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**Hamlet of Tuktoyaktuk, Town of Inuvik  
Government of Northwest Territories**

**ISSUED FOR USE**

**RESPONSE TO THE MAY 25, 2012  
INFORMATION REQUESTS  
FROM THE ENVIRONMENTAL IMPACT REVIEW BOARD  
FOR CONSTRUCTION OF THE  
INUVIK TO TUKTOYAKTUK HIGHWAY, NWT**

**EIRB FILE NO. 02/10-05**

**June 11, 2012**

## ACRONYMS

CEAA	Canadian Environmental Assessment Act
DOT	Department of Transportation (GNWT)
EIRB	Environmental Impact Review Board
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ENR	Environment and Natural Resources
GNWT	Government of the Northwest Territories
HTC	Hunters and Trappers Committee
IFA	Inuvialuit Final Agreement, as Amended April 2005
IR	Information Request
ILA	Inuvialuit Land Administration
ISR	Inuvialuit Settlement Region

The Developers of the proposed Inuvik to Tuktoyaktuk Highway are pleased to provide the six remaining responses to the Environmental Impact Review Board's Information Requests (IRs) (Appendix 3 of the Directives to the Developer ), dated May 25, 2012,. The Developers' responses are included after each information request and are organized into the following sections:

Please note that new tables or figures, created for the most recent information requests, have been numbered according to their respective IR Number. Any tables or figures from the EIS or previous response documents have retained their original number.

**IR Number: 147**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Estimates of Required Gravel Resources

**Preamble**

Tables 2.2-1 and 2.5-1 on pages 46 and 60 of the EIS indicate that a total of 4.75 million m<sup>3</sup> of gravel will be required to build the road. In response to IRs 90 and 92 Round 2), the developer presented Tables 1 and 2 on p. 4 and p. 8 of the response, and summarized on p. 27 that the total gravel required for maintenance and rehabilitation was 3,355,500 m<sup>3</sup> of borrow excavation and 1,216,390 m<sup>3</sup> of crushed aggregate. The total is 4.57 million m<sup>3</sup>.

**Request**

1. Please confirm that the estimate for total gravel required over the first 50 years of the project is  $4.75 + 4.57 = 9.32$  million m<sup>3</sup>.
2. Please indicate the precision of this estimate in per cent (%), including the precision in the requirement for construction and in the requirements for maintenance and rehabilitation.

**Developer Response: 147.1**

As stated in Tables 2.2-1 and 2.5-1 of the EIS, the estimated quantity of construction material needed to build the Highway is approximately 4.75 million cubic metres, based on preliminary design of the 2009 Primary Route. However, a further estimate of the preferred highway alignment (2009 Primary Route with incorporation of Alternative 3 (2010 Minor Realignment)) indicates that the quantity of material needed to construct the Highway is approximately 4.70 million cubic metres.

As stated in Developer Responses to IR 90.2, 92.1 and 98.1, the estimated quantity of material for the operation of the Highway (e.g., maintenance and rehabilitation) over the 50 years after construction, is in the order of 4.57 million cubic metres.

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Therefore, the total quantity of material that may be needed to construct and operate the Highway (preferred alignment) for a 50-year period is estimated to be in the range of 9.27 million cubic metres.

It is important to note that these estimates are based on the preliminary design and will be further refined during the detailed design stage. In addition, the estimates for Highway maintenance are based on the historic maintenance and rehabilitation information from the Dempster Highway. Since the design of the Inuvik to Tuktoyaktuk Highway will include the lessons learned on the Dempster and other highways on permafrost, the quantity of material required for operation of the Highway will likely be less than that estimated.

**Developer Response: 147.2**

The precision of the construction and operational material requirement estimates are  $\pm 20\%$ .

**IR Number: 148**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Terrain Analysis

**Preamble**

The Review Board has noted the terrain analysis report filed by the Developer on March 14<sup>th</sup>, 2012. The report states (p. 5-30) that *“the results of the terrain mapping should be considered preliminary and resulting from a desktop study. Detailed field investigations should be carried out to support this effort.”* The report makes over 65 recommendations regarding adjustments to the route alignment of the proposed highway (p. 3-19 to 3-22).

**Request**

1. Please provide details on field investigations conducted since March 2012 regarding the recommended adjustments to the alignment.
2. If field investigations have not been conducted at sites recommended for adjustment, please indicate, on a site-by-site basis, the reasons for not studying these locations.
3. If a field program for these sites is scheduled for summer 2012, please indicate the date by which a report on this program will be filed with the Review Board.

**Developer Response: 148.1**

Further review of the identified constraints is ongoing through detailed analysis of digital aerial photographs and LiDAR data to examine possible alignment adjustments within the identified 1 km corridor (local study area). A description of these methods is provided in IR Response 149.2. After this analysis, the remaining areas presenting challenging terrain conditions will be visually investigated in the field to better evaluate the necessary design mitigation. These investigations are now proposed for late June 2012.

Additional field investigations are being conducted at watercourse crossings in June 2012 and August 2012 to obtain hydrological and geomorphological information that will also be used to further optimize the Highway alignment at these locations.

**Developer Response: 148.2**

The majority of the recommended adjustments to the alignment can be reviewed using desktop methods. The resolution of processed digital aerial photographs and various cartographic data (e.g., contour data, LiDAR data) now allows for viewing of the project alignment at a much larger scale than was possible during the preparation of the EIS. The geometry of the alignment within the 1 km corridor can be improved without the need to visit each specific location. This alignment optimization work can also continue during the detailed engineering phase, once the general alignment corridor has been endorsed by the EIRB.

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**Developer Response: 148.3**

Any report generated by summer field investigations of terrain constraints will be provided to the EIRB by September 7, 2102.

**IR Number: 149**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Sensitive Terrain

**Preamble**

The terrain analysis report filed by the Developer on March 14<sup>th</sup>, 2012, is largely derived from interpretation of aerial photographs. The report identifies few ice wedges or bodies of massive ice on hillslopes. The report indicates areas where massive icy bodies may be expected.

**Request**

1. Please indicate on a map the location of expected massive icy bodies beneath the proposed highway alignment, or terrain containing massive ice, including both sheets of tabular massive ice and the locations of ice wedges on hillslopes.
2. In the absence of this information, please quantify the increased requirements of aggregate for construction, maintenance, and rehabilitation along the whole route, given the need for a higher embankment in such terrain and the necessary assumption that such massive ice is ubiquitous.

**Developer Response: 149.1**

Ice wedges on hill-slopes are not readily discernible using desktop mapping because their surface expression is often concealed by geomorphological processes (e.g., solifluction or creep). Likewise, massive ice, which occurs in the subsurface, may not be associated with any particular visually discernible surface features, other than the noted and recorded association with glaciofluvial or morainal terrain units. The occurrence and extent of massive ice in the project area can only be effectively confirmed using geotechnical investigative methods. Preliminary information from the recently completed geotechnical investigations program at seven borrow sources has confirmed the occurrence of massive ice within several of these glaciofluvial and till deposits. Further investigations during the detailed design phase will take into account the expected occurrence of previously unidentified icy bodies, including both ice wedges on hill-slopes and massive ice.

**Developer Response: 149.2**

In responding to this information request, the Developer feels that it is important to remind the reviewers that, as stated in the EIS and in the Board's preamble to IR 99, the height of the embankment remains a critical component of the Highway design for protecting and maintaining permafrost conditions below the road surface.

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The EIS specifically identifies different embankment heights depending upon the type of terrain crossed. The proposed embankment thicknesses range from 1.4 m for relatively dry (ice-poor) areas up to 1.8 m for peatlands and areas of ice-rich permafrost.

The EIS further states that, the routing for each Highway alignment option initially considered was largely developed based on terrain observations in an effort to select reasonable topography and avoid ice rich and other sensitive soils that are likely to result in geotechnical challenges. Such challenges can be mitigated through minor modification of the alignment to avoid ice rich terrain and/or amending the overall embankment fill design with minimum embankment height defined based on the nature of the terrain type.

As a result, as indicated in the Developer response to IR 91.1, a number of studies have been conducted to assist in delineating ice-rich terrain and ice wedges on hill slopes in upland terrain along the Highway alignment. In the fall of 2011 the Department of Transportation retained KAVIK-STANTEC to conduct a more detailed terrain evaluation along the entire proposed alignment, including Alternative 1 and Alternative 3 minor realignments in the Husky Lakes area. Surface material, surface expression, drainage slopes and geomorphic processes were mapped using a combination of recently acquired stereo digital imagery and KAVIK-STANTEC'S High Definition Mapping and APplications (HD-MAPP) system.

HD-MAPP incorporated PurVIEW™ and ArcGIS applications, making it possible to view medium to 1:30,000 scale aerial photographs in a digital environment at scales as large as 1:1,000. The ability to view stereo-imagery at such detailed scales allows for better identification, delineation and classification of surficial geology, potential ice-rich terrain features such as polygonal peat plateaus, ice wedges and terrain-related constraints (e.g. steep slopes, thaw slumps and seepage areas). This report was provided to the EIRB and is available on the public registry.

Concurrently with the terrain evaluation, GNWT DOT retained Jack M Byrne Consulting Ltd. of Killam Alberta under contract with FSC-STANTEC (formerly FSC Architects & Engineers) to complete high resolution LiDAR mapping of the proposed alignment, including Alternatives 1 and 3. The LiDAR imagery was subsequently transformed by McElhanney Engineering in Vancouver, BC. The results of the LiDAR mapping and the existing terrain mapping will be used to assist in delineating ice-rich terrain and areas with ice wedges.

