# Archaeological Overview of Northeastern British Columbia: Year One Report

Prepared for:
**The B.C. Ministry of Energy and Mines**

and Submitted to:
**The Oil and Gas Commission**
**The Fort Nelson First Nation**
**The Halfway First Nation**
**The Prophet River Band**
**The Blueberry River First Nations**
**The Dene Tha'**
**The West Moberly First Nations**
**The Doig River First Nation**
**The Acho Dene Koe**
**The Saulteau First Nation**
**The Treaty Eight Tribal Association**
**Quentin Mackie**
and
**The Archaeology Branch**


*Millennia Research Limited*
*March 31, 2001*

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Brian Braidwood, Ministry of Energy and Mines, has facilitated contract administration and is the main contact for the project steering committee.

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Doug Glaum is also directing the Archaeology Site Awareness Project, which has provided corrected site location data for portions of the study area. Thanks to Mark Stone and Margaret Rogers for organising the transfer of data.

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The staff at the BC Archives are thanked for their help in locating trails information within the study area.

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## Introduction

In July 2000 Millennia Research Ltd. was awarded a five year contract by the Ministry of Energy and Mines (MEM) to complete an Archaeological Overview Assessment (AOA) in north-eastern BC for the MEM and the BC Oil and Gas Commission (OGC). Millennia Research has partnered with Timberline Forest Inventory Consultants, who provide Geographic Information System (GIS) support, and with Big Pine Heritage Consulting and Research Ltd, as our study area specialists. This Year One report presents the results of the project to March 31, 2001.

The purpose of an Archaeological Overview Assessment (AOA) as outlined in the BC Archaeological Impact Assessment Guidelines is to "identify and assess archaeological resource potential or sensitivity within a proposed study area" (Apland and Kenny, 1995:8). An AOA is expected to produce "recommendations concerning the appropriate methodology and scope of work for subsequent inventory and/or impact assessment studies" (Apland and Kenny 1995). In meeting both of these broad objectives, the Northeast BC AOA, in conjunction with on-going consultation with First Nations, will assist MEM and OGC managers in identifying and minimising adverse impacts to archaeological resources during operational planning.

### Project Review Committee

Overall project direction is the responsibility of the Project Review Committee (hereafter referred to as the Committee). The current Committee consists of Brian Braidwood (MEM), Tom Ouellette (OGC), Doug Glaum (Archaeology Branch) and Quentin Mackie (University of Victoria). Chris Bezant represented Halfway River First Nation on the committee until recently.

## Scope and Objectives

Archaeological potential models have been completed for both the Fort St. John and Fort Nelson Forest Districts (Mackie 1997a, Mackie 1997b). However, to quote from the Request for Proposals (RFP) issued for the project:

> The current planning tools have been largely developed on the basis of general anthropological theory concerning site locations and specific data from limited areas around Fort St. John that have been relatively well investigated. The application of these studies to operational areas further north have resulted in approximately 70% of all oil and gas applications requiring some field-based archaeological research. Of those located in the Fort Nelson Forest District only 8% result in the location of archaeological sites.

The RFP goes on to state that the goal of the five-year NE AOA is to improve the archaeological planning tools available to resource planners through Archaeological Inventory Studies (AIS), improving or creating spatial datasets used in potential modelling, incorporation of trail and TUS information in the modelling process, and refining or improving the current archaeological potential model.

The Terms of Reference (TOR) identified specific tasks for each of the five years of the project. Year One tasks as identified in the RFP include:

- Preparation of a detailed five year plan
- Compilation and ground-truthing fieldwork of a portion of known archaeology sites
- Inventory of information from previous archaeological studies
- Data mapping
- Discussions with appropriate First Nations
- Construction of a predictive model
- Reporting

Year Two, Three and Four tasks include:

Fieldwork

Mapping of newly recorded archaeological sites

Inventory of new archaeological survey data

Testing and refinement of model

Reporting.

Year Five Tasks include:

Final model development

Production of archaeological potential maps

Final reporting

Five of the seven Year One tasks are complete or nearly complete. Two of the tasks were of much larger scope than originally planned. Fieldwork and predictive model development have been deferred to Year 2.

## Study Area

### Original Study Area

At the time of contract award, the project study area was limited to the Fort Nelson Forest District which covers all of NTS map sheets 94O and 94P and portions of 94I. Relatively little archaeological survey has been conducted in this area of the province and, as indicated in the RFP, only 41 sites were recorded to date for the Fort Nelson Forest District.

As per the Terms of Reference (TOR) for the project, a Five Year Plan (hereafter referred to as the Plan) was developed and submitted to the Steering Committee for review. Data acquisition, including copying of siteforms, submission of a request for digital Provincial Heritage Site Registry information, and GIS coverages was initiated. First Nations within the study area were contacted via fax. Development of a survey strategy and selection of sites to revisit was also started. A Section 14 Site Inspection Permit was drafted and submitted to the Archaeology Branch on September 1, 2000.

### Revised Study Area

Following a steering committee meeting on September 25, 2000, the study area was revised to better reflect areas of interest for oil and gas development. Shortly thereafter, alterations were made in the yearly allocation of funding. Theses changes had several implications for the project: a considerable amount of the data acquired to that date was no longer relevant, although the information gathered for the eastern half of the Fort Nelson Forest District was still useful; the territories of two First Nations contacted at the beginning of the project was no longer included in the study area; however, the territories of four additional First Nations was included in the revised study area. The application for Section 14 permit submitted to the Archaeology Branch was cancelled. A revised permit application for a small portion of the revised study area was submitted October 13, 2000. The new permit application was made in the hope that a speedy response from First Nations would allow for some fieldwork in Year One, however, weather became a factor before the permit was issued (Permit # 2000-391) and no fieldwork was conducted. The permit, which applies to portions of the traditional territories of the Blueberry, Prophet and Halfway River First Nations, expires May 31, 2001.

The revised study area in the northeastern corner of British Columbia is a continuous area defined by the following map sheets in the National Topographic Survey 1:250,000 grid: 94O, 94P, 94J, 94I, 94H, the eastern half of 94G, and the northern half of 94A (see Figure 1). This area is bounded to the north by British Columbia's border with the District of Mackenzie, Northwest Territories, and to the east by the border with Alberta. It is approximately 380 km from north to south,

and between 120 and 230 km east to west, close to 78,000 square kilometres in area. It encompasses 372 Borden blocks, and includes parts of the Fort Nelson and Fort St. John Forest Districts.

The revised study area is roughly the same size as the original and with roughly the same number of biogeoclimatic zones and sub-zones. However, as discussed in further detail below, the number of sites recorded and the amount of survey coverage are significantly larger.

## Approach

### General Approach

The general approach to this project is to combine existing data, analysis of data gaps, field survey to address data gaps, and iterative model building. We are trying to obtain a representative body of previous survey coverage, rather than trying to be exhaustive, and generally directing time and funds towards activities that will result in the "biggest bang for the buck". This said, some of the data sets are critical to the production of an accurate model. One of the dangers inherent in computerised modelling is that it will always produce a product, which might seem very good superficially, but might be completely erroneous if poor data is used. We want to avoid the "garbage in, garbage out" syndrome. For this reason, we have been meticulous in correcting known site locations, since this is so important to the final product.

