REPORT ON

AN ARCHAEOLOGICAL OVERVIEW
OF THE
NORTH COAST TIMBER SUPPLY AREA

Submitted to:

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April 13, 2000
This report describes the results of an archaeological overview assessment (AOA) of the North Coast Timber Supply Area (TSA). The study was undertaken on behalf of the Ministry of Forests (North Coast District), with substantial assistance and input provided by the MoF, the North Coast licensees (Interfor, West Fraser Mills, and Pacific Cascade), several North Coast First Nations, the Archaeology Branch, and Heather Moon (H.L. Moon Heritage Consultant).

The objectives of the study were to summarize and evaluate existing information about archaeological sites in the study area and to develop a series of predictive models to help evaluate the need for archaeological assessments (impact assessments or reconnaissance) prior to land development. The project involved four main phases: (1) background research, including a review of previous archaeological, historical, and ethnographic reports and publications; (2) GIS analysis of terrain and known archaeological site characteristics; (3) development and implementation of the models to assess the archaeological site potential of the study area; and (4) recommendations for appropriate archaeological resource management strategies for the North Coast TSA.

The project is GIS-based, providing a mapped representation of areas of potential archaeological concern that can be viewed or plotted at various scales. Information derived from the study will help the Ministry of Forests and other government agencies, including First Nations, to integrate archaeological resource management with other land use planning decisions so that heritage sites may be preserved or managed according to the British Columbia Heritage Conservation Act, the Forests Act, the Forest Practices Code Act, and other relevant legislation and protocol agreements.

Predictive models were developed according to archaeological site type. Models were created for coastal and inland habitation sites, and culturally modified trees (CMTs). Modelling involved dividing the entire study area into 10 metre grids and predicting the archaeological site potential of each grid cell, based on a series of rules. Model results were tested by evaluating the degree to which they correctly predicted the locations of recorded archaeological sites. No field testing has been undertaken to date.
The coastal and inland habitation models correctly predicted the locations of 98% of recorded habitation sites. The CMT model predicted 80% of recorded CMT sites, and an additional 24 CMT sites (14%) were captured by the habitation models. Overall, 94% of recorded CMT sites were accounted for by one of the models.

The models ranked all lands according to three classes, with Class I lands predicted to have the greatest archaeological potential and Class III lands the lowest. Site potential can also be viewed as relative site density, in which the highest density and greatest variation of sites equates with highest site potential (Class I). Given the severe terrain of much of the North Coast, it was expected that moderate to high site potential ratings would cover a relatively small portion of the study area land mass. The models predict that 5.5% of the study area (107,666 hectares) falls within the Class I category (highest site potential), while 16.5% (323,537 hectares) fall within Class II lands. This suggests that the vast majority of archaeological sites in the North Coast TSA should occur in 22% of the land mass. A significant portion of this area is designated Class II for CMT sites only. Additional field data may reduce the area encompassed by these models.

The model results can be used to guide future archaeological resource management efforts. It is recommended that archaeological field assessments (either preliminary field reconnaissance [PFR] or archaeological impact assessment [AIA]) be undertaken in all Class I or Class II lands prior to any land-altering developments. A PFR may be adequate to assess Class II areas, or field observations may indicate that a more detailed impact assessment is warranted. No archaeological fieldwork is recommended for Class III lands, although it is cautioned that occasional sites may be present in those areas. If an archaeological site is encountered during development, it is recommended that all land-altering activity cease in the immediate vicinity of the site until the Archaeology Branch and local First Nations are contacted to develop a site management plan.

In addition to risk managing, the results of this AOA can be used as a planning tool, to help prioritize archaeological assessment requirements over a period of years. One value of mapped archaeological information is that multi-year development plans can be compared against the predictive model results to evaluate archaeological requirements over time, such as a five year plan. Areas of high archaeological sensitivity, First Nations concern, or operational urgency can be addressed well in advance, reducing the potential
for unexpected delays and costs. Further, advance knowledge of potential archaeological concerns may allow the Ministry or licensees to better incorporate archaeological management into the annual business planning or funding cycle. This report also presents a number of more general recommendations relating to the AOA and future refinements to the models.
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1.0 INTRODUCTION

Archaeological sites and related cultural heritage resources may be protected under the *Heritage Conservation Act*, and are recognized in the *Forest Act* and *Forest Practices Code* as valuable components of the forested environment. A range of forestry activities, from road and landing construction, through timber harvesting, to silviculture, involve land alterations that can damage archaeological sites. The first step in managing heritage resources is to identify known and potential site locations so that a strategy can be developed to facilitate their protection and management. Archaeological overview assessments (AOAs) help to address this problem by identifying known archaeological sites and predicting where unrecorded sites are most likely to exist. This information allows land managers to assess the risk of impacting archaeological sites during development.

Archaeological sites and other types of heritage resources are non-renewable resources that are important for a number of reasons. The majority of archaeological sites in British Columbia are of aboriginal origin, and many aboriginal people maintain strong spiritual, cultural, and social connections with these places. In addition, archaeological sites are becoming increasingly important as legal evidence, as illustrated in several recent court rulings. There is widespread public interest in the past, and archaeological sites can represent a unique educational resource. Through interpretive programming, some archaeological sites can provide a basis for understanding aboriginal cultures and the histories of B.C. First Nations.

Many types of cultural heritage sites in British Columbia are currently protected under legislative or policy measures, most notably the *Heritage Conservation Act* (HCA) and the *Forest Practices Code Act* (FPCA). The HCA provides automatic protection to all archaeological sites older than 1846, as well as to certain more recent sites, if they are deemed to have heritage value. Protection, in terms of the HCA, does not necessarily imply that a site cannot be altered, or even destroyed; rather, it means that any alteration to such sites requires a permit issued by the Archaeology Branch (Ministry of Small Business, Tourism and Culture) under the appropriate section of the HCA. Heritage inspection and investigation permits are issued under Section 14 of the Act, while site alteration permits are issued under Section 12.
The HCA does not afford automatic protection to most types of sites that post-date 1846, or to spiritual or traditional land use sites where no physical evidence of human use or occupation exists. Certain site types, including burial places and rock art, are automatically protected under the HCA regardless of age. Protection for post-1846 sites not covered under the HCA may be provided under the Forest Act, Forest Practices Code or by agreement. Other government 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.

The Ministry of Forests, North Coast District, retained Golder Associates Ltd. (Golder) to undertake an archaeological overview assessment of the North Coast TSA (Figure 1) to assist with the identification of potential conflicts between forestry operations and archaeological sites (Ministry of Forests Consulting and General Service Contract IN2000DNC-01). Although this study considered traditional land use information, where available, and included some First Nations participation, the project focus was on archaeological sites, and the study is not intended to fulfill Ministry consultation requirements or to serve as a traditional land use study.

1.1 Study Objectives

The objectives of the North Coast TSA Archaeological Overview Assessment were to:

- summarize available information about archaeological sites and aboriginal land use in the study area;
- develop predictive models based on known and inferred archaeological site characteristics on the North Coast;
- produce GIS coverages indicating areas of relative predicted archaeological site potential; and
- provide management recommendations for appropriate levels of archaeological investigation prior to land-altering developments in areas of predicted archaeological sensitivity.
FIGURE 1: Map of the Study Area, Showing Modelling Test Areas

Test Areas
Study Area

Scale: 1:1,750,000
0 10 20 30 Kilometers

Projection: UTM Zone 9
Datum: NAD 83
Information derived from the study will help the Ministry of Forests, First Nations, and forestry companies to integrate archaeological resource management with other land-use planning requirements so that heritage sites may be preserved or otherwise managed according to legislation and protocols.

1.2 The Archaeological Overview Assessment (AOA) Process

Archaeological overview assessments are planning tools designed to assist resource managers in assessing the risk of adversely impacting archaeological sites when planning land developments. Through the use of “site sensitivity” (or “risk index”) maps, an AOA defines areas that have relatively high, moderate or low predicted archaeological site potential, or sensitivity. The cultural resource sensitivity ratings are based on predictive models which, in turn, are derived from information about past use of the landscape and the characteristics of documented archaeological sites. The predictive models are not designed to pinpoint specific archaeological site locations, but rather to delineate areas where archaeological sites are most likely to be present, preserved and identifiable. Fieldwork in the form of impact assessments, reconnaissance surveys or inventories must be conducted in order to locate, record and evaluate actual sites.

An AOA is intended to be a resource management tool and its use should not preclude other resource management measures, including direct consultation with First Nations. Land-use managers can overlay development plans with the archaeological sensitivity maps to assess which proposed development areas are most likely to come into conflict with archaeological sites. The AOA report and site sensitivity maps can also 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.

This AOA consists of several successive components, each of which is described below.

1.2.1 Data Acquisition

An AOA begins with the collection and synthesis of relevant archaeological, historical, environmental, and other information about the study area. Because most archaeological sites in the province are of aboriginal origin, early involvement of First Nations communities is important. Shortly after contract award, contact was initiated with First
Nations whose traditional territories encompass the study area. Several sources of information regarding First Nations’ past and present uses of the North Coast were consulted for this study, including direct consultation, ethnographies, historic journals, published and unpublished reports, articles, and monographs, maps, and archival documents. Most of the involved First Nations communities were visited in mid-January 2000 to introduce the project and to discuss heritage issues and concerns. Specific archaeological and traditional land use information was collected, where possible.

In addition to cultural information, data regarding the environment of the study area must also be reviewed. Sources of terrain, stream, climate and vegetation information gathered for this study include Terrain Resources Information Maps (TRIM), biogeoclimatic maps, and forest cover data.

The data acquisition phase also involves the review of known archaeological site data for the study area. Recorded archaeological sites are valuable sources of information because they relate specific cultural activities to particular places on the landscape. For example, most (though not all) recorded aboriginal village sites recorded on the Central and North Coast occur in areas of moderate terrain, near a source of fresh water and within a short distance of the ocean. This type of information is essential to the predictive model building phase of an AOA. A database of recorded archaeological sites, taken from the Provincial Heritage Register Database (PHRD), scanned archaeological site sketch maps, and a GIS point coverage of archaeological site locations were provided in digital format by the Archaeology Branch.

The Ministry of Forests provided several sources of data, including digital TRIM and forest cover mapping, and paper maps showing predicted archaeological potential polygons from a previous AOA project completed in the North Coast District (Commonwealth Historic Resource Management Ltd. and Millennia Research 1996).

1.2.2 Data Preparation and Predictive Model Development

The second component of the AOA involves preparing and analyzing all data sources. Digital data were prepared in a GIS, using ARC/INFO and ArcView software. Data preparation involved developing a digital elevation model (DEM), calculating elevations and slope classes, buffering hydrology, creating polygons representing waterbodies, and
clipping the data to separate water from land. The large size of the study area dictated that the data be divided into subsets to allow for efficient processing. Five geographically-defined sections were created, and data preparation was completed section-by-section.

The GIS analyses provide the base data for developing computer models to predict archaeological site potential. The objective of modelling is to develop a set of criteria, or rules, to describe places where archaeological sites are most likely to occur, and to apply those rules across the study area. In the absence of extensive probabilistic archaeological inventory data, modelling usually relies on existing archaeological site data and the collective expertise of the study team and First Nations participants. Since different kinds of sites (e.g. culturally modified trees, shell middens, and fish traps) represent different cultural activities, it is important to develop discrete modelling rules for specific site types, rather than a single general model that is intended to account for all sites.

For the North Coast TSA, predictive models have been developed for coastal and inland habitations (including villages, shell middens, and resource camps), and culturally modified trees (CMTs). Models produced for the Central Coast LRMP AOA for trails, pictographs and petroglyphs were ineffective due to data limitations, and consequently they were not implemented in this study. However, the Central Coast study showed that many petroglyph and pictograph sites were accounted for by the coastal habitation model, suggesting a correlation between habitation and rock art site locations. Detailed descriptions of each model are provided in Section 8 below.

The archaeological and GIS teams worked together to create digital coverages (computer-generated layers) of the study area that contain information relevant to model development.

1.2.3 Archaeological Site Sensitivity Mapping and Reporting

The third phase of the AOA involves presentation of the study results in a way that is useful to land-use managers. One presentation tool is the archaeological sensitivity map, or predicted site potential map. An archaeological sensitivity map graphically illustrates areas considered to have relatively high, moderate or low potential for certain archaeological site types to be both present and preserved. Relative potential rankings
are used, with the acknowledgment that all areas have some potential for archaeological sites, but that certain areas have greater constraints against human use or archaeological site preservation.

For the North Coast AOA, areas that meet the most stringent criteria of a predictive 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 could support the same site type, but do not contain the optimal conditions for doing so. Consequently, these areas are considered to have moderate site potential. Class II lands are typically adjacent to Class I lands, but further from prime resource locations or from preferred landscape features. Class III lands are considered to have relatively low archaeological site potential due to severe constraints on human occupation and use, or on archaeological site preservation. Recommendations are provided for adequate levels of archaeological assessment for each land class designation (see Section 11).

Archaeological potential maps generated for the North Coast TSA 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 as plot files and GIS coverages to the North Coast Forest District. The model results may be stitched into a contiguous coverage for the study area or clipped to correspond with the TRIM grid or other administrative boundaries. An overview-scale plot file was also provided to the Ministry of Forests.

1.3 First Nations Participation in the North Coast TSA Archaeological Overview

At the outset of this study, the First Nations with expressed hereditary interests in the study area were contacted and invited to participate. Five First Nations groups were identified by the Ministry of Forests as having interests in the study area, based on Statements of Intent and other information sources. These First Nations are the;

- Nisga’a First Nation
- Tsimshian First Nation
- Gitanyow First Nation
- Haisla First Nation, and
Heiltsuk First Nation.

On the direction of the Ministry of Forests, the Gitanyow First Nation was not contacted, because only a small portion of their identified traditional territory lies within the North Coast TSA, all of which consists of ice fields with no potential for forestry operations.

Given funding and time constraints, face-to-face consultation with First Nations in their home communities was limited. Consequently, First Nations representatives were contacted by telephone, fax and courier to discuss the project goals, progress, and plans for implementing the study results.

From January 17 to January 21, 2000, representatives of Golder Associates and the North Coast Forest District visited with 6 of the First Nations whose territories encompass the northern portions of the study area. These Nations included the Kitselas, Kitsumkalum, Kitkatla, Metlakatla, Kitamaat, and Lax-Kw’alaams. A meeting was also held with the Tsimshian Tribal Council. A brief description of the meetings is included below.

A meeting was held with Mr. Bruce Watkinson, Resource Officer for the Kitkatla First Nation, on January 17, 2000. The overall scope and schedule of the project was discussed, and Mr. Watkinson provided some general information regarding known resource use areas within Kitkatla territory. These areas were marked on the relevant 1:50,000 scale NTS maps. Mr. Watkinson accepted an offer to review the results of modeling for test areas.

Mr. Bob Hill, of the Tsimshian Tribal Council also met with the study team on January 17, 2000. Mr. Hill suggested that we continue to contact individual communities directly and offered to assist where possible.

On January 18, 2000, a meeting was held with Mr. Alec Bolton, Chief Negotiator for the Kitsumkalum First Nation. Mr. Bolton stated that Mr. Alan Bolton, GIS technician and TUS worker for the band, had left some information with him but that we should contact Alan Bolton at a later date to get copies of TUS maps and other relevant information. Some information regarding landscape use patterns was shared by Mr. Bolton.
Mr. Morris Mason of the Kitselas First Nation met with the study team on the afternoon of January 18, 2000. The GIS and TUS workers were out of the office but Mr. Mason agreed to review test maps and provide input into the AOA via the submission of relevant TUS knowledge.

At a meeting on January 19 2000, Mr. Harold Leighton and Mr. Marcel Pepin of the Metlakatla First Nation discussed the overall scope and timing of the project as well as some of their concerns regarding information confidentiality. It was agreed that, time permitting, the Metlakatla GIS and TUS team would review maps of model results for test areas and provide input.

A meeting with the Kitamaat First Nation was held on January 20, 2000. The Kitamaat Nation was represented by Mr. Amie Smith, Executive Director of the Kitamaat Village Council, Mr. Morris Amos, Resource Management Director, and Mr. Whitney Lukuku, Forester and member of the Resource Management Team. Following a discussion of the project purpose and scope, it was concluded that, at this time the Kitamaat do not have staff available to participate directly in the project. Funding of $2,000 to $3,000 would be required if the MoF wished to have Kitamaat participate fully in the project. It was decided that the Kitamaat would be interested in seeing the test maps but, if detailed analysis was requested, they would have to bill the project for their time. It was agreed that the test maps would be submitted as soon as possible, with no less than two weeks allowed for review.

