This PDF document contains two final reports:

Archaeological Review and Management Plan for the **Southern Chilliwack Forest District** (Golder 1999) **Pages 2 - 74**

AND

Archaeological Overview Assessment of Nlaka'pamux Nation Traditional Lands in the **Northern Chilliwack Forest District** (Golder 1999) **Pages 75-231**

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REPORT ON

ARCHAEOLOGICAL REVIEW AND MANAGEMENT PLAN FOR THE SOUTHERN CHILLIWACK FOREST DISTRICT

STO:LO HERITAGE INVESTIGATIONS PERMIT 1999-010

Submitted to:

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September 1999 992-1811/8000

EXECUTIVE SUMMARY

This report describes the results of a review of known and potential archaeological resources in the southern part of the Chilliwack Forest District, and recommendations for an interim cultural resource management in the absence of a detailed archaeological overview assessment (AOA). The study was undertaken on behalf of the Ministry of Forests and in co-operation with the Sto:lo Nation.

The project involved three main phases: (1) data review and preparation (2) GIS model development, implementation and evaluation, and (3) reporting and preparation of GIS deliverables. This study does not constitute an archaeological overview assessment, as commonly defined by the Ministry of Forests and the Archaeology Branch.. As such, it did not include a detailed literature review or extensive community consultation.

The primary objective of the study was to develop an archaeological resource management plan for use in the southern part of the Chilliwack Forest District, pending a more detailed archaeological overview assessment (AOA) that may be funded in the future. Related study objectives included a review of all archaeological data for the study area, preparation of GIS coverages of data pertinent to archaeological site modelling, development of predictive models designed to assess the relative potential for certain types of archaeological sites, and the establishment of a provisional management strategy for culturally modified tree sites.

Modelling results categorized the study area according to three land classes: Class I represents the highest predicted archaeological site potential (including density and variability); Class II represents moderate site potential, and Class III represents low predicted site potential. The models assigned 110,679 ha. (13.5% of the study area) to Class I and 26,488 ha. (3.2%) to Class II, for a total of 137,127 ha. (16.7%) of Class I or Class II land. Archaeological field assessments are recommended for these areas prior to any land altering development.

Due to a lack of data for the District, models were not developed for culturally modified trees. A proposed interim CMT management plan is presented in the report. The plan is consistent with a recent draft CMT management procedure prepared by the Vancouver Forest region.

CREDITS

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ACKNOWLEDGEMENTS

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Mr. John Pichugin (JS Jones Holdings – Pitt Lake Logging Division), Mr. John Gow (Prettys' Timber Co. Ltd.), Mr. Brian Martell (Canadian Forest Products), and Mr. Bill Rosenburg (International Forest Products Ltd.) provided archaeological reports and maps for studies undertaken in their operating areas.

Mr. Doug Glaum (Archaeology Branch Project Officer) is acknowledged for his role in defining and reviewing the project terms of reference and for his comments on the GIS component of the study.

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1.0 INTRODUCTION

This report presents the results of an archaeological review and GIS analysis of archaeological site potential in the southern Chilliwack Forest District. The study area encompasses all or portions of fifty-five 1:20,000 scale TRIM map sheets, roughly between Sawmill Creek and Mission (Figure 1). The project involved three main phases: (1) data review and preparation (2) GIS model development, implementation and evaluation, and (3) reporting and preparation of GIS deliverables. This study does not constitute a formal archaeological overview assessment, as commonly defined by the Ministry of Forests and the Archaeology Branch. As such, it did not include a detailed literature review or extensive community consultation.

1.1 Objectives

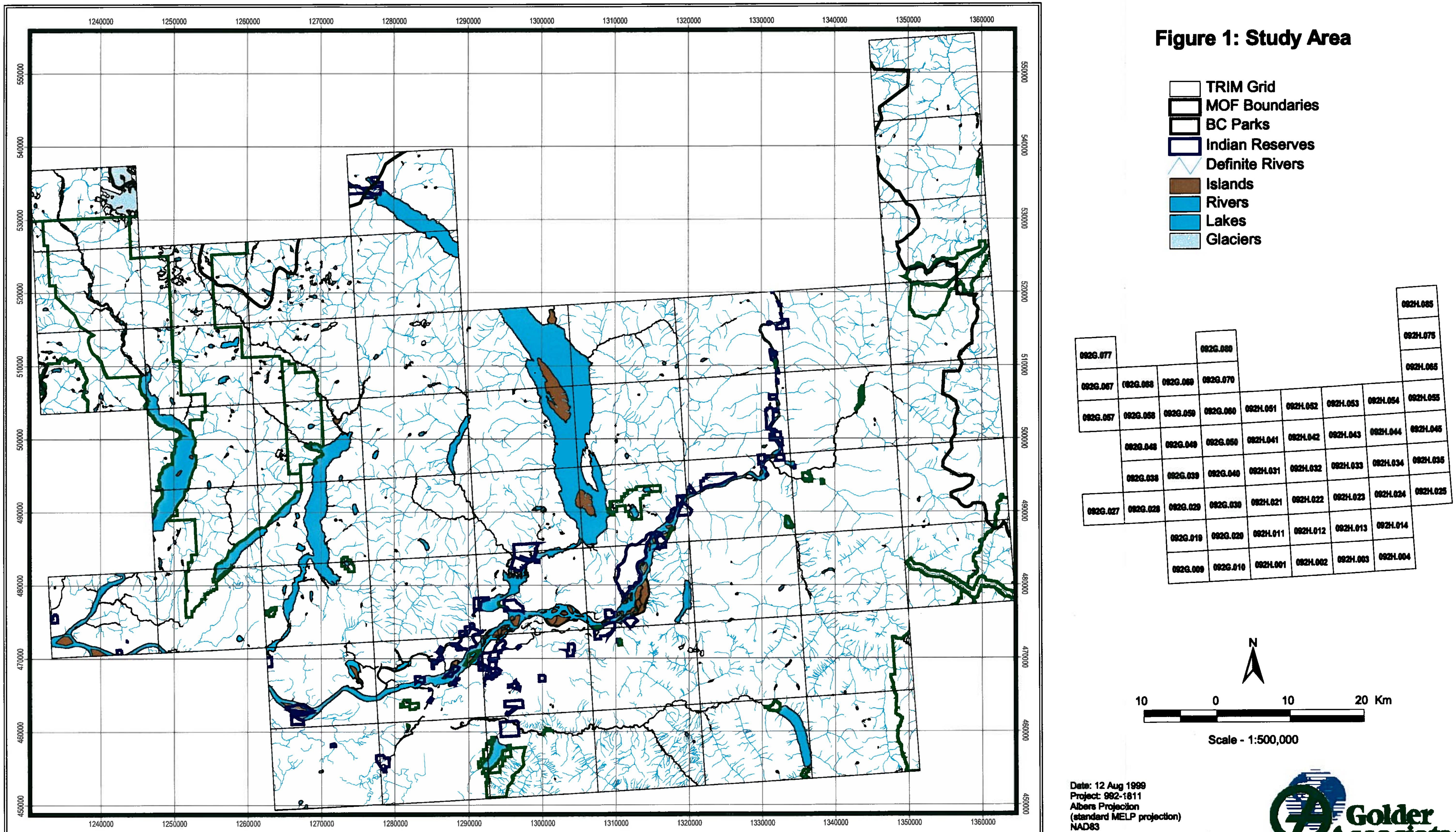
The primary objective of the study was to develop an archaeological resource management plan for use in the southern part of the Chilliwack Forest District, pending a more detailed archaeological overview assessment (AOA) that may be funded in the future. Related study objectives included a review of all archaeological data for the study area, preparation of GIS coverages of data pertinent to archaeological site modelling, development of predictive models designed to assess the relative potential for certain types of archaeological sites, and the establishment of a provisional management strategy for culturally modified tree sites.

1.2 First Nations

Several First Nations groups consider the study area to be within their asserted traditional territories. They include: the Sto:lo Nation, a largely political organization currently consisting of nineteen member bands; the Katzie, Yale, and Chehalis First Nations, all of which are politically independent, and the In-SHUCK-ch Nation.

First Nations consultation was not within Golder Associates' scope of work. All liaison was coordinated by Mr. Dave Hobbs, Aboriginal Liaison Officer for the Ministry of Forest (Chilliwack Forest District). The project was undertaken in cooperation with Sto:lo Nation.

Figure 1: Study Area



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Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

2.0 ARCHAEOLOGICAL DATA REVIEW AND QUALITY CONTROL

Archaeological predictive modelling typically uses information about the nature and distribution of known archaeological sites when making predictions about where unidentified sites may exist. To maximize predictive ability, it is essential that the known site data be as reliable as possible. To this end, attempts were made to: 1) collect all archaeological site information within the study area; 2) ensure that the major data sources were consistent; and 3) plot the sites as accurately as possible on the TRIM base maps.

Archaeological data on file with the Archaeology Branch were reviewed for accuracy and consistency, and identified errors were corrected if possible. Sources of archaeological data included the Provincial Heritage Register Database (PHRD), 1:50,000 scale site location maps from the Archaeology Branch, sketch maps from the original archaeological site inventory forms, and the Archaeology Branch GIS point coverage and associated database. Original site inventory forms were not available for review.

To supplement the data supplied by the Archaeology Branch, twenty-two archaeological site records and survey coverage data were obtained from the Sto:lo Nation. This information represents recent field results that have not yet been incorporated in to the provincial heritage register. Survey coverage data from other archaeological impact assessments completed in the District were also obtained and digitized.

2.1 Geo-Correction of Site Locations

At the time of this report there were 486 known archaeological sites located in the southern Chilliwack Forest District (including sites identified by the Sto:lo Nation but not yet in the Provincial Heritage Register). It was initially proposed that original site inventory forms and sketch maps, 1:50 000 scale site location (paper) maps, and digital site locations and databases would be compared, and misplotted site locations would be corrected as necessary. However, due to Archaeology Branch restrictions on access to site forms, it was only possible to obtain the sketch maps, not the site forms. As a result, sketch maps (where available) were used as the primary source to hand plot site locations onto TRIM maps, and for comparison with those plotted by the Archaeology Branch on 1:50,000 National Topographic System maps or in the Archaeology Branch GIS coverages. It was assumed that the original sketch maps were the most reliable data source, as they were based on field observations.

Some sketch maps did not contain enough detail to accurately plot the site location. In these cases, site location and access descriptions in PHRD were used to supplement other data sources. For some sites, no data source was adequate to confidently plot the site locations, and in these instances, the 1:50,000 Archaeology Branch site location was assumed to be correct.

Numbers were assigned to each archaeological site record in the GIS database to indicate the confidence of the location plot, as follows:

1. **Corrected location** - site has been plotted and is believed to be in the most accurate location possible at a scale of 1:20,000 (72% of sites).

2. **Partially corrected location** - site has been plotted based on incomplete information, but is believed to be correct. Unable to evaluate accuracy due to incompleteness of data (5% of sites).

3. **Uncorrected location** – inadequate information available on sketch map to plot, or no map available (20% of sites).

4. **Site disregarded –** site represented in the database but information was too vague to confirm its existence. These sites were not used for any calculations or analysis (3 % of sites).

Five archaeological sites (DgRj-003, DgRj-005, DgRi-002, DgRi-003, and DgRi-004) appeared on the Archaeology Branch NTS maps and in the PHRD, but were not represented in the Archaeology Branch GIS data. Using PHRD data fields (i.e. site location, access, UTM coordinates, latitude and longitude) and information from the Sto:lo Nation, these sites were added digitally to the database and GIS archaeological site coverage, although the locations could not be checked against any other data source.

2.2 Determination of Site Dimensions

Points in GIS coverages represent hypothetical coordinates in space that could be roughly equivalent to only a few centimetres area. In order to more accurately represent the archaeological site locations, the GIS point coverage was converted to a polygon coverage based, where possible, on actual site dimensions. The site dimensions (in square metres) were determined using sketch map and/or PHRD data, where available, and circular polygons representing the area of each site were created. Dimensions were obtained for 314 (65%) of the known sites. For sites lacking dimensional data, median values for sites of the same type were used.

It is noted that these polygons are only an estimate of the total area covered by an archaeological site, and they were not intended to represent the shapes of the sites. Digitizing the actual site boundary would be a more accurate method of creating site polygons in cases where sketch maps are unavailable.

2.3 Negative Site Data

Information about locations that have received archaeological attention but where no sites were found — sometimes known as negative data — can be valuable for predictive modelling. Over the past several years, a number of proposed forestry developments have received archaeological field assessments in which no heritage sites were found. To the extent possible, these "non-site" locations were digitized and added to the GIS data to be used to help evaluate the predictive models developed during this study.

Non-site information was gathered by contacting forest licensees operating in the project area, and from the Sto:lo Nation. A total of 1,084 ha. of surveyed land (0.1% of the study area) was digitized and classed as containing no archaeological sites.

3.0 ARCHAEOLOGICAL REVIEW

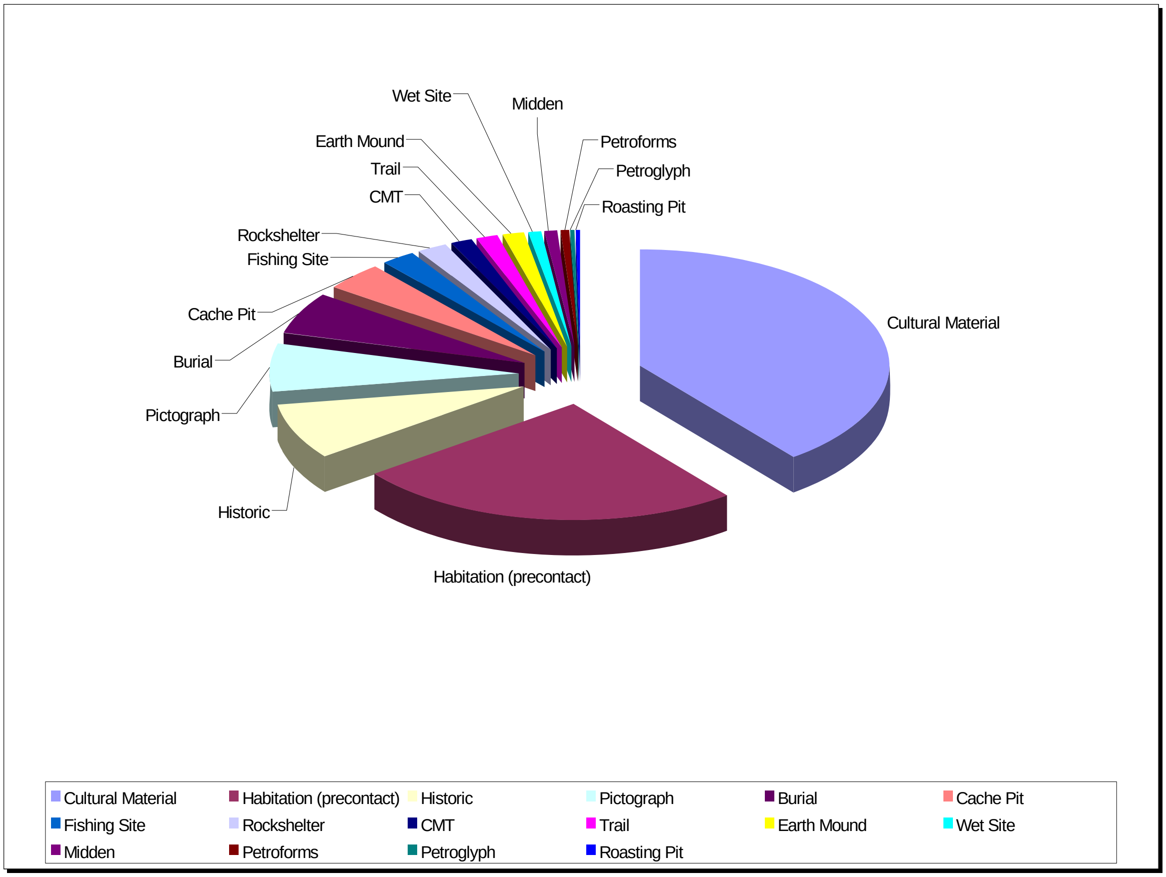
3.1 Site Types and Distribution

Following the British Columbia Archaeological Site Inventory Form classification scheme, Table 1 and Figure 2 summarize the distribution of recorded site components in the study area. Note that the total number of site components (n=743) significantly exceeds the number of discrete sites (n=486), as many sites have multiple components (e.g., habitation, lithic scatter, cache pit). Aboriginal settlement patterns differed markedly following contact with Euro-Canadians, partially in response to shifts in the subsistence economy and as a result of disease. This project focused on pre-contact archaeological sites, particularly those dating to the past 5,000 years, during which essentially modern environmental conditions have prevailed. “Historic” sites are not considered in detail I this study. Some of the more common pre-contact site types expected in the study area are described below.

Table 1 - Distribution of Site Types in the Study Area.

Site Type	Number of Site Components
Cultural Material	290
Habitation (pre-contact)	186
Historic	59
Pictograph	49
Burial	43
Cache	29
Fishing	16
Rockshelter	14
CMT	11
Trail	10
Earth Mounds	9
Wet	7
Midden	5
Petroforms	4
Petroglyph	3
Roasting	2
Total	**743**

Figure 2 - Distribution of Site Types in the Study Area



3.1.1 Cultural Material

Cultural material sites are the most common recorded site type in the study area. The majority of pre-contact period cultural material sites are lithic (stone artifact) scatters. While stone artifacts are present in many types of sites, at some sites only lithics are present or preserved. Lithic sites may represent a range of activities, including, but not limited to, stone quarrying, stone tool manufacture or maintenance, hunting, or habitation. Lithic sites can be highly significant, in part because the durability of lithic artifacts presents the potential for the survival of very old specimens. In addition, stone tool manufacturing techniques underwent stylistic changes over time, allowing the development of archaeological chronologies, particularly for projectile points. Unfortunately, many sites in which lithic artifacts are the primary component are surface finds, which can make them difficult to date or interpret. Lithic sites have been found throughout the study area, and they may occur on virtually any landform. In areas of heavy vegetation, they can be difficult to locate. For these reasons, it can be very difficult to develop predictive models for lithic scatter sites.

Other types of pre-contact cultural material sites may include scatters of bone (usually fragmented and/or burnt), fire-broken rock resulting from fires, shell middens, hearths, or other scattered materials. Culturally modified trees are sometimes considered cultural material sites, but they are treated separately in this report.

3.1.2 Habitation Sites

For this study, habitation sites included housepits, house platforms, some large lithic scatters, other structures, and rockshelters with evidence of occupation. Probably the most recognizable type of pre-contact habitation site is the winter housepit village, where large circular depressions represent the remains of semi-subterranean houses. Many housepit villages also contain lithic scatters, cache pits, earth ovens (roasting pits) and other site features. Burial sites may be associated with habitation sites, and particularly with winter villages. Winter villages were usually established on flat, sandy or silty river terraces near a source of fresh water (often at river confluences), and often near fall fishing locations.

Shorter-term summer occupations and resource gathering base camps may be represented simply by lithic scatters containing a wide variety of artifact types. Ethnographic and historic information indicates that summer dwellings were above-ground lodges that would not have left deep depressions, and these sites may lack visible features. Summer habitation sites may be found on lake shores, along rivers or near specific resource areas, such as important hunting or plant gathering locations. Post-contact habitation sites include homesteads, cabins, townsites and industrial camps, notably mining and railway camps.

3.1.3 Culturally Modified Trees

Since the late 1980s, and particularly in the 1990s, considerable archaeological research has focused on the location and analysis of culturally modified trees (CMTs). A CMT is usually defined as "a tree that has been altered by native people as part of their traditional use of the forest" (Ministry of Forests 1997). In the Fraser Valley area, virtually all recorded CMTs are bark-stripped trees. Bark stripping involved the removal of sections of outer bark, usually from cedars, for use as a raw material. Lodgepole pines were also stripped to access the edible inner bark. Bark stripped trees may have a long continuous tapered strip or a rectangular section removed, or they may be girdled by the removal of bark around the entire circumference of the tree.

Aboriginally logged trees were fully or partially felled to provide wood for the construction of houses, canoes, and other items. Tall stumps can also indicate aboriginal logging. Aboriginally logged trees include planked trees, sectioned trees, canoe trees, undercut trees, trees tested for heartwood soundness, notched trees and felled trees (Mobley and Eldridge 1992, Ministry of Forests 1997). No information was found to indicate that any aboriginally logged CMTs have been identified in the study area; however, ethnographic descriptions of plank houses, canoes and other wooden structures clearly show that aboriginal logging was an important practice.

Other types of CMTs include sap, pitch or kindling collection trees; delimbed trees, blazed trees, and dendroglyphs (carved trees) and dendrographs (painted trees) (McRanor 1997) - sometimes incorrectly labeled 'arborglyphs/ arboriglyphs' and 'arborgraphs/ arborigraphs' (e.g., Eldridge 1991, Ministry of Forests 1997).

Little research has been undertaken regarding the association of CMTs with other site types; however, CMTs may correlate with villages or shorter-term habitation sites. CMTs are often identified along trails or streams, and they have been found on landforms ranging from flat terraces to steep slopes. Both red and yellow cedar were extensively utilized by aboriginal people. Other trees, such as hemlock, Douglas-fir and lodgepole pine were also used, but to date, they have not been identified as CMTs in the study area.

In the Fraser Canyon, the majority of recorded CMTs are western redcedars, although yellow cedar examples have been recently identified at high elevations (Golder Associates 1998), and it is likely that lodgepole pine CMTs are also present in the area. CMTs are most commonly found in stands of old growth forest, and agriculture, logging, urban and recreational development have probably destroyed most valley bottom CMTs near the Fraser River.

Dendrochronology (tree-ring dating) is used to date CMTs, and this technique sometimes reveals scars that have completely healed over. At present, the oldest CMT date in British Columbia is AD 1467 (Eldridge and Eldridge 1988), but aboriginal forest utilization certainly predates this. Since CMT dating is completely reliant on the survival of the tree, and few species live longer than a few hundred years, direct evidence in the form of CMTs is limited to less than 1,000 years. Moreover, snags or girdled trees cannot be accurately dated.

3.1.4 Trails

Trail networks were integral to the aboriginal subsistence, settlement and exchange systems in B.C. Some trails linked villages sites with resource collection localities, summer camps, and special purpose sites, while others supported important exchange networks with neighbouring families or other First Nations. Directly dating trails is usually not possible, but the association of other pre-contact period sites with trails strongly suggests an aboriginal age for the trail.

3.1.5 Rock Art

Two distinct types of rock "art" are known in the study area: pictographs (images painted on a rock surface, usually with red ochre pigments) and petroglyphs (images carved or pecked into a rock surface, sometimes enhanced with pigments). To date, forty-nine (n=49) pictographs and three (n=3) petroglyphs have been documented within the study area. Both pictographs and petroglyphs tend to be found in remote areas and many are believed to be associated with spiritual or ceremonial activities

3.1.6 Historic Sites

While all archaeological sites relating to human activities since the period of contact between First Nations and European cultures are commonly termed "historic", the term is most often used to refer specifically to sites of non-aboriginal origin or to aboriginal sites containing manufactured trade goods. This does not, of course, imply that earlier aboriginal cultures lacked a history, and many archaeologists use the term "post-contact" to refer to historic period sites.

A significant number (n=59) of previously recorded archaeological sites in the study area have post-contact period components, and 37 sites have only post-contact components. Typical post-contact sites include structures (e.g., cabins, mills, stopping houses, barns), trails, wagon roads, railways, cemeteries, mining features (e.g., mineshafts or tailings piles), and logging features (e.g., flumes or stumps). Post-contact period sites are distributed across much of the landscape, often associated with travel routes, farm land or resource availability.

3.2 The Existing Archaeological Site Inventory

The current archaeological inventory for the Fraser Valley area is largely reflective of the history of archaeological work in the area. The vast majority of recorded sites are along the banks of the study area river, where the bulk of archaeological work has taken place. As a result, very little is known about site distribution in other zones of the Fraser Valley, including secondary rivers, mid-altitude lakes, the montane forest, subalpine parklands and the alpine. Furthermore, many previous field investigations did not employ subsurface site location techniques (i.e., shovel testing). Consequently, the actual extent of many sites has not been determined, as site boundaries often have been estimated from surface distributions of artifacts and/or features.

A further problem that has probably skewed known site distributions toward over-representation of river valley sites is the fact that prior to the early 1990s, CMTs were not consistently recorded as archaeological sites. The recent focus on cultural resource management, including intensive survey for CMTs in advance of forestry operations, has begun to produce information on CMT types and distribution, but few previously recorded non-CMT sites have been revisited to determine whether CMTs are also present.

4.0 GIS ANALYSIS OF TERRAIN

4.1 Data Development

The Grid module of ESRI's ARC/INFO NT version 7.1 was used to generate the elevation and slope grids developed during the modelling exercise. ArcView version 3.1 was used to generate some of the other grids used as modelling variables but all of these were based on the map extent and cell size defined in the elevation grid. A 10 metre grid cell size was used.

ARC/INFO's Topogrid command, with the enforce option on, was used to generate the Digital Elevation Model grid. The basemap data used were TRIM contour lines (primary data source), hydrology breaklines and point DEM. The slope grid was created using ARC/INFO's Slope command.

The hydrology polygon coverages were generated in ARC/INFO using the TRIM line features. Limited error checking was performed to ensure the TRIM defined definite lakes, left and right river-banks, wetlands, glaciers/icefields, sand/gravel bars, and islands were correct as this was not part of the project scope.

A river valley zone, designated the "Fraser River modelling component", was defined as areas with slopes of less than 30%, elevations below 100 metres a.s.l., and within 1500 metres of the Fraser River. This land class was used to aid in the development of specific model rules for the Fraser River floodplain and adjacent landforms.

A subalpine zone was defined using forest cover and biogeoclimatic zone data provided by the Ministry of Forests. From the forest cover data, the inventory type group number 41 (Alpine Tundra - coniferous) and 42 (Alpine Tundra - deciduous) were selected, as were all Whitebark Pine stands. Biogeoclimatic zone parameters interpreted as potentially indicating subalpine parkland are listed in Table 2 below.

Table 2 - Biogeoclimatic Variables Used to Define the Subalpine Zone

Zone	Subzone	Variant	Phase
ESSF	Mv	--	P
ESSF	mw	--	P
ESSF	wm	--	P
MH	mm	2	P
AT-E	mw	--	P

River confluence coverages were created by first buffering the hydrology features, then combining those buffers and isolating the overlapping areas. Three confluences were factored into the model. A 100m buffer was used for definite river confluences with two-line (left & right bank on 1:20,000 TRIM maps) rivers or the Fraser River. Confluences between definite or two-line rivers with definite lakes (area >= 2 ha.) also used a 100m buffer. Confluences of two-line rivers with the Fraser River used a 200m buffer.

Definite rivers and definite lakes are defined in the British Columbia Specifications and Guidelines for Geomatics, Content Series, Volume 3: Digital Baseline Mapping at 1:20,000 (Ministry of Environment, Lands and Parks 1992).

The total study area encompasses 888,257 ha., of which 821,764 ha. is ice-free land. The remaining 66,493 ha. is comprised of rivers, lakes, wetlands and glaciers. Urban or other land-altering development was not considered in the analysis.

A number of GIS analyses were undertaken to characterize the study area landscape. Variables that were believed to be important for predicting archaeological site locations were assessed in terms of their overall distribution in the southern Chilliwack Forest District. These analyses, taken together with the analysis of recorded archaeological sites (see below), helped to evaluate the discriminating power of the predictor variables. Data for the major modelling variables are discussed in the following sections.

4.1.1 Slope

Slope was considered a highly important variable, particularly for predicting habitation locations. Table 3 and Figure 3 show the distribution of various slope classes across the study area. These data illustrate the dominance of the Fraser River floodplain, as well as the steep, rugged nature of much of the remainder of the forest district.

Table 3 - Slope Classes in the Study Area

Slope	Area (ha.)	% of Study Land
0%-10%	114,360	13.9
11%-20%	64,250	7.8
21%-30%	74,406	9.0
31%-60%	273,552	33.2
61%-90%	199,988	24.4
>90%	96,312	11.7

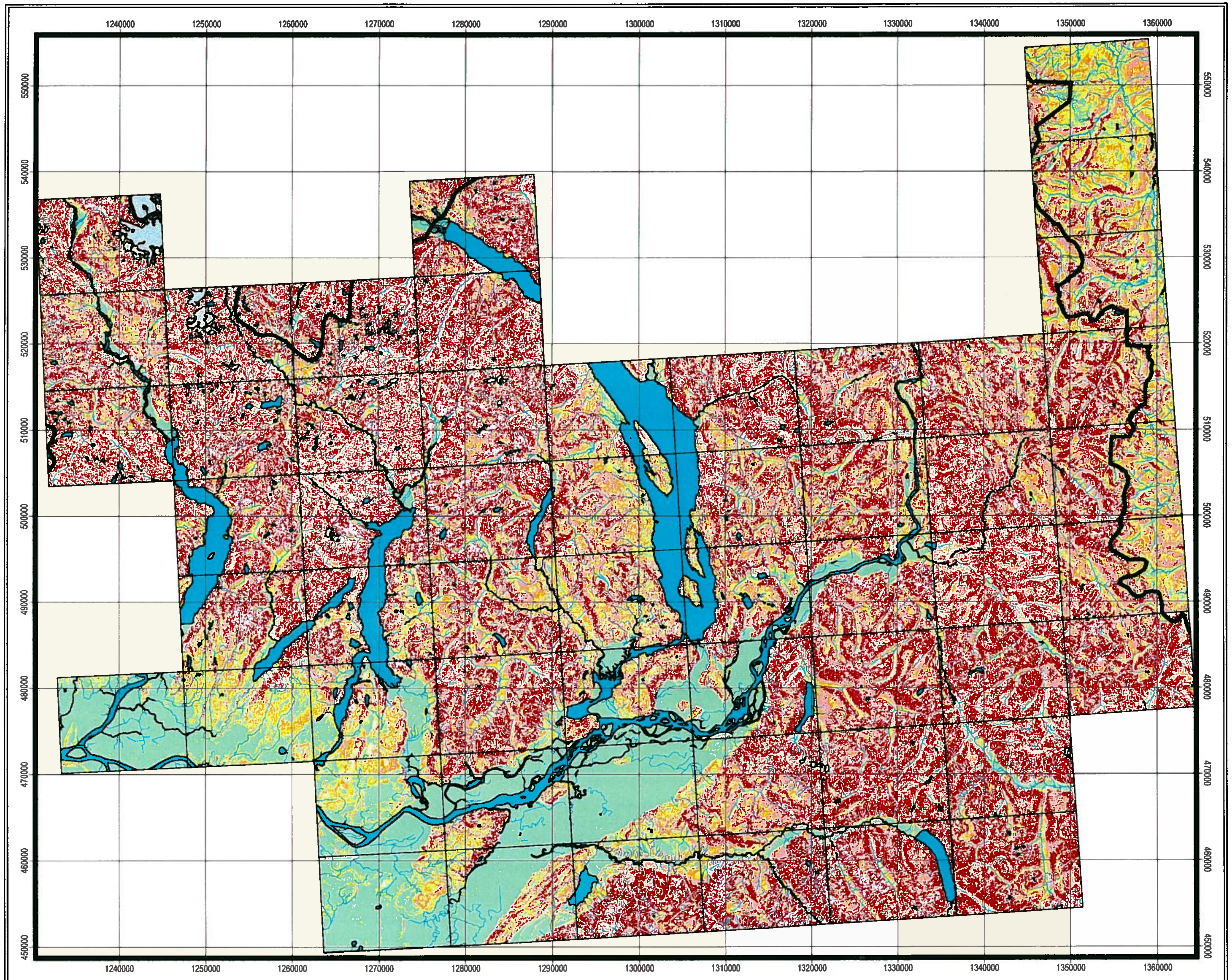
4.1.2 Elevation

Elevation was used to help define the subalpine zone for modelling campsite locations in high altitude parklands and for identifying a mid-slope zone that was excluded from the model. Table 4 and Figure 4 show the elevation ranges in the study area.

Table 4 - Elevation Ranges in the Study Area

Elevation (m asl)	Area (ha.)	% of Study Area
0-100	101,952	12.4
101-500	139,906	17.0
501-1000	205,610	25.0
1001-1500	261,734	31.8
1501-2000	110,124	13.4
>2000	3487	0.4

Figure 3: Slope Classes in the Study Area



TRIM Grid
MOF Boundaries
Definite Rivers
Rivers
Lakes
Glaciers

Slope (%)
0 - 10
11 - 20
21 - 30
31 - 60
61 - 90
> 90

N

10 0 10 20 Km

Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
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NAD83
TRIM basemap

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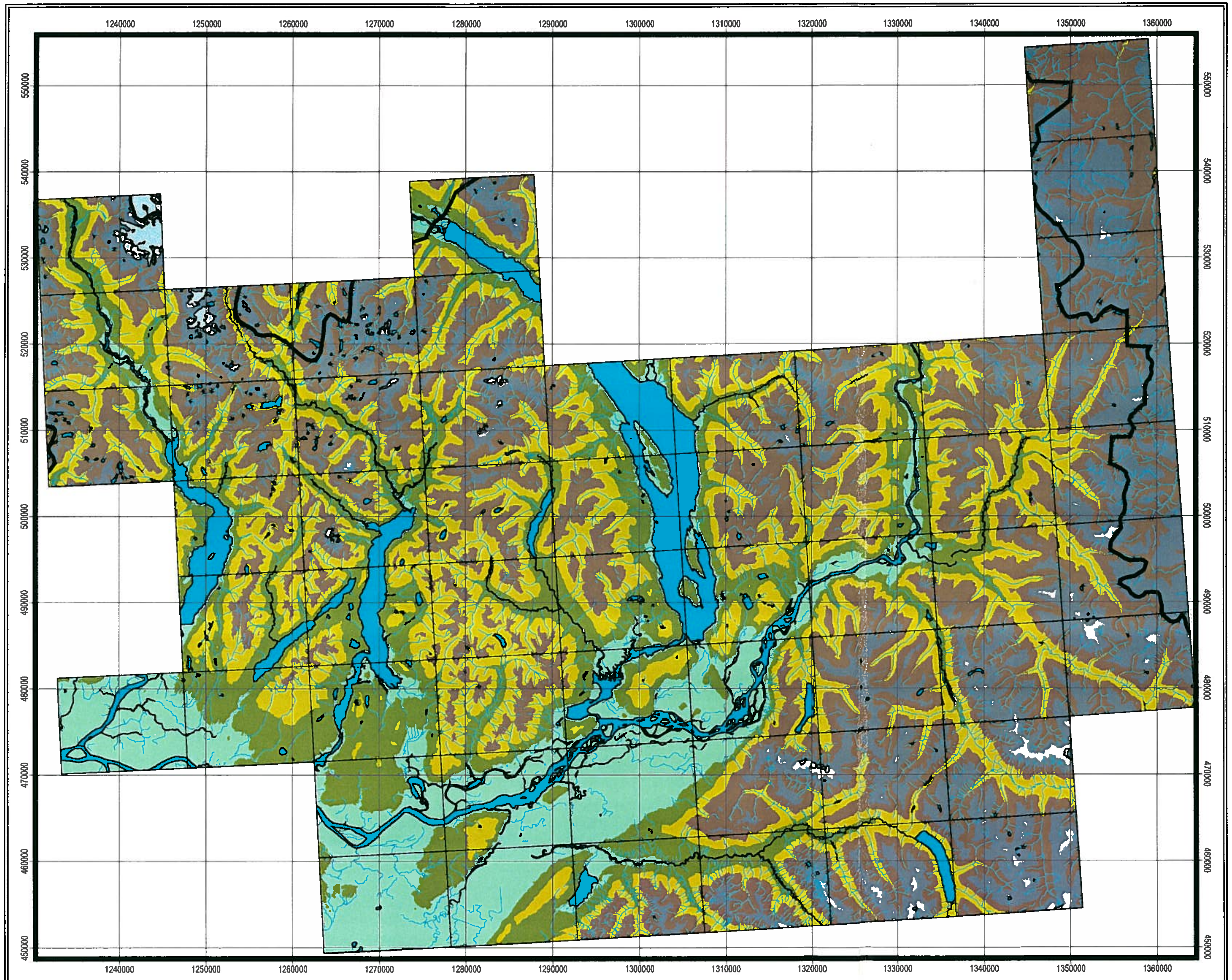
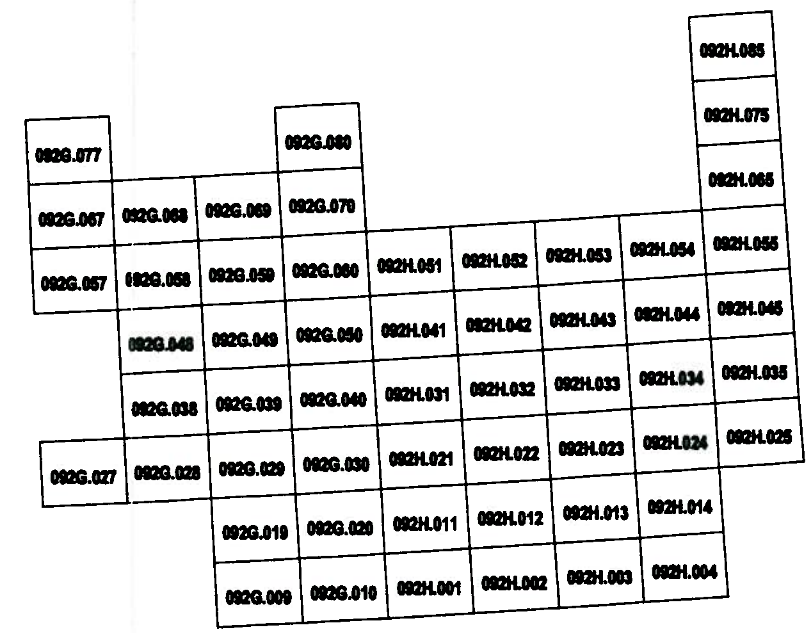
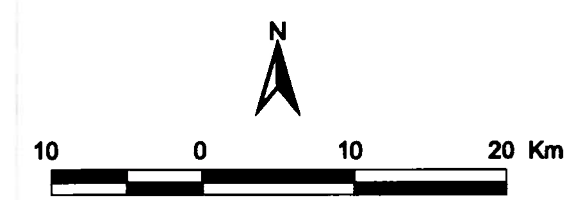
Figure 4: Elevation Classes in Study Area



TRIM Grid
MOF Boundaries
Definite Rivers
Rivers
Lakes
Glaciers

Elevation (m asl)
0 - 100
101-500
501-1000
1001-1500
1501-2000
> 2000





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Albers Projection
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TRIM basemap

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4.1.3 Distance to Fresh Water

Two categories of fresh water were considered in the analysis: rivers (consisting of major rivers and definite streams), and lakes. Major rivers (also defined as “two-line” rivers because both banks are indicated on the TRIM maps) are those with bank-to-bank widths of more than 20 metres. Lakes were defined as those 2 ha. in area or larger. Table 5 provides a breakdown of the amount of the study area within various distances to fresh water.

Table 5 - Distance to Nearest Fresh Water in the Study Area

Water Source	Distance	Area (ha.)	% of Study Area
Two Line River	100 m	13,132	1.6
	200 m	25,899	3.2
	350 m	44,588	5.4
	500 m	61,217	7.4
Definite River	100 m	119,455	14.5
	200 m	230,640	28.1
	350 m	377,859	46.0
	500 m	499,112	60.7
Lake	100 m	9,626	1.2
	200 m	20,719	2.5
	350 m	39,808	4.8
	500 m	61,168	7.4

4.1.4 Cedar Content

Although culturally modified trees were not modelled in this study, data were collected to facilitate future modelling. Presence of cedar was considered crucial to modelling bark-stripped and aboriginally logged CMTs, most of which are expected to be cedars. According to the forest cover data, 196,016 ha. of the study area (23.9 %) contains at least 1% red or yellow cedar, and 10,330 ha. (1.3 %) contains 50% or more cedar.

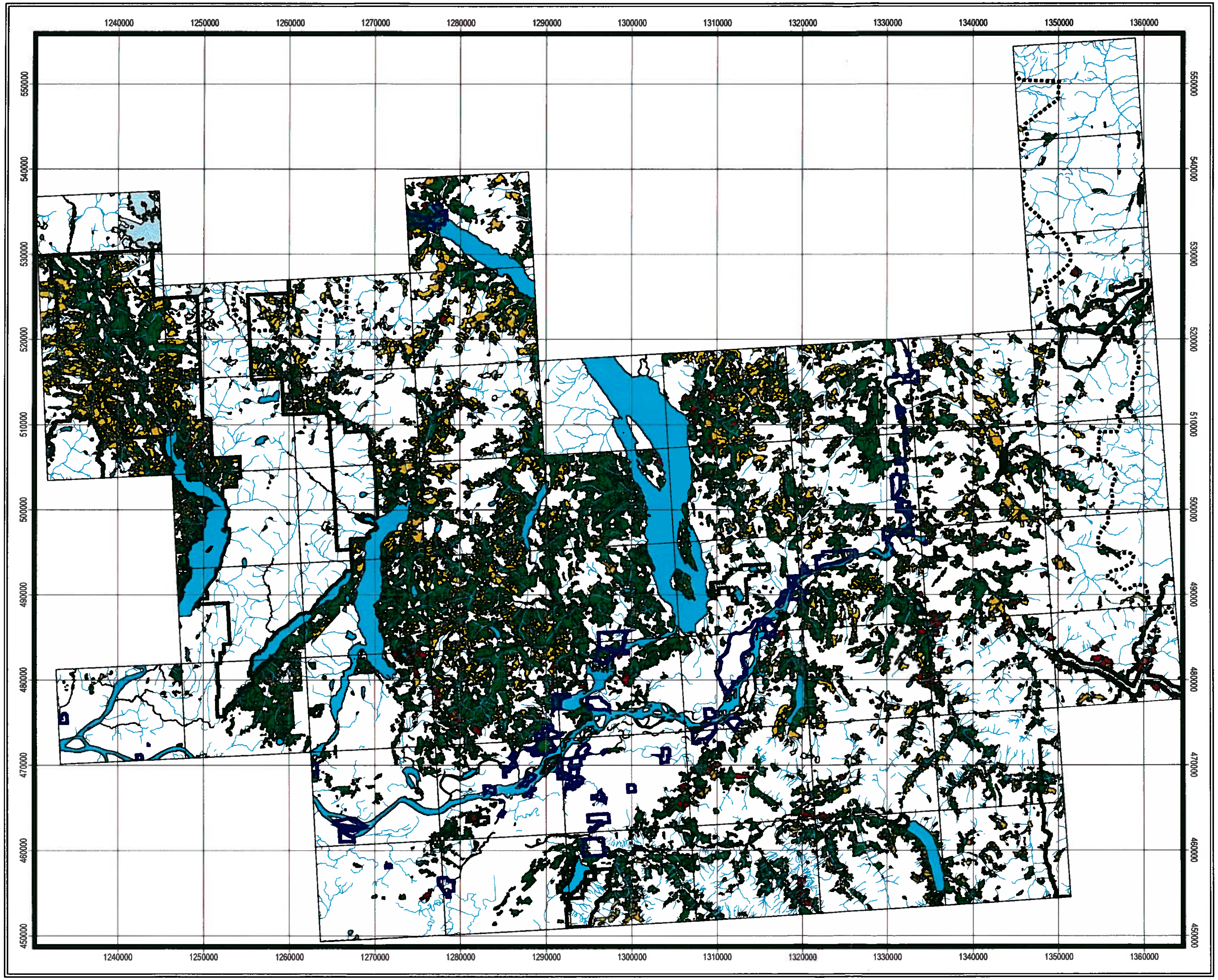
4.1.5 Age and Height Class

The age and height classes of forest stands are important for evaluating the relative probability of cedar CMTs being present. Most CMT models in B.C. have focused on age classes 8 and 9 (which together typically define old growth) because intact CMTs are most likely to be found in old growth. Height class is considered to be important primarily for excluding stunted stands that probably would not be valuable for bark or timber. Table 6 and Figure 5 show age and height class characteristics for cedar stands in the study area.

Table 6 - Age and Height Class Distribution for Cedar Stands in the Study Area

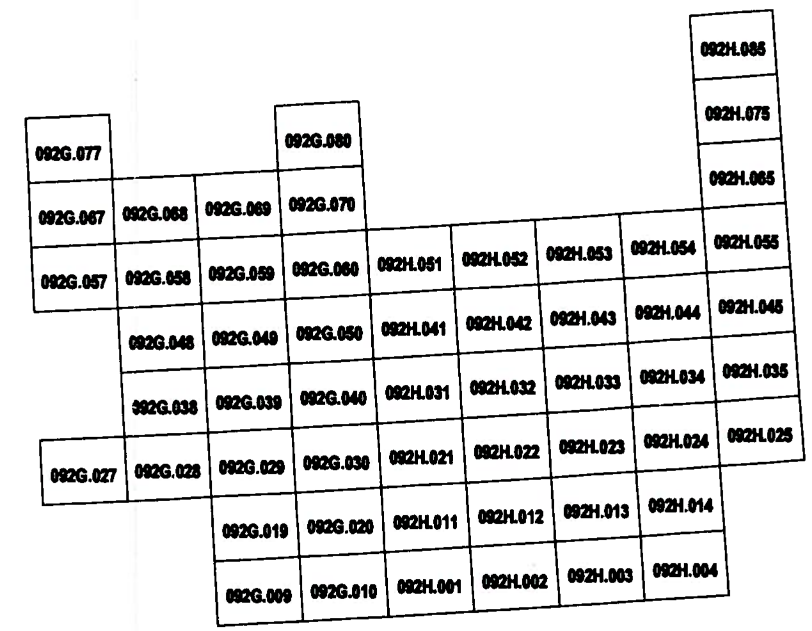
Stand Class	Area (ha.)	% of Study Area
Age Class 8+	77,873	9.5
Age Class 6+	85,407	10.4
Height Class 3+	114,348	13.9

Figure 5: Cedar Distribution



Trims75.shp
MOF Boundaries
BC Parks
Indian Reserves
Definite Rivers
Rivers
Lakes
Glaciers

Cedar Distribution
Cedar > 0 % & Age Class >= 8 & Height Class >= 3
Cedar > 0 % & Age Class >= 6 & Height Class >= 3
Cedar > 0 %



N

10 0 10 20 Km

Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

GIS1 e:\9921811\Aprs\deliver\cedardist.apr Layout: 11x17-L

5.0 GIS ANALYSIS OF RECORDED ARCHAEOLOGICAL SITES

GIS analysis of the spatial and terrain characteristics of recorded sites was used to help develop predictive models for estimating archaeological site potential. Only sites that could be checked for data accuracy were used in the GIS analyses. Sites with only post-contact components were also excluded from the analyses. Figure 6 shows all recorded sites in the study area, with those containing only post-contact deposits highlighted. Figure 7 shows all sites included in the analyses.

Slope, elevation, distance to nearest archaeological site and distance to nearest fresh water were determined for habitation, cultural material, and cultural modified tree sites. The following sections present the GIS analyses for each of the three site types.

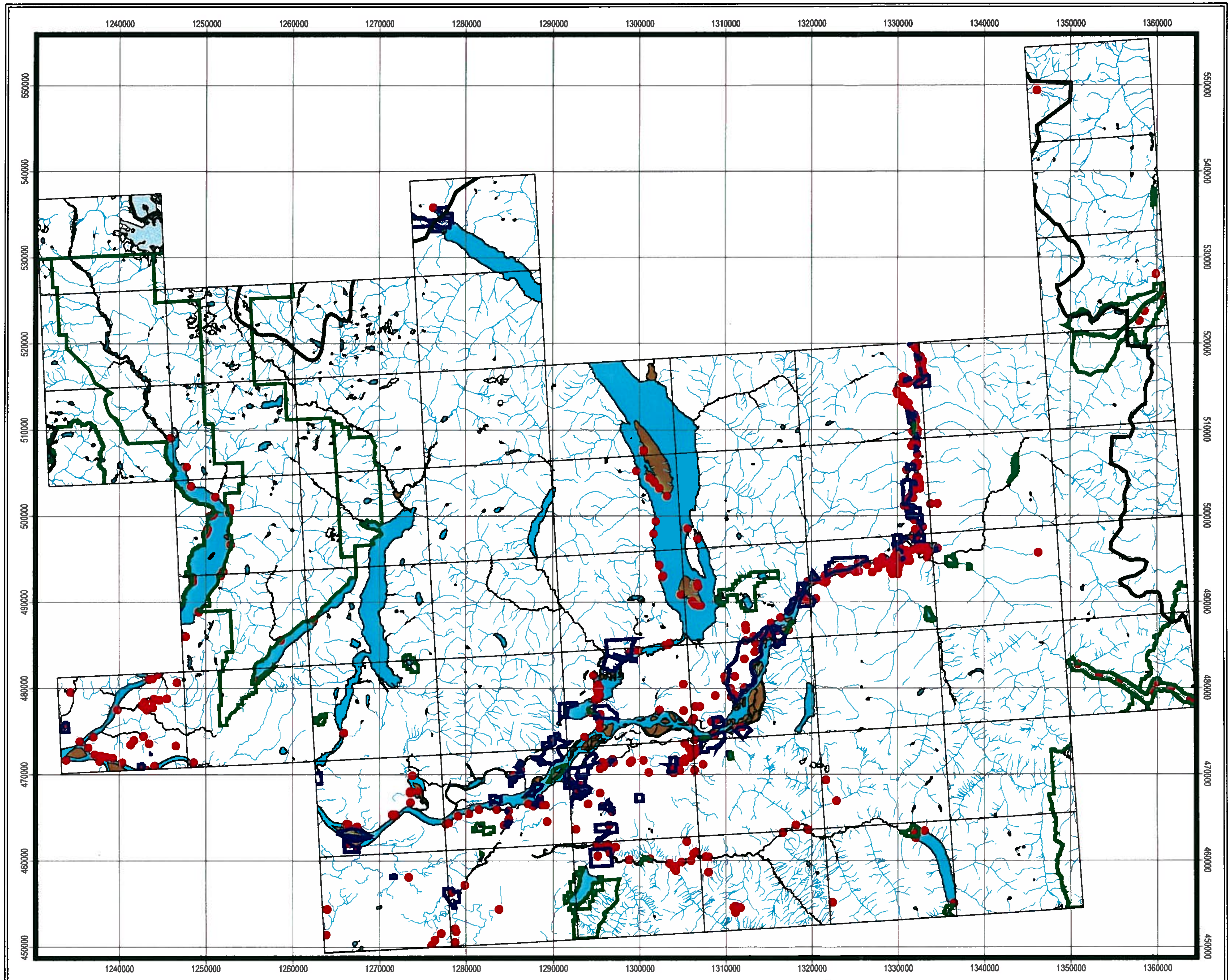
5.1 Cultural Material Sites

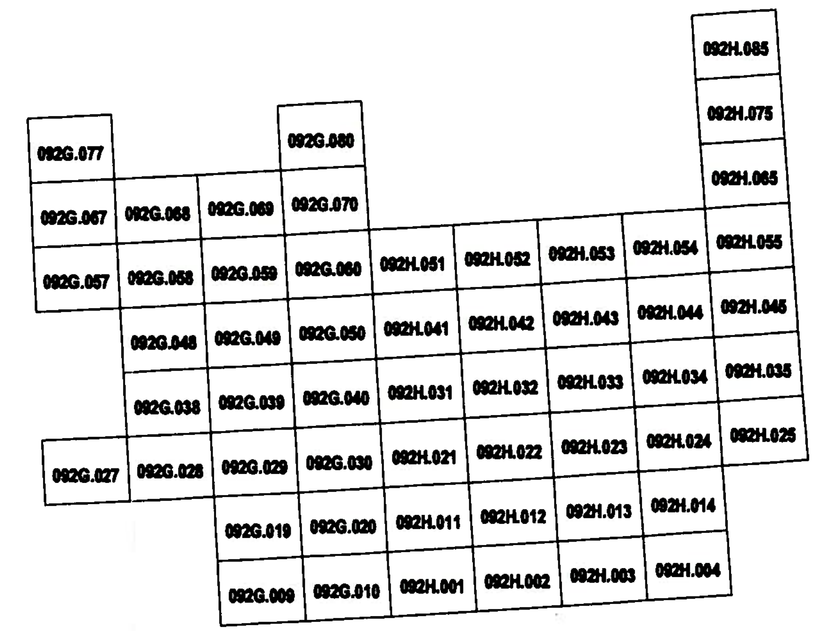
Figure 8 shows the distribution of the recorded cultural material sites in the study area. Dense concentrations of sites are notable along the banks of the Fraser River. Of the 290 recorded cultural material sites 276 (95%) are pre-contact and 212 (77%) of those were plotted with adequate accuracy for modelling.

5.1.1 Slope

Each pre-contact cultural material site was overlaid onto the slope grid to determined slope values. Two hundred and nine of the 212 locationally correct cultural material sites received values for slope. The remaining three sites were added after the site analysis had been completed. The slopes ranged from 0% to 150%, with a median of 15%. This analysis shows that 42% of recorded cultural material sites have slopes less than or equal to 10% and 73% have less than a 30% slope. Figure 9 shows the frequency of sites falling within ranges of slope values.