### Consultation with Other Consultants

While in Fort St. John, Millennia Research had the opportunity to meet with archaeological consultants from companies who have an extensive experience in the area. These individuals included Beth Hrychuck from Landsong Heritage Consulting; Rémi Farvacque, Joel Kinzie, Jeff Andersen, Nicole Nicholls, Sean Moffatt, and Ken Schwab from Big Pine Heritage Consulting and Research Ltd.; and Keary Walde and Karl Hutchings from Heritage North Consulting Services.

A number of issues were raised in these meetings. The major concern was how the model, with the limited elevation data available, could pick up the micro-topographical features on which most of the sites are being found. It is Keary Walde's assertion that these features can only be observed through ground-survey, and that any sort of archaeological predictive model based on the available data would be ineffective (Keary Walde, personal communication 2001). With regards to the issue of identifying terrain features digitally, we submit that there has never been an attempt to do this using the full DEM available in TRIM. Digital Terrain Models or DTM that have been tried in the area have been produced from digital contour data, with vastly fewer data points than the ca 50-80m grid point DEM. We expect that a sophisticated analysis will identify many of the required features. Many other small ones may require remote sensing. Undoubtedly, though, there is no absolute substitute for a skilled archaeologist on the ground.

Other issues included the following:

if the overview would address the potential for sites in muskeg. Not only were these areas used in winter, but they have been expanding over the millennia and may have covered sites which were once exposed;

concerns that the model would replace the expertise of the archaeologist, that management decisions would be taken out of the hands of those familiar with the resource; and,

whether the model would be able to take into account the small size of most sites, which often consist of only a few flakes.

### Model Development

Millennia Research and Timberline have a long history of collaboration and production of science based, but readily understandable, powerful models for predicting archaeological potential. Millennia provides the

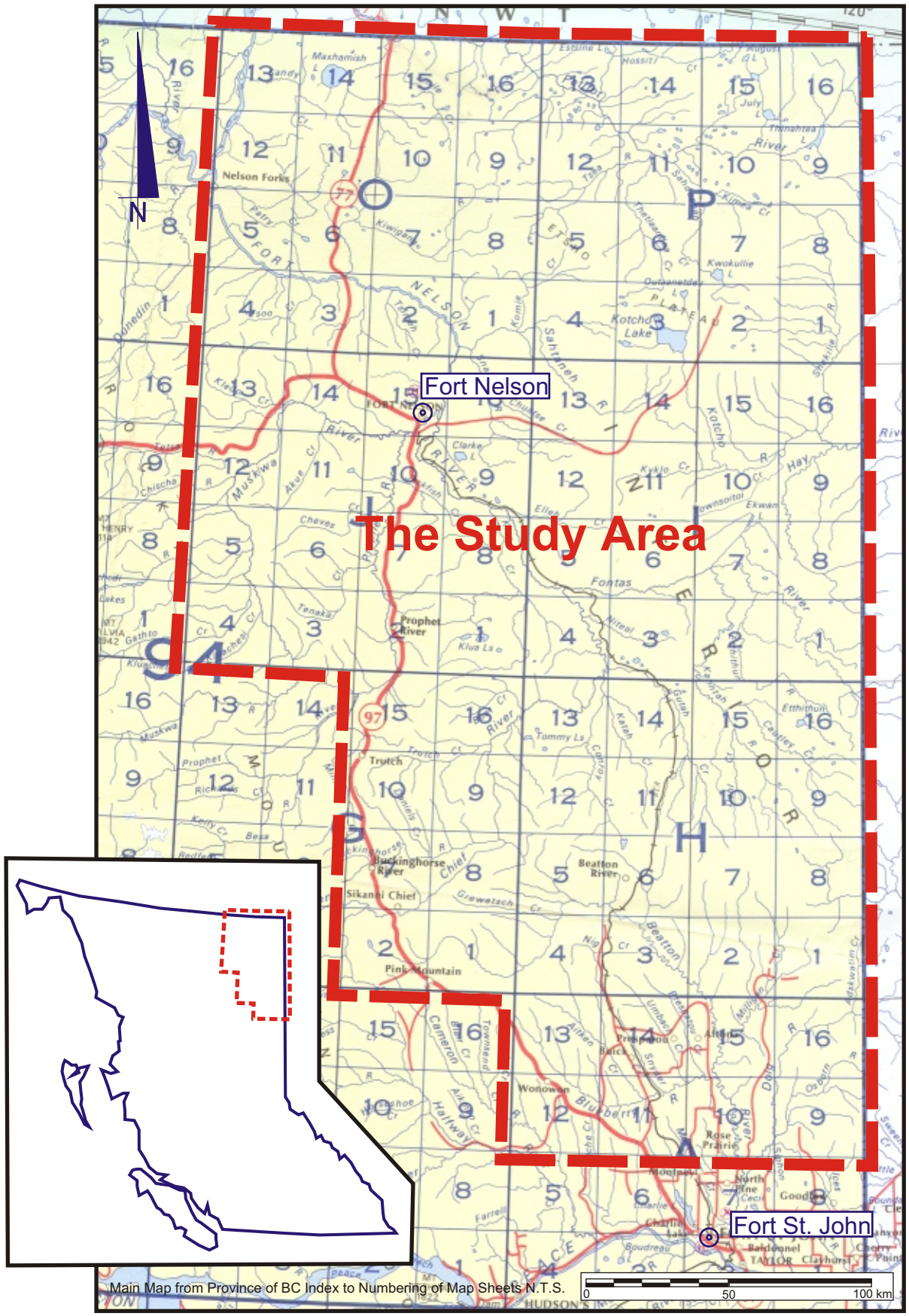


**Figure 1. The Study Area.**

archaeological expertise, Timberline provides the GIS and forestry expertise, and we work co-operatively on model development. Millennia has developed custom computer programs to assist in the modelling process; Timberline has developed GIS routines to identify topographic features that correlate with archaeological site location. Our modelling methodology and approach is inherently easy to understand and defend. Of importance for this project, our methods lend themselves to iterative model building.

Millennia Research/ Timberline models are generally produced in the following sequence:

Existing archaeological site, survey, and trail data acquisition and locational error trapping;

Compilation/creation of other GIS coverages;

GIS near functions and identities, export of data to desktop database;

Analysis of data using desktop database, producing information on data gaps and an assessment of the predictive value of variables;

Creation of GIS variable coverages based on results of #4 above, re-export of data if necessary;

Creation, refinement, and testing of initial predictive model in desktop database;

Translation of resulting database model into Arc Macro Language (AML), production of draft maps;

Review of draft maps and revision of model in AML, or both desktop database language and AML;

Ground truth testing of draft maps;

Final revisions and production of final map products.

Year One studies have been concentrated on items 1 and 2 outlined above, which are now mostly completed.

**Discussions with First Nations**

Discussions with First Nations to date have been introductory in manner, concerned with the broad picture of the AOA and opportunities for First Nations involvement in various aspects of the project. A draft of the permit application and a letter outlining the scope to the NE AOA project and introducing Millennia Research were sent to First Nations on September 5, 2000. Letters outlining the revised study area accompanied the October 13, 2000 draft of the permit application; the October 13 draft was forwarded to the Blueberry, Prophet and Halfway River First Nations.

