A score of 0 indicates a lack of known sites in a locality, but the limitations of the present site inventory must always be kept in mind.

4.1.2 Columbia River

The Columbia River was the greatest salmon producing river in North America in precontact time. It also contained an abundance of other important aquatic resources, including waterfowl and resident fish. The richness of the riparian zone with regard to diversity of plant resources and habitats for terrestrial mammals such as deer, bears and moose further underscores the importance of this river to the aboriginal economy. This large river was also a travel corridor in itself.

Scoring for this criterion reflects both proximity to and accessibility of this river. Polygons associated with the lower courses of streams draining directly into the Columbia were scored higher than upland polygons the same distance from the river due to the potential for salmon runs ascending these watercourses.

4.1.3 Corridor

The physiography of a region exerts a major influence on the movements of both animals and humans. The broad corridor represented by the Rocky Mountain Trench would obviously have been the major precontact travel corridor, both on foot and by canoe. It is scored 3. Likewise, the Selkirk Trench, which carries the Columbia River southward to the Columbia Plateau, scores 3 as a corridor.

In general, the northern Monashee Mountain crest that comprises the western boundary of the study area consists of steep-sided peaks and sharp arretes. Most eastward drainages head in cirques containing active glaciers and almost all headwaters are characterized by very steep slopes. Only two passes through this part of the Monashees have approaches that would not serve in themselves to discourage pedestrian travel, notwithstanding that these eastern drainages also occupy steep, narrow valleys with little to offer in terms of precontact subsistence resources. One exception is Scrip Creek, which heads in a high and narrow pass into the upper Adams River drainage; this route was scored 1 for this criterion. The other corridor is more significant, as demonstrated by the presence of major BC Hydro electrical transmission lines. A traditionally known trail (Teit 1920 cited in Favrholdt 1997, Bouchard and Kennedy 1985), now known as the Ratchford-Pettipiece Trail (Favrholdt 1997: 92) connects the Columbia watershed with that of the South Thompson via the Seymour River. Pettipiece Pass is situated within a large and relatively level expanse of krummholz and subalpine meadows. This route is scored 2 for this criterion.

4.1.4 Bedrock Geology

As discussed in Choquette (1981), stone suitable for tool manufacture is neither ubiquitous in the region nor restricted to a single source. Twenty-three discrete sources of flakable stone have been identified in the upper Kootenay – Columbia over the past 30 years and the approximate locations of at least four more are known. Because of the non-biodegradable nature of this material and the capability to use stone to track movements of people across the landscape relative to the location of the discrete sources, this criterion is of great importance to the archaeology of Ktunaxa territory. Since workable stone was an essential underpinning of the precontact economy, stone sources were sufficiently strong attractions that they appear to have been significant determinants of the foci for subsistence resource exploitation as well as of routes of transmountain travel. They are thus extremely valuable tools for predicting archaeological potential.

There is no specific data regarding precontact utilization of mineral resources in the study area LUs. The bedrock is dominated by high grade metamorphic rock such as schist and gneiss which is not suitable for manufacture of high quality chipped tools. At present, this criterion is essentially neutral as a predictor and all polygons were scored 0.

4.1.5 Ungulate Range

The study area is dominated by steep and rugged mountainous topography and very high precipitation values, particularly snowfall. These conditions do not favour large populations of ungulates, especially grazers. The palaeoenvironmental record suggests the possibility for past intervals when conditions were favourable for more frequent wildfire that could have episodically enhanced ungulate capability. However, only localities where terrain is suitably level for intact archaeological sites to be present were scored higher than 1. That having been said, scoring for this criterion reflects the generally low quality of the ungulate range from a regional perspective as extrapolated from present values and palaeoenvironmental reconstructions: the highest score is 2 out of 3.

4.1.6 Solar Aspect

Southerly exposures tend to support a more open vegetal cover than other aspects, making them the preferred locations of trails for both animals and humans. In northerly latitudes, human habitation sites, especially late fall, winter and early spring settlements, tend to be situated to take advantage of solar heating.

Scoring for this criterion is based both on micro- and macrotopography, with the highest score accruing to south-facing landforms situated on or at the base of concave south-facing mountainsides.