Figure 6: Distribution of Recorded Sites





N

10 0 10 20 Km

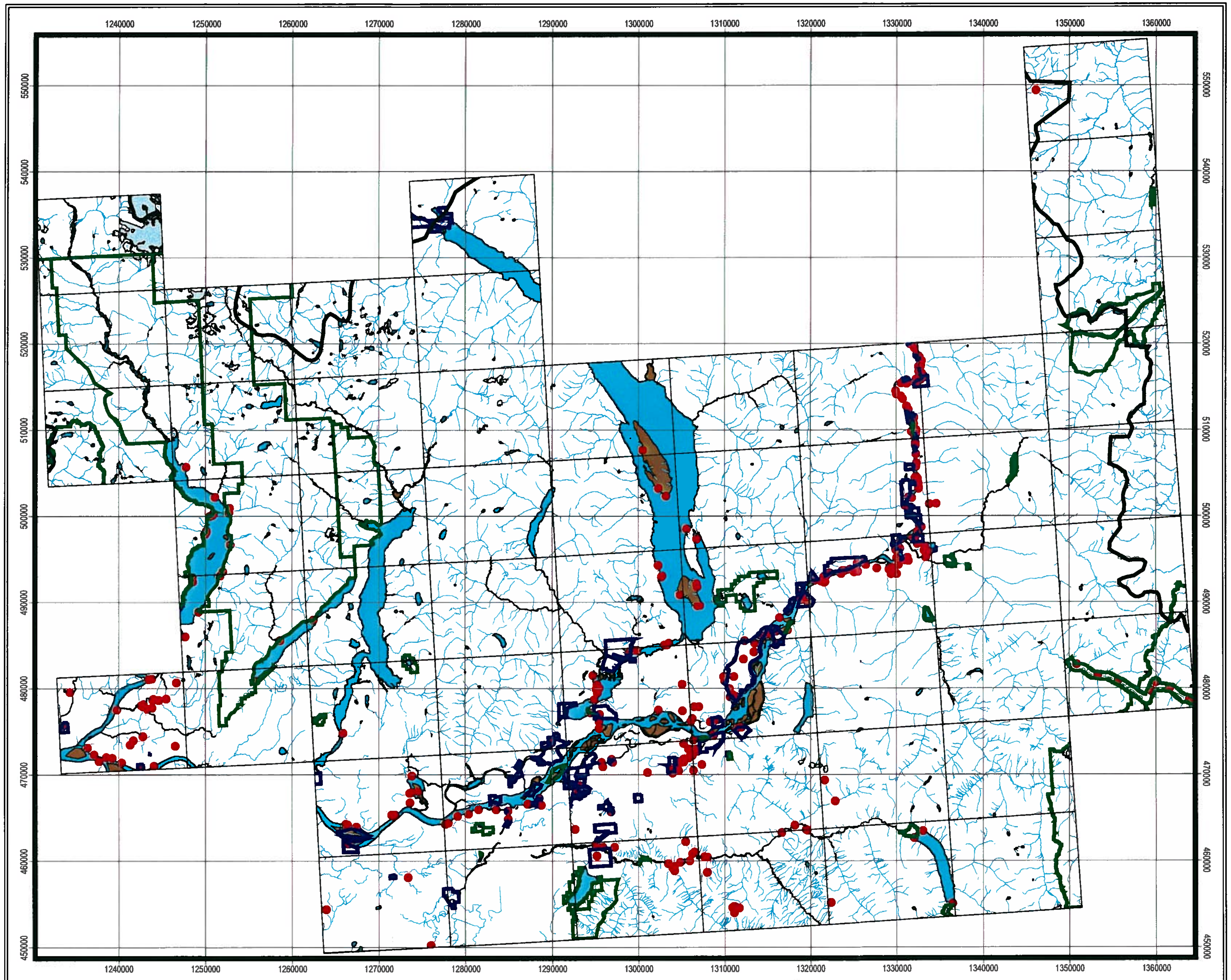
Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

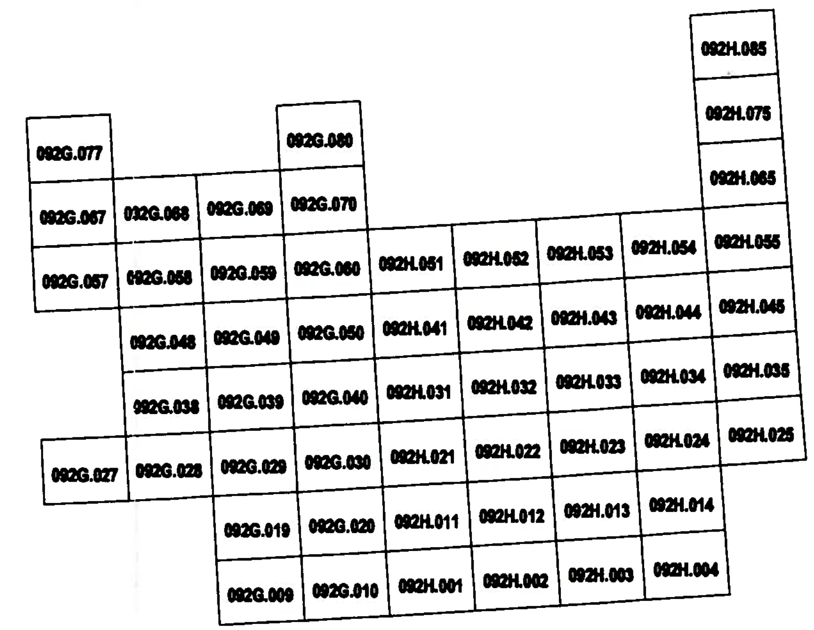
Golder Associates

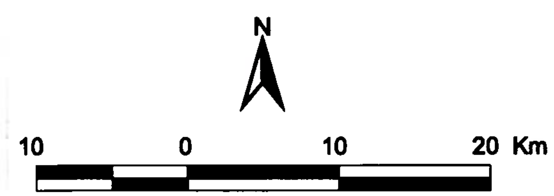
GIS1 e:\9921811\Aprs\deliver\allsites2.apr Layout: 11x17-L

Figure 7: Sites Used in GIS Analysis



Archaeological Sites
TRIM Grid
MOF Boundaries
BC Parks
Indian Reserves
Definite Rivers
Islands
Rivers
Lakes
Glaciers





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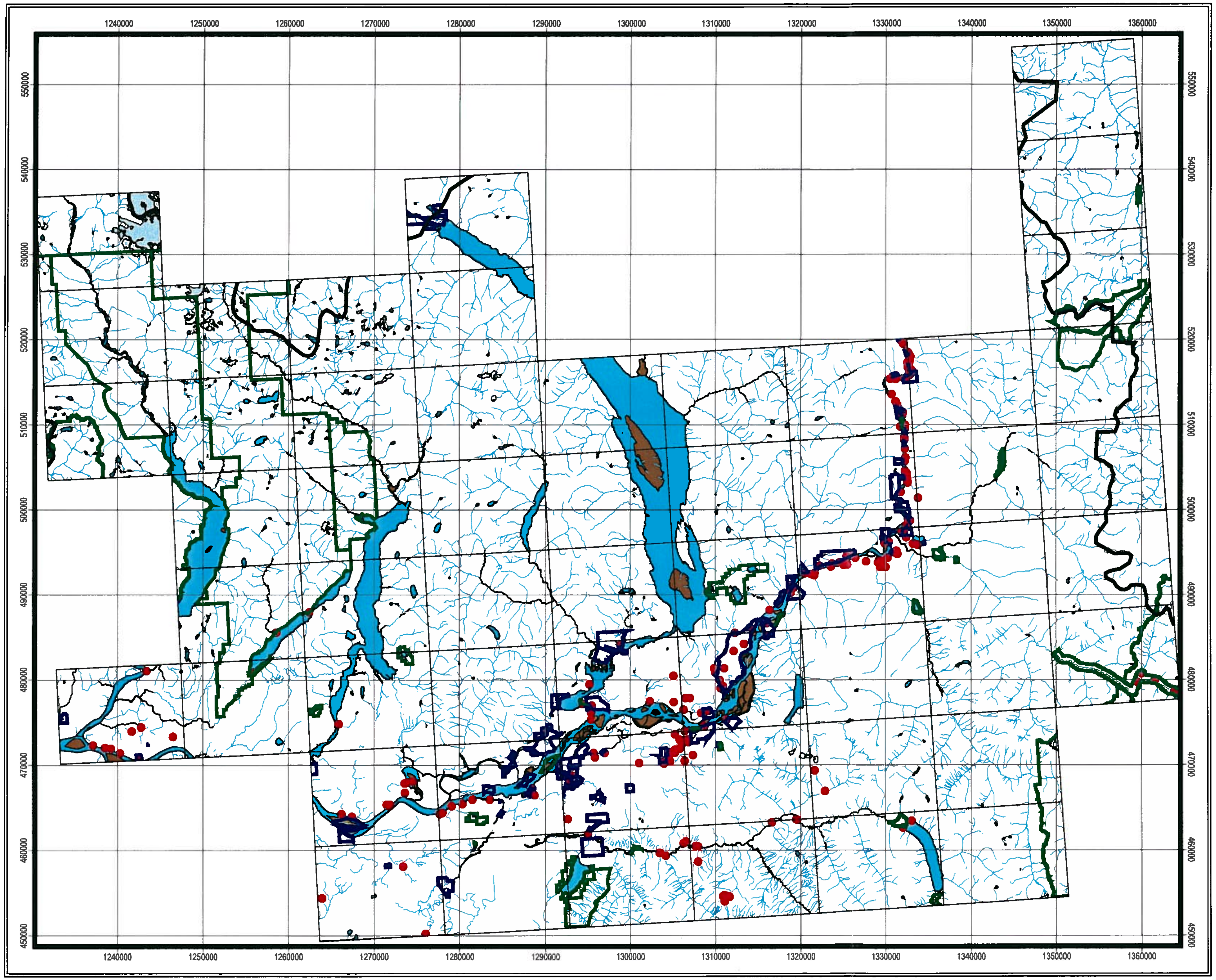
Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

GIS1 e:\9921811\Aprs\deliver\gisanalysis.apr Layout: 11x17-L

Figure 8: Distribution of Cultural Material Sites

- Archaeological Sites
- TRIM Grid
- MOF Boundaries
- BC Parks
- Indian Reserves
- Definite Rivers
- Islands
- Rivers
- Lakes
- Glaciers



GIS1 e:\9921811\Aprs\deliver\cultmat2.apr Layout: 11x17-L

N

10 0 10 20 Km

Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

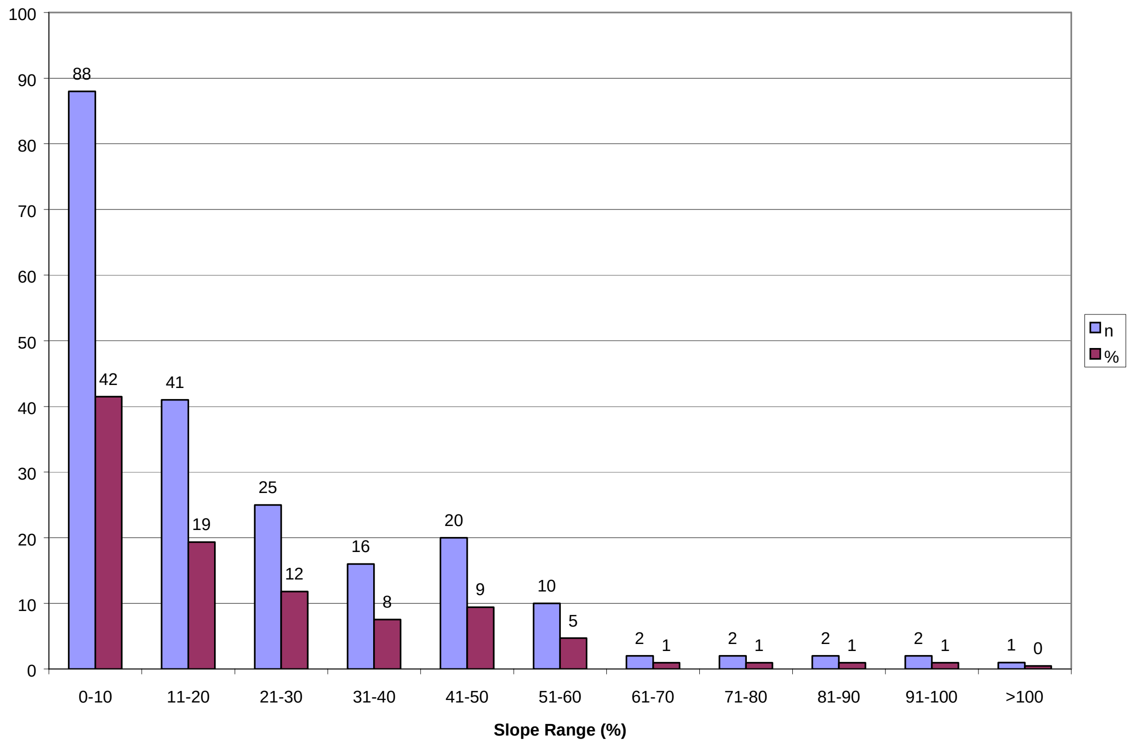


Figure 9 - Slope Ranges for Corrected Cultural Material Sites

5.1.2 Elevation

There is a very strong relationship between elevation and cultural material sites with 89% of the analyzed sites lying below 100 metres elevation (asl). The range of site elevations is from 2 metres to 1654 metres above sea level, with a median elevation of 39 metres. Figure 10 illustrates the elevation ranges of recorded pre-contact cultural material sites in the study area.

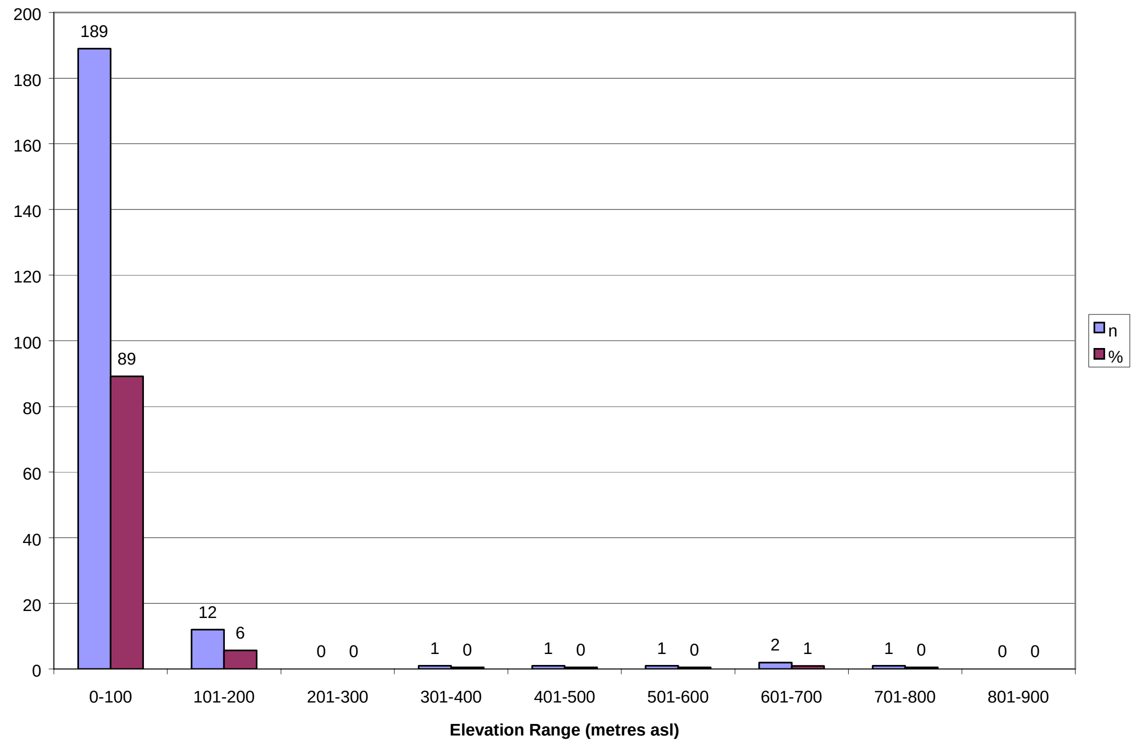


Figure 10 - Elevation Ranges for Corrected Cultural Material Sites

5.1.3 Distance to Fresh Water

A good correlation was indicated between pre-contact cultural material sites and distance to rivers, with 61% of analyzed sites falling within 100 metres of a river (two-line or definite) and 77% within 200 metres (Figure 11). Only 9% are more than 500 metres from a river. Figure 11 shows the number of sites falling within various distances from the nearest river.

Distance to the nearest lake showed a possible bimodal distribution (Figure 12). The distances from pre-contact cultural material sites to lake shorelines are much greater than the distances to rivers. This is almost certainly a reflection of limited archaeological inventory of lake shores in the study area. There are more analyzed sites (37%) greater than 2 km from a lakeshore than there are within 1 km (31%) of a lake.

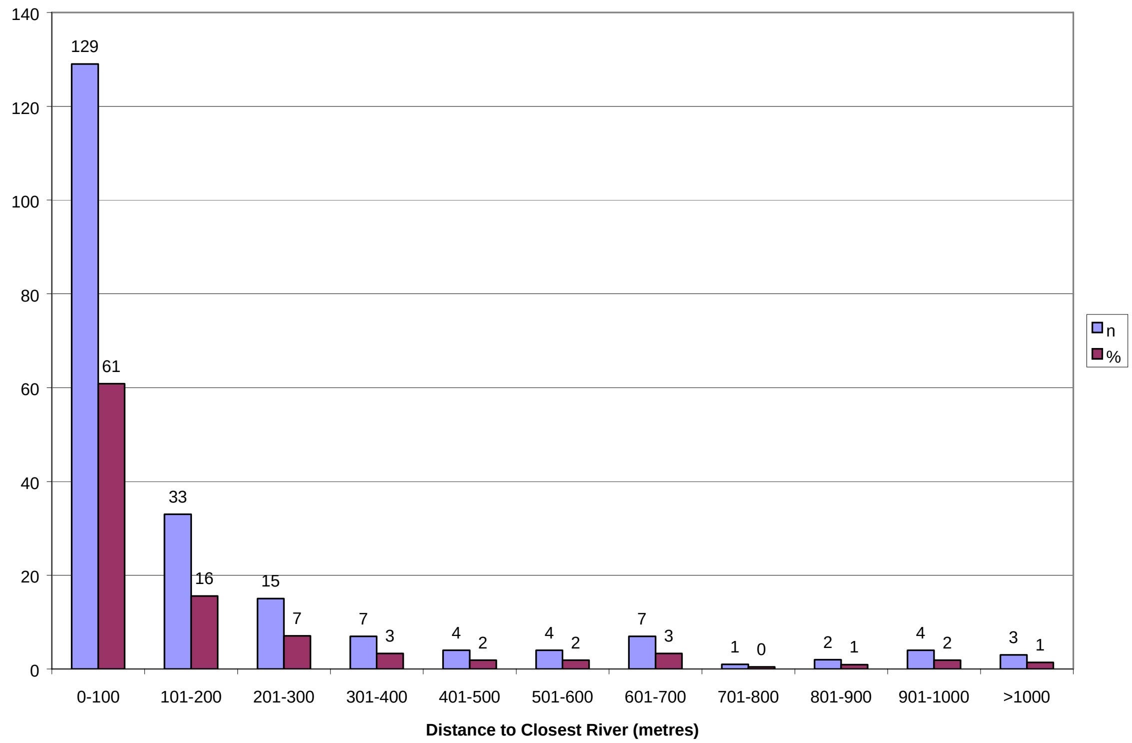


Figure 11 - Distance from Corrected Cultural Material Site to Nearest River

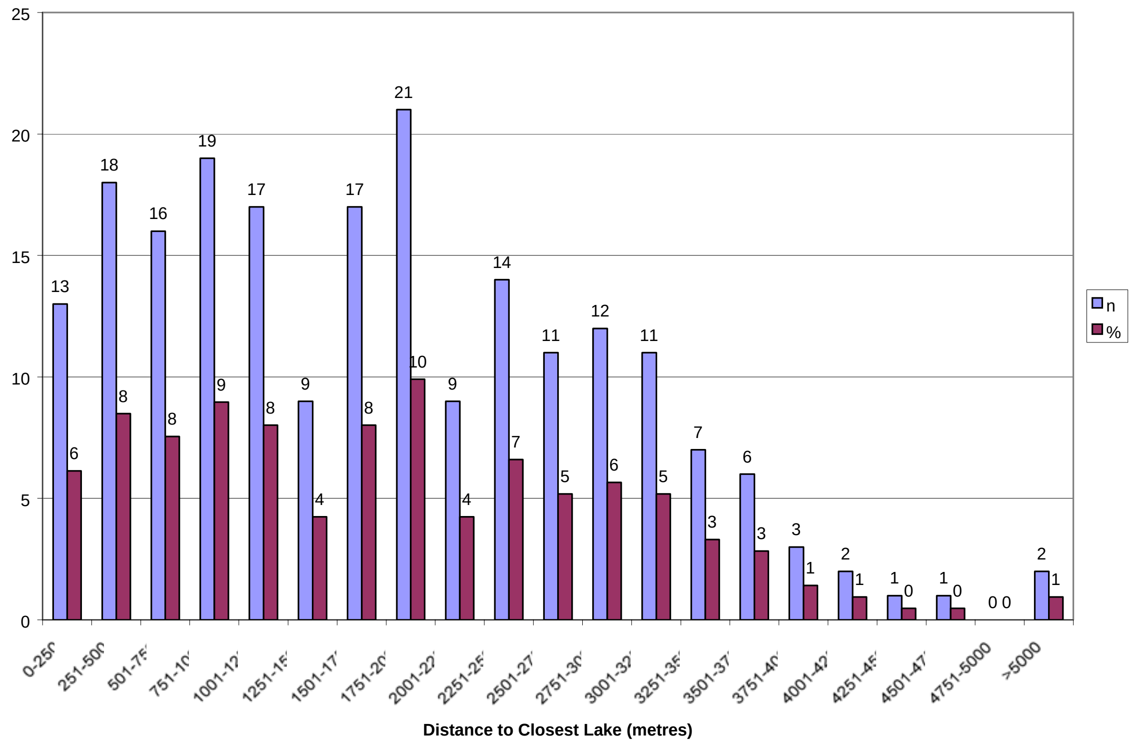


Figure 12 - Distance from Corrected Cultural Material Site to Nearest Lake

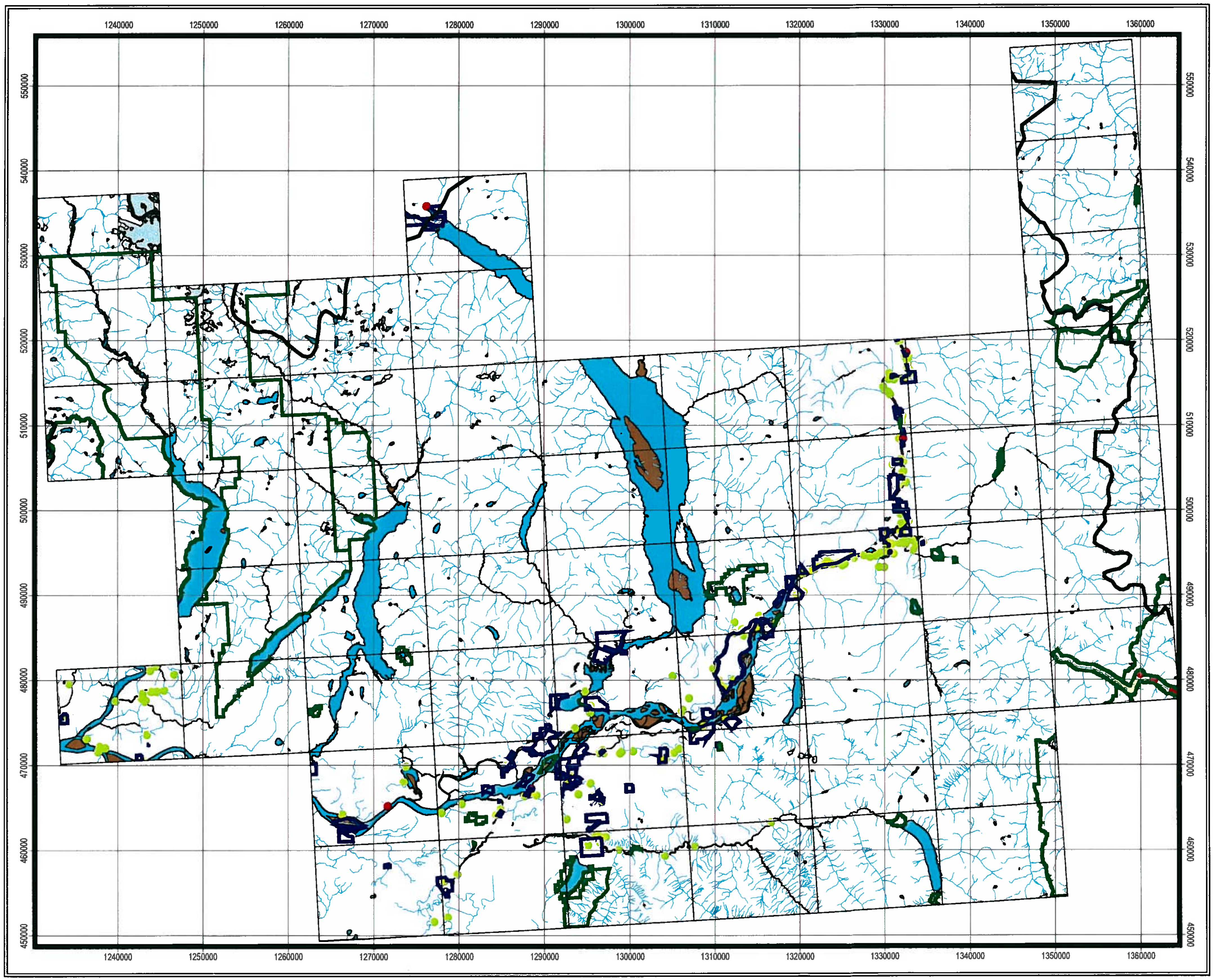
5.2 Habitation Sites

Figure 13 shows the distribution of the recorded habitation sites in the study area. Dense concentrations of sites are notable along the banks of the Fraser River. Throughout the area, sites are strongly correlated with flat landforms near water resources. One hundred and eighty-six (n=186), or 95% of the habitation sites have pre-contact components. Of those, 120 have been checked for locational accuracy and were used in the GIS analysis. This represents 65% of the recorded precontact habitation sites in the study area.

5.2.1 Slope

The slope of each pre-contact habitation site was determined from the GIS grid values, and frequencies were calculated for slope ranges. Slopes ranged from 1% to 150%, with a median of 14%. According to the DEM grid values, 41% of recorded habitation sites have slopes of less than 10%, and 79% are less than 30% slope. Figure 14 shows the frequency of sites falling within ranges of slope values. Extremely high slope values may indicate a lack of resolution in the DEM data, rather than actual site gradients.

Figure 13:
Distribution of Recorded Habitation Sites



- Historic Only Habitation Sites
- Recorded Habitation Sites
- TRIM Grid
- MOF Boundaries
- BC Parks
- Indian Reserves
- Definite Rivers
- Islands
- Rivers
- Lakes
- Glaciers

N

10 0 10 20 Km

Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

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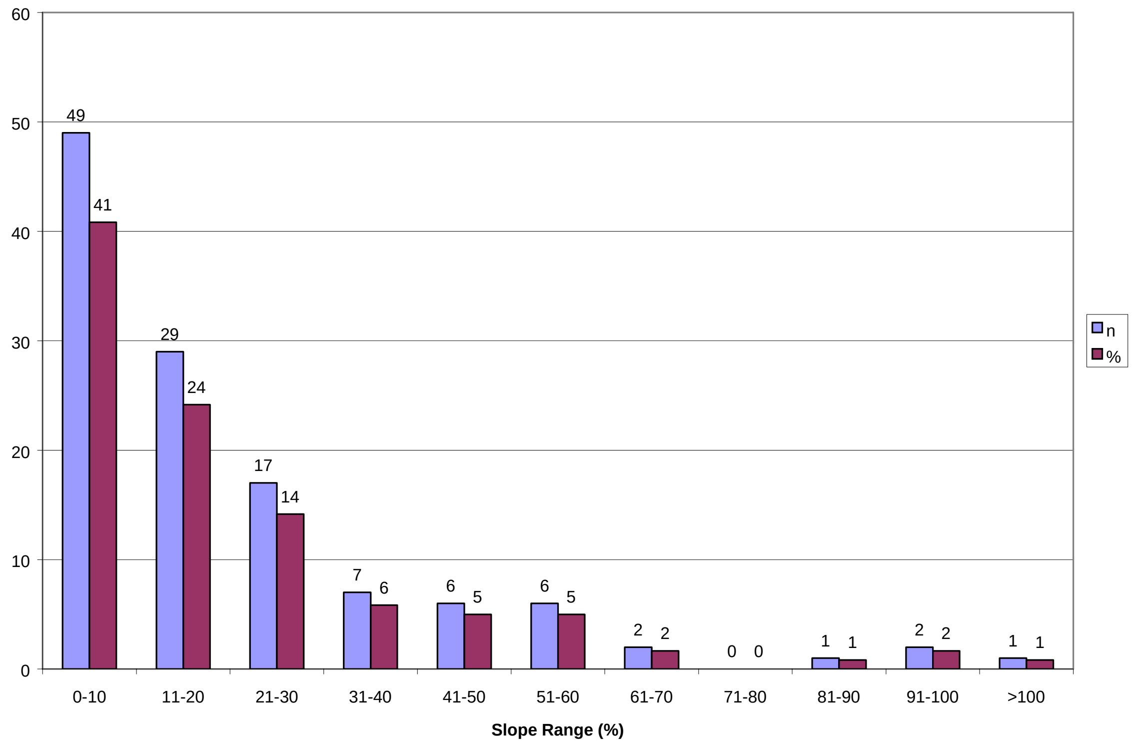


Figure 14 - Slope Ranges for Recorded Habitation Sites

5.2.2 Elevation

The relationship between elevation and recorded pre-contact habitation sites was also explored. Habitation sites have been recorded between 1 metre and 722 metres above sea level, with a median elevation of 36 metres asl. Breaking down the elevations into 100 metre classes shows that 92% of recorded pre-contact habitations lie between 0 metres and 100 metres above sea level. Figure 15 illustrates the elevation ranges of recorded habitation sites in the study area.

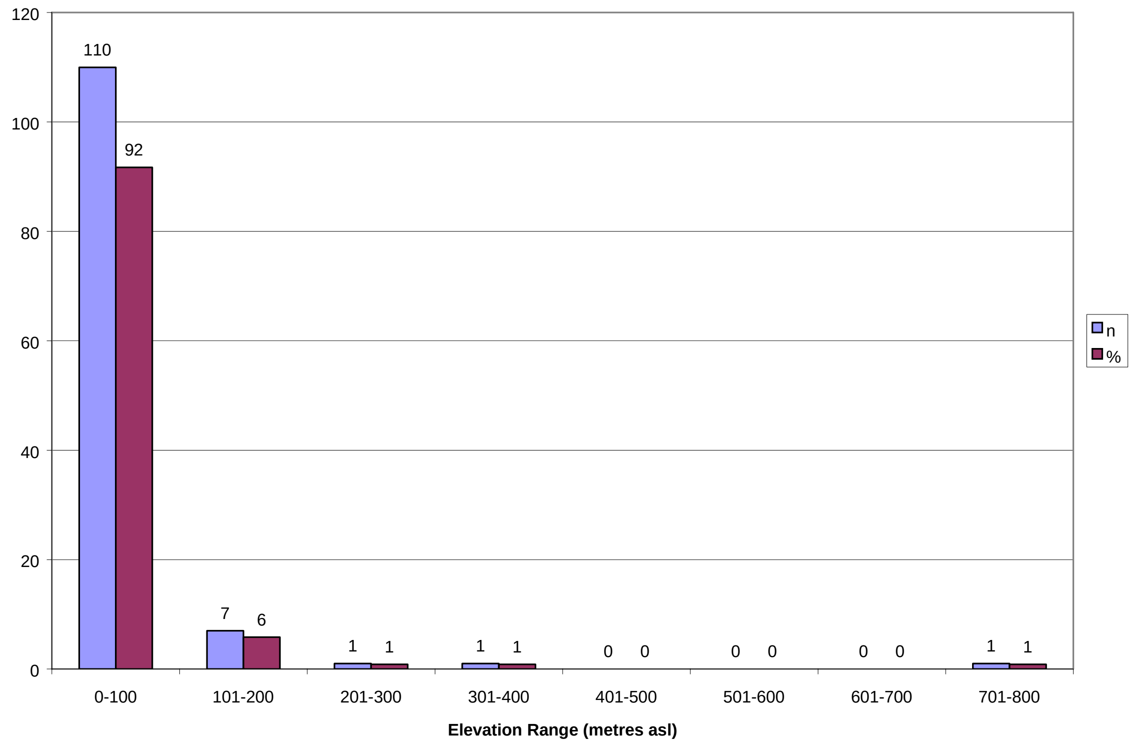


Figure 15 - Elevation Ranges for Recorded Habitation Sites

5.2.3 Distance to Fresh Water

Distance to the nearest river or lake was also calculated for each recorded site. A strong correlation was indicated between pre-contact habitation sites and rivers, with 71% of recorded sites falling within 100 metres of a river and 84% within 200. Only 4% are more than 500 metres from a river, and it is possible that extinct or seasonal water sources were present for those sites. Alternatively, the water source may not have been coded on the TRIM base map. Figure 16 shows the number of sites falling within various distances from the nearest river.

Distance to the nearest lake showed a different pattern (Figure 17). Recorded pre-contact habitation sites do not display a correlation with lakes, although this is probably a reflection of limited archaeological inventory of lake shores in the study area. Of the 120 habitation sites used in this analysis, only 24% are within 1 km of a lake, while 44% are more than 2 km away from the nearest lake. Seasonal camp sites are expected to exist along lake shores in the study area.

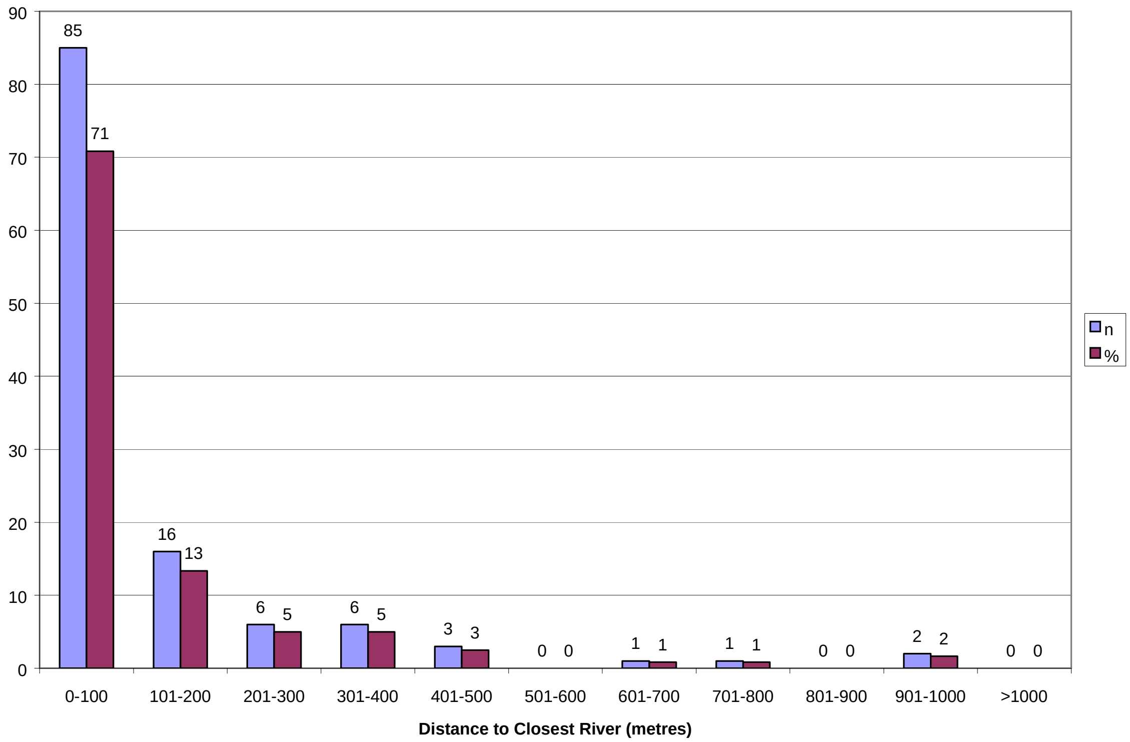


Figure 16 - Distance from Recorded Habitation Site to Nearest River

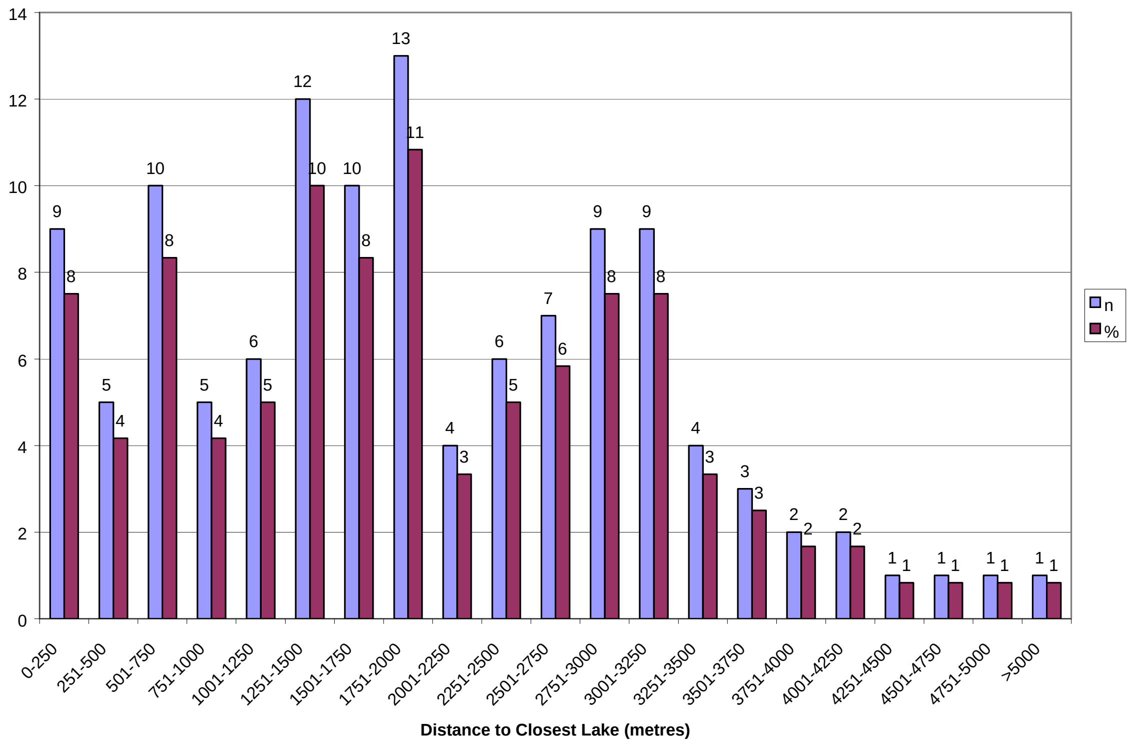


Figure 17 - Distance from Recorded Habitation Site to Nearest Lake

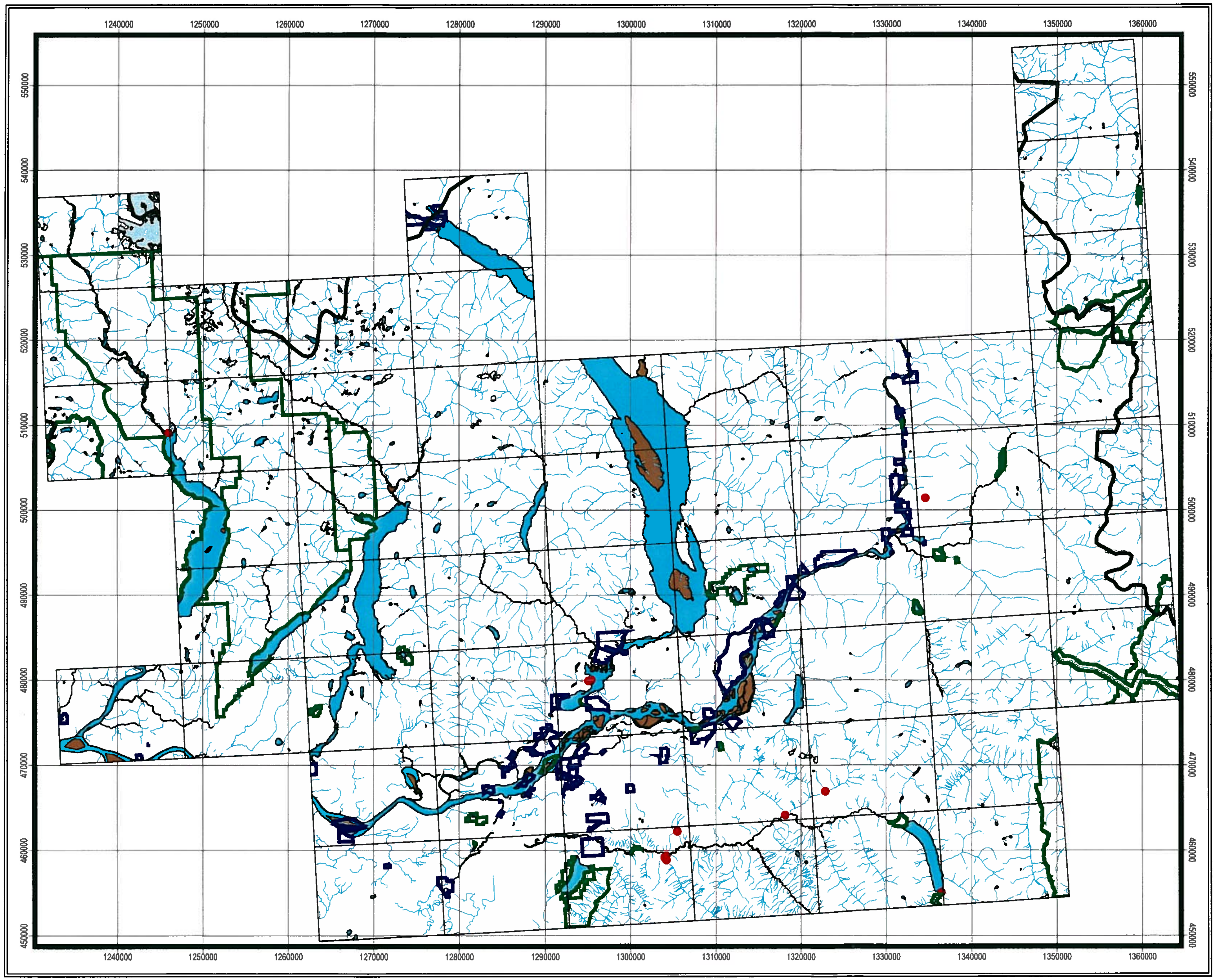
5.3 CMT Sites

Only 11 CMT sites have been recorded in the study area, most of which are along the Chilliwack River system (Figure 18). Only 10 of the CMT sites were checked for locational accuracy but, due to the small overall sample size, all 11 were used in the analysis.

5.3.1 Slope

No strong correlation was noted between slope and CMT locations, although there is a general trend of decreasing frequency with increasing slope (Figure 19). The lowest slope value for a recorded CMT site was 2% (nearly flat), and the highest is 79%.

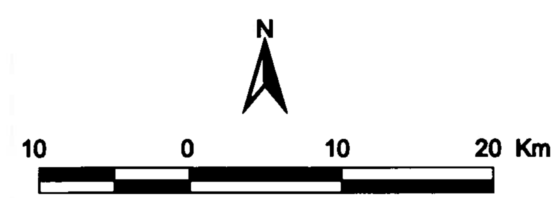
The greatest proportion (36%) of CMT sites has been recorded on moderately sloping terrain (11%-20% slope), with 27% occurring on flatter ground. Due to the small sample size, it is difficult to determine whether a correlation between slope and CMTs exists.



GIS1 e:\9921811\Aprs\deliver\cmt2.apr Layout: 11x17-L

Figure 18: Distribution of Recorded CMT Sites

- Archaeological Sites
- TRIM Grid
- MOF Boundaries
- BC Parks
- Indian Reserves
- Definite Rivers
- Islands
- Rivers
- Lakes
- Glaciers



Scale - 1:500,000

Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

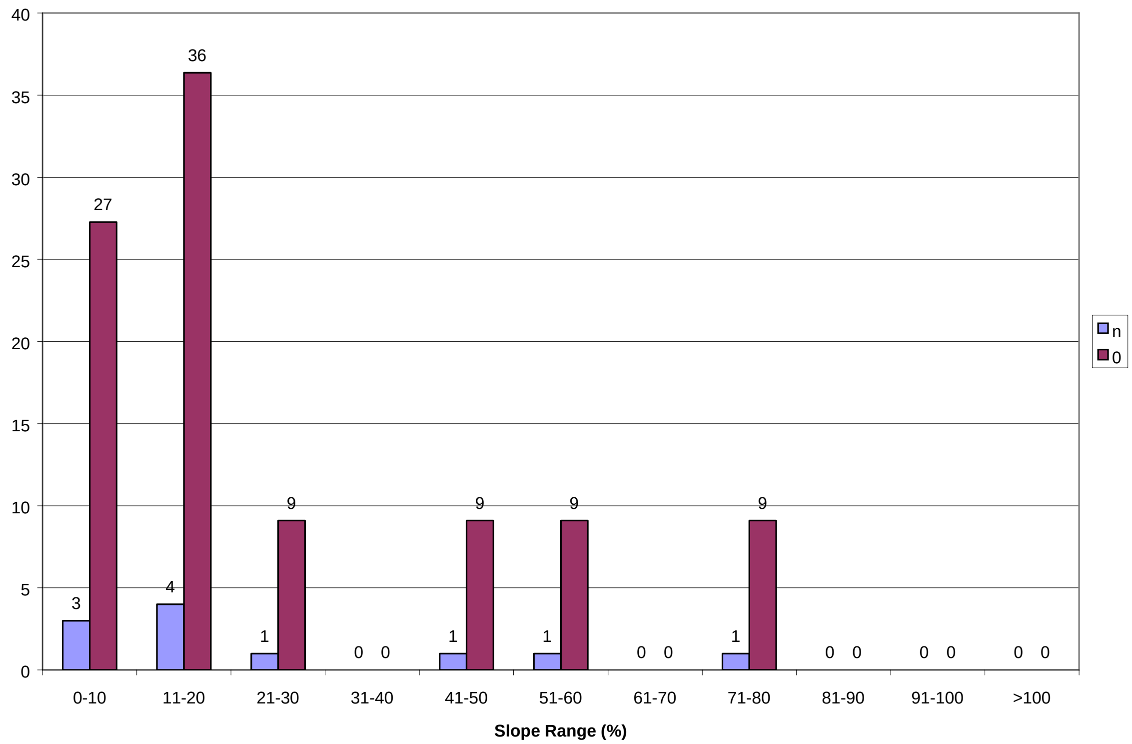


Figure 19. Slope Ranges for Recorded CMT Sites

5.3.2 Distance to Fresh Water

Recorded CMTs in the study area tend to occur along drainages but not necessarily immediately adjacent to the waterway. Thirty-six percent of the recorded CMT sites are within 100 metres of a river (Figure 20), while only nine percent are recorded within 100 metres of a lake (Figure 21). Conversely, 73% of recorded CMT sites are located more than 1000 m from the nearest lake, and 9 % of CMT sites are located more than 1000 metres from the nearest river. The minimum distance to the nearest river is 4.7 metres, and the maximum is almost 1200 metres with a median distance of 102 metres. For lakes, the minimum distance is 10.9 metres, with the maximum reaching approximately 4287 metres and a median distance of 1705 metres.

This distribution indicates that CMTs may occur in varying frequencies almost anywhere on the landscape, making them a difficult site type to model. Again, the small sample size precludes confident interpretation on the basis of present study area. Comparison with other regions would be necessary for modelling CMTs.

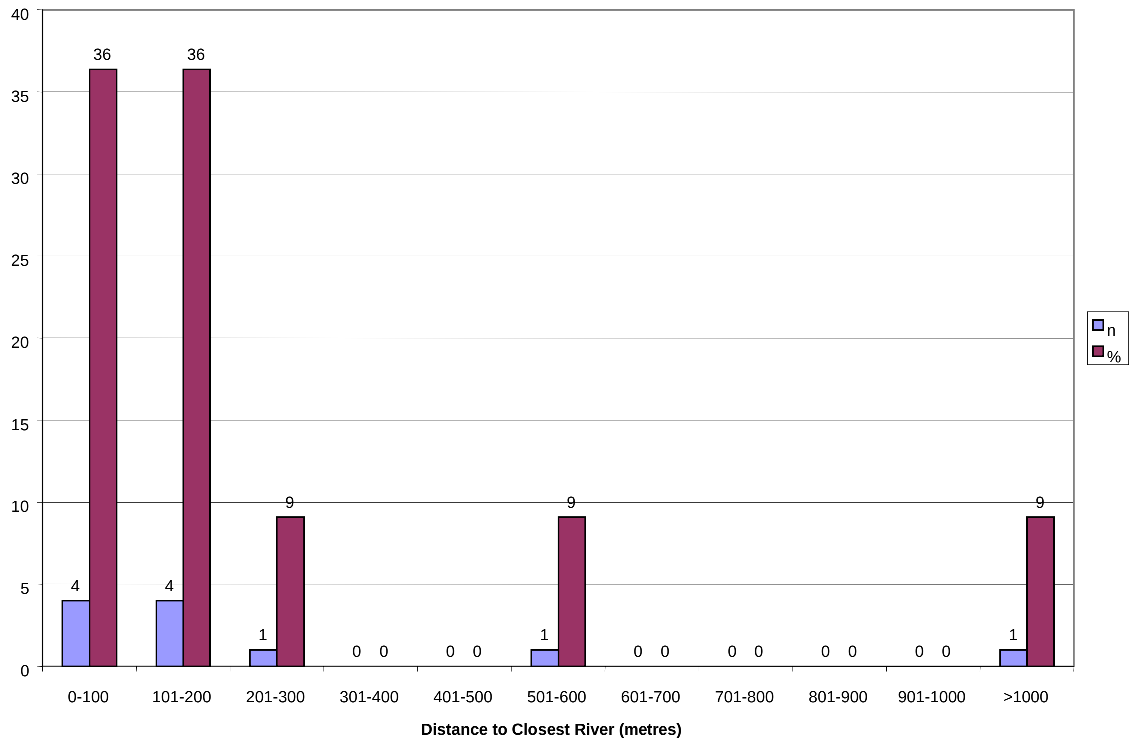


Figure 20 - Distance from Recorded CMT Site to Nearest River

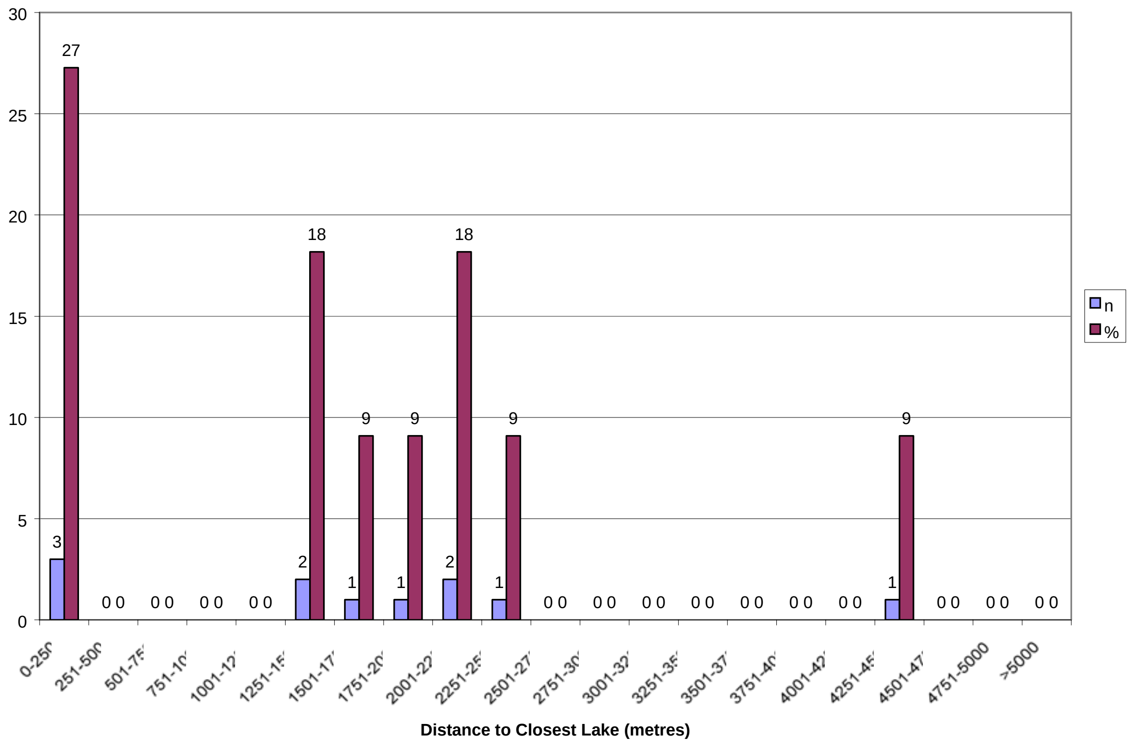


Figure 21 - Distance from Recorded CMT Site to Nearest Lake

5.3.3 Elevation

Recorded CMT sites span a range of elevations, with a notable peak between 0 and 100 metres a.s.l. (Figure 22). As with the slope and distance to water data, the elevation ranges may be more a reflection of current timber harvesting areas (and by extension, locations of archaeological impact assessments) or the small sample size, than a true representation of the elevation range of culturally modified tree sites.