Letters outlining opportunities for First Nations participation in the project and requesting meetings were forwarded to the Blueberry River, Doig River, Fort Nelson, Halfway River, Prophet River, Saulteau, and West Moberly First Nations in early February 2001. The purpose of the requested meetings was to introduce Millennia Research, to review the scope and purpose of the project, and to make follow-up requests for trail and traditional use information. Due to their distance from Fort St. John, meetings were not arranged with the Acho Dene Koe and Dene Tha' First Nations; however, they were notified that we were starting background research at the OGC offices in Fort St. John.

Meetings were held with the West Moberly, Saulteau, Fort Nelson and Halfway River First Nations. On February 20, 2001, Morley Eldridge met with Chief Roland Willson, Warren Desjarlais, Eugene Stanyer, and other council members of the West Moberly and with Tasha Lelond and other members of the Saulteau. On February 21, Morley met with Ken Barth of the Fort Nelson First Nation and Bernice Lily of the Halfway First Nation. Brian Southwell, our contact with the Blueberry River First Nation, was unable to meet with us as he was going to be out of town. Orest Curninski, contact for the Prophet River First Nation, was unable to attend a meeting but suggested meeting the

next time Millennia was in the area. A tentative meeting with Dolly Apsassin and other council members of the Doig River F.N. had been scheduled, however their archaeologist, Keary Walde of Heritage North Consultants, was unable to attend, so the meeting was postponed.

Follow-up letters were forwarded to all First Nations in early March. The letters included a written request for trail and TUS information, an assurance of confidentiality, and an outline of funds available for compilation of data. The letters were followed up with phone calls. The general response from First Nations was that the requests would be taken under consideration, but additional time was needed time to discuss the matter with Chief and Council. One issue that did come up, which will need to be addressed in the future, is how the TUS information will be kept confidential.

## Methodology

### Archival and Documentary Research

Millennia Research conducted archival and documentary research in Victoria, principally toward obtaining historic map documents for the study area, and identifying trail, camp, and habitation sites. Very extensive research was conducted of archaeological reports; this work is discussed below. Following First Nations contacts, band researchers were asked to conduct searches of Band resources, particularly trail and traditional use mapping. This work has not been started in this fiscal year, as most bands have not decided whether to share traditional use information. The documentary research component of the project examined library, archival and file literature and related material from a number of locations, including the following:

BC Records and Archives;
Surveyor General of Canada;
The Heritage Resource Centre, BC Archaeological Sites Inventory (PHRD), and the Archaeology Branch, Ministry of Small Business Tourism and Culture.

### Site Data Acquisition

Several site information datasets were available for use by the NE AOA Project Team. Detailed site information for the more than 600 archaeological sites in the study area was obtained in an Access database provided by the Archaeology Branch. The Access database contains written locational data (UTMs, longitude and latitude, a description of location, and access) as well as recorder information and a description of the site itself. The original paper site forms for all sites were reviewed.

Digital site location data was obtained from three Arc/Info sources: PHRD (Provincial Heritage Registry Database) coverage; corrected site locations from Mackie's potential mapping projects ("Mackie sites"); and corrected site locations from the Archaeology Site Awareness Program. The PHRD (Provincial Heritage Registry Database) ArcInfo database was received from the Archaeology Branch in October 2000 and again in February 2001 (see below for explanation). Arc/Info coverage was provided in NAD 83 based on locations digitized by Archaeology Branch staff.

Corrected site locational data for 188 of the sites in the study area was available from the potential mapping projects completed by Quentin Mackie for the Fort St. John and Fort Nelson Forest Districts (Mackie 1997a, Mackie 1997b). This information was sought for two reasons: 1) to confirm that the corrected site locations were incorporated into the PHRD, and 2) to check the accuracy of the corrections made. As Timberline had worked on these earlier projects with Mackie, they restored the archived site information on their system.

The Archaeology Site Awareness Project (ASAP) of the Ministry of Small Business, Tourism, and Culture is responsible for checking and correcting site locations for all sites in British Columbia. Although the project is on-going, site checks have been completed for Borden blocks containing sites

on private property in NE BC and the ASAP provided GIS ArcInfo data for 150 corrected sites in 47 Borden blocks in the NE AOA study area. The vast majority of these sites (136) are located in NTS mapsheet 94A, with remainder located in 94G (12) and 94H (2). These site correction, if conducted in a manner consistent with that of the NE AOA, would be incorporated into our dataset, eliminating the need for 150 site checks.

### *Site Location Checking and Site Polygonal Mapping*

A model must be effective in distinguishing between areas that probably contain archaeological remains and areas with a low likelihood of archaeological deposits. In order to do the analysis needed to develop a model, the location and size of archaeological sites must be accurate. For this reason, site location checks were conducted for most of the sites within the project area.

Once all site locational datasets were obtained, the PHRD site locations and the corrected Mackie and ASAP site locations were displayed, using different symbols for each. Consistently the Mackie sites and the PHRD sites overlapped, indicating that the Archaeology Branch had incorporated the corrected site data, and suggested at first that these sites need not be re-examined. This seemed particularly important given the huge increase in number of sites to be reviewed as a result of the shift in the study area. Unfortunately, an examination of a sample of the Mackie site corrections indicated that significant errors remained in this locational data; probably as a result of use of 1:50000 map scale used in the Mackie project. The whole of the Mackie site dataset was therefore reviewed.

As with the Mackie sites, incorporation of site corrections from the ASAP could greatly reduce the level of effort required to complete the site checks. To ensure consistency between projects, a sample of the ASAP corrected dataset was reviewed according to the methodology outlined above. Enquiries of the ASAP team revealed that Borden Blocks completed early on in their project are currently being error checked. Staff with the ASAP will provide a list of those sites that they found non-reconcilable. Review of the sample of ASAP sites has stopped until this information is received.

Site locations, as provided in the PHRD ArcInfo dataset, were checked and corrected against the detail maps accompanying the siteforms. The relative location of the site in PHRD to mapped features such as seismic lines, roads, water bodies, well site, or pipelines was compared to that on the detailed sitemap. This approach provided the greatest accuracy, as site maps are generally large scale; however, it was an arduous task as unique landscape features are generally few and many site maps lack ties to mapped features other than seismic line, well site or pipeline survey data which appears only on development plans, not TRIM. When ties to landscape features weren't possible, sites were corrected using 1:50,000 scale maps, alone or in combination the UTMs provided in the siteform. UTMs were not used alone to relocate sites except when they appeared to have been taken using a GPS. If the PHRD ArcInfo data could not be reconciled with the siteform map and/or the individual site 1:50000 map it was noted as not mapable; these site will not be used in the model development process. The methods used during this project are similar to those used in the Archaeology Site Awareness Project, providing consistency between projects.

Sites on the 94A and 94H areas were plotted by Timberline on TRIM 1:20,000 maps and corrections were noted on the paper maps. The revised locations were digitised by Timberline. For the remainder of the study area (NTS Map-sheets 94G, 94I, 94J, and 94P), the site location checking and polygon mapping was carried out at Millennia Research in the ArcView GIS program, rather than on paper maps. Timberline provided

TRIM data as well as the PHRD site locations which were loaded into ArcView Conducting site corrections directly in ArcView improved accuracy compared to working on paper maps. With ArcView, it was possible to zoom in on the features used to locate sites and get more precise distance measurements. ArcView also allowed one to located sites through a simple query, rather than having to sort through hundreds of paper maps. Making changes in ArcView also saved the additional steps of having to digitize them later, and then checking new plots.