4.2 Microsite Criteria

Scoring of each of these criteria reflects its relative importance in determining the specific location, along with the size and shape, of individual polygons.

4.2.1 Terrace/Fan

Elevated terraces are favourable camping areas because they tend to be better drained with regard to soil moisture and also avoid the effect of cold air drainage, an important consideration in late fall, winter and early spring. Level, typically well-drained landforms, terraces have also been selected as travel corridors, especially along the margins where vegetation tends to be more open. Although most of the large terraces have been inundated by the reservoirs, remnants of the highest occur above the reservoir levels. These are primarily graded to the level of the proglacial lake (Glacial Lake Columbia?) that extended up the Selkirk Trench and have some potential for very early cultural deposits to be associated.

4.2.2 Promontory

Bedrock prominences and ridges facilitated precontact movements across the landscape and many of these landforms are vantage points where localized ad hoc activities such as tool production and maintenance may have taken place.

4.2.3 "Saddle"

At the heads of some valleys are constrictions that are lower than the surrounding heights of land, making them the preferred routes for traversing drainage divides (see also Section 4.1.3). The term "saddle" refers to the lower, more level terrain that exists at a height of land that could have been used as a pass. Such areas typically contain archaeological deposits because they were used as temporary rest areas and overnight campsites. Besides their potential to have been utilized as transient camping and activity loci, the topographic constraints on pedestrian movements could have made such areas strategic places for the ambush of prey species such as caribou, mountain sheep and elk.

4.2.4 Standing Water

Lakes and ponds attract wildlife and thus could have hunting grounds associated with them; those containing fish would have been obviously attractive for that reason. Lakeshores are also good camping areas, especially their sunnier north and east sides. When combined with scoring for relict watercourse, this criterion pertains to the previous existence of a water body, including proglacial lakes.

4.2.5 Watercourse

Rivers and streams and the associated riparian ecosystem support a diversity and abundance of subsistence resources as well as being sources of vital fresh water. Besides the Columbia River, other rivers and streams supported a diversity and abundance of subsistence resources as well as being sources of vital fresh water.

4.2.6 Relict Watercourse

The establishment of the postglacial drainage system was accompanied by significant changes in hydrology, leaving discontinuous high terraces related to previous hydrological baselines. Although now considerably removed from water, landforms graded to previous watercourses or bodies of standing water are potential locations of early archaeological sites.

4.2.7 Confluence

Confluences of watercourses are significant predictors of archaeological site locations for several reasons. Most importantly, they usually correspond with confluences of valleys and thus represent junctions of travel corridors where temporary stopovers and activities would likely have been repeated frequently enough to produce archaeologically detectable cultural deposits. A second consideration is that the quality of water from tributaries is often better than that in the main stream, particularly during the freshet. Furthermore, confluences often are good fishing locations.

4.2.8 Watercourse Node

This refers to specific portions of watercourses that could have served to attract and/or focus human activity. Examples of watercourse nodes include: nickpoints and rapids that could have served as fords; large eddies, pools and waterfalls which can be good fishing locations; and springs. Some of these natural features can have sacred associations.

4.3 Confidence

The need for this measure was expressed by Oliver Thomae, previously of the Cranbrook Forest District, in the context of future emergency situations such as fires. It is desirable to be able to separate out those polygons where archaeological values are sufficiently well known that measures such as field investigation or mitigation are clearly necessary from other polygons whose definition is based on limited data or large extrapolative leaps in predictive modelling. As employed in this study, Confidence is a subjective measure that should be considered within the context of 'risk management'.

This criterion is a subjective combination of the predicted presence and density of archaeological sites along with an estimate of the potential significance of the archaeological values that might be contained within a given polygon. It is scored high, medium or limited confidence as 3, 2, or 1, respectively. A score of 1 equates with a lower level of confidence commensurate with data limitations or greater level of speculation and while it certainly speaks to a need for further investigation, this level of confidence reflects acceptance of the risk of losing data in the polygon if extenuating circumstances should arise that require rapid response.

