Updating Selected Digital Information Related to the Mackenzie Gas Project

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Prepared by:
Raymond Baksi

Executive Summary

The background and history of the various proposals since its inception in the early 1970's for a Mackenzie Valley gas pipeline in the Northwest Territories have been well documented. Within the most recent push of the last few years to get approval and construction started, the Proponent (Including the Producer and Aboriginal Pipeline Groups) have expressed a desire to have a pipeline in place and operating by 2010. As with many ongoing projects in the logistics and planning stages many changes have been made to streamline, simplify, and improve the overall venture. It is these changes and new release of data that was analysed for content relating to requirements of granular resources in terms of when and where, the quantity and quality, and the granular deposits projected to provide these resources.

The following data, image manipulation, and data analysis was conducted using a Geographical Information System (GIS) called Manifold GIS Universal Edition 6.5.

Preliminary Engineering Alignment Sheets dated February 1, 2005 reveal terrain units along the pipeline right-of-way. The 23 images containing this information were georegistered using a combination of matchline coordinates in degree-minute-second format and visual identification using images from the Mackenzie Gathering System COGOA Volume 4, given in UTM coordinates. The COGOA Volume 4 maps were georeferenced in the report titled "Summary of Granular Resource Requirements and Availability for the Mackenzie Valley Gas Pipeline Corridor" March 2005 by Raymond Baksi. With the help of the Canadian Spatial Reference System GSRUG's online computation, the degree-minute-second coordinates were converted to UTM coordinates and the Algorithmic method 'Affine' (Scale, shift, rotate) in Manifold was applied to georegister the images. Terrain units depicting sand and gravel within a corridor around the gathering pipelines were digitized into area polygons. One-hundred-seventy-eight (178) in total were identified and logged, 73 of those were unique values.

Pits, roads, and water sources were extracted from 1:50000 scale images of the route, georeferenced and provided by Ward Kilby at Cal Data Ltd. There were 126 distinct pits identified, 143 water sources, and 340 road or road segments connecting the pits, water sources, and the pipeline route.

Land and water project permit applications for each of the four (4) land claim settlement areas; Gwich'in, Inuvialuit, Sahtu, and Deh Cho Regions were reviewed for mention of borrow materials. A hyperlink document tree was created for each of these applications to guide those interested in borrow material directly to those sections.

Imperial Oil proposed several changes to the project on July 26, 2005. The Inuvik area facility would be relocated approximately 16 kilometres south down the pipeline from its initial location, and eight (8) pipeline line segments represent re-routes. These pipeline route segments totalled 77.3 kilometres and in all cases situated such that they shortened the total length of the pipeline.

Although certainly not new, the Mackenzie Highway route was digitized from the initial 1974 Public Works Canada Western Region report. Completion of construction and ongoing maintenance of this highway which runs parallel to the proposed pipeline will compete for the same granular resources.

The Proponent provided three large data sets, Pipeline Landform, Pipeline Sensitivity and Pipeline Vegetation prepared by AMEC Americas Limited. The pipeline landform images contained detailed polygons representing landform types. DIAND already has a set of data (from terrain units maps) representing sand and gravel landform features, so only the footprints of the 159 AMEC Pipeline landform images were digitized. If, at a later time, the data contained within these images is necessary it can easily be extracted from the georegistered files.

With the high transportation costs and limited construction season in the north there is a concern over the correct distribution of granular resources, relative to proposed linear projects in the Mackenzie Valley. A comparison between the proposed pipeline and the

Mackenzie Highway potential granular extraction haulage distance was prepared to better understand the competitive nature for these resources. Imaginary haulage buffers were created around the highway and the pipeline in one (1) kilometre increments, five (5) kilometres and 19 kilometres respectively. These buffers overlapped at various locations. This area of overlap is an area that will be "stressed" for granular resources. In total 95 different combinations of pipeline and highway overlaps were compared and percentage overlaps calculated.

Five (5) facility relocations and approximately 117 kilometres of the pipeline and gathering pipeline have been proposed to be re-routed by the project update (10800) on November 23, 2003. The reduction in the total number of compressor stations by one (1) and the re-routed pipeline will shorten the total length of the pipeline by roughly 26 kilometres. The number of primary borrow source sites cited for granular extraction has increased by one (1) to 68 and secondary sites have decreased by three (3) to 46. Despite the total reduction in granular sources, estimated granular resource requirements have increased by 1.6 Mm^3. This data was extracted from eight (8) useful images provided in the report submitted by Sandy Martin on behalf of Imperial Oil.

Data provided by the proponent group in digital shape file on the Mackenzie Gas project routing and facilities was directly compared to that which DIAND has already digitized from other various sources. Attribute data not in the DIAND database for features such as future facility site names was transferred to the DIAND data set. These files contained some new information that could be used to help build the Mackenzie Valley Granular Resources Management website for tracking the needs of the pipeline.

Samples of most of the data created during the digitization and analysis of the various sources are represented in appendices in this report. The following is a list of these layouts:

- Map 1 of 18: Gathering Pipeline Terrain Units Within MGP Corridor
- Map 2 of 15: Pits Within MGP Corridor
- Map 3 of 18: Roads Within MGP Corridor
- Map 4 of 18: Water Sources Within MGP Corridor

- Map 5 of 18: Proposed Facility Relocation and Pipeline Re-route - Imperial Oil July 26 meeting
- Map 6 of 18: Mackenzie Highway NWT, June 1974
- Map 7 of 18: AMEC Landform Map Footprints
- Map 8 of 18: 1 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers
- Map 9 of 18: 2 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers
- Map 10 of 18: 3 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers
- Map 11 of 18: 4 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers
- Map 12 of 18: 5 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers
- Map 13 of 18: Facility Relocation - MGP Update (10800)
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- Map 15 of 18: MGP Routing and Facilities (Proponent Digitized) - Pits & Proposed infrastructure
- Map 16 of 18: MGP Routing and Facilities (Proponent Digitized) - Facilities as Points
- Map 17 of 18: MGP Routing and Facilities (Proponent Digitized) - Block and Check Valves
- Map 18 of 18: MGP Routing and Facilities (Proponent Digitized) – Pipeline Route and Alternatives

These tabloid sized maps are useful to gauge what data is available, due to scale however, they are no where near as detailed as the digital files available. Digital versions of these images and their source data can be found on the enclosed digital media in Appendix L. Preferred method of viewing this information would be through the use of Manifold GIS. Alternatively all digitized data was converted to the generic ‘shape file’ format so that the data can be used by any GIS system. Along with the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. The shape files were uploaded to Ward Kilby at Cal Data Ltd. to be incorporated into the Mackenzie Valley Granular Resources Management website. Appropriate Metadata was created for all the digitized data meeting FDGC metadata standards and accompanies data on the enclosed digital media disk.

The borrow sites identified in the Environmental Impact Statement Volume 2 Project Description from August 2004 were compared with that of the newly released February 2006 update Mackenzie Gas Project EIS Additional Information for the Joint Review Panel Environmental Inputs and Outputs. This report also estimates the total increase in volume of required granular material at 1.6 million cubic meters (Mm^3) for a total of 6.5 Mm^3. There were a total of 14 borrow sites added and 22 removed from the official list of granular resources sites. This results in a total of eight (8) less granular sites under consideration for use. Additionally, some borrow sites initially considered primary sites have moved to become secondary sites and some secondary sites moved to primary consideration.

This ongoing project has seen many changes over the life of the proposal. As the proponent group moves ever closer to construction, the finer details of the project will be negotiated and finalized. As these decisions are made they should be incorporated into the knowledge base being built by DIAND. It can be reasonably expected that even after construction has commenced there will be further modifications. The Department of Indian Affairs and Northern Development in context of granular resources will likely want to stay abreast of the issues to continue its efforts in granular management.

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1 Introduction

The author was commissioned by the Department of Indian Affairs and Northern Development (DIAND), through Service Contract No. 20-05-0227, dated November 1, 2005, to undertake the work described herein. The Department Representative for the project was Robert J. Gowan, P.Geol., of the Land and Water Management Directorate, DIAND. This report and associated digital products fulfill the requirements of the contract.

The objective of this project is to monitor emerging information on the proposed Mackenzie Gas Project, and to summarize, digitize and update any such information that is related to the identification, evaluation, and use of granular resources within the Northwest Territories.

The scope of work, as outlined in the contract, included the following tasks:

1. Monitor the public registries for the environmental review process, obtain and review any additional or changed information on the Mackenzie Gas Project pertinent its granular resource requirements.

2. Provide ongoing analysis of potential value, timing and costs of obtaining digitized emerging information and establish, in consultation with the Departmental Representative, priorities and schedules for preparing and obtaining pertinent digital information.

3. Compile, process and summarize any new or amended project-specific information such as proposed alternative routings of the Mackenzie Gas Project pipeline and new or changed locations and sizes of other facilities that may affect the granular resource requirements of the project.

4. Prepare metadata consistent with current industry standards for all above data including source, compilation methods, etc.

5. Document, in tables, maps and a report, the work undertaken and results obtained as part of this project.

2 Background

The Mackenzie Valley Pipeline was first proposed to move natural gas to southern markets in the 1970's when significant reserves of natural gas were discovered in the Mackenzie River Delta. The pipeline was delayed by the Mackenzie Valley Pipeline Inquiry headed by Mr. Justice Thomas Berger. The inquiry placed a ten-year moratorium on the project to allow native groups to settle land claims and to conduct more environmental assessments.

After twenty-five years, with most land claims settled, a better understanding of the environmental impact of a pipeline, and an increased demand for natural gas, the stage has been set for the redevelopment of the Mackenzie Valley Pipeline and associated gas fields. The Producer Group and an Aboriginal Pipeline Group (The Proponent) initially planned on having the pipeline up and running by the year 2010. The project is currently undergoing environmental assessment (Joint Review Panel) and regulatory approval (NEB) processes.

The proposed pipeline will require the use of large amounts of granular resources. The management of granular resources is vital to ensure present reserves are used to their full potential and correctly allocated to prevent wasted resources. Proper management ensures that the needs of future developments can also be reasonably accommodated. Therefore it is important that those assessing the Mackenzie Gas Project have suitable information about granular resources in a pipeline corridor through the NWT (Baksi, 2005).

This project has created digital polygons, lines, and points of relevant information captured and displayed in image format by the proponent groups. It is anticipated that this digitized data will be incorporated into the web based Mackenzie Valley Granular Resource Management website under construction at Cal Data Ltd. These features will be independent entities with database properties and searchable entries.

3 The Mackenzie Gas Project

The Mackenzie Gas Project (MGP) is intended to develop known natural gas fields in the Mackenzie Delta, and deliver their products to southern markets. There are five major components to the Mackenzie Gas Project.

The five major components of the Mackenzie Gas Project involve developing:

- 1220 Km Mackenzie Valley pipeline as described in Imperial Oil Resources Ventures Limited Pipeline Overview. It will extend from Inuvik along the east side of the Mackenzie River to the Alberta border where it will connect to an extension of the NOVA Gas Transmission Ltd. system. The system is designed to provide 34 million m^3/d (1.2 Bcf/d) of gas with expansion ability to an average supply of 55 million m^3/d (1.9 Bcf/d) of gas sales to Alberta by adding an additional compression stations (IORVL A, 2004, Vol. 1).
- The three largest discovered onshore natural gas fields (the anchor fields) in the Mackenzie Delta (Taglu, Niglintgak and Parsons Lake)
- A gathering system comprising:
    - gathering pipelines to collect sweet natural gas and associated natural gasliquids (NGLs) from the gas fields and transport them to a facility located near Inuvik
    - gas processing and support facilities near Inuvik (the Inuvik area facility) to remove NGLs from the gas stream
    - a pipeline to transport NGLs from the Inuvik area facility to Norman Wells (NW), where it will tie into the existing Enbridge Pipelines Inc. pipeline (IORVL A, 2004, Vol. 1).

The main proponents and developers of the pipeline are: Imperial Oil Resources Ventures Limited, The Mackenzie Valley Aboriginal Pipeline Limited Partnership (APG), Shell Canada Limited (Shell Canada), ConocoPhillips Canada (North) Limited (ConocoPhillips), and Exxon Mobil Canada Properties (ExxonMobil) (IORVL A, 2004, Vol. 1).

The subsidiary of Imperial Oil Ltd., Imperial Oil Resources Ventures Ltd., will construct and operate the Mackenzie Gathering System and the Mackenzie Valley Pipeline on behalf of the other proponents. The Mackenzie Valley Aboriginal Pipeline Limited Partnership was formed by representatives of various Aboriginal groups to represent the ownership interest of the Aboriginal people of the NWT in the Mackenzie Valley pipeline project. Imperial Oil Resources Limited currently operates and holds the significant discovery licence for the Taglu gas field. ConocoPhillips, ExxonMobil and Shell Canada jointly hold the Parsons Lake gas field. Shell Canada holds and operates the Niglintgak gas field (IORVL C, 2004, Vol. 1).

The proposed location for the pipeline although within the Northwest Territories crosses lands that are subject to varied ownership and administration. The following is a list of lands where people will either be directly or indirectly affected by the pipeline as identified in Volume 1 of the Environmental Impact Summary by Imperial Oil Resources Ventures Limited:

- Inuvialuit Settlement Region
- Gwich'in Settlement Area
- Sahtu Settlement Area
- Deh Cho Region
- Yellowknife, Hay River and Enterprise, together referred to as the industrial and commercial centres of the Northwest Territories

While the Mackenzie Gas Pipeline extends into northern Alberta, the Alberta portion of the project is not included in the previously cited "Application for Approval" or "Environmental Impact Statement", and therefore is not included in this study either.

4 Available Digital Resource Information

Available digital data was obtained from the departmental representative, Robert J. Gowan, and the Public Registries for the environmental review process. The desired resources contained pertinent background information on the Mackenzie Gas Project, the lands that it crosses, and its granular resource requirements. The Joint Review Panel for the Mackenzie Gas project is an independent body that evaluates the potential impacts of the Mackenzie Pipeline project on the environment and the people in the project area. Their website (http://www.jointreviewpanel.ca/index.html) contains links under the public registry to many detailed documents created by the proponents for the project including the Environmental Impact Statement and supplemental filings. Much of the posted data can be downloaded from the website in .pdf form. Large data sets have been provided to the Manager of Land Programs for Indian and Northern Affairs Canada on compact disks.

There were nine main data sources used in producing the data described in this report. Most of this data was available as air photo mosaics with pipeline data overlaid. These images were once in a GIS database but provided to the Government in a format one step removed from a printed paper map. Their GIS information was exported, flattening the layers resulting in the need for this digitization in order to effectively use this data. Often it was necessary to assign theses images coordinates and projections before any information on them would be useful. Data of interest was then turned into areas lines or points to represent the different features.

As the Mackenzie Valley Pipeline project is ongoing and in constant development, there are regular releases of new or revised plans and data. As emerging information became available from the environmental review process, the data was compared with existing digital information and recommendations on digitization and future steps to be taken were prepared. Recommendations that were beyond the scope of this contract, or affected by time and budgetary constraints are listed in the Recommendations section of this report.

5 Study Technology and Methodology

Manifold GIS 6.5 Universal Edition was chosen as the preferred software program to complete the extraction and analysis of the data. Manifold GIS has been used successfully in the past for this type of work.

Some of the major tasks involved in processing the data were the same across the spread of information. All .pdf images needed to be exported to a raw .tif file formats to be worked with. The .tif files then all need to be positioned correctly in space. This was accomplished though a georegistration process. The method in order to achieve this registration depended on the document and the supporting information available. An alignment check with the images neighbour was conducted to help ensure accuracy. Any images out of alignment were reprocessed. Once the desired details were identified they were digitized into points, lines, or polygons through on screen digitization. Pertinent information describing the data digitized was entered into a database associated with each item using the 'Instant data' feature in Manifold. A data simplification process filtered the data to clean up duplicates and misaligned objects. All data was exported to the standard .shp file format for uploading to Cal Data Ltd. to build the Mackenzie Valley Granular Resources Management website, and on the enclosed digital media for those with access to a GIS software package. Appropriate metadata meeting FGDC standards was prepared for each feature type exported to .shp file. Finally a layout was created for printing purposes. These layouts are provided in a .pdf file format for those that do not have access to a GIS software package.

7 Digitize Gathering Terrain Units Containing Sand and Gravel

The Preliminary Engineering Alignment Sheets submitted on February 1, 2005 contain terrain unit information for the Mackenzie Gas Project pipeline corridor. Following recommendations in the report by Raymond Baksi titled “Digital Capture of Selected Mackenzie Gas Project Information Related to Granular Resources” of October 2005, and with guidance from the department representative, terrain units for the gathering area were digitized. In digitizing these units there is now a representation of terrain units available to DIAND for the entire length of the pipeline comprised of the gas pipeline and the gathering pipelines. The third set of data available from this source was images representing terrain units for the NGL Pipeline. Upon inspection of these images, they very closely represent the Gas Pipeline images and terrain units digitized under contract 20-05-0123. As such, a decision was made not to spend time and resources on analysis and much duplication of data.

The desired terrain units for digitization within the gathering areas of the pipeline project were those associated with the ability to provide sand and gravel of various qualities and quantities for possible use in construction.

7.1 Data Preparation

7.1.1 Getting Started

The 23 images representing the gathering pipeline, file “02 Gathering Pipelines” from the Mackenzie Gas Project Preliminary Engineering Alignment Sheets and Overview Maps report, were extracted and exported from their .pdf file format to .tif files. The gathering pipelines section of the preliminary engineering alignment sheets from January 2005 consisted of four (4) sections; Niglintgak Lateral, Parsons Lake Lateral, Storm Hill Lateral, and the Taglu Lateral.

The image identification numbers are contained within map series:

107-0010-131-XXX 002 REV A
107-0015-131-XXX 002 REV A,
107-0020-131-XXX 002 REV A, and
107-0025-131-XXX 002 REV A.

7.1.2 Georegistration

The .tif formatted images were then imported into Manifold where they were georegistered. Georegistering an image takes the page coordinates on the flat map and establishes a relationship between it and known real-world coordinates. Each image came with two matchlines that crossed the pipeline route. The given matchline coordinates were in the degree-minute-second format. Two (2) known points on a map is not sufficient for georegistration, a minimum of three points are required, and increasing the number of known coordinates increases accuracy. In order to obtain additional reference points it was necessary to visually identify land features with distinct points such as seismic survey line crossings, or lake inlets with distinct shapes from existing spatially referenced images with known coordinates. The images used for this purpose were the 18 images from Mackenzie Gathering System COGOA Volume 4, referenced in the report "Summary of Granular Resource Requirements and Availability for the Mackenzie Valley Gas Pipeline Corridor" March 2005 by Raymond Baksi. Depending on the land features available a bare minimum of 3 points comprising of the two (2) given matchline coordinates and at least one (1) visual identification were used. More points were used when possible to increase accuracy. Visual identification supplied UTM coordinates and the matchline, geographic coordinates. In order to use this combination of coordinates to georegister a single image it was necessary to use the Canadian Spatial Reference System GSRUG online computation utility (http://www.geod.nrcan.gc.ca/apps/gsrug/index_e.php) to convert the geographic degree-minute-second coordinates to UTM coordinates. Once all coordinates were in a single format they were used to georegister the image. Careful attention was given when completing this step in order to maintain co-ordinates representing only one UTM zone at a time. The algorithmic method applied for the georegistration was the 'Affine' (scale,

shift, rotate) function. This method is algorithmically equivalent to using ‘Numeric’ with an Order of 1. The maps covered 3 UTM zones, UTM 8 through 10, and used North American 1983 (Canada) Datum. Each of these images now correctly oriented on the earth were saved within their own Manifold project (.map).

7.1.3 Exporting

In order to check alignment quality of the individually georeferenced images each .map file was exported to .ecw and .xml file formats and subsequently imported into a single Manifold file where the images were strung together into a single section. These were displayed using UTM 8 projection and NAD 1983 datum. In order to get around the file types inability to handle four (4) channel data (RGBa) and therefore no ability to store information on transparent pixels resulting in black box surrounding an image, the opacity was reduced from 100% to a level where all underlying objects were visible. The reason for exporting to .ecw and importing to a single file as an alternative to importing each image as a component (i.e. importing each manifold file to combine images) is simply space saving. The string of .ecw files produces a far smaller file size than combining all the manifold components.

7.1.4 Adjustments

Any out of sequence or misaligned images were evaluated and re-georegistered to better align objects.

7.1.5 Digitization

The objective of digitization from these particular images was to capture the terrain units associated with granular resources, namely, sand and gravel. Due to the large variation in terrain units several digitization rules were set up to guide the process. These digitization rules follow those established for the main pipeline terrain units described in contract 20-

05-0123 “Digital Capture of Selected Mackenzie Gas Project Information Related to Granular Resources October 2005”, were as follows:

1. Digitize terrain units that contain sand and gravel
2. Do not digitize terrain units that start with ‘f’, silt and clay, regardless of whether or not there is some combination of sand and/or gravel complex associated with the feature
3. Digitize a ‘v’, veneer, of non sand and/or gravel, with sand and/or gravel underlying this veneer, as long as ‘f’ do not precede the sand and/or gravel in the terrain classification code (greater quantity by volume)
4. Digitize terrain units starting with ‘r’, rubble, where sand and/or gravel is underlying this rubble, as long as ‘f’ do not precede the sand and/or gravel in the terrain classification code (greater quantity by volume)
5. Digitize straight bedrock

A copy of the Terrain Unit Labels can be found in Appendix A (IORVL, 2005).

The terrain units were digitized as could best be deciphered. Each digitized polygon had a database entry associated with it. Recorded for each terrain unit polygon were column headings:

- Found on IORVL Map #
- REV
- Terrain Type
- Digitized By
- Digitized Date
- Source
- Contract #
- Area (Intrinsic value - automatically calculated)

Figure 1 below displays a sample of these terrain unit data tables.

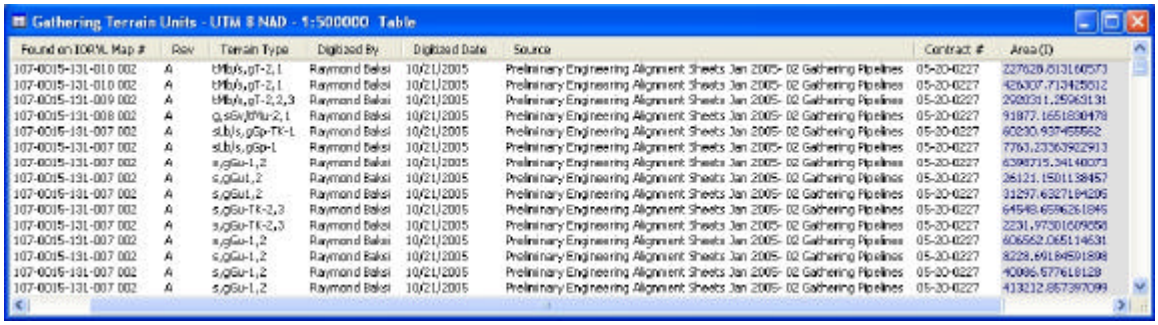

Figure 1 – Sample of the digitized PEA sheets Terrain Units data table.

7.1.6 Compiling Terrain Units

At this point for simplicity, all the digital terrain units were combined into one layer with one table. The resulting file entitled ‘Gathering Terrain Units.map’ was formatted to UTM 8 NAD 83 standards. Appropriate metadata was created for the terrain unit data meeting FDGC metadata standards and accompanies the data files on the enclosed digital media.

7.1.7 Data Simplification

Due to the nature of the overlaps in the images there are many duplicated polygons or partially overlapping polygons. In order to eliminate duplicates and eliminate overlaps as much as possible the following rules were created and implemented to simplify the data:

1. Remove incomplete polygons where whole polygons of the same terrain type exist
2. Leave intact the polygon that follows a sequence, removing the duplicate polygon that does not follow a sequence
3. Keep terrain unit polygon that connects properly to adjacent units
4. Keep whole completed polygon, removing overlapping partial polygon
5. If polygon is incomplete and stretches over multiple images, where there is no single whole polygon available, each unit is cropped to match a clean line with the edge of the page resulting in multiple polygons of the same terrain type adjacent to one another. Units are not ‘unioned’ or ‘dissolved’ in order to maintain their correct database details.