Furthermore, as discussed in IR 148.1, areas presenting challenging terrain conditions will be investigated in the field in late June 2012 to better evaluate the necessary design mitigation.

Additional analyses will be conducted as detailed engineering and design is undertaken. During the detailed design phase, one-dimensional and two-dimensional thermal design analysis will be carried out as appropriate for the proposed alignment and for selected Highway cross sections to be constructed in areas of particularly sensitive terrain. In addition, further field investigations (subsurface geotechnical investigations including ground temperature monitoring) to delineate transitions zones between more and less sensitive terrain types will be carried out to support the



detailed design work. In particular locations, specialized geotechnical techniques such as ground penetrating radar may be used to assist in mapping ground ice occurrence.

These types of studies are considered to be normal components of project planning and design, and will all contribute to the development of the optimized cross section, alignment, and quantity estimates needed for tendering and construction of the Inuvik to Tuktoyaktuk Highway.

As indicated in this preamble, it is the Developers' opinion that the acquisition of additional new information and data on the specific terrain conditions along the optimized Highway alignment may result in lower requirements for aggregate for construction, future maintenance and rehabilitation, rather than the "increased requirements" as implied in this IR.

**IR Number: 150**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Location of Gravel Resources

**Preamble**

In response to IR 92 (Round 2), the developer indicated (Table 2, p. 8; and Fig 1-1, p. 9) that a number of possible sources of borrow material are under consideration. These include: Inuvik Airport Quarry, Pit 312 at km 58, Pit 173 at km 82, Borrow areas 170, 305, 307, 312, 325, 245.

**Request**

1. Please indicate the borrow sources to be used by the project. If this information is not available at present, please indicate the date by which the information will be supplied to the Review Board.

**Developer Response: 150.1**

With respect, the borrow sources referred to in the Developers response to IR 92.1 (Round 2) related specifically to those borrow sites that may be used for future Highway **maintenance operations** as requested by the IR. These included Inuvik Airport Quarry, Pit 312 at KM 58, and Pit 173 at KM 82.

The other borrow areas referred to in Figure 1-1 (170, 305, 307, 312, 325 and 245) were those identified in response to IR 92.2, which were the priority borrow sites that were the focus of further drilling and evaluation by KAVIK-STANTEC (2012) for possible use in the **Highway construction program**.

To assist with responding to IR 150.1, Table 2.6.8-2 of the EIS, presented again with this response, indicated the initial borrow sites proposed for construction of the Highway and provided estimated quantities of borrow material to be extracted from each of these sites, based on the preliminary Highway design.

<b>TABLE 2.6.8-2: ESTIMATED QUANTITIES FROM POTENTIAL BORROW SOURCES</b>				
<b>Highway Segment</b>	<b>Potential Borrow Source</b>	<b>Estimated Borrow Quantity (m³)</b>	<b>Land Owner</b>	<b>Quality</b>
KM 0 - KM 5	1401A	198,000	Crown	Class 4
KM 5 - KM 10	2.46	198,000	Crown	Class 3, 4
KM 10 - KM 21	2.45	351,000	Crown	Class 2
KM 21 - KM 34	2.43	351,000	Crown	Class 3, 4
KM 34 - KM 45	325 (outside of Husky Lakes setback)	329,000	Crown	Class 3
KM 45 - KM 56	312 (west of alignment only)	445,000	Crown	NA
KM 56 - KM 69	309	671,000	Crown	Class 2
KM 69 - KM 83	307	516,000	Crown	Class 3
KM 83 - KM 100	173/305, 174/306	563,000	Inuvialuit	Class 1, 2
KM 100 - KM 112	172, 170	363,000	Inuvialuit	Class 3, 4
KM 112 - KM 118	27B	244,000	Inuvialuit	Class 2
KM 118 - KM 137 (Tuktoyaktuk)	177	510,000	Inuvialuit	Class 2

Subsequently, to obtain additional information on the quantity and quality of material available from a number of these proposed borrow sites, KAVIK-STANTEC was contracted by GNWT DOT to carry out further delineation drilling of seven of these borrow sites as listed in Table 3-4 from KAVIK-STANTEC (2012).

Three of the seven borrow sources are located on 7(1), (b) Private Lands near Tuktoyaktuk, three borrow sources occur on Crown lands, and one straddles both Private and Crown lands. No investigations are being conducted within 1,000 m of Husky Lakes.

<b>TABLE 3-4: LOCATION OF BORROW SOURCES AND LENGTH OF PROPOSED ACCESS ROADS</b>				
<b>Borrow Source Site</b>	<b>Corresponding Highway Kilometre Posts</b>	<b>Access Road Length (km)</b>	<b>Land Owner</b>	<b>UTM Coordinates (centroid)</b>
2.45	20	5.0	Crown	556917 / 7607670
325	40	3.8	Crown	563654 / 7626160
312	55 - 60	-	Crown	559881 / 7639562
307	77	4.9	Crown	562715 / 7657406
305	83	2.7	Inuvialuit	569176 / 7661957
172	95 (Alternate 1) 98 (Alternate 3)	2.8	Inuvialuit	579803 / 7668488
170	100	2.5	Inuvialuit	575769 / 7673248

Source: KAVIK-STANTEC (2012)

The report of borrow source analysis and evaluation describing the quality and quantity of material at these seven borrow sources will be available August 31, 2012. The report will contribute to ongoing planning regarding the requirements for and use of material resources, and will be used to develop pit management plans as required by the ILA and AANDC during their consideration of issuance of Quarry Permits.

**IR Number: 151**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Quality of Aggregate Resources

**Preamble**

The terrain analysis filed by the Developer in March 2012 states on p. 3-8 that “*The texture of the glaciofluvial materials in the project area varies considerably but generally consists of silty to medium-coarse textured sand with variable amounts of gravel and pebbles*” and that “*bodies of massive ice are commonly associated with deposits of granular materials in the Mackenzie Delta.*” These statements indicate that the quality of the available aggregate is variable, and that more excavation of resources will be required than the volume used on the road.

**Request**

1. Please indicate the aggregate resources to be extracted from each of the borrow pits selected for use by the project.
2. Please indicate the volume of excavation at each pit as well as the volume of useable aggregate expected in the excavation. These estimates should be based on the results of geotechnical investigations conducted at seven borrow sources in March and April 2012 described in the response to IR 131.
3. Please file the geotechnical reports from these investigations with the Review Board.

**Developer Response: 151.1**

Table 2.6.8-2 from the EIS, re-presented in response to IR 150.1, indicates the quantity of material proposed to be extracted from each of the main borrow sources initially selected for use for the construction of the Highway. However, as noted by the EIRB, the results of the winter 2012 geotechnical investigations should help to confirm the feasibility of the preliminary material extraction plans for these borrow sites.

**Developer Response: 151.2**

The results of the winter 2012 geotechnical investigations will help to determine the amount of overburden that may have to be removed prior to excavation of the construction materials. However, it should be noted that most of the material sources under consideration have been identified from surface exposure, suggesting that for most deposits, minimal overburden will need to be removed. Any overburden removed will be stored and used for future progressive reclamation.

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**Developer Response: 151.3**

The report of borrow source analysis and evaluation describing the quality and quantity of material at these seven borrow sources will be available August 31, 2012. The report will be used to develop pit management plans as required by the ILA and AANDC during their consideration of issuance of Quarry Permits.

**IR Number: 152**

**Source:** Environmental Impact Review Board  
**To:** GNWT Department of Transportation, Town of Inuvik, Hamlet of Tuktoyaktuk  
**Subject:** Developer's Use of Available Resources

**Preamble**

The development will utilize a significant amount of aggregate in construction, maintenance, and rehabilitation. There are other requirements for aggregate in the region, notably for municipal purposes, and potentially for industrial development. The proportion of available resources that will be used by the project is an important consideration in the Environmental Impact Review.

**Request**

1. Please indicate the total aggregate resources in the region, within 20 km of the road alignment, between Inuvik and Tuktoyaktuk, both proven and potential.
2. In particular, please indicate the resources that are currently delineated and available for use by the communities of Inuvik and Tuktoyaktuk.
3. Please supply projections from the Town of Inuvik and Hamlet of Tuktoyaktuk for their foreseeable municipal requirements.
4. Please supply an estimate of the aggregate requirements for development of hydrocarbon resources in the vicinity of Parson's Lake. The time frame for these assessments should be 50 years, i.e. up to 2065.
5. Please indicate any potential developments, for example harbor improvements at Tuktoyaktuk, for which significant gravel resources may be required.

**Developer Response: 152.1**

In responding to this question, the Developer feels that it is important to provide some general information on the total granular resources that are estimated to exist in the Inuvialuit Settlement Region. The following information was drawn directly from the Granular Resources Management Plan for the Inuvialuit Settlement Region, prepared by the Inuvialuit Land Administration and Indian and Northern Affairs Canada (ILA & INAC 2010). This document has been referenced by the Developer in various previous responses and to further assist the EIRB, a complete copy of this report is provided as Attachment 1 to this response document.

As indicated in this report, although there have been many regional inventories of granular resources in the Inuvialuit Settlement Region, there is still uncertainty about the quantity and quality of resources in the area. This is because the inventories have been largely focussed on the Mackenzie Delta, leaving the eastern ISR communities with few geotechnical studies. Furthermore, within the regional inventories, the method of calculating the amounts and types of material may be tenuous at best (using air photo interpretation only, for example), resulting in inaccuracies in the granular resource estimates presented in the report.