5. Results

Analysis of aerial photographs and background information of Landscape Units R06, R10, R11, R14, R15 and R16 in the Columbia Forest District has resulted in the mapping of a total of 156 landform-based polygons where there is some likelihood that significant archaeological deposits and/or features are present (see maps and databases).

6. Evaluation and Discussion

As employed in this study, archaeological potential represents a relative measure of the likelihood of encountering precontact heritage resources in a given locality. A number of factors are reflected by this relative measure, including probability of site occurrance, possible density of sites and/or cultural deposits, and significance. At its most basic level, the definition of archaeological potential depends upon an adequate data base to support accurate predictions of the presence of sites. The ideal situation would consist of an inventory of all sites within the study area and information regarding the nature of past human use in terms of activities, seasonality, duration of occupation and nature of social unit(s), and the time span(s) of such use.

The concept of potential arises when this ideal is not met, leading to the compromise of attempting to identify areas where sites might be located. Within the resource management context, erring on the side of caution is a necessary element in this "compromise" since archaeological heritage is a precious, unique non-renewable resource that represents a significant component of the cultural identity of living groups, their ancestors and their future generations. Thus, where a lack of systematic archaeological investigation is reflected by the absence of hard data in an inventory, it must be assumed until proven otherwise that all or most human land and resource use patterns are represented in a given landscape unit, subject to the constraints of the past environmental conditions.

The amount of previous research, including palaeoecology, is also a limitation of the capability and accuracy of predicting archaeological potential. It is fortunate that the direction of some of the archaeological research in the upper Columbia River drainage has been conducted within an explicit palaeoecological paradigm, as this expands the supporting data base to incorporate such aspects of the environment as geomorphology and palaeohydrology. As described in Section 4, analysis of aerial photographs produced a data set that includes landform and hydrological associations. These provide a scientifically objective definition of at least some past environmental constraints, thereby partially delimiting the range of potentially applicable patterns of past human land and resource use that could be projected onto a given landscape.

The level and nature of spatial sampling that has taken place previously in a landscape unit is also an important consideration in this regard. A large enough proportion of the target land base must have been examined to support correlations between the known inventory and the actual distribution of sites over the landscape. Both negative and positive data (i.e. absence vs. presence of archaeological sites) must be taken into account and places where sites have not been found at a sufficiently intensive level of sampling (especially where sites may have been expected) must be considered as well as locations where sites are actually present.

Given the above, the assessment of archaeological potential in the present context of GIS mapping and large-scale and spatially extensive field investigations (via impact assessments) can be viewed as a means of incorporating science into resource management. As such, results of field investigations can be tracked and fed back into the predictive models as represented by the mapped polygons. An ultimate scientific objective would be for multivariate spatial analyses to identify archaeological patterns on the basis of attributes whose predictive capability has been objectively confirmed. The present study should be seen as part of the ongoing progress towards this objective when this particular mapping methodology began to be applied in 1993. In this context, it must be emphasized that although a considerable body of palaeoenvironmental and archaeological data supports the culture history constructs set out in Section 3, they still must be regarded as hypothetical with regard to their applicability to the study area. Nevertheless, they serve both to guide future archaeological inquiry and to provide a primary context whereby the scientific significance of local archaeological sites can be evaluated.

Both macrosite and microsite criteria were considered during the analysis but only the former were used to rank the archaeological potential of the polygons. This is because archaeological potential derives from the characteristics of a broad environmental context, i.e. the combination of attributes such as location within a corridor, relationship to a particular resource such as stone or ungulates, solar aspect, etc. These macrosite criteria reflect the likelihood that an entire valley or even an entire landscape unit would have supported precontact human occupation or use and thus could contain archaeological sites. As discussed in Section 4, the values assigned to these criteria take into consideration such general characteristics as the intensity of previous investigation and the extent of the present archaeological inventory, the relative location of the study area in the upper Columbia River drainage as a whole as well as with regard to the river itself, the geologic history as it pertalns to physiography and relative accessibility of mineral resources, local palaeocology, etc. As such, the macrosite criteria are conceived of as components of the overall ecological synergy that in total gives potential archaeological value to polygons defined at the 1:20,000 scale.