Both the simplified and non simplified digital resources are provided in the Manifold file for alternate interpretation methods.

7.2 Data

One-hundred-seventy-eight (178) terrain unit polygons were digitized and logged. Of these there were 73 unique values. All of the data created was also converted to the generic ‘shape file’ format so that the data can be used by any GIS system. Along with

the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. These files were uploaded to Ward Kilby at Cal Data Ltd. to be put onto the Mackenzie Valley Granular Resources Management website that is under development.

7.3 Layout

A tabloid sized layout was created displaying coordinates with a graticule. The graticule layout can be found in Appendix B. This file is included on the accompanying digital media in .pdf format for printing on tabloid sized paper. All of the tabloid size layouts in this report, as a result of the limited detail resulting from the necessary scale, should be used for reference only to what is available digitally on the accompanying digital media.

8 Digitize Pits, Roads, and Water Sources within the Mackenzie Pipeline corridor – 1:50000 Images

Thirty-one (31) images in .ecw format were provided by Ward Kilby of Cal Data Ltd. These images contain information not yet digitized for use on the Mackenzie Valley Granular Resource Management website. A decision was made to make digital representations of the granular pits, roads, and water sources that are available for the proposed Mackenzie Gas Pipeline from this source.

8.1 Data Preparation

8.1.1 Getting Started

The images provided that encompass the pipeline route were pre georeferenced and 'cut outs' of a larger image collage. They were represented in UTM zone 10 and 1983 North American Datum. The image identification numbers range from 107-0000-011-479 001 to 107-0000-011-479 031

8.1.2 Georegistration

Only projection and datum data needed to be associated with each image, no georegistaration was necessary as the images were already positioned correctly. These images were strung together in a Manifold project file for data extraction.

8.1.3 Digitization

Initially to get through the digitization process as efficiently as possible, the digitization process encompassed all three desired components, pits, roads, and water sources, on a single layer. This was made possible through Manifold's flexibility in allowing area and point data to be represented on the same layer. In creating this layer the data table was set up to accommodate all attribute data for each data type. As an example, this table contained headings for 'Pit name', 'Road name', and 'Water Source name'. During the

digitization process, data relevant to that specific line or polygon was entered in the correct corresponding row and column using the 'Instant Data' feature. These specific headings were:

- Pit Name
- Road Name, or
- Water Source Name

Common Record columns between all data types were as follows:

- Digitzed Date
- Digitized By
- Source Georeferenced by
- Map Source
- REV
- Description
- Source

Figure 2 below displays a sample of the data table.

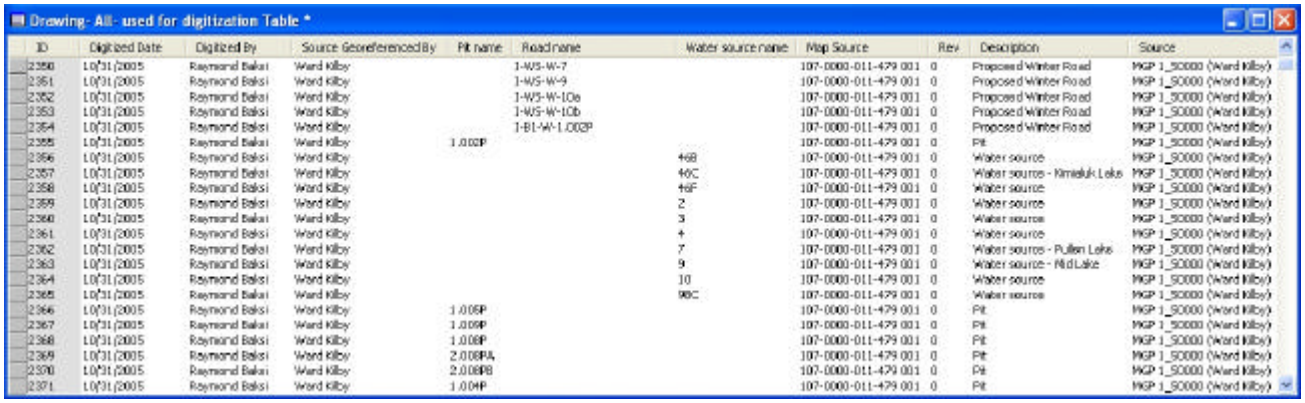

Figure 2 – Initial digitization table for MGP 1_50000 dataset

The resulting Manifold file entitled "MGP 1_50000 – pits roads water access.map" is included on the digital media and contains all the layers described above and layouts described below.

8.1.4 Data Simplification

With all the data digitized and attribute data entered using a simple process of sorting by feature type, each type of data was extracted to its own layer. This resulted in three separate files, Pits, Roads, and Water source.

8.2 Data

Pits are represented by 126 distinct polygons. There are 143 water sources. Three-hundred-forty (340) road or road segments are represented as lines. All of the data created was also converted to generic ‘shape file’ format so that the data can be used by any GIS system. Along with the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. These files were uploaded to Wark Kilby at Cal Data Ltd. for use on the Mackenzie Valley Granular Resource Management website that is under development. Appropriate metadata was created for each data layer meeting FDGC metadata standards and accompanies the data files on the enclosed digital media.

8.3 Layout

This data resulted in three (3) tabloid sized data layouts displaying coordinates in graticule. As with all tabloid layouts in this report, as a result of the limited detail resulting from the necessary scale, these layouts should be used for reference to what is available digitally on the accompanying digital media. The graticule layout for each of Pits, Roads, and Water Sources available in the Mackenzie Valley Pipeline corridor can be found in Appendix C. This layout file is included on the accompanying digital media disk in .pdf format for printing on tabloid sized paper.

9 Navigating Project Permit Applications

Each of the four (4) land claim areas, Gwich'in Settlement Region, Inuvialuit Settlement Region, Sahtu Settlement Area, and the Decho Region, have their own land and water applications for both private and Crown lands. These applications can be found on the Northern Gas Project Secretariat web site at the World Wide Web address <http://www.ngps.nt.ca/ppa/>. The highest priority areas for DIAND are that of the Crown land applications with dealings in granular/borrow materials.

Appendix D contains a list of stepped hyperlinks and very brief description of each sites content as a method of navigating the project permit applications for borrow site information. This was designed to minimize the time for finding data by eliminating potential wasted time digging through pages of irrelevant material. These links in some cases lead to very detailed information for each borrow site including photographs of the borrow sites. These .pdf files should be incorporated into the Mackenzie Valley Granular Resource Management website as reports for each borrow source.

10 Imperial Oil Proposed Changes – July 26, 2005 Meeting

Imperial Oil released several changes to facility sites and the pipeline route on five (5) .pdf images from a meeting on July 26, 2005. These images are numbered 107-0000_011_520_001_REVC, 107-0000_011_520_002_REVC, 107-0000_011_520_003_REVC, and 107-0000_011_520_005_REVC. These images contain pipeline re-route and facility relocation information.

10.1 Data Preparation

10.1.1 Getting Started

Each of the 1:60000 scale images were exported to .tif files from .pdf for use by manifold for georegistration.

10.1.2 Georegistration

These files were somewhat more difficult to align correctly than previous images as they represented a large quantity of land resulting in the need to use multiple existing images to identify and place enough control points for proper georegistration. Image 107-0000_011_520_001_REVC was simple enough as it was a revised version of Map 001_of_018 from the Application for Approval of the Mackenzie Gathering System COGOA Volume 4 Gathering Pipelines. Image 107-0000_011_520_002_REVC required Map_015_of_018 from the same gathering pipeline data set and also maps Map_001_of_119 and Map_002_of_119 from CPCN Volume 5 maps of the Mackenzie Valley Pipeline. The third image, 107-000_011_520_003_REVC required using images Map_010_of_119, Map_011_of_119, Map_012_of_119, and Map_013_of_119 form Volume 5 of the CPCN section. Finally, the last image 107-0000_011_520_005_REVC used image maps from further down the pipeline, Map_076_of_119, Map_077_of__119, and Map_078_of_119. The algorithmic method applied for the georegistration was the ‘Affine’ (scale, shift, rotate) function. This method is algorithmically equivalent to using ‘Numeric’ with an Order of 1. The maps covered 3 UTM zones, UTM 8 through 10, and

used North American 1983 (Canada) Datum. Each of these images now correctly oriented on the earth were saved within their own Manifold project (.map).

10.1.3 Digitization

From these new images pipeline re-route, facility relocation as area and point was digitized. Corresponding data tables were created, as described in above sections. Appropriate attribute data was entered during the digitization process.

10.1.4 Compiling Data

Once all objects were digitized each data type was combined into a single Manifold file named ‘Digitized Data - Imperial Oil Changes July 26.map’. The combined data was converted to a uniform UTM 8 NAD 1983 datum. All of the data created was also converted to the generic ‘shape file’ format so that the data can be used by any GIS system. Along with the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. These files were uploaded to Ward Kilby at Cal Data Ltd. to be put onto the Mackenzie Valley Granular Resources Management website that is under development. Appropriate metadata was created for each data layer meeting FDGC metadata standards and accompanies the data files on the enclosed digital media.

10.2 Data

There is a single proposed facility re-location in this data set, that of the Inuvik area facility. The facility relocation is approximately 16 Kilometres to the south down the pipeline route from the October 2004 site location. Eight (8) pipeline segments identified as pipeline route changes, totalling 77.3 Kilometres were also digitized. In all cases the re-routed pipeline straightens the route thereby shortening the total length.

10.3 Layout

Unlike other layouts created in the past, this layout consists of more than one (1) data layer. Both the facility relocation and the pipeline re-route data are displayed on this layout. The small quantity of data to display simply warranted the dual display option. Each of the four (4) images used for digitization are included and each section has its own map insert to give a better understanding of the changes. This tabloid sized layout displays coordinates using a graticule. This layout can be found in Appendix E. This file is included on the accompanying digital media in .pdf format for printing on tabloid sized paper. As with all tabloid layouts in this report, as a result of the limited detail resulting from the necessary scale, this layout should be used for reference to what is available digitally on the accompanying digital media.

11 Mackenzie Highway NWT, June 1974

The components of interest in The Mackenzie Highway N.W.T., Route Maps June 1974 report by Public Works Canada (PWC) Western Region are the status of the highway, the mile posts, and the chainage adjustments. This report is found on the Northern Granular Resources Bibliography (NGRB) database at the following web link <http://www.aina.ucalgary.ca/ngr/>.

11.1 Data Preparation

11.1.1 Getting Started

The above mentioned PWC report contains maps that will be used to extract the above noted data.

11.1.2 Georegistration

Ward Kilby of CalData had already geopositioned the map pages contained within this report. They were provided in UTM 10 NAD 83 .tif and .tif world files. The maps were strung together and used as a backdrop to digitize map components.

11.1.3 Digitization

Three components were digitized from these images, The Mackenzie Highway Route, Mile Posts, and Chainage Adjustments. The highway route was broken down into three (3) types: Highway (constructed), Highway (under construction), and Highway (proposed). This is the state of the highway as it was in 1974. To compliment the highway route, the mile markers and the chainage adjustments were digitized as point features. All data had appropriate supporting tables associated with them containing relevant feature data. Figure 3 displays an example of the attribute data recorded for the 1974 Mackenzie Highway mile post chainage adjustments.

MP chainage adjustment Table *

ID	MP Chainage adjustment (Miles)	Source	Digitized Date	Digitized By	Source Georeferenced By
150	347.0A/344.6B	PWC - Mackenzie Highway June 1974 Map 4 of 9	11/9/2005	Raymond Baksi	Ward Kilby
151	545.1A/547.7B	PWC - Mackenzie Highway June 1974 Map 5 of 9	11/9/2005	Raymond Baksi	Ward Kilby
152	629.6A/632.0B	PWC - Mackenzie Highway June 1974 Map 6 of 9	11/9/2005	Raymond Baksi	Ward Kilby
153	732.0A/734.4B	PWC - Mackenzie Highway June 1974 Map 7 of 9	11/9/2005	Raymond Baksi	Ward Kilby
154	934.7A?/938.9B?	PWC - Mackenzie Highway June 1974 Map 8 of 9	11/9/2005	Raymond Baksi	Ward Kilby

Figure 3 – Mackenzie Highway 1974 mile post chainage adjustment attribute table

11.1.4 Compiling Data

The highway line segments, mile posts, and chainage adjustment markers are in UTM 10 NAD 1983. This data is on the digital media accompanying this report and titled 'Mackenzie Highway NWT, June 1974 V3'.

11.2 Data

The length of the highway, when adding up the length of each line segment, is 1560.49 kilometers. This includes constructed, under construction, and proposed to be constructed segments. In this length there were five (5) chainage adjustments along the route. All of the data created was converted to the generic 'shape file' format so that the data can be used by any GIS system. Along with the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. These files were uploaded to Ward Kilby at Cal Data Ltd. to be put onto the Mackenzie Valley Granular Resources Management website that is under development. Metadata was created meeting FGDC standards.

11.3 Layout

A tabloid size layout was prepared for this report and is available on the accompanying digital media in .pdf file format for printing without Manifold GIS. It is also available in Appendix F of this report. The layout provides a representation of the digital data available. This single layout displays the highway in segments, mile posts, and chainage adjustments overlaid on the images they were digitized from. The pipeline route is included for a general reference for location relations and to demonstrate a potential conflict in granular resource needs. The pipeline route displayed is a combination of the pipeline identified by Cal Data and Leo Lau (student report) and includes changes up to and including July 26, 2005 modifications from Imperial Oil.

12 AMEC Pipeline Landform Maps - February 2005

The AMEC Pipeline Landform maps contain polygons drawn on a base image of aerial photographs representing landform types. Landform units are classified based upon the second version of the Terrain Classification System for British Columbia and are represented in labels using the following encryption, GM1 se1 / GM2 se2 : P pmod, where:

GM1	=	Genetic Material – describes the origin of the uppermost surficial material
se1	=	Surface expression 1 – describes the form or thickness of uppermost sufficial material
GM2	=	Genetic Material 2 – describes the origin of underlying material
Se2	=	Surface expression 2 – describes the form of the underlying material and the topographic expression of the map unit
P	=	Process – descries geomorphic processes that are modifying surficial materials or landforms
Pmod	=	Process modifier – provides additional information about the geomorphic process

(AMEC Americas Ltd, 2005)

On this occasion only the 'footprint' these images occupy will be digitized due to time and budgetary constraints. Also, as a result of already having a set of terrain units digitized from the Engineering Alignment sheets, there is less urgency for these particular polygons.

12.1 Data Preparation

12.1.1 Getting started

The AMEC landform images representing the Northwest Territories were provided in three (3) parts. Landform Maps Part 2 Feb 05 through Landform Maps Part 4 Feb 05. These large multi page .pdf files were separated into 159 separate .pdf files, each one a single map page. The 159 landform atlas images were exported from their .pdf file to .tif file format and imported into Manifold GIS for georegistering.

12.1.2 Georegistration

Each image had a convenient UTM co-ordinate grid for use. A minimum of four (4) reference point were identified and entered. The algorithmic method applied for the georegistration was the ‘Affine’ (scale, shift, rotate) function. This method is algorithmically equivalent to using ‘Numeric’ with an Order of 1. The maps covered 3 UTM zones, UTM 8 through 10, and used North American 1983 (Canada) Datum. Each of these images now correctly oriented on the earth were saved within their own Manifold project (.map).

12.1.3 Digitization

In order to facilitate smooth digitization of the footprints and to ensure proper alignment each image was exported to .ecw and then imported into a single Manifold project file. Due to the number of images even using the .ecw format resulted in a large file (~500 Mb). Three strings of images were put together each representing a singe UTM zone. Footprints were digitized from the corners of each map. Attribute data was incorporated into each footprint for identification of each source map if terrain details were desired in the future. Attribute tables resemble those shown previously in this document.

12.1.4 Compiling Data

Once the rectangular polygon footprints on each of the three strings of images were created they were combined into a single layer and formatted to UTM 9 NAD 83. The file that contains these footprints is enclosed on digital media and is titled ‘Combined Landform maps.map’.

12.2 Data

All 159 footprint polygons were exported to shape files and the georeferenced images were upload to Ward Kilby for the Mackenzie Valley Granular website. Metadata was created meeting FGDC standards.

12.3 Layout

A tabloid size layout of these footprints was prepared for this report and is available on the accompanying digital media in .pdf file format for printing without Manifold GIS. It is also available in Appendix G of this report. The layout provides a representation of the digital data available.

13 Mackenzie Valley Pipeline and Mackenzie Highway Haulage Buffer Overlaps

The following analysis was conducted to determine what percentage of the proposed pipelines corridor buffer overlaps the Mackenzie Highway corridor buffer and vice versa. Following are the steps taken and files used in Manifold GIS to generate the numbers required.

The data sources used to determine the buffer sizes are as follows:

- MGP 1_50000 Pits and MGP 1_50000 Water sources identified in section 8 above
- Pipeline Re-route July 26, 2005 identified in section 10 above
- Mackenzie Highway c. 1974 identified in section 11 above
- Pipeline route Caldata/leo - identified in contract 20-04-0238
- MacVal Granular sources Final.map identified in contract 20-04-0138
- Proposed Inuvik Tuktoyaktuk Highway identified initially from a student co-operative work term project by Raymond Baksi, and sourced from a Manifold GIS file from contract 20-04-0238

These source files were determined to be important in determining where the buffers will be and how large they will be.

13.1 Data Preparation

13.1.1 Compiling Data

The first objective was to combine all similar data so that different buffer radii could be created to encompass the granular sites identified for each project. The second step involved a comparison of overlapping buffers that encompass granular sources for various haulage distances.

In order to create a complete pipeline corridor of any width, all available pipeline route options would be needed. A combination of the pipeline routes identified by Cal Data in conjunction with Leo Lau available in files under contract 20-04-0238 were combined into the same layer as that of the proposed changes from a July 26, 2005 meeting

supplied by Imperial Oil. This is the base that would be used to create various size hauling distance buffers for the pipeline project.

A similar base was needed for the Mackenzie Highway. This was supplied through the Mackenzie Highway digitized in above section number 11, from the 1974 Public Works Canada route maps. In trying to analyze the granular needs of the northern projects rather than simply the needs of the pipeline, the proposed route for the Inuvik Tuktoyaktuk highway was included in this layer. This is the base layer that was used to create haulage buffers for road infrastructure.

It became evident by reading through various reports and looking at the data that the optimal haulage distance, or at least the maximum distance realistically considered and researched for these three projects was that of 5 Km for the highways and 19 km for the pipeline. Using these numbers as maximum buffer radii distances resulted in each granular source identified for a specific project being absorbed into a buffer and thereby part of the analysis of competing resources.

The granular sources and the water sources were not combined into a single layer; rather they were both simply added to the map image separately. The granular resources identified for the Inuvik Tuktoyaktuk road were not included because this is an analysis of the competing resource overlap for the pits identified in the pipeline project. That being said, the Inuvik Tuktoyaktuk road buffer is important as this region would also be under the “stresses” created by the two other projects.

Five (5), one (1) kilometre increment buffers were created around the combined Mackenzie and Inuvik Tuktoyaktuk Highway and placed into a dedicated folder titled ‘Highway Buffers’. Similarly one (1) kilometre increment buffers were created around the pipeline line segments. In total 19 were created and placed into a folder titled ‘Pipeline buffers’. All of the buffers, the pipeline, roads, granular resources and water source were combined into a single map. An analysis was conducted to ensure that each granular source and water source was contained within at least the largest buffer area.

The 19 km pipeline buffer for the pipeline and 5 Km buffer for the highway was the perfect size for this.

The next step in completing this analysis consists of a systematic method of comparing one buffer with the next. Simply put, starting with the 1 Km road buffer and comparing it with each of the 19 pipeline buffers. The comparison used is called 'clip with intersect'. Clip with intersect function uses "one or more areas to 'clip' other objects, leaving only those parts of the other objects that lie within the areas (Intersect)…" (System 6.5 Enterprise Edition Sp1 Build 408). In other words overlapping areas are 'cut out' and saved, areas not overlapping are removed from the equation. For example, two areas that overlap more will have a greater area of intersection and thereby retain a larger surface area after the function is run, than two objects with little overlap. Completing a full sequence for the one (1) km highway buffer and the 19 pipeline buffers resulted in 19 separate intersection results. Each of these was placed into a file titled 'Highway buffer 1 Km pipeline buffer overlaps'. This procedure was carried out for each of the pipeline buffers resulting in a total of 95 buffer intersection results with each set placed in appropriately named corresponding folders.

Each of these buffer clipped images has many polygons as a result of the twisting nature of the initial buffers. Each of these polygons is a small part of the total overlap. To understand the total surface area of overlap for a specific combination of buffer sizes the small polygons of each clipped file need to be added together. Manifold GIS has a function that does this, it is a function called 'uniform'. This function was run on each of the 95 clipped images. This created one entry for all the bits and pieces of the clipped overlapped buffer resulting in a single numeric area figure. The intrinsic area field in the data table of each clipped file now represents the area of overlap for that specific combination of buffer overlaps. One final step was necessary for comparison of the overlapping areas and that was to combine all clipped buffers into a single image, recombining the files to recreate the buffers. For example, the file named 'Combined HWY B 1 Km pipeline overlaps' contains a copy of each of the 19 images under that folder. The image looks almost like the whole undisturbed buffer but it now has

individual entries for each combination, allowing for easy calculations. It was important when recombining these buffers to add the largest (19 Km buffer overlap) first and move to the smallest. In following this sequence the smaller layers are not blocked, thereby allowing all layers to be visible.

The following itemized list attempt to describe the above procedure in a condensed more transparent manner.

1. Combine data that will represent the highway
2. Combine data that will represent the pipeline
3. Insert various features such as pits and water sources
4. Create separate buffers in increments of 1Km surrounding the highway and the pipeline until all supporting features (pits, etc.) are encompassed by a given buffer size
5. Create file: 'Highway buffer 1Km pipeline buffer overlaps'
6. From map view with all buffer components Select: 01 Km HWY Buffer Clip with (Intersect), 1 km pipeline buffer (proceed with all 19 pipeline buffers)
7. Place all 19 images of clipped overlapped buffers into above mentioned file 'Highway buffer 1Km pipeline buffer overlaps'
8. Go through each clipped image and run the union function. This will create one entry for all bits and pieces of the clipped overlapped buffer resulting in a single area numeric figure.
9. Combine all clipped buffers into a single image called 'Combined HWY B 1 Km pipeline overlaps (the image looks almost like the whole undisturbed buffer but it now has individual entries for each combination, allowing for easy calculations).
10. Repeat above steps for HWY buffer 2 km through 5 km

Calculations were performed in Microsoft Excel using the tabular data created by the above process. Below are the summary matrices. The first table (Table 1) is the actual area of overlaps of the various pipeline and highway buffers in square kilometres. These numbers were calculated by manifold as an intrinsic area field when the clipped segments were combined, step nine (9) above. The raw data tables, five in all, used to compose the buffer overlap table are in Appendix H. These tables also show the conversion from square meters to square kilometres and the calculations to fill in the matrices below (Table 2 and 3). The area conversion was done simply to help one gauge the size of areas under consideration. Following the pipeline overlap raw data tables are tables containing areas for the whole unclipped buffers for both the pipelines and the highways. These also

have been converted to square kilometres. The second and third table below (Table 2 and Table 3 respectively) calculate the % of pipeline buffer with buffer overlap, and % of highway buffer with buffer overlap, respectively.