Whether on the paper plots or in ArcView, sites that were 100 m or greater in at least one dimension were changed from points to polygons. This approach is also similar to that of the ASAP.

Version 1 of PHRD (Provincial Heritage Registry Database) ArcInfo and Access site databases were received from the Archaeology Branch in October 2000. Initial 1:20,000 plots of site locations were produced for site location checks, however it soon became apparent that approximately 200 sites contained in the Access database, which the Millennia team was using as a cross-reference, were missing from the ArcInfo database from which the plots were produced. Site checks were delayed while this problem was investigated, and a new ArcInfo database was requested and received.

Version 2 of the ArcInfo and Access databases was received; the ArcInfo database still did not contain GIS data for the "missing" sites. It was determined that the discrepancy was due to a backlog of sites to be digitised by the Archaeology Branch. To complicate matters further, the Version 2 Access database contained 34 more sites than did Version 1, presumably those sites recorded and/or processed by the Archaeology Branch between October 2000 and February 2001. In order to have site location data to work with, Leah McMillin of Timberline used locational data provided in the Access database, converted to NAD 83. In this way, the remaining circa 234 site locations could be accessed in GIS format.

### *Survey Coverage Data Acquisition*

The model development requires a knowledge of where archaeologists have looked and not found anything (often called negative data). Permitted and non-permitted survey reports filed with the OGC and the Cultural Resource Centre of the Ministry of Small Business, Tourism, and Culture (the "Archaeology Branch library") were reviewed for survey coverage information.

An attempt was made to access all reports detailing previous archaeological survey in the study area held at the Archaeology Branch library. In order to locate these reports the following were consulted: the library catalogue system; a database of reports at the library through 1995, which had the added benefit of being searchable by map sheet number; two databases obtained from the Archaeology Branch containing the permit logs for 1997 through the present; and in order to cover the time gap between the preceding databases, the list of permits for 1996 published in *The Midden*. Reports that had been received but not yet reviewed by the Archaeology Branch, and were therefore not in the library or its catalogue, were located using the permit logs. Several project officers were kind enough to lend us these reports. The permit logs were also used to locate reports in the library that had been reviewed but not yet catalogued. Romi Casper, librarian at the Cultural Resource Centre, was kind enough to lend us these reports. All non-permit (Preliminary Field Reconnaissance - PFR) reports of oil and gas-related developments on file at the Oil and Gas Commission were accessed in Fort St. John. These were not available at the Archaeology Branch library.

In addition to the above, an Access database of all the permitted reports held at the Oil and Gas Commission was made available to Millennia Research. It was

converted to a database in Endnote, a bibliographic program, and was used as a starting point for logging all reports pertaining to the study area. The original Access database consisted of several related tables with one-to-many relationships. These individual tables were read into Excel software, and then exported to dBase format. These were loaded into FoxPro software and a custom program written to find the information from each table for each report and create a text file with special embedded characters to allow for EndNote importation. This text file was then imported into EndNote. The EndNote Library needed considerable clean-up as many reports were duplicated (at times with up to four or five copies), under both the author's first and last names both correctly and reversed, with the company listed as author, and so on. Spelling mistakes, inaccuracies, and incomplete entries were common.

Each identified report was entered in the Endnote catalogue and assigned a discrete Millennia Research ("MR") number. In addition, the institutions where the report is available and map sheet number(s) for the area(s) in which the survey took place were entered into Endnote.

The mapping of well site survey coverage was facilitated by the acquisition of a database, provided by the OGC, of well site locational information in the form of latitude/longitude and UTM co-ordinates for the centre point of each well site in BC Timberline did extensive work translating the various locational data some in latitude/longitude, some in UTM, some NAD 27 and others in NAD 83 to a standard UTM NAD 83. Timberline also conducted internal checking where more than one co-ordinate set was presented, and found extensive inconsistencies. They recorded the data source as a field in the database, to allow for some judgement of accuracy, since recent UTM, NAD 83 values were likely to be more accurate than old data in latitude/longitude. The database also included a field that stated if an AIA, PFR, or Post Impact Assessment has been required by the OGC. The well sites were then presented as a coverage with attached information including well site names and numbers.

### *Survey Coverage Mapping*

Reports were reviewed for level of effort related to survey coverage and intensity. Surveys that did not meet a minimum level of effort were not considered as surveyed and will not be included in the development of the predictive model as the absence of sites cannot be reasonably assumed. Examples of such surveys include aircraft flyovers, fieldwork conducted when snow covered the ground and there was little surface exposure, little subsurface testing or both, surveys with little to no subsurface testing and no rationale for the absence of such, and surveys with sporadic coverage, unless this coverage was rationalised.

A distinction was made between those surveys conducted pre and post development impact. Post impact assessments are unlikely to identify CMTs (culturally modified trees) in their study areas, as of course they would have been removed. Development of a potential model for CMTs would have to disregard any such post-impact survey. The same might be true for other site types. However, many of the post impact surveys did identify lithic sites in the impacted area or cutbanks, suggesting that such areas can be considered surveyed with some level of comfort. Interpretation and significance of sites post-impact, is of course, a different matter.

Permitted surveys that met the minimum level of effort were plotted. For 94A and 94H areas, survey coverage other than that for oil and gas-related developments was drawn by hand on 1:20,000 scale maps printed by Timberline. Each survey coverage polygon was given a discrete number that was tied to an attribute table on the side of each map. This table included the MR number of the report that described the survey coverage, a

code for the consulting company, one for the development type (forestry cutblock, etc.) and whether the survey was carried out pre- or post development impact. These distinctions allowed sorting of survey results by well sites with archaeological ground survey, well sites surveyed by a particular company, well sites within a given distance of site, and so on.

The mapping of forestry-related survey coverage was aided by mapped cutblock polygons from Forest Development Plan data obtained from the Fort St. John Forest Districts. Once all non-oil and gas development surveys were plotted the maps were sent back to Timberline for digitising. The mapping of survey coverage for the rest of the study area was accomplished in ArcView.

When a well site that received archaeological survey was identified in a report, the oil well name was searched for within the well site database. The EndNote MR number of the corresponding report, a code for the archaeological consulting company that did the survey, and whether the field survey was completed pre- or post impact was entered into the database. This database was then converted to a GIS compatible "point shape file" by Millennia Research. It was passed back to Timberline to create additional points to represent survey coverage. They plotted the central point of each well site that had received survey coverage, then created four additional points describing a 60 m radius around it. Most surveyed ancillaries to well sites, such as access roads and construction camp areas, could not be mapped due to poor or non-existent mapping or description. A list of well sites that received coverage but were not in the oil well database was maintained.