On Friday January 21, 2000, a meeting was held with all nine hereditary Chiefs of the Lax-Kw’Alaams First Nation, as well as and Chris Turner (TUS and GIS Technician), and Susan Marsden, curator of the Prince Rupert Museum and contributor to the TUS. James Bryant, spokesperson for the hereditary Chiefs, chaired the meeting. In general, the Chiefs determined that the scope and timeline of the project was inadequate. There was concern expressed regarding the level of consultation with the Lax-Kw’Alaams. Mr. Turner indicated that it was his opinion that the Chiefs should attempt to have the MoF withdraw the project contract and renegotiate a more thorough and lengthy study. The meeting concluded with the Chiefs decision to meet with the District Manager to discuss the scope of the project. That meeting would be attended by Mr. Bryant, Ms. Marsden and Mr. Turner. Another Chief noted that the project should provide employment for members of the Lax-Kw’Alaams people.
Due to a scheduling misunderstanding, the Golder and MoF representatives missed a meeting with Ben Haisimsque of the Nisga’a Nation. Later telephone conversations resulted in an agreement to send a package complete with project description and study area map for Mr. Haisimsque to present to the relevant committee.

The study team was unable to arrange a meeting with representatives of the Gitga’at (Hartley Bay) Nation while in Prince Rupert, however, Golder met with Chief Councillor Pat Sterritt on January 27, 2000 in Vancouver. Chief Sterritt stated that the Gitga’at would like to participate in the project and requested that we send a letter detailing what level of information would best suit the needs of the project. Upon her return to Hartley Bay, Chief Sterritt will speak with the Gitga’at forester and, if time permits, arrange to send maps to Golder. At minimum, the Gitga’at were interested in reviewing the test maps.

A meeting with representatives of the Heiltsuk First Nation was held on February 15, 2000 in Waglisla, BC. During this meeting it was noted that the Heiltsuk had yet to review the Central Coast AOA plot files and maps. The Heiltsuk stated they were particularly concerned about the CMT model, as, in the case of the Central Coast AOA, they were unsure whether the CMT data collected in the Heiltsuk AOA was being used in the models for the North Coast. There was some concern that, since the North Coast AOA was building upon the models used in the Central Coast AOA, that the Central Coast maps should be reviewed first. To this end, Golder’s cultural sciences and GIS staff worked with the Heiltsuk GIS team to access and print the Central Coast AOA plot files. A test map was printed and the Heiltsuk team stated they would like to have time to review the Central Coast maps before making any statements about whether or not they supported the ongoing North Coast AOA. However, the Heiltsuk requested a copy of the North Coast AOA test map and draft report for review.

On February 18, 2000, Golder met with Percy Starr and Ben Robinson of the Kitasoo First Nation. The meeting took place in Vancouver at the downtown offices of the Kitasoo Tribal Council. After a brief introduction, the Kitasoo representatives stated that they would like Golder to forward a letter to the Kitasoo Chief and Council explaining the project in lay terms and clearly outlining what kind of information would be useful for an AOA. The Kitasoo also requested that the letter include the project deadline and a description of how the AOA maps would be used. Mr. Starr and Mr. Robinson stated
they would also like to have the opportunity to review the draft map and report but would also have to present it to the rest of the community before providing comments. A letter containing the requested information was sent from Golder to the Kitasoo Band Council on February 24, 2000.

Due to scheduling difficulties, many of the meetings with First Nations took place much later in the project schedule than would have been desired. This made it impossible for most of the communities to review and respond to the draft report and overview map in time for their input to be incorporated into this report. However, draft and final copies of this report and the accompanying 1:250,000 scale overview map were provided to each First Nation in the study area, and community input can be accommodated through the MoF consultation process. As this AOA is an evolving planning tool, additional opportunities for First Nations involvement, including participation in field assessments, should be available in the future.

1.4 Report Structure

This report is organized in general accordance with Archaeology Branch guidelines for archaeological overview assessments (Apland and Kenny 1998). This introductory section has explained the AOA process and the context and objectives of the project. The second section describes a number of forestry development types that could potentially impact archaeological sites. Section 3 summarizes the physical setting of the study area, with discussions about the climate, vegetation, and physiography, both today and in the past. Section 4 briefly describes the traditional cultures of the First Nations of the study area, based on published information. Section 5 deals with the culture history sequence of the North Coast, and describes the main archaeological sites types and their expected spatial distribution across the landscape, as presently understood. Section 5 also presents a review of previous archaeological research in the study area. Section 6 presents the results of GIS analyses of the terrain and recorded sites in the study area. Sections 7 through 9 explain the methods and results of the predictive modelling component of the study, including a description of the data, the individual models, and the variables used to develop them. Section 10 briefly discusses the study results, and Section 11 provides archaeological resource management recommendations linked to the predictive modelling results. Appendices include a glossary of technical terms (Appendix 1), and attribute data for the recorded archaeological sites in the study area (Appendix 2).
2.0 POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Many forestry-related activities have the potential to damage archaeological resources, particularly culturally modified trees (CMTs). Direct impacts may include, but are not limited to, artifact breakage or displacement, destruction of features, and disturbance of stratified deposits. Examples of indirect impact include increased public access (which 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).

One goal of this study is to help identify archaeologically-sensitive areas so proper management measures can be implemented prior to ground disturbance. The following sections summarize some of the forest development activities that may affect the integrity of archaeological sites, based in part on discussions by Eldridge (1990) and Mackie and Eldridge (1992).

2.1 Falling

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

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

2.2 Yarding

With the exception of helicopter logging, yarding activities have greater potential to impact archaeological sites than does falling. 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. 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 ground disturbance through the use of a backspar to traverse areas without roads.

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. Moreover, horse skidding may offer more flexibility in avoiding visible archaeological features.

2.3 Access Roads

Logging roads, and 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 where possible, which often has archaeological site potential. Many logging roads undoubtedly follow aboriginal trails and some have destroyed archaeological sites located along the trails. Road building severely disturbs the ground, and can completely destroy archaeological sites. Eldridge (1989) showed that road locations tend to correspond more closely with CMT locations than a random sample from nearby areas, and recent field assessments in the Fraser Canyon support this assertion (Golder Associates 1998). This suggests that ease of access may have been an important factor in aboriginal forest utilization. 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.

2.4 Associated Developments

Ancillary developments, such as log landings and sorting grounds can impact archaeological sites through terrain levelling and heavy equipment traffic. Artifact displacement and breakage are common types of damage associated with these developments Coastal log dumps often coincide with shell midden or aboriginal village locations, and ground disturbance can impact the upper levels of cultural deposits.
2.5 Silviculture

Certain reforestation techniques can be extremely damaging to archaeological deposits. Slash piling using bulldozers and skidders, stump removal, and scarification can severely disturb the ground. Tree planting, thinning, and pruning, in contrast, should have relatively little effect on archaeological sites, as long as skidding is not involved.

3.0 PHYSICAL SETTING

3.1 Modern Environment

The North Coast TSA covers an area of approximately 1.95 million hectares, from Meyers Passage (near Klemtu) north to Stewart. Much of the landscape along the coast is rugged, featuring narrow fjords and channels that rise steeply to glacier-covered mountains. Access to inland portions of the TSA from the coast is limited. Several large islands, including Princess Royal, Banks, Pitt and Porcher, are within in the TSA, as are the lower reaches of the Nass and Skeena rivers.

3.1.1 Biogeoclimatic Zones

Most of the TSA falls within various subzones of the Coastal Western Hemlock (CWH) biogeoclimatic zone, with the Mountain Hemlock (MH) zone occurring at higher elevations, and Alpine Tundra (AT) prevailing above the tree line. A very minor amount of the Engelmann Spruce-Subalpine Fir (ESSF) is also present. Figure 2 shows the biogeoclimatic zones of the North Coast TSA.

CWH Zone

The CWH zone covers low to middle elevations throughout the North Coast, extending from sea-level to about 400-450 metres a.s.l. Pojar et al. (1991) provide a thorough description of the plant and animal species characteristic of the Coastal Western Hemlock zone. The forests of the CWH zone are dominated by Western hemlock and Pacific silver (or amabilis) fir, but Western redcedar and Yellow cedar are often abundant. The understory in the CWH zone is generally lush, and it contains a number of food species important to First Nations’ traditional diets.
FIGURE 2: Biogeoclimatic Zones of the North Coast TSA
Economically-important mammal species include marten, mule deer, black bear, grouse, mountain goat, and various species of waterfowl. Low-lying areas near tidal inlets are inhabited by sea mammals such as harbour seals and Steller sea lions. Throughout the CWH zone, streams and rivers provide spawning habitat for salmon and other fish, such as the economically important eulachon. Intertidal invertebrates are diverse, and include economically significant species such as mussel, cockle, abalone, limpets, butter clam, little-neck clam, octopus and sea cucumber.

*Mountain Hemlock (MH) Zone*

The Mountain Hemlock (MH) biogeoclimatic zone is characteristic of montane slopes and subalpine areas of the Coast Mountains above the CWH zone, at elevations between about 400 and 1,100 metres (Allen Banner-man, pers. comm. 2000). The characteristics of this zone are summarized in Pojar et al. (1991).

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. Notable mammals include snowshoe hare, black bear, mule deer, Roosevelt elk and mountain goat.

*Alpine Tundra (AT) Zone*

The Alpine Tundra (AT) biogeoclimatic zone, which characterizes the highest elevations of the mountains of the North Coast, 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.

*Engelmann Spruce-Subalpine Fir (ESSF) Zone*

The Engelmann Spruce-Subalpine Fir zone lies below the Alpine Tundra on the eastern side of the Coast Mountains. Abundant plant and animal resources made 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. The extent of ESSF zone in the North Coast TSA is almost negligible.

3.2 Palaeoenvironment

Four aspects of the palaeoenvironment are particularly relevant to archaeological site distribution: (1) deglaciation, which dictated when the environment was capable of sustaining human settlement; (2) sea level changes after deglaciation, which influenced the locations of ancient shoreline sites; (3) changes in the tree line and associated resources, which may have affected high elevation site locations; and (4) the establishment of cedar forests, which contributed to the development of the sophisticated wood working tradition of Northwest Coast First Nations. Each of these factors is discussed below in terms of its potential influence on archaeological site distribution.

3.2.1 Deglaciation

Like most of British Columbia, the North Coast was covered by ice during the glacial maximum of the Pleistocene approximately 16,000 years ago. According to Clague et al. (1982), the parts of the coastline were buried beneath as much as 2,000 m of ice, but glaciers on the outer coast were not as thick (Clague 1985). It is generally accepted that the outer coast was essentially ice free by about 13,000 years ago, although glaciers remained in the fjords and valleys. Based on these data, it can be inferred that the coastal fringe and marine islands could have been occupied by about 13,000 years ago.

3.2.2 Relative Sea Level

An understanding of variations in relative sea level over time is important for interpreting early human occupation of the coast. The initial settlement of the New World may have followed a southward route along the edge of the northwest coast, and there is potential for very early sites in this region. If early coastal cultures relied on the sea for subsistence and transportation, settlement locations likely would have been concentrated along the shoreline (Easton and Moore 1991). The following discussion examines relative sea levels since the end of the Pleistocene, and the implications for archaeological site distribution.
The term “relative sea level” is used to distinguish between localized shoreline conditions and global eustatic sea levels. Relative sea level reflects a combination of actual sea level changes and the effect of isostatic rebound (the rising of land that was previously depressed by the weight of ice). Tectonic plate movement is also a minor factor, but it is not considered significant within the time frame discussed here. Because ice build up was not uniform along the coast, isostatic rebound may have been the dominant factor in regional variations in relative sea level. The magnitude of rebound was greater in the fjords and valleys, where the thickness of glacial ice was greatest. This means that archaeological sites on ancient beaches or sea terraces generally would be found at higher elevations in the fjords than on the coast, assuming similar ages.

Relative sea levels have varied significantly since deglaciation at the end of the Pleistocene (ca. 13,000-10,000 B.P. [before present]), but data specific to the North Coast are sparse and localized (Archer 1998). In general, relative sea levels were lower than today during the late Pleistocene, due to the capture of water in glaciers, and some coastal areas that are currently submerged would have been exposed at that time (Josenhans et al. 1995). Relative sea levels were significantly higher during the period of deglaciation between about 15,000 and 10,000 years ago on the North Coast (Blaise et al. 1990), although the maximum level reached during this time is not known.

Archer (1998) has proposed a sea level curve for the Prince Rupert area, based on a small sample of dated raised beach deposits and archaeological evidence. He proposes that the basic post-glacial sea level pattern for the area is clear, but that some minor questions remain unresolved (e.g., relative sea level between 8,000 and 5,000 years ago). A dated beach deposit at Port Simpson shows that ±12,400 years ago the sea level was 50 m higher than today. Between ±12,400 and ±12,100, the sea level dropped rapidly to about 13 m above present (a drop of 37 m in only about 300 years). Over the next 3,000 years or so, sea levels dropped slowly, to a level about 5 m above present by ±8,000 years ago. No data are available for the North Coast between ±8,000 and ±5,000 years ago, but elsewhere on the coast, the sea level dropped to slightly below modern levels (Archer 1998). If Archer's interpretations are correct, then early sites in the Prince Rupert area could be found on sea terraces or raised beaches up to about 50 m above current sea level.

In contrast, marine deposits radiocarbon dated to about 10,500 B.P. at the heads of fjords in the Kitimat Trough are 200 metres above present sea level (Clague 1985). This
probably indicates significantly greater isostatic rebound in the Kitimat area than in Port Simpson, due to heavier Pleistocene ice loading. Presumably, post-glacial beaches and terraces older than ±10,500 years in the Kitimat Trough would be at even higher elevations. These data suggest that late-Pleistocene and early-Holocene archaeological sites, if present, will tend to be at higher elevations in coastal river valleys and fjords than on the coast. For the North Coast TSA, palaeoshorelines may be present from just above the present sea-level, up to about 200 metres a.s.l.

3.2.3 Tree Line

Throughout the Holocene, forests expanded and contracted in response to climate shifts. During cooler periods, the tree line would have been lower than today, and during warmer climatic episodes the tree line would have been higher than today. Archaeological sites associated with subalpine parklands at the upper forest fringe, if present, may now be in the forest or in the alpine.

3.2.4 Establishment of Cedar Forests

Western redcedar and, to a lesser extent, yellow cedar, have long been the primary materials used by the aboriginal people of the Northwest Coast to build houses and to make canoes, boxes, basketry, clothing and a host of other utilitarian and ceremonial items. However, the establishment of western redcedar and yellow cedar on the North Coast appears to be relatively recent, in archaeological terms. Hebda and Mathewes (1984) used palaeobotanical data to document the expansion of western redcedar in coastal forests between approximately 6,000 and 2,500 B.P. Their data indicate that cedar gradually expanded into the North Coast beginning ±6,000 years ago, but it did not become a major species in the Prince Rupert region until about after 4,000 years ago.

These findings correspond with early archaeological evidence for the development of woodworking technology among northwest coast aboriginal cultures, which suggests that specialized woodworking tools, such as adzes, were not common until about 3,500 years B.P. on the North Coast (Matson and Coupland 1995).
4.0 FIRST NATIONS OF THE NORTH COAST

4.1 Introduction

The following section provides a brief summary of the First Nations cultures on the North Coast. This review is not exhaustive, and it emphasizes aspects of the aboriginal cultural systems that are most likely to leave physical traces that can be identified archaeologically. This summary may not necessarily express the views of the First Nations people it describes. Many of the linguistic and cultural links described below are anthropological classifications, and they do not necessarily reflect how contemporary First Nations would define their past.

It is important to note that the use of the past tense to describe traditional cultural practices in the following sections reflects the use of ethnographic and historic sources and 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 First Nations throughout the North Coast area.

4.2 First Nations Communities in the North Coast TSA

Based on First Nations’ Statements of Intent submitted to the B.C. Treaty Commission and additional information provided by the Ministry of Forests, the North Coast TSA falls within the traditional lands of the Tsimshian, Nisga’a, Haisla, Heiltsuk, and Gitanyow Nations. Aboriginal communities within the TSA include the Tsimshian villages of Lax-Kw’alaams, Metlatkatla, Kitkatla, and Hartley Bay, as well as the Nisga’a villages of Kincolith and Greenville. The Kitasoo village of Klemtu is just south of the TSA boundary. Some aspects of the cultures of these First Nations are summarized below under the generalized headings of Tsimshian (Coast Tsimshian, Southern Tsimshian and Nisga’a), Haisla, and Heiltsuk. On the direction of the North Coast Forest District, the Gitanyow were not included in this study because, according to the Ministry of Forests, no operable forest areas of the North Coast TSA fall within Gitanyow Statement of Intent lands.
4.2.1 Tsimshian

Significant linguistic and cultural variation is evident among the First Nations of the North Coast, but general similarities exist, particularly in terms of socioeconomic organization and material culture. For this reason salient aspects of Coast Tsimshian, Southern Tsimshian and Nisga’a culture are discussed collectively under the general heading of “Tsimshian”. After a brief introduction to the local groups that comprise these three broader cultural groupings, aspects of Tsimshian culture are summarized.