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Despite this, work was conducted by the Inuvialuit Land Administration to compile information from any geotechnical studies and resource inventories that have been done in the region to come up with a general idea of the quantity and quality of resources available in the region. Based on this compilation of information, it is estimated that the total volume of granular resources in the Inuvialuit Settlement Region (ISR) is 4.9 billion cubic metres, consisting of about 65.8 million cubic metres of proven reserves, 517.5 million cubic metres of probable reserves and 4.3 billion cubic metres of prospective reserves.

Granular resources, like all resources, are typically described as being either a proven resource, meaning there is certainty that the resource exists, a probable resource, meaning it is likely that the resource exists, or a prospective resource, meaning it is possible the resource exists.

The quality of a granular resource is also commonly classified on a scale of 1 to 5. Throughout the ISR Granular Resources Management Plan (ILA & INAC 2010), the INAC classification system, developed by EBA (1986), was used to describe the quality of the granular material. Class 1 is considered to be excellent quality material, Class 2 is good quality material, Class 3 is fair quality material, Class 4 is poor quality material and Class 5 is solid rock material which must be crushed and worked to produce a desired gravel size. Table 1 of the Granular Resources Management Plan provides additional descriptive information on the classes of granular resources inventoried for the ISR.

TABLE 1- DIAND CLASSIFICATION OF GRANULAR RESOURCES		
Class 1	Excellent Quality Material	Excellent quality material consisting of clean, well graded, structurally-sound sands and gravels suitable for use as high quality surfacing materials, or as high quality asphalt or concrete aggregate, with a minimum of processing.
Class 2	Good Quality Material	Good quality material generally consisting of well-graded sands and gravels with limited quantities of silt. This material will provide good quality base and surface coarse aggregates or structure-supporting fill. Production of concrete aggregate may be possible with extensive processing, except where deleterious materials are present.
Class 3	Fair Quality Material	Fair quality material consisting generally of poorly-graded sands and gravels with or without substantial silt content. This material will provide fair quality general fill for roads, foundation pads or lay-down yards.
Class 4	Poor Quality Material	Poor quality material generally consisting of silty, poorly-graded, fine-grained sand with minor gravel. These deposits may also contain weak particles and deleterious materials. These materials are considered suitable for marginal general (non-structural) fill.
Class 5	Bedrock, Felsenmeer and Talus	Bedrock of fair to good quality, felsenmeer or talus. Potentially excellent sources of construction material, ranging from general fill to concrete aggregate or building stone if quarried and processed. Also includes erosion control materials such as rip-rap or armour stone.

Source: ILA & INAC (2010)

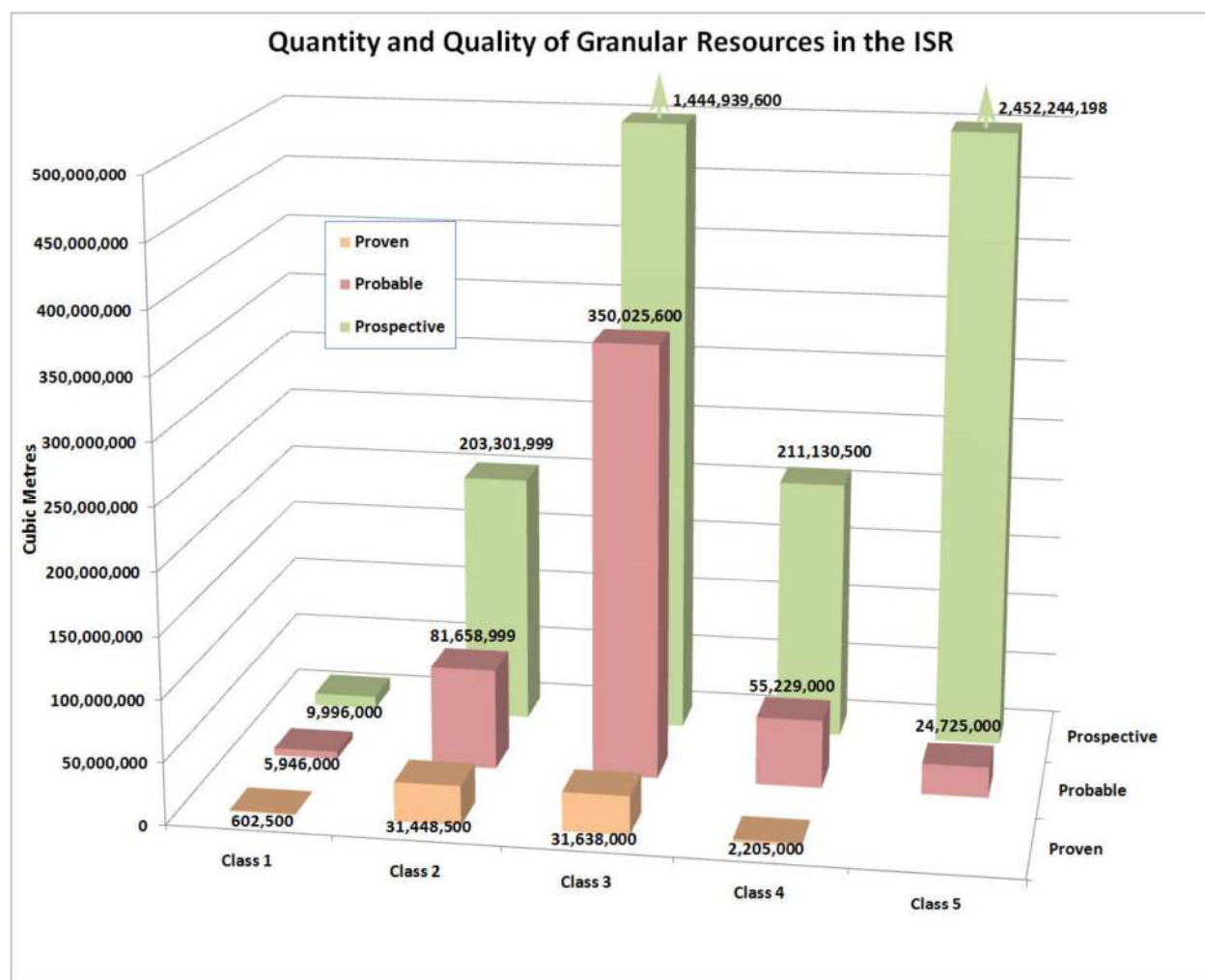


Of the 65.8 million cubic metres of proven granular resources in the ISR, 0.6 million is Class 1, 31.4 million is Class 2, 31.6 million is Class 3 and 2.2 million is Class 4. Within the regional granular resource inventories and geotechnical reports, there is no mention of proven Class 5 granular resources within the ISR.

Of the 517.5 million cubic metres of probable granular resources in the ISR, 5.9 million is Class 1, 81.6 million is Class 2, 350.0 million is Class 3, 55.2 million is Class 4 and 24.7 million is Class 5.

Finally, of the 4.3 billion cubic metres of prospective granular resources, 9.9 million is Class 1, 203.3 million is Class 2, 1.4 billion is Class 3, 211.1 million is Class 4 and 2.4 billion is Class 5.

Figure 2 from ILA & INAC (2010) summarizes the quantity and quality of the proven, probable and prospective granular resources in the ISR.



**Figure 2. Estimated Granular Resource Supply in the ISR.**

Source: ILA & INAC (2010)

Figure 1 shows all of the known borrow sources in the ILA database within the general vicinity of the Highway, and more specifically all of the known borrow sources within 20 km of the proposed Highway alignment, as requested by the EIRB.

Table 1, generated using the ILA granular resources database, summarizes all of the proven, probable and prospective granular resources located within 20 km of the proposed Highway alignment. Based on this table, approximately 27.9 million cubic metres of proven, 259.9 million cubic metres of probable and 1,034.3 million cubic metres of prospective granular resources are reported to be located in this general area.