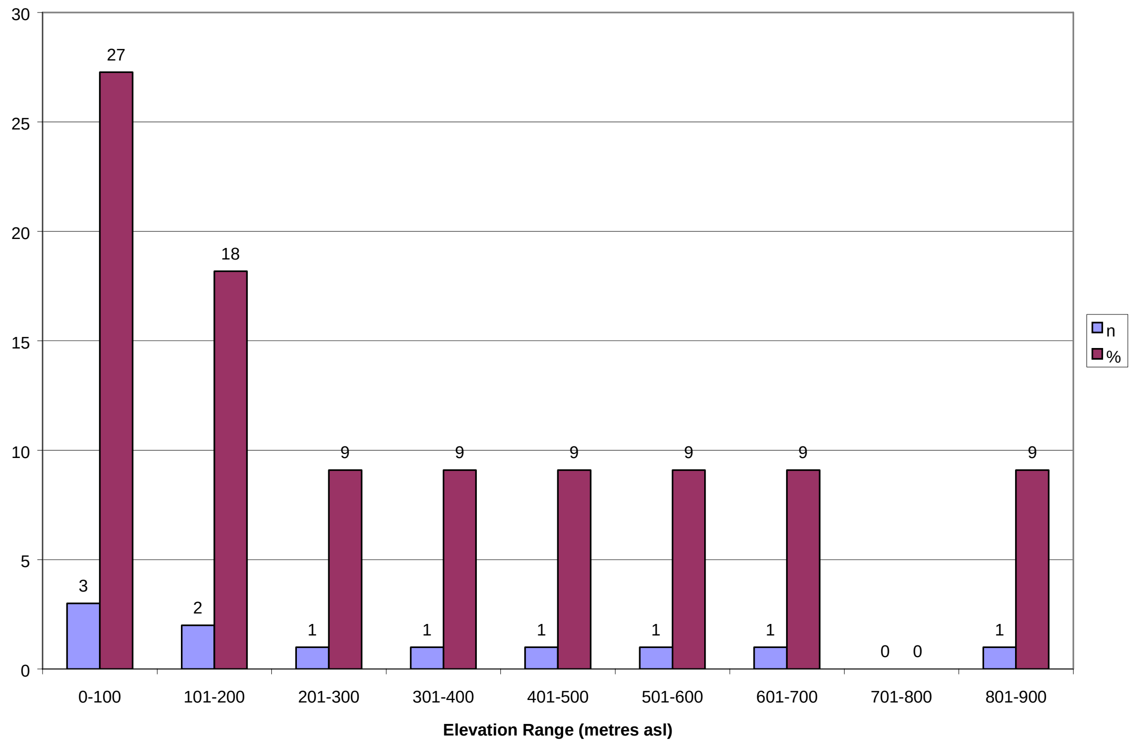


Figure 22 - Elevation Ranges for Recorded CMT Sites

Forest Cover

Only three of the eleven CMT sites fell in stands reported to have any cedar content, according to the forestry data. This is consistent with results found in other study areas. It is possible that cedar had been selectively harvested from the stands, and that some veterans remain. Alternatively, the percentage of cedar in the stand may have been too small to be reported when the forestry classification was made. The resolution of the forestry data does not adequately meet that required for CMT modelling. Figure 23 shows the distribution of recorded CMT sites plotted against cedar composition.

As described earlier, age and height class information is used to identify old growth stands. Of the eleven recorded CMT sites in the study area seven have age and height data. Table 7 shows the distribution of age and height classes for the CMT sites.

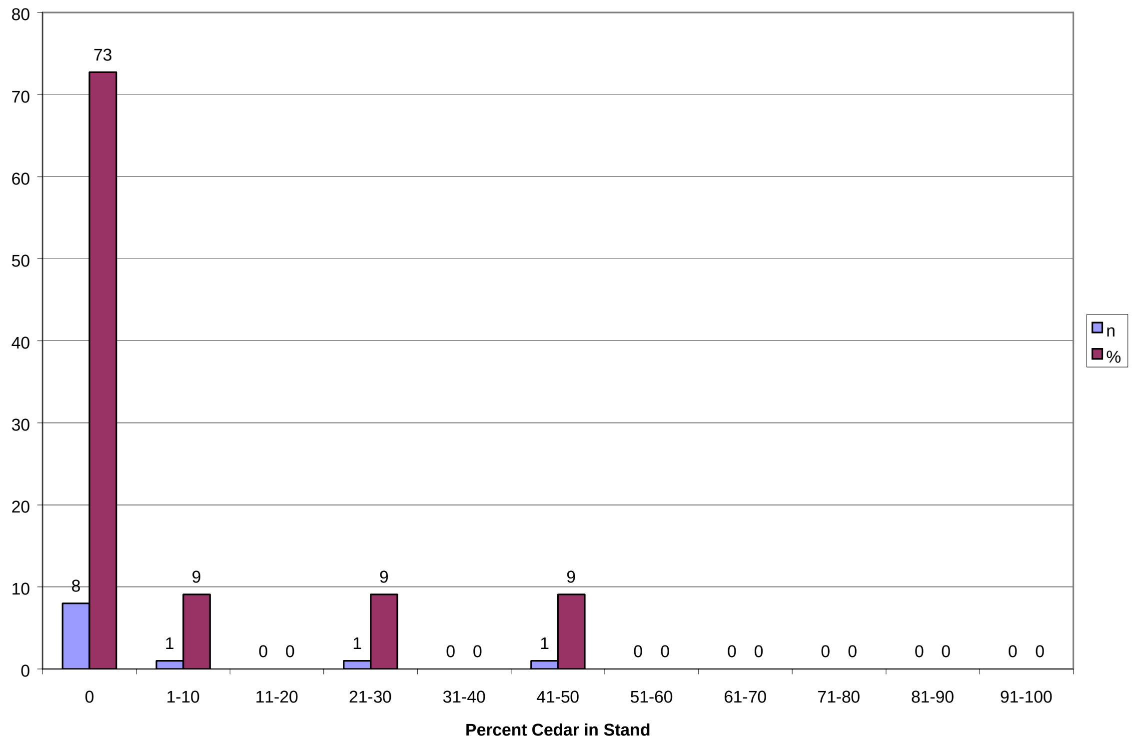


Figure 23 - Cedar Composition Ranges for Recorded CMT Sites

Table 7 - Age and Height Class Distribution for CMT Sites in the Study Area

Stand Class	Number of Sites	%
Age Class 8+	3	27
Age Class 6+	5	45
Height Class 3+	7	64

6.0 MODELLING VARIABLES

Terrain variables are important in predictive modelling because certain types of archaeological sites tend to correspond with specific landscape features. For example, village sites are typically (although not always) found on flat, well-drained, sandy terraces above major rivers. Most of the variables were selected primarily on the basis of the distribution of recorded sites and the collective expertise of the study team which has considerable knowledge of the study area. Since there was no literature review component to the study, specific ethnographic information was not used in identifying/defining the variables. The terrain variables that were used in modelling are briefly defined below.

6.1 Slope

For the purposes of this study, slope was defined as surface gradient, in percent, measured as (rise/run) x 100. For example, a rise of 100 metres over a horizontal distance of 1000 metres represents a slope of 10%, (100/1000) x 100.

6.2 Elevation

Elevation is defined as the height in metres above sea level. The study team decided to exclude model results from the mid-elevation hillsides due to a very low probability of site potential in these areas. Model results that fell between 600 and 1200 metres in elevation and were not within 100 metres of a two-line or definite river, or a lake or a were excluded.

6.3 Distance to Fresh Water

Distance to fresh water was measured as simple horizontal distance to a lake, two-line river or definite river, as defined in the TRIM data. Effective distance (accounting for terrain) was not calculated. Indefinite and intermittent rivers were excluded from the model, due to the uncertainty of the data.

6.4 Aspect and Distance to Other Archaeological Sites

The aspect and proximity to the next nearest archaeological site were calculated for each recorded site. However, due to a lack of obvious patterning, these variables were dropped from the analysis.

6.5 River and Lake Confluences

Buffers of 100 to 200 metres were defined around confluences between 1) definite rivers with the Fraser River or other two-line rivers, 2) definite or rivers with lakes, and 3) two-line rivers with the Fraser River. Of the locationally corrected sites 15% of pre-contact habitation sites and 13% of cultural material sites were within the buffers of these confluences. Twenty-seven percent of CMT site polygons also fell within these confluence buffers.

6.6 Subalpine

A subalpine zone was defined using forest cover and biogeoclimatic data. The parameters defining this zone were determined in consultation with specialist from the Ministry of Forests and the Ministry of the Environment (see Section 4.1).

7.0 PREDICTIVE MODELS

Following an analysis of several terrain variables, the study team selected a small number of criteria to develop a predictive model designed to account for short- and long-term habitation and cultural material sites. Due to the limited available site data (only 11 sites) no attempt was made to model CMTs or other site types, although data were prepared to facilitate future modelling. It is expected that a range of site types associated with villages and resource camps may be accounted for by the model developed in this study.

The model has three separate components, as outlined below. Class I lands refer to those areas predicted to have the highest density and greatest variety of archaeological sites. Class II lands are predicted to contain fewer sites and a narrower range of site types. All other lands are designated Class III. Site density and variability is expected to be low to very low in these areas.

7.1 Fraser River Component

Specific modelling rules were applied to the Fraser River floodplain and adjacent low terraces and knolls, under the assumption that site density would be particularly high in this zone. Ethnographic information and the distribution of recorded sites supports this hypothesis. It is proposed that virtually all of the Fraser River zone will have archaeological potential, with the highest site density expected near stream mouths. Slope was predicted to be the strongest predictor variable in the Fraser River zone.

Class 1 (Highest Predicted Site Potential):

- Areas with a slope of 0% to 10% and within the defined Fraser River zone ;

  or

- Areas with a slope of 10% to 15% within the areas of river/lake confluences.

Class 2 (Moderate Predicted Site Potential):

- Areas with a slope of 10% to 15% within the Fraser River zone.

7.2 Subalpine Component

Modelling rules were created to identify potential subalpine camp locations, which served as bases for subalpine plant collecting and hunting. The subalpine component of the model was run only within the defined subalpine zone (see Section 4.1).

Class 1

- Areas with a slope of 0% to 10% and within the subalpine zone;

  or

- Areas with a slope of 10% to 15%, within the subalpine zone, and within 100 m of a lake or a definite river

Class 2

- All areas with a slope of 10% to 15% within the subalpine zone.

7.3 Lakes Component

Separate modelling rules were developed to identify potential seasonal resource camps on lake shores. This model includes the Fraser River valley and the subalpine zone. Only Class I areas were identified in this model, as it was predicted that only the immediate lake shores would have site potential, and slope and distance to water were the only variables considered to be important.

Class 1

- Areas with a slope of 0% to10% and within 100 m of a lake.

7.4 Exclusion of Mid-Elevation Slopes

The model results from the Fraser River, Subalpine, and Lakes components were combined and a mid-elevation zone (600 to 1200 metres asl unless within 100m of a definite or two-line river or a lake) was eliminated from the analysis.

Hydrology features (lakes, two-line rivers, wetlands, glaciers/icefields) were erased from the model result polygon coverage to create a coverage representing model results on land only. Hydrology polygons were later re-introduced and overlaid onto the model results to mask site potential polygons in the water. Model results for islands were isolated as a separate coverage.

An evaluation of the first generation model results against the known site distribution indicated that slope appears to be the most important factor for site modelling, particularly outside the Fraser River flood plain. The study team agreed that site potential probably is low along minor tributaries at middle elevations, with the possible exception of trails and CMTs, which were not modelled.

8.0 MODELLING RESULTS

8.1 Dataset I

Dataset I consists of grids representing predicted archaeological site potential, and an accompanying database. Areas of predicted archaeological site potential were ranked as Class I or Class II, in order of relative site potential. As defined in Section 7.0, Class I lands are predicted to have the highest density and variety of sites. Class II lands are predicted to have moderate site potential (i.e., fewer sites and site types will be found than in Class I). All other lands are considered to be Class III lands. These areas represent the lowest predicted site potential and they should hold few sites and a narrow range of site types, due to greater physical constraints against human occupation or the preservation of archaeological sites. It is important to reiterate that not all site types could be modelled, and some sites may exist in Class III zones. However, it is expected that such sites will be relatively rare.

The total modelled area encompasses 821,761 hectares. The study area was divided into a 25 metre grid and each cell was assigned a score for the model. The grid values correspond with Class I and Class II archaeological potential classifications.

8.2 Model Results

8.2.1 Initial Modelling Run Results

The initial model results indicated that 114,936 hectares, or 14% of the study area falls within Class I lands (Table 8). Class II model results account for an additional 30,764 hectares (3.7% of the study area), for a total of 145,700 hectares of Class I or Class II lands (17.7% of the study area).

8.2.2 Revised Model Run Results

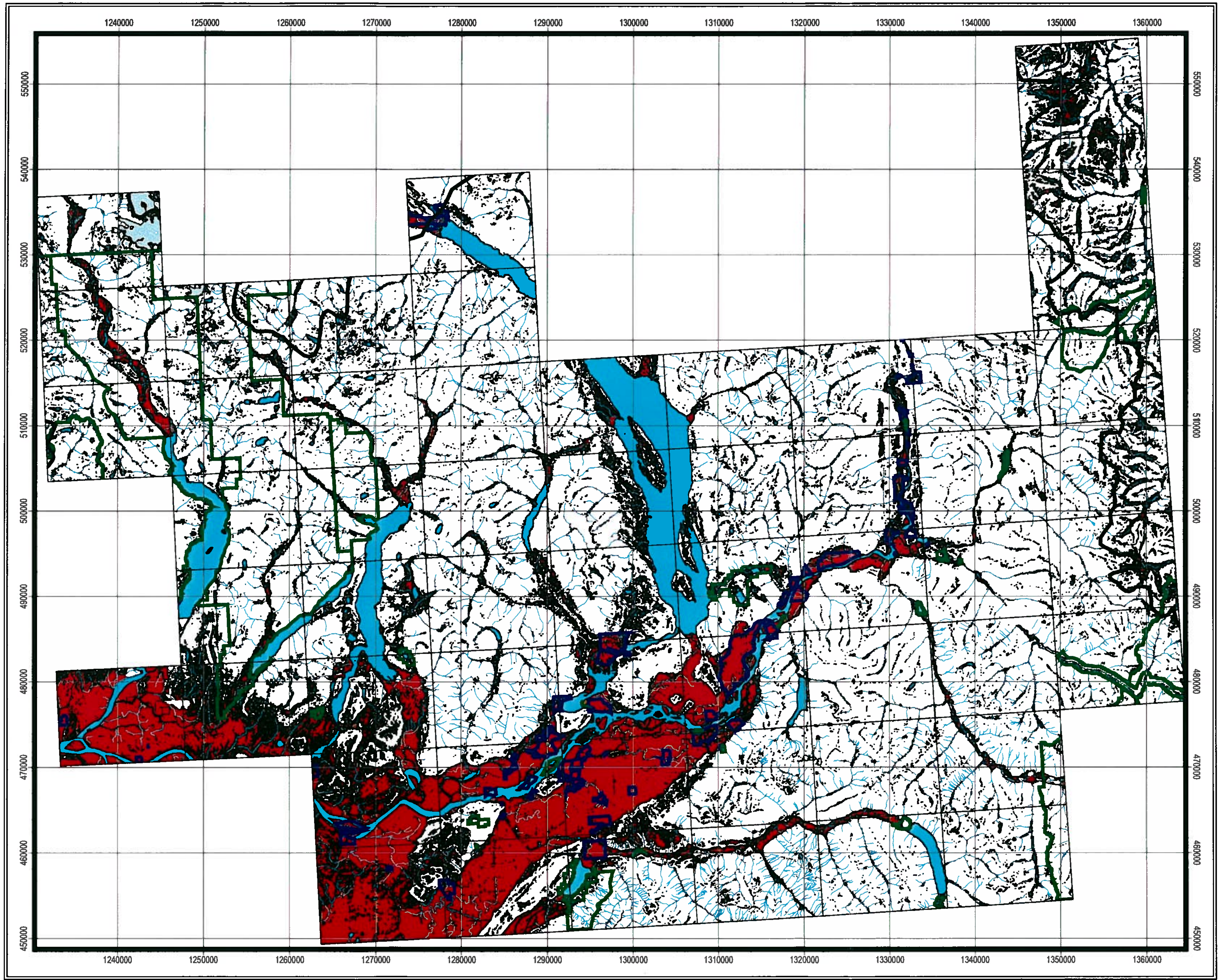
After exclusion of the mid-elevation slopes from the model, a revised model was run. The effect of removing the mid-slope area was minor (see Table 8). In the second model run, 110,679 ha. (13.5%) were ranked as Class I and 26,488 ha. (3.2%) were designated Class II, for a total of 137,127 ha. (16.7%) of Class I or Class II land.

In contrast, the northern Chilliwack Forest District AOA (Golder Associates 1999) assessed 6.6% of that study area as either Class I or Class II, based on different modelling rules. The relatively large percentage of predicted Class I or Class II land in the southern Chilliwack District reflects the high archaeological site potential of the Fraser River zone, which accounts for a large proportion of the Class I and Class II lands (see Figure 24).

Table 8 - Summary of Predictive Modelling Results

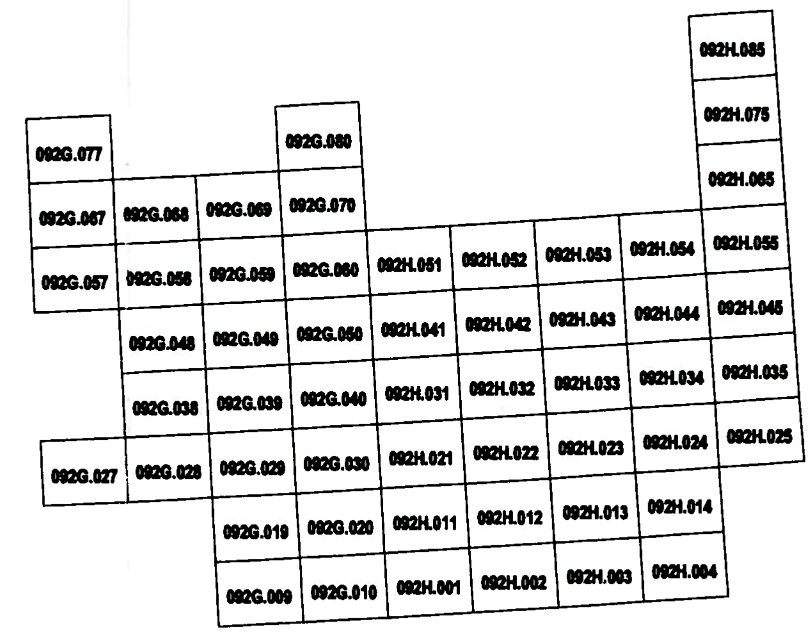
Archaeological Land Class	**Area (ha.) Initial Model**	**% of Land Initial Model**	**Area (ha.) Revised Model**	**% of Land Revised Model**
Class I	114,936 ha.	14.0%	110,679	13.5%
Class II	30,764	3.7%	26,448	3.2%
Class I or II	145,700	17.7%	137,127	16.7%
Class III	676,061	82.3%	684,634	83.3%

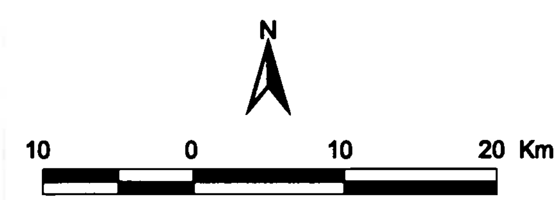
Figure 24: Model Results



TRIM Grid
MOF Boundaries
BC Parks
Indian Reserves
Definite Rivers
Rivers
Lakes
Glaciers

Model Results
Class 1
Class 2





Date: 12 Aug 1999
Project: 992-1811
Albers Projection
(standard MELP projection)
NAD83
TRIM basemap

Golder Associates

GIS1 e:\9921811\Aprs\deliver\modresults.apr Layout: 11x17-L

8.2.3 Capture Rates

The results of the predictive models were compared against the database of recorded sites in the study area to gauge the success rate of the model. Only sites for which data had been reviewed and confirmed were used for the capture rate analysis. Table 9 summarizes the results.

Table 9 - Capture Rates of Predictive Models

Model	Number of Sites	Within Class I or Class II	Within Class I or Class II
		Initial Model	**Revised Model**
All Sites	347	250 (72%)	247 (71%)
Pre-contact Habitations	120	100 (83%)	100 (83%)
Cultural Material	212	169 (80%)	169 (80%)
CMT	11	7 (64%)	7 (64%)

8.2.4 Non-Site Areas

The model results were also evaluated against digitized "non-site" data to determine how much land that has been previously inspected in the field and found not to contain archaeological sites would have been rated as Class I or Class II by the new model. This comparison provides a means of evaluating the relative field requirements under the previous model and the model developed for this study. Of 1,084 ha. of "non-site" land, 209 ha. were rated as Class I in this study, and would have required an impact assessment. An additional 117 ha. were ranked as Class II, and would have required a reconnaissance-level inspection. Taken together, 326 ha. would have required field assessment under the new model, compared to 1,084 ha. under the previous model. This represents a 70% reduction in impact assessment or reconnaissance requirements.

8.3 Dataset II Known Archaeological Sites

Dataset II consists of a database of recorded archaeological sites. Recorded sites are presented as an ARCINFO point coverage. This database has been provided to the Ministry of Forests and the Archaeology Branch.

9.0 DISCUSSION

The model results strongly emphasize the Fraser River valley and its major tributaries. This predicted archaeological site distribution pattern is consistent with currently available ethnographic and archaeological information, which identify this zone as the focus of aboriginal activity. However, the model does not consider culturally modified trees, which are likely to occur in low frequencies throughout forested zones of the study area, and in clusters near trails and in other important, but as yet unidentified, resource areas. As a result, the model results should not be taken as a complete representation of either aboriginal land use or archaeological site distribution. The maps should be used as a resource management tool that can help to reduce the risk of impacting archaeological sites during forestry operations. Taken together with a comprehensive CMT management plan, the model results should provide the Ministry with a good guide for determining where archaeological field assessments should be undertaken prior to development.

10.0 RECOMMENDATIONS

The following recommendations relate to polygons of archaeological potential created as Dataset I of this AOA. It is important to note that the site potential maps are an evolving planning tool that are subject to revision and updating as new or better data become available. It is also important to emphasize that some archaeological site types have not been modelled, most notably culturally modified trees. Separate recommendations are provided below for interim management of CMTs. Certain types of physical landscape features, notably transformer rocks, are not included in this overview, as they are not strictly "archaeological sites" , as defined in the *Heritage Conservation Act*.

Outlined below are specific recommendations regarding Class I, Class II and Class III archaeological potential ratings, followed by general recommendations regarding future archaeological work in the southern Chilliwack Forest District. The three land classes can be viewed as "risk indices" whereby the risk of impacting archaeological sites is predicted to be greatest in Class I lands and lowest in Class III lands. In the absence of detailed field investigations, no location should be considered risk-free. Site-specific recommendations are not provided, due to the large number of recorded sites in the study area.

In general, requirements for archaeological assessment will be determined by the District Manager at the Forest Development Plan stage, based on this review and other information sources.

10.1 Class I Lands

Based on the modelling criteria, Class I lands are those considered to have the highest potential for archaeological sites to be both present and preserved. These areas should also contain the greatest range of site types. The following options are provided for management of Class I lands:

Option 1: An archaeological field assessment should be undertaken prior to land-altering development in any Class I area. The assessment may follow a staged approach, but all field work should be completed under permit (see below).

Stage 1 involves a Preliminary Field Reconnaissance (PFR) to visually assess the archaeological site potential of a development location. The objective of the PFR is to use field observations to confirm the site potential rating assigned during this study. Two results are possible from the PFR:

1) If field observations indicate that the site potential is actually low, the field assessment may be terminated and a letter report may be submitted to the licensee and/or District Manager, outlining the PFR results and recommending no further archaeological work.

2) If the location is confirmed to have archaeological potential, an archaeological impact assessment (Stage 2) should be conducted immediately. The AIA should include intensive survey coverage and subsurface testing, if warranted.

All AIAs should be conducted by a qualified archaeologist under a *Heritage Conservation Act* permit issued by the Archaeology Branch, Ministry of Small Business, Tourism and Culture, and in accordance with provincial guidelines for impact assessments. All field assessments, including PFRs, should include First Nations consultation and permitting procedures, where required.

The AIA should also include an examination of any detailed data sources that were not available for this AOA, to ensure that the GIS information used to derive the site potential classification is accurate. For example, 1:5,000 scale maps may show that the slope of a cutblock is actually steeper than indicated by the DEM used in this study. If more detailed information indicates that a Class I zone has lower archaeological potential than predicted here, the land class rating should be revised, with an option to reduce the level of field effort required.

During the field inspection, it may be determined that micro-environmental conditions are not conducive to site presence or preservation. The field archaeologist may, on the basis of professional discretion, lower the site potential rating, and therefore reduce the level of field effort, as long as the revision is justified in the AIA report and accepted by the District Manager.

It must be emphasized that not all Class I lands will contain archaeological sites. The models are based on assessment of the suitability of the terrain to contain preserved archaeological sites but, for various reasons, not all suitable landforms will necessarily have sites.

Option 2 Since permit issuance for an AIA can take several weeks, a non-permit PFR may be an appropriate option in cases where development scheduling requires an archaeological assessment on short notice. However, the proponent should be aware that a PFR could result in the need for a return site visit to conduct a more detailed assessment. It is emphasized that non-permit reconnaissance should be undertaken only in emergency situations, and they should not be used as a last-minute response, due to a lack of long-range forestry planning. First Nations consultation should be included in PFRs, and it is noted that First Nations permits may be required for PFRs, even in the absence of provincial permitting requirements.

Option 3 For Class I lands within 100 metres of Stave Lake, Alouette Lake, or Jones (Wahleach) Lake, a reconnaissance-level field inspection is considered adequate. These lakes are reservoirs, and current lake levels are higher than they were prior to dam construction. Consequently, archaeological sites associated with original lake shores or river banks may be submerged. Since accurate mapping of pre-inundation water levels was unavailable for this study, a detailed evaluation of site potential surrounding the reservoirs is not provided. Field reconnaissance should be used to assess the appropriateness of Class I ratings near these three lakes. Reconnaissance may lead to an archaeological impact assessment, if warranted.

For all three options, First Nations consultation, including, in some cases, First Nations permitting, is strongly recommended prior to conducting archaeological field work of any type.

10.2 Class II Lands

Areas rated as Class II are considered to have moderate archaeological site potential, and they should also receive archaeological field inspection. A preliminary field reconnaissance (PFR) is considered an appropriate level of investigation for all Class II lands.

The primary objective of a PFR is to determine, based on field observations, whether the subject area has specific terrain features that would indicate potential for archaeological sites. We recommend that PFRs be completed under a *Heritage Conservation Act* permit (and any relevant First Nations permits), to allow an impact assessment to be conducted immediately, if required. Provision should be made in the permit application to terminate work if preliminary field reconnaissance shows an area to lack archaeological potential. This decision should be justified in the project report.

If localized terrain features suggest site potential, then an impact assessment is warranted. Impact assessments should be completed in accordance with Archaeology Branch and applicable First Nations guidelines.

10.3 Class III Lands

Class III areas are predicted to have relatively low archaeological potential due to environmental constraints on human settlement or on site preservation. No archaeological field assessments are recommended for Class III lands. It should be noted however, that all site potential classes defined in this report are relative. Low potential does not mean *no* potential, and there is always the possibility that unanticipated archaeological sites may occur in Class III areas. Should field observations, consultation with local First Nations or other information sources indicate the potential for archaeological sites to be present in a Class III area, the rating should be upgraded to Class II, and a field reconnaissance should be undertaken by a qualified archaeologist to evaluate the site potential of the area.

If archaeological materials, including CMTs, are accidentally discovered during development, all work in the immediate area should be stopped or altered such that the archaeological site is not impacted. The Archaeology Branch, Ministry of Forests District Manager, and local First Nation(s) should be contacted immediately to discuss appropriate site management measures. Site avoidance should always be the preferred management strategy. Where avoidance is not feasible, emergency impact management measures, such as artifact collection, controlled excavation, or CMT sampling may be required to mitigate damage to any newly identified site(s).

10.4 CMT Management Recommendations

The management of culturally modified trees is a problematic issue in the Chilliwack Forest District because little is known about the distribution of CMT sites in the area. This lack of information may be partially due to the significant amount of past logging in the major valley bottoms, but CMTs should be expected in other areas. However, with an increased awareness of CMTs on the part of forestry personnel, CMT sites are being reported at an increasing rate. Given this, and the fact that recent impact assessments have identified a number of large CMT sites in the Fraser Canyon area to the north, it is recommended that a CMT management strategy be developed as soon as possible for the District. The plan should be acceptable to the Ministry of Forests, First Nations, forestry licensees and the Archaeology Branch, and it should balance site preservation needs and First Nations interests with economic concerns of the Ministry and licensees. Given the current lack of CMT site information, the interim management approach should be at the operational level until such time that strategic planning may become possible.

Recommendations for interim CMT management presented below draw on recent CMT management procedures issued by the Vancouver Forest Region (VFR) (Ministry of Forests, 1999).

The VFR identifies four main stages in the management of CMTs:

1. Determine the potential for CMTs;
2. Conduct field assessments;
3. Determine the significance of the CMT(s); and
4. Determine and implement a management prescription.

10.5 Determine the Potential for CMTs

According to the VFR document, the preferred method for determining CMT potential is by predictive modelling as part of an archaeological overview assessment (AOA). Ideally, the AOA should incorporate information from a variety of sources, including archaeological data, information from First Nations, ethnographic literature, and environmental data (e.g., biogeoclimatic and forest cover data). For the Chilliwack

Forest District, insufficient data are currently available for predictive modelling, so an alternative method of assessing CMT site potential is required until more information can be compiled.

In the absence of AOA information, three lines of evidence are outlined in the VFR procedures: archaeological inventory, First Nation consultation, and forest development plan review. For the Chilliwack District, we recommend that all three sources of information be utilized, where possible, with an emphasis on inventory and consultation.

10.5.1 Recommendations

1. Archaeological inventory of a sample of the District should be considered, to provide information about where CMTs are present and, equally important, where they are absent. Given an adequate sample, inventory data could be used to develop a predictive model for CMTs. However, given the size of the study area and the expected sporadic distribution of CMT sites, considerable inventory may be required to collect enough data for modelling. Funding and scheduling factors may influence the decision to undertake CMT inventory. Any inventory sampling design should include input from the Ministry of Forests, First nations, licensees and a qualified archaeologist.

2. First Nations consultation should be an integral part of the District's CMT management plan. Some First Nation community members continue to practice aboriginal traditions that create CMTs, and their knowledge may help to identify potential CMT site locations, to explain why these locations would have been favoured, and to identify areas required to continue this tradition. Consultation at the forest development plan stage may help to identify areas of particular cultural concern for CMTs or other archaeological/heritage resources, and to provide guidance for conducting archaeological impact assessments.

3. Forest development plan review by an archaeologist may be used to guide the requirements for archaeological impact assessments. However, the current lack of CMT site distribution data for the Chilliwack District would limit the archaeologist's ability to accurately predict CMT locations. Based on existing information, forest development plan review may be the least reliable of these methods for assessing CMT potential.

10.6 Conduct CMT Assessments

According to the Vancouver Region's CMT Management Procedures, assessments should be conducted in areas where CMTs are known to exist or where there is potential for CMTs to exist (see above). For the southern Chilliwack District, these areas may include lands adjacent to recorded CMT sites, CMT sites or forest utilization areas reported by First Nations, or CMT sites reported by forestry crews during engineering, block layout, or other field activities. CMTs may also be identified through inventory or preliminary CMT surveys completed prior to carrying out an archaeological impact assessment.

Since CMT modelling has not been undertaken, guidance is required to determine where to undertake CMT assessments. The CMT assessment options presented below are adapted from the VFR procedures. According to the VFR:

> (CMT) Inventory or reconnaissance may be carried out in areas where the potential for CMTs has been identified but where there is low potential of other archaeological findings.
>
> CMT inventory or reconnaissance may be conducted by an archaeologist, a First Nation representative, or forestry personnel trained in CMT inventory and reporting. These surveys are conducted where the management intention is to identify CMTs and ensure that they are not impacted by development, or where the licensee would like to confirm the need to hire an archaeologist to conduct an AIA.

10.6.1 Recommendations

For the southern Chilliwack District, we recommend the following:

1. The Ministry and licensees should provide CMT identification training to field crews, so that they may report any CMTs encountered during engineering, block layout, silviculture prescription, or other field activities. Field crews should be particularly vigilant in areas where mature cedar is present. All field staff should receive an introduction to CMT identification, and selected staff should receive more extensive training. CMT identification and recording training is available through the Resources Inventory Committee (RIC).

2. CMT identification crews should also be established in local First Nations communities or organizations, to allow a rapid response to reports of CMTs. These crews could confirm the presence of CMTs reported by forestry crews, and record them to Level I or Level II standards (Ministry of Forests 1997).

3. If preferable to the Ministry or licensee, a professional archaeologist may be retained to undertake initial field assessments, in cooperation with First Nations.

4. If CMTs are identified and determined to be in danger of adverse impact from land development, an archaeologist should be retained to complete an impact assessment and to record the site to Level II standards (including sampling, if necessary). Since limited research has been conducted regarding possible relationships between CMT sites and other site types, it should not be assumed that the presence of CMTs negates the possibility that other archaeological materials or features are present. This possibility should be evaluated in the field by a qualified archaeologist.

   Preliminary CMT ages should be estimated to determine whether the cultural alteration is likely to pre-date 1846, as this information may be important for assessing the scientific significance of the CMT site. Age estimates can be obtained by sampling the CMT directly (under permit), by dating similar sized trees (of the same species and in comparable growing sites); or by estimating the relative age of the stand. This information will help to determine the potential need for a site alteration permit to harvest the tree(s).

10.7 Assess the Heritage Significance of the CMT Site

According to the VFR procedures, there are two primary types of significance to be considered when evaluating CMT sites: scientific (archaeological) significance, and cultural significance. For the purposes of this report, these significance criteria are together referred to as “heritage significance”. Significance ratings should be determined and reported at the assessment stage, and the ratings must be considered when establishing strategies for managing unavoidable adverse impacts to CMT sites. For CMTs that pre-date 1846, both scientific (archaeological) and cultural criteria should be assessed.

10.7.1 Scientific Significance

The Vancouver Forest Region has developed a rating determining the scientific significance of CMTs (1999 Appendix II). This rating system is intended to be used in the context of an AIA or CMT inventory. According to the VFR, some factors influencing scientific significance include:

- confidence in cultural origin;
- number of CMTs;

- variety of feature types;
- condition of CMT;
- presence of tool marks;
- rare or unique form of modification;
- dateability;
- integrity and context of site;
- potential for spatial analysis;
- relation to written and oral history;
- relation to other archaeological remains; and
- suitability for public education.

Particular attention should be paid to the condition of the tree. Snags or significantly rotted trees may not only pose challenges for dating, but they may be hazardous for work crews. This factor should be considered when evaluating the appropriateness of CMT protection.

The VFR lists the following as examples of some highly significant CMTs, although other examples could be cited, depending on the local situation:

- clusters of CMTs (a variety of types or more than 20);
- plank stripped standing tree in good condition;
- painted tree;
- mortuary tree (tree containing burials); and
- canoe blanks or logs.

Due to the lack of CMT data in the Chilliwack District, the range of scientifically significant CMT types may be greater locally than those outlined on the VFR list.

10.7.2 Cultural Significance

Cultural significance refers to the importance of the CMT or CMT site to the aboriginal community whose heritage the site represents. Cultural significance should be assessed by the appropriate First Nation(s), based on criteria they consider to be relevant. The Archaeology Branch Guidelines for Impact Assessments (Apland and Kenny 1997) and the VFR CMT procedures (Ministry of Forests 1999) provide examples of potential cultural ("ethnic") significance criteria.

Ideally, First Nations should be encouraged to develop policies that include specific guidelines for evaluating the cultural significance of CMT sites and other cultural resources, although it is recognized that some First Nations may not favour this approach.

10.8 Define a Management Prescription

The VFR (1999:6) states that:

> Management practices should be guided by information on the significance provided in the CMT inventory survey report or AIA report; and through consultation with the First Nation. Both protecting CMTs and recording and removing CMTs are consistent with the *Ministry of Forests Aboriginal Rights and Title Policy;* and both are authorized under the HCA. The Archaeology Branch will determine the appropriate impact management measures for pre-1846 CMTs. The Archaeology Branch is responsible for reviewing the results of AIAs and providing a letter indicating the appropriate Archaeological Impact Management measures.

10.8.1 Pre-1846 CMT Sites

The Archaeology Branch has the authority to determine whether a pre-1846 CMT site should be protected, or whether CMTs can be harvested under a Section 12 permit, which would be issued to the individual who will alter the CMT. It should be noted that automatic protection under the *Heritage Conservation Act* applies to sites that contain *any* evidence of pre-1846 use or occupation. For CMT sites, if one CMT is older than 1846, the entire site is protected, and a site alteration permit would be required to harvest any CMTs in the site, regardless of age. Full recording is usually required prior to harvesting of CMTs. CMT site protection details are evaluated on a site-specific basis.

10.8.2 Post-1846 CMT Sites

The Archaeology Branch does not provide management prescriptions for post-1846 CMTs. However, such CMTs may be viewed as evidence that an aboriginal right to use trees for cultural purposes has been practiced in the area (Ministry of Forests 1999). Cultural significance information obtained through consultation with the First Nation should be considered to ensure that infringement of aboriginal rights and title is avoided. The District Manager is the authority who decides to protect or allow cutting and removal of post-1846 CMT sites. It should be remembered that if a site contains evidence of any use or occupation prior to 1846, all CMTs in the site are protected. As a result, a Section 12 permit may be required to harvest a post-1846 CMT if it is within a site containing pre-1846 CMTs.

10.8.3 Protecting CMT Sites

Protection of CMTs is determined on the basis of the assessed heritage significance of the CMT site, regardless of its age. In cases where CMT significance is considered to be high enough to warrant CMT preservation, or where avoidance is feasible, several options are possible. Consistent with the VFR draft procedure, we recommend the following options:

- CMTs may be incorporated into wildlife tree patches or other special management zones;
- Block boundaries may be revised to avoid impacting CMTs; or
- No-work zones may be created within a block or other development area to protect CMTs.

In all cases, measures should be incorporated to ensure windfirmness of any preserved CMT(s) and to provide protection from nearby harvesting activities. A buffer zone is the most common means of meeting this goal. The size of the buffer may vary according to forestry practices and local environmental conditions.

10.9 Mitigation of CMT Sites Where Protection is Not Required

In cases where the CMT site avoidance is not possible or where the CMT is considered to be of insufficient heritage significance to warrant protection, mitigation measures should be implemented to collect pertinent data. These mitigation measures apply to all CMTs, regardless of age.

A Site Alteration Permit, issued under Section 12 of the *Heritage Conservation Act*, is required for any alteration to a CMT that pre-dates 1846. No provincial archaeological permits are required for assessing or removing CMTs that are post-1846 in age. For CMTs of unknown age, it is generally recommended that a Section 12 permit be obtained to remove the risk of contravening the *Heritage Conservation Act*. However, if evidence can be provided to the District Manager indicating that the CMT is probably of post-1846 age, a Section 12 permit may not be required. For example, sampling of nearby trees of similar size and growing conditions may indicate that the stand is of insufficient age to qualify for heritage protection. First Nations consultation and permitting (if required) should be completed prior to the alteration of CMTs or other aboriginal sites of any age.

Prior to harvesting, Level II recording should be completed, in accordance with the CMT Handbook (Ministry of Forests 1997). Following recording and receipt of a Section 12 permit (if required), the CMT may be felled, and a stem-round ("cookie") sample removed to facilitate accurate dating and/or other analyses. It should be noted that for large CMT sites, it may not be necessary to sample and date every CMT. A sampling strategy should be determined in consultation with an archaeologist, First Nations and the Archaeology Branch or District Manager (depending on whether the CMT site is of pre-1846 age), and it should be designed to collect data representing the range of CMT types, tree ages/size, and micro-environmental conditions. Guidelines for removing CMT samples are presented in the CMT Handbook (Ministry of Forests 1997).

10.10 Quality Assurance Process

To help ensure compliance with the *Heritage Conservation Act*, the *Forest Practices Code Act*, First Nations heritage policies, and the Region or District CMT Management Policy (once adopted), and to ensure that First Nations are confident that their heritage sites are being adequately protected, we recommend that a quality assurance process be developed.

The quality assurance process may be incorporated into existing audit procedures undertaken by the Forest Practices Board, the District, or licensees, or the District may wish to develop a separate process with the participation of First Nations. In either case, the goal of the procedure should be to ensure that forestry crews are properly identifying CMTs, and that CMT site management prescriptions are followed.

10.11 Summary of CMT Management Recommendations

The CMT management procedures recommended above are summarized in Table 10.

Table 10 - Summary of CMT Management Recommendations

OBJECTIVE	RECOMMENDATION
Determine CMT Potential	• Inventory • First Nations Consultation • Forest Development Plan Review
Conduct CMT Assessments	• Train forestry crews to identify CMTs • Train First Nations crews to complete Level I recording if CMTs can be avoided • AIA, Level II recording and initial dating of unavoidable CMT sites (Section 14 permit required if sampling)
Assess CMT Site Significance Pre- or Post	• Archaeologist to assess scientific significance • First Nations to assess cultural significance
Protection of Significant CMT Sites	• Incorporate in wildlife tree patch or other special management zone • Redesign block to avoid (with buffer) • Avoid CMTs within block (with buffer)
Mitigation of CMTs to be Harvested (Section 12 Permit Required)	• Level II recording • Stem-round (“cookie”) sample removed from some or all CMTs for dating
Audit	• Pre-harvest audits to ensure CMTs have been identified and reported • Post-harvest audits of recorded CMT sites to ensure compliance with protection measures

10.12 General Recommendations

10.12.1 Ground Truthing and Field Data Collection

- The predictive models developed and implemented in this study have not been field tested. A sample of Class I, Class II and Class III lands should be inventoried using a probabilistic or systematic research design to provide reliable site and non-site data that can be used to test and refine the models. Inventory methods should comply with Resource Inventory Committee (RIC) Standards for Archaeological Inventory or other accepted professional standards, and First Nations consultation and involvement should be an integral component of the research design and implementation.

  If field inventory is undertaken, a watershed-level approach is recommended. This would provide a manageable research unit that could be systematically sampled in a relatively short time, with the added benefit of at least partially reflecting aboriginal use of the landscape.

- A larger CMT dataset is needed for predictive modelling, and cutblock-specific impact assessments usually do not provide appropriate data for statistical modelling. A sample of old growth forest should be selected for probabilistic inventory. The sample should focus on areas with red or yellow cedar, but other areas could be considered, in consultation with First Nations, to collect information on aboriginal use of other tree species. First Nations may be aware of specific areas that were traditionally used for bark collection or aboriginal logging, or locations along known aboriginal trails could be selected, if the forest cover is appropriate.

- All archaeological impact assessments in the study area should include revisiting and updating site information (including mapping to current standards), as necessary, for any recorded sites within the AIA study area.

- Several site records could not be checked for quality due to a lack of information.. Affected sites should be revisited to update the site records.

10.12.2 Model Refinement

- Where possible, survey coverage of previous forestry-related archaeological impact assessments has been digitized as part of this study. It is recommended that the Ministry update important data source for future field assessments, to facilitate periodic re-evaluation of the models.

- Other newly available data should be periodically reviewed for their potential to enhance the predictive models, with an emphasis on palaeoenvironmental, fish and wildlife habitat, and vegetation data. The predictive models should be re-evaluated and refined as new data become available.

- Future incorporation of traditional land-use information and archival data could significantly benefit cultural resource modelling efforts. During this project, traditional land-use information was not available, although several of the First Nations in the study area may have this information on file. Archival research was not within the scope of this project. Early historic records may provide additional information about potential archaeological site locations.

- Where possible, the actual boundaries of recorded sites should be digitized, to replace the circular polygons used in this study to estimate site boundaries.

- Refinement of this AOA model should include direct First Nations involvement.

10.12.3 First Nations Consultation and Training

- Ongoing consultation with First Nations regarding cultural heritage issues is of paramount importance. This AOA can be used as a joint planning tool during the Ministry's consultation with First Nations.

- Consideration should be given to training local First Nations field crews to identify CMT sites during preliminary field inspections. Once CMTs are confirmed, an archaeologist would be retained to record, map, and sample the CMTs under permit.

10.12.4 Model Implementation Procedure

It is necessary to develop a procedure for implementing the results of this overview/GIS model at an operational and, ultimately, a strategic planning level. It is recommended that an implementation protocol be developed cooperatively between the Ministry of Forests, forestry licensees, and First Nations to ensure that the model results are implemented in a way that is agreeable to all parties.

10.13 Study Limitations

During the archaeological data review phase, a number of limitations were encountered. They are as follows:

- Sketch maps did not exist or were not attached to some original site inventory forms;

- Sketch maps were incomplete (e.g. no datum or other landform reference to allow accurate plotting of the location on a 1:20, 000 TRIM) or not to scale; and
- Site polygons were created on the basis of median site dimensions for a given site type. As such, they are only approximations of actual site areas. Circular polygons have been used to represent sites of various shapes.

11.0 CLOSURE

This report was prepared for the use of the Ministry of Forest and the Sto:lo Nation. Any use or decisions made on the basis of the report by third parties are the responsibility of such third parties. This study was not intended to address issues of traditional land use or aboriginal rights or title, and it is presented without prejudice to land claims or treaty negotiations.

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REPORT ON

ARCHAEOLOGICAL OVERVIEW ASSESSMENT OF NLAKA'PAMUX NATION TRADITIONAL LANDS IN THE NORTHERN CHILLIWACK FOREST DISTRICT

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EXECUTIVE SUMMARY

This report describes the results of a 1997-1998 archaeological overview assessment of a portion of the traditional territory of the Nlaka'pamux Nation, within the north-eastern portion of the Chilliwack Forest District. The study was undertaken on behalf of the Ministry of Forests, through a subcontract agreement with the Nlaka'pamux Nation Tribal Council.

The objectives of the project were to summarize and evaluate existing information about cultural heritage resources in the study area and to make recommendations regarding the need for further archaeological work (impact assessments or reconnaissance) prior to forestry operations. The project involved five main phases: (1) the delivery of training in basic archaeological site location and recording techniques, to Nlaka'pamux field workers (2) background research, including a review of previous archaeological, historical, and ethnographic reports and publications; (3) development of computer models to predict where archaeological sites are most likely to occur; (4) implementation of the predictive models to assess the archaeological site potential of the area; and (5) recommendations for appropriate cultural resource management strategies for the assessed areas.

The project is GIS-based, allowing a graphical representation of areas of potential archaeological sensitivity. The information can be presented at any scale, and forestry development plans or other datasets can be overlaid. Information derived from the study will help the Ministry of Forests and the Nlaka'pamux Nation to integrate archaeological resource management with other land use plans so that heritage sites may be preserved or managed according to community values and relevant legislation, policies and protocols.

Separate predictive models were developed for habitation sites, culturally modified tree (CMT) sites and subalpine camp sites. It was determined that insufficient data were available for modelling other site types, such as rock art, burials, small artifact scatters, and trails. Modelling involved dividing the entire study area into 25 metre grid cells and predicting the archaeological site potential of each cell, based on a series of model rules.

The models classified all lands according to a three-part scheme, in which Class I lands are predicted to have the highest archaeological sensitivity and Class III lands the lowest. Given the severe terrain of much of the Fraser Canyon, it was expected that Class I lands

would encompass a relatively small portion of the study area. Indeed, the habitation and subalpine models placed 2% of the study area (4,935 hectares) within the Class I category (highest site potential), while 11% (34,484 hectares) falls within the Class II category. This suggests that the vast majority of archaeological sites in the study area occur on about 13% of the land mass. It is important to note that these totals do not include the results of the culturally modified tree model, which would increase the area considered to be archaeologically sensitive.

Model results were not field tested, but were evaluated by calculating their ability to correctly predict the locations of previously recorded archaeological sites. The success rates were somewhat low, with 55.5% of recorded pre-contact habitation sites falling within an assessed Class I or Class II area. However, a proximity analysis showed that 88% of all habitations and 85% of pre-contact habitations are within 100 metres of a Class I or Class II polygon. This strongly suggests that the models are approximating actual site locations, but that the resolution of the currently available baseline data is insufficient to improve the predictive success.

For CMT sites, the pattern was not as clear. Only 13.3% of recorded CMT sites were captured by the model. Thirty percent are within 100 metres of a modelled Class I or Class II polygon, 53% are within 200 metres, and 83% are within 500 metres. Several reasons for the low capture rate are discussed in the report. The Ministry of Forests and the Nlaka'pamux Nation Tribal Council have elected not to implement the CMT model until additional field data are collected and incorporated into the model. No subalpine sites have been recorded in the study area to date, so the subalpine model could not be evaluated.

In 1999, the predictive models were re-run using a 10 metre grid size, and incorporating approximate archaeological site dimensions into the capture rates. This method resulted in a 2% decrease in the area designated as either Class I or Class II, and a substantial increase in the capture rates for recorded sites. Results of the 1999 analyses are presented in an addendum to this report.

The model results can be used as a risk index to guide future cultural resource management efforts. It is recommended that archaeological impact assessments be undertaken in all Class I lands (highest risk areas) prior to any land-altering developments. For Class II lands, preliminary field reconnaissance (PFR) is recommended to better assess site potential and search for visible archaeological sites. No archaeological field work is recommended for Class III lands, although it is cautioned that occasional sites may be present in those areas. Consistent with Section 51 of the *Forest Practices Code*, if an archaeological site is encountered during forestry operations, it is recommended that all land-altering activity in the immediate vicinity of the site should cease until the Archaeology Branch, the Nlaka'pamux Nation Tribal Council, and the District Manager of the Chilliwack Forest District are contacted to develop a site management plan. The report also presents a number of more general recommendations relating to the AOA and future refinements to the models.

Access to the results of this study is subject to confidentiality agreements between the Ministry of Forests, the Archaeology Branch, the Nlaka'pamux Nation Tribal Council and its member Bands.

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1.0 INTRODUCTION

In September 1997, the Ministry of Forests (Chilliwack Forest District) and the Nlaka'pamux Nation Tribal Council contracted **Golder Associates Ltd.** to undertake an archaeological overview assessment of a portion of the Nlaka'pamux Nation traditional territory within the Chilliwack Forest District. The overview was designed to review current archaeological information for the study area, and to produce GIS-based predictive models to assess archaeological resource sensitivity. The study area encompasses 347,000 hectares, on twenty Terrain Resource Inventory Map (TRIM) sheets in the northern part of the Chilliwack Forest District (Figure 1), which is in the geographic centre of the traditional territory of the Nlaka'pamux Nation (Figure 2). The project also involved an archaeological training program in which seven Nlaka'pamux trainees were provided with an introduction to basic archaeological field techniques, supplemented by field visits, a site assessment and a brief site excavation project.

While this report is intended for a diverse audience, some technical terminology is required for precision. A glossary of technical terms is provided in Appendix II.