4.2.1.1 Coast Tsimshian

The Coast Tsimshian are comprised of ten local groups that historically had winter villages on the lower reach of the Skeena River, below Kitselas Canyon. These local groups were known as the Gitwilgyot, Gitzaklalth (Gidzalaal), Gitsees (Git’tsiis), Ginakangeek (Ginaxangiik), Ginadoiks (Gitandoyks), Gitandau (Git’andoo), Gispakloats (Gispaxloats), Gilutsau, Gitlan, and Gitwilkseba. Prior to the arrival of Europeans in the region, these groups expanded coastward and established winter villages on the islands of Venn (Metlakatla) Pass. During the summer, the local groups returned to their territories on the Skeena to participate in the salmon fishery (Halpin and Seguin 1990).

Other groups that are considered Coast Tsimshian include the Kitselas, who now live in two villages at Kitselas Canyon on the Skeena River, and the Kitsumkalum, who lived below the Kitselas at the mouth of the Kitsumkalum River (Halpin and Seguin 1990) and now live near Terrace. These two groups are also members of the Tsimshian Tribal Council.

4.2.1.2 Southern Tsimshian

The Southern Tsimshian are comprised of three local groups, the Kitasoo, Kitkiata (also known as the Gitga’at or Hartley Bay Band), and the Kitkatla (Halpin and Seguin 1990). The original village of Kitkiata was abandoned in the late 1800s as people left to join Reverend William Duncan’s mission village of Metlakatla (and later New Metlakatla in Alaska). The present village of Kitkiata is located at a new site (Hartley Bay) and is inhabited by the descendents of those who did not follow Duncan to his New Metlakatla in Alaska (Halpin and Seguin 1990).
4.2.1.3 Nisga’a

According to Halpin and Seguin (1990), the Nisga’a living along the lower reach of the Nass River were divided into two groups — the Gitkateen and the Gitgigenik — and the Nisga’a of the upper Nass were divided into two more groups — the Gitwunksithk and the Gitlakdamiks. These latter two groups were also known as the kitanwili’ks, “the people staying temporarily”. This name was in reference to their downstream migration during the annual eulachon fishery (Halpin and Seguin 1990). Today, the main Nisga’a communities are known as Gingolx (Kincolith), Lakalzap (Greenville), Gitwinsilkw (Canyon City), and Gitlakdamiks (New Aiyansh).

4.2.1.4 Tsimshian Culture

Introduction

The following is a summary of Tsimshian and Nisga’a ethnographic information largely derived from Halpin and Seguin (1990) and the Kitasoo/Xaixais First Nations Resource Mapping Project (1995). Other materials that were consulted include the Marius Bar-beau and William Beynon microfilm collection currently stored at the British Columbia Archives and Records Service in Victoria and the ethnographic review provided in the North Coast Forest District Cultural Heritage Mapping Project (Commonwealth Historic Resource Management Ltd. and Millennia Research 1996). For more detailed information on Tsimshian language, kinship, ceremony and other cultural aspects consult Halpin and Seguin (1990), Garfield (1939, 1966, 1984).

Language

The Coast Tsimshian, Southern Tsimshian and Nisga’a each spoke their own distinct languages. While the Coast Tsimshian and Southern Tsimshian languages were common in many respects and clearly related, it is not clear if they were mutually intelligible. The Nisga’a spoke a language that was different from their coastal neighbours, but they also spoke Coast Tsimshian to facilitate communication with their Coast Tsimshian neighbours to the west (Halpin and Seguin 1990).
Settlement Pattern and Subsistence System

Among the Tsimshian, winter villages were typically inhabited year-round by at least a portion of the community. Their locations were generally sheltered from strong winter winds and somewhat protected from attack. Village sites were also usually near a source of fresh water and had plant and food resources nearby (Halpin and Seguin 1990).

Throughout the year, segments of the village population would travel to temporary or semi-permanent resource camps to collect seasonal resources. For example, at end of winter, before spring break (February-April), the annual eulachon fishery took place at fishing camps on the Nass River.

In the late winter or early spring, herring roe was gathered on grass, kelp, or submerged branches. In addition, the inner bark of redcedar, used for a variety of purposes, was gathered during this time, as was the edible cambium of several tree species.

In the early spring (May), the Coast and Southern Tsimshian gathered and dried seaweed for approximately one month at special seaweed camps along the coast. The Nisga’a obtained seaweed, which was not locally available to them, through trade with the coastal groups. While at these camps, men fished for halibut and women processed the meat. Men would also troll for the first salmon that would appear in the tidal waters during early spring. It has been suggested that for the Coastal Tsimshian peoples, halibut was second only to salmon in terms of dietary importance (Beynon 1929-30 in Barbeau Collection [B-F-168.2]).

In early summer the people moved to traditional fishing sites along the rivers to fish primarily for the five species of salmon. Women would also use the summer months to harvest a wide variety of berries (including salmonberries, wild crabapples, and high bush cranberries in autumn), roots, and shoots.

Much of the early autumn was spent smoke drying and preserving salmon. Following the preservation of winter foods, small groups of hunters would proceed to their hunting territories in search of sea and land mammals. Game taken by the Tsimshian included deer, elk, seal, sea lion, sea otter, mountain goat, mountain sheep, bear, marmot, porcupine, mountain lion, hare, lynx, swans, geese, ducks, and other waterfowl (Halpin
and Seguin 1990). Due to their inland setting, the Nisga’a had a greater emphasis on land mammal hunting.

Winter was the season of ceremony and rest. Potlatches and other major ceremonies would take place in the winter villages. While the villagers depended upon stored salmon and other preserves, some hunting also took place. Shellfish, always an abundant and accessible resource, were also gathered in the winter months (Halpin and Seguin 1990).

Habitation Structures

The largest Tsimshian structure at the time of contact was the winter house, which was comprised of massive planks split from redcedar logs attached to a post and beam frame. Winter houses were roughly 15 m to 18 m long, with chiefly families occupying cubicles at the rear and other families having quarters along the side walls. These dwellings usually featured plank-lined pits about 1.5 m deep and 9 m square, which formed the central living space and contained a central hearth for warmth and cooking. Platforms above the living area were used for living and storage purposes. House fronts were painted with crest designs, and wooden screens, painted with sacred designs, were erected inside at the rear of the house.

The winter house frames were left in place year round, but the planks were sometimes removed and carried to spring and summer camps for use in temporary summer house structures. Other structures typically used by Tsimshian peoples included menstrual huts, sweat lodges, summer houses, and underground food caches (Halpin and Seguin 1990).

Material Culture

The Tsimshian are noted for their fine basketry. On the coast, women used cedar bark for basketry and mats; upriver, women used additional materials, including maple, birch bark, and spruce roots (Halpin and Seguin 1990). Utilitarian items, including storage boxes, canoes, woodworking tools, and fishing and hunting gear were manufactured from various types of wood, but cedar was a dominant material.

Woodworking tools, fishing and hunting gear, and ceremonial items were also fashioned from stone, bone, antler, shell, and mountain goat horn.
Post Contact History

The Southern Tsimshian were the first division of the Tsimshian to come into contact with Europeans. In 1787, a fur-trading expedition run jointly by Duncan and Colnett is believed to have visited the village of Kitkatla, and, in 1792, the Spanish explorer Jacinto Caamaño visited a village on Pitt Island. Captain Vancouver explored Coast Tsimshian waters and sailed up Portland Canal into Nisga’a territory in 1793. The Hudson’s Bay Company’s Fort Simpson was established on the Nass River in 1831.

The continuing presence of the fur traders and the influx of European settlers and missionaries had a profound effect on the aboriginal inhabitants of the coast and, despite the attempts of missionaries to assimilate Native cultures, Tsimshian culture remained resilient. There were, however, changes to Tsimshian lifeways that resulted from the shift to trapping for trade, a minor gold rush along the Skeena, disease, the establishment of commercial salmon canneries, and migration of some Tsimshian peoples to Alaska.

4.2.2 Haisla

Introduction

The following summary of Haisla culture is largely derived from Hamori-Torok (1990). Other useful sources concerning Haisla ethnography include Drucker (1940, 1950), Lopatin (1945), Olson (1940), and Robinson (1962). Haisla territory is situated in the upper reaches of Douglas Channel and Gardner Canal on the inner north coast of British Columbia. In the 19th Century there were two main divisions of Haisla: the Kitamaat who resided in the Douglas Channel area, and the Kitlope of Gardner Canal (Hamori-Torok 1990:306).

Language

The Haisla speak a northern variant of the Wakashan language (sometimes known as Northern Kwakiutl), though they are somewhat isolated from their nearest linguistic relatives, the Haihais (Xaixais), Heiltsuk, and Oweekeno. It should be noted however, that some Kitamaat and the Kitasoo XaiXais people today are also Tsimshian speakers.
Settlement Pattern and Subsistence System

Similar to the Tsimshian groups to the north, the Haisla occupied principal winter villages year-round, with segments of the population traveling seasonally to various resource sites.

The Haisla harvested all five species of salmon, but coho, chum, and pink were the most important. Salmon were caught in salt water using stone tidal pounds and in fresh water rivers using weirs and traps. The Haisla also used leisters, harpoons, dip nets, and trawl nets (Hamori-Torok 1990). Like the Tsimshian, eulachon was very important to the Haisla, who traveled to the major rivers to catch it.

Land mammals were an important resource for the Haisla. In the alpine, hunting dogs were used to drive mountain goats into enclosed areas where they could be speared. Similarly deer were driven into water using dogs, and marmots, black bears, and grizzly bears were caught using dead fall traps (Hamori-Torok 1990).

Women gathered berries and other plant foods. Berries were considered very important, and the Haisla conducted controlled burns to enhance berry growth. The Kitlope area of Haisla territory was well-known for wild crab apples, and people from other territories also had harvesting rights (Hamori-Torok 1990).

Habitation Structures

The largest of Haisla structures was the winter house which was a beam and ridge pole structure with vertical wall planks, a gabled roof and a painted façade. The centre of the house contained a fire pit used for cooking and heating. The walls of the sleeping areas were lined with cedar bark mats (Hamori-Torok 1990).

Material Culture

Haisla men carved a variety of wooden utilitarian items including boxes and chests. They also wrapped twining and made burden and storage baskets (Hamori-Torok 1990:308). Women made basketry and wove mats and fabric for clothes. Typical clothing consisted of spruce root rain hats and woven yellow cedar bark robes or sewn
hides. The women wore shredded cedar bark or buckskin aprons, and, when travelling overland, people wore protective leggings.

Transportation in Haisla territory was primarily by canoe. Though most canoes were made of cedar, those used on rivers were occasionally made of cottonwood. The Haisla also made and used snowshoes.

Post Contact History

It is unclear when first contact between Europeans and the Haisla took place. Members of Jacinto Caamaño’s crew took a boat up Douglas Channel during the Spanish exploration of the area in 1792, and members of the George Vancouver expedition of 1793 explored both Douglas Channel and Gardner Canal. Although they were probably somewhat affected by the maritime fur trade, it wasn’t until the early 1830s that the Haisla were trading and selling directly to the Hudson’s Bay Company at Fort McLoughlin, established near Dean Channel in 1833 (Hamori-Torok 1990).

The Haisla were first introduced to Christianity by Charlie Amos, a Kitamaat native converted in Victoria in 1876 (Hamori-Torok 1990). The breakdown of Kitamaat religious and sociopolitical structures was initiated by the establishment of Kitimaat mission by the Reverend George Raley of the Methodist Church in 1893. A Roman Catholic mission was established among the Kitlope people at Kemano shortly after (Hamori-Torok 1990). The government ban on the potlatch and associated practices resulted in the further breakdown of traditional Haisla social organization.

In the late 19th and early 20th centuries, the Kitamaat and Kitlope bands were allotted several reserves, and in the 1930s the two bands amalgamated. During the early half of the century and extending to the 1950s, commercial fishing and cannery work became the main sources of employment for the Haisla peoples. Commercial hand-logging and trapping also served as other sources of income. In the 1950s, the establishment of the Alcan aluminum smelter and the town of Kitimat brought another major change in the local economy. By the 1970s the smelter and associated businesses in Kitimat were the major employers of many local Haisla people.
4.2.3 Heiltsuk

Introduction

The following summary of Heiltsuk culture is based on Hilton (1990) and the summary in Millennia Research (1997a,b). Other ethnographic sources include Boas (1928, 1932), Olson (1955), and Storie and Gould (1973a, 1973b).

The Heiltsuk Nation is comprised of a number of local groups that owned and used villages and resource sites on the coastal islands and on the mainland. Today, five local groups are recognized: the 'Yidsaitxv of Dean Channel and Burke Channel, the 'Wúyalítxv of the Fitzhugh Sound area, the 'Qvíqvayítxv north of Waglisla, from Milbanke Sound up Spiller Channel and Spiller Inlet, the 'Wuíítxv of Roscoe Inlet, and the 'Xíxís from Milbanke Sound up the channels as far north as Kynoch and Klekane Inlet (Heiltsuk Cultural Education Centre cited in Millennia Research 1997b).

Language

The Heiltsuk language is considered a part of the northern branch of the Wakashan language group.

Settlement and Subsistence System

Similar to First Nations to the north, the Heiltsuk settlement and subsistence pattern changed with the availability of seasonal resources within local group territories. The primary settlement site was the winter village which was likely occupied by some villagers throughout the entire year. However, as specific resources became available (e.g., the salmon fishery) a large segment of the population moved to semi-permanent camps associated with these resource sites. These locations were owned by families, local groups, or crest groups. In the winter, families returned to permanent villages to celebrate the ceremonial season and manufacture or repair equipment (Hilton 1990).

The Heiltsuk used a wide variety of subsistence technologies to fish and to collect shellfish and marine plants. Salmon were caught using stone wall traps or wooden stake weirs and traps, harpoons, dipnets, and clubs. Sea foods such as clams, abalone, and seaweed were gathered during resource harvesting expeditions. Sea mammals, including
seals, sea lions, and sea otters, were hunted using harpoons, clubs, and the bow and arrow. Land animals, such as mountain goat and deer were hunted with dogs and either snared or speared, and bears and small game were caught in deadfall traps. Archaeological evidence of these pursuits may include artifacts (stone, bone or wood artifacts), remains of deadfall traps, or stone or wood fish traps and weirs.

Habitation Structures

Heiltsuk winter villages featured rectangular cedar plank houses with gabled roofs, double ridge poles, vertical wall planks permanently attached to the house frame, carved interior posts, a central smoke-hole, and mat-lined walls in the sleeping compartments. Less elaborate, but similar, plank houses were also built at major seasonal resource sites in areas where seasonally available marine and riverine resources were abundant. Bark houses were used at hunting stations and minor camps (Hilton 1990).

Material Culture

Heiltsuk clothing and adornment styles were similar to those of neighbouring groups. The most distinctive practice was the combination of the northern custom of wearing labrets (reserved for high-status women) and the practice of cranial modification. Labrets are sometimes found in archaeological sites, and cranial deformation may be evident in human burials.

Heiltsuk society also had a strong tradition of highly skilled artisans, noted for the production and decoration of bentwood boxes, chests, canoes, and horn spoons and ladles. Such items are sometimes preserved archaeologically.

The canoe was the principal mode of transportation, with a cedar dugout style used for sea travel and a bark canoe used on lakes. While wooden canoes are infrequently recovered in archaeological sites, evidence of their manufacture may include aboriginally-logged trees, canoe blanks, and wood working tools.

Trade

Within the North Coast Forest District, Heiltsuk lands border those of the Tsimshian and Haisla. Trade in eulachon grease, clams, herring roe, and seaweed was a vital part of

Golder Associates
relations between neighbouring groups. Material items associated with subsistent trade may be found in archaeological sites.

Post Contact History

The first recorded contact with Europeans occurred in 1793, when two explorers separately entered Heiltsuk territory. Captain George Vancouver surveyed local channels and inlets while heading north, while Alexander Mackenzie traveled overland down the Bella Coola Valley and into Dean Channel. Soon after these initial explorations, maritime fur traders seeking valuable sea otter pelts entered Heiltsuk territory, often stopping at Milbanke Sound to trade. The fur trade instigated a period of rapid social and economic change for the Heiltsuk and other First Nations along the Coast. In 1833, the Hudson’s Bay Company established a second major trading center, at Fort McLoughlin on Campbell Island, and it remained the only fort and trading store on this part of the British Columbia coast for many years. The establishment of two trading centers (Milbanke Sound and Fort McLoughlin) within their territory allowed the Heiltsuk to position themselves as middlemen and to exert control on the competition between the British and the Americans.