Area of Buffers Overlaping in Km ^{2}					
	Highway Buffer (km)				
Pipeline Buffer (Km)	1	2	3	4	5
1	707.85	1079.37	1287.19	1419.93	1540.24
2	1083.16	1985.63	2482.03	2805.92	3050.87
3	1288.89	2501.61	3514.17	4114.21	4511.68
4	1430.05	2835.26	4151.34	5231.06	5886.35
5	1558.93	3094.28	4570.74	5941.17	7062.68
6	1757.72	3306.95	4899.85	6419.86	7827.41
7	1757.72	3488.86	5167.77	6798.30	8354.65
8	1826.03	3627.31	5395.34	7111.54	8775.91
9	1878.67	3739.85	5578.15	7380.08	9129.57
10	1923.89	3837.74	5732.50	7602.16	9449.50
11	1970.67	3928.12	5870.76	7808.22	9722.35
12	2015.19	4015.28	6014.98	7999.91	9967.48
13	2108.28	4112.44	6157.02	8186.14	10208.21
14	2108.28	4208.79	6296.48	8377.36	10867.47
15	2165.11	4304.69	6442.04	8563.89	10867.47
16	2208.26	4409.63	6585.23	8740.58	10867.47
17	2255.73	4501.67	6723.10	8905.55	11058.43
18	2306.69	4583.53	6839.36	9188.13	11235.89
19	2342.40	4660.19	6938.25	9188.13	11401.93

Table 1 – Area of pipeline and highway buffer overlaps

% Of Pipeline Buffer With Buffer Overlap					
	Highway Buffer (km)				
Pipeline Buffer (Km)	1	2	3	4	5
1	23.94%	36.51%	43.53%	48.02%	52.09%
2	18.51%	33.93%	42.41%	47.95%	52.13%
3	14.77%	28.67%	40.27%	47.15%	51.70%
4	12.34%	24.46%	35.81%	45.13%	50.78%
5	10.79%	21.42%	31.64%	41.13%	48.89%
6	10.17%	19.12%	28.34%	37.13%	45.27%
7	8.74%	17.34%	25.68%	33.79%	41.52%
8	7.96%	15.80%	23.50%	30.98%	38.23%
9	7.29%	14.50%	21.63%	28.62%	35.40%
10	6.72%	13.41%	20.03%	26.56%	33.01%
11	6.26%	12.48%	18.66%	24.82%	30.90%
12	5.87%	11.70%	17.53%	23.32%	29.05%
13	5.67%	11.07%	16.57%	22.03%	27.48%
14	5.27%	10.52%	15.74%	20.94%	27.17%
15	5.05%	10.04%	15.03%	19.98%	25.36%
16	4.83%	9.65%	14.41%	19.12%	23.77%
17	4.64%	9.27%	13.84%	18.33%	22.77%
18	4.48%	8.91%	13.30%	17.86%	21.84%
19	4.31%	8.58%	12.78%	16.92%	21.00%

Table 2 – This table represents the % of the pipeline buffer that is overlapped by hwy buffer

% Of HWY Buffer With Buffer Overlap					
	Highway Buffer (km)				
Pipeline Buffer (Km)	1	2	3	4	5
1	20.73%	15.83%	12.61%	10.45%	9.08%
2	31.72%	29.12%	24.31%	20.65%	17.99%
3	37.75%	36.69%	34.42%	30.28%	26.61%
4	41.88%	41.58%	40.66%	38.49%	34.72%
5	45.66%	45.38%	44.77%	43.72%	41.65%
6	51.48%	48.50%	47.99%	47.24%	46.16%
7	51.48%	51.17%	50.62%	50.03%	49.27%
8	53.48%	53.20%	52.84%	52.33%	51.76%
9	55.02%	54.85%	54.63%	54.31%	53.84%
10	56.34%	56.29%	56.15%	55.94%	55.73%
11	57.72%	57.61%	57.50%	57.46%	57.34%
12	59.02%	58.89%	58.91%	58.87%	58.79%
13	61.75%	60.32%	60.30%	60.24%	60.20%
14	61.75%	61.73%	61.67%	61.65%	64.09%
15	63.41%	63.14%	63.10%	63.02%	64.09%
16	64.67%	64.68%	64.50%	64.32%	64.09%
17	66.06%	66.03%	65.85%	65.53%	65.22%
18	67.56%	67.23%	66.99%	67.61%	66.27%
19	68.60%	68.35%	67.96%	67.61%	67.24%

Table 3 – This table represents % of the highway buffer that is overlapped by the pipeline buffer

As one can see there is an inverse relationship between table 2 and table 3. With a disproportionate amount of surface area the pipeline with its 19 kilometres of buffer has a much smaller % of conflict overall at maximum buffers than does the highway buffer. In calculating these percentages the denominator in the equation was the total area of the undisturbed pipeline buffer for table 2 and the highway buffer for table 3. Due to the large area of the 19 kilometre pipeline buffer the total percentage of pipeline buffer overlap is small. When comparing the buffer overlaps resulting from the 19 km pipeline on the highway, there is a higher percentage of overlap as the total area of the highway haulage zone is smaller

13.2 Layout

In addition to the calculation tables Appendix H contains Maps 8-12 of 18. These five (5) layout maps represent five (5), one (1) kilometre highway buffers clipped with each of the 19 pipeline buffers. One will notice that Map 12 of 18 has a greater area of overlap represented by the thicker areas. These images are very colourful; each colour represents a buffer overlap radiating from the centre. The area of each consecutive layer out from the centre is calculated by adding each layer previous to it. In reality these have not been cropped so an ‘outer layer’ is actually sitting underneath the narrower layers. However, for a visual understanding the total area is that of the sum of these ‘rings’ towards the centre.

14 MGP Project Update (10800) Sandy Martin 05-11-23

Posted on November 23, 2005 to the National Energy Board was an update to the Mackenzie Gas Project that involved some changes to the pipeline and its borrow requirements. This document composed by A.D. (Sandy) Martin from Imperial Oil is a project update from hearing order GH-1-2004 and addressed to both the National Energy Board and the Joint Review Panel for the Mackenzie Gas Project.

Primary borrow source material sites have increased by one (1) to 68 from October 2004 and the secondary sites have decreased by three (3) to 46. The total estimated requirements for borrow material has significantly increased by 1.6 Mm^3 to a total of 6.8 Mm^3. Changes within the gathering system include moving the Inuvik area facility 16 km further south, extending the length of the Storm Hills Lateral, and moving infrastructure sites to better support construction. Changes of interest within the Mackenzie Valley Pipeline project include reducing the total number of compressor stations from four (4) to three (3) and shortening the total length of the pipeline by roughly 26 km. Infrastructure sites were relocated in this area as well to better support construction efforts.

14.1 Data Preparation

14.1.1 Getting Started

This report had eight (8) useful images to georeference for data digitization purposes. Many of the images within the report were not accurate enough, represent enormous scales, and did not warrant georeferencing as very little if any useful data could be pulled from them. The images deemed to be useful and therefore georeferenced are named as follows:

107-0000-011-553 004 - A0S3D6_-_Other-3.tif
107-0000-011-553 005 - A0S3D6_-_Other-5.tif
107-0000-011-553 006 - A0S3D6_-_Other-6.tif
107-0000-011-553 007 - A0S3D6_-_Other-7.tif
107-0000-011-553 008 - A0S3D5_-_Other_8.tif
107-0000-011-553 009 - A0S3D5_-_Other_9.tif

107-0000-011-553 010 - A0S3D6_-_Other.tif
107-0000-011-553 011 - A0S3D6_-_Other-2.tif

The file naming convention used was XXX-XXXX-XXX-XXX XXX – *.pdf file name*
Where the 'X' numbers represent the numbers associated with the map legends on each image followed by the name of the .pdf file the image was extracted from.

14.1.2 Georegistration

The .tif formatted images were imported into Manifold where they were georegistered using control points identified by the grid coordinates represented on the images. The algorithmic method applied for the georegistration was the 'Affine' (scale, shift, rotate) function. This method is algorithmically equivalent to using 'Numeric' with an Order of 1. The maps covered 3 UTM zones, UTM 8 through 10, and used North American 1983 (Canada) Datum. Each of these images now correctly oriented on the earth were saved within their own Manifold project (.map).

14.1.3 Digitization

Facility, gas pipeline, and gathering pipeline relocations were digitized from these images. Once again facility locations were recorded both in area and point formats. Along with the re-route of the pipeline routes, new kilometre post markings were digitized. Similar data tables as indicated several times above in other sections were created to store attribute data.

14.1.4 Compiling Data

All of the digitized data and .tif files were combined into a single file titled 'Digitized MGP Project Update (10800) data and Images combined.map'. The data in this file is represented in UTM 9 NAD 1983.

14.2 Data

A total of five (5) facility re-locations were identified, the Loon River North Compressor Station, the Inuvik Area Facility, the Great Bear River Compressor Station, the Niglintgak Gas Conditioning Facility, and the River Between Two Mountains Compressor Station. Three (3) line segments of gas pipeline re-route represent approximately 35.6 km of the pipeline, and three (3) segments of the NGL and Gas Pipeline re-route approximately 81.6 km of routing change. All of the data created was also converted to generic 'shape file' format so that the data can be used by any GIS system. Along with the shape files (.shp) are the associated .dbf, .shx, and .xml files. These files support the .shp file containing the coordinates, datum, projection and database content. These files were uploaded to Wark Kilby at Cal Data Ltd. for use on to the Mackenzie Valley Granular Resource Management website that is under development. Appropriate metadata was created for each data layer meeting FDGC metadata standards and accompanies the data files on the enclosed digital media.

14.3 Layout

Two (2) layouts were created to represent the facility relocations and the pipeline re-routes from the project update 10800 November 23, 2005. These two layouts, maps 13 and 14 respectively, can be found in Appendix I. These files are included on the accompanying digital disk in .pdf format for printing on tabloid sized paper. As with all tabloid layouts in this report, as a result of the limited detail resulting from the necessary scale, this layout should be used for reference to what is available digitally on the accompanying digital media.

15 MGP routing and facilities – E-mail Feb 9 2006

The proponent group supplied DIAND with a set of digital shape files showing the status of the Mackenzie Gas Project. These files were provided under the condition that they are not released to the public. The files contain 12 different data sets: Facility sites as areas, facility sites as points, gas block valves as points, gathering gas block valve points, gas conditioning facilities as areas and points, the pipeline route, pipeline route alternatives, and a corridor around the pipeline. The following list is the file names given by the proponent for this data, respectively:

ENG_DISC_PF_FACILITY_A Drawing
ENG_DISC_PF_FACILITY_P Drawing
ENG_DISC_PF_GASBLOCKVALVE_P Drawing
ENG_DISC_PF_GATHBLOCKVALVE_P Drawing
ENG_DISC_PF_GCF_A Drawing
ENG_DISC_PF_GCF_P Drawing
ENG_ROUTE Drawing
ENG_DISC_PL_ROUTEALTERNATIVES_L Drawing
ENG_DISC_PL_MGPREV3CORRIDOR_A Drawing

15.1 Data Preparation

15.1.1 Getting Started

This data was provided as digital files that easily imported directly into Manifold.

15.1.2 Compiling Data

In order to compare data locations and attribute data it was necessary to combine several sources both on the DIAND data side and on the proponent data. Objects chosen for consolidation from the DIAND set of data are those that can be directly compared to the

data that the proponent has supplied. The following data was combined for the main pipeline trunk and gathering datasets:

DATA	SOURCE
Facility as Area and Gathering Facility as Area	1. COGOA Vol 4 and CPCN Vol 5 2. MGP Project Update (10800) Sandy Martin 05-11-23 3. Imperial Oil Proposed Changes July 26 meeting
Facility as Point and Gathering Facility as Point	1. COGOA Vol 4 and CPCN Vol 5 2. MGP Project Update (10800) Sandy Martin 05-11-23 3. Imperial Oil Proposed Changes July 26 meeting
Gas Block valves and Gathering Gas Block Valves	1. COGOA Vol 4 and CPCN Vol 5
Km post and Gathering Km Post	1. COGOA Vol 4 and CPCN Vol 5 2. MGP Project Update (10800) Sandy Martin 05-11-23

Table 4 – DIAND data combined for comparison against proponent shape file data

For each of these combined files a new attribute called 'Section' with a pull down menu was added revealing either ‘Main Pipeline Trunk’ or ‘Gathering Pipelines’ as options. This way the consolidated data could still be sorted by the main pipeline and the gathering areas.

15.2 Data

When the comparison between the existing data and the proponent sent data occurred, the goal was to extract as much additional data for each item and add any items not already known to DIAND. This resulted in the attribute table becoming more comprehensive and useful as a tool.

The first comparison created was facility as areas comprised between ENG_DISC_PF_FACILITY_P and ENC_DISC_PF_GCF_P from the proponent with the DIAND data set combined digitized Facility as Areas. This resulted in the addition of one (1) point as well as more attribute data including future facility names. Additional data columns added were 'OBJECTID' AND 'TYPE'. The Manners Creek facility was added.

This facility had not shown up on any previous images or data sets. The Enbridge interconnect facility as area, Little Smith creek facility (OBJECTID 100 not 99), Willowlake River facility (OBJECTID 149 not 147), and NGTL Interconnect facility (OBJECTID 101) were known to exist as potential future sites without names. These sites now have their correct name entered into their appropriate attribute tables. The duplicate OBJECTID represents a different polygon representing the same facility. There either has been a relocation or expansion in the facility area size.

The Willowlake river facility (OBJECTID 150) is over 600 meters away from the DIAND digitization and the ENG_DISC_PF_FACILITY_A proponent digitized location. Also, the proposed Inuvik Area Facility relocation from the July 26, 2005 meeting does not match up with any data points from this set of points from the proponent. The .xml file for this data indicates the last modification to this data set was on November 10, 2004, therefore the July 26th information from Imperial Oil is likely the more accurate data.

With the known surface areas of both data sets for the facility footprints, the percentage difference was calculated by dividing the areas of the proponent digitized data by that of the data digitized by DIAND. The percentage difference in footprint size ranges from negative 29% to positive 22%.

The Facility as points received the identical procedure and resulted in the same facility additions and facility name updating.

The second comparison was between the pipeline block valves files
ENG_DISC_PF_GASBLOCKVALVE_P Drawing,
ENG_DISC_PF_GATHBLOCKVALVE_P Drawing,
ENG_DISC_PF_NGLBLOCKVALVE_P Drawing
ENG_DISC_PF_NGLBLOCKVALVE_P Drawing, and the existing DIAND data. As it turned out the ENG_DISC_PF_GASBLOCKVALVE_P Drawing file covered all of the block valves along the main pipeline whereas all the gathering pipeline block valves were

covered by file ENG_DISC_PF_GATHBLOCKVALVE_P Drawing. Any attribute data not yet captured in the DIAND data set was entered for each point including the addition of three column headings; OBJECTID, LABEL, and DESCRIPT. The file by the proponents representing block valves titled ENG_DISC_PF_NGLBLOCKVALVE_P Drawing appears to be new data. Some points are in the general vicinity of some of the DIAND facility areas but are generally completely unique. As it turns out the file name is misleading. These points are in fact check valves not block valves. Due to their similarity in nature they were left on the map displaying block valves.

The third comparison was that of the pipeline route. File ENG_ROUTE and the DIAND digitized pipeline differ. The kilometre post markings from DIAND tend to line up much better with the proponents pipeline route, leading one to believe that the proponent provided data of the pipeline route should be used. Additionally there are attributes given to each line segment describing the land it crosses. There are areas however along these routes where the kilometre posts vary from both routes. The ENG_DISC_PL_ROUTEALTERNATIVES_L Drawing are new route alternatives, at least in respect to the data DIAND has identified. This is entirely new data with the exception of one small section roughly 12 km in length where part of the LANDCO route matches up with the Western Alternative Willowlake River.

The fourth and final comparison is that of most interest to this report that of granular sites. The ENG_DISC_IS_INVESTSITE_P Drawing identified 16 new borrow sites and three sites that do not match up. The following sites are new to DIAND: 2.018BP, 2.019EP, 2.027P, 2.057P, 2.059P, 4.024P, 4.060P, 4.103PA, 5.014PA, 5.023P, 5.041P, 6.034PB, 7.108P, 20.004PB, 20.039BP, and 20.066P. These have not been added to the comprehensive collection by DIAND because these are point features. The collection of pits by DIAND is polygonal areas. Pit number 5.014PB was one of the three borrow sites that did not match up properly to existing data. This location exists in a significantly different location between these resources. Site 1.002P is off about 400 meters from the edge of the existing polygon and that of site 7.109P is off approximately 82 meters.

Data contained in the last useful file supplied called ENG_DISC_IF_INFRASITE_P contains all new data. These points represent the approximate centers for the proposed infrastructure areas related to site-specific mapping originally created March-June 2003.

15.3 Layout

This data resulted in four (4) tabloid sized data layouts displaying coordinates in graticule As with all tabloid layouts in this report, as a result of the limited detail resulting from the necessary scale, these layouts should be used for reference to what is available digitally on the accompanying digital media. The graticule layout for Pits and Proposed Infrastructure, Facilities as Points, Block and Check Valves, and Pipeline Route and Alternatives can be found in Appendix J. These layout files are included on the accompanying digital disk in .pdf format for printing on tabloid sized paper. A layout for the facilities as areas was not created due to the scale necessary resulting in detail too fine to realistically print out on paper of 11 inches by 17 inches.

16 Borrow Site comparison: EIS Volume 2 Project Description August 2004 vs. EIS Additional Information February 2006 Update

The borrow sites identified in the Environmental Impact Statement Volume 2 Project Description from August 2004 were compared with that of the newly released February 2006 update Mackenzie Gas Project EIS Additional Information for the Joint Review Panel Environmental Inputs and Outputs. Table 5 below has taken each list of granular borrow sites and compared not only the totals and whether they are primary or secondary sites but the quantity on crown or private land.

As indicated in the table below the newest update related to granular sites for the Mackenzie Valley Pipeline project will use a total of eight (8) less granular sites for construction. Several of the sections in this report indicate relocation of facilities and the pipeline route and also the elimination of facilities and length of the pipeline. Despite the decrease in pipeline length and the indication for the need of less granular recourse sites, the total volume of required material has actually increased by 1.6 million cubic meters ($1.6Mm^3$) to 6.8 Mm^3 . Clearly more volume will be extracted from fewer sources. The reduction in borrow sites is spread equally between primary sites and secondary sites, each are reduced by four (4). Three (3) of these sites were crown land borrow sites two (2) primary and one (1) secondary. Five (5) were private borrow sites, two (2) were primary and three (3) were secondary borrow sites.

Quarry sites are considered sites of granular resources. The number of quarry sites that will be developed has increased to 17 from 13. Quarry sites also had a rotation in chosen sites in addition to an increase in the number of sites. An increase of six (6) primary quarry sites four (4) private and two (2) crown is countered with a decrease in secondary sits, one (1) each between private and crown. As noted at the bottom of the table a total of 14 new sites were added to the resource extraction plan while 22 were dropped. Also, besides all of the addition and deletion of resources sites, the proponents changed seven (7) sites that were originally primary sites to secondary sites. The reverse is also true where five (5) initially secondary borrow sites became primary sites.

	EIS VOL 2 Project Description August 2004	MGP EIS Additional Information for the Joint Review Panel Environmental Inputs and Outputs February 2006	Change
Total no. of borrow sites	131	123	-8
Total no. of Primary sites	78	74	-4
Total no. of Secondary/alternative sites	53	49	-4
Total no. of Crown Land borrow sites	77	74	-3
Total no. of Private Lands borrow sites	50	45	-5
Total no. of Other (commissioners/ municipal borrow sites	4	4	0
No. of Primary Private borrow sites	30	28	-2
No. of Primary Crown borrow sites	44	42	-2
No. of Primary Other borrow sites	4	4	0
No. of Secondary Private borrow sites	20	17	-3
No. of Secondary Crown borrow sites	33	32	-1
No. of Secondary Other borrow sites	0	0	0
Total Quarry Sites	13	17	4
No. of Primary Quarry sites	5	11	6
No. of Secondary Quarry sites	8	6	-2
Total no. of Primary Private quarry sites	2	6	4
Total no. of Primary Crown quarry sites	2	4	2
Total no. of Primary Other quarry sites	1	1	0
Total no. of Secondary Private quarry sites	2	1	-1
Total no. of Secondary Crown quarry sites	6	5	-1
Total no. of Secondary Other quarry sites	0	0	0
No. of borrow sites Added			14
No. of borrow sited Removed			22
No. of sites originally in primary moved to secondary		7	
No. of sites originally in secondary moved to primary		5	
Note: 7.016P was secondary in Tulita now secondary in K'shsho Got'ine (not included in above count			
Total estimated borrow requirements	5 Mm^3	6.8 Mm^3	1.8 Mm^3

Table 5 – Borrow Site Comparison Between Environmental Impact Statement Volume 2 Project Description August 2004 and Mackenzie Gas Project EIS Additional Information for the Joint Review Panel Environmental Inputs and Outputs February 2006 update

The 22 borrow sites removed from the initial list are: 2.018BP, 2.019EP, 2.027P, 2.057P, 2.059P, 4.024P, 4.060P, 4.103PA, 4.103PB, 5.014PA, 5.014PB, 5.023P, 5.041P, 6.034PB, 6.036AP, 7.022P, 7.108P, 7.109P, 20.004PB, 20.039BP, 20.066P, and 303P. The 14 newly added sites are: 2.029PB, 2.052P, 4.100P, 5.013P, 5.041PB, 5.043AP, 6.011PB, 6.042BP, 7.021P, 7.090P, 20.004PC, 20.073, 20.200P, and 20.201P. These represent a total change of negative eight (-8) granular sites.

17 New/Updated Data Themes and Suggested Changes for Mackenzie Valley Granular Website

The Mackenzie Valley Granular Resources Management website that is under development at Cal Data Ltd. is an attempt to organize the vast majority of data available. It would be useful if the data was sorted by its original source. That way it would be easy to determine the date and revision of those particular points, lines or polygons. One could argue, however, that organizing by feature type would also be useful. If organized by feature type there would be no digging or searching through different folders for similar data type. It would certainly be useful if attribute information for the data supplied in the database with each shape was easily accessible. There should be a greater capacity to generate reports displaying tabular data when for example a granular pit is clicked on. Appendix K contains an extensive list of specific changes for the website and new information uploaded to the Cal Data Ltd. ftp website on Feb 22, 2006.

An investigation could be conducted to determine the extent of tools available in MapGuide for the end user.

18 Study Outputs

The final output created in Manifold is quite comprehensive. The digital output is obviously the ideal form of viewing the information. One can manipulate layers and take full advantage of zoom and search features with the digital version. The paper output is useful for static displays and reference to the digital archives.

The digitized data surrounding the main pipeline trunk is displayed in both graticule NAD 1983 and the most appropriate UTM zone. The graticule layouts can be found in their respective Appendices. Layouts are included on the accompanying digital media disk in .pdf format for printing on tabloid sized paper for those without GIS software. The following is a list (Table 6) of digitized data displayed in layouts in this report:

Map	Feature Type
Map 1 of 18: Gathering Pipeline Terrain Units Within MGP Corridor	Area
Map 2 of 15: Pits Within MGP Corridor	Area
Map 3 of 18: Roads Within MGP Corridor	Area
Map 4 of 18: Water Sources Within MGP Corridor	Line
Map 5 of 18: Proposed Facility Relocation and Pipeline Re-route - Imperial Oil July 26 meeting	Point, Area, & Line
Map 6 of 18: Mackenzie Highway NWT, June 1974	Point & Line
Map 7 of 18: AMEC Landform Map Footprints	Area
Map 8 of 18: 1 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers	Area & Line
Map 9 of 18: 2 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers	Area & Line
Map 10 of 18: 3 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers	Area & Line
Map 11 of 18: 4 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers	Area & Line
Map 12 of 18: 5 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers	Area & Line
Map 13 of 18: Facility Relocation - MGP Update (10800)	Point & Area
Map 14 of 18: Gas & Gathering Pipeline Re- Route and Km Post Marking - MGP Update (10800)	Point & Line
Map 15 of 18: MGP Routing and Facilities (Proponent Digitized) - Pits &	Point &

Proposed infrastructure	Area
Map 16 of 18: MGP Routing and Facilities (Proponent Digitized) - Facilities as Points	Point
Map 17 of 18: MGP Routing and Facilities (Proponent Digitized) - Block and Check Valves	Point
Map 18 of 18: MGP Routing and Facilities (Proponent Digitized) - Pipeline Route and Alternatives	Line

Table 6 – List of Layouts produced

Metadata conforming to FGDC standard was created for each digital data set. The metadata is housed in folders adjacent to the data. The metadata was created using a program called Corpmet95. This program is included in the folders containing the metadata files.