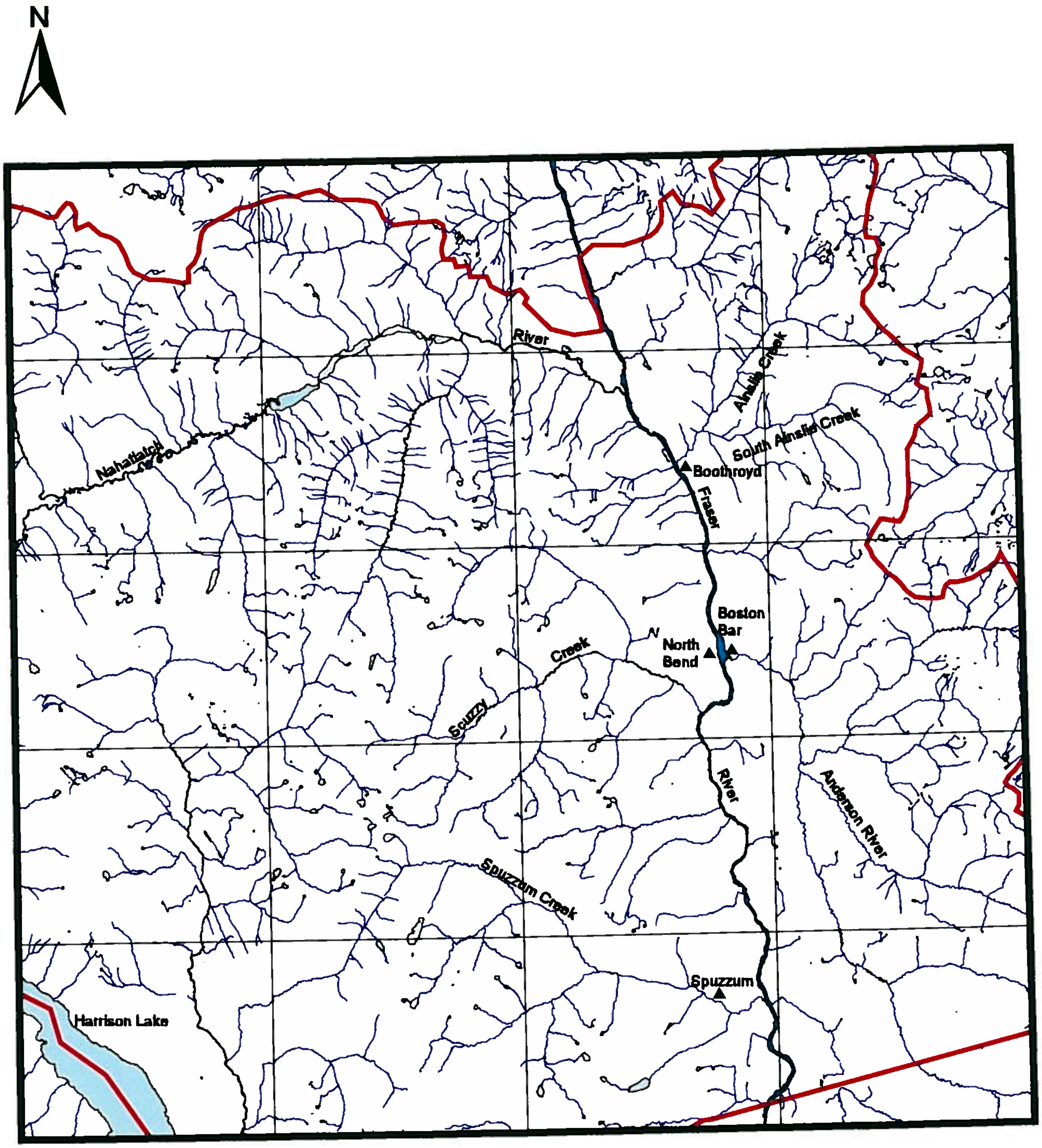
1.1 Rationale

Public and private land developments are threatening heritage sites at an unprecedented rate. In addition to direct land alterations, resource extraction industries and other developers create infrastructure that affords greater public access to remote and often sensitive areas, while public and private recreation facilities bring ever-increasing volumes of people into areas where they are likely to come into contact with heritage resources. For these and many other reasons it is important that a mechanism be developed to identify areas where potential conflict could occur and proactively work toward the protection and management of cultural heritage sites.

Archaeological and other types of heritage sites are important for a number of reasons. The majority of archaeological sites in British Columbia are of First Nations origin, and many aboriginal people maintain strong spiritual, cultural and social connections with these places. Archaeological information can be used to complement oral histories, providing a more complete picture of aboriginal heritage. In addition, archaeological sites are becoming increasingly important as legal evidence, as illustrated by the recent Supreme Court of Canada ruling on the *Delgamuukw* case.

Archaeological sites are rare and non-renewable sources of information about human history, and much of the information contained in these sites cannot be derived from any other source. Since residential and commercial developments have severely impacted the archaeological record, the remaining sites represent a rapidly diminishing information source.

For the general public, archaeological sites represent a unique educational resource. Through interpretive programming, archaeological sites can provide people of all ages and backgrounds with a more thorough understanding of First Nations cultures and the contributions aboriginal people have made to our collective histories. Many non-Native historic sites also have strong public appeal.



LEGEND

Study Area Boundary

TRIM Grid

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

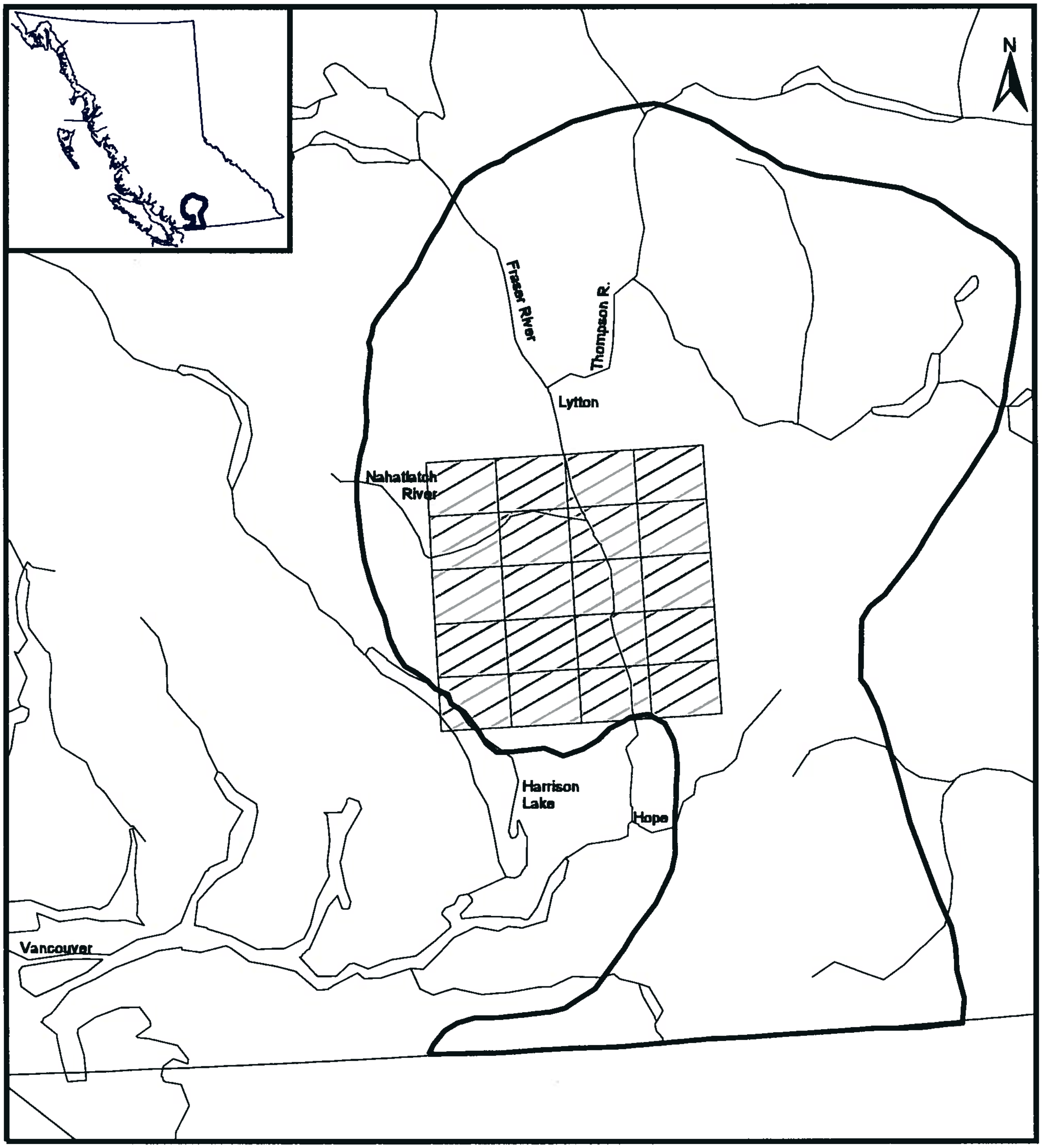
Golder Associates

MAP OF THE STUDY AREA

Scale
1:350,000

FIGURE:
1

Project Number: 972-1935 Date: August 23, 1999 File: reportmaps2-adden2.apr Layout: Study Area



LEGEND

- Study Area
- Nlaka'pamux Nation Traditional Territory (Approximate)

TRIM Grid

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

STUDY AREA WITHIN N'LAKA'PAMUX NATION TRADITIONAL TERRITORY

Scale
1:1,250,000

FIGURE: 2

Project Number: 972-1835 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: NNTC Area

Cultural heritage sites in British Columbia are currently protected under several legislative and policy measures, most notably the *Heritage Conservation Act* (HCA). Although the HCA protects most archaeological sites, it does not afford automatic protection to a number of equally significant spiritual places, traditional use areas, and relatively recent heritage sites. Other legislation, including the *Forest Practices Code Act,* have provisions for the management of cultural heritage sites, and several governmental policies and protocol agreements, such as the *Ministry of Forests/Ministry of Small Business, Tourism and Culture Protocol Agreement on the Management of Cultural Heritage Resources* also afford a measure of protection to heritage sites. On federal lands, the *Environmental Assessment Act* and the *Indian Act* may be invoked to protect important heritage sites.

The following section describes the Archaeological Overview Assessment (AOA) process and the specific steps involved in this study. Also included are descriptions of First Nations participation and study objectives and limitations.

1.2 The Archaeological Overview Assessment (AOA) Process

Archaeological overview assessments (AOAs) are planning tools designed to assist resource managers in making land-use decisions that take into account archaeological sites. Through the use of site sensitivity maps, an AOA defines areas that have relatively high, moderate or low predicted archaeological potential. The site potential ratings are based upon predictive models which, in turn, are derived from known information about historic use of the landscape and the characteristics of documented archaeological sites. The goal of the predictive model is not to pinpoint specific archaeological site locations, but to delineate areas where archaeological sites are most likely to be present and preserved. Fieldwork in the form of impact assessments, reconnaissance surveys, or inventories must be conducted in order to locate, record and evaluate individual sites.

The AOA is intended to be a tool and its use should not preclude other resource management measures, including direct consultation with First Nations. Land-use managers can overlay development plans and assess which proposed development areas are most likely to come into conflict with archaeological sites. The AOA report and accompanying potential maps can be used to assess where archaeological field work (i.e., an archaeological impact assessment [AIA] or preliminary field reconnaissance [PFR]) is required to obtain more detailed information. The AOA process can be broken down into three successive phases.

1.2.1 Phase One: Information Gathering

The first stage of an AOA involves gathering and synthesizing relevant archaeological, environmental and anthropological information about the study area. Because most archaeological sites in the province are of First Nations origin, knowledge about the use of the environment by aboriginal people is particularly important. Consequently, it is most often during the information gathering phase that consultation is initiated with First Nations whose traditional territories coincide with the study area. In addition, other sources of data regarding past and present land-use are consulted, where possible. These sources may include, but are not limited to, ethnographies, journals, reports, articles, monographs, maps, diaries and archival documents. First Nations elders and community members are often the best sources of knowledge about specific places and the traditional uses of an area. Although some of these uses may not be site-specific, many can leave behind physical remnants that are relevant to archaeological research.

In addition to cultural information, environmental data must also be reviewed. Several sources of terrain, stream, climate and vegetation information were gathered for the present study and are discussed in detail in this report. The information gathering stage also involves the acquisition and compilation of archaeological site records for the study area. Recorded archaeological sites are valuable sources of information because they relate certain activities to particular places on the landscape. For example, although exceptions are known, most recorded village sites in the Fraser Canyon occur on small terraces above the Fraser River or its main tributaries. The terrain associated with villages sites is generally quite flat, and fresh water and wood are available. This type of information is essential to the predictive model building phase of an AOA.

1.2.2 Phase Two: Data Preparation and Archaeological Predictive Model Development

Phase two involves the consolidation of information gathered in phase one to develop a series of predictive models. The objective of the modelling component is to draw on existing archaeological site data and the collective expertise of the study team and First Nations participants to develop a set of criteria, or rules, to describe places where archaeological sites are most likely to occur. Since different site types represent different cultural activities, it stands to reason that their spatial distributions will vary. For example, fishing stations will be found in valley bottoms, while subalpine plant processing camps may be expected in or near high elevation parklands and meadows, where economically important plants grow. These simplistic examples illustrate that it is important to develop modelling rules based on different site types, rather than producing a single general model that is designed to account for all sites.

The archaeological team works closely with GIS experts to create digital coverages (computer generated maps) of the study area that contain information relevant to model development. For example, if a model uses distance to fresh water, slope and forest cover type as defining variables, then the digital coverage must contain correlating terrain and biophysical data. Details of data sources used for the Chilliwack AOA are presented in Section 6.3 below.

1.2.3 Phase Three: Site Potential Mapping and Reporting

The third phase of the AOA involves presentation of the study results in a way that is accessible and useful to land-use mangers. One presentation tool is the archaeological sensitivity, or predicted site potential map. An archaeological potential map graphically illustrates those areas considered to have relatively high, moderate or low potential for certain archaeological site types to be present and preserved.

For the Chilliwack AOA, areas that meet all the criteria of a certain site type model were given a Class I designation and are considered to have the highest potential for the presence of that specific archaeological site type. Areas assigned a Class II designation are those that might support the same site type, but do not contain the optimal criteria for doing so. Consequently, these areas are considered to have moderate site potential. Class III lands are considered to have relatively low archaeological site potential due to constraints on human occupation/use, or on archaeological site preservation. These land classes can be viewed as "risk indices", under the assumption that the risk of encountering archaeological sites during development is highest in Class I lands and lowest in Class III lands. No areas should be considered risk-free. A more detailed description of these designations is provided in later sections of this report.

Archaeological potential maps generated for the Chilliwack AOA should be used with forestry and other development plans to identify potential conflicts with predicted archaeologically sensitive areas. The potential maps were produced at a scale of 1:20,000 and submitted in digital format to the Chilliwack Forest District. The 20 TRIM maps are currently stitched into a single coverage, but they can be clipped to correspond with the TRIM grid or other administrative boundaries. Access to the results of this study are subject to confidentiality agreements between the Ministry of Forests, the Archaeology Branch, the Nlaka'pamux Nation Tribal Council and its member Bands.

1.3 First Nations Participation

This study was completed in cooperation with the Nlaka'pamux Nation Tribal Council. The NNTC was involved with project design, development and implementation of the training program, and review of draft archaeological potential maps and reports. Several meetings were held in which representatives of Golder Associates, the NNTC, and the Boston Bar, Boothroyd and Spuzzum Bands and the Ministry of Forests met to discuss the objectives and progress of the project. Small portions of the study may overlap with the traditional territories of the In-SHUCK-ch/N'Quatqua and Sto:lo Nations; the Yale First Nation asserts traditional territory immediately to the south of the study area.

1.4 Study Objectives

The main objectives of the overview were to:

- summarize documentary sources concerning aboriginal land use and archaeological sites in the study area;
- develop predictive models based on known and inferred archaeological site characteristics in the northeastern Chilliwack Forest District;
- produce GIS coverages indicating areas of relative predicted archaeological site potential; and
- provide management recommendations for areas of predicted archaeological sensitivity with respect to potential land-altering developments.

1.5 Study Limitations

1.5.1 Data Limitations

- The success of a predictive model is completely dependent on the quality of the data used to generate it. Every attempt was made in this study to ensure the quality and appropriateness of the baseline data. However, one consequence of the quality control process was that a "lowest common denominator" approach became necessary. Only data that were available in GIS-ready format and for the entire study area were used in developing predictive models. Some data that could potentially improve the power of the predictive models have not yet been compiled, or are not available in a format suitable for GIS.

- No traditional land use information was available for this study. Archaeological sites can be viewed as physical remains of traditional activities, and contemporary land use information often can be valuable for locating archaeological sites.

1.5.2 Research Biases

- Probabilistic archaeological inventory data do not exist anywhere in the study area. Previous archaeological surveys have been skewed toward river valley locations and development sites. Only recently, with the extension of cultural resource management practices to forestry operations, have archaeologists begun to focus on upland sites, primarily cultural modified trees (CMTs). Unfortunately, the database of recorded CMT sites remains quite limited for predictive modelling.

1.5.3 Other Limitations

- Human behaviour is sometimes unpredictable, and cross-cultural assumptions inevitably introduce error. Using computers to model human behaviour introduces additional limitations.

- Not all archaeological site types were modelled. Some sites, such as spiritual or ceremonial places, small lithic scatters, rock art, and burials, are very difficult to model or the available data were considered insufficient to support modelling.

- The model results are untested. A field inventory would be required to ground truth the baseline data, the model assumptions, and the archaeological potential ratings.

The AOA is not intended to identify specific archaeological site locations or to address issues of site significance. All archaeological potential ratings are relative. Not all Class I lands (highest assessed archaeological potential) will contain sites, and some sites may be present in Class III zones (lowest assessed potential). The model results should be used only as a guide for land use planning.

2.0 POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Although this report is concerned primarily with forestry developments, many natural processes and activities related to development and recreation have the potential to damage archaeological resources in the Chilliwack Forest District. The following sections summarize some of the natural processes and development activities that may affect the integrity of archaeological sites.

2.1 Potential Impacts from Natural Processes

Impacts to archaeological deposits as a result of natural processes may include the destruction of archaeological features, artifact breakage, and the disturbance of cultural matrices. Some of the natural processes that may effect the integrity of archaeological sites are described below.

- Eroding shorelines and riverbanks pose a severe threat to archaeological sites. Soil erosion may result from current action, slumping, flow slides, or seepage.
- Rock, talus and mud slides (including avalanches in alpine areas) can affect sites located on or at the base of steep slopes; however, mudslides can create anaerobic environments conducive to organic preservation.
- Glacial scouring can damage or destroy archaeological sites in high elevation areas.
- Flooding and fluvial deposition can destroy sites; however, certain types of flood-deposit episodes may serve to preserve organic archaeological deposits.
- Seasonal run-off from melting mountain snowpack can cause stream bank erosion, landslides and flooding.
- Wildfires can destroy culturally modified trees and may also affect other site types such as pictographs.

2.2 Potential Impacts from Development

Most land-altering developments have the potential to adversely impact archaeological sites. Direct impacts may include, but are not limited to, artifact breakage or displacement, destruction of features, and disturbance to stratigraphic deposits. Examples of indirect impact include increased public access (may lead to site looting or vandalism, or more gradual impacts from heavy use of an area) and possible increased rate of natural degradation (e.g., increased erosion following vegetation removal). Some of the main impacts associated with particular development types are summarized below.

2.2.1 Forestry Operations

Because much of the development in the study area is related to forestry, a more detailed discussion of potential impacts resulting from forest practices is included below.

Timber harvesting and associated activities can potentially damage heritage sites through displacement or breakage of artifacts, destruction of structures or other cultural features (including CMTs), and disturbance to the integrity of stratified deposits. Eldridge (1990) and Mackie and Eldridge (1992) summarize some potential impacts associated with timber harvesting and related development activities. Relevant sections of their discussion are summarized below.

Falling

Different logging methods can create varying levels of disturbance to archaeological sites, although logging itself is often less destructive than associated invasive developments such as road building and landing construction. Since all logging methods will destroy culturally modified trees, this discussion is most pertinent with regard to other types of archaeological deposits and features.

Hand falling has little effect on archaeological deposits, and it may indeed be less destructive than windfalls, which can turn up sediments containing buried cultural deposits. Heavy equipment used in mechanical falling, in contrast, may severely impact the ground and any archaeological sites or features lying on or near the surface.

Yarding

Yarding techniques (Figure 3) have more potential for impact to archaeological sites than falling techniques. Helicopter logging is by far the least harmful to archaeological sites, but this method is not always logistically or economically feasible. A skyline system or standard high-lead yarding may reduce the potential for damage to archaeological sites by lifting logs at least partially clear of the ground (Figure 4). The use of a carriage to increase clearance is beneficial, and a high-lead system is generally preferable to a low-lead. However, the use of heavy equipment at landing areas associated with this yarding technique can significantly disturb archaeological sites. Grapple yarding can add an additional source of surficial disturbance through the use of a backspar to traverse areas without roads.

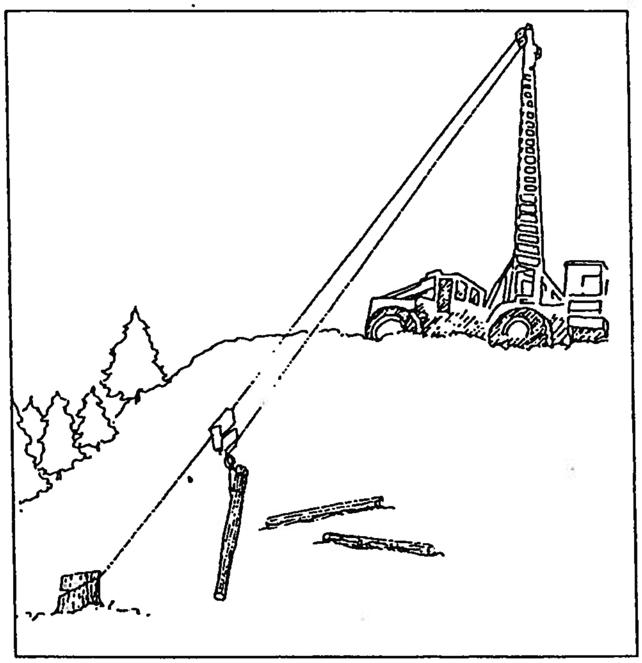


Figure 3 - Sketch of Yarding System (from Forestry Canada 1993:62)

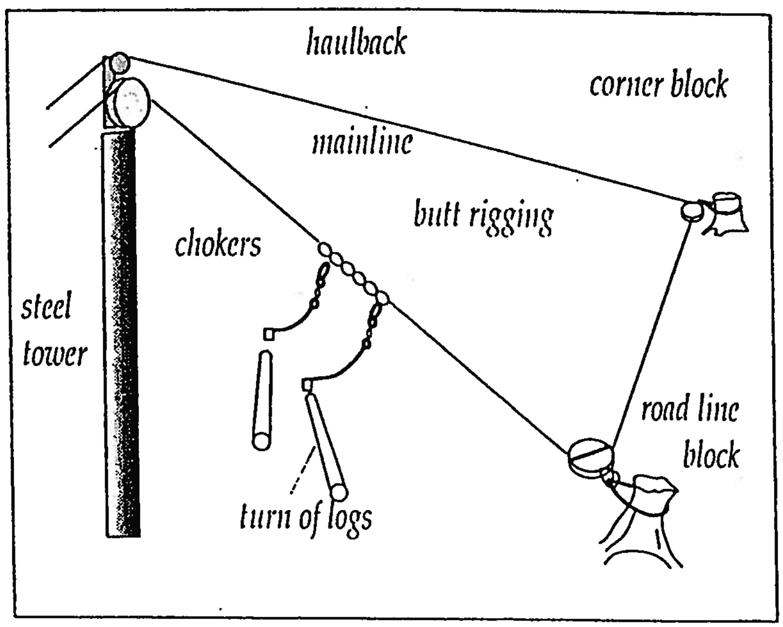


Figure 4 - Highlead System (from Forestry Canada 1993:31)

Skidders can cause severe ground disturbance, and even horse skidding can cause some surficial damage to archaeological sites. However, this problem — and those associated with many other yarding techniques — can be mitigated by restricting operations in archaeologically-sensitive areas to winter, when the ground is frozen and preferably covered with snow.

Access Roads

Logging roads, particularly mainlines, pose one of the most serious threats to archaeological sites because they often cover large areas, and they tend to follow subdued terrain, which often has the greatest archaeological site potential. Many logging roads undoubtedly follow aboriginal trails and some have destroyed archaeological sites located along the trails. For instance, two pithouse dwellings (DlRj 9) located in the Nahatlatch River area, were partially impacted by road construction (I.R. Wilson 1994). Road building severely disturbs the ground, and can completely destroy archaeological sites. Eldridge (1989) also showed that road locations tend to correspond more closely with CMT locations than a random sample from nearby areas. This suggests that ease of access may have been an important factor in aboriginal logging and forest harvesting. A potential indirect impact of road construction is increased public access to archaeological sites. Site vandalism is a serious concern in many regions of British Columbia, and it is an issue of great importance to many First Nations.

Ancillary Developments

Associated land-altering developments, such as log landings and sorting grounds can impact archaeological sites through terrain leveling and heavy equipment traffic. Artifact displacement and breakage are common types of damage to archaeological sites.

Silviculture

Reforestation techniques may be second only to road construction in their potential to damage archaeological deposits. Slash piling using bulldozers and skidders can severely disturb the ground, as does stump removal. Scarification has obvious negative implications for archaeological sites, as it is specifically designed to disturb the ground surface (Figure 5). Tree planting, thinning and pruning, in contrast, should have relatively little effect on archaeological sites unless skidding is involved.

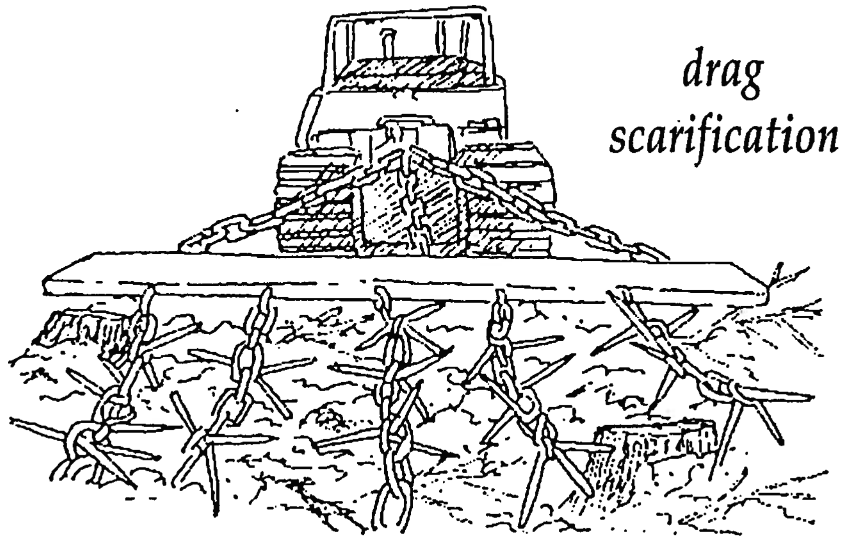


Figure 5 - Example of Scarification Method (from Forestry Canada 1993:19)

2.2.2 Recreational and Residential Developments

A number of activities related to recreational and residential development have the potential to impact archaeological sites. Road construction, excavation of building foundations, leveling of lots and trenching for service installation may damage archaeological sites by disturbing cultural deposits and features, damaging artifacts, and destroying contextual information essential for interpreting site function and age. Less intensive activities such as auguring for fence posts, planting trees, or rototilling may also damage intact archaeological sites. Increased access to archaeological sites may lead to site vandalism or unauthorized disturbance of deposits.

- Downhill ski facilities may involve the removal of vegetation, including mature trees; grooming of runs would include the extraction of large stumps and the disturbance of the upper substrate; and erosion of slope surfaces could cause indirect disturbance to archaeological sites.

- Road construction often occurs in areas suitable for past travel corridors and may involve blasting; increased access to remote sites as a result of road construction heightens the chances that vandalism may occur.

- Off-road vehicles can have direct impacts by increasing erosion, disturbing the ground surface, compacting subsurface archaeological deposits, or breaking or displacing artifacts.

- construction of airfields may involve levelling of well-drained terrain with good potential for archaeological sites.

2.2.3 Mining

Most mines involve several levels of large scale development. From the initial exploration to the final reclamation stages, mining developments can pose serious threats to archaeological sites.

- In the exploration stage, the construction of roads, drill pads, ponds, camps/buildings, helicopter pads/air strips, and fuel storage/spill collection areas can all disturb archaeological sites, as can vegetation removal.

- During the construction phase, archaeological sites can be impacted by stream diversion, open pits, clear cuts, roads, transmission lines, bridges, water storage and tailings ponds, dams, larger camps, mill/concentrator buildings, and waste dumps.

- In the extraction phase, use of heavy machinery, construction of tailings ponds, excavation of open pit mines, large rig drilling, increased access to remote areas, and accumulation of tailings piles can impact sites.

- Potential archaeological site impacts in the reclamation phase include construction of decontamination ponds, excavation of trenches for water diversion and treatment, reshaping and revegetation of tailings piles, and redistribution of tailings.

2.2.4 Hydroelectric Developments

Many archaeological sites are found along lake shores or rivers, which may be susceptible to impact from hydroelectric projects and reservoirs.

- Construction of dams and reservoirs related to hydroelectric power projects may inundate archaeological sites. In addition, sites located above maximum reservoir levels may be damaged through secondary impacts such as the erosion of shoreline.

- Hydroelectric power lines and pipelines (e.g., for natural gas) often cover long sections of terrain, and involve the removal of vegetation, the excavation of footings for power line towers, and excavation of long trenches for pipeline installation and associated facilities. These types of developments are likely to impact archaeological sites because they tend to correspond with areas that may have been used as travel corridors.

2.2.5 Agricultural Activities and Ranching

Although agriculture and ranching are not major economic activities in most of the study area, even small-scale agricultural development can effect archaeological deposits. Some typical types of sub-surface disturbance associated with ranching or farming include:

- construction of irrigation canals;
- construction of fences over long tracts of land;
- domestic livestock grazing may damage archaeological sites through artifact breakage and displacement, and also through erosion caused by loss of vegetation; and
- use of heavy machinery can cause soil compaction and artifact breakage, while the use of plows may severely disturb deposits to some depth.

3.0 PHYSICAL SETTING

An understanding of the physiographic and biogeoclimatic setting of the study area is important to archaeological research because First Nations peoples practice specialized adaptations to the environment that are reflected in the archaeological record. The location, preservation and visibility of archaeological sites are often directly linked to physical factors such as terrain, climate, proximity to water, and vegetation. The following sections summarize the physical setting of the study area, including the location of the portion of the AOA in the Chilliwack Forest District, physiography, climate, the establishment of cedar forests and biogeoclimatic zones.

3.1 Study Area

The study area encompasses parts of both the Coast and Cascade Mountain Ranges, separated by the Fraser Canyon. The southern boundary stretches from Sawmill Creek near Spuzzum, westward to the edges of Harrison Lake, and eastward to the Anderson River drainage. The northern extent of the study area includes the Nahatlatch River drainage located west of the Fraser, and Mowhokam Creek east of the Fraser (Figure 1).

The overview assessment encompasses approximately 347,000 hectares of land and water, which is only a small portion of the Chilliwack Forest District. Some of the main communities include Boothroyd, Boston Bar, North Bend, and Spuzzum. First Nations groups living in the area are the Boston Bar, Boothroyd and Spuzzum Bands, all of which are represented by the Nlaka'pamux Nation Tribal Council (NNTC).

Major rivers in the study area include the Fraser, Nahatlatch and Anderson. Moderate-sized creeks include the Kookipi, Ainslie, Scuzzy and Spuzzum.

3.2 Physiography

The study area lies within the Coast Mountain physiographic unit (Holland 1976). The Coast Mountains are a nearly continuous inland range running roughly parallel to the Pacific Coast and forming the boundary between the wet coastal region and drier regions to the east. The differential uplift and erosion of the late Tertiary period (65-5.3 million years ago) established the present arrangement of mountains, plateaus, and plains (Holland 1976). This late Tertiary topography was modified by the subsequent Pleistocene glaciation to produce the current landscape of sharp high peaks, round and soft lower ones, and wide and deep valleys (Holland 1976). The bedrock geology of the Coast Range is predominantly coarse-grained granite, quartz and diorite with unconsolidated deposits left by glaciers and streams.

An understanding of the geography of the Chilliwack Forest District is important for predicting archaeological site potential. Certain site types, notably habitations, are constrained by topography. For example, village sites require well-drained, relatively flat landforms near a fresh water source. These variables can be used to model predicted village locations. Geological processes can also affect site preservation. Certain factors, such as unusually dry or wet soil conditions, can enhance preservation (particularly of organic materials) while other processes such as erosion and avalanching can destroy archaeological evidence. Much of the study area is quite steep and subject to the above noted factors. Therefore surviving habitation locations are largely confined to river valleys and lakeshores.

3.3 Climate and Paleoenvironment

In general, the study area lies within the rainshadow of the Coast Mountains, and as such, it is characterized by normally dry and warm summers. Mean annual temperatures of 15°

Celsius represent a greater continental influence than on the outer coast (Schaefer 1978). This area, along with the southeastern lowlands of Vancouver Island, and the islands of the Strait of Georgia, are considered the driest regions of the coast, with precipitation amounts at sea level as low as 650 mm.

At increasing elevations, climate conditions change from moderate and rainy to cold and snowy. Mean temperatures decrease an average of 5° Celsius for every 1000 metres in elevation, with summers becoming increasingly cool and short, and snowpack lingering into mid-summer (Schaefer 1978).

Western redcedar is known to have long been a primary material used by aboriginal people to make houses, canoes, boxes, basketry and a wide range of other utilitarian and ceremonial items. However, the establishment of western redcedar and yellow cedar on the Chilliwack Forest District appears to be relatively recent, in archaeological terms, starting perhaps 6,000 years B.P. These species found refuge in California during Pleistocene glaciation, then expanded northward during the late Holocene (Hebda 1995, Hebda and Mathewes 1984).

Hebda and Mathewes (1984) used palaeobotanical data to document the expansion of western redcedar in coastal forests between 6,000 and 2,500 B.P. Their data indicate that, beginning around 6,000 year ago, cedar pollen gradually increased in abundance. Macrofossils of redcedar at Marion Lake near Vancouver also appear in significant quantities after about 6,000 B.P. Maximum pollen frequencies are seen in deposits between 5,000 and 2,000 years old. These findings correlate with early archaeological evidence for the development of woodworking technology among aboriginal cultures, which suggests that specialized woodworking tools, such as adzes, were not common until after about 5,000 years B.P. (Hebda and Mathewes 1984). Archaeological evidence of structural remains at the X̱á:ytem site (DgRn-23), near Mission, B.C., dates to about 4,700 B.P., with radiocarbon dates averaging 4,725± 39 B.P. (Mason 1994). Hebda and Mathewes (1984) conclude that woodworking technology was well established by 3,500 to 3,000 years ago and attained its peak beginning 2,500 years ago and continuing to the present.

Based on the information sources discussed above and Souch (1990), Table 1 summarizes the inferred major trends in climate, glaciation, relative sea-level and dominant vegetation in the study area since the late Pleistocene.

Table 1 - Summary of Palaeoenvironmental Data Relevant to the Chilliwack Forest District

Approx. Date	Climate	Glacial Activity	Vegetation
14,000 BP	Cold, dry	Glacial maximum	
13,500	Cool, moist	Deglaciation begins	Lodgepole pine forest begins
12,000	Cool, moist	Deglaciating	Lodgepole pine forest
10,000-10,500	Warming	Largely deglaciated	Abrupt increase in Douglas fir and alder
9,5000	Warming and dryer	High altitude glaciers	Mixed Douglas fir, pine forest
8,000-6,800	Becoming cooler And wetter	High altitude glaciers	Douglas fir and alder decrease, hemlock and Amabilis fir increase
6,000 – 4,500	Cool, moist	High altitude glaciers	Hemlock reaches peak, cedar increases
4,500 – 3,000	Approaching modern conditions	High altitude glaciers	Mixed hemlock and cedar forest
3,000 - today	Modern	High altitude glaciers	Modern vegetation

3.4 Modern Biogeoclimatic Zones

Fourteen biogeoclimatic zones have been identified in British Columbia (Meidinger and Pojar 1991), of which five are represented in the study area. These include: Coastal Western Hemlock (CWH), Mountain Hemlock (MH), Alpine Tundra (AT), Engelmann Spruce-Subalpine Fir (ESSF) and Interior Douglas-fir (IDF) biogeoclimatic zones.

3.4.1 Coastal Western Hemlock Zone (CWH)

The CWH zone covers low to middle elevations throughout the study area. This is the most productive zone in British Columbia in terms of overall biomass (Jones and Annas 1978).

On average, the CWH zone is the rainiest zone in British Columbia, and features cool summers and mild winters. The mean annual temperature is about 8° Celsius, while mean annual precipitation for the zone is 2,228 mm, ranging between 1,000 to 4,400 mm. Less than 15 percent of total precipitation occurs as snowfall in the south, but as much as 40 to 50 percent in the northern parts of the zone is snow (Pojar et al. 1991a)

Pojar et al. (1991a) provide a thorough description of the plant and animal species characteristic of the Coastal Western Hemlock zone. The forest of the CWH zone are dominated by western hemlock and Pacific silver (or amabilis) fir. Other tree species that are commonly found in this biogeoclimatic zone include western red cedar and Douglas-fir in dry areas and Sitka spruce in moist areas (especially on floodplains). All of these tree species, most notably cedar, were traditionally used by the Nlaka'pamux.

The understory in the CWH zone is generally lush and contains a number of food species important in traditional First Nations' subsistence, including blueberry, salmonberry, bunchberry, soopolallie (soapberry), sword fern and lady fern. Red huckleberry, stink currant, Nootka rose and prickly rose are also characteristic of CWH.

Economically-important mammal species include marten, mule deer, black bear, grouse, mountain goat, and various species of waterfowl. Throughout the CWH zone, streams and rivers provide spawning habitat for salmon and other fish.

3.4.2 Mountain Hemlock (MH) Zone

The Mountain Hemlock (MH) biogeoclimatic zone is characteristic of montane forest and subalpine areas of the Coast Mountains, above the CWH zone. The characteristics of this zone are summarized in Pojar et al. (1991b). The climate of the MH zone features relatively dry, short, cool summers, and very wet, long, cool winters, with heavy snow cover for several months. The mean annual temperature varies from 0° to 5° C, while mean annual precipitation ranges from 1700 to 5000 mm, of which 20% to 70% is snow. The deep winter snowpack is slow to disappear, resulting in a short growing season.

Dominant tree species in the MH zone include mountain hemlock, western hemlock and amabilis fir, with redcedar, yellow cedar and subalpine fir found in smaller proportions. Common shrubs in the MH zone include Alaskan and oval-leafed blueberry, black huckleberry, salmonberry, bunchberry and lady fern. Due to the long period of snowpack, the diversity of animal species is low. Mammals of economic or ceremonial importance to First Nations include snowshoe hare, black bear, mule deer, Roosevelt elk and mountain goat.

3.4.3 Alpine Tundra (AT) Zone

The Alpine Tundra (AT) biogeoclimatic zone, which characterizes the highest elevations of the Coast Mountains, consists of treeless meadows, windswept ridges, snowfields and icefields in high elevation mountainous terrain (Pojar and Stewart 1991). Harsh conditions prevail in the AT zone and much of this area lacks vegetation, being typically covered with rock, ice and snow.

The Alpine Tundra zone is by definition treeless, although some species are found at lower elevations in Krummholtz (stunted) form, the most common being subalpine fir, Engelmann spruce, white spruce, mountain hemlock and whitebark pine. The partially treed interface between the AT and high elevation forested zones may contain subalpine parklands. These openings often yield edible root and berry crops that were staples of the traditional Nlaka'pamux diet. Due to a very short frost-free growing season, lower alpine subzone vegetation is typically characterized by dwarf alpine scrub or deciduous shrub vegetation such as willow species and scrub birch. Mountain heathers, kinnikinnick, lingonberry and bog blueberry grow in moister, snowier regions, and herb meadows are found in drier regions of the lower alpine elevations, where soil depth is sufficient. Species include various arnicas, pussytoes, groundsel, arctic lupine, subalpine daisy and Indian paintbrush.

Despite the harsh climate and rugged topography, the AT zone provides habitat for several economically significant mammal species, though overall species density and diversity is low. Ungulates, including Roosevelt elk, black-tailed deer and mule deer, forage at lower elevations of the Alpine Tundra zone adjacent to ESSF zones, and they were traditionally hunted in the alpine during the summer. In the driest regions, bighorn sheep and caribou winter on steep south-facing slopes, and some of the densest populations of mountain goat in North America are found in these areas. Other animal species found seasonally in the AT zone include grizzly bear, black bear, golden-mantled ground squirrel, hoary marmot, wolverine, golden eagle and common pika.

3.4.4 Engelmann Spruce—Subalpine Fir (ESSF) Zone

The Engelmann Spruce-Subalpine Fir zone lies between the Alpine Tundra and Mountain Hemlock forests on the eastern side of the Coast Mountains. The ESSF is characteristic of steep, rugged mountainous terrain and has a cold, moist and snowy continental climate (Coupé et al. 1991). Winters are long, snowy and cold, while summer growing seasons are cool and short. Precipitation is highly variable within the zone.

Engelmann spruce and subalpine fir are the dominant tree species, although lodgepole pine is a common forest fire succession species that dominates some of the drier regions of the zone. Other tree species occasionally found in the ESSF zone include whitebark pine, limber pine, alpine larch, Pacific silver (or amabilis) fir, mountain hemlock, western white pine, Douglas-fir, Western hemlock and western red cedar. Subalpine heath, grasslands and meadows are also characteristic of the ESSF zone, and these areas often offer edible roots and bulbs that were harvested by the Nlaka'pamux.

Ungulates such as moose, mountain goat, caribou and mule deer are common throughout the ESSF zone, and elk, bighorn sheep, white-tailed deer and stone sheep appear in more limited distributions. The zone is a favourable habitat for grizzly bear, and fur-bearing mammals such as snowshoe hare, marten, fisher, red squirrel and wolverine are common. Subalpine parklands also provide habitat for hoary marmot, ground squirrels and porcupine.

Abundant plant and animal resources make the ESSF zone important to aboriginal economies. Tiger lily, avalanche lily, cow parsnip, and saskatoon berry are some of the ESSF zone plant species used by First Nations groups for food, and common juniper stinging nettle and other plants were used in traditional medicines.

3.4.5 Interior Douglas-Fir Zone

The IDF zone is found in the low to mid elevations of south-central interior British Columbia. Climate within this zone is controlled mainly by the rainshadow created in the lee of the Coast, Cascade, and Columbia Mountains. Mean annual precipitation ranges from 300 to 750 mm, except in the wettest areas where precipitation exceeds 1000 mm (Hope et al. 1991).

Douglas-fir, ponderosa pine, hybrid white spruce, grand fir, trembling aspen and lodgepole pine at higher elevations are common species found in this zone. Paper birch is commonly found on moist sites and in the wettest subzones, while Rocky Mountain juniper is found at lower elevations, usually on dry sites.

Non-forested wetlands such as marshes, open water, sedge fens, and saline meadows are common in the IDF zone. Vegetation in these areas include cattails, great bulrush and water sedge.

A wide range of wildlife habitat exists within the IDF zone. Winter range for ungulates such as Rocky Mountain elk, mule deer, white-tailed deer, and bighorn sheep are found in the southern parts of the zone. Birds, such as the pileated woodpecker, northern flicker, and red-breasted nuthatch are also found in this zone.

4.0 ETHNOGRAPHIC SUMMARY

4.1 Introduction

Ethnographies are descriptions of indigenous cultures, usually written by non-Native people and often based on participation in, and observation of, cultural practices. One of the earliest written historical accounts of the Nlaka'pamux comes from an 1808 journal by Simon Fraser (Lamb 1960). Ethnographic accounts include the works of Boas (1890), Hill-Tout (1978a,b,c), Steedman (1930), Teit (1900, 1912), and Ray (1939,1942). Lower Thompson ethnography is concisely summarized by Albright (1993) in her overview of the Nahatlatch drainage. Nlaka'pamux oral narratives are presented in the works of Hanna and Henry (1995), Billy and Walkem (1992) and Frye (1993).

The following summary provides a general description of the culture and traditional territory of the Nlaka'pamux, giving context to the historic and ethnographic details that appear throughout the report. This review is by no means exhaustive, and it emphasizes aspects of the aboriginal cultural systems that are most likely to leave physical traces that can be identified archaeologically. It should be stated that this summary is written from a non-Native perspective and, as such, it may not accurately express the views of the First Nations people it describes. However, it is hoped that the involvement of the NNTC in this study has helped balance the perspective.

It is also important to explain that the use of the past tense to describe traditional cultural practices is not intended to imply that these activities no longer occur. Many of the traditions described in this report remain integral to the cultures of the Nlaka'pamux.

4.2 The Nlaka'pamux Nation

The Chilliwack Forest District encompasses three Nlaka'pamux communities: the Spuzzum; Boston Bar and Boothroyd First Nations. The traditional territory of the Nlaka'pamux Nation encompasses much of the Cascade Mountain Range, including the Fraser Canyon from below Lillooet to Sawmill Creek near Spuzzum and westward to the edges of Harrison Lake. It also extends eastward into the interior dry belt south of Kamloops, including Nicola and Pennask Lakes, then southward to the headwaters of the Nooksack and Skagit rivers, and the headwaters of the Tulameen and Coldwater rivers.

The Nicola River and parts of the Fraser and Thompson Rivers flow through Nlaka'pamux territory.

The Nlaka'pamux, often referred to as the Thompson Indians by non-Natives, are speakers of a language closely related to other Interior Salish languages, including Shuswap, Okanagan, and Lillooet, and more distantly related to other Salish languages such as Halkomelem and Bella Coola.

According to Teit (1900), the Nlaka'pamux are divided into two groups, with the dividing line being near Lytton, at the junction of the Thompson and Fraser Rivers. Those living to the south are known as the Lower Thompson (Uta'mqt) and those to the north the Upper Thompson (Nku'kuma). The Uta'mqt were said to have their villages along the banks of the Fraser River, from just below the village of Siska, to south of Spuzzum; hunting areas extended westward to Harrison Lake and the mountains east of the Nooksack and Skagit Rivers, and eastward to the headwaters of the Tulameen and Coldwater Rivers (Teit 1900). This overview is concerned with a portion of Uta'mqt territory.

4.2.1 Structure Types and Settlement Patterns

The traditional winter house type was known as a 'Si'istkin', or pithouse (Figure 6). References to winter dwellings can be found in a variety of sources, beginning with Boas (1890), Dawson (1891), and Teit (1900) and more recently in Laforet and York (1981). Pithouses were commonly occupied during the cold winter months (from December to February or March). These semi-subterranean structures were usually circular in shape, with a wood and earth superstructure, although oval to rectangular examples are known. Four main roof beams were angled down to the rim of the pithouse, and were supported by vertical posts positioned in the centre of the floor. Poles, split wood, and pine needles or dry grass were used to cover the structure, with earth as the outer layer. Typically, entrance to the pithouse was gained through the centre of the roof, via a large notched log, or sometimes through a side tunnel at ground level (Albright 1993). According to Teit (1900), one of the last Nlaka'pamux pithouses, located in the Spences Bridge area, was used until about 1890.

From spring through fall, the Nlaka'pamux lived in summer lodges consisting of a square or round framework (Teit 1900). These structures were built above ground and were covered with bark or long reed mats (Teit 1900; Albright 1993).

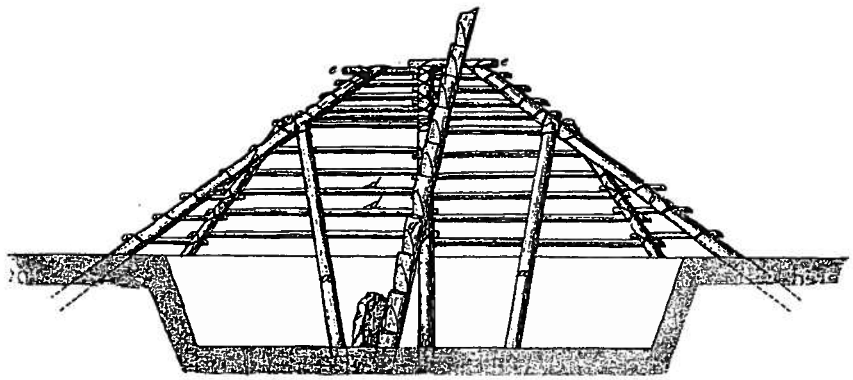


Figure 6 - Sketch of a 'Si'istkin' or pithouse (from Teit 1900:193)

The structural design of the hunting lodge was similar to that of the summer lodges, with the exception of fir branches replacing mats and bark for covering, and a heavier framework. Such lodges were often built close to optimal hunting areas in sheltered valleys. Brush houses were used as a more temporary shelter, erected by hunting parties in the winter or early spring. These structures consisted of a square or conical framework of light poles covered with fir or spruce branches (Teit 1900). Other structures built close to the village or camp include menstruation and puberty houses (Teit 1900, Albright 1993).

In order to accommodate large groups of people, such as at feasts and fishing gatherings, large structures with open fronts and closed backs were built. Supported by braces, the roof rested on leaning poles (Teit 1900).

Built near water sources, dome-shaped sweathouses consisted of willow wands bent over, with both ends stuck into the ground. Large heated rocks were placed in the house and the structure was covered over with mats or skins to retain hot air (Teit 1900).

Caches or storage facilities were made by tying together the lower limbs of a tree and stringing poles across the limbs. Provisions could then be safely placed on top of the poles and covered with bark and mats. Another type of cache ("Indian cellar") used to store berries, fish, meat, etc., was built by digging a circular pit about four feet deep and placing a roof of small poles laid closely side by side across the hole (Teit 1900). Above the hole, another row of poles was placed at right angles. Pine needles and earth covered the structure.

Circular pits were also dug for earth ovens, though of a shallower depth (Frye 1993). Flat stones were placed at the bottom of the oven, with kindling placed on top and another set of small stones above the kindling (Teit 1900, Frye 1993).

4.2.2 Subsistence

Subsistence refers to the basic means by which a group uses the surrounding environment to survive. The Nlaka'pamux subsistence economy was, and continues to be, based primarily on fishing, hunting, trapping and plant gathering.

Fish Resources

Once plentiful every year, salmon were caught in both the Fraser and Thompson rivers (Teit 1900). A variety of methods were used to catch fish. Bag nets were used in large fast-moving waters; the net was made of bark twine fastened to a fir or cedar hoop, with a handle on the other end (Figure 7). Small horn rings allowed the net to close or come together upon feeling the weight of the fish. The captured fish was then placed on shore in a circular hole with a retaining wall built of boulders and cobbles.

Spearing was another popular fishing method. A spearhead was loosely attached to a long handle with a connecting line. Typically used along the shore, when the spear was thrust into the body of a fish, the barbed point would become detached and the fish could be hauled in by means of the line (Teit 1900).

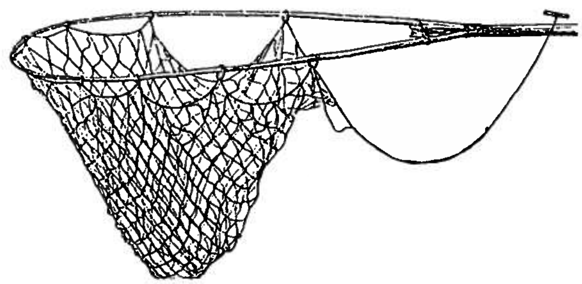


Figure 7 - Sketch of Bag-net (from Teit 1900:250)

Hooks and lines, consisting of bone hooks with a wooden shank and a heavy bark line with a stone sinker fastened above the hook, were used to catch sturgeon in the Fraser River.

Animal Resources

At the time of European contact, the bow and arrow was the most common hunting weapon used for large game such as deer, elk, bear, mountain goat, and bighorn sheep (Teit 1900). Stone points were fastened to arrows made of serviceberry or other hard wood. According to Teit (1900), stone for the arrowheads were found near the headwaters of the Skagit River, possibly the Hozameen chert source (Mierendorf 1993). Projectile points of other raw materials – notably basalt – have been found in archaeological sites throughout Nlaka'pamux territory.

Ungulates, such as deer, were also captured using fences in valley crossings following their migration patterns. This method was used especially between late September and early or mid-December. Fences were constructed using poles or limbs of trees; an opening, with a snare placed in a shallow hole forced the animal to pass through the entrance (Figure 8). A spring pole, held down by a trigger was released when the animal set foot on the trap, forcing it off the ground (Teit 1900).

Small game such as hares, squirrels, and grouse were often caught using snares set on the animal's run (Teit 1900). Coyotes and foxes were caught by smoking or digging them out of their holes.

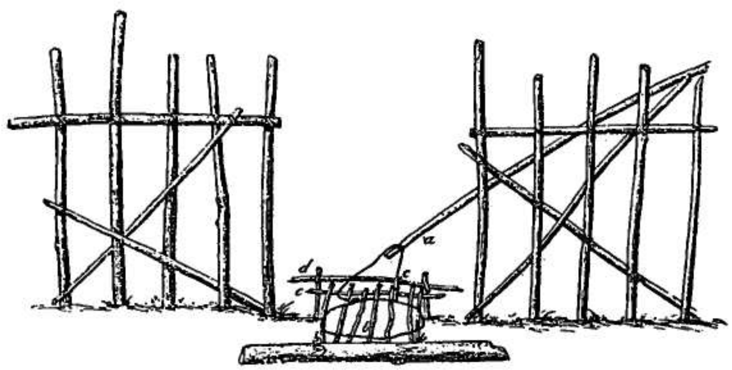


Figure 8. Sketch of deer fence (from Teit 1900:247)

Plant Resources

According to Turner et al. (1990), over 120 species of plants were utilized by the Nlaka'pamux as a source of food, flavouring or beverage, at least 7 species were used for smoking, at least 10 species were used specifically in preparations of food, more than 115 species were used as sources of materials (e.g., dwellings, canoes, baskets, utensils, etc.), and over 200 species were used in some way as medicines (Turner et al. 1990). A detailed description of Nlaka'pamux traditional plant use is summarized in Turner et al. (1990).