Non-permit, preliminary field reconnaissance reports were viewed at the Oil and Gas Commission office in Fort St. John, as they are not necessarily on file with the Archaeology Branch. Survey coverage in 94A was drawn by hand as described above. An advantage to doing this at the OGC offices was that they maintain 1:20,000 scale maps showing most of the oil and gas related developments, and it was possible to simply overlay Millennia maps onto OGC maps and trace in the locations. For the remainder of the study area, survey coverage was mapped using ArcView or simply a database editor. Well centres that had received a PFR were flagged in the database provided to us by the OGC. Two additional shape files were created in ArcView to map in the ancillary developments described in the PFR reports. One was used to map in linear features such as proposed roads, pipelines, and seismic lines; the other to map in polygonal areas, such as a remote sump site, temporary campsites, working areas, etc. Both the linear and polygonal features were tied into the well centres, as determined from the PFR reports.

Coverage related to pipeline developments was not mapped this year. We have learned that the OGC is digitizing pipeline locations; when available survey coverage for pipelines can be incorporated in a manner similar to the well site data, resulting in a considerable reduction in the effort required to map such coverage and presumably in increased plotting accuracy.

### *Trails Research and Mapping*

Not surprisingly, archaeological sites are strongly associated with trails. Trail networks connect people with resources, residences, and camps, and serve as communication and trade corridors in the same way as the highway and secondary road network which crosscuts the study area. In fact, a number of roads follow old trail systems. Given the importance of trails considerable effort was made to obtain a vast database of trail information.

Preliminary research identified mapped trails and trail fragments in various sources: in archaeological permit reports; on

siteform maps on file at the Archaeology Branch and copied by Millennia Research; from trails information on file at the Archaeology Branch and supplied by Project Officer Dave Suttill (Archaeology Branch 2001); and on pre-emptor's maps and first-edition National Topographic Survey 1:50,000 maps at the BC Provincial Archives in Victoria (see list in Appendix 2).

Trails located on the above listed sources were copied by hand onto 1:50,000 scale TRIM maps created by Timberline. Each trail or trail fragment was given a discrete number, which linked it to a specific source in a dedicated database (see Appendix 1). This database also includes the type of trail and confidence in its mapped location. Trails were recorded as either "T" - trails (including "pack trails"), "C" - cart tracks, or "O"- other. The other category was used for rough roads which appeared trail-like, i.e., they joined trails, took obvious trail-like routes along ridges, etc, or they meandered according to landforms. A confidence rating (1-4) for trail locations was also noted. The highest confidence rating (1) was for "ground-truthed" trails recorded as a result of fieldwork. The second-highest rating was for trails mapped on preliminary first edition NTS 1:50,000 maps; the third for those on marked as "position approximate" on NTS 1:50,000 maps; and the lowest rating (4) for trails found on small scale early maps. The locational confidence is not the only value of the trail data; in fact, mapped trails rated as "4" often have associated notes regarding camp locations that are of equal value to the trail itself.

First Nations in the study area were contacted by letter and by follow-up phone call regarding available trails data and additional trails research. The Treaty 8 office is believed to house compiled trail data, however the library is open only to member First Nations and their researchers. Several groups indicated an interest in providing trail data, but all felt that the time-constraints of the project would not allow them to participate in Year One. Several groups have compiled trails data as part of TUS (Traditional Use Studies), and may be willing to share their data if its security could be guaranteed. This is an issue that can be negotiated in the subsequent years of the present project.

## Results

### Report Review, Bibliography

Many reports were reviewed for survey coverage, of which about 330 reports were found to pertain to the study area see **Appendix 3** of this report. Another 225 reports are in a supplementary EndNote library. These were not reviewed in detail because they were out of the study area, or duplicates of those in the main library, or in the case of a few of which review has been deferred to next year. There will be more reports added to this list when the survey coverage of pipeline projects is reviewed.

### Surveyed Well Sites

The mapping of surveyed well sites had been anticipated to provide a large set of essentially random data, and had been recommended as a useful step by Mackie (1997a, 1997b). Report reviews found that 407 mapped well sites had been ground surveyed (Figure 2). An additional 72 well sites were reported but were not found in the database, and consequently could not be mapped. Further investigation may allow these to be mapped. This number of surveyed wells was much lower than anticipated (averaging only one and one-half wells per report). Often very large reports would deal with many dozens or even hundreds of well sites, but all but one or two would be "written off" from further concern at an overview level, on the basis of topographic map location or helicopter flyovers. In other cases, many had apparently been well surveyed on the

ground, but inadequate reporting did not allow the identification of which well sites were surveyed, which flown over, and which excluded from any field observation.

### *Increase in Archaeological Site Inventory*

The number of recorded archaeological sites has increased tremendously in the few years since Mackie did his overview study. At that time, 188 sites were known. This number has more than tripled since, with 606 sites now recorded (Figure 3). The increase has not been uniform in terms of density. The sites are very much concentrated in the south, and west of the study area. There are only five sites recorded in mapsheet 94I and just four in 94P, an area some 25,595 square kilometres giving a density of one site for every 284,300 ha. At least in terms of recent work, this lack of sites in these two mapsheets is not due to a lack of survey effort. Figure 2 shows that the number of well sites ground truthed in these mapsheets is about average across the area, and actually higher than in 94J and perhaps 94O, which have many more recorded sites. This is confirmed by the map of 731 well sites tagged as having requirements for archaeological fieldwork (Figure 4). Many well sites with archaeological requirements are found in these mapsheets 94I and 94P, and it may be that the low archaeological site density represents a real absence, rather than a datagap resulting from a lack of survey. This type of analysis will be carried out formally in the next stage of work, which will be to identify datagaps.

### *Additions to Well Sites, Pipelines*

The 731 well sites listed in the OGC database as requiring archaeological work, all dating from the past three years, is considerably more than the 479 found in reports. Only 115 of these 731 wells were identified as ground surveyed in reports. Many of the remainder may be surveyed in the last year, but their reports have not been submitted to the Archaeology Branch or OGC as yet. Others may have been among the many that may have been surveyed, but which could not be identified from reports or which were surveyed from the air or in deep snow and so did not meet our standard of intensive systematic survey. Yet others may be recent requirements for work not undertaken as yet, or for proposed wells that were deferred or cancelled in the planning stage. However, even with these caveats, it seems likely that the number of surveyed wells available for modelling could easily double or triple in the next year.

Relatively few sites appear to be found during well site surveys. In an initial query of the data (using uncorrected site locations for 94A and H), only 12 sites are within 150 m of surveyed well centres. Most sites appear to be recorded along linear exposures from roads, pipelines, and seismic lines.

A number of large 3D seismic programs were well reported and provided maps that allowed mapping of the surveyed areas (e.g., Farvacque 1998, Walde 1997). These have been digitized but the area surveyed has not been reported as yet.