19 File Structure

The file structure for this project is kept quite simple as a result of Manifolds ability to incorporate most of the data into a single project file. Figure 4 displays the file structure of the enclosed digital disk. In order to keep readers of this report from having to dig through many gigabytes of data, only the most relevant data was extracted and included. Intermediary steps, images, phases, and miscellaneous work will reside with the author. These files can be obtained at any time via a request through the department representative Robert J. Gowan, of Land and Water Management/NRE, Department of Indian Affairs and Northern Development. The Report folder in the file structure contains the file for this report.

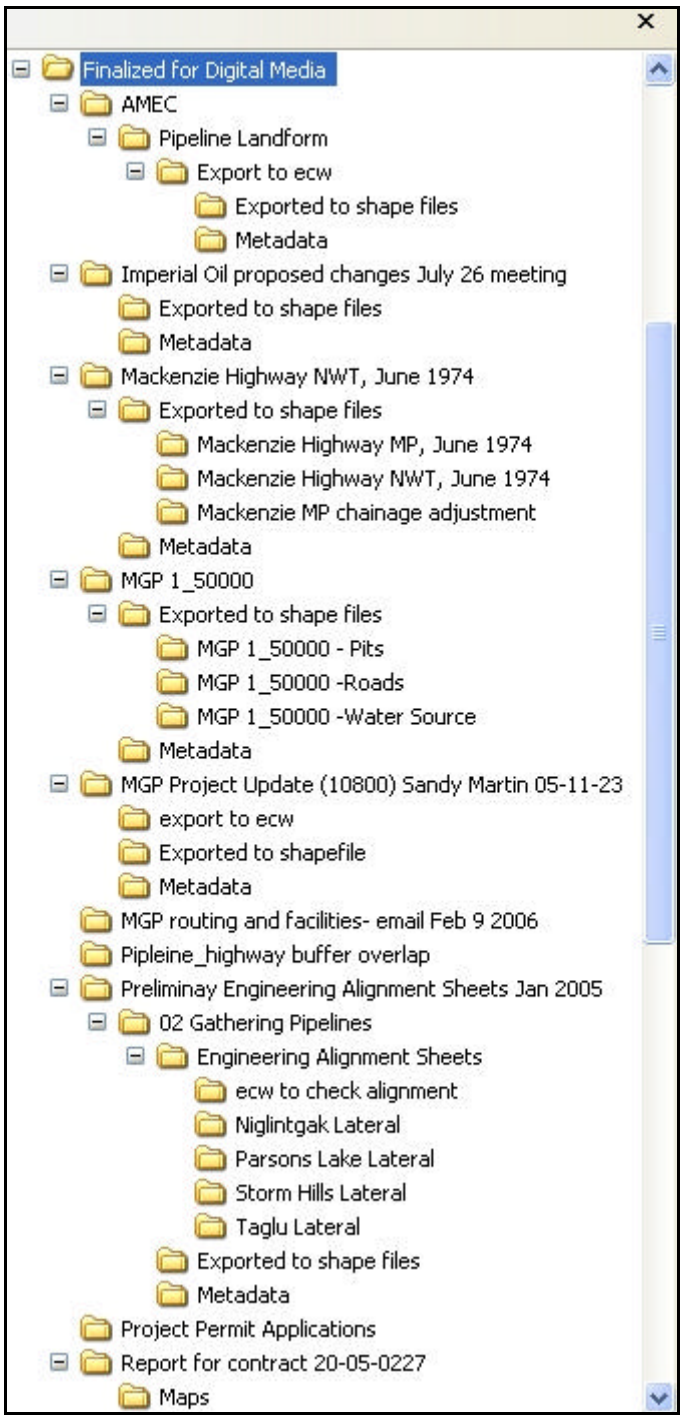

Figure 4 – File structure of enclosed digital disk

20 Recommendations

At some point in the future it may be of interest for DIAND to digitize the landform polygons from the AMEC Pipeline landforms files. Currently only footprints of this data have been captured. These landform classifications differ from those already digitized from another source.

Further work needs to be carried out on the Mackenzie Valley Granular Resource Management website to better integrate the attribute data. This data should be accessible from the website. Depending on the capabilities of the MapGuide software, various items should be able available through supplement attribute data. If further analysis functions are available these should also be added. An investigation into how advanced MapGuide is capable of being for the end user might be in the interest of DIAND. Targets could be set to have certain capabilities built into the online resources. Manifold GIS has web creation capabilities that have not been explored. Exploring these capabilities is something that may be useful for DIAND, Cal Data Ltd., and the author of this report to explore.

The next step after reviewing the pipeline and highway buffer overlap analysis in section 13 is to identify those granular sources described as primary or secondary borrow sites for the pipeline construction that are contained within the overlapping buffer zones. It may not, however, very useful to analyze this for each of the 95 overlapping scenarios. A discussion with the department representative on the value of this analysis will define the data scope desired.

The information contained in the permit applications data in section 9 above has a wealth of information. It would be useful if this resource could also be incorporated into the website.

Works Cited

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Natural Resources Canada (NRCan). 2005. Canadian Spatial Reference System GSRUG Online Computation. Online source retrieved from <http://www.geod.nrcan.gc.ca/apps/gsrug/index_e.php

Public Works Canada Western Region. 1974. Mackenzie Highway N.W.T. Route Maps June 1974.

Appendix A – Terrain Unit Legend

Simple Terrain Unit Label

tMb-V-2

Terrain unit *Textural Composition Modifier* (**t**)
Terrain unit *Terrain Class* (**M**)
Terrain unit *Landform Modifier* (**b**)
Terrain unit *Geomorphological Process Modifier* (**V**)
Terrain unit *Slope Class* (**2**)

Stratigraphic Composite Terrain Unit

tMb/lsR -V-2

Till 1-3 m thick (**tMb**)
overlies (*/*) limestone bedrock (**lsR**)
Area is gullied (**V**)
Surface slope is 6-26% (**2**)

Complex Composite Terrain Unit

tMp (7) fOp (3)

70% till **tMp (7)** combined with
30% organic fen veneer **fOp (3)**

TERRAIN UNIT LABEL DETAILS

Textural Composition Modifiers

(dominant texture is placed first followed by a comma)

b	boulder
r	rubble
g	gravel
s	sand
f	silt and clay
t	till

Bedrock Composition Modifiers

(dominant texture is placed first followed by a comma)

ls	Limestone
do	Dolomite
sh	Shale
ss	Sandstone
g, s	Tertiary sediments

Terrain Classes

fO	Organic (Fen)
pO	Organic (Peat)
A	Alluvial
C	Colluvial
E	Eolian
L	Lacustrine/Glaciolacustrine
G	Glaciofluvial
M	Moraine
R	Bedrock
T	Tertiary (unconsolidated)

Morphology

		Thickness (m)
z	veneer, shallow	<0.5
v	veneer	<1.0
b	blanket	1 to 3
a	apron	>3 m
f	fan	>3 m
c	cone	>3 m
p	plain	>3 m
u	undulating	>3 m
m	rolling	>3 m
r	ridged	>3 m
h	hummocky	>3 m
t	terraced	>3 m
x	complex	>3 m

Geomorphological Processes *(multiple processes separated by a comma)*

Erosional Processes		***Fluvial Processes***		***Deglacial Processes***	
D	Deflation	B	Braiding	C	Channeled
K	Karst	M	Meandering	H	Kettled
V	Gullying				

Permafrost processes (Periglacial)

TK	Thermokarst
Xf	Thaw-flow slides
Xe	Thermokarst; thermal erosion by water
Xp	Palsas, Peat polygons
Xw	Ice wedge polygons

Slope Processes *(multiple processes separated by a comma)*

R	**Rapid Mass Movement**	**F**	**Slow Mass Movement**
d	Debris flow (saturated)	m	Slump; bedrock
m	Slump; bedrock	u	Slump; surficial material
u	Slump; surficial material	x	Slump/Earthflow (combined)
b	Rockfall; bedrock		
f	Debris fall; surficial material		

Slope Classes *(dominant slope is placed first followed by a comma)*

NOTE: where slopes present fall in more than one class, several class terms may be used eg. - 1, 2

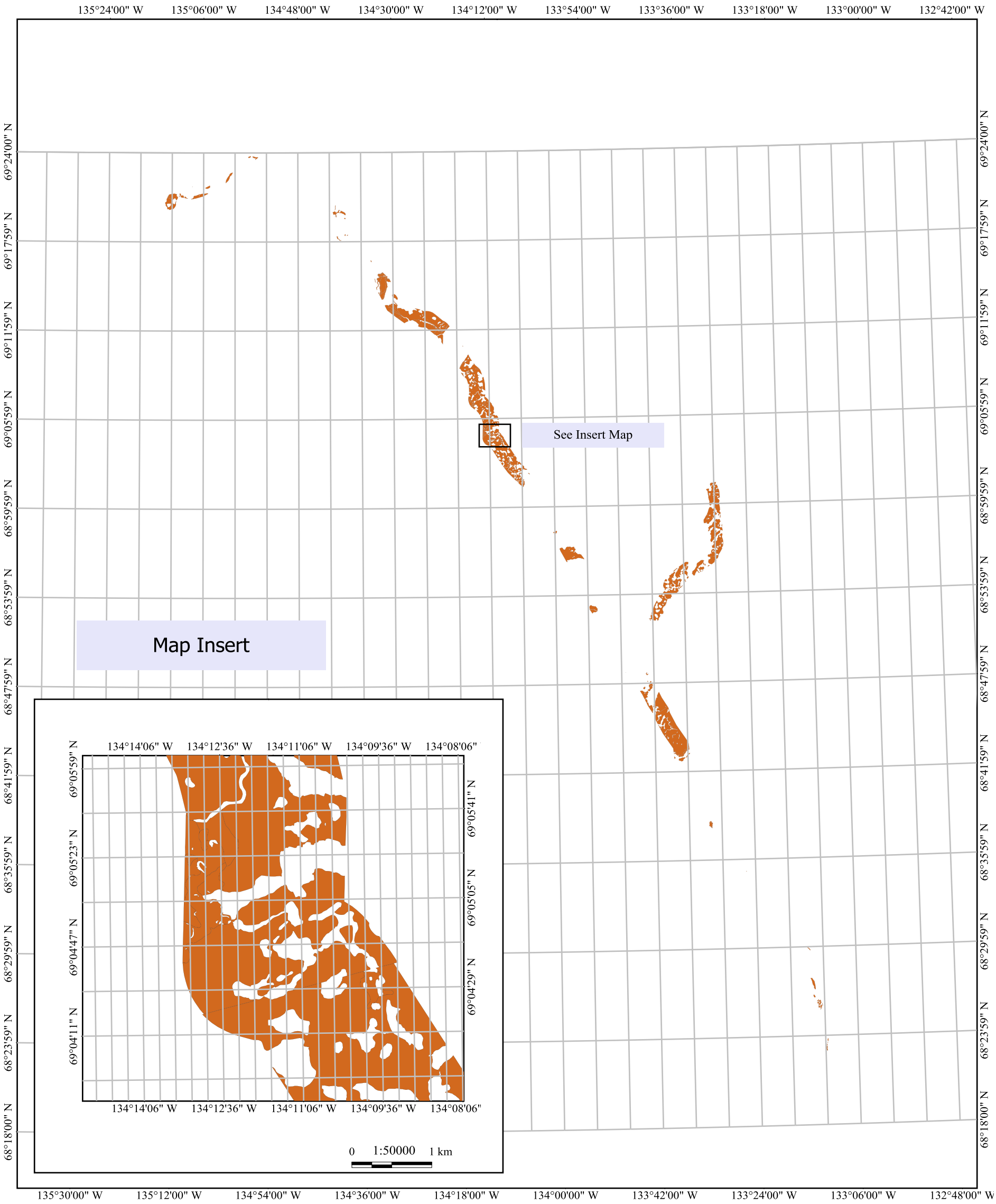
Class	***%***	***Degrees***
1	0-5	0-3
2	6-26	4-15
3	27-49	16-26
4	50-70	27-35
5	>70	>35

Boulder Content

		%
N	None	0
F	Few	0-5
S	Some	5-20
C	Common	>20

Figure 1-2: Terrain Unit Labels

Appendix B – Preliminary Engineering Alignments Gathering Terrain Units Layout



Map 1 of 18: Gathering Pipeline Terrain Units Within MGP Corridor

Legend

Gathering Terrain Units
Areas

N

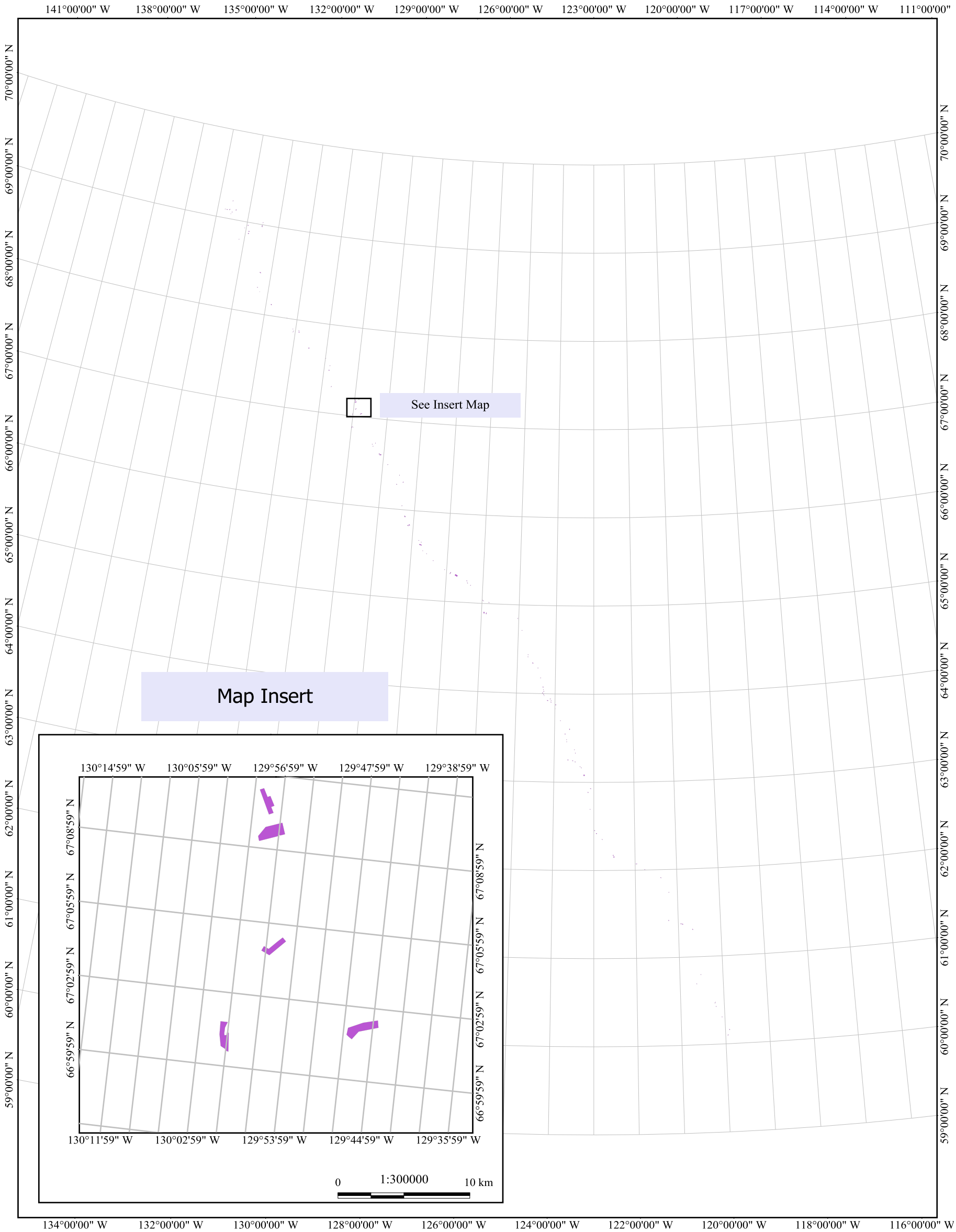
1:500000

0 10 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005
Digitized from 107-0010-131-XXX 002 REV A, 107-0015-131-XXX 002 REV A,
107-0020-131-XXX 002 REV A,107-0025-131-XXX 002 REV A

Appendix C – Pits, Roads, and Water Sources - MGP 1_50000



Map 2 of 18: Pits Within MGP Corridor

Legend

Pits

Areas

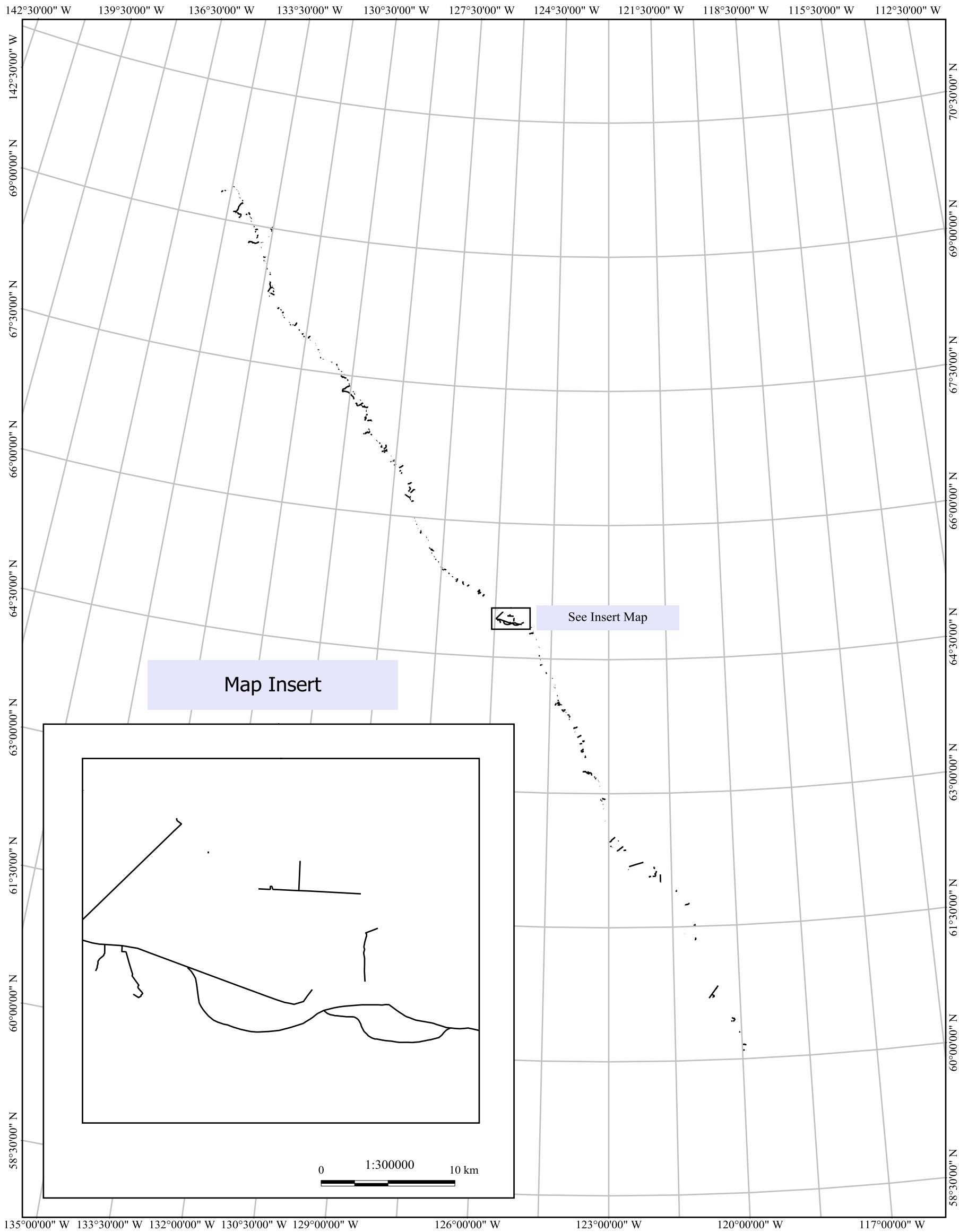
N

1:5000000

0 100 km

Projection:	Universal Transverse Mercator - Zone 10 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005
Digitized from MGP 1_500000 map series 107-0000-011-479 XXX REV 0



Map 3 of 18: Roads Within MGP Corridor

Legend

Roads
Lines

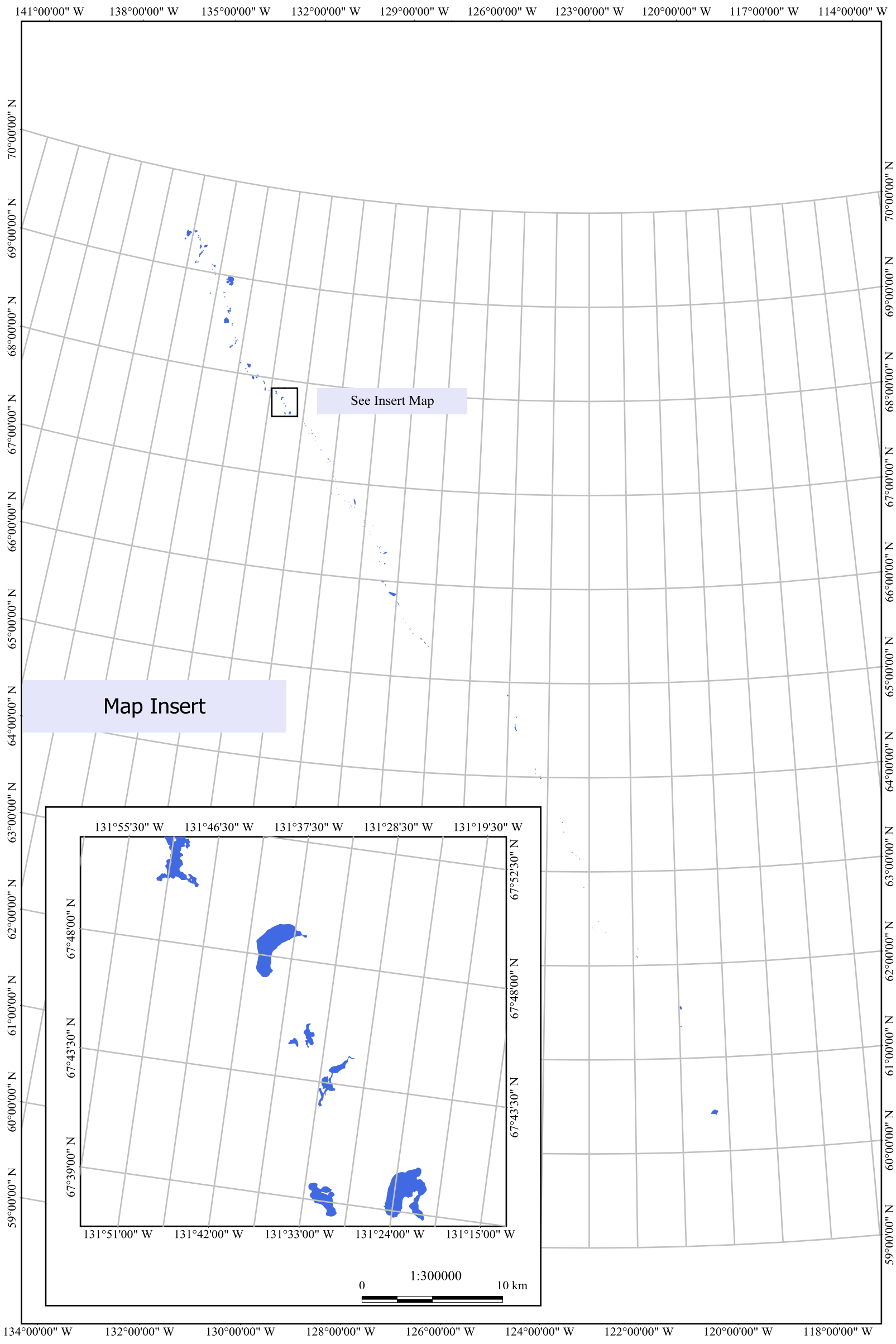
N

1:5000000

0 100 km

Projection:	Universal Transverse Mercator - Zone 10 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005
Digitized from MGP 1_500000 map series 107-0000-011-479 XXX REV 0