While the fur trade provided some economic benefits for northwest coast First Nations, European diseases, most notably smallpox, swept through the region, causing a massive decline in aboriginal populations. Boyd (1994) reports smallpox epidemics in the late 1770s, 1801-02, 1836-38, 1853, and 1862-63. The extensive 1770s epidemic reportedly affected the entire Pacific Northwest (Boyd 1990), while subsequent outbreaks were more localized. For example, the 1836-38 epidemic apparently affected the ’Yídsátxv and ’Xíxs sub-tribal groups more drastically than other Heiltsuk groups, due to the distribution of vaccines to those groups from Fort McLoughlin. Using culturally modified tree data, Lepofsky and Pegg (1995) documented evidence that this epidemic also affected the Haisla to the north. In 1862 a devastating smallpox epidemic spread from Victoria and nearly decimated the Heiltsuk (Millennia Research 1997b).
5.0 ARCHAELOGICAL CONTEXT

5.1 Expected Archaeological Site Types and Distributions

An archaeological site is a location containing physical evidence of past human activity, usually in the form of artifacts or cultural features. Artifacts are human-made or modified objects, such as tools of stone, bone, shell, antler, and wood. Cultural features are modifications to the landscape that cannot be moved without altering them: fire hearths, culturally modified trees, and trails, for example.

Artifacts of metal and stone are the most resistant to decay and are most often preserved in archaeological sites. Other relatively durable materials include shell, bone, antler, and horn, especially when contained within non-acidic soil matrices, such as shell middens. Wood and other plant materials are rarely well preserved in archaeological sites, except under specific conditions, such as waterlogged deposits. This significantly limits the amount of information that can be recovered archaeologically, especially on the northwest coast, where aboriginal technologies relied heavily on wood, bark, and other plant materials.

The following is a summary of the major types of archaeological sites that can be expected in the North Coast study area.

5.1.1 Culturally Modified Trees

Oral histories, ethnographies, and archaeological reports clearly show that western redcedar wood and bark were extremely important raw materials for northwest coast aboriginal cultures. Although most wooden implements are not archaeologically preserved, there is abundant archaeological evidence of bark and wood harvesting in the form of culturally modified trees (CMTs). CMTs are trees that have been altered by aboriginal people as part of their traditional use of the forest (Ministry of Forests 1998). The most important tree species to the First Nations of the North Coast was the western redcedar, but yellow cedar, cottonwood, western hemlock, western yew, and other trees were also used (Turner 1998).

The First Nations of the North Coast are well-known for their sophisticated woodworking and cedar bark-working technologies. Trees were felled, trimmed and rough-hewn with
wedges and then pulled out of the forest and towed to the village for more refined working. Prior to felling, a hole was often chopped into the trunk of the tree to test the soundness of the heartwood, a consideration that was particularly important when looking for a tree suitable for a canoe or planks. Stone mauls and chisels with bits of stone, bone, and antler were the traditional means of felling trees until the post-contact period, when iron chisels and axes became abundant. Planks were split from felled logs, wind-fallen trees, and standing trees by a notch-and-wedge technique. Log sections were shaped into canoes in the forest. Due to their size, stumps of various types (dependant on the felling technique employed), planks, planked logs and windfall, tested trees, and unfinished canoes all have the potential to survive several hundred years in the forest and to be identifiable as archaeological sites (Ministry of Forests 1998).

The inner bark of the cedar was collected by pulling long, narrow strips beginning from a cut near the base of the tree, which was preferably young and devoid of lower branches. The outer bark was discarded at the harvest site and the inner bark transported to the village for processing. On the North Coast, large slabs of outer cedar bark (sometimes called bark boards) were used for the roofing of temporary shelters and the covering of canoe logs in the forest (Ministry of Forests 1998). Because the trees survive the bark-stripping event, evidence of harvesting is identifiable as an archaeological site for as long as the tree survives, and for some time after.

**Expected Distribution**

Little research has been undertaken regarding the association of CMTs with other site types, but preliminary indications are that CMT sites may correlate with shoreline villages, middens, drainages, and trails (Millennia Research 1996, Archer 1990, Turner 1998). Recent impact assessments in the Kumealon Inlet and Work Channel areas suggest that wood and bark procurement sites (represented by CMTs) tend to be in close proximity to known habitation sites (Arcas Consulting Archeologists 1998). However, given the predominant use of western redcedar and the wide distribution of cedar within the study area, forest utilization sites have also been found in other contexts.

CMTs are often identified near the foreshore area, but they have also been recorded several kilometres inland, and on landforms ranging from flat beaches to steep slopes. According to The Bastion Group (1996a), culturally modified trees occur randomly
within the Hevenor Inlet area, but are present in greater densities near lakeshores. Turner (1998:77) indicates that different cultural groups had individual bark collection strategies, but that the general pattern involved travelling “long distances along creeks and into the mountains to find trees with suitable bark for harvesting”.

In Kitkatla territory, Archer (1990) reported that virtually no information was available in the ethnographic literature regarding logging and bark stripping locations, but that these sites would be included in the “exploitation territory of an occupation site”. In other words, most CMT sites should be accessible from habitation sites.

While CMTs of red and yellow cedar, as well as hemlock, have been found on the North Coast, the vast majority of recorded CMTs are western redcedars. Due to the extent of past logging, intact CMT sites are most commonly found in stands of old growth forest.

5.1.2 Habitations and Shell Midden Sites

Habitation sites are locations that were used for permanent, semi-permanent, or short-term residence, and they may be characterized by features such as house depressions, platforms, caves and rockshelters, hearths, and refuse deposits, such as shell middens.

Shell midden sites most often represent household refuse deposits resulting from the extended use of a habitation site, but they may also indicate non-habitation shellfish harvesting and preparing areas. The primary component of middens is shell, generally dominated by clam or mussels, but also including other species. Other common constituents of habitation-related midden deposits include animal and fish bone and fire-cracked rock. The midden soil matrix is typically highly organic, black, and greasy, with a high ash or charcoal content.

In their description of two midden sites in Kiltuish Inlet, Mackie and Eldridge (1988) noted that 90% of the matrix was composed of crushed mussel shell, cockle, marine snail, barnacle and charcoal. A small portion of the midden consisted of fire broken rock. In addition, they noted that, unlike many other shell middens, fish and mammal bone were not present in large numbers. In the Prince Rupert Harbour area however, shell middens indicate a broad hunting-fishing-gathering subsistence base, characterized by a shifting focus on various resources throughout time (Fladmark et al. 1990).
Midden deposits are frequently found in association with other archaeological components, such as house platforms, burials, and canoe runs. The size of a midden is widely assumed to reflect the length or intensity of occupation, although this may not always be the case (see Hobler 1990).

Due to their inferred use as refuse dumps, artifacts (typically broken) are commonly recovered from shell middens, although usually in small numbers. However, artifact density varies greatly between middens, and in some cases artifact totals can be exceptionally high. Because of their range of cultural materials and long periods of deposition, shell midden sites can be important for the development of cultural chronologies. The possibility of discovering temporally diagnostic artifacts in datable stratigraphic contexts makes middens an extremely significant site type.

Human remains are also often associated with shell midden deposits, indicating that not all middens are refuse dumps. Carlson (1998) suggests that shell or shellfish may have been used as offerings to the dead, and that some shell middens should be considered sacred sites.

*Expected Distribution*

Along the coast, the majority of habitation sites, especially those occupied during the windy winter season, are expected to be located on beaches, near sources of fresh water, in protected locales suitable for landing canoes.

Archer (1990) notes that Kitkatla winter village sites were located on salt water, facing the ocean. Preferred localities were relatively level and well-drained, with a beach suitable for landing canoes. No mention is made of fresh water being a requirement for site location.

The Bastion Group reports that habitation sites, including villages, camps, and processing areas (i.e., shell middens) are generally located on well-developed landform features near shorelines and rivers (The Bastion Group 1996b). These locations were chosen to take advantage of a variety of factors such as “1) the supply of fresh water, 2) the relatively easy access to land-based resources provided by the low slope of the surrounding...
hinterland 3) the presence of a suitable canoe beaching area, 4) a nearby defensible position, and 5) shelter from wind and heavy weather” (Halpin and Seguin 1990).

Drucker (1943:29) also reported that village sites are found along the shoreline, stating “One need not wonder that the natives were beach dwellers who penetrated the woods but rarely. Dwelling along the shore, they were conveniently situated to exploit the vast aquatic food resources of the area – fish (salmon of five species, herring, eulachon, halibut, etc.), mollusks, and for variety, various marine mammals, and birds”. Specifically, he mentions a midden at McLoughlin Bay on Campbell Island that extends about 1,000 feet from the mouth of a creek, flowing into the bay (Drucker 1943: 105).

Harlan Smith mentions numerous shell midden sites on islands on the North Coast (in Capes 1976). Burial caves are reportedly present near several midden sites. Villages sites are also reported along the Skeena River, although most or all of these are outside the North Coast Forest District study area.

Defensive sites are special purpose habitations that were used as refuges during times of conflict. These sites are usually located on small islands or peninsulas with steep cliffs and a single access corridor. Although there may be exceptions, defensive sites typically do not show evidence of long-term intensive habitation. Drucker (1943: 105) described a defensive site on Chatfield Island as follows: “At Raven Cove on the northwest end of Chatfield Island, near the southern entrance of Return Channel, a midden is located on a small isolated knoll connected to the main island by a narrow low saddle. The beach is very rocky. The site conforms to ethnographic descriptions of refuge island settlements”.

Further inland, major habitation sites are expected to be closely associated with major rivers, such as the Nass and Skeena, while seasonal resource camps may be found on lake shores (fishing, hunting, or plant collecting camps), along smaller rivers (fishing camps), or in the subalpine or alpine (hunting or plant collecting camps). Gentle terrain and a source of water are expected to be important factors for site location.

For the Tsimshian, Archer (1991) reports that eulachon fishing sites were occupied at the mouth of the Nass River between February and early April, after which stored eulachon were taken back to the permanent winter villages. In late summer, fishing camps were set up on the lower reaches of salmon streams.
5.1.3 Artifact Scatters

Artifact scatters consist of formed stone, bone, antler, and horn implements or tools and the waste materials resulting from their manufacture. Scatters may be found on or below the ground surface. On the coast, most artifact scatters are quite small, and contain a low density of artifacts. However, some scatters can extend for hundreds of meters, or include numerous raw materials and tool types.

Most known artifact scatters in the study area have been found along the coastline, but they could exist almost anywhere that people undertook activities that could result in the discard or loss of material items. Inland artifact scatters, if present, may be very difficult to locate in the dense coastal forest.

5.1.4 Canoe Runs

Canoe runs are sections of beach that have been cleared of rocks to allow the safe landing of canoes. Canoe runs are often associated with habitation and/or shell midden sites.

5.1.5 Stone Wall Fish Traps

Stone wall fish traps consist of loosely piled rock walls that were used to impede the movement of fish with the falling tide. Some fish traps may have incorporated additional perishable components such as stakes, nets or basket traps, and they occasionally show complex histories of repair and expansion. Fish traps occur in the intertidal zone, sometimes near habitation sites, and often near the mouths of rivers. I.R. Wilson Consultants (1994) report that a Hartley Bay elder indicated that most fish-bearing creeks within bays, coves and inlets contain fish traps.

5.1.6 Fish Weirs

Fish weirs commonly consist of a line of wooden stakes protruding above the river floor and are thought to have been designed exclusively to trap spawning salmon (Hobler 1990). Only three fish weir sites have been recorded in the study area, all of which occur along the coastline, at or near the mouths of streams.
5.1.7 Rock Art

Rock art can consist of pictographs (paintings on rock), petroglyphs (rocks with carvings or etchings), or petroforms (man-made alignments or piles of rocks or boulders).

Pictographs are generally located on vertical rock exposures or boulders along the coastline or on lakeshores, while petroglyphs tend to be found on horizontal or vertical sedimentary rock faces along the shoreline.

5.1.8 Burial Places

Burial places contain material evidence and features associated with mortuary practices, including human skeletal remains and the burial pits, mounds, cairns, boxes, trees, and caves in which they are found, as well as grave goods and grave markers. Most of the 23 recorded burial sites in the study area are located within a few metres of the coastline, near habitation sites, or on islands. Burials are often found in rock crevices associated with cliff formations along shorelines or inland rock falls close to traditional village sites (the Bastion Group 1996b:3).

5.1.9 Trails

Overland trail routes were important for reaching inland resource collection areas and for interacting with inland First Nations. Major eulachon trading trails, known as “Grease Trails” are well-known in the Nass River area.

Overall, trails tend to follow subdued terrain, although segments may be steep. Trails can be expected to connect habitation sites with inland resource localities in various environmental zones. Trading trails will serve as a link between neighbouring cultural groups.

5.2 Previous Archaeological Investigations in the North Coast Region

While the North Coast has seen considerable archaeological research, most of it has been geared toward specific site types (e.g., rock art), or narrow geographic zones (e.g., Prince Rupert Harbour and Skeena River Valley). The major research and cultural resource management (CRM) projects in the North Coast region are reviewed in Commonwealth
According to Equinox Research and Consulting Ltd. (1997), just over 1700 hectares of the North Coast Forest District had been adequately assessed for archaeological sites as of the end of 1996. Of those, almost all were near the coast and within the CWH biogeoclimatic zone. The Equinox report recommended that 1% or 4,000 (whichever is less) hectares should be inventoried from each of the CWH, MH and AT zones to provide more representative data for the TSA. That goal has not been satisfied to date.

Since the early 1990s, much of the archaeological focus in the North Coast TSA has been on cultural resource management in relation to forestry developments. Archaeological impact assessments (AIAs) and, more recently, less-intensive preliminary field reconnaissance (PFR) have become common components of forestry planning. In reviewing previous archaeological work for this AOA, forestry-related CRM reports were emphasized, as those data were considered most pertinent to the study objectives.

Copies of archaeological reports commissioned by the Ministry of Forests, Interfor, and Pacific Cascades were provided by the Ministry and licensees. West Fraser Mills provided a list of archaeological permits covering work completed for their operations, and the reports were obtained from the Heritage Resource Centre. Table 1 summarizes the reports reviewed for this study. All assessed cutblocks from these reports were digitized in ArcView. These areas encompass 4,512 hectares of land, or 0.23% of the TSA. Twenty-two archaeological sites were identified in these assessments, which equates to 0.005 sites per hectare, or 5 sites per 1,000 hectares inventoried.
### Table 1
Summary of Archaeological Assessments for Forestry Clients in the North Coast TSA

<table>
<thead>
<tr>
<th>Year of Field Work</th>
<th>General Location</th>
<th>Development Type</th>
<th>Level of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>Kitkiata Inlet</td>
<td>floating barge camp</td>
<td>Monitor</td>
</tr>
<tr>
<td>1989</td>
<td>Gardner Canal</td>
<td>general area</td>
<td>AIA</td>
</tr>
<tr>
<td>1991</td>
<td>Alpha Creek, Ogden Channel</td>
<td>5 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1991</td>
<td>Alder Creek</td>
<td>10 cutblocks</td>
<td>PFR/inventory</td>
</tr>
<tr>
<td>1991</td>
<td>Crow Lagoon, Steamer Passage</td>
<td>5 blocks, road, dump, camp</td>
<td>AIA</td>
</tr>
<tr>
<td>1992</td>
<td>Captain Cove, Pitt Island</td>
<td>4 blocks, road, dump, bridges</td>
<td>AIA</td>
</tr>
<tr>
<td>1992</td>
<td>Chute Lake</td>
<td>8 cutblocks</td>
<td>inventory/AIA</td>
</tr>
<tr>
<td>1992</td>
<td>Drake Inlet</td>
<td>&quot;several blocks&quot;</td>
<td>AIA</td>
</tr>
<tr>
<td>1993</td>
<td>Kennedy Island</td>
<td>4 blocks, road, dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1993</td>
<td>Goat Harbour and Fishtrap Bay</td>
<td>&quot;several blocks in two areas&quot;</td>
<td>AIA</td>
</tr>
<tr>
<td>1993</td>
<td>Hevenor Lagoon</td>
<td>general logging area</td>
<td>INV</td>
</tr>
<tr>
<td>1993</td>
<td>Chapple Inlet</td>
<td>9 cutblocks, haulroad, dryland sort</td>
<td>AIA/inventory</td>
</tr>
</tbody>
</table>
Table 1
Summary of Archaeological Assessments for Forestry Clients in the North Coast TSA (cont’d)