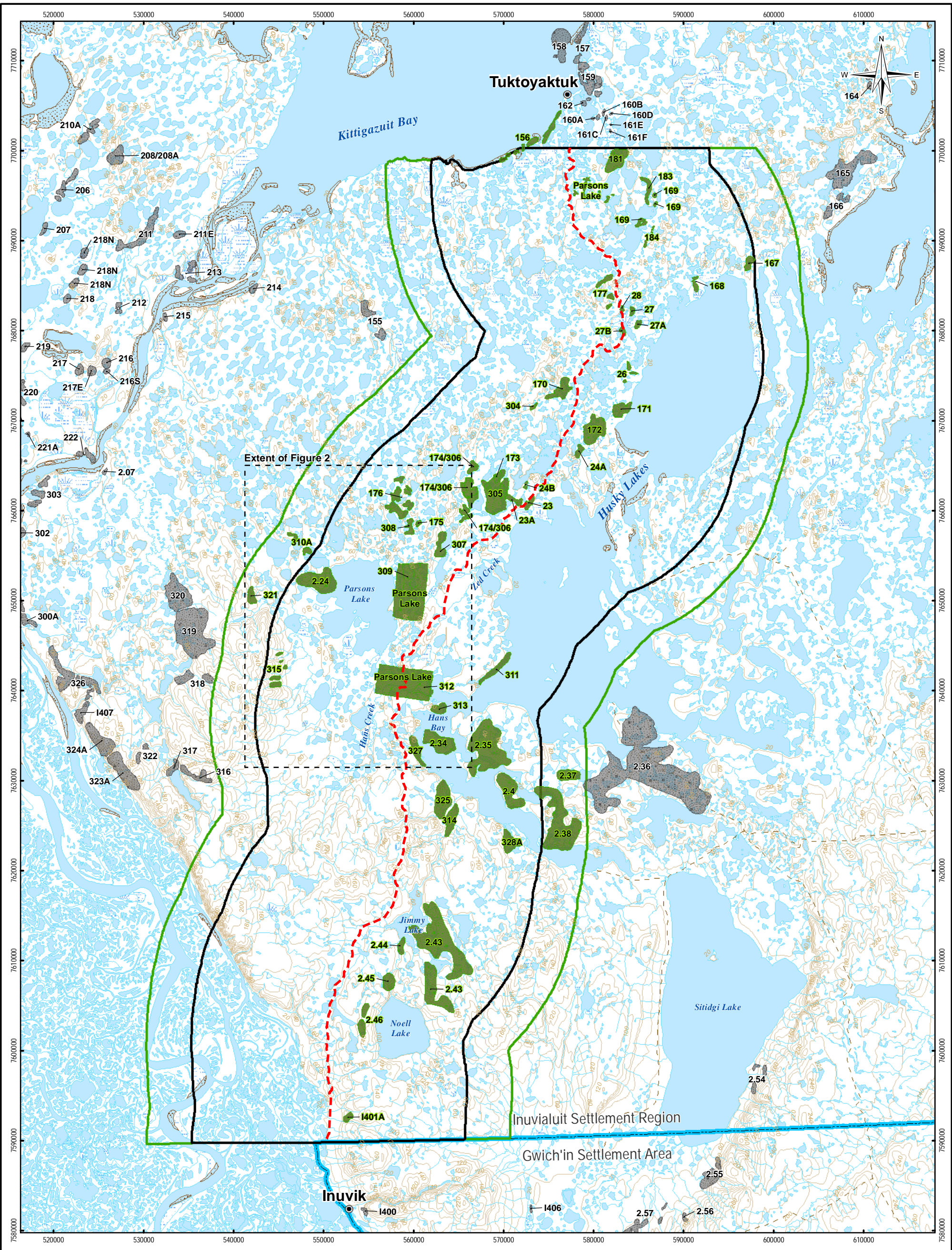
The proven resources include approximately 8.2 million cubic metres of Class 2 resources, 18.5 million cubic metres of Class 3 resources and 1.2 million cubic metres of Class 4 resources.

The probable resources include approximately 0.7 million cubic metres of Class 1 resources, 47.9 million cubic metres of Class 2 resources, 200.1 million cubic metres of Class 3 resources and 11.1 million cubic metres of Class 4 resources.

The prospective resources include approximately 49.2 million cubic metres of Class 2 resources, 874.3 million cubic metres of Class 3 resources and 110.8 million cubic metres of Class 4 resources.

As indicated in Table 1, the volumes of materials found in borrow sources 167, 168, 169 and 175 were identified, but not categorized into proven, probable or prospective, and as such, were not included in the totals stated above.





LEGEND

- Preferred Alignment
- Borrow Sources within 20 km
- Borrow Sources
- Regional Study Area (15 km buffer)
- 20 km Buffer
- Gwich'in / Inuvialuit Boundary
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES  
1. Borrow Sources: ILA  
2. Base data source: NTS 1:250,000

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Borrow Sources

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:400,000	
5 2.5 0 5 10 Kilometres	
FILE NO. V23201322_IR3_Map002_BorrowSources.mxd	
PROJECT NO. V23201322	DWN SL
OFFICE EBA-VANC	DATE June 4, 2012
CKD TS	REV 0



Figure 1

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TABLE 1: GRANULAR RESOURCES WITHIN 20 KM OF THE PROPOSED HIGHWAY																
Proven						Probable					Prospective					
Source	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	Land Ownership
2.24			400,000					4,000,000					12,000,000			Crown
2.34			1,500,000					15,000,000					55,000,000			Tuktoyaktuk 7(1)(b)
2.35			2,500,000					25,000,000					100,000,000			Tuktoyaktuk 7(1)(b)
2.37			1,000,000					12,500,000					50,000,000			Tuktoyaktuk 7(1)(b)
2.38			2,500,000					25,000,000					100,000,000			Tuktoyaktuk 7(1)(b)
2.40			1,000,000					10,000,000					40,000,000			Tuktoyaktuk 7(1)(b)
2.43			900,000	900,000				9,000,000	9,000,000				90,000,000	90,000,000		Crown
2.44			25,000					250,000					1,000,000			Crown
2.45		800,000					8,000,000					25,000,000				Crown
2.46			5,000	5,000				10,000	10,000				12,500	12,500		Crown
23																Tuktoyaktuk 7(1)(b)
23A																Tuktoyaktuk 7(1)(b)
24A							134,000									Tuktoyaktuk 7(1)(b)
24B																Tuktoyaktuk 7(1)(b)
26																Tuktoyaktuk 7(1)(a) Tuktoyaktuk 7(1)(b)
27							34,000									Tuktoyaktuk 7(1)(a)
27A							191,000									Tuktoyaktuk 7(1)(a)
27B							38,000									Tuktoyaktuk 7(1)(a)
28																Tuktoyaktuk 7(1)(a)
156								288,800								Tuktoyaktuk 7(1)(a) Parks Canada
167*																Tuktoyaktuk 7(1)(a)
168*																Tuktoyaktuk 7(1)(a)
169*																Tuktoyaktuk 7(1)(a)
170								4,560,000								Tuktoyaktuk 7(1)(a) Tuktoyaktuk 7(1)(b)
171							1,520,000									Tuktoyaktuk 7(1)(b)
172									912,000							Tuktoyaktuk 7(1)(b)
173						684,000										Tuktoyaktuk 7(1)(b)
174/306							3,268,000									Tuktoyaktuk 7(1)(b) Crown
175*																Crown
176																Inuvik 7(1)(b) Crown
177							19,000,000									Tuktoyaktuk 7(1)(a)
181								260,000					260,000		181	Tuktoyaktuk 7(1)(a)
183								118,500					118,500		183	Tuktoyaktuk 7(1)(a)
184															184	Tuktoyaktuk 7(1)(a)
304								45,600					45,600		304	Tuktoyaktuk 7(1)(b)
305							228,000					228,000			305	Tuktoyaktuk 7(1)(b)

TABLE 1: GRANULAR RESOURCES WITHIN 20 KM OF THE PROPOSED HIGHWAY																
Proven						Probable					Prospective					
Source	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	Land Ownership
307			30,000					300,000					650,000		307	Crown
308			5,000					300,000					1,500,000		308	Crown
309		350,000					1,000,000					4,000,000			309	Crown
310A				55,000					550,000					5,500,000	310A	Inuvik 7(1)(b) Crown
311				250,000					400,000					9,000,000	311	Tuktoyaktuk 7(1)(b)
312		4,000,000					4,500,000					10,000,000			312	Tuktoyaktuk 7(1)(b)
313				7,500					45,000					5,500,000	313	Tuktoyaktuk 7(1)(b)
314			30,000					3,000,000					30,000,000		314	Tuktoyaktuk 7(1)(b) Crown
315		3,000,000					10,000,000					10,000,000			315	Crown
321			200,000					2,000,000					3,700,000		321	Crown
325			600,000					6,000,000					25,000,000		325	Tuktoyaktuk 7(1)(b) Crown
327			350,000					7,500,000					15,000,000		327	Tuktoyaktuk 7(1)(b)
328A															328A	Tuktoyaktuk 7(1)(b) Crown
I401A				20,000					250,000					750,000	I401A	Inuvik 7(1)(b)
Parsons Lake			7,500,000					75,000,000					350,000,000		Parsons Lake	Tuktoyaktuk 7(1)(b) Crown
TOTAL		8,150,000	18,545,000	1,237,500	0	684,000	47,913,000	200,132,900	11,167,000	0	0	49,228,000	874,286,600	110,762,500	TOTAL	Crown

Source: IIA Granular Resources Database

\*Note: For the following borrow sites, it is not known whether these resources are proven, probable or prospective and as such, these values are not included in the total:

167 - 1,700,000 m3 of Class 2-3 sand and gravel

168 - 350,000 to 500,000 m3 of Class 2 sand and gravel

169 - 750,000 m3 of Class 2-3 sand and some gravel

175 - 1,500,000 m3 of Class 2-3 sand and local gravel

**Developer Response: 152.2 and 152.3**

In responding to IR 152.2 and IR 152.3, the Developer notes that similar information was previously provided to the EIRB in the Developers' Part B1 responses to AANDC's conformity review Item 14 of the Terms of Reference Section 9.2, dated August 2011.

As previously indicated in that response, the Inuvialuit Settlement Region Granular Resources Management Plan (2010), prepared by the ILA and INAC, includes a discussion on supply and demand of granular resources, which are based on several demand forecast reports (EBA Engineering Consultants Ltd. 1987; Hardy BBT Limited 1991; North of 60 Engineering Ltd. 1995 and 2001). Gravel demands for each community in the ISR are based on community maintenance and development, including operation and maintenance, road resurfacing and protection, Community Capital Plan Projects, housing construction and maintenance, and runway expansion and maintenance projects, on both Crown and Inuvialuit Lands. Demands for individual, private use are also calculated. A summary of the relevant portions of the report are provided below.