Map 4 of X: Water Sources Within MGP Corridor

Legend

Water Source Areas

N

1:5000000

0 100 km

Projection:	Universal Transverse Mercator - Zone 10 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005
Digitized from MGP 1_500000 map series 107-0000-011-479 XXX REV 0

Appendix D – Navigating Project Permit Applications

Navigating Project Permit Applications for Borrow Site Information:

Applications in the Gwich'in Settlement Region

- **Application for Type A Land Use Permit - Crown Lands**
  - 1. Introduction
    - GSA_Crown_LUP_Section_1
      - Total borrow sites needed, and % per area
  - 2. Type A Water License Application
    - WL_ISR_Section_2
      - Estimate water use per year
  - 3 Overview of Activities in the GSA
    - GSA_Crown_LUP_Section_3E
      - Borrow Site Lists
  - 5. Borrow Sites
    - GSA_Crown_LUP_Section_5A
    - GSA_Crown_LUP_Section_5B
    - GSA_Crown_LUP_Section_5C
    - GSA_Crown_LUP_Section_5D (linked to 5B, 5d is missing)
    - GSA_Crown_LUP_Section_5E
    - GSA_Crown_LUP_Section_5F
    - GSA_Crown_LUP_Section_5G
      - Detail on each Borrow site
  - Appendices
    - GSA_Crown_LUP_Appendices

- **Application for Type A Land Use Permit - Private Lands**
  - 3 Overview of Activities in the GSA –
    - GSA Private LUP Section_3E
      - Borrow Site Lists
  - 5. Borrow Sites
    - GSA_Private_LUP_Section_5A
    - GSA_Private_LUP_Section_5B
    - GSA_Private_LUP_Section_5C
    - GSA_Private_LUP_Section_5D
    - GSA_Private_LUP_Section_5E
    - GSA_Private_LUP_Section_5F
    - GSA_Private_LUP_Section_5G
    - GSA_Private_LUP_Section_5H
  - Appendices
    - GSA_Private_LUP_Appendices

- **Application for a Class A Water Licence**
  - 4 Water use for Access Roads
    - GSA_WL_Section_4
      - Names winter roads to assess borrow sites- however it names borrow sites different from those listed in above crown and private Gwich'in land use permits

- **Application for an Amendment to the Gwich'in Land Use Plan**
  - Contents
    - GSA_GLUP_Amendment
      - Contains information on amendments in order to extract borrow materials

Applications for the Gathering Pipelines in the Inuvialuit Settlement Region

- **Application for Class A Land Use Permit - Crown Lands**
  - 3. Overview of Activates in the ISR
    - LUP_ISR_Crown_Section3N1&2&3
      - Estimate and required quantities
    - LUP_ISR_Crown_Section3N4&5
      - Borrow Site Lists
  - 5. Borrow Sites
    - LUP_ISR_Crown_Section5N1
    - LUP_ISR_Crown_Section5N2
    - LUP_ISR_Crown_Section5N3
    - LUP_ISR_Crown_Section5N4
    - LUP_ISR_Crown_Section5N6
    - LUP_ISR_Crown_Section5N7
    - LUP_ISR_Crown_Section5N8
    - LUP_ISR_Crown_Section5N9
      - Detail on each Borrow site
  - Appendices
    - LUP_ISR_Crown_AppendicesN

- **Application for a Land Use Permit on Inuvialuit Private Land**
  - 3. Overview of Activities in the ISR
    - ISR_Private_Section_3B
      - Borrow Site Lists
  - 5. Borrow Sites
    - SR_Private_Section_5A
    - ISR_Private_Section_5B
    - ISR_Private_Section_5C
    - ISR_Private_Section_5D
  - Appendices
    - ISR_Private_References (Incorrectly linked to glossary)

- **Application for a Type A Water License**
  - 2. Type A Water License Application
    - WL_ISR_Section_2
      - Estimate water use per year
  - 3. Overview of Activates in the ISR
    - WL_ISR_Section_3S5
      - List of Borrow sites, years in use
  - 4 Water use for Access Roads
    - WL_ISR_Section_4
      - Names winter roads to assess borrow sites- however it names borrow sites different from those listed in above overview of Activities ISR Section 395

Applications in the Sahtu Settlement Area

- **Application for a Land Use Permit within the Municipal Boundaries of Norman Wells, Fort Good Hope**
  - 3. Overview of Activities in the SSA
    - MACA_SSA_Section_3A
      - Estimate and required quantities
    - MACA_SSA_Section_3B
      - Borrow Site Lists
  - 5. Borrow Sites

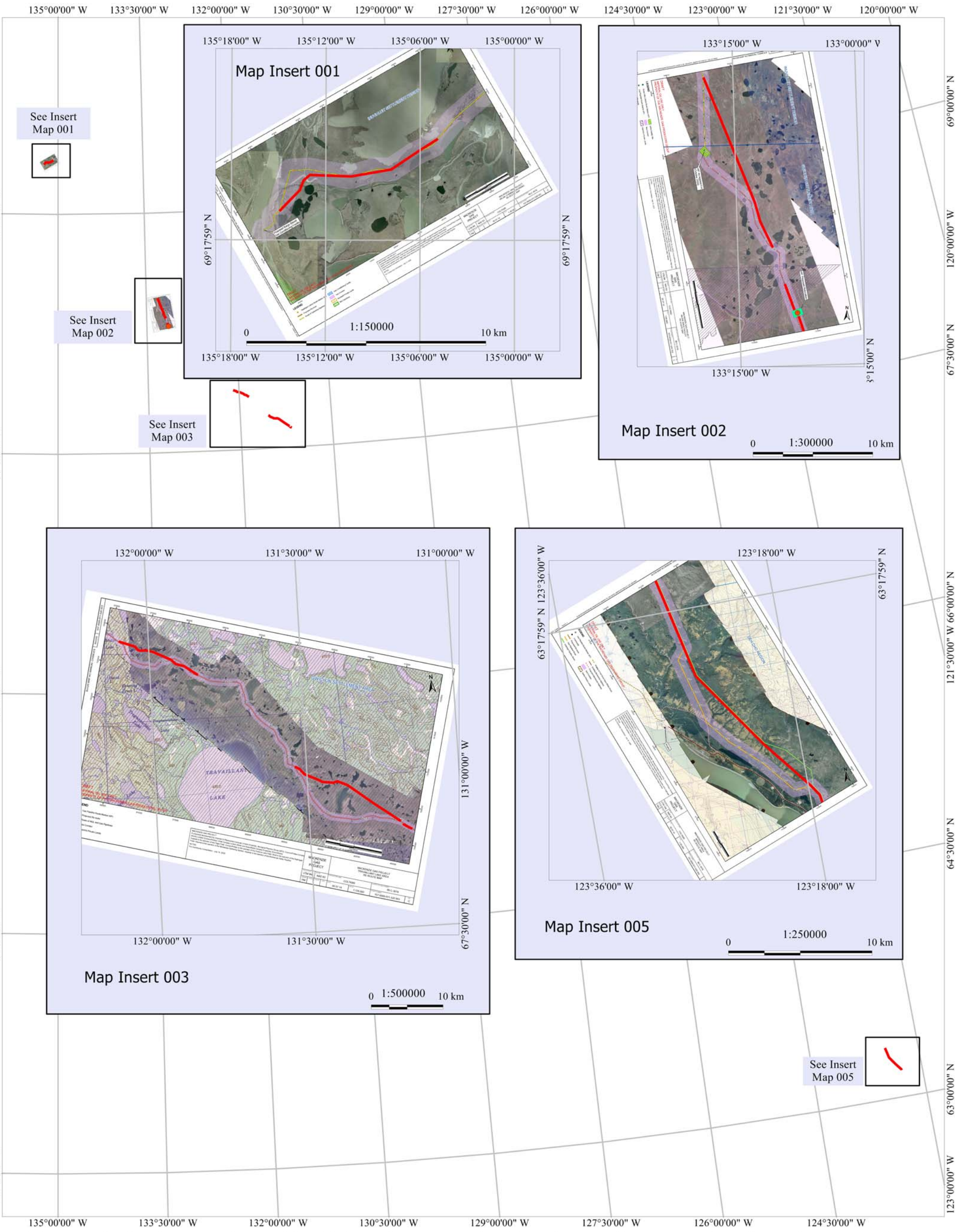
- MACA_SSA_Section_5
  - Detail on each Borrow site
- Appendices
  - MACA_SSA_AppendicesA
  - MACA_SSA_AppendicesB1

- **Application for a Type A Water License**
  - 2. Type A Water License Application
    - SSA_WL_Section_2
      - Estimate water use per year
  - 3. Overview of Activites in the SSA
    - SSA_WL_Section_3C
      - List of Borrow sites, years in use
  - 4. Water Use for Access Roads
    - SSA_WL_Section_4
      - Names winter roads to assess borrow sites- however it names borrow sites MAY be different from those listed in above SSA WL Section 3c
  - Appendices
    - SSA_WL_Appendices

Applications in the Dehcho Region

- **Application for a Type A Water License**
  - 2. Type A Water License Application
    - DCR_WL_Section_2
      - Estimate water use per year
  - 3. Overview of Activites in the DCR
    - DCR_WL_Section_3C
      - List of Borrow sites, years in use
  - 4. Access Roads
    - DCR_WL_Section_4
      - Names winter roads to assess borrow sites- however it names borrow sites MAY be different from those listed in above
  - Appendices
    - DCR_WL_Appendices

Appendix E – Facility Relocation and Pipeline Re-route from July 26 2005 meeting



Map 5 of 18: Proposed Facility Relocation and Pipeline Re-route - Imperial Oil July 26 meeting

Legend

- **Facility Relocation as Point** — Points
- **Facility Relocation as Area** — Areas
- **Pipeline Re-route** — Lines

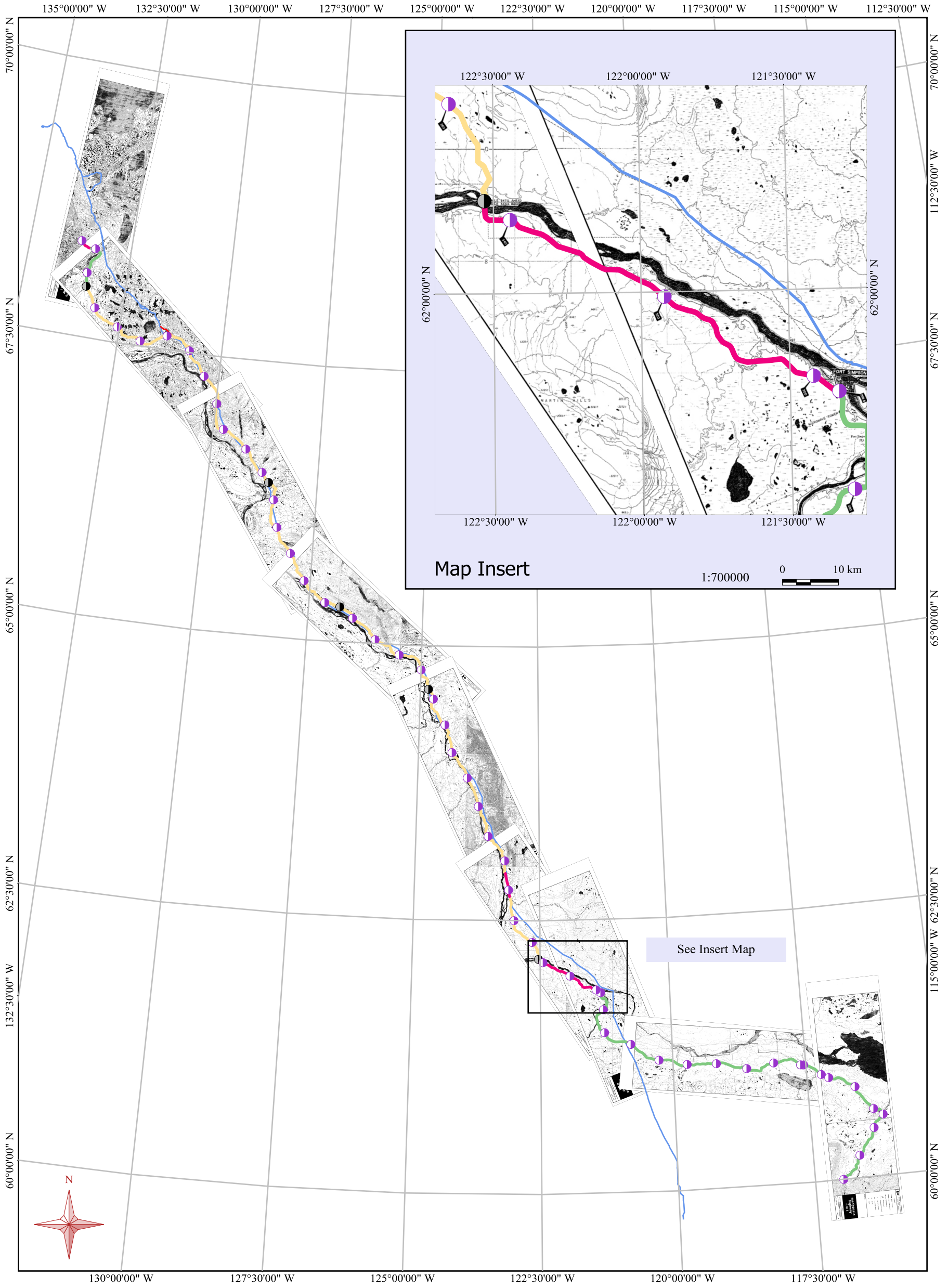
N

1:2500000

0 100 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)
Prepared by: Raymond Baksi, November 2005 Digitized from were 107-0000_011_520_001_REVC to 107-0000_011_520_004_REVC, and 107-0000_011_520_005_REVC	

Appendix F – Highway NWT, June 1974 – Route, Mile Markers, Chainage Adjustment



Map 6 of 18: Mackenzie Highway NWT, June 1974

Legend

Highway MP
Points
MP chainage adjustment
Points
1:4000000

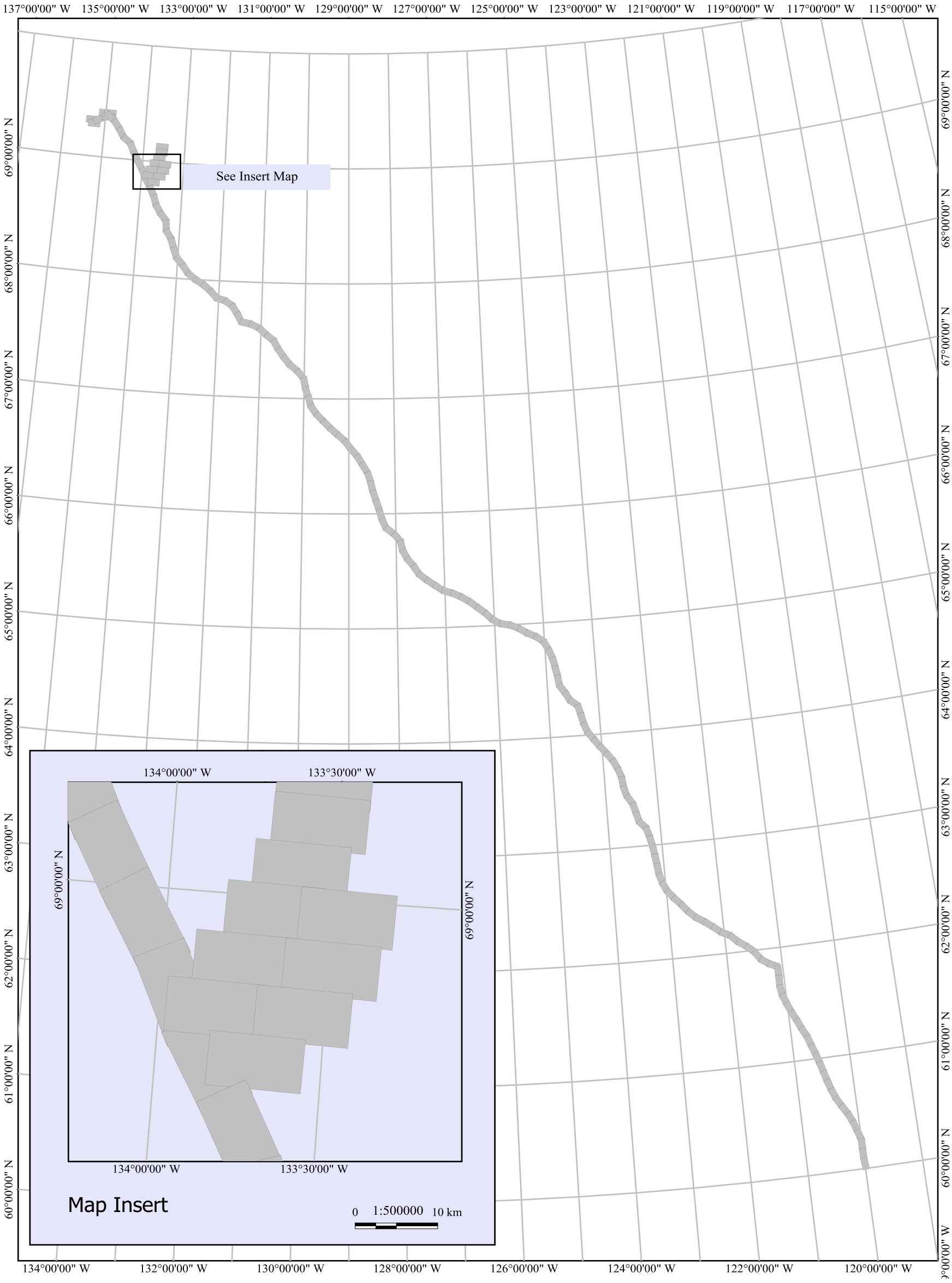
0 100 km

Highway c. 1974
Lines : HWY Type
Highway (constructed)
Highway (proposed)
Highway (under construction)
Combined Pipeline (Including July 26, 205 changes)
Lines (For positional reference only)

Projection:	Universal Transverse Mercator - Zone 10 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005
Digitized from Public Works Canada. Western Region
Mackenzie Highway, N.W.T., route maps, June 1974

Appendix G – AMEC Pipeline Landform Footprints



Map 7 of 18: AMEC Landform Map Footprints

Legend

All footprints in (UTM 9 NAD 83)

Areas

N

1:4000000

0 100 km

Projection:	Universal Transverse Mercator - Zone 09 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, December 2005
Digitized from AMEC Landform Maps Part 2 Feb 05_(p1).PDF to ...(p50).PDF,
Landform Maps Part 3 Feb 05_(p1).PDF to ...(p53).PDF, and
Landform Maps Part 4 Feb 05_(p1).PDF to ...(p56).PDF
IOR Map #'s 107-0000-014-035 001 to 107-0000-014-035 158

Appendix H – Buffer Overlap Raw Data

HWY B 1 Km pipeline overlaps				
HWY and Pipeline buffer overlaps	Area (I)	Area Km squared	% Of Pipeline Buffer With Buffer Overlap	% Of HWY Buffer With Buffer Overlap
HWY B 1Km Pipeline B 01 Km	707854502.9740	707.85	23.94%	20.73%
HWY B 1Km Pipeline B 02 Km	1083156365.4381	1083.16	18.51%	31.72%
HWY B 1Km Pipeline B 03 Km	1288886524.5652	1288.89	14.77%	37.75%
HWY B 1Km Pipeline B 04 Km	1430051224.7494	1430.05	12.34%	41.88%
HWY B 1Km Pipeline B 05 Km	1558934017.8994	1558.93	10.79%	45.66%
HWY B 1Km Pipeline B 06 Km	1757722745.4869	1757.72	10.17%	51.48%
HWY B 1Km Pipeline B 07 Km	1757722745.4869	1757.72	8.74%	51.48%
HWY B 1Km Pipeline B 08 Km	1826034829.7216	1826.03	7.96%	53.48%
HWY B 1Km Pipeline B 09 Km	1878673311.3661	1878.67	7.29%	55.02%
HWY B 1Km Pipeline B 10 Km	1923886721.8215	1923.89	6.72%	56.34%
HWY B 1Km Pipeline B 11 Km	1970671922.3021	1970.67	6.26%	57.72%
HWY B 1Km Pipeline B 12 Km	2015193922.2745	2015.19	5.87%	59.02%
HWY B 1Km Pipeline B 13 Km	2108276171.0051	2108.28	5.67%	61.75%
HWY B 1Km Pipeline B 14 Km	2108276171.0051	2108.28	5.27%	61.75%
HWY B 1Km Pipeline B 15 Km	2165105931.2316	2165.11	5.05%	63.41%
HWY B 1Km Pipeline B 16 Km	2208255537.4117	2208.26	4.83%	64.67%
HWY B 1Km Pipeline B 17 Km	2255729658.5751	2255.73	4.64%	66.06%
HWY B 1Km Pipeline B 18 Km	2306693123.3635	2306.69	4.48%	67.56%
HWY B 1Km Pipeline B 19 Km	2342402676.6940	2342.40	4.31%	68.60%

HWY B 2 Km pipeline overlaps				
HWY and Pipeline buffer overlaps Overlap	Area (I)	Area Km squared	% Of Pipeline Buffer With Buffer Overlap	% Of HWY Buffer With Buffer Overlap
HWY B 2 Km Pipeline B 01 Km	1079372992.3433	1079.37	36.51%	15.83%
HWY B 2 Km Pipeline B 02 Km	1985625304.4089	1985.63	33.93%	29.12%
HWY B 2 Km Pipeline B 03 Km	2501605658.4403	2501.61	28.67%	36.69%
HWY B 2 Km Pipeline B 04 Km	2835256024.3158	2835.26	24.46%	41.58%
HWY B 2 Km Pipeline B 05 Km	3094284939.4287	3094.28	21.42%	45.38%
HWY B 2 Km Pipeline B 06 Km	3306949754.8588	3306.95	19.12%	48.50%
HWY B 2 Km Pipeline B 07 Km	3488862601.2621	3488.86	17.34%	51.17%
HWY B 2 Km Pipeline B 08 Km	3627312089.5359	3627.31	15.80%	53.20%
HWY B 2 Km Pipeline B 09 Km	3739854420.5474	3739.85	14.50%	54.85%
HWY B 2 Km Pipeline B 10 Km	3837740867.2153	3837.74	13.41%	56.29%
HWY B 2 Km Pipeline B 11Km	3928118343.2460	3928.12	12.48%	57.61%
HWY B 2 Km Pipeline B 12 Km	4015276158.5648	4015.28	11.70%	58.89%
HWY B 2 Km Pipeline B 13 Km	4112439155.4072	4112.44	11.07%	60.32%
HWY B 2 Km Pipeline B 14 Km	4208786340.4785	4208.79	10.52%	61.73%
HWY B 2 Km Pipeline B 15 Km	4304687224.1990	4304.69	10.04%	63.14%
HWY B 2 Km Pipeline B 16 Km	4409627923.8946	4409.63	9.65%	64.68%
HWY B 2 Km Pipeline B 17 Km	4501667675.4523	4501.67	9.27%	66.03%
HWY B 2 Km Pipeline B 18 Km	4583528827.0470	4583.53	8.91%	67.23%
HWY B 2 Km Pipeline B 19 Km	4660187151.5564	4660.19	8.58%	68.35%