<table>
<thead>
<tr>
<th>Year of Field Work</th>
<th>General Location</th>
<th>Development Type</th>
<th>Level of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>Fan-ant Island</td>
<td>1 block, 2km road, dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Devon Lake, Pitt Island</td>
<td>8 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Somerville Island</td>
<td>3 blocks</td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>Khutzeymateen Inlet (McGregor Point)</td>
<td>3 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Leavitt Lagoon (Pitt Island)</td>
<td>1 block</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Douglas Channel (Bardon Creek, Stair Creek)</td>
<td>3 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Cornwall Creek</td>
<td>8 cutblocks, road, log sort and dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1994</td>
<td>Marion Lake</td>
<td>6 cutblocks, haul road</td>
<td>AM/inventory</td>
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<tr>
<td>1995</td>
<td>Walskakul Point, Khutzeymateen Inlet</td>
<td>1 block</td>
<td>AIA</td>
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<tr>
<td>1995</td>
<td>Halfway Creek</td>
<td>13 cutblocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1995</td>
<td>Bill Creek, Work Channel</td>
<td>2 blocks, road, bridge, dump</td>
<td>AIA</td>
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<tr>
<td>1995</td>
<td>Ayton Creek</td>
<td>12 cutblocks, haul road</td>
<td>AIA/inventory</td>
</tr>
<tr>
<td>1995</td>
<td>Hawkesbury Island</td>
<td>4 cutblocks, 7.2km road, 2 bridges, 1 log dump and sort area</td>
<td>PFR/AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Rix Island</td>
<td>1 block</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Heavenor Inlet</td>
<td>1 block, road, log dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Verney Passage</td>
<td>1 block</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Newcombe Harbour</td>
<td>1 block</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Payne Channel, Pitt Island</td>
<td>1 block</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Cornwall Inlet</td>
<td>2 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Steamer Passage/Somerville Island</td>
<td>23 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Kennedy Island</td>
<td>3 blocks, road, 2 bridges</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Gribbell Island and Silver Creek</td>
<td>13 cutblocks, 1 log dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1996</td>
<td>Kiskosh Inlet</td>
<td>7 blocks</td>
<td>AIA</td>
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<tr>
<td>1996</td>
<td>Kunealon Inlet, Greenville Channel</td>
<td>12 cutblocks, 13 km haul road</td>
<td>AIA</td>
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<tr>
<td>1996</td>
<td>McShane Creek, McNeil River</td>
<td>9 cutblocks, 7.950km road</td>
<td>monitor</td>
</tr>
<tr>
<td>1996</td>
<td>Kitkiata Inlet</td>
<td>road</td>
<td>monitor</td>
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<tr>
<td>1997</td>
<td>Pitt Island</td>
<td>8 cutblocks</td>
<td>AIA</td>
</tr>
</tbody>
</table>

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Table 1
Summary of Archaeological Assessments for Forestry Clients in the North Coast TSA (cont’d)

<table>
<thead>
<tr>
<th>Year of Field Work</th>
<th>General Location</th>
<th>Development Type</th>
<th>Level of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>various locations</td>
<td>66 cutblocks, 25.7 km road</td>
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<td>1997</td>
<td>Captain Cove, Pitt Island</td>
<td>2 blocks, 6 km road</td>
<td>AIA</td>
</tr>
<tr>
<td>1997</td>
<td>Porcher Inlet</td>
<td>2 blocks, 5 km road</td>
<td>AIA</td>
</tr>
<tr>
<td>1997</td>
<td>Alan Reach, Gardner Canal</td>
<td>3 blocks, 7 km road, dump</td>
<td>AFR/AIA</td>
</tr>
<tr>
<td>1997</td>
<td>Gribbell Island</td>
<td>1 block, road, dump</td>
<td>AIA</td>
</tr>
<tr>
<td>1997</td>
<td>Kumealon Inlet</td>
<td>7 blocks</td>
<td>AIA</td>
</tr>
<tr>
<td>1998</td>
<td>Kumealon Inlet</td>
<td>9 blocks</td>
<td>AFR</td>
</tr>
<tr>
<td>1998</td>
<td>Work Channel</td>
<td>15 blocks</td>
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<td>Work Channel</td>
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<td>AIA</td>
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<td>1998</td>
<td>Tag Creek</td>
<td>general area</td>
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<td>Work Channel, Denise Inlet</td>
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<td>1998</td>
<td>Princess Royal Island</td>
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<td>AFR/AIA</td>
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<td>Union Inlet</td>
<td>log dump, 3.9 km road</td>
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<td>1999</td>
<td>Smith Inlet</td>
<td>2 blocks, 1 road</td>
<td>AIA</td>
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<tr>
<td>1999</td>
<td>Bear Lake, Princess Royal Island</td>
<td>1 cutblock (H3022)</td>
<td>AIA</td>
</tr>
<tr>
<td>1999</td>
<td>Bear Lake</td>
<td>1 cutblock (H3037)</td>
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<tr>
<td>1999</td>
<td>Cougar Lake, Princess Royal Island</td>
<td>cutblock (H6002)</td>
<td>AIA</td>
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<tr>
<td>1999</td>
<td>Bear Lake</td>
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<td>Cougar Lake, Princess Royal Island</td>
<td>cutblock (H6004)</td>
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<td>Surf Inlet</td>
<td>dryland sort, Dam M/L, and West Dam M/L</td>
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<td>1999</td>
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<td>1999</td>
<td>Cougar Lake, Princess Royal Island</td>
<td>1 cutblock (6210)</td>
<td>AIA</td>
</tr>
</tbody>
</table>

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Since 1986, forestry-related assessments have identified 11 shell midden sites, 1 pictograph site, 1 petroglyph site, 1 lithic site, and 99 CMT sites. Nineteen CMT sites have been described in reports, but were not officially recorded as sites, following common procedure prior to about 1994. These CMT sites were digitized during the present study, and they are included in the total of 99 CMT sites. Several consulting firms have undertaken CRM work in the North Coast TSA, and differing levels of field effort and widely varying reporting standards are evident.

5.3 The North Coast Archaeological Sequence

The archaeological sequence for the North Coast has been developed primarily on research work in the Prince Rupert Harbour and Kitselas Canyon areas. No archaeological sites older than 5,000 years B.P. have been found on the North Coast, but it is unlikely that earlier sites are absent. Very early sites have been found on the Queen Charlotte Islands, in southern Alaska, and on the Central Coast, suggesting that such sites should be present on the North Coast. As discussed in Section 3.2.2, sites older than 5,000 years may be either submerged or on elevated shorelines associated with historic changes in relative sea level.

Based on current information, the following archaeological sequence is proposed for the North Coast region. As more information becomes available, revisions to this sequence can be expected. Unless otherwise noted, this summary is based on Matson and Coupland’s (1995) synthesis of Northwest Coast prehistory.

5.3.1 Early Period (Initial Occupation to ±5,000 B.P.)

According to Matson and Coupland (1995), the earliest clear archaeological complex on the North Coast is the North Coast Microblade Tradition, which prevailed from northern Vancouver Island to the Alaska Panhandle between about 9,000 and 5,000 B.P. Characterized by the use of microblades and pebble tools, and the absence of chipped biface technology, this archaeological tradition contains evidence of shellfish and ocean fish consumption. Despite rapid changes in sea levels and forest succession, the limited archaeological information to date suggests cultural stability throughout this period. It should be emphasized, however, that no archaeological sites dating to this period have been reported for the North Coast TSA. The only dated site with a North Coast Microblade component near the study area is the Paul Mason site at Kitselas Canyon, on

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the Skeena River. This is an inland riverine site with an early component dating to between 5,000 and 4,300 B.P., at the end of the Early Period. This period has been designated the Bornite Phase at Kitselas Canyon (Coupland 1988).

5.3.2 Prince Rupert Harbour Period III / Skeena Valley Bornite, Gitaus, and Skeena Phases (5,000 to 3,500 B.P.)

The first known occupation of Prince Rupert Harbour took place in this time period, known archaeologically as Period III. Matson and Coupland (1995) assert that distinctive coastal cultures first emerged in Period III, with numerous “archaeological cultures” developing where the more homogeneous North Coast Microblade tradition previously prevailed. Major changes are evident in the artifact record: microblades disappear, and bone and ground stone tools become abundant by the end of Period III.

Excavated animal remains indicate a generalized subsistence at this time, with a relatively high proportion of land mammals, as well as marine mammals and fresh and salt water fish (Matson and Coupland 1995). Shell middens are small, and salmon, though present, do not appear to have been intensively harvested or stored. No house remains dating to this period have been excavated, but Matson and Coupland (1995) cite the lack of heavy woodworking tool and the small size of excavated postholes as evidence that large plank houses were not used at the time, possibly indicating a small, mobile population.

Three archeological phases have been defined in the Skeena Valley during this time span, based on excavations at the Paul Mason and Gitaus sites in Kitselas Canyon. The Bornite phase persisted from the Early Period well into Period III. At about 4,300 B.P., the Gitaus Phase began, signaled by the disappearance of microblades and the appearance of chipped bifaces and an increased in the use of ground stone tools (Matson and Coupland 1995). Between about 3,600 and 3,200 years ago, changes in lithic raw material types and evidence for a well-developed chipped stone industry identify the onset of the Skeena Phase (Matson and Coupland 1995). While some researchers (e.g., Ives 1987) have interpreted these archaeological changes to a population incursion from the Interior, Coupland (1988) argues for a coastal population, with seasonal movements inland and an increasing emphasis on land mammal hunting.
5.3.3 Prince Rupert Harbour Period II / Skeena Valley Paul-Mason and Kleanza Phases
(±3,500- ±1,500 B.P.)

In Prince Rupert Harbour, Period II sites represent the first clear archaeological evidence of a relationship with ethnographically-known cultures (Matson and Coupland 1995). Winter villages, large shell middens with varied shellfish remains, new fishing technologies, salmon storage, increased reliance on marine resources at the expense of land mammals, and differential (ascripted) status of individuals have been inferred from the archaeological record during this period. In the Skeena Valley, evidence of large rectangular houses and salmon storage appear at the Paul Mason site this time, which is represented locally by the Paul Mason phase. Throughout the North Coast, populations appear to have grown rapidly during Period II/the Paul Mason Phase.

Between about 2,500 and 1,400 years ago, the Developed northwest Coast Pattern was fully achieved. Artifact assemblages dated to late Period II are similar to those of Early Period II, but with greater variety, indicating an expansion of material culture throughout the period. Exotic materials, such as dentalia, obsidian, and copper suggest long distant trade systems existed. Matson and Coupland (1995:229, 231) cite evidence of a possible “warfare complex” at Prince Rupert Harbour, which they say is in contrast with Central Coast evidence, which lacks indications of conflict.

5.3.4 Prince Rupert Harbour Period I (±1,500- ±150 B.P.)

Several archaeological sites in the Prince Rupert Harbour area have components dating to Period I. The historically known Tsimshian culture is fully developed by this time. Material items indicate general cultural continuity with late Period II sites, although several new artifact types were introduced in Period I. Subsistence continued to focus heavily on marine resources and salmon, and large winter villages with permanent houses were occupied. Defensive sites seem to have been introduced in Period I, indicating continued or increasing warfare. Little research has been completed on non-villages sites dating to Period I, and consequently our knowledge of the seasonal round is limited.
6.0 GIS ANALYSIS OF THE NORTH COAST TSA LANDSCAPE

A number of GIS analyses were completed to characterize the North Coast landscape. Variables that were believed to be important for predicting archaeological site locations were assessed in terms of their overall distribution in the study area. These analyses, taken together with the analysis of recorded archaeological sites, helped to evaluate the model variables. Data for the major modelling variables are discussed in the following sections.

6.1 Test Areas

Three areas, each comprised of 4 TRIM sheets, were selected by representatives of the Ministry of Forests and Golder’s GIS team for testing the predictive models prior to applying them to the entire TSA (Figure 1). Test Area 1 consists of map sheets 103P 032, 042, 043 and 052 in the Alice Arm area. Test Area 2 includes map sheets 103J 058, 059, 068, and 069, in the vicinity of Port Simpson. Test Area 3 is in the Surf Inlet area, and consists of TRIM sheets 103A 095 and 096, and 103H 005 and 006. The test areas were selected to represent different geographic sectors of the study area.

Terrain analyses were not completed specifically for the test area, as it was not certain that they were statistically representative of the entire study TSA. Instead, the test areas were used to evaluate the results of models that were developed on the basis of terrain and recorded archaeological site data from the entire TSA.

6.2 North Coast TSA

6.2.1 Slope

Slope was considered a highly important variable, particularly for predicting habitation site locations. Table 2 shows the distribution of various slope classes across the North Coast study area. Note that the percentages cannot be summed, due to overlap in the categories. These data clearly illustrate the steep, rugged nature of much of the northwest coast. Figure 3 shows the slope characteristics of the North Coast.
Table 2
Slope Classes in the Study Area

<table>
<thead>
<tr>
<th>Slope</th>
<th>Area (ha.)</th>
<th>% of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20%</td>
<td>447,074</td>
<td>22.7</td>
</tr>
<tr>
<td>0-30%</td>
<td>662,087</td>
<td>33.6</td>
</tr>
<tr>
<td>0-40%</td>
<td>874,096</td>
<td>44.4</td>
</tr>
<tr>
<td>0-70%</td>
<td>1,487,021</td>
<td>75.5</td>
</tr>
<tr>
<td>0-90%</td>
<td>1,716,662</td>
<td>87.2</td>
</tr>
</tbody>
</table>

These data show that about two-thirds of the study area lies on a slope of more than 30%, and more than half of the TSA has a gradient of more than 40%. Since these conditions are not conducive for most types of habitation sites, slope is considered to be a useful variable for predicting habitation site locations.

6.2.2 Elevation

Elevation was used in concert with slope to help identify shoreline locations with habitation potential, and also as a supplement to biogeoclimatic zone data for CMT site analyses. Table 3 shows the breakdown of elevation classes in the North Coast TSA. The vast majority of the TSA is more than 100 m asl, and approximately 10% may be above the tree line. This information, combined with an analysis of elevation ranges of known archaeological sites, is useful for predictive modelling.

Table 3
Elevation Ranges in the Study Area

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Area (ha.)</th>
<th>% of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 m asl</td>
<td>19,943</td>
<td>1.0</td>
</tr>
<tr>
<td>0-20 m asl</td>
<td>73,283</td>
<td>3.7</td>
</tr>
<tr>
<td>0-100 m asl</td>
<td>432,867</td>
<td>22.0</td>
</tr>
<tr>
<td>0-300 m asl</td>
<td>881,772</td>
<td>44.8</td>
</tr>
<tr>
<td>0-400 m asl</td>
<td>1,046,802</td>
<td>53.1</td>
</tr>
<tr>
<td>0-1000 m asl</td>
<td>1,740,277</td>
<td>88.4</td>
</tr>
<tr>
<td>0-1100 m asl</td>
<td>1,806,093</td>
<td>91.7</td>
</tr>
</tbody>
</table>
6.2.3 Distance to Coast

Distance to the shoreline was considered a very important modelling variable, since the First Nations of the study area have largely maritime-oriented cultures. With the exception of CMT sites and resource camps on lakes or inland reaches of rivers, most archaeological site types are expected to be associated with foreshore or near shore contexts. Table 4 represents the study area in terms of distance to the coastline.

<table>
<thead>
<tr>
<th>Distance to Coast</th>
<th>Area (ha.)</th>
<th>% of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100 m</td>
<td>69,705</td>
<td>3.5</td>
</tr>
<tr>
<td>0-200 m</td>
<td>122,702</td>
<td>6.2</td>
</tr>
<tr>
<td>0-300 m</td>
<td>169,369</td>
<td>8.6</td>
</tr>
<tr>
<td>0-500 m</td>
<td>252,326</td>
<td>12.8</td>
</tr>
<tr>
<td>0-1000 m</td>
<td>427,492</td>
<td>21.7</td>
</tr>
<tr>
<td>0-2000 m</td>
<td>706,625</td>
<td>35.9</td>
</tr>
<tr>
<td>200-2000 m</td>
<td>570,215</td>
<td>28.9</td>
</tr>
</tbody>
</table>

While most recorded habitation sites are near the coastline, Table 4 shows that most of the TSA is distant from the coastline. This means that the majority of habitation sites is found within a small portion of the study area, in terms of distance to salt water. Consequently, distance to coast should be a good variable for predicting habitation site locations.

6.2.4 Islands

Approximately 986,950 ha. of the North Coast study area lies on islands. Marine islands account for almost 784,000 ha. (about 40% of the study area), of which about 8,275 ha. are islands smaller than 50 hectares. Fresh water islands in lakes and rivers comprise an additional 2,950 ha.