The archaeological potential of each polygon is thus a composite of its macrosite criteria. It is derived by totalling the numerical scores for Confidence and Macrosite Variables. The totals are then grouped into two modal classes (high and medium) within the ranked universes. Table 1 presents a breakdown of these potential classes by LU.

LU	Total Polygons	High Potential	Medium Potential
R06	8	0	8
R10	26	4	22
R11	5	0	5
R14	41	1	40
R15	30	1	29
R16	46	3	43
Total	156	9	147

Table 1. Breakdown of archaeological potential polygons by LU.

Microsite variables, on the other hand, have determined the placement of polygon boundaries and the sizes of the individual polygons. As such, they are specific to each polygon in relationship to the components of the immediately surrounding landscape, which either has low archaeological potential (and thus is not delineated with polygons at all) or which is delineated by separate polygons because of differences in microenvironmental characteristics such as landform or relationship to water. The archaeological significance of the microsite criteria is that they are responsible for the definition of a given polygon relative to its immediate surroundings. These criteria are best conceived of as independent descriptors of each polygon. However, the microsite scores for the polygons do not provide useful information regarding archaeological potential as such, because terraces, promontories and saddles or watercourses, lakes and confluences do not have archaeological potential in themselves - their potential relates to the relationship between their settings and the precontact human land and resource use models. The scores for each microsite criterion represent a measure of the contribution each has made to the delineation of a given polygon. This information is provided primarily for future use when a sufficiently large number of polygons has been examined in the field so that the results of such fieldwork can be utilized as tests of the relative value of these criteria as predictors of archaeological site locations in a given landscape unit and, by extension, of the applicability of the various precontact land and resource use models to the landscape unit in question.

Those areas that have not been mapped as polygons are considered to have *low archaeological potential*, that is, areas where sites are not likely to be present. It must be emphasized, however, that this *does not imply the absence of sites and certainly does not imply a lack of heritage significance for those sites that may be present*. Indeed, the very scarcity and isolation of sites can convey upon them a relatively greater significance than for sites in denser zones because they may contain unique information.

Although they are grounded in a considerable depth of background research and experience, the scores placed on the macrosite criteria used in this study are still somewhat subjective and thus the ranks as sums of these scores are also subjective to some degree. It is to be hoped that this subjectivity will be steadily reduced as results of field investigations guided by the maps are factored back into the process.

Since there is no archaeological inventory from the study area itself and that upon which this study draws does not represent the product of systematic investigation, the product of the present study must be considered as hypothetical. Furthermore, the maps are conservative in nature, given the non-renewable nature of the resource. Nevertheless, the assessment is based on considerable background material and experience and it represents a valuable planning tool to facilitate the integration of archaeological resource conservation with other types of future land use, especially that related to forest industry activities.

Forest development planning identifies areas where road and landing construction, harvesting and site preparation are proposed. Since all of these activities involve some degree of ground disturbance, they represent significant threats to the integrity of archaeological sites and features. By overlaying the locations of proposed forest industry activities onto the mapped polygons of archaeological potential, it is possible to identify potential circumstances that could result in the destruction of non-renewable archaeological resources. These areas of overlap represent potential conflicts which if unavoidable, should be examined in the field via archaeological impact assessments and appropriate avoidance or mitigative measures identified if results warrant. Over time, as discussed previously, the results of archaeological field investigations can be utilized to formally test and refine the models that serve as the basis for polygon definition.

It must be emphasized that the accuracy of polygon location is limited by the precision of the TRIM map base and also by the degree to which forest canopy closure allows for the accurate delineation of landform boundaries. Therefore, the locations of the polygon boundaries on the maps should not be viewed as exact and landform context as determined in the field (for example, during reconnaissance, cruising or layout) is desirable as an adjunct to the mapping if avoidance is chosen in the planning stages. With regard to using the archaeological potential maps to determine the need for archaeological impact assessments, the assessment of potential impact should be based on proximity (e.g. within 50 m) of a polygon to a proposed road, landing or block as opposed to direct overlap.