Plant harvesting began in the early spring with bulbs, such as cluster lily and yellowbells. Roots, such as nodding onion, balsamroot, and bitterroot, were dug/collected throughout the summer and into fall. Roots were dug by means of a root-digger consisting of a pointed stick with a handle made of wood or bone inserted at the other end. Cedar baskets were used to hold the harvested plant food (Albright 1993; Teit 1900).

Plant foods were important trade items between the Upper and Lower Nlaka'pamux, as well as between neighboring groups (Turner et al. 1990). For instance, strings of dried bitterroot from the Upper Thompson were often brought down to the Spuzzum area to trade for salmon (Turner et al. 1990). Likewise, Pacific crab apples from the Halkomelem were obtained by the Spuzzum people (Turner et al. 1990).

According to Teit (1900: 238-239), the Nlaka'pamux calendar was divided into 12 "moons" based on the primary activities being undertaken at the time. Table 2 summarizes Teit's reconstruction of the Lower Nlaka'pamux calendar.

Table 2 - Summary of Nlaka'pamux Calendar (adapted from Teit 1900: 237-239)

Moon	Nlaka'pamux Name/Translation	Activities/Natural Phenomena
First Moon		Deer rut
Second Moon	N'u'lx• ("going in")	People go into their winter houses
Third Moon	Wawi't ta sn'ulx ("the last going in")	The last of the people go into their winter
Fourth Moon	Nxu'xuet ("little coming out")	Alternate cold and warm winds. Some
Fifth Moon	N'ulx•wa'uas ("going in again")	Last cold. People return to their winter
Sixth Moon	Nxu'it	Winter houses abandoned. People catch
Seventh Moon		People go on short hunts
Eighth Moon		People pick berries
Ninth Moon		Salmon fishing begins
Tenth Moon		People fish and cure salmon
Eleventh Moon	KokauXEmu's ("to boil food a little")	People prepare fish oil
Autumn		People trap and hunt large game

4.3 Culture History of Nlaka'pamux Territory

Culture history, or cultural chronology, refers to the way archaeologists classify past material cultures into descriptive units, usually based on changes in artifact types or styles over time. Although culture history sequences are very broad and are often based on limited data, they can be useful for placing archaeological remains into a general temporal and regional context, and for testing hypotheses about archaeological sites. It should be emphasized that culture history frameworks are subject to revisions as new data are uncovered. While archaeological sequences are useful depictions of aboriginal technologies through time and space, they are of limited utility in defining boundaries between the traditional territories of cultural groups.

Due to the areal extent of the study area, cultural attributes associated with the Interior Plateau, Fraser Canyon, and Gulf of Georgia may all be expected at various archaeological sites. The following section briefly summarizes the culture-historical sequences from each of these regions, as they are presently understood.

The Fraser Canyon discussion is derived largely from the work of Charles Borden (1961, 1965, 1968a, 1968b, 1975) who, on the basis of cultural material excavated from the Milliken, Esilao Village and South Yale sites, defined eight cultural phases. The Gulf of Georgia sequence is compiled from a number of sources, most notably R. Carlson (1990), Suttles (1990), Burley (1989), Matson and Coupland (1995) and Mitchell and Pokotylo (1996). Finally, the Interior Plateau sequence is summarized from published syntheses on each of the three major periods of prehistory. The Early Period discussion is based on Rousseau (1993), the Middle Period summary emphasizes Stryd and Rousseau's (1996) analysis, and the Late Period section draws heavily upon Richards and Rousseau (1987). Figure 9 illustrates the three sequences.

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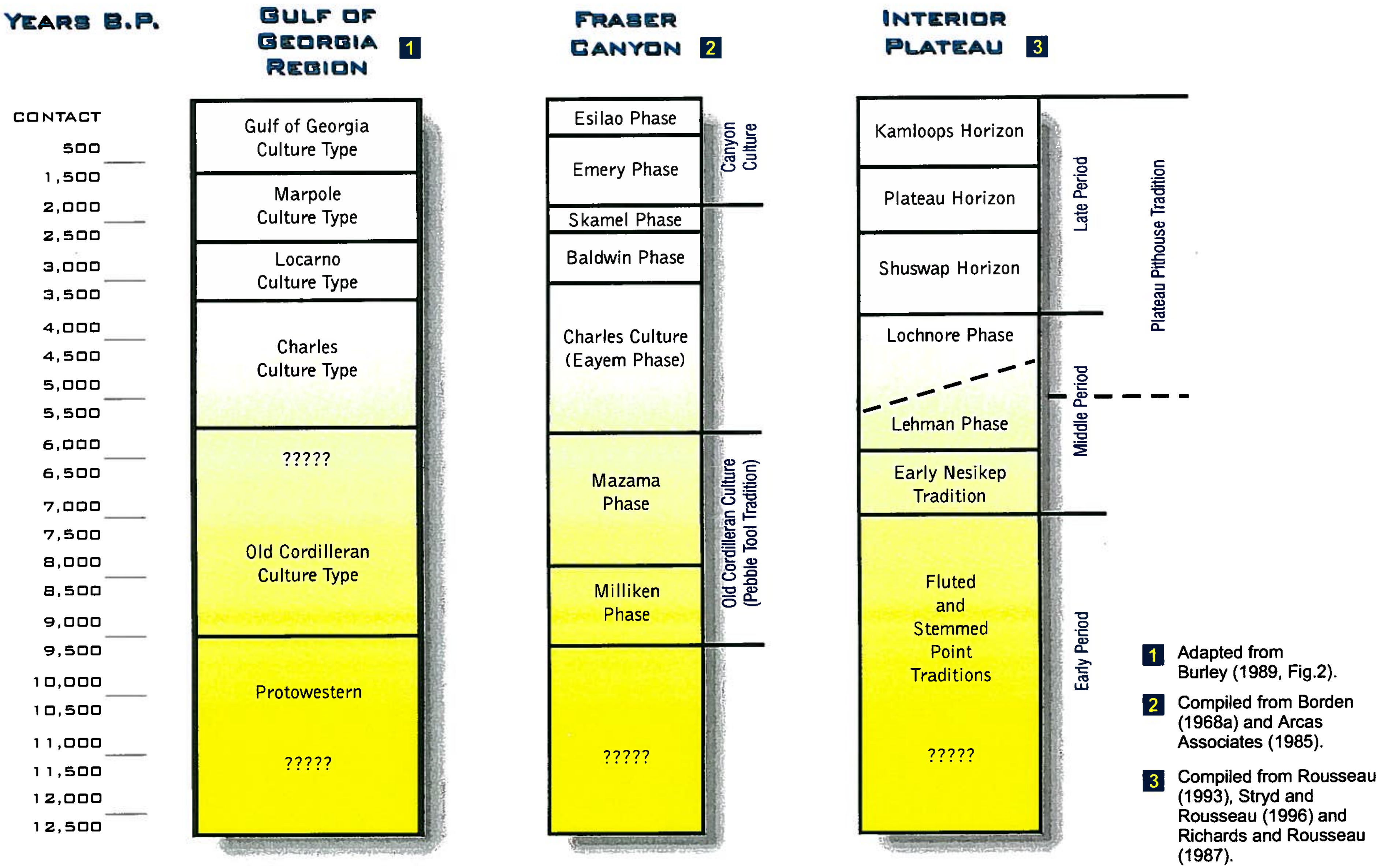


Golder Associates

Current Culture-Historical Models for the Gulf of Georgia, Fraser Canyon and Interior Plateau Culture Areas

Figure 9

4.3.1 Fraser Canyon Sequence

The Fraser Canyon sequence is generally applied to the area upstream from around Chilliwack or Hope to Boston Bar. As elsewhere, early cultural components are virtually unknown, with the Milliken phase, beginning about 9500 years ago, representing the earliest accepted cultural period.

Pasika Complex (ca. 12,500-11000 BP)

This putative archaeological construct is based on an excavated assemblage from the South Yale site (DjRi-7) and surface finds elsewhere in the lower Fraser Canyon (Kidd 1969; von Krogh 1975). The Pasika Complex is characterized by heavy chopping tools made by removing a few flakes from the end or side of water-worn cobbles. Observed variability in the form and angle of working edges may be indicative of functional specialization among these artifacts (Archer 1980). Other items included in the Pasika tool-kit include hammer stones and utilized and retouched flakes. Interestingly, chipped bifaces are entirely absent. The reality of the Pasika complex has always been debated (Borden 1975), and at present it is not considered to represent a distinct cultural "complex." A detailed re-evaluation of the South Yale Pasika material led Haley (1987, 1996) to discount the typological separation of the Pasika artifacts. Using radiocarbon estimations, sediment analysis, and artifact distribution data, Haley made a strong argument that the 'crude' cobble tools characteristic of Borden's Pasika Complex are in fact part of "a technological system designed to maximize the utilization of river cobbles as a raw material source, and [that] it was operated contemporaneously with other 'more sophisticated' technologies" (1987:115).

Milliken Phase (ca. 9500-8000 BP)

Evidence of this phase is known from the type site (DjRi-3) and possibly the Kopchitchin site (Arcas Associates 1985). The Milliken phase lithic tool inventory contains laurel leaf-shaped projectile points, large ovate and semi-lunar bifaces, burins, perforators, several types of scrapers made on thin flakes, "crude" unifacial cobble choppers, cortex spall tools, and utilized flakes. Ornamental items include a few ground and polished steatite pieces, and indirect evidence that ochre was used as a pigment (Borden 1968a, 1975).

Mazama Phase (ca. 8000-6000 BP)

The Mazama phase was defined on the basis of a small assemblage of artifacts and debitage (fewer than 100 pieces) from the Milliken site, and relatively few Mazama phase components have been identified in excavated contexts since. Exceptions include the Maurer site (DhRk-8), which is reported to have "affinities" with Mazama phase and other lower Fraser Canyon material (LeClair 1976), with Component 1 of site DiRi-14 (Eldridge 1979), and possibly with the Kopchitchin site (DlRi-6), at which a component was dated to about 6500 BP (Arcas Associates 1985). It has been tentatively suggested that this phase indicates cultural and/or technological continuity with the preceding Milliken phase (Borden 1975, Archer 1980). Persisting Milliken phase artifact types include laurel leaf-shaped points, large bifaces, varied scrapers, unifacial cobble tools, hammer stones, utilized flakes, and ochre. Mazama phase additions to the Milliken phase tool kit include: small ovate bifaces, multiple-tipped gravers, spokeshaves, discoidal tools made from split cobbles or thick cortex spalls, and pièces esquillées (Borden 1975).

Eayem Phase (ca. 5500-3500 BP)

The Eayem phase was defined on the basis of the lower component at Esilao Village and Maurer sites (Borden 1975; LeClair 1976). Again, general technological continuity with the preceding phases is indicated, with some new artifact types apparently introduced. Use of a wider range of lithic material types is indicated in Eayem phase assemblages, and the earliest evidence of a local ground slate industry is represented by chipped and partially ground slate projectile points and thin ground knives at Esilao Village (Borden 1975). Side-notched projectile points first appeared in the Fraser Canyon during the Eayem phase, as did key-shaped and straight drills, fine gravers, microblades, and abrading stones. Decorative objects associated with this phase include a siltstone plaque with incised cross-hatching and two spindle-shaped phylite objects with a series of encircling grooves (Borden 1975). A rectangular semi-subterranean dwelling at the Maurer site has been attributed to the Eayem phase (Borden 1975, LeClair 1976).

Baldwin Phase (ca. 3500-2350 BP)

The Baldwin phase was defined on the basis of excavated material from the Milliken and Esilao Village sites, and possibly the lower component at Katz (Archer 1980). Diagnostic artifacts include small stemmed projectile points, microblades, mortars and pestles, ground nephrite celts, and a striking proliferation of ornamental items including beads, pendants, rings, ear spools, labrets, and carved figurines (Archer 1980).

Continuity with the preceding Eayem phase is indicated by continued occurrences of leaf-shaped projectile points, large and small ovate bifaces, various scrapers, unifacial cobble tools, and pièces esquillées (Hanson 1973).

Skamel Phase (ca. 2350-1800 BP)

Skamel phase material is known from Esilao Village, Zone A at the Katz site, the lower component at the Flood site, and at least the three lowest components at the Pipeline site (Archer 1980), as well as sites DiRi-14 (Eldridge 1979) and DlRi-6 (Arcas Associates 1985). Characteristics of the Skamel phase include corner-notched and basally notched projectile points; small specialized tools, including drills and gravers; and an increase in the use of fine cryptocrystalline lithic materials (Archer 1980). Microblades, labrets, ear spools, rings, pendants and stone carvings all apparently fell out of use around 2500 BP (Archer 1980). Circular semi-subterranean dwellings were used at the beginning of the Skamel phase (Hanson 1973, von Krogh 1980).

Emery Phase (ca. 1800-800 BP)

Emery phase material is known from excavated components at Esilao Village (partially disturbed), the pithouse component at the Flood site (DiRi 38), and possibly the upper zones of the Pipeline site (DiRj-14; Archer 1980). This phase is characterized by an apparent revival of stone carving, including beads, pendants, pipes and figurines. The basic stone tool kit is consistent with that of the preceding Skamel phase, containing basally notched projectile points, drills, gravers, cortex spall tools, ground slate knives, nephrite celts and stone abraders (von Krogh 1980).

Esilao Phase (ca. 800-150 BP)

The Esilao phase is represented in the upper component at Esilao Village and the intrusive burials at the Maurer and Milliken sites (Archer 1980). Esilao assemblages indicate general continuity with the Emery phase. Common artifacts include small side-notched projectile points, small triangular stemmed points, small barbed points with concave edges, small bifaces, end scrapers, drills, ground slate knives, stone pipes and abrading stones. Esilao phase deposits at Esilao Village also contained European trade goods (Archer 1980).

Summary

Archaeological evidence supports a model of continuous human occupation in the Fraser Canyon from the early post-glacial period to the present. Although several notable technological changes are evident in the archaeological record, the overall impression is one of cultural continuity throughout the pre-contact period.

Perhaps the most marked technological shift took place during the Baldwin-Skamel phase transition period (ca. 2350 BP), at which time semi-subterranean dwellings first appear in the archaeological record, and numerous material items (i.e., microblades, carved decorative objects) apparently disappear. Overall technological and, it is postulated, cultural continuity is indicated from at least the Skamel phase through to the traditional aboriginal cultures at the time of contact, with a continued fishing, hunting and plant-collecting subsistence system (Archer 1980). Archaeological site distributions should be fairly similar throughout that time span, while earlier sites may have somewhat different spatial patterns in response to varying environmental conditions.

4.3.2 Interior Plateau Sequence

The previously discussed excavations at the Kopchitchin site generally support the Fraser Canyon archaeological sequence, with seven assemblages identified and correlated with the above phases (Arcas Associates 1985). Specifically, chronometric and artifactual evidence indicates that the Kopchitchin sequence begins during either Milliken or Mazama phase, and continues through the Eayem, Baldwin, Skamel and Esilao phases, terminating in the early contact period (Arcas Associates 1985). Affiliations with Interior Plateau cultural sequences, however, were also noted at the site. Assemblages E and C were identified as having possible late Shuswap or early Plateau horizon characteristics, and Assemblage B, which had attributes suggestive of the middle to late Kamloops horizon. A brief description of the Interior Plateau horizons sequence, which is applicable to the upper Fraser Canyon and Thompson River drainage, is outlined in the following paragraphs. More detailed descriptions and interpretations are found in Richards and Rousseau (1987), Rousseau (1993), and Stryd and Rousseau (1996).

Early Period (ca. 12,000-7,000 BP)

Information for the initial part of this period in B.C. is based entirely on surface finds which resemble artifacts dated elsewhere to the Early Period. Only three investigated sites on the southern interior plateau have been chronometrically dated to the Early Period.

The Drynoch Slide site (EcRi-1) is located south of Spences Bridge in the Thompson River valley. Cultural materials were collected from a stratum underlying Mazama tephra, and charcoal associated with the artifacts yielded a radiocarbon date of 7530 +/- 150 BP (Sanger 1967). The Landels site (EdRi-11) is located in the Oregon Jack Creek valley a short distance north of the study area. Excavations revealed a pre-Mazama component suggesting two brief occupation episodes (Stryd and Rousseau 1996). The uppermost of the pre-Mazama occupations yielded a radiocarbon date of 7700 BP, while the older occupation was dated to 8400 BP (Stryd and Rousseau 1996). The only other dated Early Period site in the southern plateau region is the Gore Creek site, located in the South Thompson River valley, a considerable distance from the present study area.

Although direct evidence is scanty, Rousseau (1993) has hypothesized that Early Period inhabitants of the area were primarily big-game hunters. Shortly after deglaciation, Late Pleistocene megafauna, such as extinct bison and larger forms of modern species, were probably dietary staples. Throughout the Early Period, a gradual shift to a broader subsistence base is suggested, although the limited archaeological data intimates that hunting remained the main subsistence focus. Technological complexity also seems to have increased over time, with a wider range of artifact types known from the later part of the Early Period. Finally, Rousseau (1993) speculates that population slowly increased throughout the Early Period, possibly resulting in regional cultural adaptations by about 9000 to 7000 years ago.

Middle Period (ca. 7000 to 3500 BP)

According to the Stryd and Rousseau (1996) model, the Middle Period covers the time span from about 7000 BP to the commencement of the Shuswap horizon around 3500 BP. During this period, a distinctive southern interior ungulate hunting tradition is believed to have developed. Known as the Nesikep Tradition, it is divided into the early Nesikep Tradition (ca. 7000-6000 BP) and the subsequent Lehman phase (ca. 6000-4500 BP). It is expected, however, that further regional phases of the Nesikep Tradition will be defined in the future (Stryd and Rousseau 1996).

Beginning about 5500 BP, there is some evidence for a second, possibly unrelated, cultural tradition represented by the Lochnore phase. Stryd and Rousseau (1996) propose that the Lochnore phase signals an inland migration of Coastal Salish peoples, who relied on the improving salmon runs and forest resources of the Mid-Fraser-Thompson River area. This interpretation, however, has been disputed by Wilson (1991) and Wilson et al. (1992), and the issue remains unresolved.

The Lochnore phase is presently defined on the basis of excavated and dated components in the Mid-Fraser and Thompson River regions (Stryd and Rousseau 1996). At least fifteen sites with Lochnore phase components have been excavated, and associated surface finds have been collected throughout the Thompson River area (Stryd and Rousseau 1996). Recently, Lochnore phase surface finds were reported from site DlRj 9, a pithouse village above the Fraser River near the mouth of the Nahatlatch River (Golder Associates 1998). However, there was no clear evidence to suggest the Lochnore component was associated with the pithouses.

Recorded Lochnore phase habitation sites are often small to medium in size, fairly deeply buried, and suggest relatively short-term occupation episodes bearing medium to high density scatters of lithics, bone, and fresh water mussel shell. Some of the larger residential encampments indicate repeated occupations. Many known sites are situated on the edges of flat upper river terraces along major rivers (e.g., the Fraser and Thompson), especially near junctures with major tributary creek valleys. They have also been found and investigated in mid-altitude valley contexts, where they are found beside small lakes and streams, and are interpreted to be seasonal field camps occupied by small groups for short time periods.

Pithouses were initially thought to be absent during this phase, but a group of three house pits thought to relate to the late Lochnore phase were excavated at the Baker site (EdQx-43) near Monte Creek in the South Thompson River valley (Wilson et al. 1992). Radiocarbon dates from the Baker site structures place them between 4450 and 3950 BP, in the latter part of the Lochnore phase (Stryd and Rousseau 1996). As a result, the Plateau Pithouse Tradition (PPT), formerly believed to have coincided with the beginning of the Late Period (ca. 3500), has been revised by Stryd and Rousseau (1996) as commencing around 4500 BP.

Diagnostic Lochnore phase artifacts include "Lochnore side-notched" points, concave-edged endscrapers made of silicas, and macroblade technology. Other tool types resemble those of earlier and later archaeological horizons.

Faunal assemblages suggest that, during the Lochnore phase, people participated in a generalized subsistence economy based on hunting, fishing, and collecting plants and shellfish. Fauna represented in Lochnore phase components include deer, elk, beaver, migratory fowl, turtles, and freshwater mussels. Until recently, there was no direct evidence for intensive utilization of salmon during this phase, but salmon consumption may have increased over time, as storage pits containing articulated salmon vertebrae were found within the Lochnore phase housepits at the Baker site (Wilson et al. 1992).

Late Period (ca. 3500 to 200 BP)

Late Period cultural horizons appear to represent an intensification of the Lochnore phase adaptive strategy, showing general continuity of artifact types (with some stylistic changes), ongoing use of pithouses, and increasing harvesting of salmon (Stryd and Rousseau 1996). Many of the features now attributed to the Lochnore phase were formerly believed to have originated during the Shuswap horizon, and, as indicated above, some modification of the sequence has been necessary as a result of the recent findings in the South Thompson River valley.

Shuswap Horizon (ca. 3500-2400 BP)

Although no Shuswap horizon component in the Mid-Fraser-Thompson River region has been unequivocally dated to earlier than 3000 BP, Stryd and Rousseau (1996) have suggested that the horizon may extend back as far as 3500 BP. This is based, however, on questionable dates from two sites, and that date ultimately may be revised closer to 3000 BP.

Palaeoclimatic data from the Canadian Plateau suggest that sometime between about 4500 and 4000 BP, a gradual change from warm and dry conditions to a significantly cooler and wetter climate began, with grasslands reaching their minimum extent by about 3000 BP (Hebda 1995). The effects of this climatic change on local cultural systems are not yet clear.

The transition from the Lochnore phase to the Shuswap horizon is not very well understood, due to the limited excavation data available for the period between 4000 and 3000 BP. Models proposed by Stryd and Rousseau (1996), Kuijt (1989), and Rousseau (1990) suggest that the transition occurred between about 3600 and 3300 BP. Some cultural changes that differentiate the Shuswap horizon from the later Lochnore phase are an apparent increase in the use of pithouses, larger semi-permanent winter pithouse villages, and more intensive salmon fishing (Richards and Rousseau 1987).

Plateau Horizon (2400-1200 BP)

Between about 3000 and 2500 BP, cool and moist climatic conditions gradually changed to the warmer and drier environment experienced today (Hebda 1995). The archaeological record on the Canadian Plateau indicates that shortly after about 2500 BP, there were notable changes in subsistence and settlement adaptive patterns, marking the commencement of the Plateau horizon (Richards and Rousseau 1987).

The Plateau horizon is characterized by several material traits that are distinct from the preceding Shuswap horizon, including differences in house size and shape, artifact assemblages, and village size (Richards and Rousseau 1987). An apparent increase in storage features suggests a heavy reliance on stored foods during the Plateau horizon. Numerous small field camps and resource extraction locations attributed to this phase have been identified in mid- and high-altitude areas, suggesting an increased use of resources in these zones. Notably, intensive root resource collection is clearly evident (Rousseau and Howe 1987). The high degree of site variability suggests a relatively wide spectrum of economic activities were undertaken by specific task groups (Richards and Rousseau 1987).

Kamloops Horizon (1200-200 BP)

Material traits of the Kamloops horizon express major differences from those found during the preceding Plateau horizon. According to Richards and Rousseau (1987), many aspects of the basic subsistence-settlement pattern remained constant during the Plateau and Kamloops horizons, but notable differences in the latter include: (1) significantly larger average housepit size (about 8-9 m diameter); (2) the appearance of the Kamloops side-notched arrow point; (3) an apparent elaboration in mobile art and decoration of utilitarian items; (4) possibly increased interaction with Northwest Coast groups; (5) and an inferred decline in specific task-group mobility, which is indicated by an obvious decrease in the relative frequency of sites in mid-altitude and upland settings compared to the preceding Plateau horizon. This lower site density is interpreted to reflect a reduced emphasis on middle and high altitude faunal and floral resources.

Summary

Current archaeological evidence from the Interior Plateau suggests that three main periods can be identified. Although these periods are largely defined on the basis of projectile point types and inferred technological systems, more general cultural shifts are also suggested, perhaps in response to environmental changes. During the Early Period, a mobile settlement pattern based on big-game hunting is inferred from the limited evidence currently available. The Middle Period, commencing about 7000 years ago, seems to signal a shift to a more generalized subsistence base with an increased reliance on riverine resources, including shellfish and salmon. General cultural continuity is indicated from the beginning of the Plateau Pithouse Tradition (about 4500 BP) to European contact, with some variability in house and village sizes, technology, and other cultural attributes. Shellfish harvesting seems to have been replaced by intensive salmon fishing, as shell is virtually absent in Late Period sites, while cache pits increase in frequency.

5.0 REVIEW OF PREVIOUS ARCHAEOLOGICAL RESEARCH

As a background to this overview, a review of previous archaeological research in the study area was conducted. The purpose of the review was to identify which portions of the study area have received archaeological attention. This information allows for an assessment of how well the existing archaeological inventory represents the entire range of sites that may be present and is complementary to a gap analysis recently completed for the Chilliwack Forest District (Equinox 1997).

A moderate amount of academic research has focused on Nlaka'pamux territory and the results of these investigations have been published as theses, articles, academic papers and reports. More recent work has been conducted by professional archaeologists at the request of First Nations groups or in response to development plans related to forestry, railway, and other land developments with the potential to disturb archaeological resources.

5.1 Methodology

Several lines of information were used during the literature review phase of the overview. In addition to reference materials in the NNTC and Golder Associates libraries, the : *Annotated Bibliography* of *Archaeological Field Research in British Columbia* (Archaeology Branch 1996), was consulted in order to locate overview, inventory, impact assessment and excavation reports. The published and unpublished reference fields of recorded sites in the study area were searched in the Canadian Heritage Information Network (CHIN) database and referenced reports were obtained where possible. The majority of these documents are unpublished, but most are on file at the B.C. Heritage Library in Victoria. Several non-permit reports that were not on file were obtained from the NNTC. A previous archaeological overview of the Chilliwack Forest District (Millennia Research 1996) and a province-wide archaeological gap analysis (Equinox 1997) provided additional background information.

The following review begins with a brief description of early research in Nlaka'pamux territory. For a more detailed summary, it was considered useful to subdivide the study area by watershed. Reference is made occasionally to archaeological studies conducted outside, but adjacent to, the study area when they can contribute to interpreting the archaeological context within the study area.

5.2 Categories of Archaeological Investigation

The main categories of archaeology that have been undertaken in the study area are research-oriented excavation and inventory, and development-related overviews, inventories, impact assessments and mitigative excavations (cultural resource management). The following sections describe each of these categories.

5.2.1 Inventory

Archaeological inventories in the Chilliwack Forest District have employed a variety of field strategies including systematic intensive surveys, and localized, non-systematic surveys. The following summary of survey techniques is based on a discussion by McRanor and Bailey (1996).

Probabilistic Inventory

Probabilistic inventory is often considered the most "objective" type of archaeological survey, as it is designed to reduce many of the biases and assumptions inherent in other research designs. Consequently, it is the most appropriate approach for obtaining data that can be used for predictive modelling. Probabilistic survey involves the random selection of units for field investigation, without consideration of predicted site potential or other factors. In theory, all areas selected for field inspection are examined equally, regardless of terrain, vegetation or preconceived ideas of site distribution.

Probabilistic sampling strategies may be stratified, or divided into discrete sub-units based on criteria such as physiographic units (e.g., river valleys, lake shores, alpine) or inferred archaeological potential (e.g., high, moderate or low). Within each stratum, individual study units are randomly selected for field survey. A key feature of probabilistic survey is that all portions of the study area have an equal chance of being selected for analysis, and therefore assumptions about site potential can be field-tested. Archaeological investigations of areas of predicted low potential may confirm or refute the assumed absence of sites in certain types of locales. Negative data (i.e., areas that have been inspected and shown to not contain sites) are often as important for archaeological modelling as positive site location data.

Although probabilistic survey is clearly the most useful approach for the development of predictive models and archaeological site potential mapping, few surveys of this type have been undertaken in British Columbia, and none have been conducted in the study area. The absence of probabilistic survey data for the Chilliwack Forest District area is a limiting factor in the development of archaeological site potential models for this region.

Systematic Intensive Inventory

Systematic intensive inventory was conducted throughout B.C. during provincial government projects of the mid-1970s to mid-1980s. More recent archaeological impact assessments conducted in response to proposed land use developments also typically employ this survey technique, although the degree of systematic versus judgmental inventory varies among researchers. Most often, this type of inventory involves a systematic survey and subsurface testing of selected locations. Field coverage often follows landforms or specific development corridors, such as roads, rail lines, pipelines or transmission lines. Areas designated as having low archaeological potential are often left unexplored by these studies.

Other Types of Inventory

Some archaeological inventories cannot be easily classified into the categories of "probabilistic" or "systematic intensive". They are characterized by non-systematic methodologies or a lack of a description of field methods and survey coverage. Prior to the 1970s, few archaeologists included subsurface testing as part of their methodology, though today it is standard practice. As a result, archaeological sites that were not evident on the surface or in existing exposures may have been overlooked. Early inventory techniques varied significantly, from undefined methods to exclusive use of informant testimony. These types of projects tended to be small in scope.

5.2.2 Excavation

Archaeological excavations most often occur as academic research, or as mitigation projects related to immovable land developments. Consequently, excavations vary substantially in objectives, research methods, and analytical and reporting detail.

5.3 Review of Previous Archaeological Research in the Study Area

The present study covers a large area and a broad range of biophysical zones. This brief review of previous archaeological work in various parts of the region begins at the north end of the study area and moves down the Fraser River, focusing on published and unpublished material most relevant to the goals of the overview. The review is not exhaustive, but an attempt was made to address all archaeological studies that have advanced our understanding of past human settlement and subsistence practices in ways that can contribute to site location models.

5.3.1 Overviews

An archaeological overview assessment of the Chilliwack Forest District's five year development plan (Millennia Research 1996) produced a predictive model based on environmental, terrain, forest cover and known archaeological/environmental data within the Chilliwack Forest District. A data gap analysis for the Chilliwack Forest District (Equinox 1997) showed that most previous investigations had been concentrated in the southwestern portion of the forest district, at relatively low elevations, and within close proximity to major drainage systems. Very little archaeological work had been completed in the present study area, and surveys away from major drainages and/or at higher elevations are lacking. These two projects are discussed in greater detail in Section 6.1 below.

Between 1983 and 1986, a heritage resource assessment and inventory was conducted along a Canadian National railway twin-tracking corridor stretching 440 miles between Valemount and Vancouver (Arcas Associates 1984). The initial assessment phase of the project involved identifying high potential areas within the proposed Twin Tracking corridor at a 1:20,000 scale. Previously twinned areas were excluded from the assessment. All previously recorded archaeological sites within the study area were included in high potential polygons however, no field inspection was undertaken.

Preliminary field reconnaissance of portions of the Twin Tracking corridor was undertaken in 1983 (Arcas Associates 1984). This initial survey was conducted from a high rail car and did not involve sub-surface investigations. The objectives of the reconnaissance were to confirm or refine the moderate-to-high and high potential ratings, revisit previously recorded sites, and determine routes of access.

A second field testing phase involved sub-surface investigations of high potential areas within a restricted zone along the CN right-of-way (Arcas Associates 1984). Low potential landforms were not investigated as thoroughly as the more promising landforms such as river terraces.

Some 59 archaeological sites were reported as a result of the twin tracking study. However, of all areas surveyed, the greatest site density for the entire Valemount to Vancouver corridor was calculated for the area between Spences Bridge and Lytton, with 4.54 sites recorded per inventoried mile, averaged over at least a ten mile section of track. Major site types located during the survey included housepit villages, burials and lithic scatters.

Following the completion of the Arcas Associates survey, the Twin Tracking Alliance, comprised of representatives of the Sto:lo Nation Tribal Council, Nlaka'pamux Nation Tribal Council, North Thompson and Deadman Creek (Skeetchestn) Indian Bands, conducted an independent survey of the Twin Tracking corridor (Mohs 1984). As a result of this re-examination, a moratorium on the Twin Tracking project was recommended until a completed archaeological inventory could be conducted.

Arcas Associates returned to the area in 1986; however, the details of the work conducted in that year have never been formally released, and their final statement for the C.N. Rail Twin Tracking project is still considered to be in progress. Additional archaeological work related to the twin tracking project was completed by Sylvia Albright on behalf of the Nlaka'pamux Nation, but the results of that work are currently confidential.

In 1998, Golder Associates and the Nlaka'pamux Nation Tribal Council conducted a joint research project involving the documentation of aboriginal trails in portions of the traditional territories of the Boston Bar, Boothroyd and Spuzzum First Nations (Golder Associates and NNTC 1998). The study involved interviews with community member and field truthing and recording of reported trail locations. Although final results have not been reported, at least 46 trails were identified during the interviews, and more than 15 trails and 6 culturally modified tree sites were located in areas such as the Anderson, Uztlius, Nahatlatch, Spuzzum, and Scuzzy drainages.

Reported and confirmed trails were digitized using GIS (ArcView), in an attempt to evaluate the predictability of trail locations and assess the degree to which knowledge of trails would enhance modelling for other site types.

5.3.2 Nahatlatch River Valley

Detailed archaeological work in the Nahatlatch River area began with the Boothroyd Indian Band's 1988 Summer Archaeology Project (Albright 1988). The goal of the project was to produce an inventory of archaeological sites in the traditional territory of the Boothroyd Band, north of Boston Bar. Forty-five heritage sites were newly recorded in the Band's territory and several previously recorded sites were revisited to update site data. This work brought the total number of documented sites in the Boothroyd Band area to 66 as of 1988. Newly recorded sites included historic cabins, housepits, fishing stations, cache pits, a pre-contact village, an historic village, homesteads, a cemetery, and an historic ditch (Albright 1988). Among the revisited sites, it was noted that some were larger and contained more cultural features than indicated on the original site forms. Updated information was submitted to the Archaeology Branch and is on file with the NNTC.

Two detailed cultural resource management studies (Albright 1993, Zacharias 1994a) have been undertaken in the Nahatlatch River valley as part of the Integrated Resource Management Planning process for the Nahatlatch drainage. In 1993, Albright prepared a detailed overview of heritage resources and values in the drainage. Her report provides valuable information about past and ongoing Nlaka'pamux land use, as well as a review of non-Native historic use of the Nahatlatch valley. Based on documentary evidence, oral histories, and a brief field reconnaissance, Albright indicates correlations between cultural activities and archaeological site types and locations.

Discussions with local residents and five days of field reconnaissance resulted in the identification of 35 heritage sites. Some of these sites were visited by Albright, while others were only reported to her and exact locations were not confirmed. Archaeological sites identified during Albright's overview have not been formally recorded or described in detail (Albright 1993).

Albright's overview assessment was followed in the fall of 1993 by a heritage inventory of identified significant use areas in the Nahatlatch Valley (Zacharias 1994a). The inventory focused on the north side of the valley bottom, from the river mouth upstream to the confluence of Mehatl Creek. Field investigations targeted existing and proposed forestry recreation development areas and associated access roads. Fourteen heritage sites were identified, some of which represented multiple occupations or activities. Observed site types included habitations on lakeshores and in rockshelters, bark-stripped cedars, a pictograph, remains of homesteads and temporary historic structures, and evidence of early placer mining and logging activities. These sites were not formally recorded by Zacharias, but they have been added to the Archaeology Branch database during this overview project.

Zacharias' (1994a) study supported Albright's (1993) conclusion that the Nahatlatch valley bottom has high archaeological site potential and high heritage significance. According to Zacharias (1994a), site potential is particularly high at lake and river narrows; on points of land along lakeshores; on flat river benches/terraces; and at the mouths of tributary streams. Locations along old trails are also mentioned as having high site potential, and old river terraces are suggested as possible locations of early sites. One of the most significant recommendations of Zacharias' (1994a) report is that a heritage inventory and impact assessment be undertaken within all moderate and high potential areas identified in Albright (1993) or Zacharias (1994a) prior to any land-altering activity.

Also in 1993, Deva Heritage Consulting conducted a cultural and sustenance impact study relating to the proposed Pacific Talc Project in the Nahatlatch valley (Zacharias 1994b). No pre-contact archaeological concerns were identified within the proposed development area, but an historic log structure was recorded and ongoing traditional subsistence activities were documented for the area.

During the training program associated with this overview study, an impact assessment of proposed logging operations on Chukcheetso IR #7 (Keefers) was conducted. A large pre-contact Nlaka'pamux winter village, previously recorded as EaRj 59 and EaRj 60

(Albright 1988) was located, mapped and re-recorded (see Appendix 1). Sub-surface testing was also employed to determine the integrity and significance of the deposits. Fifty-six additional cultural depressions were identified and sites EaRj 59 and EaRj 60 were found to represent a single very large site.

A pre-contact village site was located and recorded near the mouth of the Nahatlatch River during the 1988 Boothroyd Summer Archaeology Project (Albright 1988). The site had been damaged by road construction and logging and conditions at the site were considered poor in 1988 and in 1994 when I.R. Wilson Consultants Ltd. revisited the site (I.R. Wilson 1994). A salvage excavation of two damaged housepits was carried out by Golder Associates and the NNTC in the fall of 1997 (Golder Associates 1998a). A systematic surface and sub-surface testing program was conducted, and surface features were re-recorded and mapped. Several of the originally recorded small depressions were no longer visible. A trench was excavated across the southern half of one of the house pits, and a series of rim and floor units were dug in a second housepit. A radiocarbon assay dated a hearth feature in one of the houses to 2400+/- 60 BP, but surface finds indicate an earlier occupation of the site dating to the late Lochnore phase (ca. 5500-3500 BP).

5.3.3 Ainslie Creek Area

No archaeological work had been reported in the Ainslie Creek drainage prior to 1996. No archaeological concerns were observed during a 1996 impact assessment of a proposed forestry mainline road south of Ainslie Creek (I.R. Wilson 1996), nor were any archaeological concerns observed during an impact assessment of a proposed cutblock in the North Ainslie Creek area (Golder Associates 1997b).

During two 1997 impact assessments of proposed forestry developments, Golder Associates recorded over 360 culturally modified trees (bark stripped cedars) along a broad bench in the South Ainslie Creek area, some of which were modified over 250 years ago (Golder Associates 1998b).

5.3.4 The Kopchitchin Site (DlRi 6)

Mitigative excavations at the Kopchitchin Site (DlRi 6) yielded absolute and relative dated evidence for human occupation and use of the site for at least 6,000 years (Arcas Associates 1985). The site is considered archaeologically important because of its considerable time depth, its location near the interface of the ethnographic Coastal and Interior culture areas, and the relatively large artifact assemblage recovered from the excavations. The excavators noted evidence of variation in site activities over time, and this was interpreted to indicate changes in the role of the site in the local settlement and subsistence pattern, as well as an evolving landscape and environment.

The comparatively large lithic assemblage recovered from the Kopchitchin site provided an opportunity to evaluate aspects of Coastal and Interior material culture influences at the site. It was inferred that the site represents a similar sequence to that at the Milliken-Esilao locality (Arcas Associates 1985). The local cultural tradition was seen as largely affiliated with the coast, with local and Interior Plateau elements also present.

5.3.5 Anderson River Area

Little archaeological work has been conducted in the Anderson River area, located on the east side of the Fraser River between Spuzzum and Boston Bar. Golder Associates completed an archaeological reconnaissance inspection of proposed forestry operations south of the confluence of the Anderson River and the East Anderson River in 1996 and 1997 with no archaeological sites identified (Golder Associates 1997b).

5.3.6 Scuzzy Creek Area

In 1990, Points West Heritage Consulting conducted an impact assessment in the Scuzzy Creek area (A. Carlson 1990). The investigation resulted in the recording of four circular depressions interpreted as cache pits on the south side of Scuzzy Creek. Further south, in an area known as China Bar, Antiquus Archaeological Consultants Ltd. recorded four archaeological sites during an inventory and impact assessment (Rousseau 1994). The sites include a lithic scatter, an historic fishing camp and two groups of cultural depressions.

Approximately 184 culturally modified trees were recorded in the Scuzzy Creek area during reconnaissance and impact assessment investigations of proposed forestry operations (Golder Associates 1998b). According to the model currently used by the Chilliwack Forest District, the potential for identifying archaeological sites in these block location was assessed as low, due to the steep slope, terrain instability and difficult access, however an engineer working for the forest licensee reported the presence of culturally modified trees in one of the proposed cutblocks, warranting an inspection of the others. Fifty-two of the CMTs were dated by removing increment bore samples. Dates of the cultural modifications ranged between 63 and 183 years.

5.4.7 The Milliken Site (DjRi 3)

The 1956 discovery of the Milliken site significantly enhanced our understanding of early human occupation in British Columbia. Mr. August Milliken escorted Charles Borden to the site, where a deeply buried cultural horizon was observed in a naturally exposed surface. A few artifacts were collected, and charcoal was collected for radiocarbon dating (Borden 1960). Borden subsequently led excavations at the site in 1959 and 1960 as part of the Fraser Canyon Project.

Borden (1975) published a preliminary regional cultural history sequence which incorporated the Milliken site data, but detailed analyses and reports are only now being prepared for both the Milliken and nearby Esilao (DiRj 5) sites. Mitchell and Pokotylo have provided the impetus for the analysis of these sites, and their recent paper on the Early Period components at the Milliken site describes the stratigraphy and lithic assemblage of the lower zones excavated in 1959 and 1960 (Mitchell and Pokotylo 1996). No detailed report has yet been published for the more recent occupations.

Based on artifact types, radiocarbon dates and the stratigraphic position of Mazama ash, Borden (1975) described two Early Period components at the Milliken site, designated Milliken (ca. 9000-8000 BP) and Mazama (ca. 8000-6000 BP). Close scrutiny of profiles, maps and field notes led Mitchell and Pokotylo (1996) to separate out a third component, named the Gravel component after its stratigraphic context. The gravel component has not been securely dated, but radiocarbon dates from underlying and overlying strata, its stratigraphic position above Mazama ash, and some artifact similarities with Eayem phase material dated elsewhere to between 5500 and 3100 BP (Borden 1975), tentatively places this component between about 6700 and 3000 BP. Mitchell and Pokotylo's (1996) interpretation of the overall lithic assemblage generally supports Borden's view of cultural continuity throughout the early occupations at the site. Most artifact types are present in all three Early Period sub-assemblages, possibly suggesting a similar site function over time, but some artifact styles are unique to each of the components, indicating changes in lithic technology or site function.

The site was probably related to hunting, based on the presence of mammal bone and numerous artifacts generally thought to relate to hunting activities, but other site activities are not ruled out. Poor preservation of organic materials hinders site interpretation, but its location at a narrow spot on the Fraser River known for its fishing opportunities supports the hypothesis that fishing was also an important activity there (Mitchell and Pokotylo 1996). The presence of charred choke cherry pits and the fact that until 7000 to 8000 years ago the site would have seasonally flooded, suggest a late summer/fall occupation, which today would coincide with a major Fraser River salmon run. However, the reliability of Fraser River salmon runs prior to about 5000 years ago is presently a matter of some debate, and stable carbon isotope analysis of a 8300 year old skeleton from the Gore Creek site suggested that salmon was not a dietary staple at that time (Chisholm and Nelson 1983).

It is hoped that ongoing detailed analyses of lithic debitage and further synthesis of existing data will provide a clearer picture of human occupation of the Milliken site.

5.3.8 South Yale Site

In 1963, Borden's group excavated the South Yale site (DjRi 7), tentatively identifying a previously unknown lithic tradition, designated the Pasika Complex, which was thought to pre-date the earliest component at the nearby Milliken site (Mitchell 1965). More intensive excavations were completed in 1970 with the goal of substantiating this preliminary conclusion, but this goal was not achieved. The Pasika Complex is no longer accepted as a cultural marker (Irvine 1973, Borden 1975, Archer 1980, Haley 1987), but is considered by some to be a lithic industry that "operated within a larger techno-complex" (Haley 1996:62) and by others to be remnants of aboriginal logging sites (Stryd and Eldridge 1993).

<u>Summary</u>

Current archaeological evidence supports a model of continuous human occupation in the Fraser Canyon from the early post-glacial period to the present. Although several important technological changes are evident in the archaeological record, the overall impression is one of general cultural continuity throughout the pre-contact period. As elsewhere in British Columbia, there is a general trend towards smaller stone tools and an increased number of lithic raw material types over time, but certain large tools (such as cortex spall tools and cobble choppers) clearly persisted over a long time span.

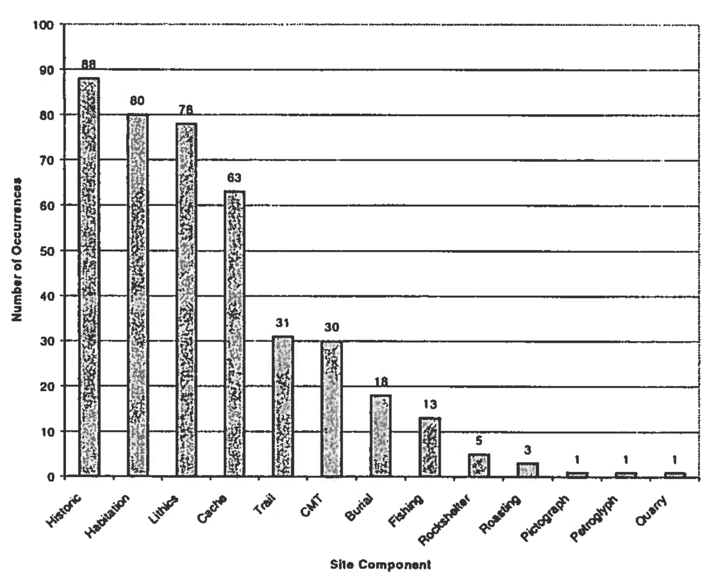
5.4 Archaeological Site Types and Distribution

According to the archaeological site database supplied by the Archaeology Branch, 207 archaeological sites had been recorded in the study area as of November 3, 1997. Following the British Columbia Archaeological Site Inventory Form classification scheme, Table 3 and Figure 10 summarize the distribution of recorded site components in the study area. Note that the total number of site components (n=412) significantly exceeds the number of discrete sites (n=207), as many sites have multiple components (e.g., habitation, lithic scatter, cache pit). Some of the more common site types are described in the following sections.

Table 3 - Distribution of Site Types in the Study Area

Site Type	Number of Site Components	Site Type	Number of Site Components
Historic	88	Fishing	13
Habitation	80	Rockshelter	5
Lithic Scatter	78	Roasting	3
Cache	63	Pictograph	1
Trail	31	Petroglyph	1
CMT	30	Quarry	1
Burial	18		
Sub-total	**388**	**Sub-Total**	**24**
		TOTAL	**412**

Figure 10 - Chart Showing Distribution of Site Types in the Study Area



5.4.1 Habitation Sites

Pre- and post contact habitation sites are the most common recorded site type in the study area. Included under this label are housepit sites, "villages", house platforms, some large lithic scatters, structures and rockshelters with evidence of occupation. Probably the most recognizable type of pre-contact habitation site is the winter housepit village, where large circular depressions represent the remains of semi-subterranean houses. Many housepit villages also contain lithic scatters, cache pits, earth ovens (roasting pits) and other site features. Burial sites may be associated with habitation sites, and particularly with winter villages. Winter villages are usually located on flat, sandy or silty river terraces near a source of fresh water (often at river confluences), and often near fall fishing locations.

Shorter-term summer occupations and resource gathering base camps may be represented simply by lithic scatters containing a wide variety of artifact types. Ethnographic and historic information indicates that summer dwellings were above-ground lodges that would not have left deep depressions, and these sites may lack visible features. Summer habitation sites may be found on lake shores, along rivers or near specific resource areas, such as important hunting or plant gathering locations.

5.4.2 Culturally Modified Trees

Since the late 1980s, and particularly in the 1990s, considerable research has focused on the analysis of culturally modified trees (CMTs). A CMT is usually defined as "a tree that has been altered by native people as part of their traditional use of the forest" (Ministry of Forests 1997). In the Fraser Canyon area, virtually all recorded CMTs are bark-stripped trees. Bark stripping involved the removal of sections of outer bark, usually from cedars, for use as a raw material, but also from lodgepole pines, to access the edible inner bark. Aboriginally logged trees were fully or partially felled to provide wood for the construction of houses, canoes, and other items. Tall stumps can also indicate aboriginal logging. No information was found to indicate that any aboriginally logged CMTs have been identified in the study area.

Specific scar patterns, tool marks and morphology are used to identify and assess CMTs. Bark stripped trees may have a long continuous tapered strip or a rectangular section removed, or they may be girdled by the removal of bark around the entire circumference of the tree. Aboriginally logged trees include planked trees, sectioned trees, canoe trees, undercut trees, trees tested for heartwood soundness, notched trees and felled trees (Mobley and Eldridge 1992, Ministry of Forests 1997). Other types of CMTs include sap, pitch or kindling collection trees; delimbed trees, blazed trees, and dendroglyphs (carved trees) and dendrographs (painted trees) (McRanor 1997) - sometimes incorrectly labeled 'arborglyphs/ arboriglyphs' and 'arborgraphs/ arborigraphs' (e.g., Eldridge 1991, Ministry of Forests 1997).

Little research has been undertaken regarding the association of CMTs with other site types; however, CMTs may correlate with villages or shorter-term habitation sites. CMTs are often identified along trails or streams, and they have been found on landforms ranging from flat terraces to steep slopes. Both red and yellow cedar were extensively utilized by the Nlaka'pamux. Other trees, such as hemlock, Douglas-fir and lodgepole pine were also used, but to date, they have not been identified as CMTs in the study area. In the Fraser Canyon, the majority of recorded CMTs are western redcedars, although yellow cedar examples have been recently identified at high elevations (Golder Associates 1998c), and it is likely that lodgepole pine CMTs are also present in the area. CMTs are most commonly found in stands of old growth forest.

Dendrochronology (tree-ring dating) is used to date CMTs, and this technique sometimes reveals scars that have completely healed over. At present, the oldest CMT date in British Columbia is AD 1467 (Eldridge and Eldridge 1988), but aboriginal forest utilization certainly predates this. Since CMT dating is completely reliant on the survival of the tree, and few species live longer than a few hundred years, direct evidence in the form of CMTs is limited to less than 1,000 years.

5.4.3 Lithic Scatters

While lithic artifacts are present in many types of sites, at some sites only lithics are preserved. Lithic scatters may represent stone quarry areas, stone tool manufacturing or maintenance sites, hunting locales or habitations. Lithic sites can be extremely significant, in part because the durability of lithic artifacts presents the potential for the survival of very old specimens. In addition, stone tool manufacturing techniques underwent stylistic changes over time for which specific chronologies have been constructed. Unfortunately, many sites in which lithic artifacts are the primary components are surface finds, which makes them difficult to date or interpret. Lithic sites have been found throughout the study area, and they may occur on virtually any landform. For this reason, it can be very difficult to develop predictive models for lithic scatter sites.

5.4.4 Trails

Trail networks were integral to the aboriginal subsistence, settlement and exchange systems in the Fraser Canyon, and the Nlaka'pamux were well known for their trail building tradition. During his trip down the Fraser River, Simon Fraser remarked on the complex scaffolding that allowed foot travel along the precipitous Fraser Canyon (Lamb 1960). Many more trails linked villages sites with resource collection localities, summer camps, and special purpose sites, as well as providing important exchange networks with neighbouring First Nations.

Thirty-one site records included mention of a trail. Recent research (Golder Associates and NNTC 1998) has begun to identify more Nlaka'pamux trails, using a combination of documentary research, interviews and field inventory to locate and record trails. This information ultimately should be useful for predicting the locations of archaeological sites associated with the trails.

5.4.5 Rock Art

Two distinct types of rock "art" are found in the study area: pictographs (images painted on a rock surface, usually with red ochre pigments) and petroglyphs (images carved or pecked into a rock surface, sometimes enhanced with pigments). Recorded rock art sites are rare in the Fraser Canyon, with only one pictograph and one petroglyph documented to date. Both pictographs and petroglyphs tend to be found in remote areas and many are believed to be associated with spiritual or ceremonial activities. Numerous examples are known in the Stein River valley, north of the present study area.

5.4.6 Historic Sites

While all archaeological sites relating to human activities since the period of contact between First Nations and European cultures are commonly termed "historic", the term is most often used to refer specifically to sites of non-aboriginal origin or to aboriginal sites containing manufactured trade goods. This does not, of course, imply that earlier aboriginal cultures lacked a history, and many archaeologists use the term "post-contact" to refer to historic period sites.