Pipeline survey is a major activity of archaeologists in the NE and is expected to yield an excellent sample of surveyed area, since the distances are often great and the width of survey systematic. They also tend to crosscut a large number of landscape features. We began to digitize pipelines, but decided to concentrate on well sites for the time being. This was because well sites were points with existing georeferencing that could be identified through searches in a database, and did not require use of a GIS. The OGC plans to have GIS mapping done of all pipelines within the next year (Mike Wood, personal communication 2001). We decided that it would be a duplication of effort to map surveyed pipelines at this time. The new GIS layer and database will allow searching by pipeline name, at which time the archaeological data such as MR

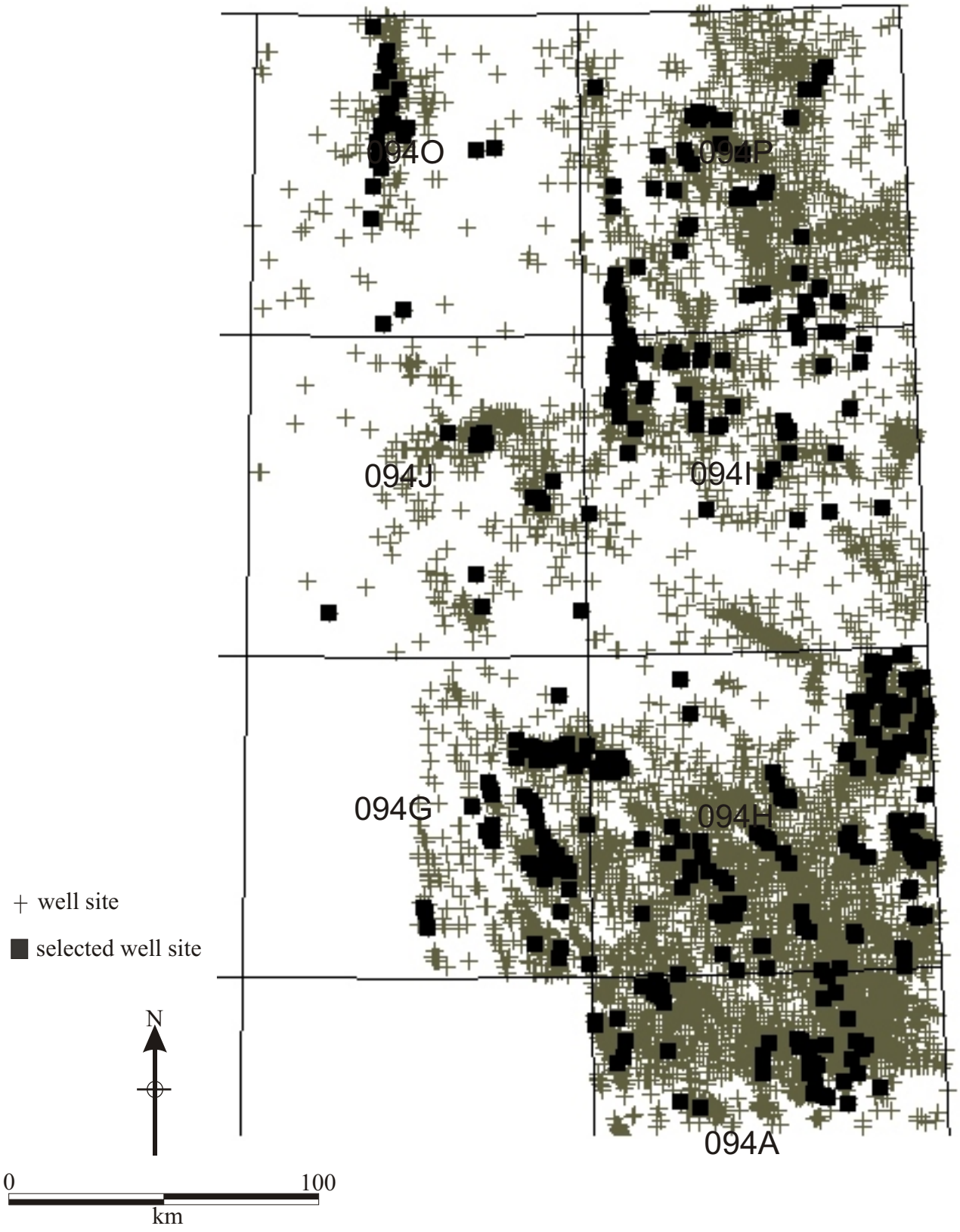


Figure 2. Well sites with archaeological ground survey.

number and consultant can be added to the database. The methods of identifying pipelines will be similar to that used for well sites.

The tracking of field survey conducted post- impact, for its bearing on modelling for CMTs, originally thought to be critical, was found to be of little use once limited site analysis had been undertaken. So few CMT sites (18) have been recorded in the study area that there will not be enough data to model with until this data gap is filled by AIS survey.

### *Forest Cutblock Survey*

Where an entire block was found to have been surveyed, a MR number notation was simply added to the GIS database. If only part of the cutblock was surveyed or, in the case of GIS erros where cutblocks were portrayed as lines instead of polygons, the surveyed portions were digitized in ArcView. All identified forestry cutblock survey is in the Fort St John Forest District, since the GIS layers for Fort Nelson have had problems that are still to be resolved. To date, 30 archaeologically surveyed cutblocks have been digitized, totalling 1648 ha. The 1648 ha represents about four times the amount of surveyed area compared to the surveyed well sites and the effort to find and document them was a fraction of the effort to identify surveyed well sites. The forestry cutblock reports have not been fully reviewed even for Ft St John, and the amount of surveyed area will increase greatly. This suggests that the forestry survey is more efficient for modelling than well site survey, but the well sites are probably superior even though their area is much smaller. This is because much of the locational data used in modelling which would result from the large cutblocks is redundant, because of an inherent characteristic of adjacent locations called "spatial autocorrelation" (Hageman and Bennet 2000). This means that adjacent locations will have virtually the same values for variables such as distance to a medium sized lake, compared with two locations drawn at random.

### *Site Location Corrections*

Checking and correcting site locations is, as discussed above, critical to the success of modelling. One hundred and fifty were not checked since they had been checked through the Archaeology Site Awareness Project. Spot checks of a few of these sites revealed some lingering errors, with errors up to 50 m noted. A few more spot checks will be done on the revised site locations next year.

The checking program for the remaining 456 sites found that most sites in the Archaeology Branch data had substantial errors compared to the original site forms, although most would not be obvious at the 1:50,000 scale mapping that the Archaeology Branch has traditionally used. Figure 5 shows the scope of corrections. About 70 sites needed no corrections, more than one-eighth of the total. Seven sites were not in Archaeology Branch databases and were added to ours, so these had no correction value. Over 100 sites were corrected by about 100 m, with a smooth distribution of error corrections either side of this mode. In excess of 250 m, the frequency drops off substantially, with few sites more than 500 m in error (although those few were all over 2000 m in error).

Because of the small size of most archaeological sites in the study area, and the small landforms they are often associated with, it is important to correct even 50 to 100 m errors to the TRIM map base on which the model will be based. One should keep in mind that all maps have errors or inconsistencies, and TRIM data for features such as small creeks can often be in error by 50 m. Our site corrections used relative location wherever possible: if a site was field mapped showing the site as 20m NW of the confluence of two creeks, 10 m south of a pipeline, we mapped the location