7. Recommendations

Maps of archaeological potential for Landscape Units R06, R10, R11, R14, R15 and R16 have been developed on the basis of biogeographic criteria, precontact human land/resource use models and stereoscopic air photo analysis. Areas delineated by polygons have some likelihood for containing archaeological deposits or features. As such, ***these polygons can be used to identify areas where more detailed investigations via preliminary archaeological field reconnaissance (PFR) or archaeological impact assessments (AIAs) should be undertaken***. The intensity of such investigation will depend upon the extent and location of previous disturbance.

At this juncture, it can be re-emphasized that environmental conditions have varied considerably over the past 12,000 years. Palaeoenvironmental reconstructions suggest more benign conditions in some of the mountainous parts of the upper Columbia drainage during parts of the Holocene than prevailed during the post-contact era to which most of the existing biogeographic data pertains. It is on this basis that much of the archaeological potential of the upland parts of the study area is predicated. However, there is minimal information at present that actually relates to the nature of the activities that would have taken place in these mountains other than the general postulate that higher subsistence resource values, such as occur in fire succession forests, could have drawn groups of hunter-gatherers up the tributary valleys.

On another note, it must be emphasized that this study focuses on precontact archaeological resources; its methodology is not suitable to predict locations of culturally modified trees. These are also protected heritage resources but they are more reliably located by field survey of areas containing old growth forest. Therefore, ***it is recommended that the presence of culturally modified trees be determined by field examination in proposed forest developments where the age of trees exceeds ca. 100 years.***

It is further recommended that the process of mapping of archaeological potential be continued in the other landscape units in the Columbia Forest District.

8. References

Baker, Richard G.

1983 Holocene Vegetational History of the western United States. in Wright, H.E. Jr. ed. Late Quaternary Environments of the United States, Vol. 2: 109-127. Minneapolis: University of Minnesota Press.

Bouchard, Randy and Dorothy Kennedy

1985 Lakes Indian Ethnography and History. Report prepared for the BC Heritage Conservation Branch, Ministry of Provincial Secretary and Government Services, Victoria.

2000 First Nations' Ethnography and Ethnohistory in British Columbia's Lower Kootenay/ Columbia Hydropower Region. Report prepared for Columbia Power Corporation, Castlegar.

Braumandl, T.F., M.P. Curran, G.D. Davis, H.J. Quesnel, G.P. Woods, D.L. DeLong and M.V. Ketcheson

1992 Biogeoclimatic Subzones and Variants of the Nelson Forest Region. in Braumandl, T.F. and M.P. Curran (eds.) A Field Guide for Site Identification and Interpretation for the Nelson Forest Region. Victoria: Research Branch, Ministry of Forests.

Brunton, William

1998 Kootenai. Pp. 223-237 in Walker, Deward Jr. ed. Plateau, Handbook of the North American Indians, Volume 12. Washington, D.C.: Smithsonian Institution.

Bussey, Jean

1979 Revelstoke Archaeology Project: Final Report. On file, Archaeology Branch, Ministry Responsible for Culture, Victoria.

1998 Preliminary Archaeological Assessment of the J & L Property – McKinnin Creek Project near Revelstoke, B.C. Report prepared for Rescan Environmental Services Ltd., Vancouver.

Bussey, Jean and Diana Alexander

1994 Mount Revelstoke and Glacier National Parks Prehistoric Archaeological Site Assessment. On file, Archaeological Services, Parks Canada, Calgary.

Campbell, Bonnie

2000 Report on Archaeological Impact Assessments of proposed Forestry Developments within the Columbia Forest District. Permit 1999-126 Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Chance, David H. and Jennifer V. Chance

1985 Kettle Falls: 1978, Further Archaeological Excavations in Lake Roosevelt. University of Idaho Anthropological Research Manuscript Series, no. 84.

Chance, David H., Jennifer V. Chance, and John Fagan

1977 Kettle Falls: 1972, Salvage Archaeology in Lake Roosevelt. University of Idaho Anthropological Research Manuscript Series, no. 31.

Choquette, Wayne T.

1981 The role of lithic raw material studies in Kootenay archaeology. B.C. Studies 48: 21-36.

1984 A proposed cultural chronology for the Kootenay Region. in Gough, Stanley, ed. Cultural resource investigations of the Bonneville Power Administration's Libby Integration Project, northern Idaho and northwestern Montana. Archaeological and Historical Services, Eastern Washington University Reports in Archaeology and History 100-29: 303-316.