In addition to the above approach for forecasting future demand, the *Inuvialuit Final Agreement* has stipulated priorities for access to granular resources within the ISR private lands. First priority is given to public community needs, second priority for private and corporate needs of the Inuvialuit, and third priority for any project approved by an appropriate government agency.

The 2009 Community Demand Forecasts for Inuvik and Tuktoyaktuk are identified in the ISR Granular Resources Management Plan. It is estimated that the 20 year demand, including contingency, for Inuvik is approximately 3,700,000 m<sup>3</sup>, including public community use and personal allotments. As indicated in the ISR Granular Resources Management Plan, the Town of Inuvik is actively quarrying three sources of granular materials (Navy Road Pit, Old Baldy Pit (I400) and Airport Pit (I402) within the town's boundaries). The nearest source of granular materials to Inuvik on Inuvialuit Private Lands is Source I401A, but due to the poor quality of granular materials (Class 4), this source has been described as being unsuitable for development. Additional suitable sources are located in Sources 323A, 234A, and I407.

It is estimated that the 20 year demand, including contingency, for Tuktoyaktuk is approximately 1,100,000 m<sup>3</sup>, including public community use and personal allotments. Source 177, now accessible via the Tuktoyaktuk to Source 177 Access Road, is estimated to contain approximately 19,000,000 m<sup>3</sup> of prospective Class 2 ("good") material. As indicated in the ISR Granular Resources Management Plan, Source 159 has been designated for Tuktoyaktuk in the event that the quality or quantity of gravel in Source 177 is not adequate. Records do not indicate that Source 159 has been used or developed previously. Other prospective sources near Tuktoyaktuk include Sources 157, 160A, 160B, 160D, 161C, 161E, and 161F. Sources 177, 160A, 160B and 160D have been developed in the past.

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In addition to the summarized information previously provided above, the Developer is pleased to provide the following more detailed information, which was extracted directly from the ISR Granular Resources Management Plan (ILA & INAC 2010) for each of the Town of Inuvik and the Hamlet of Tuktoyaktuk. The quoted text is shown in italics.

### **Inuvik Gravel Demand Summary**

*Being the Inuvialuit Settlement Region's largest community, Inuvik has the greatest 20 year forecasted gravel demand for the 2009-2029 period. The total 20 year demand for the community, including public community use and personal gravel allotments is 3,707,618 m<sup>3</sup> (see Table 4 below from the ISR Granular Resources Management Plan). It is estimated that 1,453,200 m<sup>3</sup> will be required by the community of Inuvik for public use, and with a 10% contingency added, this number increases to 1,598,520 m<sup>3</sup> for the 20 year period.*

*The Town of Inuvik requires 5,000 m<sup>3</sup> of granular material per year for road maintenance, and another 45,000 m<sup>3</sup> per year for operation and maintenance of community infrastructure. The volume of gravel required for Community Capital Plan projects varies greatly by year, and ultimately totals 157,072 m<sup>3</sup> over the 20 year forecast period. Other users of gravel that fall under the community use (Priority 1) demand category include the NWT Housing Corporation, and departments of the GNWT including Education, Culture and Employment (EC&E), Department of Transportation, Industry, Tourism and Investment (IT&I), Health and Social Services, Public Works and Services, and general GNWT maintenance. The Government of the Northwest Territories is forecasted to require 146,661 m<sup>3</sup> of granular material between 2009 and 2029 for general purposes.*

*The total potential demand forecasted for Inuvialuit Private use, including personal beneficiary allotments for the 2009-2029 period is calculated as 829,082 m<sup>3</sup>. The number of beneficiaries in 2009 enrolled with the Inuvik Community Corporation was 984, and Inuvik is experiencing population growth. Non-beneficiary personal allotment for Inuvik, which could be obtained from Crown land for the twenty year period is calculated to be 1,280,016 m<sup>3</sup>. It must be noted that the personal allotment calculations assume that every eligible person will require their personal allotment each year, which is unlikely.*

**TABLE 4: INUVIK 20 YEAR DEMAND FORECAST (m<sup>3</sup>)**

Inuvik						
Priority 1- Community Use	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	Future 2014-2029
Capital/O&M						
Roads	5,000	5,000*	5,000*	5,000*	5,000*	75,000*
O&M	45,000	45,000*	45,000*	45,000*	45,000*	675,000*
Community Plan/Projects	9,450~	7,250~	8,100~	8,267**	8,267**	124,005**
NWTHC						
Housing Corporation	450~	875~	1,000~	775**	775**	11,625**
O&M Private Housing	3,500	3,500	3,500	3,500	3,500	52,500
GNWT						
General	11,150~	7,175~	3,675~	7,333**	7,333**	109,995**
DOT Maintenance Garage	-	-	-	-	-	1,100
DOT Apron Expansion	-	-	-	-	-	3,500
O&M 19 mm (Highway & Airport)	2,000	2,000	2,000	2,000	2,000	30,000
EC&E Schools	2,000	-	-	-	-	-
Aurora College Gym	-	-	900	-	-	-
H&SS Group Home	-	-	-	-	-	1,000
IT&I Park Development	-	-	5,000!	-	-	-
Justice Courthouse Expansion	-	-	-	-	-	1,200
PWS Garage	-	-	-	-	-	1,000
Totals	78,550	70,800	74,175	71,875	71,875	1,085,925
! Park Development to occur between 2011-2017				20 Year Total		1,453,200
				10% Contingency		1,598,520
Priority 2- Inuvialuit Private Use	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	Future 2014-2029
Beneficiary Personal Allotment (IPL)	37,616	38,113	38,648	39,107	39,527	636,071
				20 Year Total		829,082
Priority 3- Projects Approved by Government Agencies						
	-	-	-	-	-	-
Other						
Non Beneficiary	58,068	58,871	59,673	60,400	61,011	981,993



**TABLE 4: INUVIK 20 YEAR DEMAND FORECAST (m<sup>3</sup>)**

<b>Inuvik</b>						
<b>Priority 1- Community Use</b>	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>	<b>2012/2013</b>	<b>2013/2014</b>	<b>Future 2014-2029</b>
Allotment (Crown)						
*indicates values which have been projected based on the 2007 <i>Territorial Granular Resources Forecast</i>				<b>20 Year Total</b>		<b>1,280,016</b>
~indicates forecasted values from the May 2009 update of the <i>Territorial Granular Resources Forecast</i>				<b>20 Year Total Demand</b>		<b>3,707,618</b>

Source: ILA & INAC (2010)

## **Inuvik Gravel Supply and Source Reservation on Inuvialuit Private Land**

*The Town of Inuvik is actively quarrying three sources of granular materials within the town's boundaries in order to meet the demands of the community; Navy Road Pit, Old Baldy Pit (I400) and Airport Pit (I402). The quantity of granular materials or the lifespan of all three deposits is unknown as the community does not track their rates of extraction.*

*The nearest source of granular materials on Inuvialuit Private Land to Inuvik is Source I401A, which is located approximately 4 km northeast of the community. According to the available data on Source I401A it has 20,000 m<sup>3</sup> of proven Class 4 granular materials, 250,000 m<sup>3</sup> of probable Class 4 granular materials and 750,000 m<sup>3</sup> of prospective Class 4 granular materials (Hardy BBT Ltd. 1991). Due to the poor quality of granular materials (Class 4) this source has been described in several consultant reports as unsuitable for development.*

*More suitable sources for granular materials have been identified 45 km to the north of Inuvik (adjacent to the Mackenzie River Delta), in deposits 323A and 324A. Both of these deposits are classified as Class 2 quality and contain millions of cubic metres of probable and prospective materials. Specifically, Source 323A contains 10,000 m<sup>3</sup> of proven, 1,000,000 m<sup>3</sup> of probable and 45,000,000 m<sup>3</sup> of prospective Class 2 granular resources, and Source 424A contains 120,000 m<sup>3</sup> of proven, 12,000,000 m<sup>3</sup> of probable and 35,000,000 m<sup>3</sup> of prospective Class 2 materials (Hardy BBT Ltd. 1991).*

*In addition to the aforementioned sources is another source, I407, which is moderately more distant but containing granular materials of equally high quality and quantity. Source I407 is also an attractive source, as significant geotechnical work has already been completed at the site, resulting in reliable data. According to a 1990 geotechnical investigation by Hardy BBT Ltd., Source I407 is mainly composed of material Classes 2 to 3 and divided between 655,500 m<sup>3</sup> in proven reserves, 3,556,000 m<sup>3</sup> of probable reserves and 9,055,000 m<sup>3</sup> of prospective reserves (Hardy BBT Ltd. 1990).*

*Since Inuvik has three equally attractive sources of granular materials located on Inuvialuit Private Lands (Sources I407, 323A and 324A), the Inuvialuit Land Administration cannot at this time predict or prescribe which source will be developed next. However, under the IFA, ILA is required to reserve an appropriate volume of quality granular materials from a reasonably accessible site for all ISR communities. Therefore, whichever of the three aforementioned sources is developed next, it shall be the source containing the reserved materials as required by the IFA.*

*It should also be noted that the development of new borrow sources for the Highway and access to them will increase the availability of granular resources for the use of the Town of Inuvik and its residents.*

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## **Tuktoyaktuk Gravel Demand Summary**