6.2.5 Proximity to Fresh Water

Four categories of fresh water were considered in the analysis: two-line rivers (>20 m bank-to-bank), definite rivers, intermittent rivers, and lakes. Lakes were defined as those
5 ha. in area or larger. Table 5 provides a breakdown of the amount of the study area within various buffers of fresh water sources.

### Table 5
Proximity to Nearest Fresh Water in the Study Area

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Buffer (m)</th>
<th>Area (ha.)</th>
<th>% of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Line River</td>
<td>100</td>
<td>18,897</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>35,211</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>51,914</td>
<td>2.6</td>
</tr>
<tr>
<td>Definite River</td>
<td>100</td>
<td>272,214</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>526,088</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>720,274</td>
<td>36.6</td>
</tr>
<tr>
<td>Intermittent River</td>
<td>100</td>
<td>564,606</td>
<td>28.7</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1,010,037</td>
<td>51.3</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>1,313,236</td>
<td>66.7</td>
</tr>
<tr>
<td>Lake</td>
<td>100</td>
<td>47,812</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>97,911</td>
<td>5.0</td>
</tr>
<tr>
<td>Nearest Fresh</td>
<td>100</td>
<td>1,008,778</td>
<td>51.2</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>1,412,191</td>
<td>71.7</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>1,592,515</td>
<td>80.8</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>1,692,047</td>
<td>85.9</td>
</tr>
</tbody>
</table>

This table shows that more than half of the study area is within 100 metres of a source of fresh water. Taken on its own, distance to fresh water probably would not be a robust modelling discriminator, because there is a strong chance that any given location will be near a fresh water source. However, combined with other variables, distance to fresh water may be a useful factor, especially in light of ethnographic and archaeological reports of habitation and CMT sites being associated with fresh water sources.

#### 6.2.6 Cedar Content

Presence of cedar was considered crucial to the CMT model, which focused on bark-stripped and aboriginally logged cedar CMTs. According to the forest cover data, 1,089,620 ha. of the study area (55.3%) contains at least 1% cedar (Figure 4), and
617,781 ha. (31.4%) contains 50% or more cedar. In order to be useful for predictive modelling, it would be necessary to combine cedar content with other variables.

6.2.7 Age and Height Class

The age and height classes of cedar stands are important for evaluating the probability of CMTs being present. The models focused on age classes 7 through 9 (>121 years) because CMTs are most likely to be intact in older (i.e., un-logged) stands. This does not imply that CMTs did not previously exist in stands that have been logged or otherwise impacted, but simply that they are less likely to remain intact.

Height class was considered to be important for excluding stunted stands that probably would not be valuable for bark or timber. Table 6 and Figure 5 show the distribution of the relevant age and height classes within cedar stands.

<table>
<thead>
<tr>
<th>Stand Class</th>
<th>Area (ha.)</th>
<th>% of Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Class 8+</td>
<td>1,127,721</td>
<td>57.3</td>
</tr>
<tr>
<td>Age Class 7+</td>
<td>1,149,9956</td>
<td>58.4</td>
</tr>
<tr>
<td>Age Class 6-8</td>
<td>1,162,172</td>
<td>59.0</td>
</tr>
<tr>
<td>Height Class 4+</td>
<td>237,064</td>
<td>12.0</td>
</tr>
<tr>
<td>Height Class 3+</td>
<td>564,505</td>
<td>28.7</td>
</tr>
<tr>
<td>Height Class 2+</td>
<td>874,177</td>
<td>44.4</td>
</tr>
</tbody>
</table>

The age class analysis shows that over half of the forestry polygons in the study area are old enough to be considered old growth (age class 8+; see Figure 5). In isolation, age class does not appear to be a good discriminator, but combining age with height class improves the predictive power. For example, 58.4% of the study area contains cedar of age class 7 or older, but adding a height class requirement of 3 or greater reduces this area to about 24%.

Golder Associates
FIGURE 4: Distribution of Cedar Stands

- Study Area
- Cedar
- Coastline

Scale: 1:1,750,000

Projection: UTM Zone 9
Datum: NAD 83
7.0 GIS ANALYSIS OF RECORDED SITES

GIS analyses of the spatial characteristics of recorded sites in the TSA and immediately adjacent areas were used to help develop predictive models for estimating archaeological site potential. The following sections present the GIS results of the analyses of recorded sites.

The slope, elevation, distance to the coastline, and distance to the nearest source of fresh water (major river, definite river, intermittent river, or lake), cedar content, and forest stand age and height class were calculated for each site (Appendix 2). The sites were then broken down by site type to summarize the data. These analyses, together with the landscape information, were used to evaluate the applicability of archaeological models previously developed for the Central Coast LRMP area (Golder Associates 1999a) and for a portion of TFL 25 (Golder Associates 1999b).

7.1 Overall Site Analysis

Analyses were performed on recorded archaeological sites in the TSA as well as a small surrounding buffer, which was included to increase the sample size. According to information supplied by the Archaeology Branch, the TSA and adjacent areas contained 732 recorded archaeological sites. Of these, 343 (46.9%) have habitation components (including shell middens, “villages” and house depressions), and 164 (22.4%) contain CMTs. There are 62 fish traps, 21 pictographs, 3 fish weirs, 45 canoe runs, 25 burials, 29 petroglyphs, 22 lithic scatters, 12 historic sites, 1 trail, and 5 sites with inadequate records to determine site type. Figure 6 shows the relative frequency of the major site types in the North Coast, as presently known. Note that some sites have multiple components, so the total number of site components shown in the figure is greater than the number of recorded sites.

Overall, the recorded sites tend to be found along the coastline or on islands, reflecting the history of archaeological research in the region. The following sections describe the spatial and terrain characteristics of the recorded sites in the study area. Table 7 and Figures 6 through 20 summarize the data.

Golder Associates
Figure 6 - Relative Frequency of Major Components in the North Coast TSA

7.1.1 Slope

Slope values for the sites ranged from virtually flat (less than 1%) to 148%, with a median of 10%. Almost half (47%) of the sites are on slopes between 0% and 10%, and 69% are on gradients less than or equal to 20%.

7.1.2 Elevation

The sites range in elevation from sea level to 520 metres asl. The median elevation is 12 metres, and 78% of the sites lie between 0 and 30 metres asl.

7.1.3 Distance to Coastline

Most site types show a strong correlation with the coastline. The sites range from less than 1 metre from the shore to more than 2 km inland, but the median distance is only
16 metres from shore. This site distribution pattern is consistent with the strong maritime emphasis of North Coast First Nations cultures. However, the high proportion of shell midden and village sites in the current recorded sites database also indicates an historical bias toward archaeological investigations of shoreline contexts rather than inland areas. As more inland sites, including CMTs, are located, this median value can be expected to increase somewhat.

7.1.4 Distance to Fresh Water

A weak relationship is indicated between recorded archaeological sites and fresh water sources. Although the median distance from a site to the nearest TRIM-coded fresh water source is 222 m, only 48% are within 200 m of fresh water, and 27% are more than 500 m distant. This apparent pattern may be partially a function of the resolution of hydrology mapping in TRIM, and partially due to the inclusion of all site types in the analysis, some of which (e.g., pictographs, petroglyphs, and burials) may not correlate with fresh water. A more detailed evaluation shows that 98% of the sites are within 200 m of either salt water or fresh water.

Table 7
North Coast Test Area Site Characteristics (Median Values, All Site Types)

<table>
<thead>
<tr>
<th>Terrain Variable</th>
<th>North Coast Test Area Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope</td>
<td>10%</td>
</tr>
<tr>
<td>Elevation</td>
<td>12 m asl</td>
</tr>
<tr>
<td>Distance to Salt Water</td>
<td>16 metres</td>
</tr>
<tr>
<td>Distance to Fresh Water</td>
<td>222 metres</td>
</tr>
</tbody>
</table>

While the overall site analysis provides a general perspective on recorded site characteristics, an analysis by site type is more useful for assessing site distribution patterns. Site-type analysis was limited to habitations and CMTs, due to sample size considerations and because these site types (particularly CMTs) were deemed best suited to modelling and most likely to be impacted by forestry operations. Other site types were not modelled, but their expected distributions are discussed in Section 5.1.
FIGURE 7: Distribution of Recorded Archaeological Sites

Legend:
- Study Area
- Archaeological Site

Scale: 1:1,750,000

Projection: UTM Zone 9
Datum: NAD 83
7.2 Site Type Analyses

7.2.1 Habitation Sites

A total of 343 habitation sites were used for the analysis. Table 8 compares the attributes of these habitation sites with those of the Central Coast LRMP area to the south, using median values. In general, the site distribution pattern is very similar to that of the Central Coast, where coastal villages and shell midden sites tended to occur on islands and in sheltered bays along the mainland coast (Figures 8 through 12).

Slope

The slope of each habitation site was determined from the GIS grid values, and frequencies were calculated for slope ranges (Figure 8). Habitation site slopes range from less than 1% to 47%, with a median of 8%. Sites with slope values of less than or equal to 10%, total 214 (62%), and 305 (89%) are on slopes of 20% or less. On the Central Coast, slopes ranged from 0% to 129%, with a median of 15%.

Figure 8
Slope Ranges for Habitation Sites
FIGURE 9: Distribution of Recorded Habitation Sites

- Study Area
  - Archaeological Site

Scale: 1:1,750,000

Projection: UTM Zone 9
Datum: NAD 83
Elevation

Elevations for the habitation sites ranged from 1 m to 51 m asl, with a median of 11 m. Forty-three percent of the sites are between sea level and 10 m asl, and 96% are between 0 m and 20 m asl (Figure 10).

Figure 10
Elevation Ranges for Habitation Sites

Distance to Salt Water

As expected, almost all of the test area habitation sites (95%) are within 100 metres of salt water and coastal habitations are within 300 metres (Figure 11). The remaining 5 sites (1.5%) are more than 2 km inland and are considered inland habitations.

Distance to Fresh Water

There appears to be little correlation between habitation sites and fresh water sources (Figure 12). The median distance from a habitation site to the nearest source of fresh water is 409 metres. Only 22% of the sites fall within 100 metres of fresh water, and just 31% are within 200 metres. Almost half (43%) of recorded sites fall more than 500 metres from a source of fresh water, possibly indicating that water was carried in to the site (defensive sites, for example), or that rain water was collected during winter.
storms. Alternatively, the water source may not have been correctly coded on the TRIM base maps.

**Figure 11**
Distance from Habitation Sites to Coast Line

![Graph showing distance from habitation sites to coast line.](image)

**Figure 12**
Distance from Habitation Sites to Fresh Water

![Graph showing distance from habitation sites to fresh water.](image)
Table 8
Comparison of GIS Analyses for Habitation Sites

<table>
<thead>
<tr>
<th></th>
<th>NORTH COAST TSA SITES</th>
<th>NORTH COAST TEST AREA SITES</th>
<th>CENTRAL COAST SITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Sites</td>
<td>343</td>
<td>72</td>
<td>957</td>
</tr>
<tr>
<td>Slope</td>
<td>8%</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>Elevation</td>
<td>11 m asl</td>
<td>11 m asl</td>
<td>5 m asl</td>
</tr>
<tr>
<td>Distance to Salt Water</td>
<td>7 metres</td>
<td>6 metres</td>
<td>30 metres</td>
</tr>
<tr>
<td>Distance to Fresh Water</td>
<td>409 metres</td>
<td>105 metres</td>
<td>297 metres</td>
</tr>
</tbody>
</table>

This summary shows that, with the exception of the fresh water variable, the analyzed site characteristics for the test areas were representative of the entire population of habitation sites in the TSA. Some differences are seen between the TSA habitation sites and those on the Central Coast, but the median values for most variables are within a narrow range. The differing sample sizes may contribute to this difference, or it may be a reflection of cultural or geographic variability.

7.2.2 CMT Sites

One hundred and fifty-eight CMT sites were included in the site analysis, and an additional 19 CMT sites were subsequently digitized from information provided in archaeological reports. The CMT sites are found primarily along the mainland coast and on islands (Figure 13), probably as a function of archaeological survey coverage. Site characteristics are summarized in Figures 13 through 19 and Table 9.

Slope

The CMT sites are found on slopes between 1% and 148%, with a median of 19%. Eighty-seven sites (56%) are on slopes of 20% or less, while 73% are between 0% and 30%. Figure 13 shows the distribution of recorded CMT sites, and Figure 14 shows their slope ranges.
FIGURE 13: Distribution of Recorded CMT Sites

- study Area
- Archaeological Site

Scale: 1:7,750,000

Projection: UTM Zone 9
Datum: NAD 83
Elevation

CMT sites range in elevation from sea level to 261 m asl, with a median of 22 m. This pattern may be a result of limited archaeological inventory of higher elevations. Figure 15 shows the elevation ranges for CMT sites.

Figure 15 - Elevation Ranges of CMT Sites
Distance to Coastline

The CMT sites vary from 1 m from shore to over 2000 m, with a median distance of 69 m (Figure 16). Of the 32 CMT sites located more than 500 m from shore, 24 (88%) are within 200 m of a fresh water source.

Distance to Fresh Water

The correlation of CMT sites with fresh water is not clear. Seventy-five percent (n=119) are within 400 m of a source of fresh water, but only 34% are within 100 m (Figure 17). Based on a range from 1 m to over 2000 m, the median distance from a CMT site to fresh water in the test area is 163 m.

Forest Cover

The height class, age class and cedar content (expressed as a percentage of the stand) was determined for each CMT site, using Ministry of Forests forest cover data (Figures 18 through 20). Seventeen sites did not have forest cover attributes, because they are within TFL 25, for which forest cover data were not obtained. These sites were excluded from the analyses. Most (76%) of the CMT sites are in height classes 3 and 4, while an additional 16% are height class 2. Age class exhibits a clearer pattern, with 90% of the sites falling in age class 8 or 9 stands, which together are generally defined as old growth forest. Cedar composition ranged from 0% to 95%, with a median of 40%. Sites labelled as having 0% cedar apparently are mis-coded in the forest cover data.
Figure 16 - Distance from CMT Sites to Coast Line

Figure 17 - Distance from CMT Sites to Fresh Water
Figure 18 - Height Classes of CMT Sites

Figure 19 - Age Classes of CMT Sites
Figure 20 - Cedar Content of CMT Sites

Table 9
Comparison of GIS Analyses for CMT Sites

<table>
<thead>
<tr>
<th></th>
<th>North Coast TSA Sites</th>
<th>North Coast Test Area Sites</th>
<th>Central Coast Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Sites</td>
<td>158</td>
<td>7</td>
<td>194</td>
</tr>
<tr>
<td>Slope</td>
<td>19%</td>
<td>20%</td>
<td>23%</td>
</tr>
<tr>
<td>Elevation (m asl)</td>
<td>22 m asl</td>
<td>46 m asl</td>
<td>79 m asl</td>
</tr>
<tr>
<td>Distance to Salt Water (metres)</td>
<td>69 metres</td>
<td>163 metres</td>
<td>52 metres</td>
</tr>
<tr>
<td>Distance to Fresh Water (metres)</td>
<td>163 metres</td>
<td>75 metres</td>
<td>169 metres</td>
</tr>
<tr>
<td>% Cedar</td>
<td>40</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Age Class</td>
<td>9</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Height Class</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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Although the sample sizes for CMT sites are relatively small, the terrain analyses show remarkable similarities between the North and Central Coast sites. On the basis of currently available data, it is difficult to determine whether this is a true spatial pattern, or whether similar timber harvesting strategies in the two areas have focussed archaeological assessments on similar types of terrain.

7.3 Summary

The GIS analyses indicate that site distribution patterns are similar in the North Coast TSA to those observed on the Central Coast. Taken together, these two data sets provide a fairly substantial body of information for modelling, although the degree to which the data represent the entire study area, rather than selective archaeological inventory locations, has not been demonstrated. For this reason, it is important to attempt to incorporate some level of deductive reasoning into predictive models, and to avoid the temptation to model strictly on the basis of numerical data from known sites. The following section attempts to combine an inductive method, based on quantifiable landscape and site data, with a deductive approach based on an interpretation of past human activities and the environmental factors that influenced them.
8.0 PREDICTIVE MODELLING

Following a review of archaeological literature and other relevant documents, and GIS analysis of the landscape and recorded archaeological sites in the study area, it was concluded that predictive models developed for the Central Coast should be generally applicable to the test areas. The coastal habitation, inland habitation, and CMT models were initially run on the three test areas. As explained in the Central Coast AOA report (Golder Associates 1999a), the pictograph, petroglyph, and trails models were not successful, and they were not used for this study. As with the Central Coast models, the coastal and inland habitation models are general enough to account for a range of site types that tend to be spatially associated with habitations (e.g., rock art, burials, canoe runs, intertidal lithic scatters). The Central Coast subalpine model was also excluded, for three reasons: (1) only a small amount of subalpine parkland exists in the North Coast TSA, and access to it is difficult (Allen Banner, MoF, pers. comm. 2000); (2) the ethnographic and archaeological literature does not indicate substantial use of the subalpine; and (3) forestry impacts to high elevation parklands are minimal.