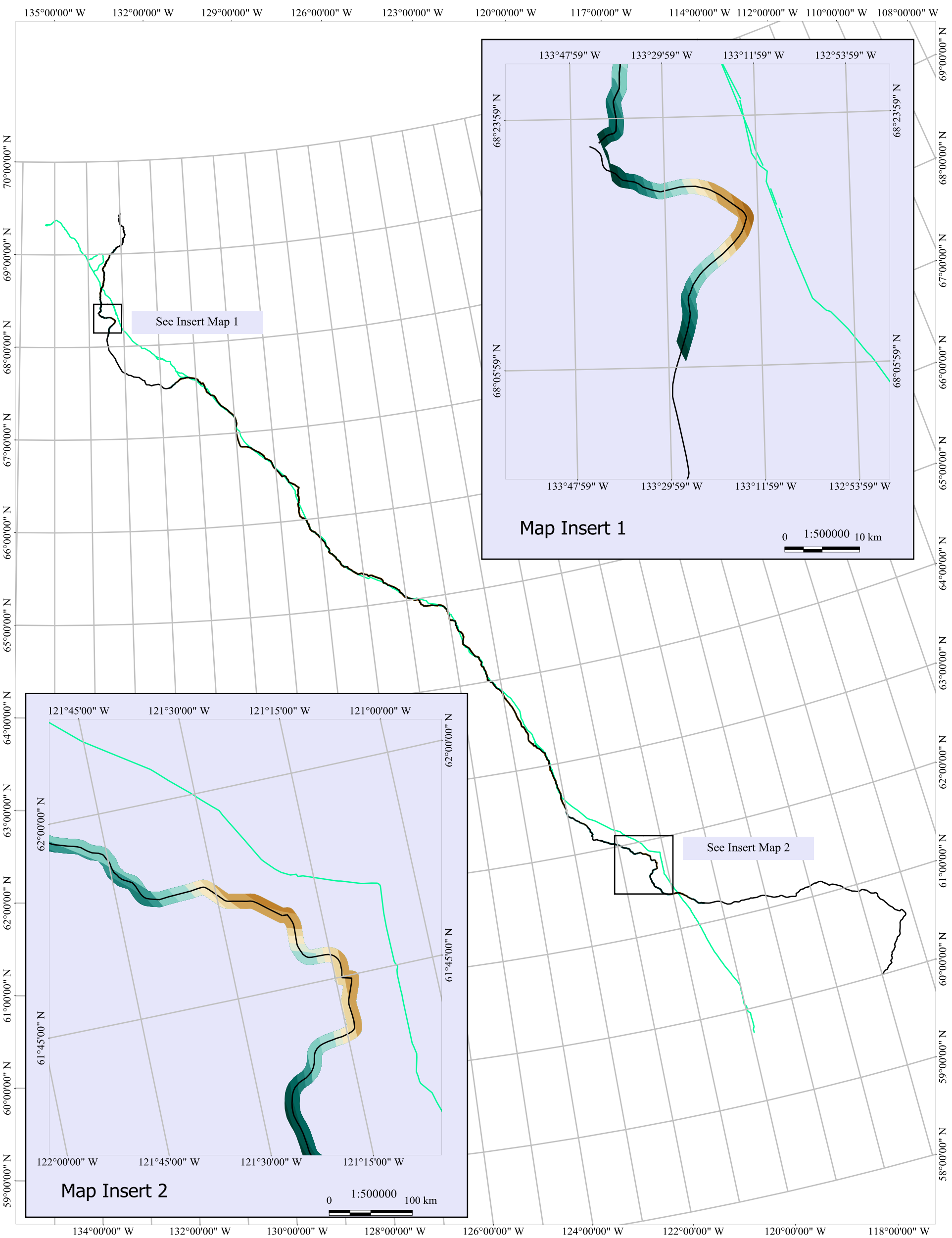
HWY B 3 Km pipeline overlaps				
HWY and Pipeline buffer overlaps Overlap	Area (l)	Area Km squared	% Of Pipeline Buffer With Buffer Overlap	% Of HWY Buffer With Buffer Overlap
HWY B 3 Km Pipeline B 01 Km	1287192321.7600	1287.19	43.53%	12.61%
HWY B 3 Km Pipeline B 02 Km	2482028006.4318	2482.03	42.41%	24.31%
HWY B 3 Km Pipeline B 03 Km	3514169308.0591	3514.17	40.27%	34.42%
HWY B 3 Km Pipeline B 04 Km	4151339633.0426	4151.34	35.81%	40.66%
HWY B 3 Km Pipeline B 05 Km	4570742323.6736	4570.74	31.64%	44.77%
HWY B 3 Km Pipeline B 06 Km	4899847975.3776	4899.85	28.34%	47.99%
HWY B 3 Km Pipeline B 07 Km	5167773705.4522	5167.77	25.68%	50.62%
HWY B 3 Km Pipeline B 08 Km	5395338617.8841	5395.34	23.50%	52.84%
HWY B 3 Km Pipeline B 09 Km	5578153592.3051	5578.15	21.63%	54.63%
HWY B 3 Km Pipeline B 10 Km	5732502867.9396	5732.50	20.03%	56.15%
HWY B 3 Km Pipeline B 11 Km	5870761606.6160	5870.76	18.66%	57.50%
HWY B 3 Km Pipeline B 12 Km	6014982696.0552	6014.98	17.53%	58.91%
HWY B 3 Km Pipeline B 13 Km	6157021869.5096	6157.02	16.57%	60.30%
HWY B 3 Km Pipeline B 14 Km	6296484513.9198	6296.48	15.74%	61.67%
HWY B 3 Km Pipeline B 15 Km	6442040687.9726	6442.04	15.03%	63.10%
HWY B 3 Km Pipeline B 16 Km	6585230490.8455	6585.23	14.41%	64.50%
HWY B 3 Km Pipeline B 17 Km	6723095197.2062	6723.10	13.84%	65.85%
HWY B 3 Km Pipeline B 18 Km	6839361085.4767	6839.36	13.30%	66.99%
HWY B 3 Km Pipeline B 19 Km	6938248178.1679	6938.25	12.78%	67.96%

HWY B 4 Km pipeline overlaps				
HWY and Pipeline buffer overlaps Overlap	Area (l)	Area Km squared	% Of Pipeline Buffer With Buffer Overlap	% Of HWY Buffer With Buffer Overlap
HWY B 4 Km Pipeline B 01 Km	1419929316.1319	1419.93	48.02%	10.45%
HWY B 4 Km Pipeline B 02 Km	2805916737.9673	2805.92	47.95%	20.65%
HWY B 4 Km Pipeline B 03 Km	4114211924.6469	4114.21	47.15%	30.28%
HWY B 4 Km Pipeline B 04 Km	5231062534.3335	5231.06	45.13%	38.49%
HWY B 4 Km Pipeline B 05 Km	5941167271.2509	5941.17	41.13%	43.72%
HWY B 4 Km Pipeline B 06 Km	6419859014.6777	6419.86	37.13%	47.24%
HWY B 4 Km Pipeline B 07 Km	6798300729.6170	6798.30	33.79%	50.03%
HWY B 4 Km Pipeline B 08 Km	7111538560.5206	7111.54	30.98%	52.33%
HWY B 4 Km Pipeline B 09 Km	7380082830.6385	7380.08	28.62%	54.31%
HWY B 4 Km Pipeline B 10 Km	7602155017.1658	7602.16	26.56%	55.94%
HWY B 4 Km Pipeline B 11 Km	7808222769.5072	7808.22	24.82%	57.46%
HWY B 4 Km Pipeline B 12 Km	7999914640.9206	7999.91	23.32%	58.87%
HWY B 4 Km Pipeline B 13 Km	8186139314.6352	8186.14	22.03%	60.24%
HWY B 4 Km Pipeline B 14 Km	8377361244.1261	8377.36	20.94%	61.65%
HWY B 4 Km Pipeline B 15 Km	8563888878.5689	8563.89	19.98%	63.02%
HWY B 4 Km Pipeline B 16 Km	8740583132.0504	8740.58	19.12%	64.32%
HWY B 4 Km Pipeline B 17 Km	8905547185.5442	8905.55	18.33%	65.53%
HWY B 4 Km Pipeline B 18 Km	9188131011.4045	9188.13	17.86%	67.61%
HWY B 4 Km Pipeline B 19 Km	9188131011.4045	9188.13	16.92%	67.61%

HWY B 5 Km pipeline overlaps				
HWY and Pipeline buffer overlaps Overlap	Area (l)	Area Km squared	% Of Pipeline Buffer With Buffer Overlap	% Of HWY Buffer With Buffer Overlap
HWY B 5 Km Pipeline B 01 Km	1540237904.0964	1540.24	52.09%	9.08%
HWY B 5 Km Pipeline B 02 Km	3050873930.3022	3050.87	52.13%	17.99%
HWY B 5 Km Pipeline B 03 Km	4511684812.3069	4511.68	51.70%	26.61%
HWY B 5 Km Pipeline B 04 Km	5886349233.9266	5886.35	50.78%	34.72%
HWY B 5 Km Pipeline B 05 Km	7062684251.8812	7062.68	48.89%	41.65%
HWY B 5 Km Pipeline B 06 Km	7827414229.0765	7827.41	45.27%	46.16%
HWY B 5 Km Pipeline B 07 Km	8354648769.0128	8354.65	41.52%	49.27%
HWY B 5 Km Pipeline B 08 Km	8775912596.8053	8775.91	38.23%	51.76%
HWY B 5 Km Pipeline B 09 Km	9129572183.9379	9129.57	35.40%	53.84%
HWY B 5 Km Pipeline B 10 Km	9449495917.9159	9449.50	33.01%	55.73%
HWY B 5 Km Pipeline B 11 Km	9722351164.5220	9722.35	30.90%	57.34%
HWY B 5 Km Pipeline B 12 Km	9967483785.3538	9967.48	29.05%	58.79%
HWY B 5 Km Pipeline B 13 Km	10208207723.2577	10208.21	27.48%	60.20%
HWY B 5 Km Pipeline B 14 Km	10867472027.7288	10867.47	27.17%	64.09%
HWY B 5 Km Pipeline B 15 Km	10867472027.7288	10867.47	25.36%	64.09%
HWY B 5 Km Pipeline B 16 Km	10867472027.7288	10867.47	23.77%	64.09%
HWY B 5 Km Pipeline B 17 Km	11058430403.3251	11058.43	22.77%	65.22%
HWY B 5 Km Pipeline B 18 Km	11235888666.6388	11235.89	21.84%	66.27%
HWY B 5 Km Pipeline B 19 Km	11401932069.0986	11401.93	21.00%	67.24%

Pipeline Buffers		
Km Pipeline Buffer	Area (l)	Area Km squared
01 Km Pipeline Buffer	2956719039.9651	2956.72
02 Km Pipeline Buffer	5852128612.1610	5852.13
03 Km Pipeline Buffer	8726692894.6479	8726.69
04 Km Pipeline Buffer	11591072310.0179	11591.07
05 Km Pipeline Buffer	14446542319.5142	14446.54
06 Km Pipeline Buffer	17291562738.6383	17291.56
07 Km Pipeline Buffer	20122078932.5243	20122.08
08 Km Pipeline Buffer	22954033763.5668	22954.03
09 Km Pipeline Buffer	25788004793.6657	25788.00
10 Km Pipeline Buffer	28624590571.5082	28624.59
11 Km Pipeline Buffer	31464203777.3189	31464.20
12 Km Pipeline Buffer	34307165070.4640	34307.17
13 Km Pipeline Buffer	37153730567.1996	37153.73
14 Km Pipeline Buffer	40003662257.9472	40003.66
15 Km Pipeline Buffer	42856712098.7969	42856.71
16 Km Pipeline Buffer	45713434874.7273	45713.43
17 Km Pipeline Buffer	48573952192.8310	48573.95
18 Km Pipeline Buffer	51438185437.5163	51438.19
19 Km Pipeline Buffer	54306247563.6499	54306.25

HWY Buffers		
Km HWY Buffer	Area (l)	Area Km squared
01 Km HWY Buffer	3414481934.1827	3414.48
02 Km HWY Buffer	6818000887.1363	6818.00
03 Km HWY Buffer	10209902678.3672	10209.90
04 Km HWY Buffer	13588995300.7898	13589.00
05 Km HWY Buffer	16955824893.3232	16955.82



Legend

- **Combined HWY B 1Km pipeline overlaps**
- HWY B 1Km Pipeline B 01 Km
- HWY B 1Km Pipeline B 02 Km
- HWY B 1Km Pipeline B 03 Km
- HWY B 1Km Pipeline B 04 Km
- HWY B 1Km Pipeline B 05 Km
- HWY B 1Km Pipeline B 06 Km
- HWY B 1Km Pipeline B 07 Km
- HWY B 1Km Pipeline B 08 Km
- HWY B 1Km Pipeline B 09 Km
- HWY B 1Km Pipeline B 10 Km
- HWY B 1Km Pipeline B 11 Km
- HWY B 1Km Pipeline B 12 Km
- HWY B 1Km Pipeline B 13 Km
- HWY B 1Km Pipeline B 14 Km
- HWY B 1Km Pipeline B 15 Km
- HWY B 1Km Pipeline B 16 Km
- HWY B 1Km Pipeline B 17 Km
- HWY B 1Km Pipeline B 18 Km
- HWY B 1Km Pipeline B 19 Km
- **Mackenzie & Inuvik Tuk HWY**
- Lines
- **Combined Pipeline**
- Lines (Including changes)

N

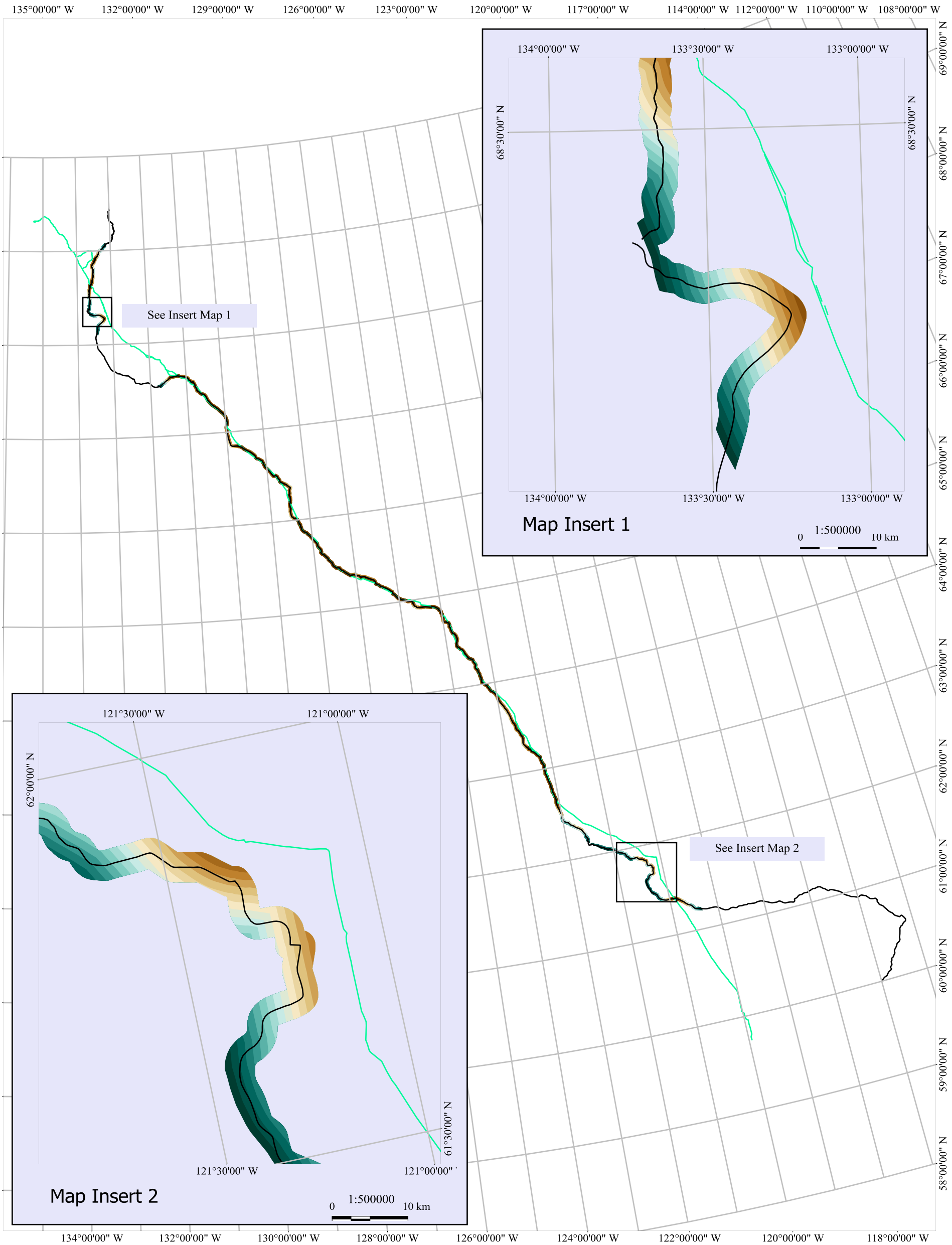
1:4500000

0 100 km

Map 8 of 18: 1 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006



Legend

- **Combined HWY B 2 Km pipeline overlaps**
- HWY B 2 Km Pipeline B 01 Km
- HWY B 2 Km Pipeline B 02 Km
- HWY B 2 Km Pipeline B 03 Km
- HWY B 2 Km Pipeline B 04 Km
- HWY B 2 Km Pipeline B 05 Km
- HWY B 2 Km Pipeline B 06 Km
- HWY B 2 Km Pipeline B 07 Km
- HWY B 2 Km Pipeline B 08 Km
- HWY B 2 Km Pipeline B 09 Km
- HWY B 2 Km Pipeline B 10 Km
- HWY B 2 Km Pipeline B 11Km
- HWY B 2 Km Pipeline B 12 Km
- HWY B 2 Km Pipeline B 13 Km
- HWY B 2 Km Pipeline B 14 Km
- HWY B 2 Km Pipeline B 15 Km
- HWY B 2 Km Pipeline B 16 Km
- HWY B 2 Km Pipeline B 17 Km
- HWY B 2 Km Pipeline B 18 Km
- HWY B 2 Km Pipeline B 19 Km
- **Mackenzie & Inuvik Tuk HWY**
- Lines
- **Combined Pipeline**
- Lines (Including changes)

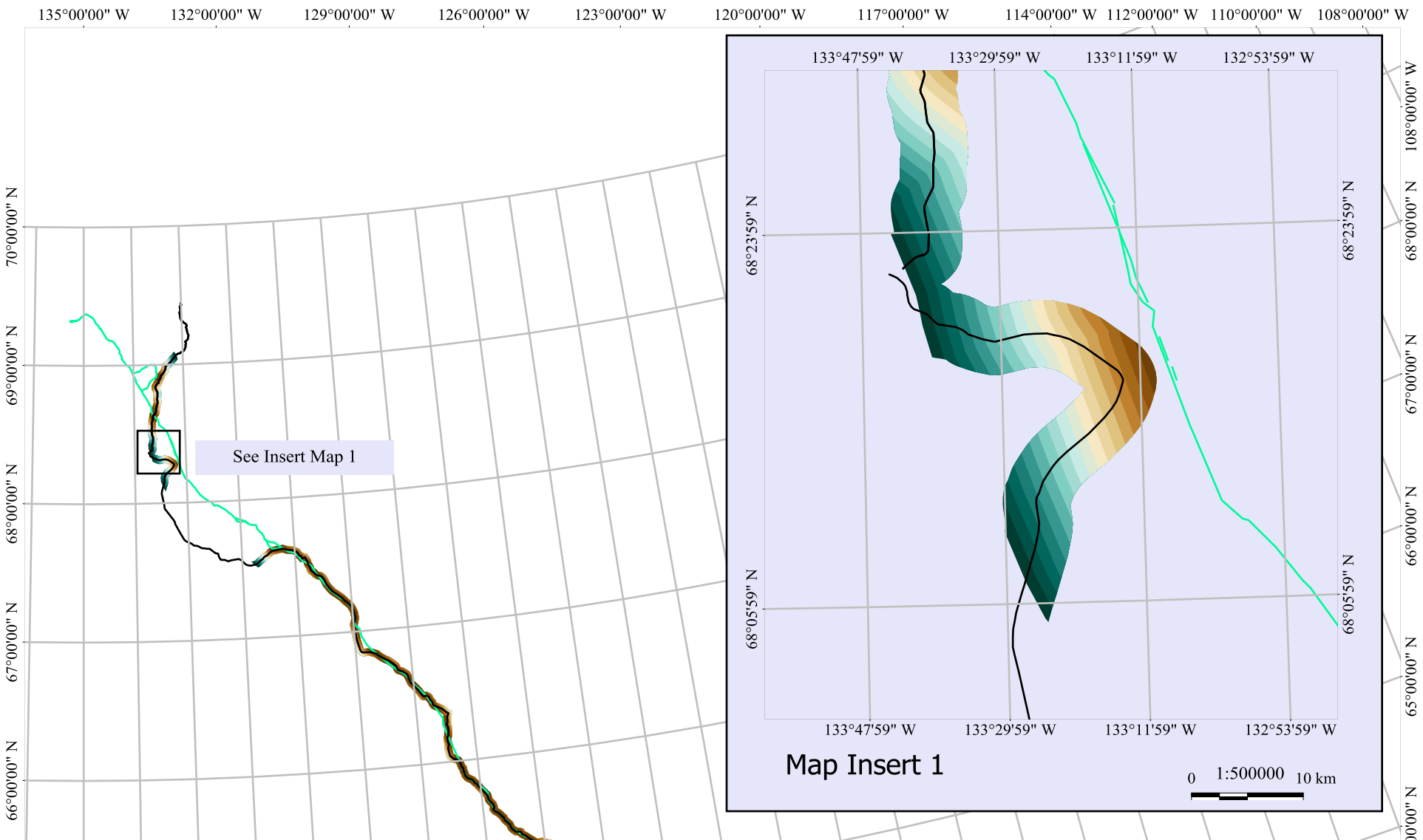
N

1:4500000
0
100 km

Map 9 of 18: 2 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006



Legend

- **Combined HWY B 3 Km pipeline overlaps**
- HWY B 3 Km Pipeline B 01 Km
- HWY B 3 Km Pipeline B 02 Km
- HWY B 3 Km Pipeline B 03 Km
- HWY B 3 Km Pipeline B 04 Km
- HWY B 3 Km Pipeline B 05 Km
- HWY B 3 Km Pipeline B 06 Km
- HWY B 3 Km Pipeline B 07 Km
- HWY B 3 Km Pipeline B 08 Km
- HWY B 3 Km Pipeline B 09 Km
- HWY B 3 Km Pipeline B 10 Km
- HWY B 3 Km Pipeline B 11 Km
- HWY B 3 Km Pipeline B 12 Km
- HWY B 3 Km Pipeline B 13 Km
- HWY B 3 Km Pipeline B 14 Km
- HWY B 3 Km Pipeline B 15 Km
- HWY B 3 Km Pipeline B 16 Km
- HWY B 3 Km Pipeline B 17 Km
- HWY B 3 Km Pipeline B 18 Km
- HWY B 3 Km Pipeline B 19 Km
- **Mackenzie & Inuvik Tuk HWY**
- Lines
- **Combined Pipeline**
- Lines (Including changes)

Map 10 of 18: 3 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006

Map 11 of 18: 4 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers

See Insert Map 1

See Insert Map 2

Map Insert 1

133°47'59" W — 133°29'59" W — 133°11'59" W — 132°53'59" W

68°23'59" N — 68°05'59" N

0 1:500000 10 km

Map Insert 2

121°30'00" W — 121°00'00" W — 122°00'00" W

62°00'00" N — 61°30'00" N — 60°00'00" N

0 1:500000 10 km

135°00'00" W — 132°00'00" W — 129°00'00" W — 126°00'00" W — 123°00'00" W — 120°00'00" W — 117°00'00" W — 114°00'00" W — 111°00'00" W — 108°00'00" W