1985 Excavations at DiQj-18, South Slocan: A Test of a Model of Upper Columbia Basin Human Settlement Dynamics. On file, Ministry Library, Ministry Responsible for Culture, Victoria.

1987a A Palaeoclimatic model for the Upper Columbia River drainage basin. in McKinnon, Neil and Glenn Stuart, eds. Man and the Mid-Holocene Climatic Optimum. Calgary: The Students' Press, pp. 311-344.

1987b Archaeological investigations in the Middle Kootenai Region and vicinity. Chapter 3 in Thoms, Alston and Greg Burtchard, eds. Prehistoric Land Use in the Northern Rocky Mountains: a perspective from the Middle Kootenai Valley. Washington State University, Center for Northwest Anthropology, Project Report, no. 4: 57-119.

1993 Archaeological Resource Overview for the Nelson Forest Region. On file, Archaeology Branch, Ministry Responsible for Culture, Victoria.

1995 Heritage Resources Impact Study of an Emergency Drawdown of the Revelstoke Reservoir. Prepared for BC Hydro, Burnaby.

1996 Early post-glacial habitation of the upper Columbia region. In Carlson, R. ed. Early Human Occupation in British Columbia. Vancouver: University of British Columbia Press.

2002. Archaeological Component of Arrow, Mica and Revelstoke Reservoirs Water Use Planning Process, 2002. Summary Report prepared for BC Hydro, Burnaby.

2004 Archaeological Overview Assessment of BC Hydro's Transmission Line Clearance Upgrade Project. Prepared for BC Hydro, Burnaby.

2006 Archaeological and Cultural Resources. Section 6.6 in Revelstoke Unit 5 Environmental Assessment Certificate Application, Volume 1 Supplemental Information Report on file, BC Hydro, Burnaby.

Choquette, Wayne T. and Michael Keefer

2003 High Altitude Archaeology Survey of Mount Revelstoke and Glacier National Parks. On f ile, Canadian Parks Service.

Clague, John

1989 Cordilleran Ice Sheet. In R. J. Fulton, ed. Quaternary Geology of Canada and Greenland. Geological Survey of Canada, Geology of Canada 1.

Dawson, George M.

1892 Notes on the Shuswap People of British Columbia. in Proceedings and Transactions of the Royal Society of Canada for the Year 1891, Vol. 9: 3-44. Montreal.

Douglas, R.J.W., H. Gabrielse, J.O. Wheeler, D.F. Stott and H.R. Belyea

1969 Geology of Western Canada in R.J.W. Douglas, ed. Economic Minerals of Canada. Geological Survey of Canada, Economic Geology Report No. 1: 365-488.

Favrholdt, Ken

1997 Trails in the Okanagan TSA. Section 4.4.3 in Arcas Consulting Archeologists Ltd. Okanagan Timber Supply Area Archaeological Overview Assessment, pp. 87-97. Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Fulton, Robert

1971 Radiocarbon geochronology of southern B.C. Geological Survey of Canada Paper 71-37.

Fulton, R.J. and R.A. Achard

1985 Quaternary Sediments, Columbia River Valley, Revelstoke to the Rocky Mountain Trench, British Columbia. Geological Survey of Canada Paper 84-13.

Fulton, Robert, Barry Warner, Helen Kubiw and Rene Achard

1989 Geology and Palaeocology of early Holocene lacustrine deposits in the Columbia River valley near Fauquier, southern British Columbia. Canadian Journal of Earth Sciences 26: 257-265.

Hallett, Douglas and Robert Walker

2000 Palaeocology and its Application to fire and vegetation management in Kootenay National Park. Journal of Palaeolimnology 24: 401-414.

Hazell, S.D.

1979 Late Quaternary vegetation and climate of Dunbar Valley, British Columbia. M.Sc. thesis, University of Toronto.

Hebda, Richard J.

1995 British Columbia Vegetation and Climate History With Focus on 6 KA BP. Geographie Physique et Quaternaire 49: 55-79.