Model rules were divided into two classes, based on predicted archaeological site potential. The highest site potential rating (Class I) was assigned to locations that would best support the aboriginal cultural activities that are believed to have created archaeological sites. Similar, but slightly less optimal conditions resulted in a Class II (moderate site potential) rating. For example, the difference between Class I and Class II might be based on wider water buffers, a broader slope range, or inclusion of additional biogeoclimatic zones.

Modelling proceeded in an iterative manner, with the models being revised and re-run several times. Each time a model was run, the results were reviewed to ensure that the GIS was accurately reflecting what the model was intended to represent. For example, review of the first model run showed that the method used to calculate slope was not correctly identifying steeply rising shorelines in certain fjords. Adjustments were made to the model, and it was re-run. Ultimately, the habitation models were run four times.

The first generation CMT model was fairly general, and it predicted that a significant amount of land in the test areas had potential for CMTs. During a project meeting involving the MoF, the Archaeology Branch, and Heather Moon (an independent
consultant retained to review the project), it was generally agreed that the CMT results for the test areas indicated significantly more site potential than had been predicted for nearby coastal areas in B.C, and that an alternative model approach should be explored.

For the second CMT model, four separate scenarios were developed to represent potential for coastal and inland bark-stripped trees, aboriginally logged trees, and yellow cedar CMTs. Biogeoclimatic zones and subzones were added to the model to assist with the identification of appropriate forest stands, and hydrology buffers were adjusted. Overall, the second model run was considerably more specific than the first.

Following an evaluation of the results of both models, the second model was slightly revised and re-run. Results of this third model run were then extended to the entire study area. Following review by the Ministry of Forests, it was felt that the third CMT model was too exclusive, and that it may under-represent CMT site potential. Ultimately, the first generation CMT model was run on the entire study area, and it was found that the inferred over-representation inferred from the test areas was not indicative of the entire TSA. As a result, the first CMT model, which was initially developed for the Central Coast LRMP overview and later applied to the northern part of TFL 25, was adopted for this study.

The final CMT and Habitation models are defined below.

8.1 CMT Model

Previous archaeological work has shown that CMTs, and particularly bark-stripped trees, may occur in low frequencies almost anywhere on the landscape (Eldridge and Stafford 1996, Stryd and Eldridge 1993). However, some patterning is apparent, with the highest density of CMTs found to date being near the shoreline (but set back from the immediate foreshore), in major valley bottoms, near aboriginal village sites or other occupation sites, or along trails (Stryd and Eldridge 1993) Elevation was introduced because the distributions of red and yellow cedar are elevation-dependent.

Cedar content was considered to be important because the majority of recorded CMTs are cedars. Although CMTs on hemlock and other species have been reported, relatively little is known about their ages or distribution, and it was therefore considered prudent to
exclude them from modelling. Management considerations for these species are discussed in Section 11. The CMT model predicts that CMT site density will increase with cedar content, simply because more cedars are available for harvesting. However, this relationship requires field testing, and there is some evidence to suggest that CMT site potential is highest in areas with few cedars (Millennia Research 1996, Allen Banner, pers. comm. 2000).

Due to the extensive history of logging on the northwest coast, 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 (141 years old and older) for identifying the zones with highest predicted CMT potential. GIS analyses of recorded CMT sites in the North Coast TSA generally supported these interpretations. Age classes 6 and 7 were added to the Class II model based on the forestry characteristics of recorded CMT sites. It should be noted that more recent CMTs may require management consideration under the Forest Act and/or the Forest Practices Code, as possible evidence of aboriginal rights.

Height class limits were set to exclude stunted trees at the upper limit of the cedar range, because these trees are often twisted and short, and therefore are less likely to have been used for aboriginal logging or bark stripping. It is noted that some recorded CMT sites in the study area are in stands less than 101 years old (age class 6), but they are relatively rare.

Slope, elevation, and distance to salt or fresh water were included on the basis of relationships inferred from the spatial distribution of known CMT sites in the study area and adjacent regions, and information found during the literature review. Cutoff values for the models were based on analyses of recorded CMT sites, with the exception of distance to fresh water, which was inferred from the literature (e.g., Turner 1998).

8.1.1 Model Variables

Based on the literature review, GIS analyses, and inferences about the physical requirements of bark stripping and logging, the following variables were predicted to correlate with the occurrence of recorded CMT sites:
species composition (cedar percentage as defined by forest cover data)
- height class
- age class
- elevation
- slope
- distance to a river or lake, and
- distance to the coast

8.1.2 Model Rules

Based on the landscape characteristics of recorded CMT sites in the North Coast TSA and the Central Coast LRMP area, a review of literature pertaining to bark stripping and aboriginal logging, and an evaluation of other CMT models in coastal settings (e.g., Arcas Consulting Archeologist 1998, Millennia Research 1999), the model shown in Table 10 was developed for culturally modified trees.

Table 10
Predictive Model for Culturally Modified Tree Sites

<table>
<thead>
<tr>
<th>Class I (Highest Potential)</th>
<th>Species Composition (\geq 50%) Cw or Yc AND Height Class (\geq 3) AND Age Class (\geq 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Type</td>
<td></td>
</tr>
<tr>
<td>Terrain</td>
<td>Slope = 0-30% AND elevation = 0-100 metres asl AND</td>
</tr>
<tr>
<td>Hydrology Buffers</td>
<td>Distance to coast = 0-300 metres OR distance to two line river or definite river or intermittent river or lake = 0-200 metres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class II (Moderate Potential)</th>
<th>Species Composition (&gt;0%) Cw or Yc AND Height Class (\geq 3) AND Age Class (\geq 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Type</td>
<td></td>
</tr>
<tr>
<td>Terrain</td>
<td>Slope = 0-90% AND elevation = 0-100 metres asl AND</td>
</tr>
<tr>
<td>Hydrology Buffers</td>
<td>Distance to Coast = 0-1000 metres OR distance to two line river or definite river or intermittent river = 0-300 metres OR distance to lake = 200 metres</td>
</tr>
</tbody>
</table>
8.2 Coastal Habitation Model

For the purposes of modelling, coastal habitation sites were considered to include villages, shell middens (with or without clear evidence of settlement), and house depression, within 2 kilometres of the coastline. Similar sites further inland were considered under the inland habitation model. Ethnographic information and existing archaeological data suggest that, with the exception of sites on the few major rivers and large lakes in the study area, the vast majority of habitation sites will be on or near the coastline. In an overview of Heiltsuk traditional territory, all recorded shell midden sites are within 2.4 kilometres of the coast line (Millennia Research 1997b), and this distance was considered in setting the arbitrary 2 kilometre cut-point to distinguish between coastal and inland habitation sites. The GIS analyses discussed above support these interpretations.

8.2.1 Model Variables

Given the maritime focus of North Coast First Nations cultures, it was assumed that most coastal habitation sites would be located on relatively flat landforms near the shoreline (but beyond the storm tide zone) and usually near a source of fresh water. Many of the recorded sites in the North Coast area are in sheltered bays on islands, and some ethnographic and archaeological references describe village sites on beaches on islands at the mouths of rivers (Capes 1976). It is recognized that there will be exceptions to these patterns, such as defensive/refuge sites, which may be surrounded by steep terrain, and to which water may have been transported from another source (Lepofsky 1985).

The variables used for the coastal habitation model were:

- slope
- elevation
- distance to coastline
- distance to fresh water (lake, river or stream), and
- size of island
8.2.2 Model Rules

Based on recorded site and landscape data, and inferences from archaeological and ethnographic information, the model shown in Table 11 was developed for coastal habitation sites.

Table 11
Predictive Model for Coastal Habitation Sites

<table>
<thead>
<tr>
<th>Class I (Highest Predicted Potential)</th>
<th>Case 1: Distance to coastline = 0-100 m OR Distance to definite or intermittent river (IF within 200 m of coast) = 0-100 m OR Distance to double line rivers = 0-100 m OR Distance to lakes (IF larger than 5 ha.) = 0-100 m AND Slope = 0%-30% AND Elevation = 0-30 m asl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class II (Moderate Predicted Potential)</td>
<td>Case 1: Distance to coastline = 0-300 m OR Distance to lake (IF greater than 5 ha.) = 0-200 m OR Distance to double line river = 0-200 m AND Slope = 0%-30% AND Elevation = 0-30 m</td>
</tr>
<tr>
<td>Case 2: Small Coastal Islands (&lt;=50 ha.)</td>
<td>Distance to coastline = 0-100 m AND Slope = 0%-20% AND Elevation = 0-30 m asl</td>
</tr>
</tbody>
</table>
Table 11
Predictive Model for Coastal Habitation Sites (cont’d)

<table>
<thead>
<tr>
<th>Case 2: Islands</th>
<th>Distance to coastline = 0-200 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no size restriction. Includes fresh water islands)</td>
<td>ANI Slope = 0%-30%</td>
</tr>
<tr>
<td></td>
<td>ANI Elevation = 0-30 m asl</td>
</tr>
<tr>
<td>Class II</td>
<td>Moderate Predicted Potential</td>
</tr>
<tr>
<td>Case 3: Mainland River Valleys (lower reaches)</td>
<td>Distance to coastline = 200-2000 m</td>
</tr>
<tr>
<td></td>
<td>AND Distance to double line river = O-100 m</td>
</tr>
<tr>
<td></td>
<td>AND Slope = 0%-30%</td>
</tr>
<tr>
<td>Class III</td>
<td>Lowest Potential</td>
</tr>
<tr>
<td>All other lands</td>
<td></td>
</tr>
</tbody>
</table>

8.2.3 Inland Habitation Model

Habitation sites further than 2 km from the coastline were considered inland sites. Only 5 such sites have been recorded in the North Coast TSA to date, two of which are on small rivers, one is on a two line river, and one is on a lake. It was hoped this approach might help to highlight differences in settlement patterns between the riverine-adapted Nisga’a and their more maritime-adapted neighbours, and account for resource camps that may exist on lake shores. An all-encompassing habitation model designed to account for all types of habitations in the study area would have to be very general and likely would result in exaggerated site potential in many locations.

The information reviewed for this study suggests that, with the exception of sites on major rivers and possibly large lakes, inland habitations will be relatively rare. Where present, it is assumed that settlement sites would require level, well-drained ground and a
source of fresh water. Most inland habitations can be expected to have associated trails, especially where canoe access is restricted.

8.2.4 Model Variables

For the purposes of this study, all inland habitation sites are, by definition, at least 2 km from salt water, and marine islands are excluded. Additional variables used in the model are slope and distance to fresh water (lakes and double line, definite, and intermittent rivers). The model focuses on confluences of rivers and inlets and outlets of lakes, where slope conditions are appropriate for habitation.

8.2.5 Model Rules

Based primarily on inferences from archaeological and ethnographic information from other areas of the province, the following simple model (Table 12) was developed for inland habitations:
## Table 12
Predictive Model for Inland Habitation Sites

| Class I (Highest Predicted Potential) | Slope = 0-20% AND Distance lake (IF > 5 ha.) = 0-100 m IF distance to definite river = 0-100 m OR Distance to two line river = 0-100 metres IF distance to definite River = 0-100 m OR Distance to two line river = 0-100 metres IF distance to lake = 0-100 m AND Distance to coastline > 2000 metres |
| Class II (Moderate Predicted Potential) | Slope = 0-20% AND Distance lake (IF > 5 ha.) = 0-200 m IF distance to definite river = 0-100 m OR Distance to two line river = 0-200 metres IF distance to definite River = 0-100 m OR Distance to two line river = 0-200 metres IF distance to lake = 0-200 m AND Distance to coastline > 2000 m |
| Class III | All other lands |
9.0 RESULTS

Two datasets were produced: Dataset I consists of grids representing predicted archaeological site potential, and an accompanying database, and Dataset II consists of a database of recorded and reported archaeological sites. Recorded sites are presented as an ArcInfo point coverage.

9.1 Dataset I

Archaeological site potential was ranked as Class I, Class II or Class III, in order of relative predicted 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. It is also likely that these areas will have the greatest density and variety of sites. Overall, the risk of impacting an archaeological resource is greatest for developments within this zone.

Class III lands represent the lowest predicted site potential, and should hold few sites and a narrow range of site types. These lands are predicted to have the greatest 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, and the risk of impact is considered to be lowest in Class III.

The total modelled area encompasses 1,969,723 hectares. The study area was divided into a 10 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. The habitation site models were overlain on the CMT mode results for plotting, so that areas predicted to have potential only for CMTs are easily identified.

9.2 Area Results

The model results predict that 47,809 ha (2.4% of the study area) have high potential (Class I) for coastal habitations sites and 3,122 ha (1.6%) have moderate predicted potential (Class II). For the CMT model, 69,823 ha (3.6%) fall in Class I and 303,456 ha (15.5%) are ranked as Class II. The inland habitation model predicted that 6,251 ha (0.3%) have high site potential and 4,674 ha (0.2%) have moderate site potential. The data are summarized in Table 13.
The model results cannot be simply summed, as there is considerable overlap between the habitation models and the CMT model (>32,000 ha, or 1.6% of the study area). The coastal habitation and inland habitation models do not overlap. The combined model results indicated that 107,666 hectares (5.5% of the study area) falls within Class I lands. Class II model results account for an additional 323,537 hectares (16.5% of the study area), for a total of 431,193 hectares of Class I or Class II lands (22% of the study area).

Table 13
Summary of Predictive Modelling Results

<table>
<thead>
<tr>
<th>Archaeological Land Class</th>
<th>Area (Hectares)</th>
<th>% of Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>107,666</td>
<td>5.5</td>
</tr>
<tr>
<td>Class II</td>
<td>323,537</td>
<td>16.5</td>
</tr>
<tr>
<td>Class III</td>
<td>1,526,704</td>
<td>78</td>
</tr>
</tbody>
</table>

9.3 Capture Rates

The results of the predictive models were compared against the database of recorded sites to assess their success rate. Even though 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.

The initial capture rate calculations used non-buffered point coverages, which may underestimate the performance of the models. In the GIS point coverages, sites are represented by hypothetical points on the landscape. Using UTM coordinates taken to three decimal points, this point could actually represent only about a one centimetre area on the land. A second capture rate analysis used 100 metre buffers on the site points, effectively giving all sites a 100 metre radius.

Table 14 shows the success rates of the habitation and CMT models, using both points and buffered points. Where sites are less than 200 metres apart, the buffers overlap, creating a single polygon. For this reason, the number of habitation site polygons shown in Table 14 is smaller than the total number of sites. For CMTs, some sites with missing forest cover data were excluded from the point analysis. In some cases, nearby sites with overlapping buffers provided relevant forestry data for the shared polygon; consequently,
the number of buffered CMT sites is greater than the number of raw points. The percentage values for points and buffered points are directly comparable. Coastal and inland habitations were combined for the analysis, because only five inland sites have been recorded.

Table 14
Capture Rates of Predictive Models

<table>
<thead>
<tr>
<th>Model</th>
<th>No. of Sites</th>
<th>Class I Capture Rate (Points)</th>
<th>Class II Capture Rate (Points)</th>
<th>Total Capture (Points) (n)</th>
<th>Total Capture (Points) (%)</th>
<th>No. of Buffered Sites</th>
<th>Capture Rate (Buffers) (n)</th>
<th>Total Capture (Buffers) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal or Inland Habitation</td>
<td>343</td>
<td>287</td>
<td>34</td>
<td>321</td>
<td>94%</td>
<td>299</td>
<td>293</td>
<td>98%</td>
</tr>
<tr>
<td>CMT</td>
<td>167</td>
<td>45</td>
<td>72</td>
<td>117</td>
<td>70%</td>
<td>173</td>
<td>138</td>
<td>80%</td>
</tr>
</tbody>
</table>

In addition to the 80% of buffered CMT sites correctly predicted by the model, 24 CMT sites fell within areas predicted to have high or moderate potential for habitation sites. Consequently, 94% of recorded CMT sites are in locations predicted to have archaeological site potential.

The model results were visually compared with mapped areas identified by the Kitselas First Nation as having cultural importance. While not all the areas were predicted by the models as having site potential, at least portions of each area were properly identified.