70°30'00" N — 69°00'00" N — 67°30'00" N — 66°00'00" N — 64°30'00" N — 63°00'00" N — 61°30'00" N — 60°00'00" N — 58°30'00" N

135°00'00" W — 133°30'00" W — 132°00'00" W — 130°30'00" W — 129°00'00" W — 127°30'00" W — 126°00'00" W — 124°30'00" W — 123°00'00" W — 121°30'00" W — 120°00'00" W — 118°30'00" W

Legend

Combined HWY B 4 Km pipeline overlaps

- HWY B 4 Km Pipeline B 01 Km
- HWY B 4 Km Pipeline B 02 Km
- HWY B 4 Km Pipeline B 03 Km
- HWY B 4 Km Pipeline B 04 Km
- HWY B 4 Km Pipeline B 05 Km
- HWY B 4 Km Pipeline B 06 Km
- HWY B 4 Km Pipeline B 07 Km
- HWY B 4 Km Pipeline B 08 Km
- HWY B 4 Km Pipeline B 09 Km
- HWY B 4 Km Pipeline B 10 Km
- HWY B 4 Km Pipeline B 11 Km
- HWY B 4 Km Pipeline B 12 Km
- HWY B 4 Km Pipeline B 13 Km
- HWY B 4 Km Pipeline B 14 Km
- HWY B 4 Km Pipeline B 15 Km
- HWY B 4 Km Pipeline B 16 Km
- HWY B 4 Km Pipeline B 17 Km
- HWY B 4 Km Pipeline B 18 Km
- HWY B 4 Km Pipeline B 19 Km

Combined Pipeline

Lines (Including changes)

Mackenzie & Inuvik Tuk HWY

Lines

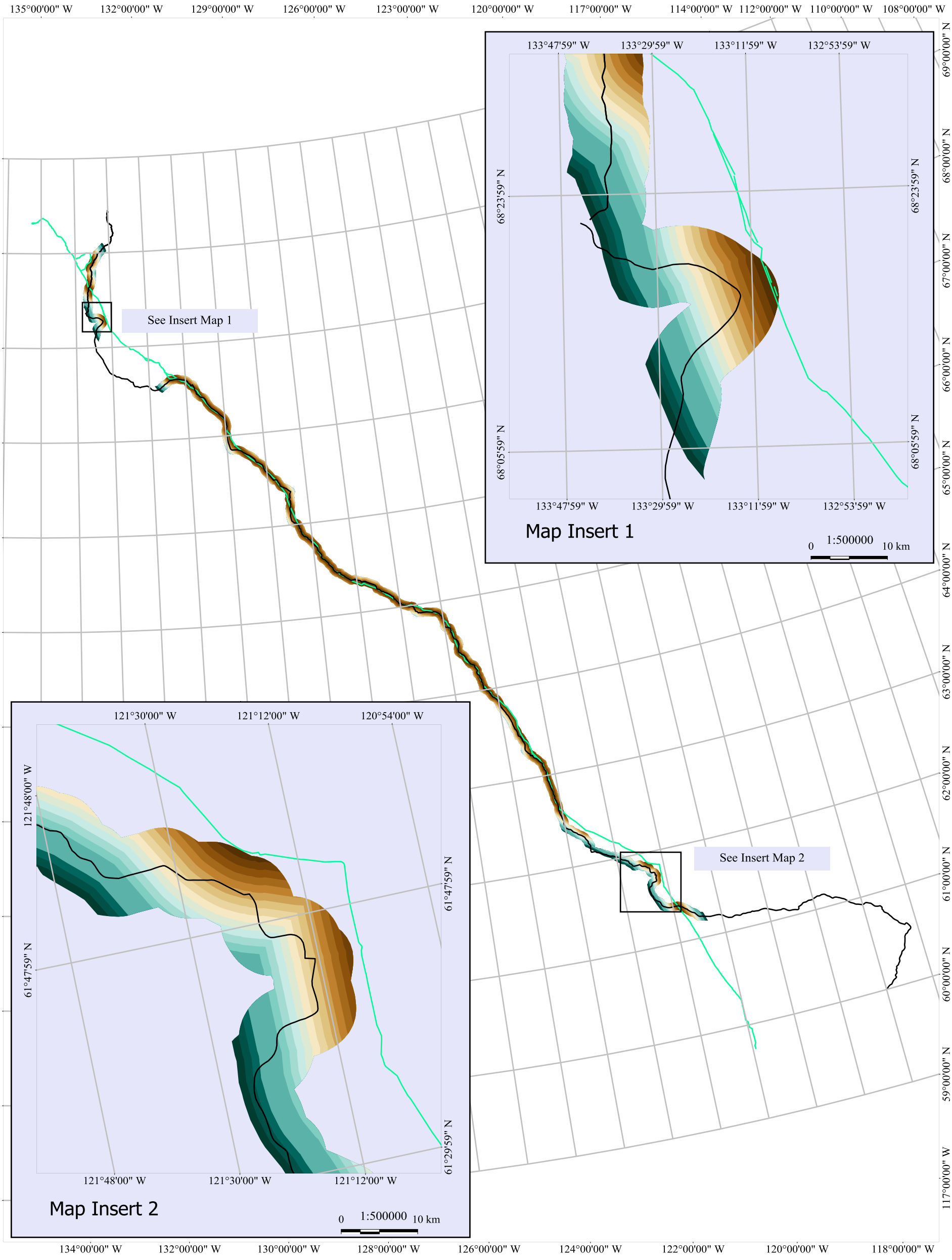
N

1:4500000

0 100 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006



Legend

- **Combined HWY B 5 Km pipeline overlaps**
- HWY B 5 Km Pipeline B 01 Km
- HWY B 5 Km Pipeline B 02 Km
- HWY B 5 Km Pipeline B 03 Km
- HWY B 5 Km Pipeline B 04 Km
- HWY B 5 Km Pipeline B 05 Km
- HWY B 5 Km Pipeline B 06 Km
- HWY B 5 Km Pipeline B 07 Km
- HWY B 5 Km Pipeline B 08 Km
- HWY B 5 Km Pipeline B 09 Km
- HWY B 5 Km Pipeline B 10 Km
- HWY B 5 Km Pipeline B 11 Km
- HWY B 5 Km Pipeline B 12 Km
- HWY B 5 Km Pipeline B 13 Km
- HWY B 5 Km Pipeline B 14 Km
- HWY B 5 Km Pipeline B 15 Km
- HWY B 5 Km Pipeline B 16 Km
- HWY B 5 Km Pipeline B 17 Km
- HWY B 5 Km Pipeline B 18 Km
- HWY B 5 Km Pipeline B 19 Km
- **Mackenzie & Inuvik Tuk HWY**
- Lines
- **Combined Pipeline**
- Lines (Including changes)

N

1:4500000

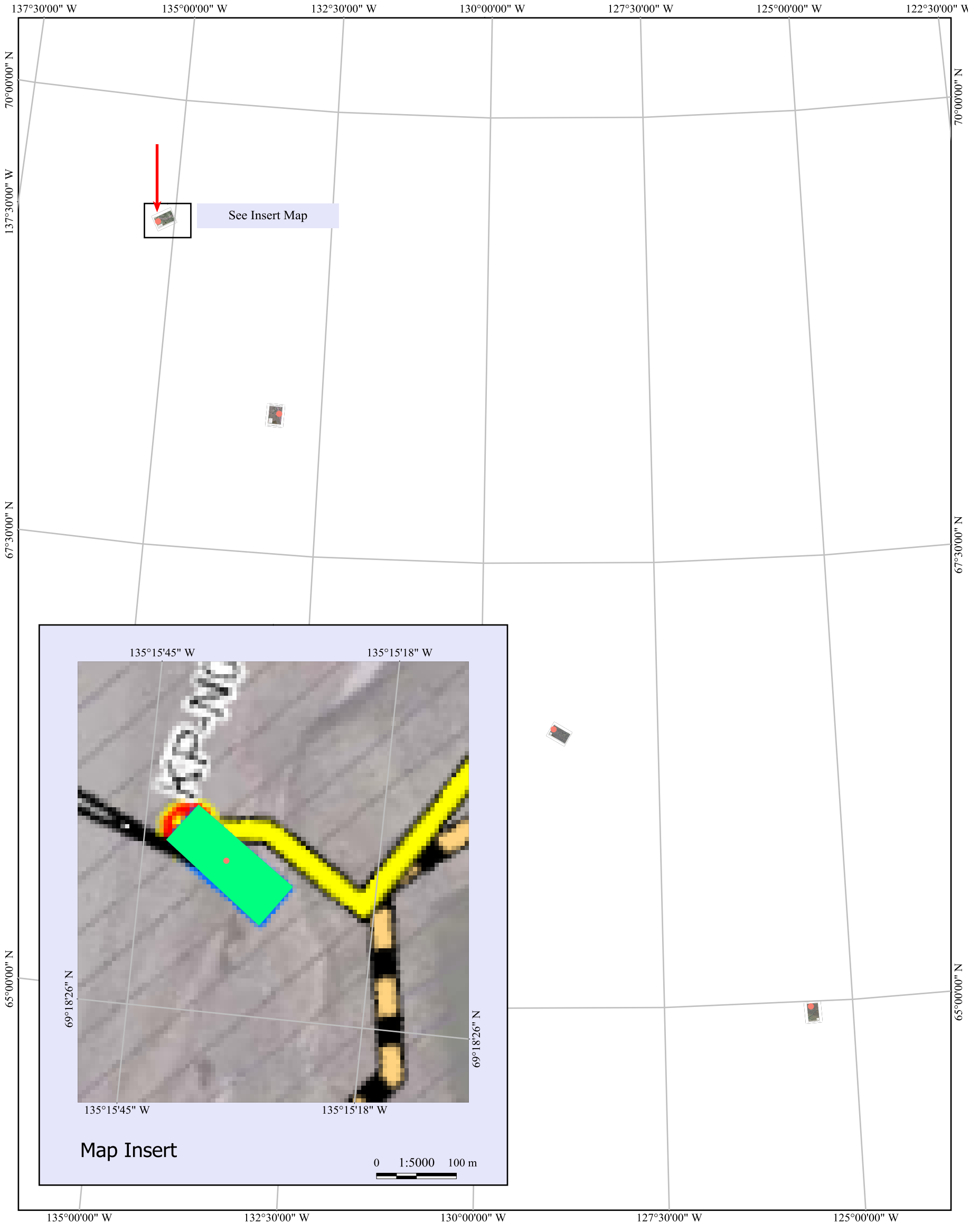
0 100 km

Map 12 of 18: 5 KM Highway Buffer Overlap With 1 Through 19 Km Pipeline Buffers

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006

Appendix I – MGP Project Update (10800) Sandy Martin 05-11-23



Map 13 of 18: Facility Relocation - MGP Update (10800)

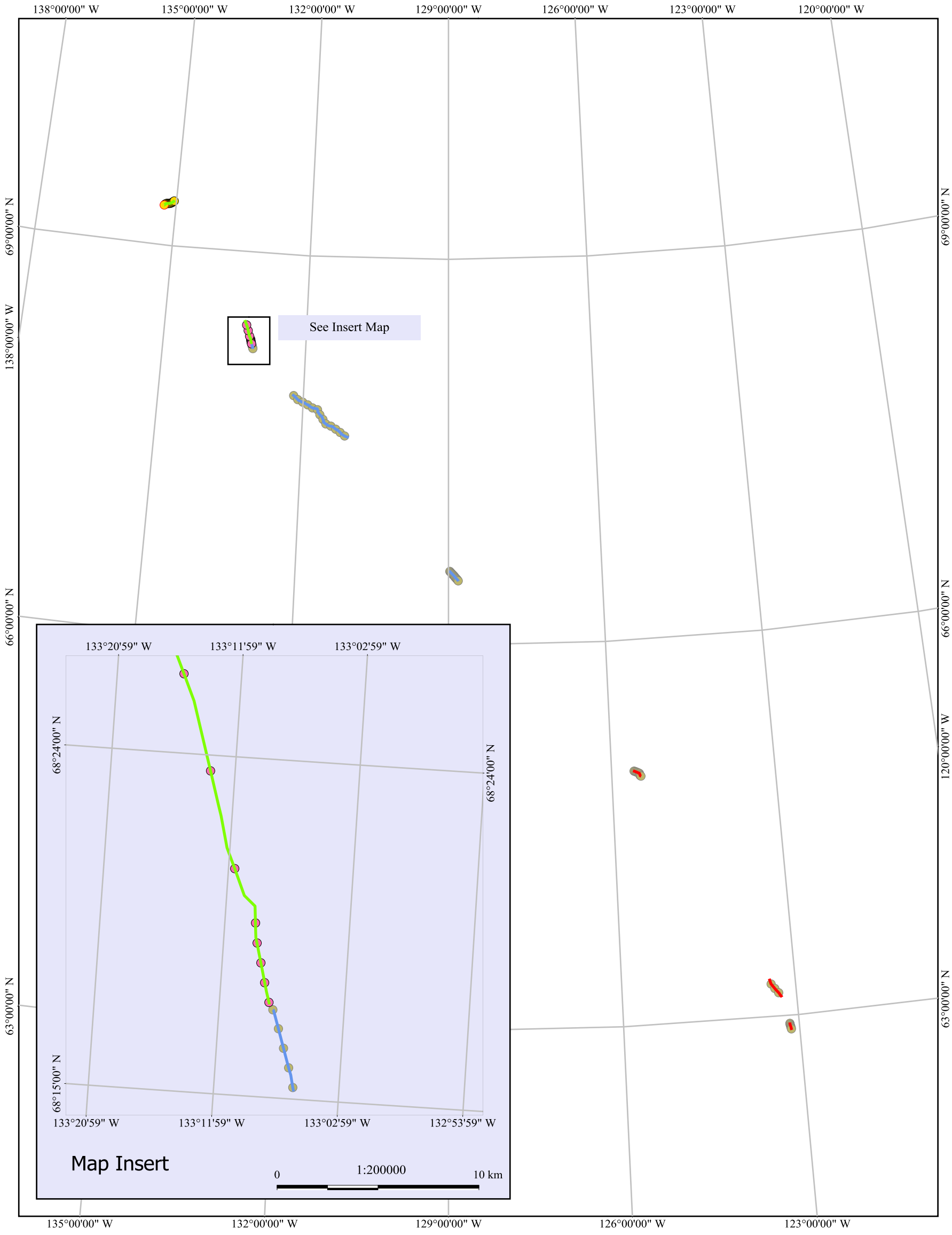
Legend

Facility Relocation as Point
Points
Facility Relocation as Area
Areas

N
1:2500000
0 100 km

Projection:	Universal Transverse Mercator - Zone 09 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005 digitized from maps:
107-0000-011-553 010 - A0S3D6_-_Other.tif to 107-0000-011-553 009 - A0S3D5_-_Other_9.tif
from MGP Project Update (10800) Sandy Martin 05-11-23 source



Map 14 of 18: Gas & Gathering Pipeline Re- Route and Km Post Marking - MGP Update (10800)

Legend

- **Gathering Pipeline Re-route**
  - Lines
- **Gas Pipeline Re-Route**
  - Lines
- **Pipeline Route of NGL and Gas Pipelines**
  - Lines
- **Gathering Pipeline KM post**
  - Niglintgak lateral re-route
- **Gathering Pipeline KM post**
  - Storm Hill Lateral re-route
- **Gas pipeline KM post**
  - Re-route marker

N

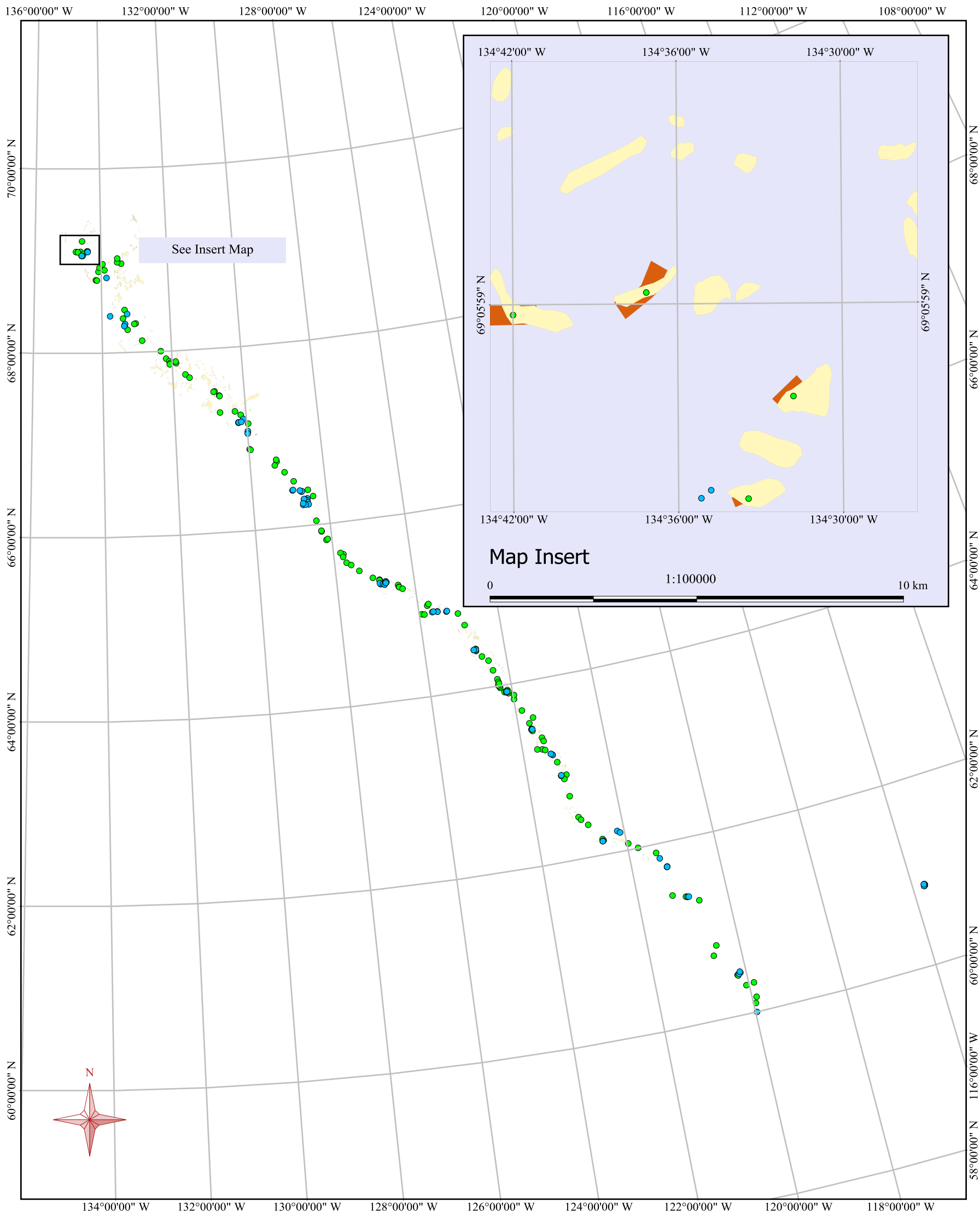
0 100 km

1:3500000

Projection:	Universal Transverse Mercator - Zone 09 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, November 2005 digitized from maps:
107-0000-011-553 010 - A0S3D6_-_Other.tif to 107-0000-011-553 009 - A0S3D5_-_Other_9.tif
from MGP Project Update (10800) Sandy Martin 05-11-23 source

Appendix J – MGP routing and facilities - Pits, Proposed Infrastructure, Facilities as Points, Block and Check Valves, and Pipeline Route and Alternatives



Map 15 of 18: MGP Routing and Facilities (Proponent Digitized) - Pits & Proposed infrastructure

Legend

ENG_DISC_IF_INFRASITE_P Drawing
Points (proposed Infrastructure)
ENG_DISC_IS_INVESTSITE_P Drawing
Points (Pits)

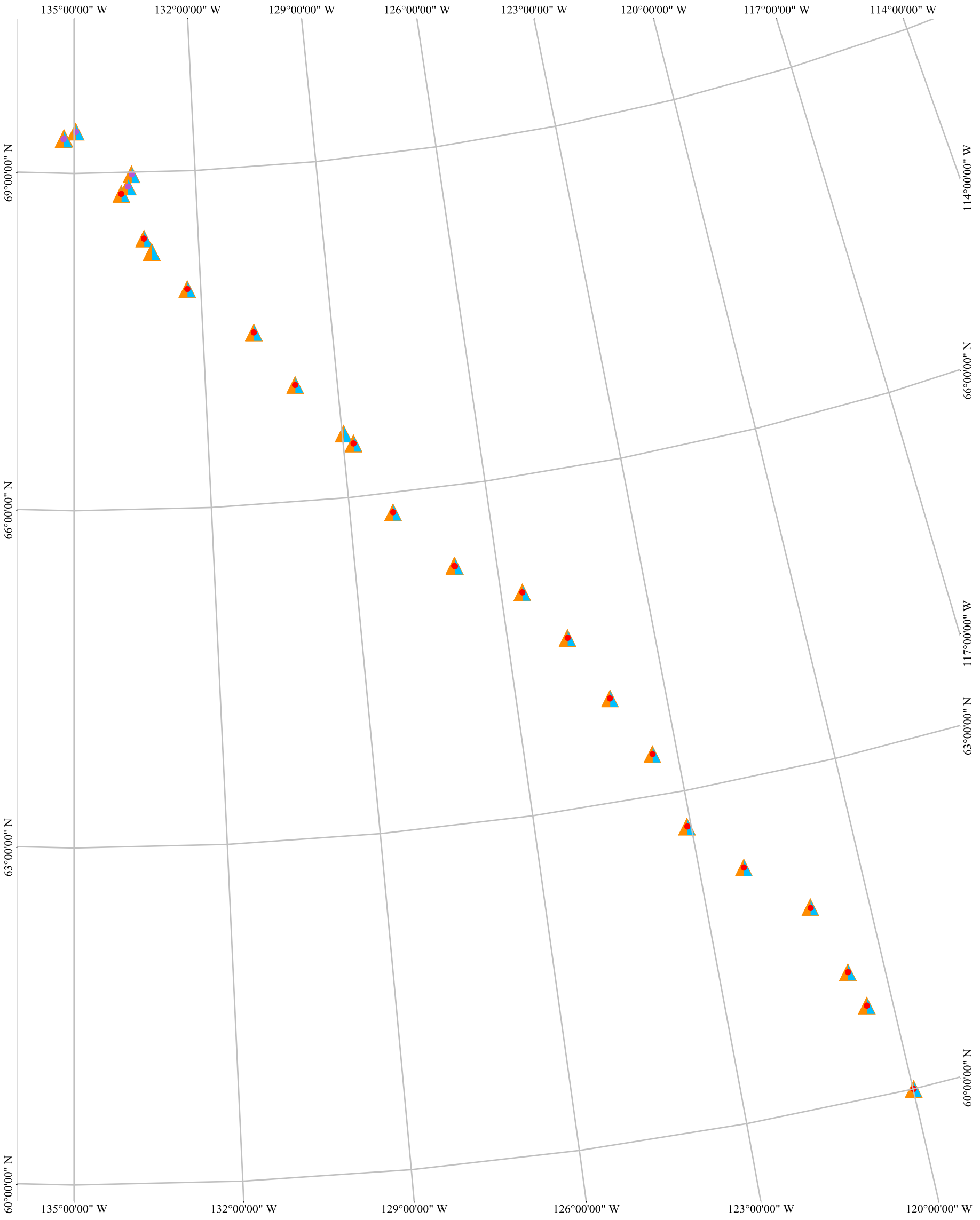
Pits Combined
Granular 20-04-0238
MGP 1-50000