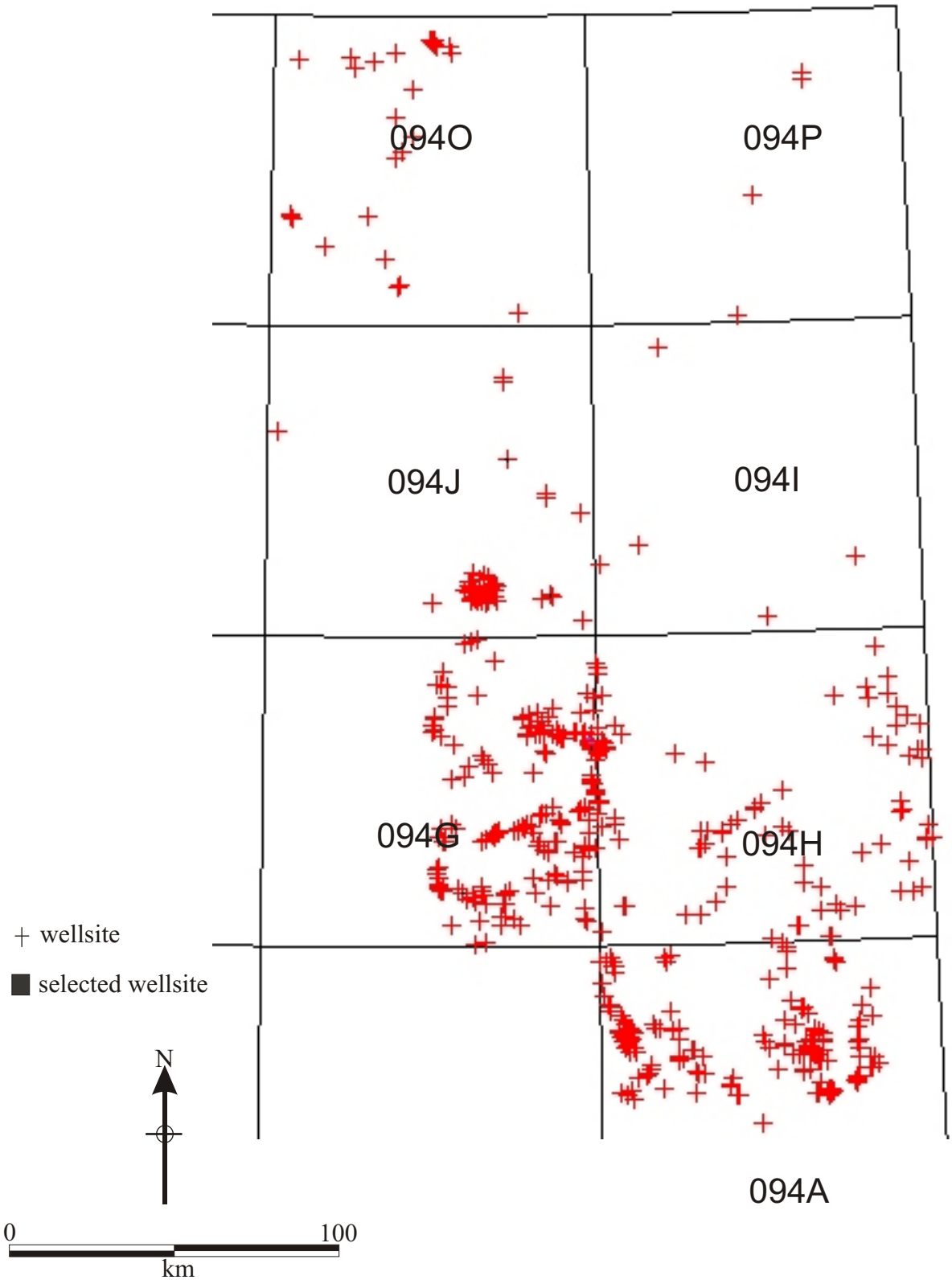


Figure 3. Recorded archaeological sites in the study area.

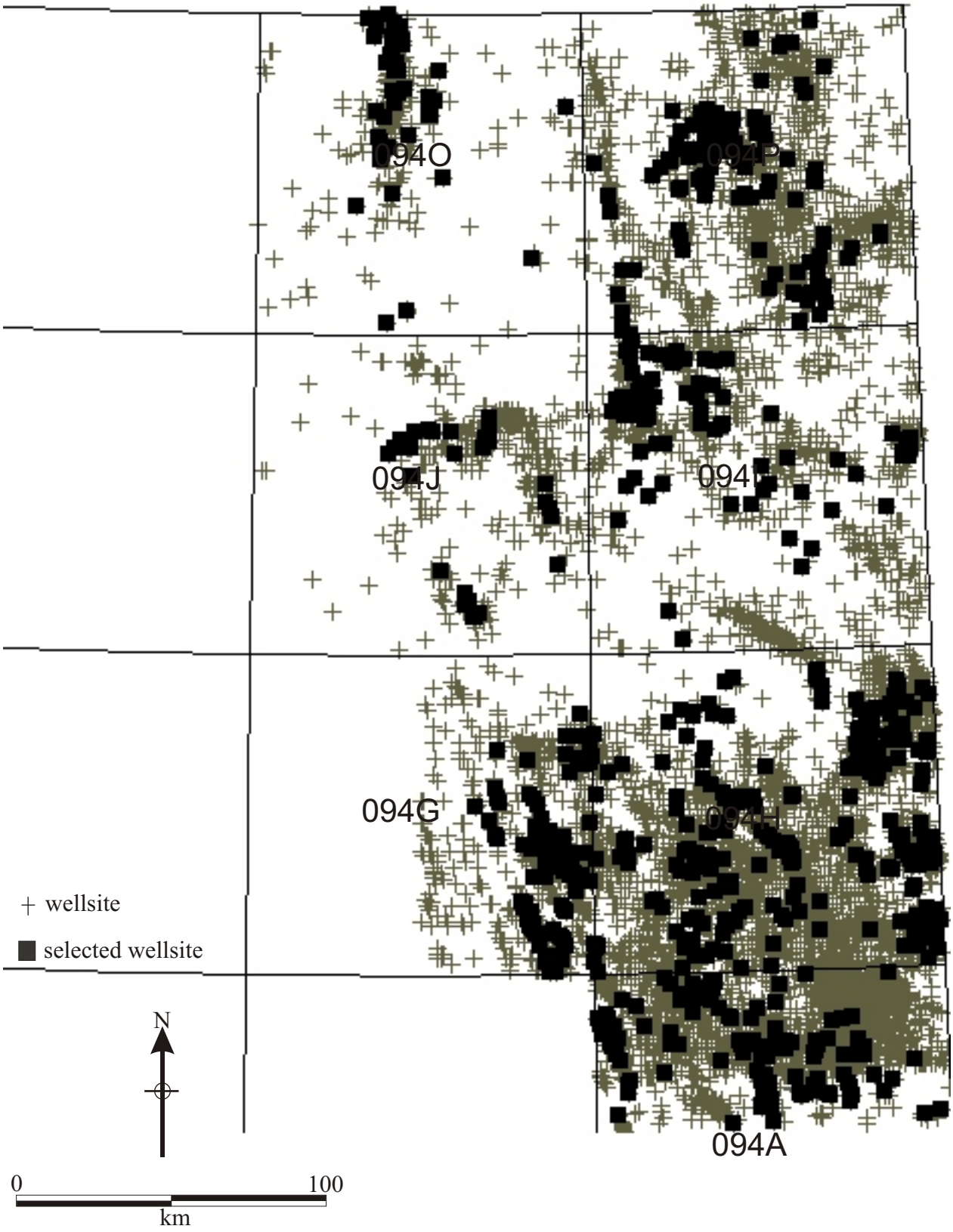


Figure 4. Wellsites with AIA, PFR, or Post-Impact requirements.