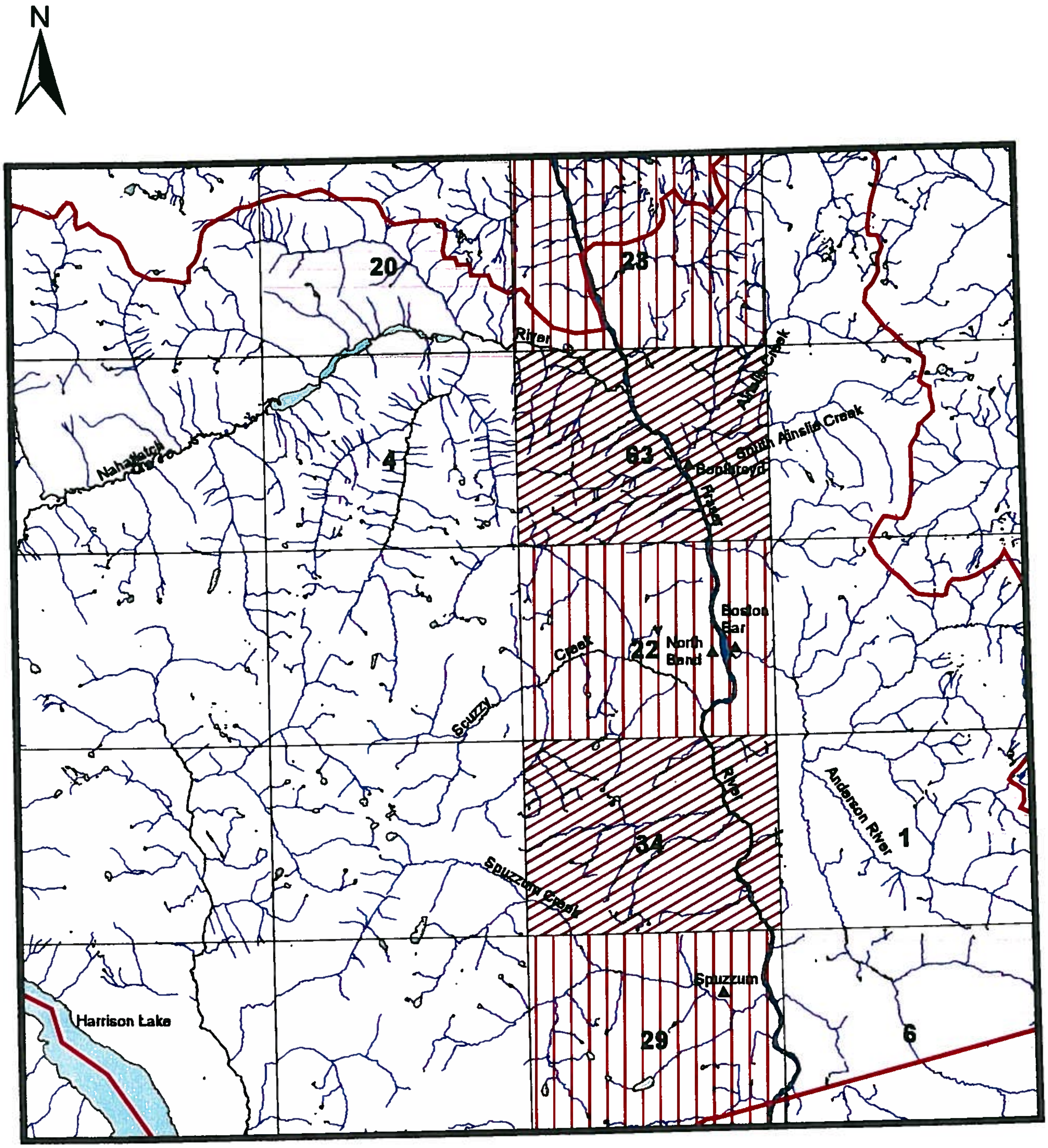
A significant number (n=88) of previously recorded archaeological sites in the study area have post-contact period components. Typical post-contact sites include structures (e.g., cabins, mills, stopping houses, barns), trails/wagon roads, hunting features (e.g., traps), mining features (e.g., mineshafts or tailings piles), and logging features (e.g., flumes or stumps). Post-contact period sites are distributed across much of the landscape, often associated with travel routes, farm land or resource availability. Sites relating to gold mining can be located almost anywhere in the region.

5.4.7 The Existing Archaeological Site Inventory

The current archaeological inventory for the Fraser Canyon area is reflective of the history of archaeological work in the area. A large proportion of the recorded sites (29%) were found within the narrow CN Rail twin-tracking corridor. This represents a significant bias in the database. An additional 40 sites (19%) are in the Nahatlatch River valley, meaning that almost half of all recorded sites in the study area lie within two narrow corridors. The vast majority of the remainder are along the banks of the Fraser River. As a result, very little is known about site distribution in other zones of the Fraser Canyon, including secondary rivers, mid-altitude lakes, the montane forest, the subalpine and the alpine. Furthermore, many previous field investigations did not employ subsurface site location techniques (i.e., shovel testing). Consequently, the true extent of many sites has not been determined, as site boundaries have been estimated from surface distributions of artifacts and/or features.

A further problem that has probably skewed known site distributions toward over-representation of river valley sites is the fact that prior to the early 1990s, CMTs were not consistently recorded as archaeological sites. The recent focus on cultural resource management, including intensive survey for CMTs in advance of forestry operations, has begun to produce information on CMT types and distribution, but few previously recorded non-CMT sites have been revisited to determine whether CMTs are also present.

Figure 11 shows the number of recorded sites in each 1:50,000 NTS map sheet in the study area, and Figure 12 shows the locations of all recorded sites in the study area.



LEGEND

- Study Area Boundary
- 6 Number of sites on TRIM

Site Frequency Scale:
- 0
- 1 - 20
- 21 - 30
- 31 - 63

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

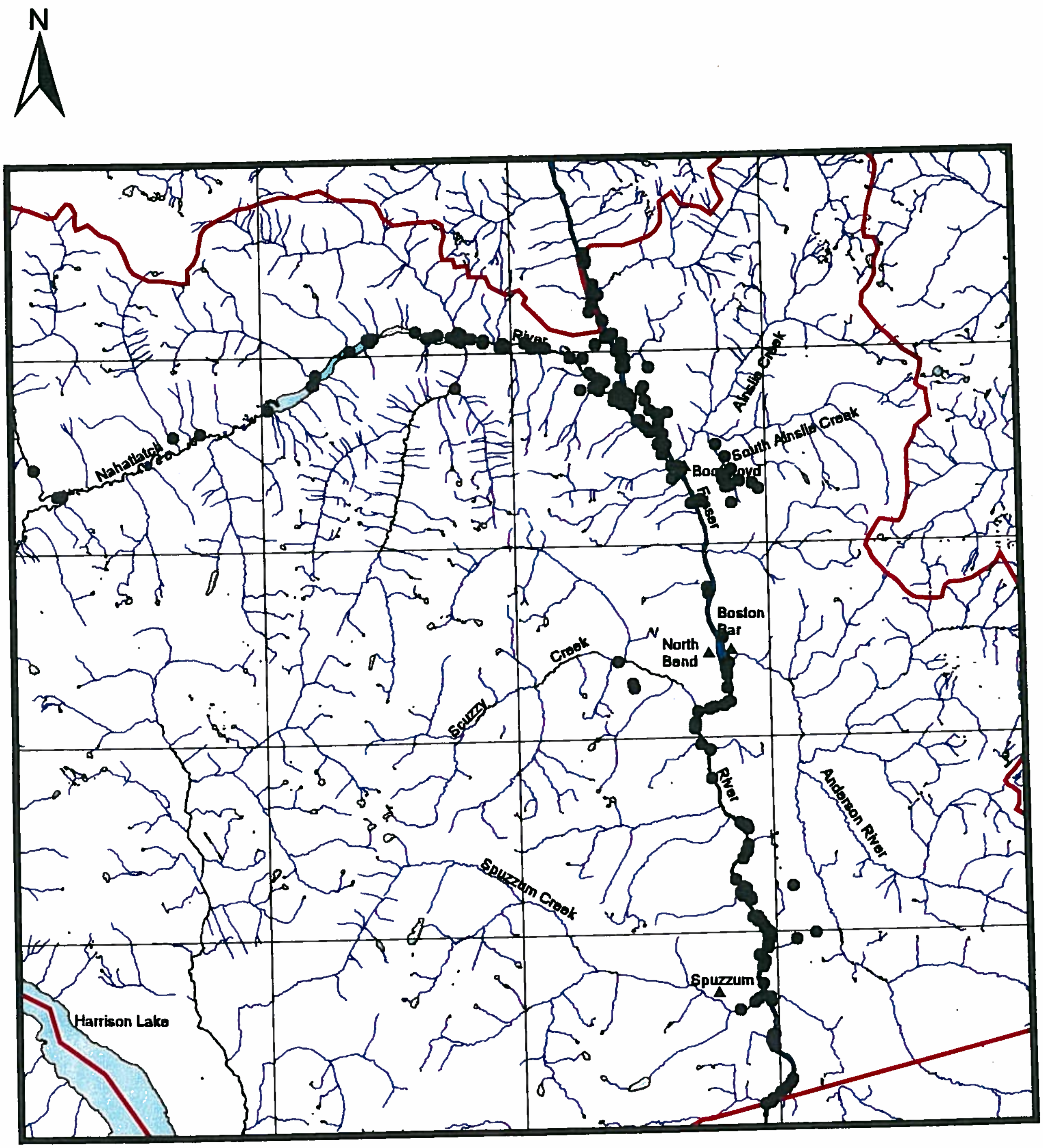
Golder Associates

NUMBER OF PREVIOUSLY RECORDED SITES BY TRIM MAP

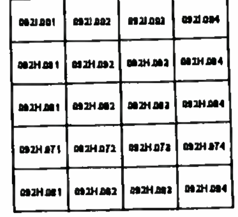
Scale
1:350,000

FIGURE:
11

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Frequency-L



TRIM Grid



LEGEND

- Previously Recorded Archaeological Sites
- Study Area Boundary

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED ARCHAEOLOGICAL SITES

Scale
1:350,000

FIGURE:

12

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Sites-L

5.6 GIS Analysis of Recorded Archaeological Sites

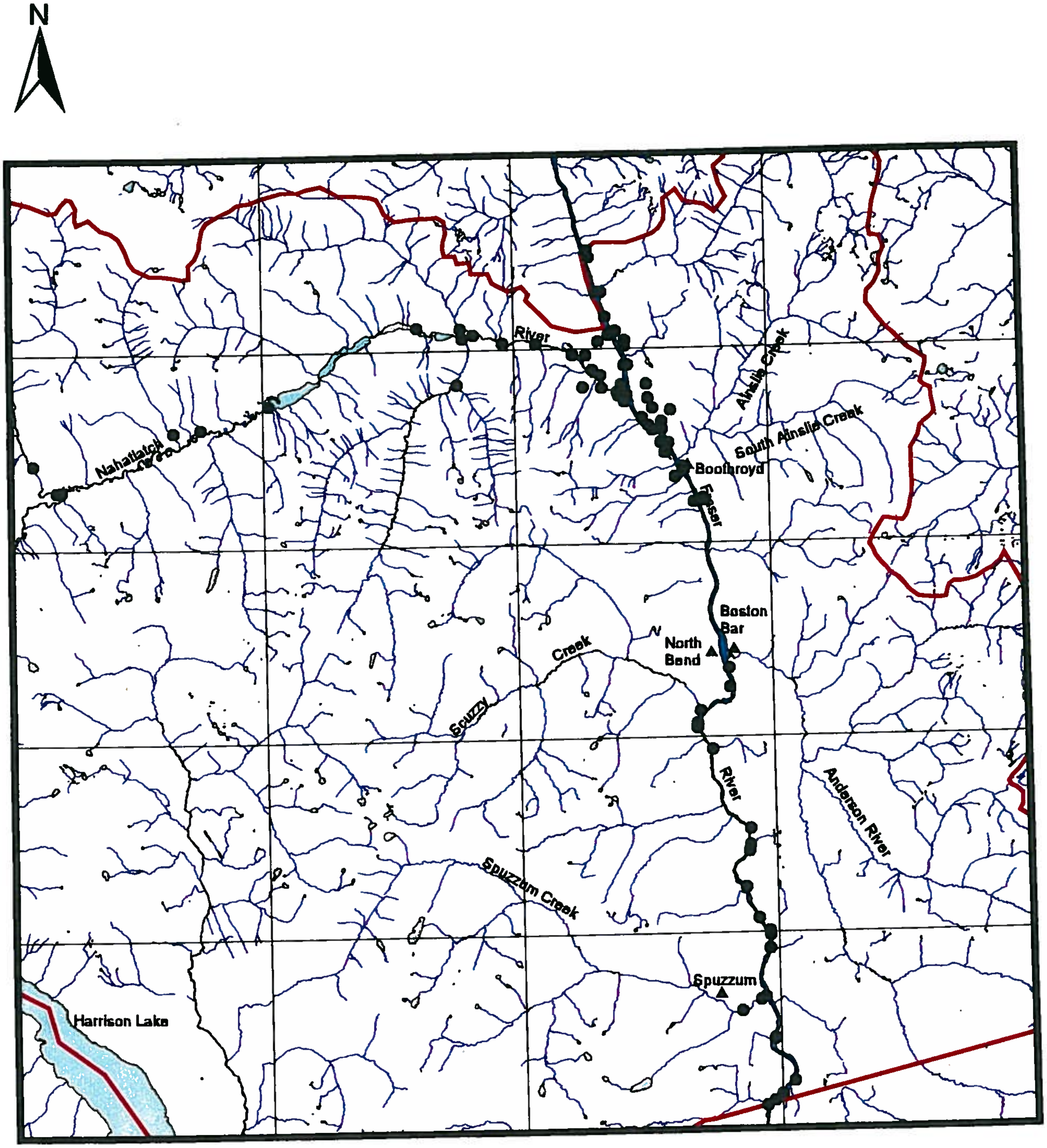
GIS analysis of the spatial and terrain characteristics of recorded sites was used to help develop predictive models for estimating archaeological site potential. Slope, distance to nearest fresh water, and forest cover type were determined for each recorded site. The following sections present the GIS analyses for habitation and CMT sites. Forest cover is discussed for CMTs only.

5.6.1 Habitations

Figure 13 shows the distribution of the recorded habitation sites in the study area. Dense concentrations of sites are notable along the banks of the Fraser and Nahatlatch rivers. Throughout the area, sites are strongly correlated with flat landforms near water resources. Forty of the habitation sites have pre-contact components.

<u>Slope</u>

The slope of each pre-contact habitation site was determined from the GIS grid values, and frequencies were calculated for slope ranges. Slopes ranged from 1% to 83%, with a mean of 31%. According to the DEM grid values, 43% of recorded habitation sites have slopes of less than 20% , and 60% are less than 30% slope. Unexpectedly, 40% of the recorded habitation sites have slope values greater than 30%; however, this may simply indicate that the 25 metre DEM grid size was inadequate to discern small terraces on which habitation sites often occur. Figure 14 shows the frequency of sites falling within ranges of slope values.



LEGEND

- ● Previously Recorded Habitation Sites
- ▭ Study Area Boundary

TRIM Grid

092I.001	092I.002	092I.003	092I.004
092H.091	092H.092	092H.093	092H.094
092H.081	092H.082	092H.083	092H.084
092H.071	092H.072	092H.073	092H.074
092H.061	092H.062	092H.063	092H.064

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED HABITATION SITES

Scale
1:350,000

FIGURE:
13

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Habitation-L

Figure 14 - Slope Ranges for Recorded Habitation Sites

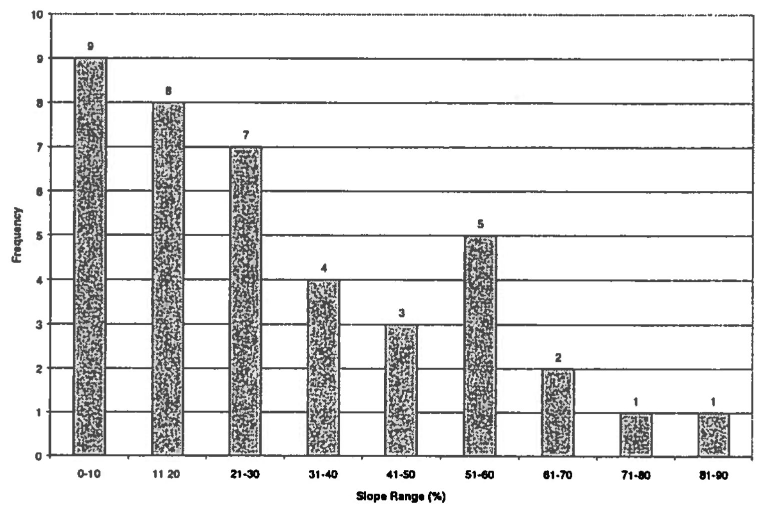
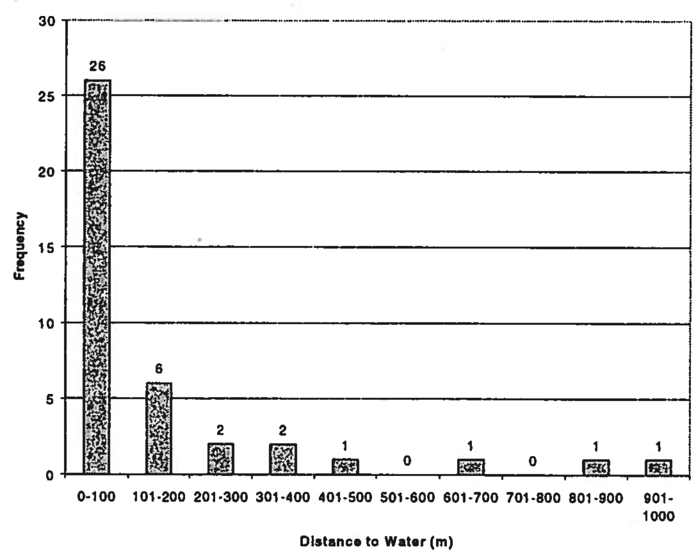


Figure 15 - Distance from Recorded Habitation Site to Nearest Fresh Water

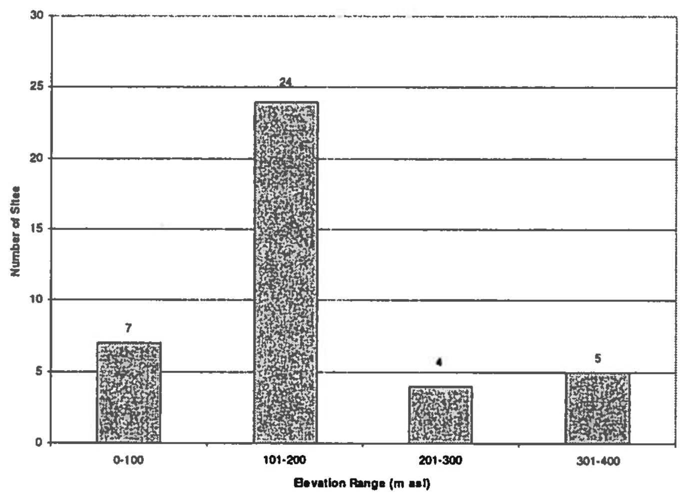


Elevation Distance to Fresh Water

Distance to the nearest source of fresh water was also calculated for each recorded site. A strong correlation was indicated between pre-contact habitation sites and water resources, with 65% of recorded sites falling within 100 metres of fresh water and 80% within 200 metres. Still, 7.5% are more than 500 metres from a source of fresh water, although it is possible that extinct or seasonal water sources were present. Alternatively, the water source may not have been coded on the TRIM base map. Figure 15 shows the number of sites falling within various distances from fresh water.

The relationship between elevation and recorded pre-contact habitation sites was also explored. Habitation sites have been recorded between 59 metres and 338 metres above sea level. Breaking down the elevations into 100 metre classes shows that 60% of recorded pre-contact habitations lie between 101 metres and 200 metres above sea level. Figure 16 illustrates the elevation ranges of recorded habitation sites in the study area.

Figure 16 - Elevation Ranges for Recorded Habitation Sites



5.6.2 CMT Sites

Only 30 CMT sites have been recorded in the study area, and almost all are along the Fraser, Scuzzy, Nahatlatch and South Ainslie drainages (Figure 17). The majority of recorded CMT sites have been documented in the past year, as a result of forestry-related impact assessments (Golder Associates 1998b,c). Two additional CMT sites have been recently recorded by Golder Associates in the Scuzzy Creek area, but they were not included in this analysis.

<u>Slope</u>

No strong correlation was noted between slope and CMT locations, although there is a general trend of decreasing frequency with increasing slope (Figure 18). The lowest slope value for a recorded CMT site 2% (nearly flat), and the highest is 82%. It is notable that there appears to have been a preference for stripping bark from trees on slight to moderate slopes rather than flat ground, probably to allow a longer bark strip to be removed. No distinction was made in the analysis between tapered and rectangular bark strips, but it is plausible to suggest that rectangular strips may tend to occur on flatter ground, since it would not be necessary to remove a long strip.

The largest proportion (23%) of CMT sites have been recorded on moderately sloping terrain (11-20% slope), with only 13% occurring on flatter ground. Only a weak correlation is evident for the remainder of the slope classes, perhaps due to the small sample size currently available.

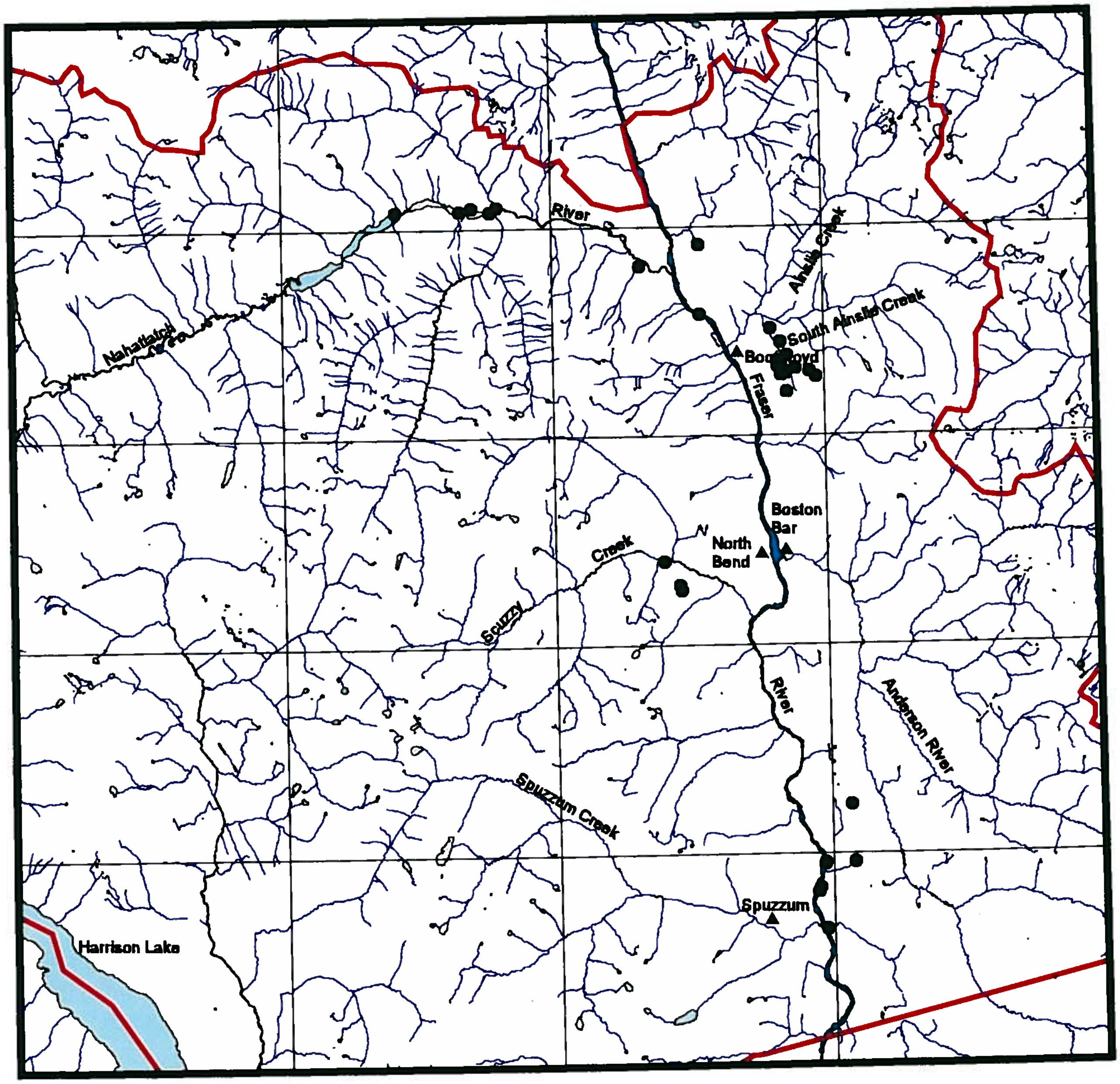
Distance to Fresh Water

Recorded inland CMTs tend to occur along drainages but not necessarily immediately adjacent to the waterway. Forty percent of recorded CMT sites are within 100 metres of a fresh water source, 50% are within 200 metres, and only 3% are more than 500 metres from fresh water (Figure 19). The minimum distance to fresh water is 8.4 metres, and the maximum is over 1200 metres. This distribution indicates that CMTs may occur in low frequencies almost anywhere on the landscape, making them a difficult site type to model. Again, the small sample size precludes confident interpretation.

Elevation

Recorded CMT sites span a range of elevations, with a notable peak between 800 metres and 900 metres a.s.l. (Figure 20). As with the slope and distance to water data, the elevation ranges may be more a reflection of current timber harvesting areas (and by extension, locations of archaeological impact assessments) than a true representation of the elevation range of culturally modified tree sites.

N



LEGEND

- ● Previously Recorded CMT Sites
- Study Area Boundary

TRIM Grid

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED CMT SITES

Scale
1:350,000

FIGURE:
17

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: CMT-L

Figure 18 - Slope Ranges for Recorded CMT Sites

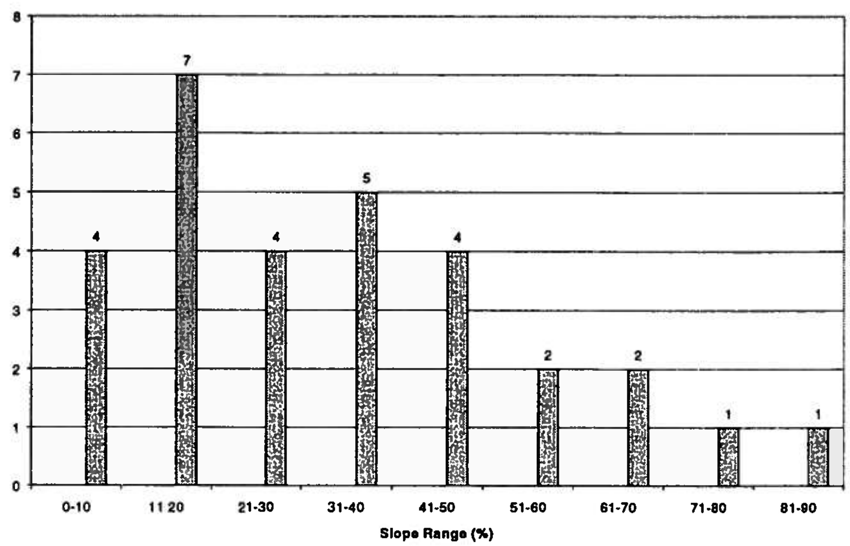


Figure 19. Distance from Recorded CMT Site to Nearest Fresh Water

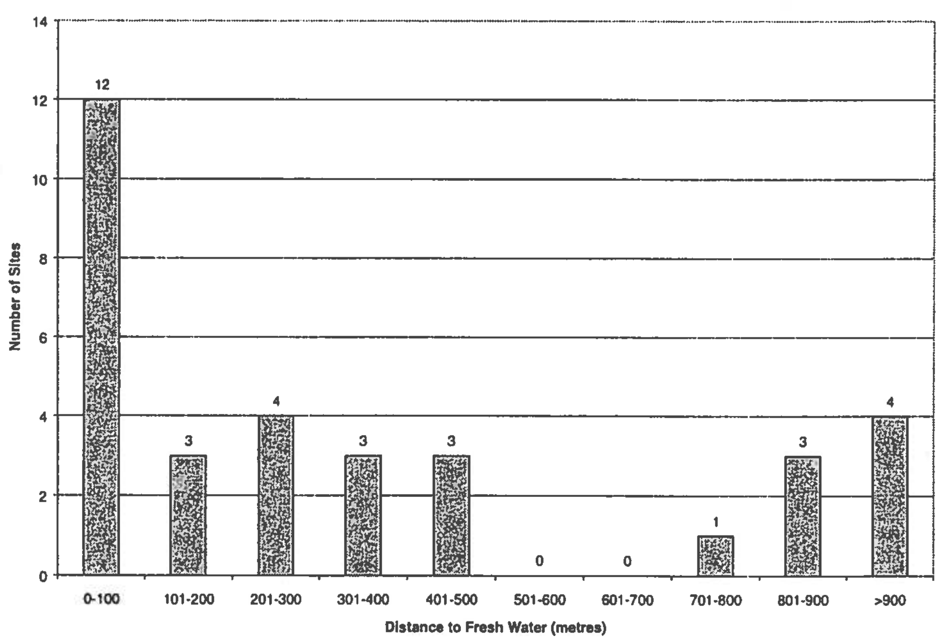
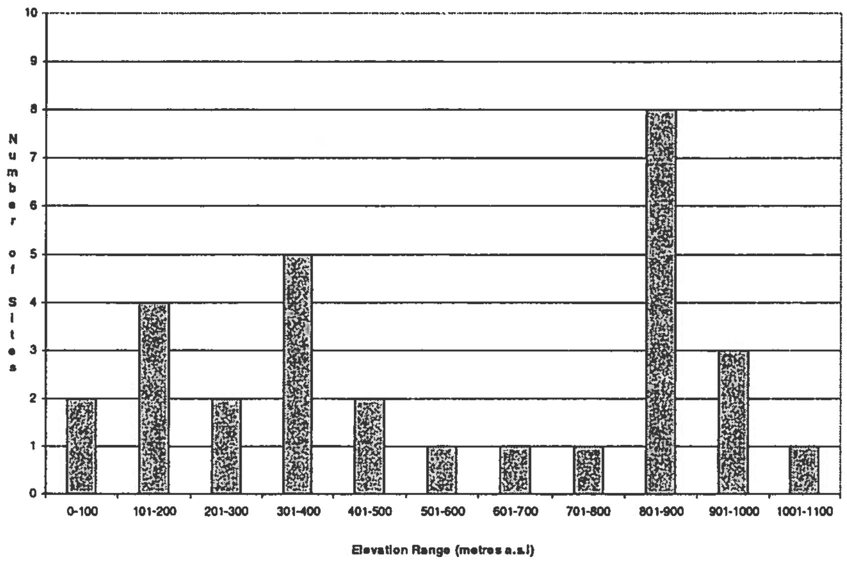


Figure 20 - Elevation Ranges for Recorded CMT Sites



Age and Height Classes

The age and height classes for each recorded CMT site were determined using Ministry of Forests forest cover data. Age and height class data were unavailable for one CMT site. Over 65% of the recorded CMT sites with data are in forests of age class 6 or older (more than 100 years old), most of which are in age class 8 or older (more than 104 years old). Unexpectedly, all recorded CMT sites are coded as height class 5 or less (less than 46.5 metres tall). Figures 21 and 22 show the distribution of recorded CMT sites across age and height classes.

Figure 21. Age Class Distribution for Recorded CMT Sites

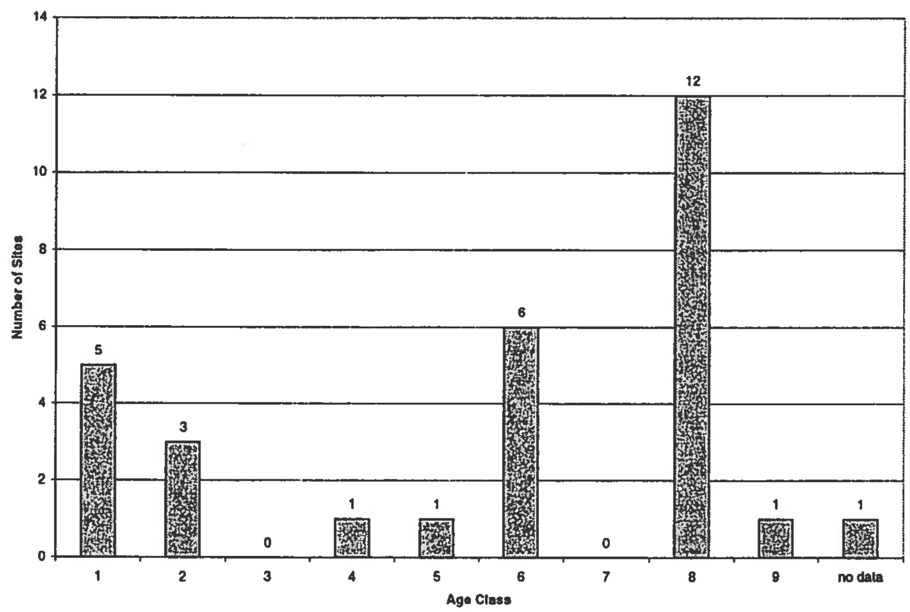
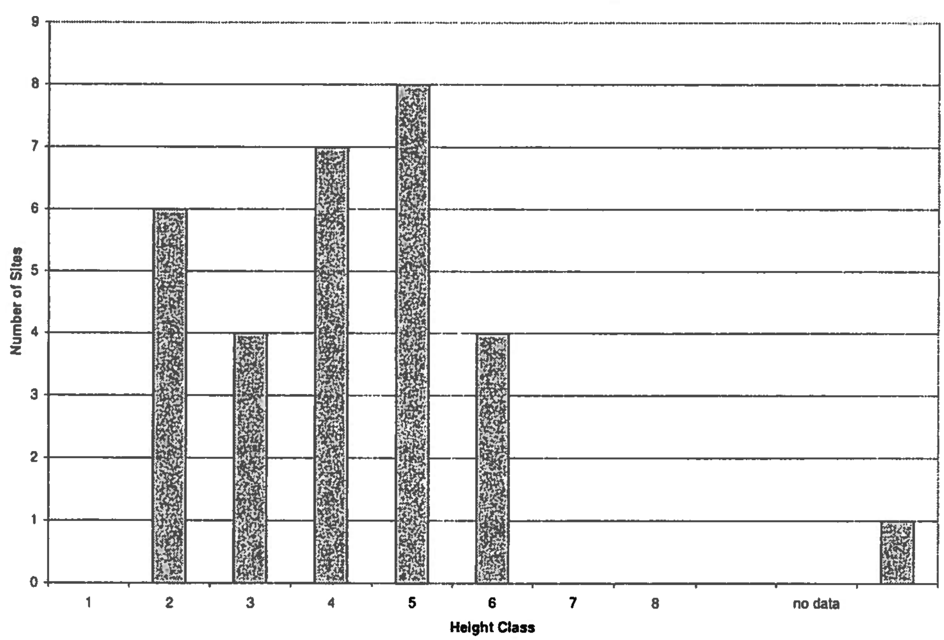


Figure 22 - Height Class Distribution for Recorded CMT Sites

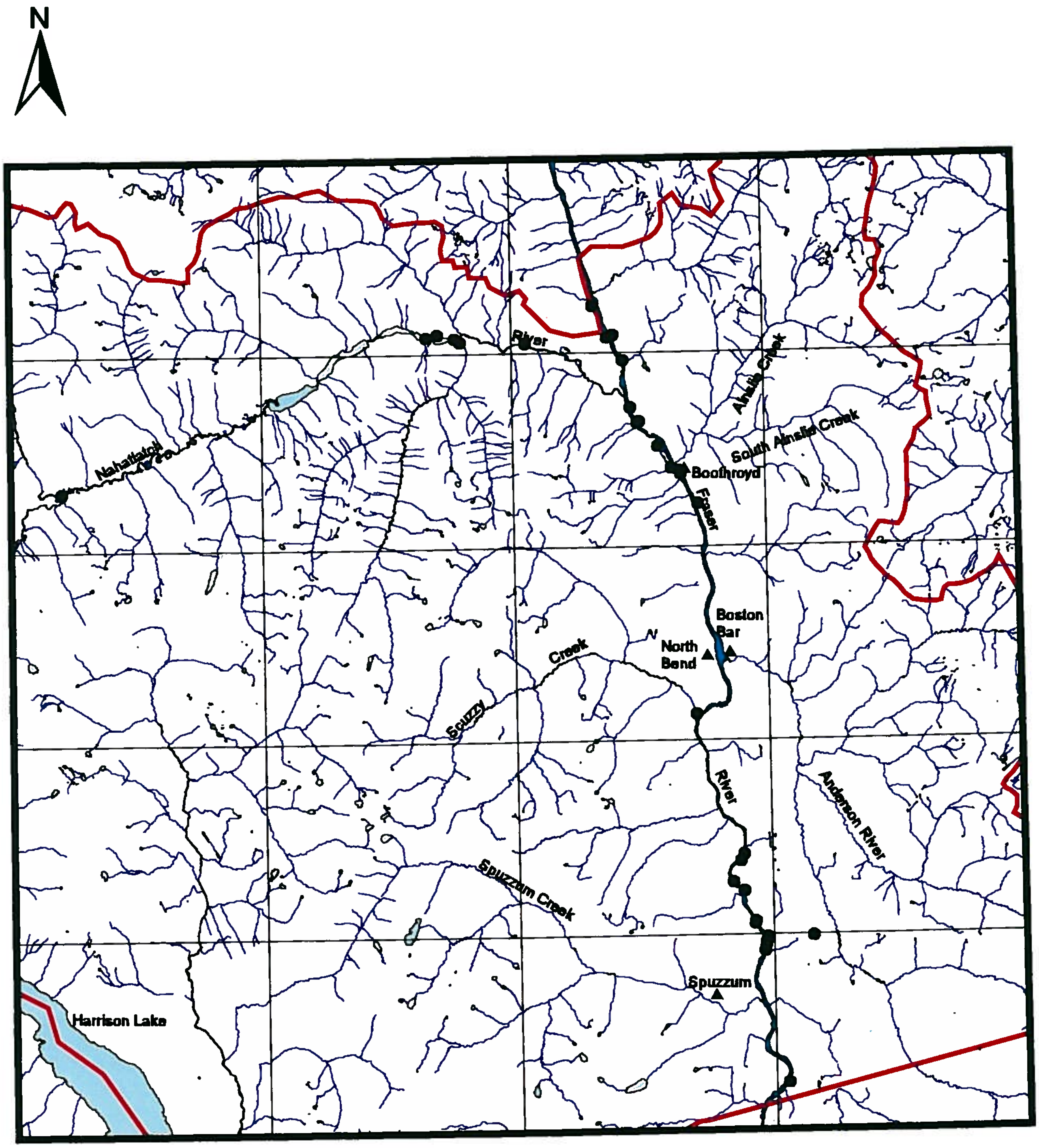


Distance to Recorded Habitation Site

The distance from each CMT site to the nearest habitation site was calculated to test for correlations between the two site types. The available data did not show a strong correlation, with only 33% of the recorded CMTs being within 500 metres of the nearest recorded habitation site, 33% between 1 km and 2 km away, and 33% lying more than 3 km from the nearest recorded habitation. These numbers should be interpreted with caution, however, since only 30 CMT sites and 40 habitation sites were considered, and 12 of the CMT sites are located in a limited area in the South Ainslie drainage. Moreover, the inventory of recorded habitation sites probably represents only a fraction of the total number of such sites that exist.

5.6.3 Other Site Types

Other recorded site types tended to cluster along major drainages, reflecting both the Nlaka'pamux settlement system and a bias in previous archaeological survey coverage. Figures 23-25 show the distributions of recorded archaeological sites with reported trails, historic components, and lithic scatters.



TRIM Grid

LEGEND

- ● Previously Recorded Trail Sites
- ▭ Study Area Boundary

Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED TRAIL SITES

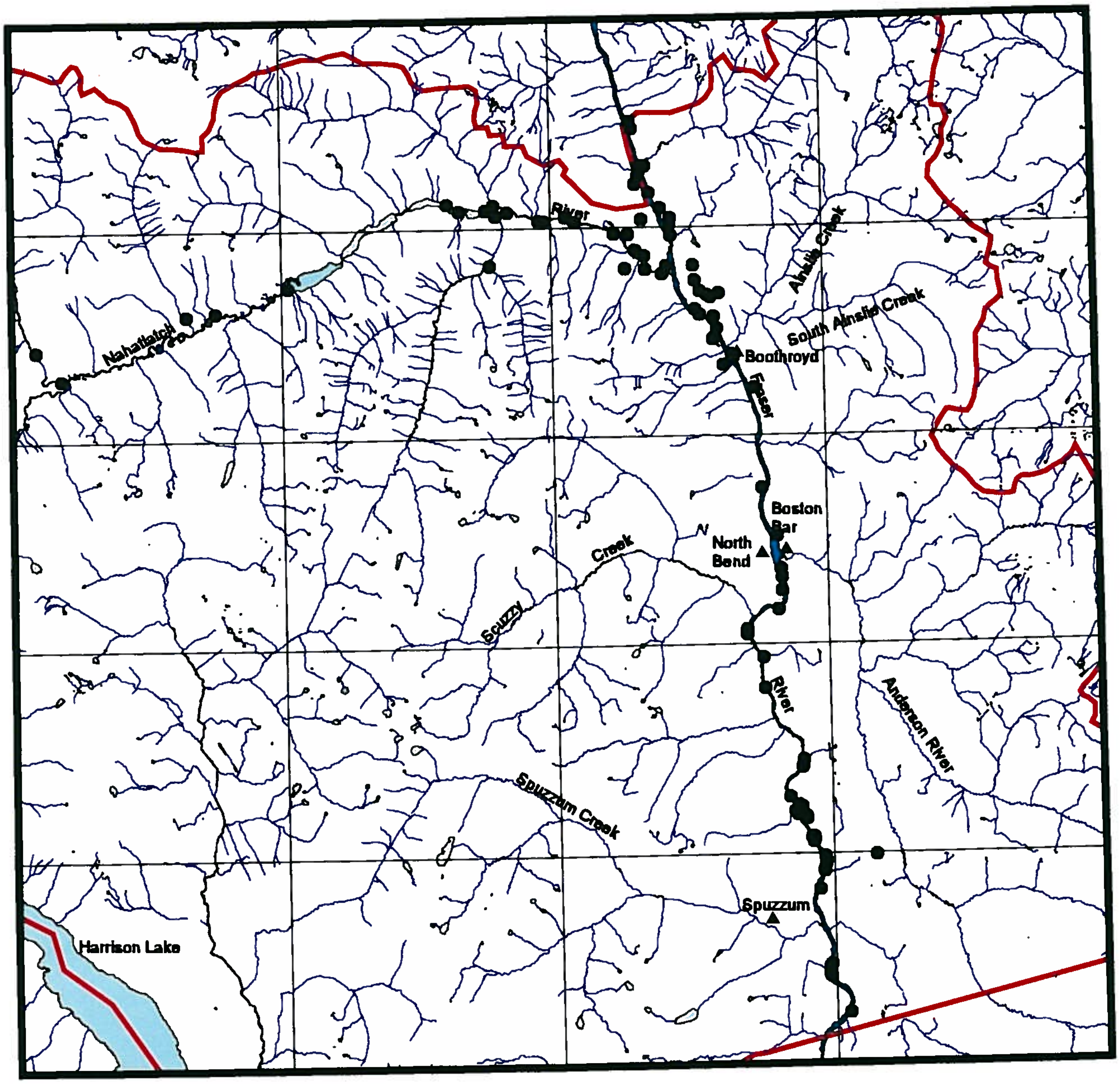
Scale
1:350,000

FIGURE:

23

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Trails-L

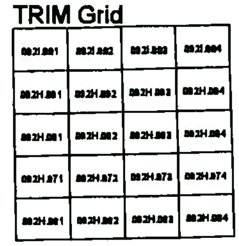
N



LEGEND

- Previously Recorded Historic Sites
- Study Area Boundary

TRIM Grid



Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED HISTORIC SITES

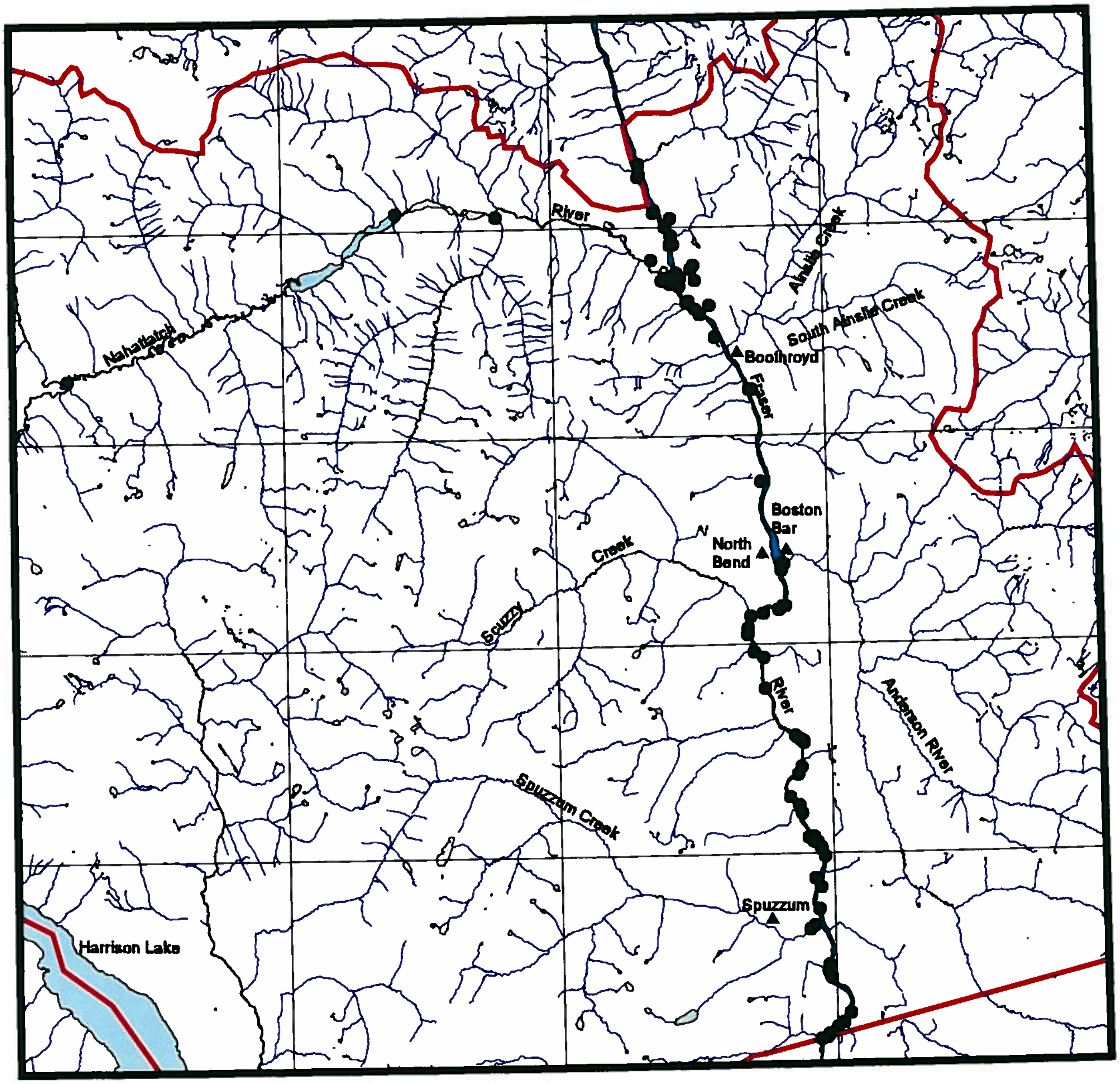
Scale
1:350,000

FIGURE:

24

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Historic-L

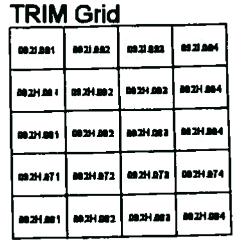
N



LEGEND

- ● Previously Recorded Lithic Sites
- ▭ Study Area Boundary

TRIM Grid



Projection: UTM Zone 10
Units: meters
Datum: NAD 83
Map Data Source:
TRIM

Golder Associates

PREVIOUSLY RECORDED LITHIC SITES

Scale
1:350,000

FIGURE:

25

Project Number: 972-1935 Date: 23 August 1999 File: reportmaps2-adden2.apr Layout: Lithics-L

6.0 PREDICTIVE MODELLING

One of the primary objectives of this study was to produce archaeological site potential maps that could be used to assess the need for archaeological field assessments prior to development. To produce these maps, it was necessary to develop a series of GIS-based predictive models.

Predictive modelling has been used as an archaeological tool for a number of years, and many published papers discuss the merits and limitations of its application (e.g., DeBloois 1985; Kohler 1985; Dalla Bonna 1995). The complexity of site location models has varied widely, from simple inductive models based on a researcher's knowledge and experience (expert inference models) to much more complex statistical techniques, such as multiple regression analysis. Regardless of the method used, most predictive models rely on observed patterns of known archaeological sites across the landscape to suggest where unrecorded sites are most likely to be found. Sophisticated modelling may simultaneously analyze numerous data sources to develop complex statistical models.

Years of archaeological research has provided a fairly substantial body of site location information for certain parts of the province, and some general distribution patterns can be identified. This information, together with knowledge shared by aboriginal people and other informants, ethnographic evidence, historical accounts, and other data can often provide a good understanding of what types of archaeological sites are likely to exist in a given area.

The accuracy, reliability and complexity of a predictive model is completely dependent on the quantity and quality of available data, especially when GIS is used. Probabilistic archaeological inventory, in which areas of both high and low site potential are investigated, is the preferred field methodology for producing data for modelling. However, since no probabilistic inventory projects have taken place in the NNTC/Chilliwack Forest District overview area (Eldridge and Mackie 1993), we do not know enough about site distributions to successfully employ statistical models.

Some areas, however, have received enough archaeological attention to produce fairly large archaeological datasets. In these cases, more sophisticated computer modelling can be applied, and the results can be presented in GIS formats that provide clear graphical representations of the results. The river valley zone of the Fraser Canyon is one area that offers a fairly large dataset. Unfortunately, very few sites have been recorded in the upland portion of the study area.

In-field ground truthing is usually required to test the hypotheses used to create predictive models, and to provide both positive and negative data that can help to refine them. This is particularly true for forested environments, where limited site visibility, poor preservation of organic materials, and a small body of detailed archaeological and ethnographic data are constraining factors.

In summary, site location modelling is a means of focusing limited archaeological management resources on locations that are believed to have the greatest cultural and archaeological sensitivity. Modelling can be an effective resource management tool, and can help to ensure the protection of many archaeological sites. It is not, however, a substitute for systematic field inventory. Models help predict the potential for sites to be present in a given area, but field investigations are required to actually locate and record the sites. No model should be expected to account for the locations of all sites.

6.1 Previous Modelling Projects

Previous modelling in the Chilliwack Forest District sought to assess specific proposed timber harvesting or road construction locations in terms of archaeological potential. Site potential classes were defined as high (requiring an impact assessment), moderate (requiring a reconnaissance investigation), and low (indicating no further work) (Millennia Research 1996). A model identifying the environmental contexts in which sites are most likely to occur was created and scores were assigned to nine variables: slope; landform/terrain; distance to a stream, lake or wetland; presence of known ethnographic sites; ethnographically known use of similar biophysical area; presence of recorded or known archaeological sites; presence of old growth forest; presence of subalpine parkland resources; and, accessibility. These variables were scored to rank the archaeological potential of each cutblock or road.

Several refinements were made to the model, the most notable of which involved increasing the weight of the slope variable in the overall ranking, essentially making slope the overriding factor for archaeological potential. Subsequent impact assessments have shown that this approach can result in a high percentage of "false positives", in which site potential ratings are inflated (Golder Associates 1996). Specifically, relatively flat areas some distance from water sources, or near a very minor stream, but distant from other resources, have sometimes been assigned higher potential ratings than is warranted. This may be partially a consequence of using a single model to account for all site types.

More recently, a data gap analysis for the Chilliwack Forest District (Equinox 1997) looked at biophysical variables that focused on significant environmental diversity rather than archaeological site potential (i.e., biogeoclimatic zone, elevation, distance from major drainage, distance from marine water, and latitude). The major focus of the study was not to examine or model archaeological site distribution, but to determine survey coverage and point out significant gaps in the existing archaeological inventory. It was shown that previous investigations had been concentrated in the southwestern portion of the forest district, at relatively low elevations, and within close proximity to major drainage systems. Surveys away from major drainages and/or at higher elevations are lacking. Results of the analysis suggest that although there is no ideal survey sample size from which to begin predictive modelling, approximately 1% of each major biophysical zone within the forest district should be investigated (Equinox 1997).