*Between 2009 and 2029, it is estimated that Tuktoyaktuk will require 1,097,348 m<sup>3</sup> of granular resources. Over the twenty year period, Tuktoyaktuk is forecasted to require 634,600 m<sup>3</sup> of gravel for community use (Priority 1 under the IFA), or 698,060 m<sup>3</sup> with the addition of a ten percent contingency volume. According to the Territorial Granular Resources Forecast (2007), the community will require 10,000 m<sup>3</sup> of granular material per year for operation and maintenance of community infrastructure. Furthermore, for Community Capital Plan projects, the Hamlet of Tuktoyaktuk will require a total of 134,000 m<sup>3</sup> of granular material over the twenty year period.*

*The NWT Housing Corporation in Tuktoyaktuk requires on average, 1,200 m<sup>3</sup> of gravel per year, while the operation and maintenance of private dwellings has a yearly demand of 600 m<sup>3</sup>. There are other demands for gravel by the Government of the Northwest Territories, including a large project for a road to gravel Source 177. This project will require 309,100 m<sup>3</sup> of granular material between 2009 and 2012, according to the May 2009 update of the Territorial Granular Resources Forecast. Because the forecasted gravel demand that falls under general GNWT demand was inflated due to the road to Source 177 project, it was not possible to forecast the average yearly demand for the remaining 17 years between 2012 and 2029. Therefore, the forecasted gravel demand for Tuktoyaktuk may be under estimated, however this would likely be covered by the ten percent contingency volume that is calculated for each community.*

*In 2009, there were 569 enrolled Inuvialuit beneficiaries with the Tuktoyaktuk Community Corporation. The population of Tuktoyaktuk is forecasted to decline, thus the amount of gravel required for beneficiary personal allotments is expected to decrease as well over time. The forecasted demand for gravel by beneficiaries for 2009 is 21,752 m<sup>3</sup>, and 406,475 m<sup>3</sup> over the next twenty years. It must be noted that the forecast for beneficiary demand is likely over estimated, because it is calculated as though each beneficiary will use their personal allotment each year, which is not likely. Non-beneficiary demand is calculated to be 27,944 m<sup>3</sup> for the period 2009-2029. At the time of the forecast there were no Priority 3 projects known for Tuktoyaktuk.*

**TABLE 7: TUKTOYAKTUK 20 YEAR DEMAND FORECAST (m³)**

<b>Tuktoyaktuk</b>						
<b>Priority 1- Community Use</b>	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>	<b>2012/2013</b>	<b>2013/2014</b>	<b>Future 2014-2029</b>
Capital/O&M						
O&M	10,000	10,000	10,000	10,000	10,000	150,000
Community Plan/Projects	5,600~	6,500~	8,000~	6,700**	6,700**	100,500**
NWTHC						
Housing Corporation	1,600~	2,000~	ND~	1,200**	1,200**	18,000**
O&M Private Housing	600	600	600	600	600	9,000
GNWT						
General	100,500~	107,000~	101,600~			
DOT Runway Improvements	-	-	TBD	-	-	-
DOT Maintenance Garage	-	-	-	-	-	1,000
O&M 16 mm	100	100	100	100	100	1,500
IT&I Park Interpretative Centre	-	-	-	-	-	800
EC&E School	-	-	-	-	-	1,000
<b>Totals</b>	<b>118,400</b>	<b>126,200</b>	<b>120,300</b>	<b>15,700</b>	<b>15,700</b>	<b>238,300</b>
				<b>20 Year Total</b>		<b>634,600</b>
				<b>10% Contingency</b>		<b>698,060</b>
<b>Priority 2- Inuvialuit Private Use</b>	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>	<b>2012/2013</b>	<b>2013/2014</b>	<b>Future 2014-2029</b>
Personal Allotment	21,752	21,637	21,522	21,408	21,255	298,902
				<b>20 Year Total</b>		<b>363,316</b>
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						
Non Beneficiary Allotment	2,026	2,026	2,026	1,988	1,988	27,944
<b>*indicates values which have been projected based on the 2007 Territorial Granular Resources Forecast</b>				<b>20 Year Total</b>		<b>35,972</b>
<b>~indicates forecasted values from the May 2009 update of the Territorial Granular Resources Forecast</b>				<b>20 Year Total Demand</b>		<b>1,097,348</b>
<b>**indicates values which have been projected based on the May 2009 Update of the Territorial Granular Resources Forecast</b>						

Source: ILA & INAC (2010)

## **Tuktoyaktuk Gravel Supply and Source Reservation on Inuvialuit Private Land**

*In 2009-2010 the Hamlet of Tuktoyaktuk and Government of the Northwest Territories Department of Transportation are constructing a road to gravel Source 177 using materials quarried from Source 177. A 1991 report by Hardy BBT Limited estimates that there are approximately 19 million cubic metres of prospective granular material, which are classified as "good," or Class 2 (Hardy BBT, Ltd., 1991b). During the last twenty years quarrying has taken place at Source 177 intermittently. The total volume of known granular resources extracted from Source 177 prior to 2009 totals 40,091 m<sup>3</sup>. According to the quarry licence application for the project, the construction of the road to Source 177 is expected to use a further 450,000 m<sup>3</sup> of granular materials resulting in a remaining volume of approximately 18.5 million cubic metres in Source 177.*

Based on the Developers actual records, the total quantity of material used for construction of the Source 177 access road was 357,328 m<sup>3</sup> (quantity measured by pit survey) resulting in a remaining volume of approximately 18.6 million cubic metres in Source 177.

*The remaining volume [of Source 177], if in fact present, is sufficient to cover the remaining needs of Tuktoyaktuk for granular resources during the 20 year forecast period, and for many years beyond the forecast period. Furthermore, if there is 19 million cubic metres of granular material in the source, there will be enough gravel to designate to Priority 2 and 3 demands for gravel resources as well. A secondary source has been designated for Tuktoyaktuk in the event that the source does not contain as much gravel as was estimated in the 1991 Hardy BBT Limited report, or if the gravel source becomes depleted.*

*The next best source of granular materials for Tuktoyaktuk, based on accessibility, quantity of granular materials present, quality of granular materials present and environmental impacts, is Source 159. This gravel source is located 4 km east of Tuktoyaktuk and has a probable volume of 3,500,000 m<sup>3</sup> of granular materials respectively (Hardy BBT, Ltd., 1991b). ILA has no record of Source 159 ever having been used in the past meaning a quarry would need to be developed prior to use. Source 159 is composed of Class 1 and Class 3 materials and has been rated as a good prospect for granular resources by EBA Engineering Consultants in a report prepared for Indian and Northern Affairs Canada (EBA Engineering Consultants, Ltd. 1987).*

*In the event that Source 159 is deemed to be insufficient in volume, or unusable, then another source would need to be utilized. Other prospective sources near Tuktoyaktuk include 157, 160A, 160B, 160D, 161C, 161E and 161F. These sources have all been rated as favourable and are all located within a few kilometres of Tuktoyaktuk. Sources 160A, 160B and 160D have the additional benefit of having already been developed in the past, meaning that the environmental disturbance and cost associated with developing these quarries is reduced.*

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*For the purpose of meeting the requirements of Section 7.(27) of the IFA, a volume of 698,060 m<sup>3</sup> of Source 177 granular materials is hereby designated as reserved for Tuktoyaktuk public community needs (Priority 1). This volume must not be depleted by either private Inuvialuit use or for any other government-approved project.*

*For the purpose of meeting the requirements of Section 7.(28) of the IFA, an additional volume of 363,316 m<sup>3</sup> of Source 177 granular materials is hereby designated as reserved for direct Inuvialuit private and corporate needs (Priority 2). This volume must not be used for any government-approved projects.*

It should also be noted that the development of new borrow sources for the Highway and access to them will increase the availability of granular resources for the use of the Hamlet of Tuktoyaktuk and its residents.