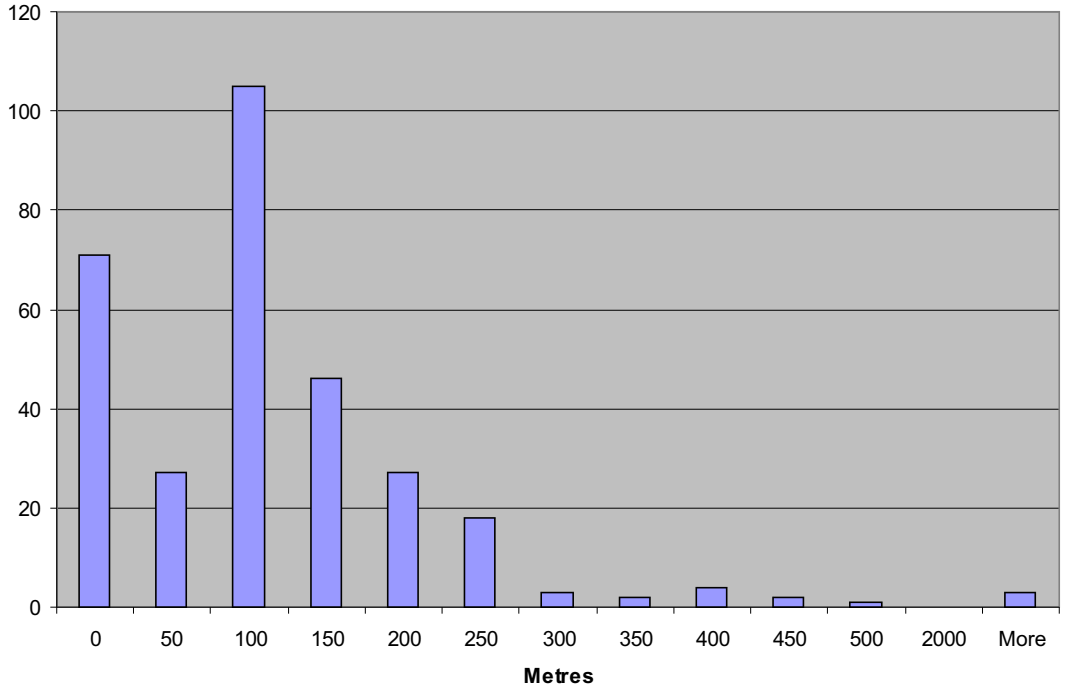


Figure 5. Frequency of site location corrections in metres..

relative to the display of these features in TRIM. In some cases, the site form might have a UTM location that was actually more accurate and precise in the real world, but would display incorrectly relative to TRIM features due to the error factors noted above. This situation was rare, and was only encountered when sites were mapped to legal survey points, or for sites recorded using GPS averaging in the last year, after selective availability was turned off by the US military. We anticipate that the situation of field survey becoming more accurate than available maps will become more common in the future as GPS units become widely used by archaeologists.

Only 20 sites were changed from points to polygons, where sites were more than 100 m long. In a few cases, two or three isolated finds or small clusters that had been grouped as one site were given individual points for each find, using the same Borden number identifier. This low number of polygons is partly the result of the nature of archaeological sites in the study area, but partly the result of the tradition of defining the sites by the archaeologists working in the area. Most recorded sites consist of a few lithic flakes scattered over a few square metres. However, in many cases, other small lithic scatters were found close by. In one case, two Borden numbers were assigned to two clusters only about 15 m apart, although on different landforms (small terraces above a river, separated by a few vertical metres). Nearby, the same archaeologist had recorded two different sites that were clusters separated by about 30 m, on the same ridge. In most areas of the province, these sites would have been 'lumped' and given the same Borden numbers, and the site dimensions would have been recorded as the aggregate distance from the edge of one cluster to the far edge of the next. Although this should be kept in mind when making comparisons of the archaeology of the region to other regions, it makes little difference to modelling.

Some 33 sites, about 5% of the total, could not be mapped due to inadequate site forms and site maps. There were no mapped landforms on site forms or accurate ties and often no 1:50,000 key map. UTMs were often missing or apparently accurate only to the nearest 100 m, or had major

obvious errors.

The Mackie site checks were found to be inadequate for 1:20,000 scale modelling. The site checks done by Mackie and his staff were "rough and ready" (Q. Mackie, personal communication 2000).

### *Results of Trails Research*

Forty-eight trails and trail fragments have been mapped to date, from 52 sources (see **Appendices 1 and 2**). It is important to recorde fragments because they have often been mapped at a large scale, allowing greater accuracy. Some trail fragments may turn out to be portions of larger trails that have been numbered separately. Some early maps indicate important additional information about archaeological correlates, such as camping sites along a trail.

The importance of trails research to archaeological modelling was made clear by the number of sites that were found to be recorded on or near trails in permit reports. The number of recorded sites near trails is likely greatly under-reported, in that anecdotal evidence suggests that trails have often not been recorded or reported by archaeologists conducting fieldwork.

Much more trail information is likely available in various TUS studies conducted in the study area, and at the Treaty 8 office.

## *Requests to Consultants Regarding Recording and Reporting Standards*

One small addition to report titles would make a huge difference to anyone searching for reports in a library. If 1:50,000 NTS or 1:20,000 TRIM mapsheet numbers were included in report titles (or, for projects spanning a large area, the NTS 1:250,000 mapsheet numbers) it would allow rapid and accurate software searches. Most titles do include a geographic name, but if it is a minor feature, a gazetteer is required to determine if a report is of interest. A more minor point is that the common report titles such as "Archaeological Inventory and Impact Assessment of Oil and Gas Developments..." defeats the limited width available on many library browse systems, and each title needs to be opened in a full details window to see the client or location of the project. If location could come early in titles, it would make for more efficient searching.

More serious is the fact that much survey has been undertaken in the Northeast that cannot contribute to modelling, since some consultants have only reported survey coverage for areas with positive results. These reports only list all wells or other developments considered, and provide a 'methodology' section that describes a range of evaluation methods used for the project, but not for specific well sites. This seems more common with well sites than with pipelines, so we ask that any ground-surveyed locations are specifically noted in reports. In the case of well sites, even a simple tabular listing of well sites where ground survey occurred, or flagging with an asterisk in a list of evaluated wells, would make this data useful.

For those not doing so already, archaeologists should be recording trails in the field and reporting them. A trail can indicate a higher archaeological potential for an area by increasing the potential to find other sites nearby. Correlations between trails and archaeological sites can be tested in GIS analysis. Archaeological sites along a trail may help confirm the aboriginal nature of the trail. ground-truthing the trail and logging its route with GPS can also provide accuracy and corroboration of archival or oral history evidence for trails. Trails suspected of being pre-contact or of historic interest should be recorded as archaeological sites themselves.

We also recommend the universal use of GPS in recording site locations, using an averaging function to achieve 10-20 m

accuracy whenever possible. The georeferencing co-ordinates being submitted on site forms to date have been almost universally in NAD 27, while use in the provincial standard, TRIM, requires NAD 83 data. While NAD 27 may be useful for 1:50,000 paper maps, it requires many more steps to translate to NAD 83, which provides opportunities for transcription errors or software calculation errors. We recommend that GPS units be set to NAD 83 datum for field use, and that sites be reported in NAD 83.

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