1:5000000

0 100 km

Projection:	Universal Tranverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006
Digitized from ENG_DISC_IF_Infrasite_P & ENG_DISC_IS_Investsite_P



Map 16 of 18: MGP Routing and Facilities (Proponent Digitized) - Facilities as Points

Legend

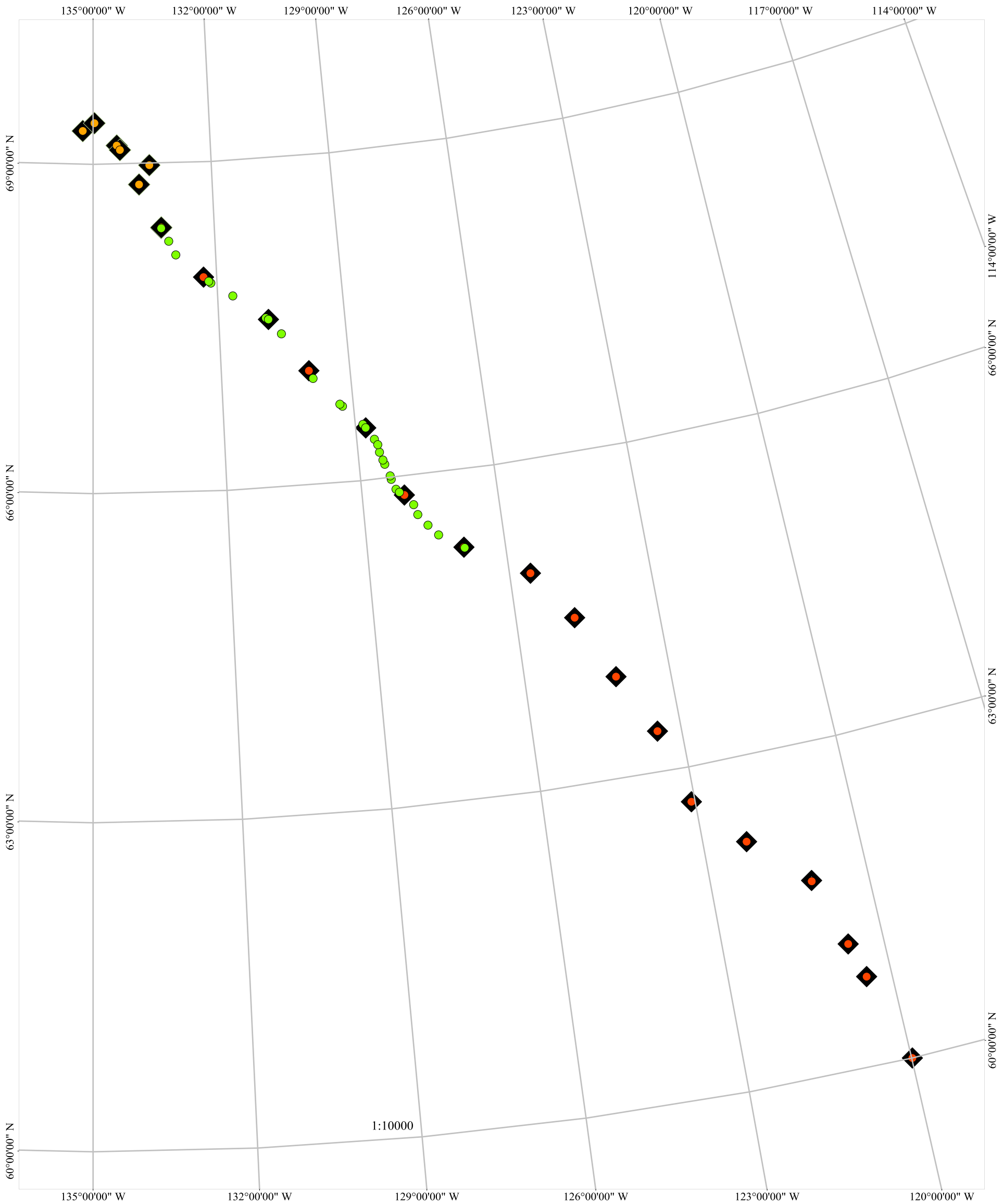
ENG_DISC_PF_GCF_P Drawing
Gas Conditioning Facilities
ENG_DISC_PF_FACILITY_P Drawing
Proposed Pipeline Facilities
Facility as Point
Points

N

1:4000000

0 100 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)
Prepared by: Raymond Baksi, March 2006 Digitized from ENG_DISC_PF_GCF_P & ENG_DISC_PF__FACILITY_P	



Map 17 of 18: MGP Routing and Facilities (Proponent Digitized) - Block and Check Valves

Legend

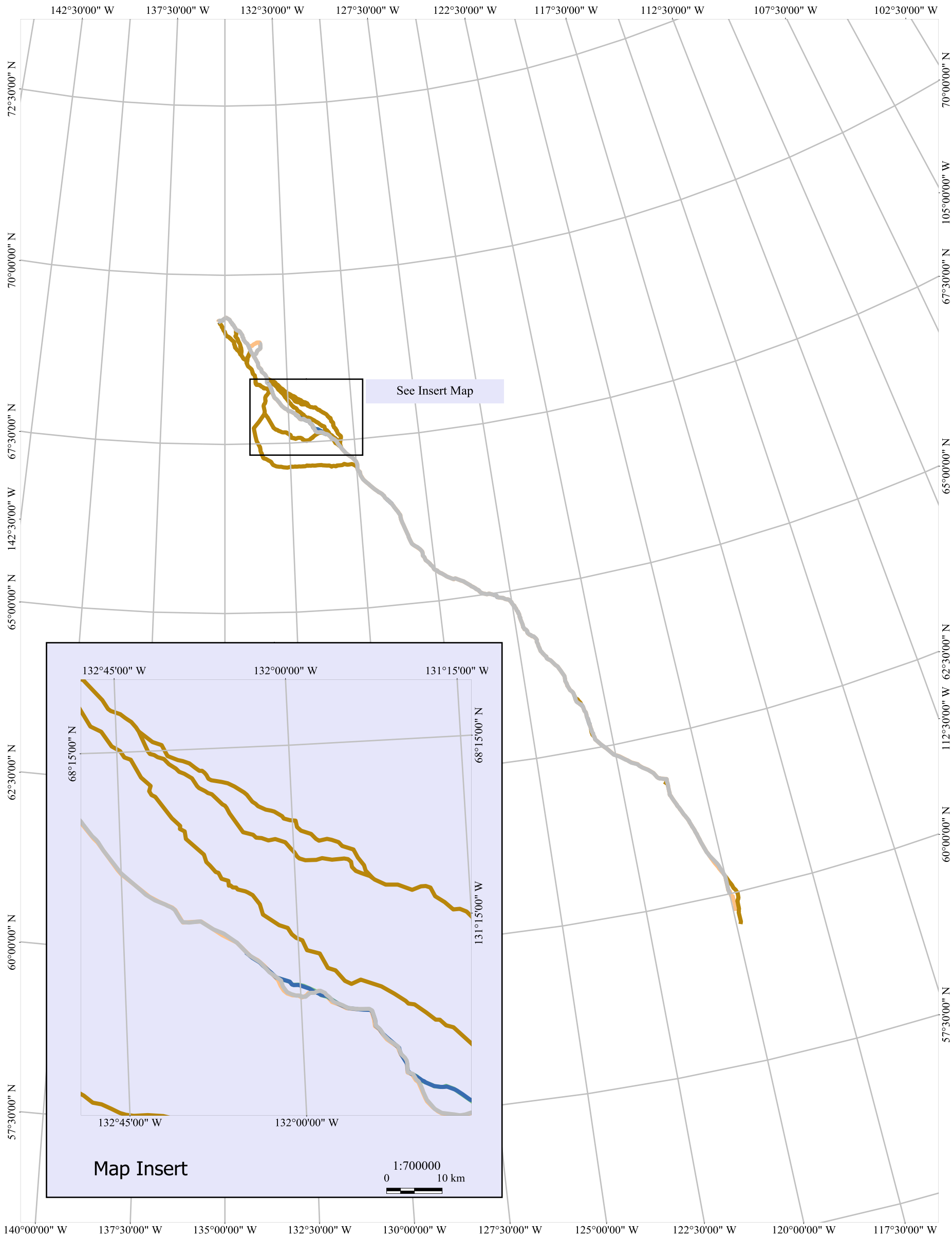
- **ENG_DISC_PF_NGLBLOCKVALVE_P Drawing**
- NGL Gas and Check Valves
- **ENG_DISC_PF_GATHBLOCKVALVE_P Drawing**
- Gathering Gas Block Valves
- **ENG_DISC_PF_GASBLOCKVALVE_P Drawing**
- Pipeline Gas and Check Valves
- **Gas Block Valve**
- Points

1:4000000

N

0 100 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)
Prepared by: Raymond Baksi, March 2006 Digitized from ENG_DISC_PF_NGLBLOCKVALVE_P, ENG_DISC_PF_GATHBLOCKVALVE_P, ENG_DISC_PF_GASBLOCKVALVE_P	



Map 18 of 18: MGP Routing and Facilities (Proponent Digitized) - Pipeline Route and Alternatives

Legend

- **ENG_ROUTE Drawing**
- MGP pipeline route revision
- **ENG_DISC_PL_ROUTEALTERNATIVES_L Drawing**
- MGP pipeline route revision alternatives
- **Pipeline route combined**
- Imperial Oil proposed changes July 26 meeting
- LANDCO
- MGP Project Update (10800) Sandy Martin 05-11-23

1:4000000

N

0 100 km

Projection:	Universal Transverse Mercator - Zone 08 (N)
Datum:	North American 1983 (Canada)

Prepared by: Raymond Baksi, March 2006
ENG_ROUTE, ENG_DISC_PL_ROUTEALTERNATIVES_L

Appendix K – New/Updated data Themes and Suggested Changes for the MV and ISR Granular Website

	Data theme	Type	Source	MVGan Web location	Comment
1	Mackenzie Gathering System COCOA Vol4	Image	Mackenzie Gas Project Mackenzie Gathering System Vol 1-4 Mackenzie Gathering System COCOA Vol4 Gathering Pipelines and NGL Pipeline Route maps MVP pipeline group Map IRO Map Series 107-0000-011-395 XXX REV 0.	Uploaded to CalData Website on Feb 22, 2006	Could be combined as a single layer
2	Mackenzie Valley Pipeline CPCN Vol. 5 images 1-119	Image	Mackenzie Gas Project Mackenzie Valley Pipeline Vol 1-5 Mackenzie Valley Pipeline CPCN Vol 5 Gas Pipeline Route Maps MVP pipeline group Map IRO Map Series 107-0000-011-397 XXX REV 0	Uploaded to CalData Website on Feb 22, 2006	
3	Granular Sources (Mackenzie Highway)	Area	Combination of sources: Aggmap R02035MV, Alex Cicuttini – Co-op project Leo Lau – Co-op project - Influence of Length of Haulage Distances on Potential development of Granular Resources Raymond Baksi –Co-op project Granular Resources Along the Proposed Inuvik – Tuktoyaktuk Highway (Mackenzie Highway Mile 975 to 1059)	http://207.81.155.158/diand_mv/maps/MacValley.mwf NOT AVALIABLE ON THIS SITE http://207.81.155.158/DIAND_GR/maps/MasterEDITmap.mwf Baksi Selected → Basik (Spelled wrong) Selected → GSC Resources → Public Works Resources Also found at: http://207.81.155.158/diand_gr/maps/baksi.mwf Baksi Resource Layers	http://207.81.155.158/diand_mv/maps/MacValley.mwf In regards to this site: http://207.81.155.158/DIAND_GR/maps/MasterEDITmap.mwf My last name is spelled wrong here http://207.81.155.158/diand_gr/maps/baksi.mwf not that useful use the above setup – (Mackenzie.tif) base image no longer available

				→ Merged Resource Layers → Merged → Recources2 → Resources1 → Baksi Lakes → GSC Resources → Parsons Lake Resources → Public Works Resources	
4	Pipeline Route	Line	Caldata 2004 MV Web Leo Lau – Co-op project - Influence of Length of Haulage Distances on Potential development of Granular Resources	http://207.81.155.158/diand_mv/maps/MacValley.mwf ISR Pipeline → Gathering Pipeline → Flow Pipe → Pipeline → 2001 Proposed Pipeline Route and Proposed Pipeline Route	http://207.81.155.158/diand_mv/maps/MacValley.mwf ISR pipeline → Only from Delta to Inuvik "Pipeline" is labelled as "Existing Pipeline" – Need to confirm is this is the Ikhil Pipeline or if it has been mislabled Proposed pipeline route is from Inuvik to Alberta
5	Gathering Pipeline Block Valve	Point	Mackenzie Gas Project Mackenzie Gathering System Vol 1-4 Mackenzie Gathering System COCOA Vol4 Gathering Pipelines and NGL Pipeline Route maps Mackenzie Gas Project Mackenzie Gathering Pipelines Route Map	http://207.81.155.158/DIAND_mv/MV_START.cfm Proposed Pipeline Route And http://207.81.155.158/DIAND_mv/MV_START.cfm ISR Pipeline → Gathering Pipeline → Flow Pipe → Pipeline http://207.81.155.158/diand_mv/maps/MacValley.mwf Cannot find on website	Cannot find on website

			MVP pipeline group Map IRO Map Series 107-0000-011-395 XXX REV 0.		
6	Gathering System - Inuvialuit Private Lands	Area	Mackenzie Gas Project Mackenzie Gathering System Vol 1-4 Mackenzie Gathering System COCOA Vol4 Gathering Pipelines and NGL Pipeline Route maps Mackenzie Gas Project Mackenzie Gathering Pipelines Route Map MVP pipeline group Map IRO Map Series 107-0000-011-395 XXX REV 0.	http://207.81.155.158/diand_mv/maps/MaValley.mwf Baksi July 05 Inuvialuit Private Lands http://207.81.155.158/diand_mv/MV_START.cfm Baksi July 05 Inuvialuit Private Lands	Should be labelled as Inuvialuit Private Lands within the pipeline corridor of the gathering system
7	Gathering System - Significant Discovery Licence Area	Area	Mackenzie Gas Project Mackenzie Gathering System Vol 1-4 Mackenzie Gathering System COCOA Vol4 Gathering Pipelines and NGL Pipeline Route maps Mackenzie Gas Project Mackenzie Gathering Pipelines Route Map MVP pipeline group Map IRO Map Series 107-0000-011-395 XXX REV 0.	http://207.81.155.158/diand_mv/maps/MacValley.mwf Baksi July 05 Significant Discovery Licence http://207.81.155.158/diand_mv/MV_START.cfm Baksi July 05 Significant Discovery Licence	Should be labelled as Significant discovery area within the gathering system
8	Enbridge Pipeline Disturbed Areas	Area	Mackenzie Gas Project Mackenzie Valley Pipeline Vol 1-5 Mackenzie Valley Pipeline CPCN Vol 5 Gas Pipeline Route Maps MVP pipeline group Map IRO Map Series 107-0000-011-397 XXX REV 0	http://207.81.155.158/diand_mv/maps/MacValley.mwf BAKSI July05 Enbridge Disturbed Areal And Enbridge Disturbed Area http://207.81.155.158/diand_mv/MV_START.cfm Baksi July 05 Enbridge Disturbed Areal And Enbridge Disturbed Area	Areal = Area line features such as access to the sites When exported to .shp file manifold adds the 'l' onto the end of the file to indicate line features Area = combination of actual disturbed area and the area line with a buffer around for calculation of disturbed area

9	Mackenzie Highway Disturbed Area	Area	Mackenzie Gas Project Mackenzie Valley Pipeline Vol 1-5 Mackenzie Valley Pipeline CPCN Vol 5 Gas Pipeline Route Maps MVP pipeline group Map IRO Map Series 107-0000-011-397 XXX REV 0	http://207.81.155.158/diand_mv/maps/MacValley.mwf Baksi July 05 MV Disturbed Area And Baksi July 05 MV Disturbed Areal http://207.81.155.158/diand_mv/MV_START.cfm Baksi July 05 MV Disturbed Area And Baksi July 05 MV Disturbed Areal	Should be renamed to Mackenzie HWY disturbed area not MV Area = combination of actual disturbed area and the area line with a buffer around for calculation of disturbed area When exported to .shp file manifold adds the 'l' onto the end of the file to indicate line features
10	Preliminary Engineering Alignment Sheets – Gas pipeline	Image	Preliminary Engineering Alignment Sheets Jan 2005 04 Gas Pipeline MAP IORVL Map Series Series 107-0060-131-XXX 002 REV A	Not provided to Ward Kilby	
11	Terrain Units	Area	Preliminary Engineering Alignment Sheets Jan 2005 04 Gas Pipeline MAP IORVL Map Series Series 107-0060-131-XXX 002 REV A	Uploaded to CalData Website on Feb 22, 2006	
12	Gathering Terrain Units	Area	Preliminary Engineering Alignment Sheets Jan 2005 02 Gathering Pipelines MVP pipeline group MAP IORVL Map Series 107-0010-131-XXX 002 REV A, 107-0015-131-XXX 002 REV A, 107-0020-131-XXX 002 REV A, 107-0025-131-XXX 002 REV A	Uploaded to CalData Website on Feb 22, 2006	
13	Preliminary Engineering Alignment Sheets –	Image	Preliminary Engineering Alignment Sheets Jan 2005 02 Gathering Pipelines MVP pipeline group MAP IORVL Map Series 107-0010-131-XXX 002 REV A,	Uploaded to CalData Website on Feb 22, 2006	

	Gathering Pipelines		107-0015-131-XXX 002 REV A, 107-0020-131-XXX 002 REV A, 107-0025-131-XXX 002 REV A	
14	MGP 1_50000 - Pits	Area	Files georeferenced by Ward Kilby Original source: Mackenzie Gas Project Pipeline, Facilities, Infrastructure, and Construction Preliminary Overview Map MGP 1_500000 map series 107-0000-011-479 XXX REV 0	Uploaded to CalData Website on Feb 22, 2006
15	MGP 1_50000 - Roads	Line	Files georeferenced by Ward Kilby Original source: Mackenzie Gas Project Pipeline, Facilities, Infrastructure, and Construction Preliminary Overview Map MGP 1_500000 map series 107-0000-011-479 XXX REV 0	Uploaded to CalData Website on Feb 22, 2006
16	MGP 1_50000 – Water Source	Area	Files georeferenced by Ward Kilby Original source: Mackenzie Gas Project Pipeline, Facilities, Infrastructure, and Construction Preliminary Overview Map MGP 1_500000 map series 107-0000-011-479 XXX REV 0	Uploaded to CalData Website on Feb 22, 2006
17	Mackenzie Highway June NWT 1974	Line	Files georeferenced by Ward Kilby Original source: Ward Mackenzie Highway, N.W.T., route maps, June 1974 / Canada. Public Works Canada. Western Region Public Works, 1974. 9 maps ; 28 cm. Cover title. 1:250,000. ASTIS record 55152. English http://pubs.aina.ucalgary.ca/gran/55152.pdf XQGLW	Uploaded to CalData Website on Feb 22, 2006

18	Mackenzie Highway MP, June 1974	Point	Files georeferenced by Ward Kilby Original source: Ward Mackenzie Highway, N.W.T., route maps, June 1974 / Canada. Public Works Canada. Western Region Public Works, 1974. 9 maps ; 28 cm. Cover title. 1:250,000. ASTIS record 55152. English http://pubs.aina.ucalgary.ca/gran/55152.pdf XQGLW	Uploaded to CalData Website on Feb 22, 2006
19	Mackenzie MP Chainage adjustment		Files georeferenced by Ward Kilby Original source: Ward Mackenzie Highway, N.W.T., route maps, June 1974 / Canada. Public Works Canada. Western Region Public Works, 1974. 9 maps ; 28 cm. Cover title. 1:250,000. ASTIS record 55152. English http://pubs.aina.ucalgary.ca/gran/55152.pdf XQGLW	Uploaded to CalData Website on Feb 22, 2006
20	Facility as Area Relocation July 26 meeting	Area	Imperial Oil Proposed Changes July 26 meeting 107-0000_011_520_001_REVC 107-0000_011_520_002_REVC 107-0000_011_520_003_REVC 107-0000_011_520_005_REVC	Uploaded to CalData Website on Feb 22, 2006
21	Facility as Point Relocation July 26 meeting	Point	Imperial Oil Proposed Changes July 26 meeting 107-0000_011_520_001_REVC 107-0000_011_520_002_REVC 107-0000_011_520_003_REVC 107-0000_011_520_005_REVC	Uploaded to CalData Website on Feb 22, 2006
22	Pipeline Re-route July 26	Line	Imperial Oil Proposed Changes July 26 meeting 107-0000_011_520_001_REVC	Uploaded to CalData Website on Feb 22, 2006

	meeting		107-0000_011_520_002_REVC 107-0000_011_520_003_REVC 107-0000_011_520_005_REVC	
23	AMEC Pipeline Landform – images georefere4nced	Image	Digitized the AMEC Landform Pipeline map footprints AMEC Pipeline Landform LandForm Maps Part 2 Feb 05__(p1).PDF toLandForm Maps Part 2 Feb 05__(p50).PDF, LandForm Maps Part 3 Feb 05__(p1).PDF to LandForm Maps Part 3 Feb 05__(p53).PDF, and LandForm Maps Part 4 Feb 05__(p1).PDF to LandForm Maps Part 4 Feb 05__(p56).PDF IOR Map #'s 107-0000-014-035 001 to 107-0000-014-035 158	Uploaded to CalData Website on Feb 22, 2006
24	AMEC Pipeline Landform – images georefere4nced - Footprints	Area	Digitized the AMEC Lanform Pipeline map footprints AMEC Pipeline Landform LandForm Maps Part 2 Feb 05__(p1).PDF toLandForm Maps Part 2 Feb 05__(p50).PDF, LandForm Maps Part 3 Feb 05__(p1).PDF to LandForm Maps Part 3 Feb 05__(p53).PDF, and LandForm Maps Part 4 Feb 05__(p1).PDF to LandForm Maps Part 4 Feb 05__(p56).PDF IOR Map #'s 107-0000-014-035 001 to 107-0000-014-035 158	Uploaded to CalData Website on Feb 22, 2006
25	Pipeline highway buffer overlap	Area	Pipeline_highway buffer overlap Pipeline_highway buffer overlap V2.map	Not really useful as a layer, but used to calculate % of overlaps found in file Pipeline_HWY Buffer Overlap Calculations.xls Uploaded to CalData Website on Feb 22, 2006
26	MGP Project Update (10800) Sandy Martin 05-11-23 – updated reroute, facilities etc	Image	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif	Uploaded to CalData Website on Feb 22, 2006

			107-0000-011-553 010 - A0S3D6_-_Other.tif	
27	Facility Relocation as Area	Area	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
28	Facility Relocation as Point	Point	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
29	Gas Pipeline Re-Route	Line	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
30	Gas pipeline Re-route marker KM post	Point	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006

31	Gathering Pipeline KM post Re-route (Niglintgak lateral Route Marker)	Point	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
32	Gathering Pipeline KM post Re-route (Storm Hill Lateral route marker)	Point	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
33	Gathering Pipeline Re-route	Line	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006
34	Pipeline Route of NGL and Gas Pipelines	Line	MGP Project Update (10800) Sandy Martin 05-11-23 107-0000-011-553 004 - A0S3D6_-_Other-3.tif 107-0000-011-553 005 - A0S3D6_-_Other-5.tif 107-0000-011-553 006 - A0S3D6_-_Other-6.tif 107-0000-011-553 007 - A0S3D6_-_Other-7.tif 107-0000-011-553 008 - A0S3D5_-_Other_8.tif 107-0000-011-553 009 - A0S3D5_-_Other_9.tif 107-0000-011-553 010 - A0S3D6_-_Other.tif 107-0000-011-553 011 - A0S3D6_-_Other-2.tif	Uploaded to CalData Website on Feb 22, 2006

Appendix L – Digital Version of Data and Report