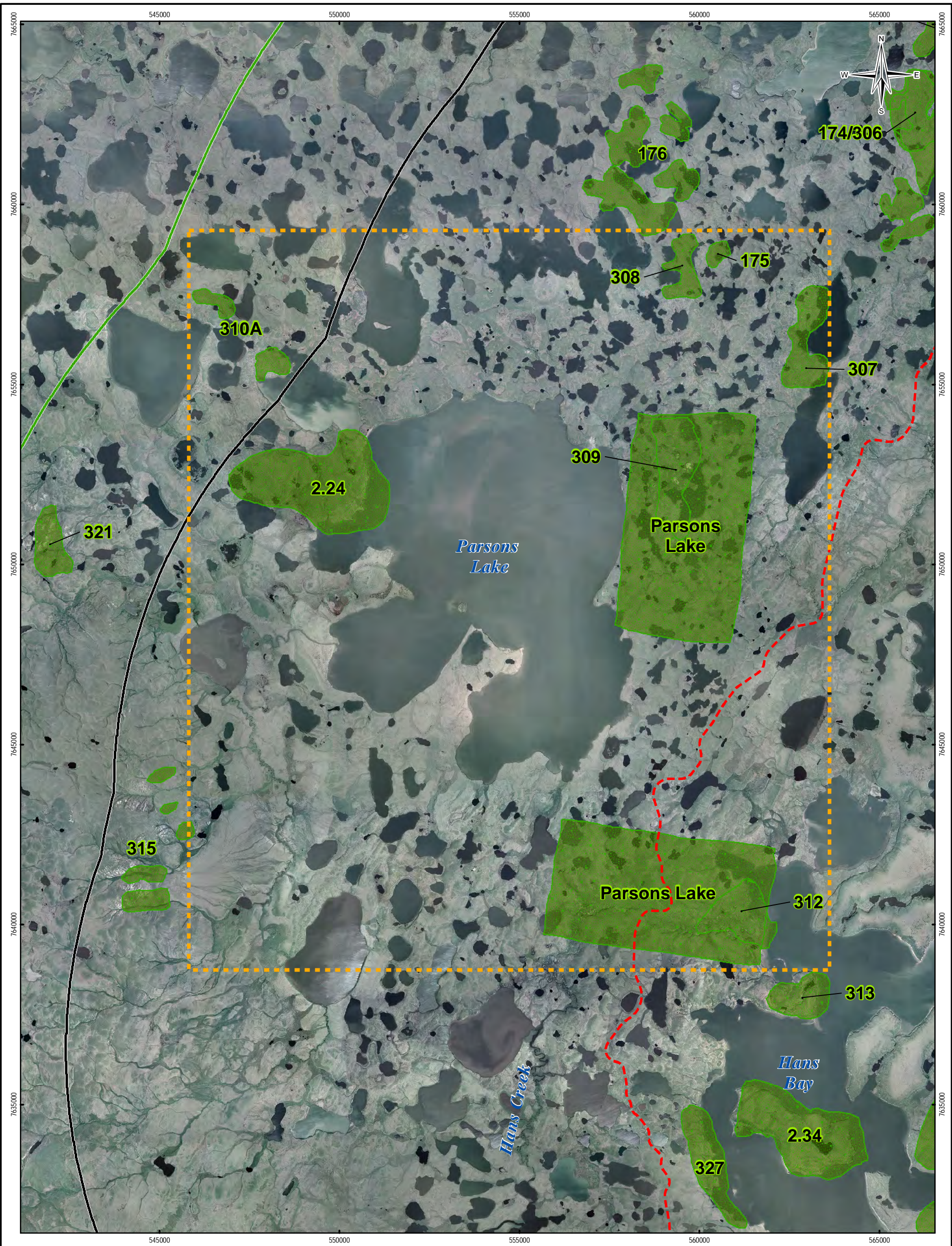
**Developer Response: 152.4**

Based on information reported in the ISR Granular Resources Management Plan, the estimated aggregate requirements for the development of hydrocarbon resources in the vicinity of Parsons Lake is 1.271 million cubic metres. This information was contained in a project update report, which was submitted to the National Energy Board and the Joint Review Panel (Imperial Oil Resources Ventures Limited, May 2007).

The development of the Parsons Lake gas field is entirely dependent upon whether the Mackenzie Gas Project moves forward or not. It remains unknown at this time whether construction of the Mackenzie Gas Project will proceed in the foreseeable future.

Figure 2 shows the known granular deposits located in the Parsons Lake area and Table 2, summarizes the estimated granular resources available from these deposits. The Developer also understands that Conoco Phillips may have conducted some additional gravel source investigations in the Parsons Lake area around 2006, but any data collected have not been made available to the ILA (Josh Mackintosh, Inuvialuit Lands Administration, personal communication June 5, 2012).





LEGEND

- Preferred Alignment
- Borrow Sources within 20 km
- Granular Resources of the Parsons Lake Area
- Regional Study Area (15 km buffer)
- 20 km Buffer
- Gwich'in / Inuvialuit Boundary

NOTES  
1. Borrow Sources: ILA  
2. Base data source: Mackenzie Valley Aerial Photography (2004).

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Parsons Lake  
Borrow Sources

PROJECTION UTM Zone 8	DATUM NAD83
Scale: 1:100,000	
<div><div></div><div>2102</div><div>Kilometres</div></div>	
FILE NO. V23201322_IR3_Map003_ParsonsLakeBorrow.mxd	
PROJECT NO. V23201322	DWN SL
	CKD TS
	REV 0
OFFICE EBA-VANC	DATE June 4, 2012



Figure 2

ISSUED FOR USE



TABLE 2: GRANULAR RESOURCES OF THE PARSONS LAKE AREA																
Proven (m³)						Probable (m³)					Prospective					Land Ownership
Source	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	Class 1	Class 2	Class 3	Class 4	Class 5	
2.24			400,000					4,000,000					12,000,000			Crown
175*																Crown
307			30,000					300,000					650,000			Crown
308			5,000					300,000					1,500,000			Crown
309		350,000					1,000,000					4,000,000				Crown
310A				55,000					550,000					5,500,000		Inuvik 7(1)(b) Crown
312		4,000,000					4,500,000					10,000,000				Tuktoyaktuk 7(1)(b)
TOTAL	0	4,350,000	435,000	55,000	0	0	5,500,000	4,600,000	550,000	0	0	14,000,000	14,150,000	5,500,000	0	

\* For borrow site 175, it is not known whether the 1,500,000 m³ of Class 2-3 material are proven, probable or prospective; therefore, these values are not included in the total.



**Developer Response: 152.5**

Although there are currently no firmed up plans for future harbor improvements at Tuktoyaktuk, the Developer is aware of past harbor improvement activities that have taken place in the area. These improvements have typically involved dredging to deepen portions of the shallow shipping channel into the harbour, or the straightening out of the “S” bend into the harbour to facilitate the movement of ships in and out of the harbor. Kavik-Axys (2010) reported on these previous activities in their review of Tuktoyaktuk Harbor as a base for future potential offshore oil and gas exploration and development activities.

As reported by Kavik-Axys (2010) and based on the direct past experience of EBA with these projects, previous dredging in the harbor area resulted in the production of sands and gravels, a large portion of which which was piped to shore for subsequent use in the construction of the current water reservoir that serves the Hamlet of Tuktoyaktuk. Since most future harbor improvements that could be anticipated would probably also involve harbor dredging, no demand on existing, land-based granular resources would be expected to be required.

## **ATTACHMENT 1**

### **Inuvialuit Settlement Region Granular Resources Management Plan**

# **INUVIALUIT SETTLEMENT REGION**

## **GRANULAR RESOURCES MANAGEMENT PLAN**



**Inuvialuit Land Administration**  
Leaders in Aboriginal Land Management



**Indian and Northern  
Affairs Canada**

**Affaires indiennes  
et du Nord Canada**

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## SECTION 1: INTRODUCTION

### RATIONALE

The Inuvialuit Settlement Region (ISR) gravel management plan is a joint initiative by the ISR's largest landowners – the Inuvialuit and the Government of Canada. Both of these respective parties recognize that effective use of finite gravel resources in one of the most geographically remote places in Canada is crucial in meeting local community socio-economic objectives as well as ensuring the sustainable management of all natural resources. It is the intention of the Government of Canada and the Inuvialuit to establish a cooperative approach to managing this valuable resource. To accomplish this will result in more consistent approaches to planning, extraction and reclamation of sites where activity currently exists, or may take place in the future. Reduction of legal liability and enhancement of the efficiencies of the material usage will also occur.

This plan will create an integrated approach to management of granular resources through an agreed upon process regardless of tenure. The resource will be managed in the most effective manner through the prioritization process identified in the Inuvialuit Final Agreement on Inuvialuit owned lands. It will also be achieved through the application of current best management practices coupled with environmental terms and conditions applied through associated authorizations deemed necessary throughout the Settlement Region.

It is also realized that while demand forecasts can help determine future projects, situations can change and that new economic opportunities may present challenges to established management criteria. Regional developments and changes to the gravel management plan will need to be explored as and when events unfold. It is also realized that the current royalty rates for gravel resources on Crown lands is less than that of resources on Inuvialuit Private lands, and as such these economic differences will impact proponent desired site selection. The challenge will be the differentiation between ideal gravel source prioritization versus the economic practicalities of the project in question.

The Inuvialuit Land Administration (ILA) and Indian and Northern Affairs Canada (INAC) will continue to consult on these issues to ensure that the management plan effectively meets current objectives while providing the flexibility to adapt to meet changing conditions in the future. The goal of the plan is to promote sustainable approaches to gravel utilization and site restoration that may inspire other organizations across the north to work with the Government of Canada and other partners in the development of similar natural resource management plans for their geographical areas.

## **CONTRIBUTORS**

The ISR Granular Resources Management Plan is a document that has been contributed to by many employees of Indian and Northern Affairs Canada (INAC) and the Inuvialuit Land Administration (ILA). Other contributors to the development of the management plan include the Inuvialuit Land Administration Commission (ILAC), the ISR Community Corporations and Hamlets, the Government of the Northwest Territories, and the citizens of the Inuvialuit Settlement Region.

## OBJECTIVES

In 2002 a Memorandum of Understanding (MOU) was signed, in which the Inuvialuit Regional Corporation (IRC) and Indian and Northern Affairs Canada - Northwest Territories Region (INAC) agreed to co-manage Crown and privately owned Inuvialuit Settlement Region (ISR) granular resources (see Appendix A). The following management plan provides an approach for the management of all potential granular resources on both public (Crown) and private (Inuvialuit-owned) lands, but does not compromise the authority of either organization to administer lands under their jurisdiction. A co-ordinated and systematic approach to granular resource management will be developed through the compilation and utilization of existing information, sharing of research and project data, and a commitment to joint planning, action and resource allocation. This joint management approach is supported in the *Inuvialuit Final Agreement* (IFA).



## AREA

The Inuvialuit Settlement Region is located in Canada's Western Arctic and spans from the Alaska-Yukon border to Victoria Island on the Beaufort Sea (see Figure 1). With an area of 450,000 square kilometres, the ISR includes the Mackenzie Delta, Victoria Island and Banks Island. There are six communities that are part of the ISR: Aklavik (population 594), Inuvik (3,484), Paulatuk (294), Sachs Harbour (122), Tuktoyaktuk (870) and Ulukhaktok (formerly known as Holman) (398) (Statistics Canada, 2006).