6.2 Modelling Rules and Rationale

This section summarizes the steps taken to develop and apply a series of archaeological predictive models for the study area.

6.2.1 Model Development

The predictive models used in this project were developed using data collected in the earlier literature review, consultation and site analysis phases. Ethnographic and historical documents were reviewed to glean information about past cultural activities in the study area, including subsistence practices, technologies, architecture, and exchange systems. Archaeological reports and publications were reviewed to correlate past activities with archaeological site types. Physical evidence of occupation, such as housepits or culturally modified trees, was linked with specific activities (habitation, and bark-stripping, for example). These relationships were used to create statements that could be used in GIS modelling. Simple examples of this process are illustrated in Table 4 below. Note that Table 4 is an example only and is not intended to represent a functional model.

Table 4 - Example of Predictive Modelling Criteria

Activity	Archaeological Evidence	Modelling Statement	Archaeological Potential
Winter Village	Cultural Depressions (housepits, cache pits, earth ovens, etc.), scattered artifacts.	Distance to river <150 m AND Slope < 20% AND Distance to known trail < 100 m	High
Bark collection for basketry	Culturally modified trees	Forest cover includes cedar AND Age class = 8 or 9 AND Distance to river < 200 m	High

In the absence of probabilistic inventory data, an inductive modelling approach was adopted, whereby the characteristics of previously recorded archaeological sites provided the primary modelling data. Models were developed for three site types, which are described in the following sections.

6.3 Data Sources

The following data sources were used for modelling:

- Terrain Resource Information Management (TRIM) maps (1:20,000 scale, ARC/INFO format);
- Gridded DEM (25 metre grid size);
- Forest cover maps (1:20,000 scale, ARC/INFO format);
- Recorded archaeological site data (1:50,000 scale paper maps; ARC/INFO point data and associated database; site forms and sketch maps, where available);
- Watershed Atlas Maps (1:50,000 scale, ARC/INFO format); and
- Indian reserves coverage.

6.3.1 TRIM and Gridded DEM

The TRIM base maps provided the most consistent and reliable source of spatial data used in this study. Twenty TRIM files were obtained from the Ministry of Forests, covering most of the traditional territory of the Nlaka'pamux Nation within the northern Chilliwack Forest District, north of Sawmill Creek (Figure 1). The digital elevation model (DEM) that accompanied the TRIM data was found to be inadequate to allow the resolution necessary for modelling. Specifically, the spot elevations in the TRIM DEM were too far apart to support a small enough modelling cell size to suit the project goals. Consequently, a "Gridded DEM Product" was purchased from Geographic Data B.C. for the analysis. The Gridded DEM represents a re-sampled version of the TRIM DEM in which spot elevations are interpolated to create a grid of elevations at 25 metre interval, allowing a 25 m cell size for modelling.

Features extracted from the Gridded DEM and TRIM coverages include elevation contours and point files and surface hydrography. Hydrographic features such as major rivers (bank to bank width greater than 20 metres), definite and indefinite rivers, lakes and wetlands were extracted and merged into a single raster coverage. Unfortunately, the grid-based nature of a raster GIS data model degrades the quality of linear features, and streams smaller than 25 metres are nonetheless represented by a 25 by 25 metre cell. Intermittent and indefinite streams were not extracted due to uncertainty inherent in the data. TRIM data were also used to identify data types to be excluded from the analysis (e.g., exposed rock, ice, and glaciers).

6.3.2 Forest Cover Data

Forest cover data were provided by the Ministry of Forests in ARC/INFO format. Thematic coverages extracted from the forest cover data pertained to the distribution, age, and height of major tree species, primarily western redcedar, yellow cedar and whitebark pine. Forest cover attributes used for modelling included species class code, inventory type group number, biogeoclimatic zone, age class and height class. The selected data were subsequently exported into a raster database and merged into contiguous data layers.

6.3.3 Recorded Archaeological Site Data

The Archaeology Branch provided several sources of data for recorded archaeological sites in the study area, including:

- GIS point data and an associated database for all recorded archaeological sites;
- original site forms; and
- 1:50,000 scale NTS maps showing recorded site locations.

Additional site information was downloaded from the Canadian Heritage Information Network (CHIN) database. These information sources were compared to ensure that all site location and type records were current and as accurate as possible prior to modelling. A relatively high error rate was found in all sources of recorded site data, and some interpretations and corrections were required before the data were suitable for modelling. The error-trapping and correcting process is described in Section 6.4 below.

Analytical tables were created to summarize the spatial and terrain attributes of the recorded sites. For each site type, tables were created to describe relevant variables such as slope, elevation, distance to fresh water, and forest cover (CMT and subalpine models only). The resultant information was used to evaluate and revise the modelling rules and threshold values.

6.3.4 Watershed Atlas

The 1:50,000 B.C. Watershed Atlas (Ministry of Environment, Lands and Parks) was used as a base map for digitizing the traditional territory of the Nlaka'pamux Nation. The watershed atlas was not used for modelling.

6.3.5 Indian Reserves Coverage

An ARC/INFO coverage of all Indian Reserves in the study area was obtained from the Ministry of Aboriginal Affairs and was used in the composite model.

6.4 Review for Archaeological Site Data

An accurate database of known sites and their attributes is crucial to the development of effective predictive models of archaeological resources. To this end, several archaeological data sources were reviewed for completeness, accuracy and concurrence.

6.4.1 Methodology

Canadian Heritage Information Network (CHIN) site type data and 1:50,000 scale maps of recorded site locations and were checked against B.C. Site Inventory forms and maps to ensure accuracy of the data. In cases of conflicting information, the site forms and maps were assumed to be most accurate, because they were recorded by in-field personnel. Any deviations were noted and corrected, and the revised information was compared with GIS data provided by the Archaeology Branch. Where necessary, corrections were made to the GIS point coverages and associated database.

6.4.2 Results

All examined data sources were found to contain errors. Some of the major types of errors include misplotted sites, site type errors, incorrect mapsheet references, duplicated sites (more than one site number assigned to the same site), and incorrect site numbers. In total, 177 site records had one or more errors, 50 of which had multiple errors. In addition, 54 new sites were added to the database. These include 14 CMT sites recorded by Golder Associates (1998b), 39 sites in the Nahatlatch drainage that had been recorded by Albright (1993) and Zacharias (1994a), and one other site. Table 5 summarizes the errors found in the data sets and Appendix 3 provides more detailed information.

Table 5 - Summary of Observed Errors in Archaeological Data

Type of Error	Number of Occurrences
Misplotted on 1:50,000 NTS map	64
Site Type Error	51
Misplotted or Missing from GIS Data	24
Incorrect Site Number	15
Missing Site Form	7
Missing from CHIN	6
Incorrect Map Sheet Reference	6
Duplication (more than one site number)	6
New Site	54
Multiple Errors	50

6.4.3 Site Location Errors

Misplotted sites were distributed throughout the study area and did not appear to be related to a specific archaeological project or time period. It is likely that the topography of the Fraser Canyon (small terraces and irregular river banks), combined with the gross 1:50,000 mapping scale contributed to the plotting inaccuracies. Many of the site type errors probably occurred during transcription from the site forms to CHIN. The source of GIS data errors is unknown, particularly in the case of misplotted sites that were correctly plotted on the 1:50,000 maps, which were the source of the GIS data.

7.0 MODELLING VARIABLES

Terrain variables are important in predictive modelling because certain types of archaeological sites correspond with certain landscape features. For example, village sites are typically (although not always) found on flat, well-drained, sandy terraces above major rivers. The terrain variables that were used in modelling are briefly defined below.

7.1 Slope

For the purposes of this study, slope was defined as surface gradient, in percent, measured as (rise/run) x 100. For example, a rise of 100 metres over a horizontal distance of 1000 metres represents a slope of 10% (100/1000) x 100. Slope values and coverages were derived from the Gridded DEM.

7.2 Distance to Fresh Water

Distance to fresh water was measured as simple horizontal distance to a lake, two-line river or definite river, as defined in the TRIM data. Effective distance (accounting for terrain) was not calculated. Indefinite and intermittent rivers were excluded from the model, due to the uncertainty of the data.

7.3 Forest Cover

Forest cover and other plant species were the basis for defining the subalpine zone and for modelling CMTs. Biogeoclimatic zone data were also used to define the subalpine zone. Forest cover was a key variable for CMT modelling, which used species composition, age class, and height class data in combination with terrain variables.

7.4 Distance to Other Archaeological Sites

Proximity to a recorded habitation site was used as a variable in the CMT model, under the assumption that areas surrounding villages and major camps would have been intensively utilized for many activities, including bark stripping and logging. It is important to note that the value of the inter-site distance variables is limited by the fact that not all archaeological sites have been located and recorded. Consequently, actual inter-site distances may be lower than suggested by the present data. In addition, simple distance measurements do not account for temporal variability, and it was necessary to assume that all sites were occupied or used at the same time.

8.0 PREDICTIVE MODELS

Separate models were developed for habitation sites, CMTs and subalpine camp sites. Not all archaeological site types were modelled. Certain sites, such as small lithic scatters, burials, trails, stone quarries and rock art, were not modelled due to insufficient data, or a lack of detailed understanding of their spatial distributions. It is anticipated that some of these sites, notably burials and some lithic scatters, will be accounted for by the habitation model, as it is likely that they will generally (although not always) correspond with village locations.

Those areas that best meet the criteria of the model, and therefore are predicted to have the greatest site potential, are labeled Class I lands. Locations that meet slightly less stringent criteria are identified as Class II lands. Class III areas are the remaining lands, which are predicted to have relatively low archaeological sensitivity. It should be noted that low potential does not indicate a total lack of potential for archaeological sites. Unanticipated archaeological sites may occur in these areas.

The following sections explain the underlying assumptions of each model and provide a summary of the modelling rules.

8.1 Habitation Model

For the purposes of modelling, habitation sites were considered to include villages, housepits, and large lithic scatters with a wide variety of tool types. It was assumed that most habitation sites would be located on relatively flat, well-drained sand or silt river terraces (especially near major confluences) or on lake shores, where shelter and fresh water are available.

8.1.1 Variables

The primary variables for the habitation model were slope, distance to fresh water (lake, or river) and elevation. Glaciers, wetlands, swamps, avalanche tracks, exposed rock, and the subalpine and alpine were all considered to have low potential for habitation sites, except subalpine camps, which were modelled separately.

8.1.2 Model Rules

Based on recorded site data and inference from archaeological and ethnographic information, the simple model presented in Table 6 was developed for habitation sites.

Table 6 - Criteria for Predictive Model of Habitation Site Locations

HABITATIONS		
Class I		Slope = 0-20%
	AND	Distance to lake (≥ 2 ha.) OR two line river OR definite river = 0-200 metres
	AND	Elevation < 500 metres asl.
Class II		Slope = 0-30%
	AND	Distance to lake (≥ 2 ha.) OR two line river OR definite river = 0-500 metres
	AND	Elevation < 500 metres asl.
Class II		Slope = 0-30%
	AND	Distance to lake (≥ 2 ha.) OR two line river OR definite river = 0-200 metres
	AND	Elevation > 500 metres asl.
Class III		All other lands

8.3 Subalpine Camp Model

Subalpine parkland areas at high elevations were preferred localities for collecting certain plants, such as avalanche lily, huckleberries and whitebark pine nuts. Since these areas may be some distance from the main villages along valley bottoms, base camps were often established along the forest fringe, near the desired plant resources. It is reasoned that where subalpine sites occur, the archaeological and cultural significance of this relatively uncommon site type would be high.

Subalpine plant collecting or hunting base camps will, by definition, occur only in the subalpine zone. Other habitation sites will occur at lower elevations, primarily in the CWH and IDF biogeoclimatic zones. It is further assumed that the subalpine zone can be defined largely by forest cover data.

Although no subalpine sites have been recorded in the study area, it is assumed that preferred base camp locations would have fairly level, well-drained ground and a source of potable water. Subalpine site information from other parts of the province supports this inference. A source of fresh water for drinking, cooking and washing is considered important for almost all habitation sites, and a reliable water source would be particularly important for plant processing that involved large-scale steaming or boiling.

8.3.1 Variables

For modelling, subalpine camps were considered special-purpose, high elevation inland habitations. Variables used in the model include slope, elevation, forest cover and distance to fresh water (lake or river). Based on forest cover data, the subalpine was defined as follows:

- all areas coded as "Alpine Forest" (Inventory Type 41 or 42);
- the upper Mountain Hemlock biogeoclimatic zone (>= 1400 metres asl);
- the upper Engelmann Spruce-Subalpine Fir zone (>= 1600 metres asl); and
- areas containing Whitebark pine.

The subalpine camp model was applied only to areas meeting these criteria. All lands outside the subalpine zone were excluded from the subalpine camp model.

8.3.2 Model Rules

A simple buffer zone was set around lakes, two-line rivers and definite rivers in the subalpine zone. It is expected that the buffer of 200 m will be sufficient to account for most, if not all subalpine camp sites, with highest site potential probably being in the 0-100 m range. It is cautioned that the model relies on modern surface hydrology characteristics, and sites associated with old drainages or extinct lakes may not be properly identified by the model.

A maximum value of 20% slope was selected for Class I lands, and 30% for Class II, based on comparisons with previous research. In the Squamish Forest District, all recorded subalpine sites are reported to occur on slopes of 10% or less (Hoffmann et al. 1997). Since no recorded site data were available for the study area, this variable could not be evaluated. Given the steep terrain of much of the Fraser Canyon, it is possible that slightly steeper locales may have been used for subalpine camps than for valley bottom. Based on these assumptions and variables, the model shown in Table 7 was developed for subalpine camp sites.

Table 7 - Criteria for Predictive Modelling of Subalpine Camp Locations

SUBALPINE CAMP		
		Subalpine zone = TRUE
Class I		Slope = 0-20%
	AND	Distance to lake OR two line river OR definite river = 0-100 metres
Class II		Slope = 0-30%
	AND	Distance to lake OR two line river OR definite river = 0-200 metres
Class II		Slope = 0-30%
	AND	Whitebark pine present
Class III		All other lands

8.4 Culturally Modified Tree (CMT) Model

Trees were used for a wide variety of aboriginal practices, many of which continue today. For example, western red cedar bark was used for making baskets, clothing, and a host of other items; hemlock was used to make bows and other implements; yew wood was used to make digging sticks, bows, snowshoes and other items; and cedar, Douglas-fir, hemlock and other trees were used for house planks, canoes and other items. Trees also provided food, in the form of cambium and nuts, as well as medicines, fuel, roofing material and a range of other items.

As described in Section 5.4.2, the physical remains of these activities are known as culturally modified trees. The major categories of CMTs are bark stripped trees, aboriginally logged trees, and stumps. Previous CMT research has focused almost exclusively on cedar, and less is known about hemlock, pine or other CMTs (although large stands of lodgepole pine CMTs have been recently documented in several parts of the province). Consequently, it was reasoned that a reliable model could not be developed for non-cedar CMTs at this time. Moreover, the small sample size of recorded CMT sites (n=30) did not allow for detailed analysis. Such modelling would require a significantly larger dataset, and preferably reliable non-site data (i.e., locations that have been inspected and found not to contain archaeological sites) as well.

It was hypothesized that, while CMTs may occur in low frequencies almost anywhere on the landscape, the highest density of CMTs would be found near villages, along major valleys, or along trails. Due to extensive logging and other development in some of the valleys of the study area, it was reasoned that the majority of intact CMTs will be found in older forest stands. Since the cutoff date for automatic protection under the *Heritage Conservation Act* is A.D. 1846, an emphasis was placed on age class 8 and 9 stands (more than 140 years old). With the exception of whitebark pine, dominant species type was not used as a modelling variable, as recorded CMT sites did not exhibit a strong correlation with the species codes in the forest cover data.

8.4.1 Model Variables

Based on the characteristics of recorded CMT sites in the study area and elsewhere, the following variables were selected for modelling:

- height class;
- age class;
- slope;
- distance to river (two line or definite);
- distance to lake;
- distance to recorded habitation site; and
- presence of whitebark pine.

8.5.3 Model Rules

Based on the above terrain, forest cover and archaeological data, the model in Table 8 was developed for culturally modified trees.

Table 8 - Criteria for Predictive Modelling of CMT Site Locations

CMTs		
Class I		No species restriction
	AND	Slope = 0-30%
	AND	Age class = 8 or 9
	AND	Height Class = 4-8
	AND	Distance to lake (> 2 ha.) OR two line river OR definite river = 0-350 metres
Class I		No species restriction
	AND	Slope = 0-80%
	AND	Age class = 8 or 9
	AND	Height Class = 4-8
	AND	Distance to recorded pre-contact habitation site = 0-500 metres
Class II		Whitebark pine present
	AND	Slope = 0-30%
Class II		No species restriction
	AND	Slope = 31%-80%
	AND	Age class = 8 or 9
	AND	Height Class = 4-8
	AND	Distance to lake OR two line river OR definite river = 0-500 metres
Class III		All other lands

9.0 RESULTS

Two datasets were produced from the model results. The following sections describe the datasets.

9.1 Dataset I

Dataset I consists of polygons representing predicted archaeological site potential, and an accompanying database. Archaeological site potential was ranked as Class I, Class II or Class III, in order of predicted relative site potential. As defined in Section 1.2.3, Class I lands meet the most stringent model criteria, and are considered to have the highest site potential. Class II lands are predicted to have moderate site potential (i.e., fewer sites will be found than in Class I), and Class III lands represent the lowest site potential, according to the models. It is important to reiterate that not all site types could be modelled, and some sites may exist in Class III zones. However, it is expected that such sites will be comparatively rare.

The total study area encompasses 319,794 hectares, of which 309,588 hectares of land were included in the modelling exercise (ice fields, lakes, rivers and wetlands were excluded from modelling). The study area was divided into a 25 metre grid and each cell was assigned a score for each model. The grid values correspond with Class I, Class II and Class III archaeological potential classifications.

9.1.1 Combined Habitation and Subalpine Model Results

A composite model was created that combined the results of the habitation and subalpine models. The area contained within each land class was calculated for the composite results. At the request of the Ministry of Forests and the NNTC, the results of the CMT model were not included in the composite calculations, as it was felt that the CMT model required additional refinement prior to implementation. Tables 9 and 10 present the results for the composite and CMT models. Results were not calculated separately for the habitation and subalpine models.

The composite Class I lands account for 4,935 hectares, or 2% of the modelled area. Class II model results account for an additional 34,848 hectares (11% of the study area), for a total of 39,783 hectares of modelled Class I or Class II habitation/subalpine lands (13% of the study area). All remaining lands were assigned a Class III rating (lowest archaeological potential) for habitations or subalpine camps. These results reflect the severe terrain of much of the study area.

Table 9 - Summary of Combined Predictive Modelling Results for Habitation and Subalpine Models

Archaeological Land	Area	Percent of Modelled
Class I	4,935	2%
Class II	34,848	11%
Class III	269,805	87%

9.1.2 CMT Model Results

The CMT model results are presented for information purposes only, as the NNTC and Ministry of Forests have elected not to implement the CMT model at this time. Class I CMT lands encompass 6,480 hectares (2.1% of the modelled area) and Class II lands account for an additional 20,775 hectares (6.7% of the area). This means that 8.8% of the land mass of the study area was assessed as having moderate to high potential for CMT sites. No attempt was made to discern how much of the Class I/Class II CMT lands overlapped with Class I or Class II areas for the other models. It is likely that the CMT model results underestimate the actual areal extent of CMT sites in the study area.

Table 10 - Summary of Predictive Modelling Results for CMT Model

Archaeological Land	Area	Percent of Modelled
Class I	6,480	2.1%
Class II	20,775	6.7%
Class III	282,333	91.2%

In addition to the modelled Class I and Class II areas, all Indian Reserves were automatically given a Class II rating, unless over-ridden by a Class I model result. Recorded archaeological sites in the study area were buffered by 150 metres on all sides to provide a mechanism for ensuring field inspection of areas immediately surrounding known sites, assuming terrain conditions do not preclude assessment.

9.2 Model Success Rates

The results of the predictive models were compared against the database of recorded sites to assess their success rate. While the models were based partially on the characteristics of recorded sites, a 100% success rate cannot be expected, as only a few spatial characteristics of the sites were used in the models, and any number of additional factors may have influenced site locations. Table 11 shows the success rate of the habitation, and CMT models. As there are presently no recorded subalpine sites, the subalpine model success could not be evaluated.

Table 11 - Capture Rates of the Habitation and CMT Models

Model	Total Number of Sites	Class I Capture Rate	Class II Capture Rate
Habitation	40	32.5%	20%
CMT	30	10%	3.3%

Initially, these results appear disappointing; however, closer analysis reveals that the effectiveness of the models may be significantly greater than the values suggest. For habitation sites, it was evident that many sites may have been missed due to limitations introduced by the 25 metre DEM grid size, since many small village sites are located on narrow terraces that might not be discriminated by the available DEM. To test this hypothesis, a proximity analysis was completed to determine how many recorded habitation sites are within 100 metres of an area modelled as Class I or Class II. It was found that 88% of all habitations and 85% of pre-contact habitations are within 100 metres of a Class I or Class II polygon. This strongly suggests that the models are approximating actual site locations, but that the resolution of the available data are insufficient to improve the predictive success.

For CMT sites, the pattern was not as clear. Only 13.3% of recorded CMT sites were captured by the models. Thirty percent are within 100 metres of a modelled Class I or Class II polygon, 53% are within 200 metres, and 83% are within 500 metres. There are several obvious reasons for the lower success rate of the CMT model. Only 9 of 30 CMT sites fell within the vegetation zone being considered by the CMT model (i.e., age class 8 or 9, height class 4 or greater). As a result, the maximum success rate possible, given appropriate terrain characteristics, would have been 30%.

Another reason for the limited success of the CMT model is the lack of spatial variability in the available dataset. Twelve of 30 recorded CMT sites are located in a cluster in the South Ainslie drainage, where the terrain and vegetation are relatively homogeneous across sites. Consequently, if the model failed to account for one of these sites, there was a strong probability that none would be captured. In fact, only two of twelve recorded CMT sites in the South Ainslie drainage were accounted for by the model. Closer examination shows that 9 of the 12 sites did not meet the age or height class requirements of the model because the CMTs were on veteran cedars in much younger stands (some of age class 1 [1-20years]). This was also the case in the Nahatlatch River valley, where several CMT sites not accounted for by the models did not meet the defined age or height class requirements. Two CMT sites in the Scuzzy Creek drainage were missed due to the unexpectedly steep slope (80-90%) on which they occur, while a third nearby site along Scuzzy Creek was correctly assessed. Five small CMT sites were found at high elevation near Scuzzy Creek subsequent to the GIS analyses for this report. All the relevant variables for these sites also would have been captured by the CMT model, except stand height, which was Class 3. In future CMT modelling efforts, it may be necessary to reduce the height class requirements at high elevation, due to slower growth rates in these zones.

Finally, the fact that CMTs span the pre-contact and post-contact periods hinders modelling efforts. Contact with Europeans influenced Nlaka'pamux settlement and subsistence practices, and it is reasonable to expect that forest utilization systems also changed over time. To date, little or no research has addressed the question of post-contact changes in Nlaka'pamux use of the forest, and no comparisons have been made between pre- and post-contact CMT distributions.

9.3 Discussion

Results for the habitation model are encouraging. Taking into account the 100 metre proximity analysis, relatively high capture rates were achieved without identifying unnecessarily large areas of Class I or Class II lands. The CMT model results were less successful, but were difficult to evaluate, given the small sample size and the degree of variety among recorded CMT sites. Other important limitations on CMT modelling include the significant degree of past harvesting that may have destroyed many CMTs, and the fact that the forest inventory data are only accurate to the stand level. Based on these factors, the CMT model should be considered preliminary at this time and will not be implemented by the Ministry of Forests until additional data are collected. The

Ministry of Forests and the NNTC have discussed interim CMT management strategies, pending the development of improved vegetation data and the collection of additional CMT information.

Several site types, such as rock art, lithic scatters, burials and rockshelters, were not individually modelled. However, it is anticipated that many of these sites may be located within Class I and Class II lands identified under the habitation, subalpine and CMT models.

9.4 Dataset II Known Archaeological Sites

Dataset II consists of the ACR/INFO point coverage of recorded archaeological sites and the associated INFO table (database). The database contains site type descriptions using Archaeology Branch descriptors, an indication of which model the site relates to (if any), and data for slope, distance to water, and vegetation characteristics (where relevant). Attribute records are linked to each site location using the Borden number as a unique identifier. A separate text file documented the map projection, North American datum, and other metadata.

10.0 EVALUATION AND DISCUSSION

As expected, the model results indicated that the highest archaeological potential is near major watercourses. This pattern is consistent with the ethnographically reported Nlaka'pamux subsistence and settlement system, which relied heavily on salmon harvesting and exchange. The CMT and subalpine models suggest greater upland site potential than the current site inventory would indicate, and it is likely that existing ethnographic and archaeological information under-emphasizes aboriginal use of these zones. Subalpine site potential is predicted to be greater in the northeastern part of the study area, due to ecological factors that provide for more subalpine parkland habitat.

The success rates of the predictive models confirm that archaeological sites, particularly habitation sites, can in fact be modelled. Incorporation of better baseline data (notably DEM and vegetation) in the future should allow significant refinement of the models, ultimately leading to an effective cultural resource management tool. The present results provide a good foundation for that process and can be used to guide archaeological impact assessments pending refinement.

11.0 RECOMMENDATIONS

Three levels of recommendations are provided below. Planning-level recommendations provide direction for developing proactive strategies for managing cultural heritage resources in the study area. The operational-level recommendations explain how the AOA modelling results should be implemented. Finally, technical recommendations are provided to help standardize future archaeological and GIS efforts in the study area.

11.1 Planning Level Recommendations

11.1.1 CMT Management

The management of culturally modified trees is currently an important and problematic issue in many regions of British Columbia. Until recently, most CMT management schemes have been site-specific and *ad hoc*; broad management plans have only recently begun to develop. Given the fact that recent impact assessments have identified a number of large CMT sites in the Fraser Canyon area, it is recommended that a CMT management strategy be developed as soon as possible. The plan should take into consideration a variety of resource values, and should be acceptable to the Ministry of Forests, the Nlaka'pamux Nation, local forestry licensees and the Archaeology Branch.

11.1.2 General Cultural Resource Management Plan

In addition to developing a management plan specific to CMTs, it is recommended that an overall cultural resource management strategy be considered. Although a relatively large number of archaeological sites have been recorded in the lower elevations of the study area, many have been identified during inventories (e.g., Albright 1988) or field overviews (Arcas Associates 1984, Albright 1993, Zacharias 1993) that did not produce site management recommendations. Much of this information is out of date, and many sites have undoubtedly been impacted or destroyed. This situation hinders the development of a resource management plan, as non-current baseline data do not allow a proper assessment of the significance of newly identified sites.

An effective plan would require updated site information to improve the quality of the archaeological data. While this overview included a data correction component, no field assessments were completed. All archaeological sites recorded prior to the introduction of site alteration permits in 1994, (now under Section 12 of the *Heritage Conservation Act*) should be revisited and the site information should be updated. At present, no good information exists regarding the status of recorded sites in the study area, making it virtually impossible to gauge the uniqueness and significance of newly found sites. First Nations communities and other interested parties (e.g., historical societies) should be consulted to identify specific sites that are of particular importance, so that they may be considered for preservation. Once up-to-date site information has been collected and public concerns have been documented, it would be possible to properly assess the current status of heritage sites in the study area, and to develop a plan to preserve an appropriate sample of sites of different ages, types and environmental contexts. Such a proactive approach could provide clear direction for developers and create a framework under which the management of newly-identified sites could be discussed.

11.2 Operational Level Recommendations

The following recommendations relate to polygons of archaeological potential identified in Dataset I of this AOA. Outlined below are specific recommendations regarding Class I, Class II and Class III archaeological potential ratings. The three land classes can be viewed as "risk indices" whereby the risk of impacting archaeological sites is predicted to be highest in Class I lands and lowest in Class III lands. In the absence of detailed field investigations, no location should be considered completely risk-free. Note that specific recommendations have not been made for the CMT model results, as the model will not be implemented at this time. Class I and Class II field assessment methods for CMTs may differ from those presented below for the composite model (habitations and subalpine) results.

11.2.1 Class I Lands – Combined Habitation and Subalpine Models

Based on the modelling criteria, Class I lands are those considered to have the highest potential for archaeological sites to be both present and preserved. An archaeological impact assessment (AIA) should be undertaken prior to land-altering development in any Class I zone. An AIA should be conducted by a qualified archaeologist under a *Heritage Conservation Act* permit issued by the Archaeology Branch, Ministry of Small Business, Tourism and Culture. All field assessments should involve consultation with the appropriate First Nations. At the present time, all forestry-related archaeological projects in the NNTC administrative area are reviewed and coordinated by the NNTC.

It must be emphasized that not all Class I lands will contain archaeological sites. The models are based on assessment of the suitability of the terrain to contain preserved archaeological sites but, for various reasons, not all suitable landforms will necessarily have sites. Moreover, many prime locations have been severely disturbed by development, and any associated archaeological sites have been impacted or destroyed.

11.2.2 Class II Lands

Areas rated as Class II are considered to have moderate archaeological potential and should also receive archaeological field inspection. A preliminary field reconnaissance is considered an appropriate level of investigation for Class II lands. The reconnaissance may lead to a recommendation for an impact assessment, or further work may not be warranted.

11.2.3 Class III Lands

Class III areas are considered to have relatively low archaeological potential due to environmental constraints on human use or on site preservation. No archaeological assessment is recommended for Class III lands. It should be noted however, that all site potential classes defined in this report are relative. Low potential does not mean *no* potential, and there is always the possibility that unanticipated archaeological sites may occur in Class III areas. Should direct observations, consultation with local First Nations or other information sources indicate the potential for archaeological sites to be present in a Class III area, a field reconnaissance should be undertaken by a qualified archaeologist to evaluate the site potential of the area. If archaeological materials are accidentally discovered during development, all work in the immediate area should be stopped or altered such that the archaeological site is not impacted. The Archaeology Branch and local First Nations should be contacted immediately to discuss appropriate site management measures. Emergency impact management measures, such as artifact collection, controlled excavation or CMT sampling, may be required to mitigate damage to any newly identified site(s).

11.3 Technical Recommendations

The following recommendations focus on refining the predictive models, improving the resolution of GIS mapping, and collecting archaeological data that will enhance future modelling and cultural resource management efforts. It is important to note that an archaeological overview assessment is an evolving planning tool that is subject to revision and updating as new or better data become available. As such, the AOA results should not be interpreted as a static representation of archaeological site potential in the study area.

11.3.1 Ground Truthing and Field Data Collection

1. As previously discussed, the predictive models developed and implemented in this study have not been field tested. A representative sample of Class I, Class II and Class III lands should be inventoried, preferably using a probabilistic field approach, to provide reliable site and non-site data that can be used to test and refine the models. Inventory methods should comply with Resource Inventory Committee (RIC) Standards for Archaeological Inventory, once they are implemented, and First Nations consultation should be an integral component of the research design.

   It is recommended that field inventory be completed on either a watershed or landscape planning unit basis. This approach provides a manageable research unit that could be systematically sampled in a relatively short time. A watershed approach would have the added benefit of reflecting, at least in part, aboriginal use of the landscape. A landscape planning unit approach, on the other hand, may help to reconcile cultural resource management needs with timber harvesting plans.

2. A larger CMT dataset is needed for predictive modelling. In addition, the information being obtained from cutblock-specific impact assessments does not provide appropriate data for statistical modelling. A sample of old growth forests should be selected for CMT inventory. The sample should focus on areas with red or yellow cedar, but other areas could be considered, in consultation with First Nations, to collect information on aboriginal use of other tree species. The sampling design could also take into consideration timber harvesting priorities.

3. Future impact assessments in the study area should include clear reporting of the terrain characteristics of examined areas, including slope, distance to water, forest cover and other variables used in predictive modelling. Survey coverage and site/non-site locations should be clearly mapped. A mechanism should be developed for ensuring that these data are stored in a central database and are accessible for future model refinements. Possible mechanisms might include making this type of data collection mandatory under Ministry of Forests contracts, requiring that licensees provide the information with cutting permit applications, adding the requirement as a condition of a Heritage Inspection permit, or revising the British Columbia Archaeological Site Inventory Form to include relevant fields. As the site inventory form is currently being revised, the last option may be the most appropriate. As public access to sensitive site information is of concern, these or other options should be discussed with the Archaeology Branch and the Nlaka'pamux Nation.

11.3.2 Data Improvement and Model Refinement

1. Limitations in the baseline forest cover appear to have adversely affected the CMT, and to a lesser extent, the subalpine modelling results. Improved vegetation data should help to increase the resolution of these models, and they may even indicate correlations between habitation sites and certain post-disturbance vegetation communities. Detailed vegetation mapping is currently under way in the Chilliwack Forest District, and the results should be evaluated in terms of their applicability to archaeological modelling. Unfortunately, these datasets were not available on time for inclusion in this study.

2. Newly available data should be periodically reviewed for their potential to enhance the predictive models, with an emphasis on palaeoenvironmental, fish, and wildlife habitat and vegetation data. When available for the study area, Terrain Ecosystem Maps (TEM) should be evaluated in terms of their value for archaeological predictive modelling. A great deal of valuable mapped information exists on a wide variety of terrain and biological features (e.g., fish, and wildlife habitat; surface geology). However, much of this information is currently unavailable in a format that can be used directly in GIS, or is only available for portions of the province. Alternatively, relevant information could be digitized from paper maps. This level of data preparation was beyond the scope of this study.

3. Habitation site modelling was limited by the resolution of the Gridded DEM, which was incapable of discerning terraces smaller than 25 metres wide. It is recommended that a 10 metre grid size be used in future modelling efforts. This should significantly increase the effectiveness of all models, by allowing smaller landforms to be identified.

4. Future incorporation of traditional land use information could significantly benefit cultural resource modelling efforts. Archaeological sites provide only a partial view of the history of human occupation and land use. Traditional land use studies can greatly enhance our understanding of the past by providing information about places of special cultural importance or cultural practices that may, or may not, have left physical (archaeological) evidence, and by helping to explain the reasons behind the distribution of certain site types and activity locales. During this project, traditional land use information was not available for the study area.

5. To the extent possible, archaeological survey coverage from previous impact assessments should be mapped and digitized to provide "non-site" data for modelling. It is recognized that in many cases, this information is not presented in permit reports.

11.3.4 First Nations Consultation and Training

Ongoing consultation with First Nations regarding cultural heritage issues is of paramount importance. Despite substantial First Nations participation in the planning and implementation of this project, the size of the study area precluded detailed community consultation about specific heritage sites. A watershed or landscape planning unit focus would provide for better consultation opportunities.

A stronger First Nations role in strategic planning initiatives may help to improve the quality of available cultural resource data and facilitate cooperative approaches to heritage site management. This AOA can be used as a joint planning tool during government-First Nations consultation, allowing First Nations to view and comment on the assessed archaeological site potential relevant to specific proposed developments.

12.0 CLOSURE

This report was prepared for the use of the Ministry of Forests, the Nlaka'pamux Nation and the Archaeology Branch. Any use or decisions made on the basis of the report by third parties are the responsibility of such third parties. This study was not intended to address issues of traditional land use or aboriginal rights or title, and it is presented without prejudice to land claims or treaty negotiations.

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APPENDIX I

LETTER REPORT ON ARCHAEOLOGICAL IMPACT ASSESSMENT OF CHUKCHEETSO RESERVE (I.R. # 7)

(NON-PERMIT)

Golder Associates Ltd.

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Golder Associates

August 5, 1999

E/99/1384
6170-00

Archaeology Branch
P.O. Box 9816
Stn. Prov. Govt.
Victoria, B.C. V8W 9W3

Attention Doug Glaum:

RE: LETTER REPORT ON ARCHAEOLOGICAL IMPACT ASSESSMENT OF CHUKCHEETSO RESERVE (IR # 7) (NON-PERMIT)

Dear Doug:

This letter report describes archaeological field inspections of the Chukcheetso Reserve (IR #7) and CPR right-of-way that cuts through the Reserve boundaries. The Chukcheetso Reserve is commonly referred to as "Keefers" by the local community but it should not be confused with the historic Keefers townsite located north of IR #7.

The project was undertaken on behalf of the Nlaka'pamux Nation Tribal Council (NNTC), Boothroyd Band, and the Ministry of Forests (Chilliwack Forest District). This non-permit archaeological impact assessment (AIA) served a dual purpose. It provided an excellent training opportunity for NNTC band members enrolled in an archaeological training program and it also provided site management recommendations to the Boothroyd Band prior to proposed timber harvesting within the C.P. Rail right-of-way.

1.0 OBJECTIVES

The objectives of the impact assessment were:

1. to provide the Boothroyd Band with direction for managing archaeological site EaRj-59 during planned timber harvesting;

2. to undertake subsurface testing within the I.R. #7 boundaries to determine the nature and depth of buried archaeological deposits at previously recorded sites EaRj 59 and EaRj 60;

3. to provide Nlaka'pamux trainees with an opportunity to observe, record and test an archaeological site; and

4. update the site inventory forms for sites EaRj 59 and EaRj 60.

2.0 LOCATION

The Chukcheetso Reserve is located on the west bank of the Fraser River, approximately 1.2 km north of the confluence of the Nahatlatch and Fraser River, and 0.5 km south of the historic town of Keefers (Figure 1). Vegetation is dominated by Douglas-fir, ponderosa pine, and some Western redcedar. Forest cover is open and mature, with a minimal amount of deadfall. The understory includes saskatoon berry, red alder and rose species.

3.0 DEVELOPMENT TYPE, FACILITIES AND SCHEDULE

According to the logging plan provided by the Boothroyd Band, the C.P.R. right-of-way (consisting of 300 ft on either side of the railway tracks) running through I.R. #7 has been slated for selective timber harvesting. Timber will be hand-felled and skidded by horse. An existing landing is situated on the east side of Log Creek Dump Road. Skidding routes have not been finalized.

4.0 PREVIOUS ASSESSMENT

During a 1988 archaeological inventory of the Chukcheetso Reserve, two archaeological sites (EaRj 59 and EaRj 60) were recorded (Albright 1988). Albright concluded that the clusters of cultural features located at the north-east and south-west ends of the reserve represented different site types. As a result, separate site designations were given.

Following is a brief description of the two archaeological sites originally recorded on the Chukcheetso Reserve:

EaRj 59 was described as a fishing camp. The site is located on a high terrace above the Fraser River, east of the CPR tracks and the existing Log Creek Dump Road (Figure 2). Cultural features include 1 rectangular and 5 circular house depressions, 6 cache pits and a rock mound (Albright 1988).

EaRj 60 was recorded as the Chukcheetso winter village, and is located on the east side of the CPR tracks and west of Log Creek Dump Road (Albright 1988). EaRj 60 is slightly south of, but less than 100 metres from EaRj 59. Recorded cultural features include 9 possible pithouse depressions and 21 cache pits (Figure 3).

5.0 FIELD METHODS

Our non-permit assessment entailed pedestrian transects and visual inspection, combined with subsurface testing on Reserve land only. Initial surface inspection of the property was restricted to the flat terraced area at the toe of the slope that runs along the western edge of the reserve. For the purposes of ground inspection, two crews were deployed, one on each side of the existing Log Creek Dump Road that runs roughly north-west to south-east through the middle of the Reserve. Parallel transects were walked on the east and west sides of the road, with crew members spaced no more than 10 metres apart. In areas of high archaeological potential, (i.e. the terrace above the Fraser River) transect widths were reduced to 5 metres or less.

The locations and dimensions of features in the eastern part of the study area (i.e. east of Log Creek Dump road and roughly corresponding with site EaRj 59) were recorded using a transit and stadia rod. Recorded features include major landforms, roads, historic mining features, a rock mound, shovel tests, cache pits and house depressions. Dense forest and time constraints precluded the use of the transit in the western portion of the project area (which roughly corresponds with site EaRj 60). Features located to the west of the road were mapped using compass and chain.

Depressions on the west side of the road are within the C.P. Rail right-of-way. These features were clearly marked using flagging tape. Housepit depressions were flagged with red and white striped paired with fluorescent green flagging tape, and remaining depressions (e.g. cache pits, earth ovens, etc.) were flagged with red and white striped flagging tape only.

All surface exposures such as unpaved roads and foot paths, wind throws, and cut banks were examined for evidence of archaeological deposits. Judgmental shovel tests were excavated in areas deemed to have relatively high archaeological potential, and in suitable locations adjacent to archaeological features (i.e., cache pits and house depressions), but only within the Reserve boundaries. As this was a non-permit investigation, areas within the CPR right-of-way could not be tested. Shovel tests measured approximately 50 cm^2 and were excavated in 10 cm levels and screened through ¼ " (6mm) mesh. Sediments consisted of orange-brown sandy silt, with few pebbles and cobbles.

6.0 FIELD RESULTS

The field assessment indicated that previously recorded sites EaRj 59 and EaRj 60 are more continuous than originally thought, and that there is no significant separation between features found at the north-east and south-west ends of the Reserve. As a result, the features have been recorded as a single large site, designated EaRj 59. Despite intensive survey, some features recorded by Albright could not be relocated; however, several additional features were identified and recorded during the field inspection. The

Log Creek Dump Road was used as a reference point for recording purposes. For descriptive clarity, the results are presented below in two discrete sections - one for the east side of the dirt road and the other for the west.

East side of Log Creek Dump Road

In the eastern portion of the site, 3 housepits, 16 presumed cache pits, a placer ditch, a mining prospect, the rectangular remains of a possible cobble foundation and a circular rock mound (possibly a grave) were recorded (Figure 4). It should be noted that field crews were unable to correlate all features with Albright's map and as a result, depression features were re-numbered (see Table 1).

Two of the housepits observed in the eastern portion of the site are intact, with each measuring approximately 8 m in diameter. The third housepit is situated on the terrace edge – the eastern margin of which has been eroded. The remaining portion of this housepit measures approximately 6 m across. Note that all housepit dimensions in this report are derived from inner-rim to inner-rim measurements.

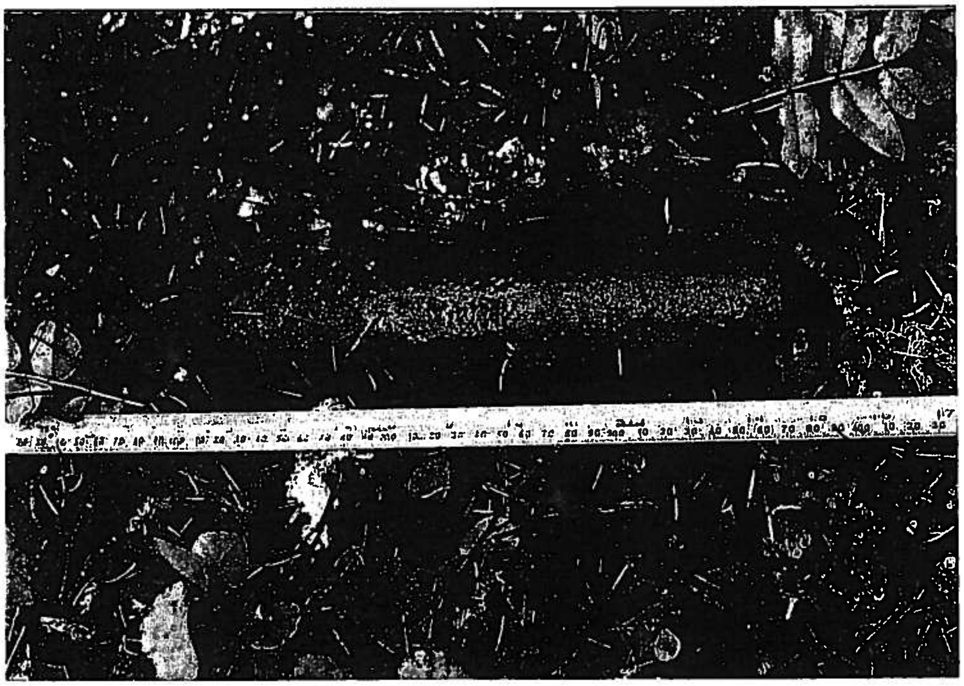
Smaller circular depressions, averaging 1-2 m in diameter, were generally located in clusters around housepit depressions. These depressions are believed to be cache pits, but some may be earth ovens, boiling pits or other archaeological features.

A placer ditch was recorded just west of the terrace edge. The feature consists of a sinuous trench, approximately 18 m long and 50 cm deep, with a slightly raised rim along both edges. The surrounding area has re-vegetated since its construction and there are no exposed gravel or cobbles. The structure is clearly cultural and is interpreted to be a sluice channel, a mining feature that was commonly associated with historic placer mining operations in the Boston Bar area.

A mining prospect was found in close association with the ditch feature. The circular depression measures 5 m in diameter and is approximately 1 m deep. The interior walls exhibit a low, shallow gradient, and the outer edge shows no uniform rim, unlike the depressions identified as housepits. A spoil pile was observed directly west of the hole. Like the placer ditch, the prospect pit is consistent in size and shape associated with hand mining operations.

A roughly rectangular cobble foundation was found east of the road at the southern end of the project area. Only the eastern wall and portions of the north and south edges remain. The structure measures approximately 6 m north-south by 15 m east-west. Though shovel testing in and around the feature proved negative, the concise rectangular shape suggests a structure of some kind once stood at this location.

A low rock mound, previously recorded by Albright (1988), is located at the eastern edge of the terrace, beside two small cultural depressions. The mound consists of small- to medium-sized cobbles in what may be an in-filled housepit. Sediments are slightly built up forming a low mound in the centre. The feature measures 3 metres in diameter and stands approximately 60 centimetres high. A ground stone pestle was found lying on the surface in the centre of the mound (Photograph 1). The mound may be a cairn marking a burial, although this was not confirmed. The Boothroyd Band intends to return the pestle to its original position on the mound.



Photograph 1. Pestle found on rock mound

Twenty (n=20) shovel tests were excavated in the eastern portion of the study area, of which four yielded archaeological materials. Recovered cultural materials consisted of twelve pieces of basalt debitage, located in the upper 40 cm of the orange-brown sandy silt deposits (see Table 1). All archaeological materials were reburied.

West Side of Log Creek Dump Road

The cultural depressions on the west side of Log Creek Dump Road are distributed in clusters between the western edge of the road and the toe of the steep bank leading up to the CPR tracks (Figure 4). All features on the west side of Log Creek Dump Road are believed to be located within the western 300 ft (91 m) CPR right-of-way.

Assessment of the western portion of the site resulted in the recording of eight relatively circular depressions, interpreted to be housepits, along with 48 smaller depressions, most of which are probably cache pits, though again, some may have had other functions. The northernmost housepit has been partially damaged by the existing road and is interesting to note as it is unlike the other housepits recorded on this side. Exhibiting steep walls and a slightly raised rim on the south side, this housepit was excavated into uncharacteristically rocky sediments.

In addition to the pre-contact features, a lean-to and fire pit, interpreted as a relatively recent camp, and debris associated with the railway were noted at the south end of the subject property.

A visual assessment of the right-of-way was conducted on the west side of the CPR tracks (Figure 1). The area is generally steep in terrain and well above the site located at the base of the slope. No cultural features were observed west of the railway tracks within the right-of-way boundary, and shovel testing was not considered to be warranted.

7.0 SUMMARY

On the east side of Log Creek Dump Road, Albright originally recorded 13 cultural features as archaeological site EaRj 59. These consisted of a rock mound, 5 large circular depressions (probably housepits), 6 cache pit depressions and one rectangular depression. During the present assessment, 10 additional small depressions were located. They are inferred to be cache pits. Following our assessment, 23 cultural features have been recorded on the east side of Log Creek Dump Road.

West of the road, Albright recorded 30 cultural features at site EaRj 60. These consisted of 8 probable housepits (referred to as either "housepits" or "pit depressions"), and 22 cache pits. After further assessment, an additional 26 cache pits were recorded for a total of 56 cultural features on the west side of Log Creek Dump Road.

Archaeological evidence indicates that Chukcheetso Reserve contains a single, large, primarily intact village site. Seventy-nine (n=79) cultural features have been recorded in the assessed portion of the site, and it is possible that additional deposits and/or features may be present beyond the northern Reserve boundary. Shovel tests indicated that low density buried deposits are present in parts of the site, notably east of the Log Creek Dump Road. Table 1 presents the results of the shovel tests and housepit diameters. Based on this information, it is probable that subsurface deposits within the CPR right-of-way on the west side of the site will be shallow and of low density.

Table 1: Housepit Features and Shovel Test Locations

Location	Feature	Size	Results	Location
(East side of Log Creek Dump Road)	Housepit 10	8m	Not tested	Terrace
	Housepit 9	8m	Not tested	Terrace
	Housepit 11	6m	Tested sterile	Terrace edge
	Prospect	5m	Not tested	Terrace
	Rock mound	3m	Not tested	Terrace edge
	Placer ditch	18m	Not tested	Terrace
	Cobble foundation	6m x 15m	3 tests: sterile	Terrace edge
	Shovel test 1		Sterile	Inside cobble foundation
	Shovel test 2		Sterile	1 m east of cobble foundation
	Shovel test 3		Sterile	1 m north of cobble foundation
	Shovel test 4		Sterile	Terrace edge
	Shovel test 5		Sterile	5 m southeast of rock mound
	Shovel test 6		Sterile	Cache pit
	Shovel test 7		Sterile	Terrace
	Shovel test 8		1 debitage: 18 cm b.s.	Terrace
	Shovel test 9		Sterile	Terrace
	Shovel test 10		Sterile	Terrace
	Shovel test 11		Sterile	Terrace
	Shovel test 12		Sterile	Terrace
	Shovel test 13		1 debitage: 10-20 cm b.s.	Terrace
	Shovel test 14		Sterile	3 m west of prospect
	Shovel test 15		6 debitage: 10-40cm b.s.	1 m west of Housepit 9
	Shovel test 16		Sterile	Terrace
	Shovel test 17		4 debitage: 10-20 cm b.s.	7 m southwest of Housepit 10
	Shovel test 18		Sterile	Terrace
	Shovel test 19		Sterile	Interior Housepit 19
	Shovel test 20		Sterile	Terrace edge

Location	Feature	Size	Results	Location
West side of Log Creek Dump Road	Housepit 1	8 m	Not tested	Terrace
	Housepit 2	7 m	Not tested	Terrace
	Housepit 3	8 m	Not tested	Terrace
	Housepit 4	8 m	Not tested	Terrace
	Housepit 5	8 m	Not tested	Terrace
	Housepit 6	7 m	Not tested	Terrace
	Housepit 7	6 m	Not tested	Terrace
	Housepit 8	4 m	Not tested	Terrace

8.0 POTENTIAL IMPACTS

A number of timber harvesting and associated activities, such as ground disturbance from falling trees, landing construction, and skidding can potentially damage heritage sites through displacement or breakage or artifacts, destruction of structures or other cultural features, and disturbance to the integrity of stratified deposits. Skidding logs over house depressions could impact rim deposits, as well as impact any subsurface artifact deposits outside the cultural depressions.

Generally, falling produces relatively minor impacts to archaeological sites. Unlike more conventional logging techniques (i.e., use of heavy equipment such as skidders), horse logging will cause less damage, especially if the ground is dry.

The planned and existing landing is south of the estimated site boundary, and should not impact the site in any way.

9.0 SIGNIFICANCE EVALUATION

The following evaluation of the significance of archaeological site EaRj-59 is based on *Archaeological Impact Assessment Guidelines* published by the Archaeology Branch (Apland and Kenny 1997). Table 2 summarizes the significance evaluation. The overall significance rating emphasizes the cultural and scientific significance scores.

Scientific Significance	Cultural Significance	Public Significance	Historic Significance	Economic Significance	Overall Significance
High	High	Moderate	Low-Moderate	Low-Moderate	Mod-High

Scientific Significance

The scientific significance rating assesses the amount and types of archaeological information that could be recovered from the site. EaRj 59 is assigned a high scientific significance score based on its size and integrity, the number and range of cultural features present, the possible presence of human remains, and the probable long history of occupation, as inferred from the presence of pre- and post-contact features. Although numerous housepit villages have been recorded in Nlaka'pamux traditional territory, few are as large as EaRj 59, and fewer still have been systematically excavated or radiocarbon dated. The Chukcheetso Village site has the potential to substantially increase our knowledge of the architecture, material culture and other facets of pre-contact Nlaka'pamux life.

Cultural Significance

The cultural significance of the site was evaluated by the Boothroyd Band. The site is considered to have high significance, based on reasons similar to those presented in the Scientific Significance section above.

Public Significance

This significance category is intended to assess the degree to which the site has potential for public education, interpretation and enjoyment. Because the site has a large number of visible features and is fairly accessible, it has some interpretive and educational potential. As it is near the historic town of Keefers, there may be an opportunity for interpretation of changing settlement patterns over time, through a comparison of the pre- and post-contact villages. Being located on Reserve, any interpretive development or public access would be subject to approval by the Boothroyd Band.

Historic Significance

Although the historic (post-contact) component at EaRj 59 appears to be minor, it warrants a significance ranking. The historic significance is assessed as low-moderate. The proximity of the site to the historic Keefers townsite deserves some consideration, as does the presence of mining features, which represent an important period in the post-contact history of the Fraser Canyon. In addition, the function and age of the recorded rock mound remain speculative and, if human remains are present, they could be of post-contact age.