Hopwood, Victor G.

1971 David Thompson Travels in Western North America, 1784-1812. Toronto: McMillan.

Ignace, Marianne Boelscher

1998 Shuswap. Pp. 203-219 in in Walker, Deward Jr. ed. Plateau, Handbook of the North American Indians, Volume 12. Washington, D.C.: Smithsonian Institution.

Kane, Paul

1974 Wanderings of an artist among the Indians of North America. Edmonton: Hurtig Publishers.

Kearney, M.S.

1981 Late Quaternary Vegetation and Environments of Jasper National Park, Alberta. PhD Dissertation, University of Western Ontario, London.

Kearney, M.S. and B.H. Luckman

1983 Postglacial Vegetational History of Tonquin Pass, British Columbia. Canadian Journal of Earth Sciences 20: 776-786.

Larsson, M. and B.P. Wood

2005 Archaeological Impact Assessments, Columbia Forest District Harvesting Areas, Permit 2005-412 report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Mirau Neil A.

2001 Columbia Forest District Timber Harvesting Areas. Permit 2001-217, Final Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Mitchell, Donald H. and Chris Turnbull

1968a 1968-015, Archaeological Investigations, Summer, 1968. On file, Ministry Library, Ministry Responsible for Culture, Victoria.

1968b Site form for ElQm-1. On file, Archaeology Branch, Ministry of Tourism, Sport and the Arts, Victoria.

Murton, Phillip and George Ferguson

1973 Report of an archaeological survey of proposed B.C. Hydro generating sites at Seven Mile (Pend Oreille River), High Revelstoke (Columbia River), and Site One (Peace River). On file, Ministry Library, Ministry Responsible for Culture, Victoria.

Porter, Stephen C. and George H. Denton

1967 Chronology of Neoglaciation in the North American Cordillera. American Journal of Science 265: 177-210.

Quesnel, H. and F. Thiessen

1993 Ecosection Summaries for the Kootenay-Boundary Region. Appendix 1 in A Protected Areas Strategy for British Columbia, Best P.A.S. Report. Nelson: Kootenay Regional Protect Areas Team.

Richards, Thomas H. and Michael K. Rousseau

l987 Late Prehistoric Cultural Horizons on the Canadian Plateau. Department of Archaeology, Simon Fraser University Publication l6. Burnaby: Archaeology Press, Simon Fraser University.

Richmond, G.M., R. Fryxell. G.E. Neff and P.L. Weiss

1965 The Cordilleran Ice Sheet of the Northern Rocky Mountains and Related Quaternary History of the Columbia Plateau. Pp. 231-42 in H.E. Wright and G. Frey, eds. The Quaternary of the United States: A Review Volume of the VII Congress of the International Association for Quaternary Research. Princeton University Press.

Robinson, Michael and Ken Martin

1972 Mica Creek Survey Report, 1972. Report on file, Ministry Library, Ministry Responsible for Culture, Victoria

Ryder, J. M.

1981 Biophysical Resources of the East Kootenay Area: Terrain. British Columbia Ministry of the Environment, APD Bulletin no. 7.

Schaeffer, Claude E.

1940 The Subsistence Quest of the Kutenai. Ph.D. Dissertation, University of Pennsylvania.

Smith, Allan H.

1984 Kutenai Indian Subsistence and Settlement Patterns, northwest Montana. Seattle: U.S. Army Corps of Engineers.

Spry, Irene M.

1963 Routes Through the Rockies. The Beaver 294: 26-39.

Teit, James A.

1909 The Shuswap. American Museum of Natural History Memoirs Vol. 2: 448-594.

1930 Salishan Tribes of the Western Plateaus. Bureau of American Ethnology, Annual Report, vol. 45: 23-296.

Turnbull, Christopher J.

1977 Archaeology and Ethnohistory in the Arrow Lakes, Southeastern British Columbia. National Museum of Man, Mercury Series, 65.

Turney-High. H.H.

1941 Ethnography of the Kutenai. American Anthropological Association Memoir 56: 1-202.

Wood, Barry P.

2006 Archaeological Impact Assessment, La Forme Creek Recreation Site (2005-412). Final Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.