The model results were also compared with “non-site”, or “null” data from locations that have been inspected in the field with no archaeological sites found. This information was obtained from consultants’ reports and digitized. In cases where only a sample of the development are was inspected in the field, it was necessary to assume that the level of assessment was adequate to state that no sites were present in the remainder of the area.

As noted in Section 5.2, the digitized cutblocks encompass 4,512 hectares, within which 22 archaeological sites were identified. All areas outside the sites are considered to be “non-sites”. According to the model results from the present study, only 2,299 hectares (51%) would have required field assessments. Based on buffered sites, all
22 archaeological sites in the assessed cutblocks were correctly predicted. Using raw points, 73% were correctly predicted.

9.4 Dataset II Recorded Archaeological Sites

Dataset II consists of a database of recorded and reported archaeological sites and trails. Recorded sites are presented as an ArcInfo point coverage. Reported and recorded trails are presented as a separate line coverage within Dataset II.

10.0 EVALUATION AND DISCUSSION

As intended, the model results indicated that the highest archaeological potential for most site types is near the coastline and on islands. This pattern is consistent with the ethnographically-reported Northwest Coast subsistence and settlement system, which focused heavily on marine resources. The CMT model results suggest that inland site potential may be considerable, despite the maritime orientation of the North Coast First Nations, and it is suspected that existing ethnographic and archaeological information under-emphasizes aboriginal use of these zones. For the more riverine-oriented Nisga’a, inland site potential is predicted to be greater than for the Coast Tsimshian, largely due to their geographic position.

Following review of a draft version of this report, one of the licensees expressed concern regarding the CMT model. One concern was with respect to the use of fresh water buffers in general, and specifically about the lack of stream differentiation based on navigability or fisheries values. As noted in this report, the history of archaeological inventory in the North Coast is strongly oriented to coastal areas, and relatively little work has been completed inland. This lack of representative sampling, combined with ethnographic references to the collection of bark well up drainages, indicated that a conservative approach to CMT modelling was warranted, until such time that additional data can be collected for inland areas. Following discussion with the Ministry of Forests, this approach was adopted, with the knowledge that the model probably over-predicts CMT potential.

Another comment related to the consideration of detailed information that may not have been available for the AOA. For example, licensees may be aware of localized forest cover or terrain conditions that are not adequately reflected in the TRIM or forest cover
data. Similarly, First Nations may have knowledge of archaeological resources or culturally important areas that have not been formally recorded. These types of information could be incorporated into future model refinements, which should take place on a more localized scale. Specific information could be digitized and made available for land use planning, subject to potential confidentiality issues regarding culturally significant locations.

**10.1 Study Limitations**

This study provides a good basis for making archaeological resource management decisions in the North Coast TSA, and for guiding future archaeological inventory and impact assessment studies. However, the results are limited by certain factors, which are discussed below.

1. There was no field component to this study and consequently, the predictive models are untested.

2. Only GIS-ready data were used for this study, and the quality of the data varied. Some additional information sources, such as salmon, shellfish, and mountain goat habitat, prevailing wind directions, beach types, and traditional land use data could be useful for modelling, but they would require digitizing and/or authorization for use.

3. The modelling results are affected by the resolution and accuracy of the digital elevation model, TRIM base map data, and forest cover data. It has been shown elsewhere (e.g., Golder Associates 1998, Arcas Consulting Archeologists 1999), that stand-level forest cover data may be insufficiently detailed for identifying small cedar stands that contain CMTs.

4. The existing archaeological site inventory for the area is very limited and biased toward shoreline sites. Archaeological information for inland areas is negligible.

5. Not all archaeological site types were modelled, due to inadequacies in baseline data. It is anticipated that certain un-modelled site types will be accounted for by the habitation and CMT models, but this assumption has not been tested.

The project would have benefited from more direct involvement of members of the First Nations whose territories encompass portions of the North Coast TSA. For example, traditional use information may have provided a more complete picture of aboriginal land/resource use in the study area.

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11.0 RECOMMENDATIONS

The following recommendations relate to polygons of archaeological potential identified in Dataset I of the GIS component of this AOA. It is important to note that an archaeological overview assessment is an evolving planning tool that is subject to revision and update as new or better data become available. For this reason, some of the following recommendations are geared toward ground truthing and model refinement.

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 North Coast TSA. 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 can be considered to be completely risk-free.

11.1 Class I Lands

Class I lands are those that satisfy most of the environmental criteria predicted to be associated with archaeological sites. Further archaeological assessment should be undertaken prior to development in any Class I zone. As a first step, a qualified archaeologist may undertake a field reconnaissance to field truth the terrain data used for modelling, and to visually assess the site potential of the development area. We recommend that such an assessment be conducted under a Heritage Conservation Act permit so that an impact assessment may be undertaken immediately, if warranted. If the field reconnaissance suggests that archaeological sites are unlikely to exist in the project area, then no further archaeological work would be necessary for that location.

All field assessments should meet or exceed Archaeology Branch guidelines, and should involve consultation with, and if possible, involvement of the appropriate First Nation(s). For cost effectiveness and scheduling purposes, it may be possible for an archaeologist to obtain a single permit for a number of planned developments (commonly known as a “blanket permit”). This approach may reduce the permit review and issuance time, and would streamline reporting by eliminating redundancy.

Areas rated as Class I for culturally modified trees only may receive a Preliminary Field Reconnaissance (PFR), in accordance with Archaeology Branch guidelines.

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Reconnaissance typically involves less-intensive ground coverage than an AIA and does not include subsurface testing or other invasive techniques (and therefore does not require a Heritage Conservation Act permit). CMT reconnaissance should be conducted by a professional archaeologist or other individual with adequate training in CMT identification and recording (e.g., a trained local First Nations person or forestry worker). The objective of a PFR is to search for visible evidence of archaeological sites, and to evaluate the site potential of the local environment. A PFR may be adequate to assess a development area, or a detailed impact assessment may be recommended. A PFR should be adequate to locate and document any CMTs present.

One advantage of the PFR approach is that a permit is not required (as long as no subsurface testing is undertaken), and therefore it may be possible to expedite the assessment process. However, if dating of CMTs by a destructive method (e.g., increment borer or stem-round sample) is desired, it is strongly recommended that a permit be obtained. It is unlawful to alter an archaeological site with evidence of pre-1846 use or occupation without a permit, and invasive dating techniques constitute an alteration. Since it cannot be known in advance whether pre-1846 CMTs are present at a site, we recommend that dating be completed under permit to remove the risk of accidentally contravening the Heritage Conservation Act.

If site types other than CMTs are encountered during a PFR, an impact assessment should be conducted under permit by a qualified archaeologist.

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

11.2 Class II Lands

Areas rated as Class II are considered to have moderate archaeological potential and should also receive archaeological field inspection. A PFR is considered an appropriate level of investigation for all Class II lands, including those rated by the models as having potential for CMTs only. A PFR may lead to a recommendation for an impact assessment, or additional work may not be warranted.
Class II lands are predicted to have moderate site potential. It is predicted that fewer sites and fewer site types will be found in this zone than in Class I. From a risk management perspective, this land class offers the greatest challenges because the information available for modelling was generally inadequate to make a firm prediction.

A significant amount of land falls within the Class II CMT designation and, depending on the amount of development planned for these areas, it may not be feasible to conduct field studies over 100% of this area. If this is the case, three main risk management approaches are suggested:

1. a ground-truthing inventory of a sample of Class II lands could be undertaken to assess the model results. Based on the inventory results, the CMT model should be adjusted, if necessary

2. archaeological impact assessments could be required for a sample of the Class II lands. For example, 50% of proposed roads and cutblocks falling within Class II lands could be selected for PFR, with the results serving as ground truthing inventory.

3. the District Manager may decide to manage only Class I CMT lands, accepting the risk associated with waiving the requirements for field assessments of lands ranked as Class II for CMT sites.

Option 3 is the least preferred of these strategies and carries the greatest risk to the Ministry of Forests. It is strongly recommended that any management approach that does not involve field assessment of all Class II lands should be developed in consultation with First Nations and the Archaeology Branch.

11.3 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 field observations, consultation with local First Nations or other information sources indicate the potential for archaeological sites to be present in
a Class III or any other 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 District Manager, 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).

### 11.4 Un-Modelled Site Types

Several site types were not specifically modelled due to a lack of information about their distributions, or limitations in the GIS data. Many of these site types, such as burials, lithic scatters, and possibly rock art will be relatively well accounted for by the habitation and CMT models. For the Central Coast LRMP area, over 80% of pictograph sites fell within areas predicted to have potential for habitation sites.

High elevation sites other than CMTs in the North Coast TSA may not be adequately considered by the models. If developments are planned in the limited subalpine parkland zone or in the alpine, archaeological reconnaissance should be considered in areas of gentle terrain. Forestry crews or engineers should be aware of the possibility of aboriginal trails, stone quarries/lithic reduction areas (represented by large amounts of flaked stone), cairns/bunting blinds, and cultural depressions (earth ovens or cache pits) in these areas, and should report them to the District Manager if encountered. We recommend that the District Manager require an archaeological impact assessment in such cases.

Non-cedar CMTs are likely to exist in the TSA, but current information is insufficient for modelling their distributions. Bark-striped hemlock CMTs, in particular, are likely to be found, primarily near the shoreline, but possibly inland as well. Blazes (usually trail, traline or territory markers), carvings (dendroglyphs) or paintings (dendrographs) on bark-striped trees could exist in the area. Dendroglyphs and dendrographs would be rare, and of particular significance. Their locations should be reported to the District Manager, local First Nations, and the Archaeology Branch.
Maple, cottonwood and other trees were also used by aboriginal people, and some evidence of their use may be encountered. In most cases, cultural modifications of non-cedar trees either heal over or become otherwise undetectable in relatively short periods, so the probability of finding non-cedar CMTs of adequate age to be protected under the Heritage Conservation Act may be low. Nonetheless, the locations and characteristics of such trees should be recorded when they are encountered, and we recommend that First Nations be informed of their presence. If the modifications are recent, they may represent ongoing use of the resource, which could be subject to aboriginal rights issues.

11.5 General Recommendations

Ground Truthing and Field Data Collection

- The predictive models developed and implemented in this study have not been field tested. It is strongly recommended that a sample of Class I, Class II and Class III lands 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. First Nations consultation and involvement should be an integral component of the inventory program.

- In addition to, or as part of the ground truthing inventory, a sample of old growth forests should be selected for probabilistic inventory to provide a larger CMT dataset for predictive modeling. We recommend that the sample 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.

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

- All future archaeological field 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, regardless of whether any archaeological sites are found. Survey coverage and site/non-site locations should be clearly mapped.

Data Improvement

- Ideally, individual CMT locations should be digitized where this information is available. This could greatly increase the amount of CMT data available for modelling.
Model Refinement

- The predictive models should be re-evaluated and refined as new data become available. It was not possible to exhaust all possible information sources or to digitize all mapped information for this AOA, but the models could be tailored and made more specific for particular operational areas.

- Future incorporation of traditional land use information could significantly benefit cultural resource modelling efforts. If made available by First Nations, the results of traditional land use studies should be added to Dataset II of this overview. If available in digital form, the TUS data could be compared against the model results to help refine their predictive ability.

First Nations Consultation and Training

- Ongoing consultation with First Nations regarding cultural heritage issues is of great importance. Detailed consultation was not undertaken for this project, but the AOA results 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. Some First Nations have expressed an interest in training for local archaeological crews. This approach could provide a corps of knowledgeable personnel that can provide preliminary assistance in situations requiring rapid response, as well as assisting professional archaeologists with field projects.

- An archaeological overview was previously completed for the Heiltsuk Nation’s traditional territory (Millennia Research 1997b). That study involved considerable input form the Heiltsuk Nation, and its recommendations should be considered when planning developments in Heiltsuk territory.

The results of this AOA should be of benefit to the MoF and the North Coast licensees for long-term planning, to prioritize archaeological management requirements over a period of years (the five year planning cycle, for example). In some cases, it may be possible to plan forestry developments in ways that avoid or minimize impacts to Class I or Class II lands, thereby reducing assessment costs. By using the AOA maps as a consultation tool, the MoF could work with First Nations to identify or confirm locations that have particular cultural significance, so that consultation and field assessments, if necessary, can be completed well in advance of development. All of these applications of the AOA deliverables could result in cost reductions, improved relations with First Nations, and more effective development planning.

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12.0 CLOSURE

This report was prepared for the use of the Ministry of Forests and the Archaeology Branch. While its use by First Nations or other appropriate agencies is encouraged, any 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.

We trust that this report meets with your current requirements. Should you have any questions, or require further information, please contact the undersigned.

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APPENDIX 1

GLOSSARY OF TECHNICAL TERMS
**Aboriginally-logged tree:** A tree that has been felled, planked or otherwise modified to obtain wood by First Nations people.

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

**Archaeology:** The study of human cultures though the material remnants 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.

**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 cremation, 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.
Canoe run: A long narrow beach area cleared of rocks to facilitate the landing of boats on shore.

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

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.

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.

Dentalium: A long, thin mollusk shell used for ornamentation by Northwest Coast cultures; considered a wealth item and sometimes used as a form of currency. Dentalium is known to have been traded widely in pre-contact times.

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.

Eulachon: A fatty type of smelt, highly valued by First Nations along the Northwest Coast. Various other spellings are common, including oolichan and ooligan.

Eustatic: Pertaining to changes in absolute sea-level on a global scale, and not regional changes produced by localized movements of land or the sea floor.

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.

Fish trap: A wall of loosely piled stones used to capture fish feeding in the intertidal zone, sometimes incorporating perishable components such as stakes, nets and basketry traps.

Fjord: A long, steep-sided coastal inlet produced as a result of intense glaciation of a previously existing river valley.

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.

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.

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.

Grease trail: A trail used by aboriginal people as part of a regional exchange system; the term is a reference to eulachon oil, a commonly-traded commodity.

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.

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.

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.

Isostatic: Pertaining to sea-level changes resulting from the tendency of the earth’s crust to maintain a state of equilibrium, in which forces tending to elevate balance with those tending to depress. For example, continental plates may be depressed under the weight of glacial ice, and rebound following ice melting, resulting in variations in relative sea-level.

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

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.

Midden: A deposit of soil and cultural debris produced as byproducts of human activities. Middens of clam and mussel shell, often containing artifacts, are common on the coast of British Columbia.

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.

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.

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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.

Petroform: An alignment of rocks intentionally produced by human activity, such as a stone wall fish trap or canoe run.

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

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

Planked tree: A log or tree from which a long, flat piece of timber has been removed.

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.

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.

Potlatch: A feasting complex that is the central social and political institution among First Nations of the Northwest Coast and portions of the adjacent Interior Plateau, which employs the reciprocal redistribution of material goods to establish and reinforce sociopolitical order.

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 construct developed to make inferences about unobserved phenomena based on the observed characteristics of similar phenomena. In archaeology, models are often used to predict site distributions in areas that have not been examined in the field.
**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 implement used to tip a projectile such as a spear, arrow or dart. Projectile points were typically made from stone, bone, wood, shell or metal.

**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.

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

**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.

**Test hole:** A deep cut or chop into a tree, to check the soundness of heartwood. Test holes have been found on standing trees, on windfallen trees, and on sections of aboriginally logged trees.

**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.

Weir: A type of fish trap consisting of a line of wooden stakes placed at the mouth of a river designed to trap spawning salmon, often incorporating additional elements such as nets or basketry traps.
APPENDIX 2

RECORDED ARCHAEOLOGICAL SITE DATA
# APPENDIX 2: SITE ATTRIBUTES

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**Golder Associates**
## APPENDIX 2: SITE ATTRIBUTES

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<tr>
<th>SITE</th>
<th>STATE</th>
<th>X</th>
<th>Y</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
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Note: The table above provides a summary of site attributes, including X and Y coordinates for each site, along with respective values for T1, T2, T3, and T4.
### APPENDIX : SITE ATTRIBUTES

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<th>PCDU</th>
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<th>INTG</th>
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<th>AGRONEGR</th>
<th>PETROGR</th>
<th>WITSTAFF</th>
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**Golder Associates**
## APPENDIX 2: SITE ATTRIBUTES

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<th>Site</th>
<th>Date</th>
<th>Site Attributes</th>
<th>Land Use</th>
<th>Distance</th>
<th>Description</th>
<th>Sample Size</th>
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<th>Forest</th>
<th>Swamp</th>
<th>Meadow</th>
<th>Wetland</th>
<th>Vegetation</th>
<th>Soils</th>
<th>Saltmarsh/Littoral Zone</th>
<th>Tidal</th>
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Golder Associates
## APPENDIX 2: SITE ATTRIBUTES

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*Note: The table above lists the site attributes for the LOTT, WEST, and EAST locations.*
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**APPENDIX 2: SITE ATTRIBUTES**