Economic Significance

Placed within a cultural tourism framework, the type of interpretive development discussed above could have economic benefits. However, the site's distance from Highway 1 reduces the economic possibilities somewhat, and advertising or linkage with other attractions would probably be key to the success of an interpretive development at Chukcheetso. For these reasons, the economic significance of the site is assessed as low-moderate.

10.0 RECOMMENDATIONS

Site EaRj 59 is primarily intact and contains at least 79 presumably pre-contact cultural features and possibly human remains. A series of site management options is presented below, in order of preference. In all options, every effort should be made to avoid the rock mound in the southeastern corner of the site, as human remains may be present.

Option 1

It is recommended that timber harvesting plans be designed to completely avoid any adverse impacts to the site. Ideally, this would entail deleting the entire archaeological site area from the logging plan. This option would essentially negate the opportunity to log below (east of) the CPR tracks.

Option 2

If Option 1 is not considered feasible, we recommend that the logging plan be amended to minimize site impacts. Specifically, if skid trails are necessary, they should be designed to avoid dragging logs across the cultural depressions. Figure 5 provides recommended skidding routes. Golder could assist with marking these routes in the field. Recognizing that safety factors may dictate otherwise in some cases, harvesting should be conducted in a way that will avoid falling trees into the depressions. Any required blading should avoid impacting the depressions, where possible, and particularly the housepit depressions.

Option 3

If it is not possible to design the logging plan so that skid trails and blading do not impact the site features, it is recommended that all unavoidable site impacts be specifically identified, and that systematic data recovery (mitigative excavation) be undertaken in a representative portion of the impact area. Excavations should focus on locations that will be subject to significant ground alteration, such as skidder trails, and where either buried archaeological deposits or cultural features have been identified. Depending on the results of the excavations, monitoring during log removal may be necessary, in case human remains are unexpectedly uncovered, and to ensure that any uncovered artifacts are collected.

If either Option 2 or Option 3 is chosen, a *site alteration permit*, issued by the Archaeology Branch under Section 12 of the *Heritage Conservation Act* will be required prior to any land-altering activities. This permit should be held in the name of the individual or company scheduled to alter the site.

Post-Harvest Assessment

If either Option 2 or Option 3 is selected, it is also recommended that a post-harvest assessment be conducted following timber harvesting operations to assess and record any damage to the cultural depressions in EaRj-59. The Boothroyd Band has agreed that this approach would be appropriate. It is recommended that, if possible, any post-harvest assessment requirements be combined with the Section 12 Site Alteration Permit to allow the reporting requirements to be combined.

11.0 CLOSURE

We trust the information in this report is satisfactory for your present needs. Should you require additional information or clarification, please do not hesitate to contact the undersigned at your earliest convenience.

Yours very truly,

GOLDER ASSOCIATES LTD.

Jeff Bailey, M.A.
Project Manager

Gail Wada, B.A., Dipl. Tech.
Archaeologist

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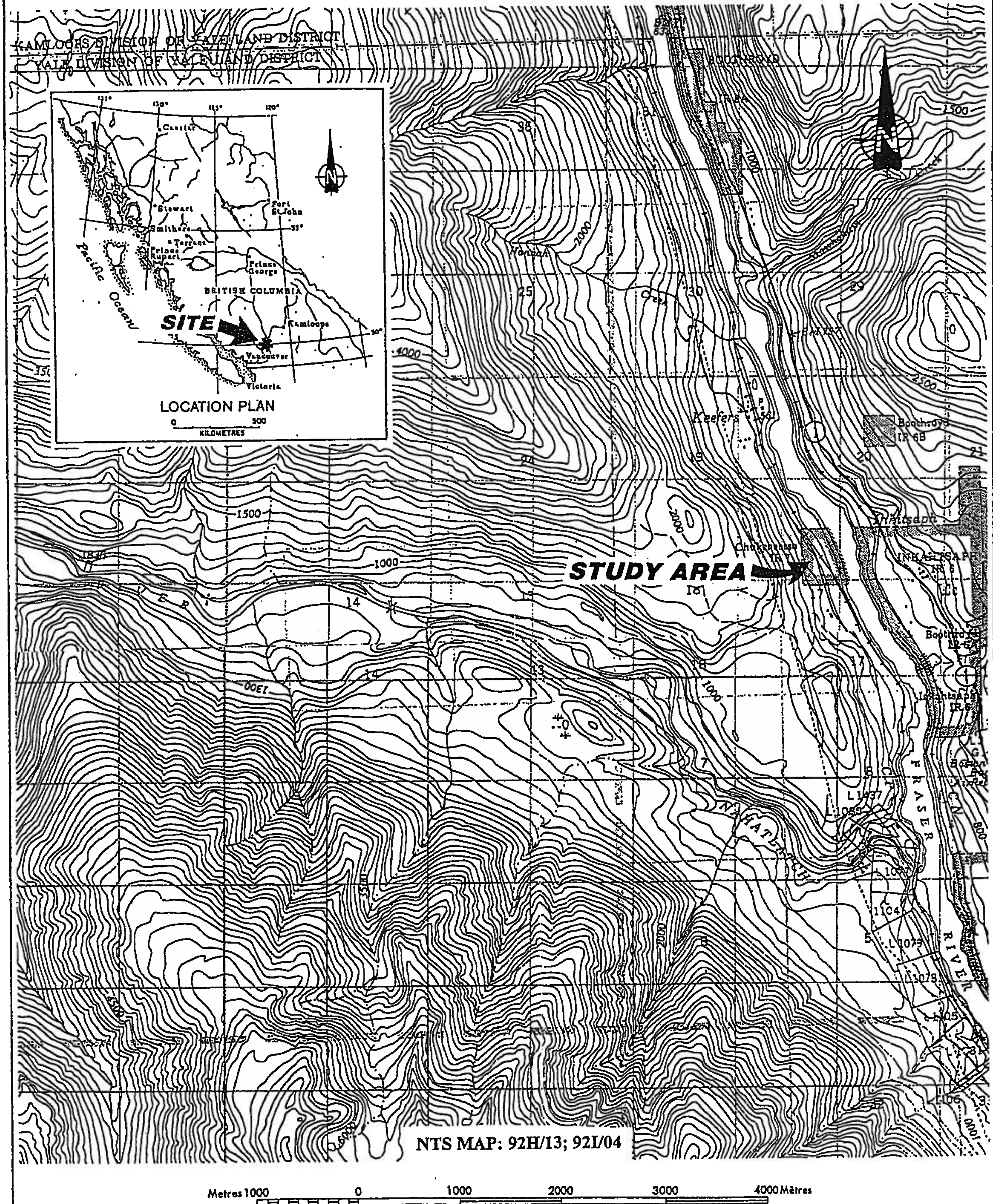
12.0 REFERENCES

Albright, Sylvia

1988 *Inventory of Heritage Sites in Boothroyd Band Area of the Middle Fraser Canyon, British Columbia.* Report on file with the Archaeology Branch, Victoria.

Apland, Brian, and Ray Kenny (editors)

1997 *British Columbia Archaeological Impact Assessment Guidelines.* Second Revised Edition. Archaeology Branch, Ministry of Small Business, Tourism and Culture, Victoria.

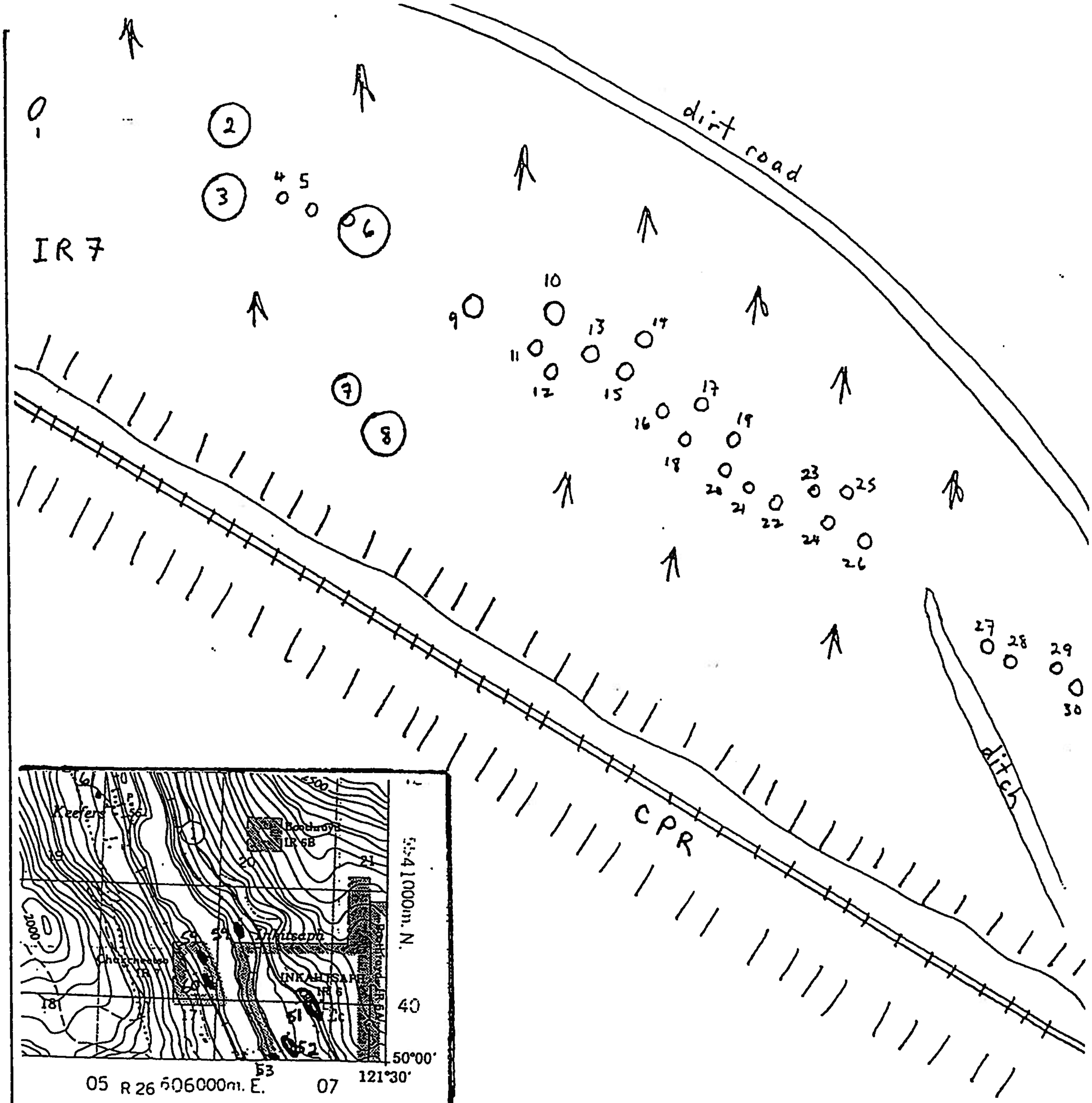


Project No. 972-1935 Drawn S.S. Reviewed J.D.B. Date Oct.'98

Golder Associates

KEY PLAN

Figure 1



EXTENT OF SITE
BUILDING
FOUNDATION
ROAD
TRAIL
RAILWAY
FENCE
RIVER/CREEK
STEEP RISE

ADDITIONAL LEGEND

↑ Douglas fir / cedar
O 4 cultural feature

1:50,000 MAP NO. 92I/04
LATITUDE 50° 00' 22"
LONGITUDE 121° 31' 17"
UTM GRID REF. 10UFL E058 N402
TRUE ☐ MAGNETIC ☑
DECLINATION USED 22°
DATE July 26, 1988
SCALE: 1 CM. = 10 M.

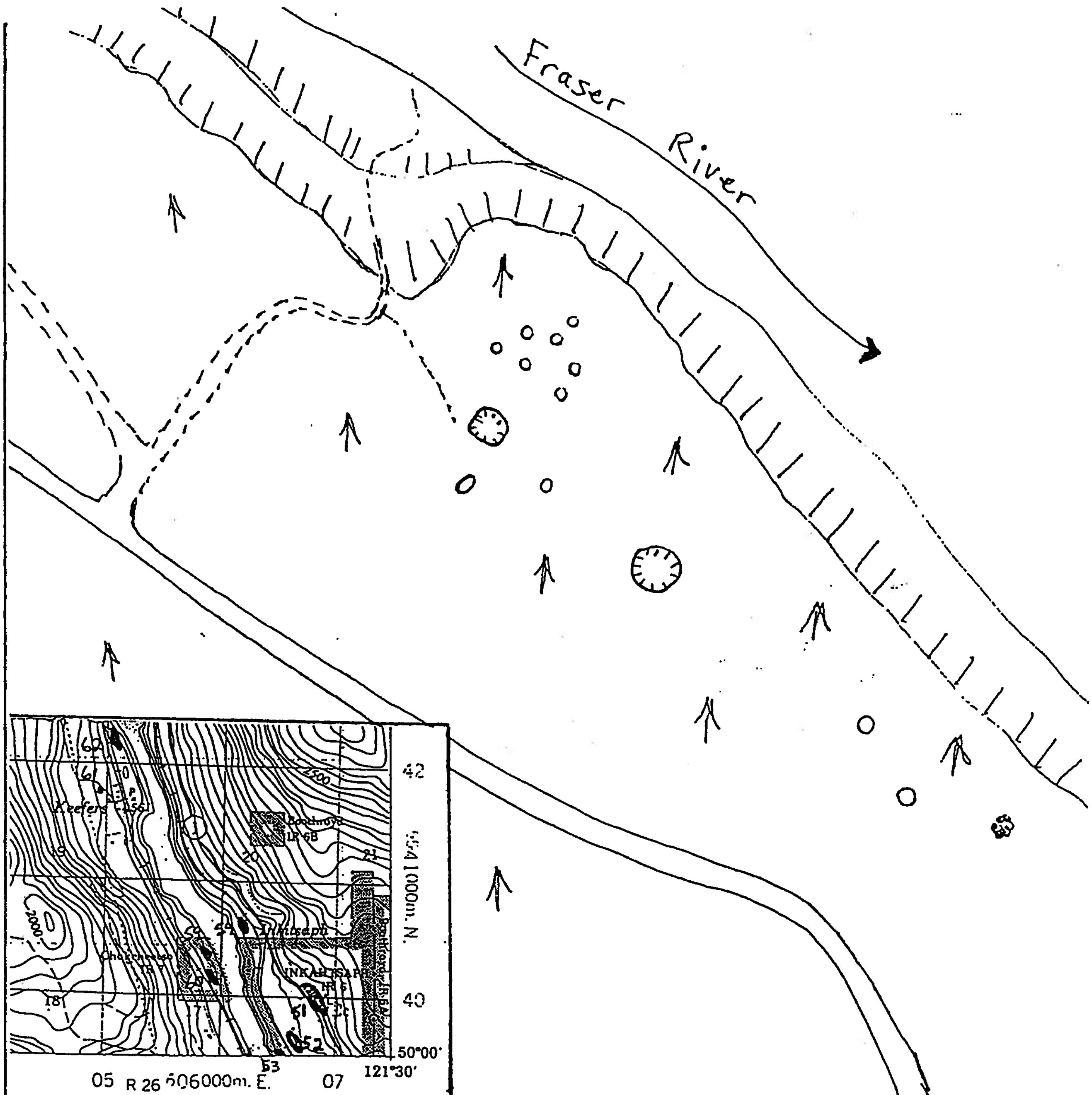
0 10 20 30 40 50

Project No. .... Drawn .... Reviewed .... Date ....

Golder Associates

ARCHAEOLOGICAL SITE EaRj-59
RECORDED BY ALBRIGHT (1988)

Figure 2



EXTENT OF SITE
BUILDING
FOUNDATION
ROAD
TRAIL
RAILWAY
FENCE
RIVER/CREEK
STEEP RISE

ADDITIONAL LEGEND

↑ Douglas fir Forest
o cultural features

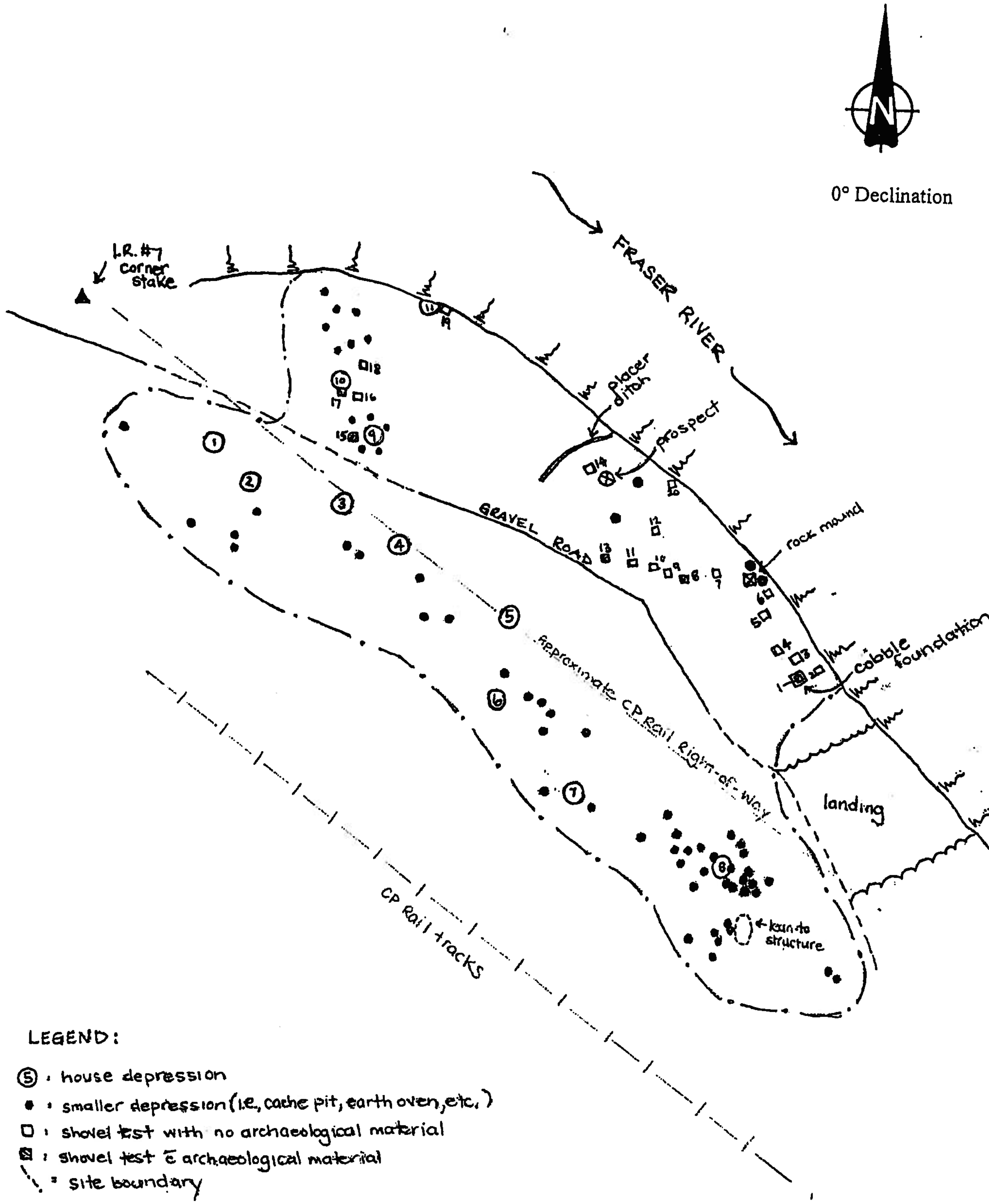
1:50,000 MAP NO. 92 I/04
LATITUDE 50° 00' 29"
LONGITUDE 121° 31' 17"
UTM GRID REF. 10 UFL E059 N403
TRUE ☐ MAGNETIC ☑
DECLINATION USED 22°
DATE July 26, 1988
SCALE: 1 CM. = 10 M.
0 10 20 30 40 50 m

Project No. .... Drawn .... Reviewed .... Date ....

Golder Associates

ARCHAEOLOGICAL SITE EaRj-60
RECORDED BY ALBRIGHT (1988)

Figure 3



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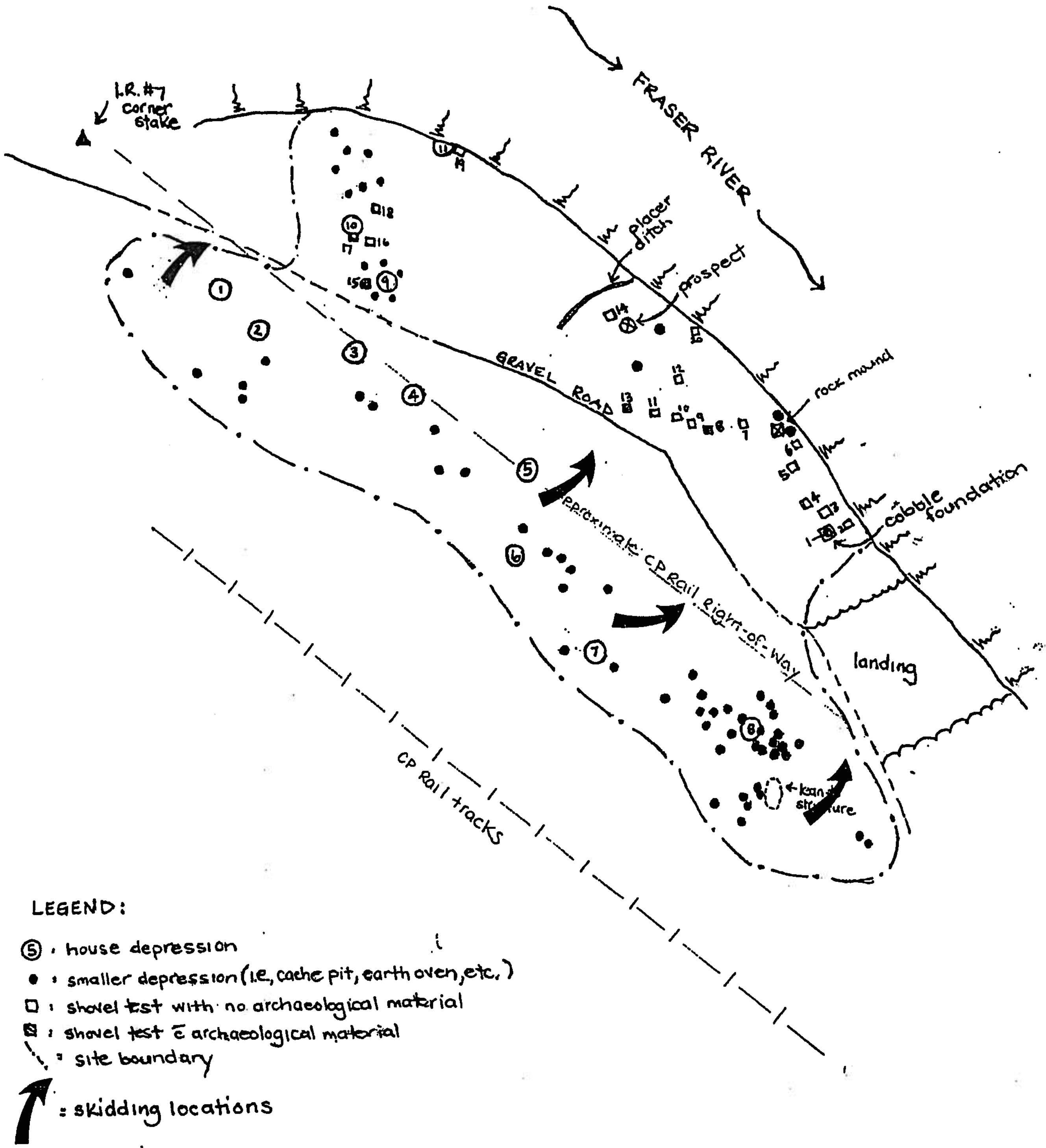
Golder Associates	ARCHAEOLOGICAL SITE EaRj-59 AS RECORDED IN 1999	Figure 4



Project No. .... Drawn .... Reviewed .... Date ....

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RECOMMENDED SKIDDING LOCATIONS

Figure 5

APPENDIX II

GLOSSARY OF TECHNICAL TERMS

GLOSSARY OF TECHNICAL TERMS

Aboriginally-Logged Tree: A tree that has been felled, planked or otherwise modified to obtain wood by First Nations people.

Abrader: A stone used as an abrasive element to shape or sharpen tools.

Adze: A woodworking tool typically consisting of a wedge-shaped ground stone blade hafted or bound onto a wooden handle.

Archaeological Correlate: An observed or predicted association between a landscape feature and a type of archaeological site.

Archaeology: The study of human cultures though the material remains of their activities.

Artifact: A portable object manufactured or intentionally modified by human action. Examples include stone tools, cedar baskets and wooden utensils.

A.S.L.: Above Sea-Level, based on the position of the sea's surface at mean level between high and low tide.

Bark-Strip Scar: A section of a tree in which the outer bark has been removed, exposing the underlying wood.

Basalt: A fine-grained volcanic rock that was commonly used to make stone tools.

Biface: A general term for stone artifacts that have been modified on two opposing sides, or faces. Examples include stone projectile points and knives.

Biogeoclimatic Zone: An ecosystem classification scheme based on vegetation, soils, topography and climate.

Blazed Tree: A tree displaying chop marks used to indicate a boundary, trail, trapline or other feature on the landscape.

Borden Number: A system for numbering archaeological sites which divides Canada into a series of rectangles based on latitude and longitude. Each rectangle (or Borden block) is given a four letter code and sites are numbered sequentially as they are recorded in each block. For example, FcSm-11 is the Borden number for the Tsini Tsini site near Bella Coola, B.C.

B.P.: Before Present; a dating convention often used with radiocarbon dating. "Present" is universally considered to be A.D. 1950.

Burial Site: A site used for the placement of human remains. Some sites referred to as "burials" do not actually involve burying the dead. A number of different burial practices were used by aboriginal people, including interment in trees, rockshelters, grave houses and cemeteries. In many cases, the remains were placed in cedar boxes prior to interment.

Cache pit: An underground storage feature, usually used to preserve dried food, but also sometimes used to store tools and other items.

Chopper: A cobble tool typically having a unifacially or bifacially flaked cutting edge.

Climatology: The study of the prevailing weather conditions of a region.

Cobble: A rounded stone with a diameter between 64 and 256 mm.

Cobble Tool: A tool produced by striking flakes from the edge of a cobble to produce a working edge.

Colluvium: Weathered material transported by gravity to the base of a slope. Includes scree, talus, etc.

Core: A stone from which flakes have been removed during the manufacture of lithic artifacts.

Culture: 1. A pattern of human activity transmitted between individuals by teaching; includes both material culture (e.g., artifacts and features) and non-material culture (e.g. practices and beliefs). 2. A term used by some archaeologists to refer to an assemblage of cultural material recurring in a restricted geographic area within a specified time period.

Culture History: An archaeological construct used to describe cultural changes over time, often based on variations in artifact styles.

Culturally Modified Tree (CMT): A tree that has been intentionally altered by First Nations people as part of their traditional use of the forest. Examples of CMTs include bark stripped trees, blazed trees, planked trees and notched trees.

Debitage: Waste material produced during the manufacture of flaked stone tools.

Dendrochronology: A technique of dating living or dead wood through the examination of tree growth rings.

Dendroglyph: A carved tree used for a traditional First Nations purpose, such as marking an important cultural location or a territorial boundary. Also sometimes called an arborglyph/arboriglyph.

Dendrograph: A painted tree used for a traditional First Nations purpose. Also sometimes called an arborgraph/arborigraph.

Ethnography: A detailed descriptive study of a culture through participant-observation techniques, including interviews with community members.

Ethnohistory: The study of the past using both non-Western, indigenous historical records (particularly oral traditions) and early historic written records.

Excavation: The controlled and systematic removal and exploration of subsurface archaeological deposits.

Faunal Remains: The remains of animals, fish or shellfish, found in archaeological deposits which have not been intentionally modified for use as tools, ornaments, etc.

Feature: A cultural component of an archaeological site, such as a housepit or hearth, that cannot be removed intact from the site.

Fire-Cracked Rock: Stone that has been altered as a result of rapid or alternate heating and cooling, caused, for example, by stone boiling or in campfires.

Flake: A piece of stone intentionally removed from a core during the manufacture of stone tools. Flakes were sometimes used as expedient tools and may show evidence of retouch or use wear.

Fluvial: Of or pertaining to streams or rivers.

Geographic Information System (GIS): A computerized database and analysis system with the primary functions of capturing, storing and manipulating geographic information. Geographic information contains a combination of location, attribute and topographical data.

Geomorphology: The description and interpretation of landforms and the processes that create them.

Glacial: Of or pertaining to glaciers.

Glacier: An extended ice mass that originates as compacted snow at high mountain elevations. When the ice achieves a certain depth it will begin to move from its point of origin.

Glaciomarine: Refers to sediments or landforms created through a combination of glacial and marine forces.

Groundstone: A class of stone tools, manufactured by pecking, grinding and polishing to achieve the desired shape.

Ground Truthing: Field investigations designed to assess the accuracy of inferences or predictions made about a dataset. Ground truthing is often used in cultural resource management to test the results of predictive modelling studies.

Hafting: The process of attaching a tool of flaked stone, bone or other material to a handle to facilitate use.

Historic Site: A site dating from the period following early contact between First Nations and European or Euro-American cultures. Includes sites produced by Native and non-Native activities.

Holocene: A geological term referring to the post-glacial period spanning approximately the past 10,000 years, following the Pleistocene Ice Age.

Housepit: A depression, usually circular or rectangular, marking the former location of a semi-subterranean dwelling.

Igneous: Rocks of volcanic origin.

Impact Assessment: In archaeology, a study designed to assess possible impacts of proposed developments on archaeological resources. Impact assessments typically incorporate documentary research, field inspections, and other lines of inquiry. Recommendations regarding the significance of any archaeological resources encountered and resource management strategies are usually provided.

Inventory: The compilation of information on archaeological resources within a given project area, through documentary research and field investigations, often supplemented with interviews. Inventory does not typically include an assessment of the significance of these resources or of potential development-related impacts upon them.

Lithic: Of, or pertaining to, stone. In archaeology, a general term for stone tools and debitage.

Microblade: A small parallel-sided blade removed from a core using a distinctive "punch" technique. Microblades were typically set into bone or wood handles to form cutting tools.

Mitigation: Archaeological work required to lessen the impact of a development on an archaeological site; typically consists of the excavation of the site or a representative sample thereof.

Obsidian: A semi-transparent volcanic glass, usually black, grey or olive green formed by rapid cooling, resulting in a lack of crystalline structure. Obsidian has excellent flaking qualities and was highly valued by aboriginal people as a raw material for use in stone tool manufacture.

Ochre: A general term, applied to coloured oxide and carbonate precipitates, often red in colour and used as a pigment in pictographs and ceremonial activities.

Old Growth: Natural stands of old and young trees and their associated plants, animals and ecological systems, that have remained essentially undisturbed by human activity. The age and structure of old growth forests varies by forest type and between biogeoclimatic zone.

Oral History: A method by which aspects of an individual's life experience and cultural knowledge are collected by an interviewer.

Oral Tradition: A non-material process of creating, transmitting and preserving cultural knowledge across generations.

Overview: An assessment of the archaeological resources present in a defined study area. Typically includes an assessment of the potential for unexplored areas to contain archaeological sites

Pebble Tool: A common term synonymous with "cobble tool". A pebble tool may be bifacially or unifacially worked, often with the original rounded cortical portion opposite the working edge left unmodified.

Pecking: A technique of lithic manufacturing which uses percussion (tapping or hammering) to wear down a stone tool into the desired shape. The technique is also used to incise petroglyph designs into rock surfaces.

Petroglyph: An image carved or pecked into a rock surface, sometimes enhanced with pigments.

Physiographic Zone: A system of zones based on geomorphology and climatology.

Pictograph: An image painted on a rock surface, typically using red ochre pigments.

Pithouse: A semi-subterranean dwelling with a superstructure of wooden beams, soil and other insulating materials. Pithouses were commonly used in areas of British Columbia prior to European contact.

Pleistocene: The most recent geological period of glaciation, beginning about 1.6 million years ago and continuing until the onset of the Holocene between 13,000 and 10,000 B.P.

Polishing: A tool manufacturing technique involving intentional smoothing of an object through rubbing with finely abrasive materials.

Post-Contact: The period of time following early contact between First Nations and European cultures. Contact occurred intermittently over a period of approximately 50 years, between the late eighteenth and early nineteenth centuries. Written documents, in conjunction with archaeological data and oral tradition, can be used to study this period.

Pre-Contact: The period of time prior to the earliest contact between First Nations and European cultures, for which written documents are unavailable. Research into this time period relies on archaeological information and oral tradition. Contact occurred intermittently over a period of approximately 50 years, between the late eighteenth and early nineteenth centuries.

Predictive Model: A set of variables used to infer the locations of archaeological sites in the absence of field data.

Probabilistic Survey: Archaeological field inventory involving the random selection of survey units with the intention of eliminating judgmental biases regarding site distribution and location normally inherent in archaeological survey. Typically, the study area is divided into units of high, moderate and low archaeological potential, based on topography, physiography, and other factors, and specific units are then randomly selected for field inspection.

Projectile Point: A sharpened stone, bone or wooden implement used to tip a projectile such as a spear, arrow or dart.

Quarry: A source area for lithic materials used in the production of stone tools. Such areas are often characterized by dense concentrations of flaking or chipping debris.

Radiocarbon Dating: A technique used to determine the age of organic material through analysis of the proportions of naturally-occurring radioactive carbon isotopes.

Reconnaissance: Non-intensive field investigation designed to assess the archaeological site potential of landforms within a prescribed area. Reconnaissance typically does not involve subsurface testing. Also known as Preliminary Field Reconnaissance (PFR).

Retouch: Intentional, patterned modification of the surface of a material, most often related to the sharpening of a stone cutting edge.

Rockshelter: A small cave or rock overhang used for shelter, habitation, or human burials.

Scraper: A type of stone tool, typically consisting of a thick flake with steep retouch on one side or end, with minimal retouch on the remaining margins.

Significance: In cultural resource management, the relative scientific, cultural, public, economic and historic importance of an archaeological site.

Site: A place exhibiting physical evidence of past human activity.

Stratigraphy: The layering of natural and cultural subsurface deposits in archaeological sites.

Subsistence Strategy: A cultural system for obtaining and processing food and raw materials.

Tapered Bark-Strip: A relatively long bark removal feature which narrows to a point at the upper end.

Topography: The physical features of an area, for example mountains and rivers.

Traditional Territory: An area used by a cultural group for subsistence, ceremonial and other cultural practices.

Traditional Use Area: A natural area used by First Nations people to practice traditional activities including, but not limited to, resource gathering (e.g., plant gathering, hunting, fishing, etc.), raw material procurement (e.g. stone quarries, timber or bark harvesting areas, etc.) and ceremonial or spiritual activities. Traditional use sites may lack physical evidence of their use, but maintain cultural significance to a living community of people.

Uniface: An artifact that has been modified, usually through the removal of flakes, on one face or side of its cutting edge only.

Utilization: Chipping along one or more edges of flake produced as a result of use as a tool and not by intentional modification.

X-Ray Fluorescence (XRF): A spectroscopic technique for measuring the composition of chemical elements in geological materials. In archaeology, XRF is most commonly used to correlate obsidian artifacts with parent geological sources, based on trace element "fingerprints".

APPENDIX III

CORRECTED ARCHAEOLOGICAL SITE DATABASE

DkRi-064	1:50 vague plot; in TSL A35066
DjRi-087	delete; add "depression; circular" to DjRi-69
DkRi-004	map sheet reference error
DjRi-028	misplotted
DjRi-056	misplotted
DjRi-077	misplotted
DkRi-005	misplotted
DkRi-021	misplotted
DkRi-027	misplotted
DkRi-035	misplotted
DkRi-040	misplotted
DkRi-044	misplotted
DkRi-045	misplotted
DkRi-053	misplotted
DlRi-011	misplotted
DlRi-014	misplotted
DlRi-015	misplotted
DlRi-017	misplotted
DlRj-002	misplotted
DlRj-007	misplotted
DlRj-011	misplotted
EaRj-019	misplotted
EaRj-020	misplotted
EaRj-022	misplotted
EaRj-023	misplotted
EaRj-024	misplotted
EaRj-026	misplotted
EaRj-052	misplotted
EaRj-055	misplotted
EaRj-056	misplotted

EaRj-060	misplotted
EaRj-062	misplotted
DlRi-003	misplotted digitally
DlRi-016	misplotted digitally
DlRi-005	misplotted digitally; site type error
DlRi-030	misplotted digitally; site type error; wrong site number
DlRi-028	misplotted digitally; wrong site number
DlRi-029	misplotted digitally; wrong site number
DlRi-031	misplotted digitally; wrong site number
DlRi-033	misplotted digitally; wrong site number
DkRi-010	misplotted in digital data
DkRi-046	misplotted in digital data
DkRi-012	misplotted in digital data; aka DkRi-14
DjRi-083	misplotted in digital data; site aka DjRi-66b
DjRi-001	misplotted in digital data; site type error
DkRi-034	misplotted in digital data; site type error
DkRi-036	misplotted in digital data; site type error
DkRi-048	misplotted in digital data; site type error
DkRi-049	misplotted in digital data; site type error
DkRi-013	misplotted in digital data; site type error; aka DkRi-15
DkRi-008	misplotted in digital data; site type error; typical pre-contact sites thought to be historic
DkRi-031	misplotted; DkRi-56 within site boundaries
DkRi-002	misplotted; human remains component reported, not observed
DkRi-065	misplotted; map sheet reference error
DkRi-066	misplotted; map sheet reference error
DkRi-067	misplotted; map sheet reference error
DkRi-068	misplotted; map sheet reference error
DkRi-061	misplotted; not in CHIN
DjRi-067	misplotted; not in CHIN; site type error
DkRi-056	misplotted; not in CHIN; situated within DkRi-31

DkRi-006	misplotted; petroglyph reported, not observed
DjRi-084	misplotted; site aka DjRi-66a
DkRi-60b	misplotted; site aka DkRi-11 (CHIN); site type error; no sketch map
DkRi-60a	misplotted; site aka DkRi-60 (CHIN)
DjRi-004	misplotted; site type error
DjRi-066	misplotted; site type error
DjRi-068	misplotted; site type error
DjRi-078	misplotted; site type error
DjRi-081	misplotted; site type error
DjRi-082	misplotted; site type error
DkRi-020	misplotted; site type error
DkRi-030	misplotted; site type error
DkRi-032	misplotted; site type error
DkRi-038	misplotted; site type error
DkRi-041	misplotted; site type error
DkRi-043	misplotted; site type error
DkRi-051	misplotted; site type error
DkRi-009	misplotted; site type error; site aka DkRi-H9
DlRi-025	misplotted; site type error; wrong site number
DkRi-011	misplotted; this DkRi-11 (Arcas) is not in CHIN, but is on 1:50; site type error
DjRi-055	misplotted; vague sketch map; site type error
DlRi-022	misplotted; wrong site number
DlRi-036	misplotted; wrong site number
DkRi-050	msiplotted in digital data; site type error
DlRj-NS1	new CMT site (Scuzzy Creek)
DlRj-NS2	new CMT site (Scuzzy Creek)
DlRi-B4-	new site
DlRi-B4T	new site
DlRi-B4T	new site
DlRi-B5T	new site

DIRi-B5T	new site
DIRi-B5T	new site
DIRi-B7T	new site
DIRi-B7T	new site
DIRi-B7T	new site
DIRi-MLT	new site
DIRi-S2T	new site
DIRi-S4T	new site
DIRj-AL1	new site
DIRjAL19	new site
DIRj-AL2	new site
DIRj-AL3	new site
DIRj-AL4	new site
DIRj-AL5	new site
DIRj-ZT2	new site
DIRkAL30	new site
DIRkAL31	new site
DIRkAL32	new site
DIRkAL33	new site
DIRkAL34	new site
EaRjAL10	new site
EaRjAL11	new site
EaRjAL12	new site
EaRjAL15	new site
EaRjAL16	new site
EaRjAL18	new site
EaRjAL21	new site
EArjAL24	new site
EaRj-AL8	new site
EaRj-ZT1	new site

EaRj-ZT5	new site
EaRj-ZT7	new site
EaRj-ZT9	new site
EaRlAL27	new site
DlRkAL28	new site; insufficient information
DlRkAL29	new site; insufficient information
EaRjAL13	new site; insufficient information
EaRjAL14	new site; insufficient information
EaRjAL17	new site; insufficient information
EaRjAL22	new site; insufficient information
EaRjAL25	new site; insufficient information
EaRjAL26	new site; insufficient information
EaRjAL23	new site; insufficient information for "fishing camp"
DlRj-AL6	new site; insufficient information for fishing camp
EaRjAL20	new site; insufficient information on "fishing camp"
EaRj-AL7	new site; insufficient information on site form
EaRj-AL9	new site; insufficient information on site form
DkRi-NS1	new site?; see 1:50,000 map
DjRi-085	no site form
DjRi-086	no site form
DkRi-001	no site form
DlRh-001	no site form
DlRj-015	no site form
EaRk-001	no site form
DjRi-029	no sketch map
DlRj-003	not in CHIN; misplotted
DkRi-055	not in CHIN; no site form
DlRi-008	not plotted digitally but in CHIN and site form
DkRi-019	site type error
DkRi-023	site type error

DkRi-024	site type error
DkRi-033	site type error
DkRi-039	site type error
DkRi-052	site type error
DkRi-059	site type error
DkRi-062	site type error
DlRi-002	site type error
DlRi-009	site type error
DlRj-004	site type error
DlRj-006	site type error
DlRj-008	site type error
DlRj-009	site type error
EaRj-053	site type error
DlRi-010	site type error; misplotted
DlRi-001	site type error; misplotted digitally
DlRi-013	site type error; misplotted digitally
DkRi-047	site type error; possible rockshelter
DlRi-034	site type error; wrong site number
DlRi-020	site type errors
EaRj-061	was not plotted digitally
DlRj-001	wrong map reference; site type error
DlRi-023	wrong site number
DlRi-024	wrong site number
DlRi-026	wrong site number
DlRi-027	wrong site number
DlRi-032	wrong site number
DlRi-035	wrong site number

APPENDIX IV

REPORT ON ARCHAEOLOGICAL TRAINING PROGRAM

Note: This appendix is a condensed version of a detailed training report previously submitted to the Ministry of forests, the NNTC and the Archaeology Branch.

1.0 INTRODUCTION

From September 29, 1997 to October 8, 1997, Tanja Hoffmann and Tom Hoffert of Golder Associates Ltd. conducted a training program for six Nlaka'pamux community members. The program consisted of two days of classroom training at the NNTC office in Lytton, a day of site visits in the Boston Bar area, a trip to record culturally modified trees in the South Ainslie watershed, an impact assessment of IR #1 (Keefers), and four days of excavation at DlRj 9, an archaeological site located near the confluence of the Nahatlatch and Fraser Rivers. The study was conducted on behalf of the NNTC which holds a contract with the Ministry of Forests, Chilliwack Forest District, for an Archaeological Overview Assessment of the northern part of the District.

2.0 BACKGROUND

2.1 Project Location

The Chilliwack Forest District Archaeological Overview (AOA) study area consists of the northern portion of the District which lies within the traditional territory of the Spuzzum, Boothroyd and Boston Bar First Nations. Because the training program was funded through the AOA, field trips were conducted in the AOA study area. Training was geared toward introducing Nlaka'pamux participants to archaeological resources near their communities. Consequently, classroom content and field-trips were tailored to interior archaeology site types and methodologies.

3.0 OBJECTIVES

The objectives for the training were as follows:

1. To introduce participants to basic archaeological concepts and methodologies;
2. To provide a description of the Chilliwack Forest District AOA and to introduce concepts involved in modeling for cultural heritage resources;
3. To expose participants to the variety of archaeological sites near their communities;
4. To provide trainees with practical experience in identifying, mapping and recording archaeological sites;
5. To teach the skills required to assist archaeologists in basic field survey, impact assessments and inventory;

6. To introduce participants to basic cultural resource management (CRM) concepts and encourage discussion of the ramifications of CRM in their respective traditional territories, and;

7. To explain the *Heritage Conservation Act* and associated permitting processes.

4.0 METHODOLOGY

Adult education training is most successful when designed around a 'hands-on' approach. Thus the Chilliwack AOA training was specifically geared toward introducing new concepts in a practical manner. In addition, time was set aside for discussion and activities that focused on 'real-world' scenarios rather than abstract concepts. The classroom session was designed to introduce basic concepts in a multi-media oriented manner. Participants were also required to partake in a number of field-trips to a variety of sites where they engaged in activities that would be expected of them in a field situation.

5.0 TRAINING CONTENT

In keeping with the above noted objectives, training content was designed to provide participants with enough background knowledge to assist archaeologists in their field-work, and to understand the nature of the work they participate in. A brief description of the training program is outlined below.

Day One: NNTC offices, Lytton B.C. (September 29, 1997)

This classroom day was devoted to the introduction of archaeology as a discipline. Time was spent discussing the evolution of archaeology from its inception to current, cultural resource management practices. Some time was spent defining technical terms such as 'archaeological site' and 'artifact', and participants were introduced to the *Heritage Conservation Act*, the roles and responsibilities of the Archaeology Branch, and the permitting process. Much of the afternoon was spent reviewing specific artifact and site recognition information. Participants were given the opportunity to examine a variety of artifact types and were encouraged to discuss manufacturing technology. Concepts of differential preservation and taphonomic processes were also introduced and discussions ensued as to how these processes affect the interpretation of the archaeological record.

Day Two: Classroom session, NNTC office, Lytton, BC (September 30, 1997)

The second day was devoted to a detailed review of field methods including inventory and excavation techniques. Participants were exposed to the different sources of mapped and data base information commonly used by archaeologists. In addition, trainees were taught basic map reading, hip-chain and compass skills. More specific skills required to map features within a site were also introduced. In the afternoon the group travelled to a nearby archaeological site and conducted a mapping and survey exercise.

Day Three: Field Session, Boston Bar, BC (October 1, 1997)

Day three was spent visiting three known sites, each representing a different site type. Site types explored included a soapstone quarry, a prehistoric village, and a historic homestead. Once on site, participants were required to map several cultural features in relation to a fixed datum and were given an introduction on how to use a transit. Trainees were encouraged to locate and determine the nature of surface features and to conduct a surface inspection for artifacts.

Day Four : Field Session, South Ainslie Creek, BC (October 2, 1997)

Previous archaeological investigations in the South Ainslie drainage by Golder Associates and the NNTC had identified several large clusters of rectangular and triangular bark-stripped cedar trees. Participants were taken to one of the clusters and were introduced to basic CMT identification and Level II recording (Ministry of Forests 1997). Trainees were required to determine the boundary of the cluster, flag and record each CMT to Level II standards, and map the location of each CMT in relation to the block boundary.

While in the South Ainslie watershed, Jackie Johnson and Hank Andrew noted a prime cedar root gathering area. Ms. Johnson and Mr. Andrew lead a discussion about cedar root gathering and the manufacture of twine and baskets. Trainees assisted Ms. Johnson and Mr. Andrew in harvesting some of the roots for Ms. Johnson's use.

Day Five: Field Session, IR #7 Chuckcheetso Winter Village (Keefers) (October 3, 1997)

The Boothroyd Band, in co-operation with a local licensee, wish to log a portion of IR#7. Remains of a single, large pre-contact Nlaka'pamux winter village were recorded as two separate archaeological sites (EaRj 59 and EaRj 60) by Sylvia Albright with the assistance of several Band members (Albright 1988). Prior to conducting any logging on the site, the Band wished to conduct an archaeological impact assessment. Trainees were required to re-inventory the site, locate and map cultural features and conduct a series of sub-surface tests to determine the significance of the deposits.

Days Six Through 8: Excavation, DlRj 9, Nahatlatch River, BC (October 6, 1997-October 8, 1997)

From Monday, October 6, 1997 to Wednesday, October 8, 1997 trainees took part in the salvage excavations of heavily impacted archaeological site DlRj 9. Trainees inspected the surface of the site, placing pin-flags where artifacts and features were discovered. Clearing of two of three remaining house pits commenced while the surface inspection was conducted.

Individual tasks were assigned participants who, by this time were demonstrating a good understanding of the archaeological process. Two team members surveyed the site noting the location of the surface artifacts and features as well as the major landforms in the study area. Other participants began to lay out excavation units in one of the housepits while others collected the surface finds. Excavation of two 1 m x 1 m units began on Tuesday and each pair of trainees had an opportunity to excavate and screen for artifacts. Detailed record keeping was the responsibility of each participant. An example of the level sheets trainees were required to complete is included in Appendix 2. Excavation training for the participants ended on October 8, 1997; however, the excavations at the site continued until October 10, 1997 with participation of 2 trainees for the Boothroyd Band.

ADDENDUM

1999 ANALYSES, MODEL RESULTS, AND CAPTURE RATES

1.0 INTRODUCTION

The initial modelling results showed a lower capture rate for known sites than expected. A review of the data suggested two possible reasons: 1) the DEM grid size may have been too large to discern narrow river terraces or other small landforms typically associated with archaeological sites, or 2) the use of a point coverage for site capture rates may have under-represented the actual effectiveness of the models. To assess these potential limitation, the models were re-run using a 10 metre grid cell size. In addition, capture rates were re-calculating using a polygon coverage to represent recorded archaeological sites, in place of the original point coverage. The analyses are described below.

2.0 GRID CELL SIZE

To test the effect of grid cell size on model performance, the original models were re-run using a 10 metre grid. It was anticipated that the smaller grid size would improve the identification of narrow river terraces or other small landforms with the potential to hold archaeological sites. No changes were made to the model rules.

2.1 Results

It was found that grid size had a fairly minor effect on overall model performance in terms of areas assigned to Class I or Class II. Comparing the composite model results, the 10 metre grid resulted in a 2% (4,975 ha.) decrease in the amount of land designated Class I or Class II. While this is a small variation in terms of percentage of the study area, the cost impact of the reduction in archaeological field assessments may be significant.

In addition to a small decrease in the overall Class I and Class II areas, a spatial shift in the land classes was evident. A visual review of the calculated slopes from the 25 metre and 10 metre grids overlaid with the TRIM contour lines indicated that the 10 metre grid cell size more effectively identified small river terraces, where aboriginal village sites are common.

Table 1 compares the results of the composite model runs using 10 metre and 25 metre grid sizes.

Table 1 - Comparison of Model Results for 25 metre and 10 metre Grid Sizes

GRID SIZE	CLASS 1	CLASS 1	CLASS 2	CLASS 2	CLASS 3	CLASS 3
	Area (ha.)	% Study	Area (ha.)	% Study	Area (ha.)	% Study
25 metres	4,935	2%	34,849	11%	269,805	87%
10 metres	3,952	1%	30,856	10%	274,780	89%

3.0 RECORDED SITE CAPTURE RATE

The effectiveness of the model results was evaluated by calculating the number of previously recorded sites that fall within designated Class 1 or Class 2 lands. For the initial model run, sites were represented by a GIS point coverage. Points represent hypothetical locations in space, with no actual areal dimension. Converting the points to polygons allows a more accurate representation of the true size of a site, providing for a better assessment of site capture rates. For this analysis, polygons consisted of circles representing either: a) the actual area of the site (if known), or b) the median area for recorded sites of the same type in the study area. Capture rates were calculated for both the 25 metre and 10 metre grids, using the polygon coverage for sites. Capture rates were also re-calculated for the point coverage, as a number of new sites had been recorded since the initial model run.

3.1 Results

For the habitation model, a marked improvement in site capture was achieved by using the polygon coverage. Table 2 compares the capture rates using the point coverage versus the polygon coverage for both the 10 metre and 25 metre grids. For the point coverage, the 10 metre grid size did not perform as well as the 25 metre grid, presumably because the probability of capturing a very small point is reduced with a small grid. For the polygon coverage, the 10 metre grid size improved the capture rate, probably because the landforms associated with the sites are better represented using the smaller grid size. Interestingly, the results varied not only by the *number* of sites captured by the models, but also *which* specific sites were captured. For example, while the relative capture rate for habitation sites was identical for the 10 metre and 25 metre grids (54.8%), the specific sites captured were not the same.

Table 2 - Comparison of Habitation Site Capture Rates Using Point Coverage and Polygon Coverage

GRID SIZE	POINT COVERAGE	POLYGON COVERAGE	POINT COVERAGE	POLYGON COVERAGE
	Capture Rate (All Sites)	Capture Rate (All Sites)	Capture Rate (Habitation Sites Only)	Capture Rate (Habitation Sites Only)
25 metre	49.1%	68.1%	54.8%	76.2%
10 metre	42.6%	73.1%	54.8%	83.8%

4.0 RECOMMENDATIONS

The general recommendations of the AOA are not changed by the revised model runs. However, archaeological assessments for specific proposed development locations may change as a result of the smaller grid cell size. Archaeological assessment requirements should be based on the 1999 model results, using the 10 metre grid cell size.

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