Within the ISR there are four land owners: the Inuvialuit (Inuvialuit Private lands), the Government of the Northwest Territories (Commissioner's lands), the Gwich'in (Gwich'in Private lands), and the Federal Government of Canada (Crown lands). Inuvialuit Private lands comprise approximately twenty percent of the lands within the ISR. The Inuvialuit Land Administration has jurisdiction over Inuvialuit Private lands that fall under the categories of "7(1)(a)" and "7(1)(b)" lands as defined in the *Inuvialuit Final Agreement*. 7(1)(a) lands refer to lands to which the Inuvialuit hold both surface and subsurface rights, while 7(1)(b) lands refer to lands to which the Inuvialuit hold only surface rights. Surface rights were granted for granular resources only, while subsurface rights include rights to granular resources, as well as oil, gas, other hydrocarbons, coal, sulphur and minerals. The distribution of 7(1)(a) and 7(1)(b) lands can be seen in Figure 1. 7(1)(a) lands consist of approximately 13,000 square kilometres of land, which lie in 1,800 square kilometre blocks belonging to each of the six ISR communities, as well as a block (approximately 2,000 square kilometres) at Cape Bathurst. 7(1)(b) lands consist of 78,000 square kilometres which lie further afield from the communities.

Nearly eighty percent of the land within the ISR belongs to the Federal Government. Surface and subsurface rights on Crown lands within the ISR are administered by the Minister of the Department of Indian and Northern Affairs Canada. INAC also administers the subsurface rights on 7(1)(b) Inuvialuit Private lands and subsurface rights for resources on Commissioner's Lands.

Commissioner's land is land which has been transferred from the Government of Canada to the Commissioner of the Northwest Territories for the purposes of future Community development. This land is also referred to as Block Land Transfer (or BLT) lands and accounts for two percent of the land within the Northwest Territories. Commissioner's lands within the ISR are administered by the Lands Administration section of the Government of the Northwest Territories' Department of Municipal and Community Affairs (MACA). MACA administers the Commissioner's land by selling, leasing, or otherwise disposing of land within the BLT existing outside Municipal boundaries in the Northwest Territories. Thus, MACA is responsible for the management of gravel on these lands which is used mainly by the GNWT Departments of Transportation and Public Works and Services.

There are multiple methods of access to the six ISR communities and the areas surrounding them. Inuvik is accessible from the south almost year-round by the Dempster Highway (with

the exception of spring break-up and fall freeze-up). During the winter (approximately December-April) Aklavik and Tuktoyaktuk are accessible by an ice road which is constructed on the Mackenzie River. All communities have airstrips and are accessible by air. All communities are also accessible by barge during ice-free seasons. Granular sources outside of a community's municipal infrastructure can also be accessed through the construction of a seasonal winter road or ice road, or an all-weather road.

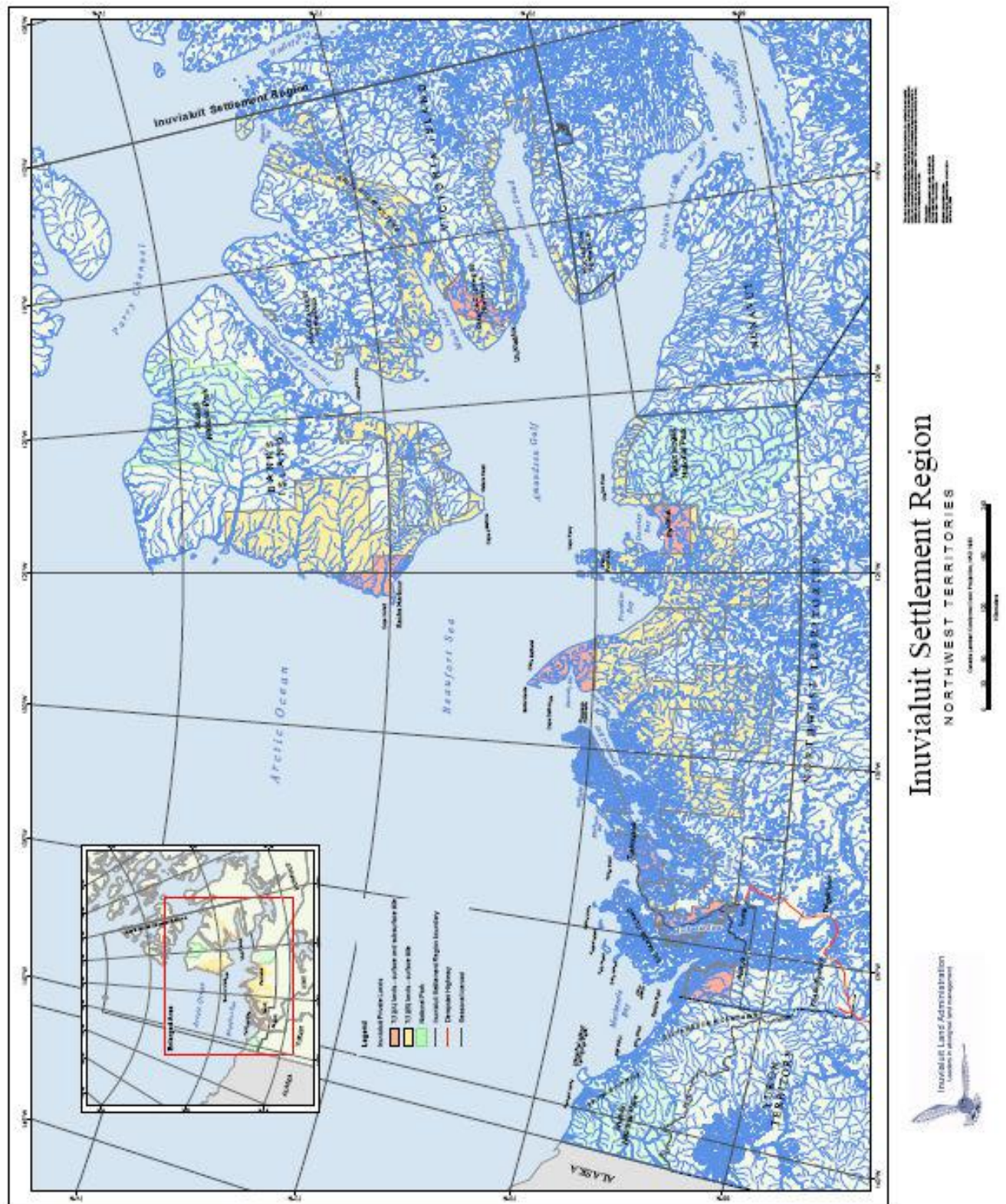


Figure 1- The Inuvialuit Settlement Region Source: Inuvialuit Land Administration

## REGULATIONS

This section includes relevant legislation and regulations regarding granular resource management in the Inuvialuit Settlement Region for both Indian and Northern Affairs Canada and the Inuvialuit Land Administration. Pertinent legislation includes, but is not limited to - provisions of the Inuvialuit Final Agreement, ILA Rules & Procedures, the Territorial Lands Act, the Territorial Land Use Regulations, the Territorial Quarry Regulations, and the NWT Waters Act.

The legislation, regulations, and rules and procedures included in this section are subject to change, and the gravel management plan will be updated accordingly. In the foreseeable future, the Inuvialuit Land Administration will be implementing a new land management system entitled “Inuvialuit Land Management System” which may make significant changes to gravel permitting and royalties. Indian and Northern Affairs Canada is currently reviewing and considering changes to the existing Territorial Quarrying Regulations.

### **Documents Applicable to Inuvialuit Private Lands**

#### ***The Inuvialuit Final Agreement***

The Western Arctic (Inuvialuit) Claims Settlement Act approved, gave effect to and declared valid the Inuvialuit Final Agreement in 1984. The Inuvialuit Final Agreement is the agreement which delineates the Inuvialuit Settlement Region, establishes ownership of lands, and creates the Inuvialuit Regional Corporation and its subsidiaries including the Inuvialuit Land Corporation, which is managed by the Inuvialuit Land Administration. The following are the sections of the Inuvialuit Final Agreement that dictate the management of granular resources in the ISR:

7(27) With respect to sand and gravel on Inuvialuit lands, as a first priority the Inuvialuit shall reserve supplies of sand and gravel of appropriate quality and within reasonable transport distances on Inuvialuit lands in order to meet public community needs in the Western Arctic Region and in Inuvik, based on reasonable twenty (20) year forecasts of the volumes required from Inuvialuit lands. The forecasts shall be prepared jointly by the Inuvialuit and the appropriate levels of government on the basis of community estimates of requirements, and shall be revised from time to time as required but, in any event, not less frequently than once every five (5) years.

7(28) As a second priority, the Inuvialuit shall reserve adequate supplies of sand and gravel of appropriate quality on Inuvialuit lands for the direct private and corporate needs of the

Inuvialuit and not for sale, based on reasonable twenty (20) year forecasts of required volumes prepared by the Inuvialuit Land Administration.

7(29) As a third priority, the Inuvialuit shall make available sand and gravel for any project approved by an appropriate governmental agency.

7(30) The Inuvialuit and the appropriate level of government may jointly identify certain zones within the Western Arctic Region including, for greater certainty, Inuvialuit lands, where sand and gravel may not be removed, or may not be removed during certain periods of the year, for environmental reasons or because of other conflicting uses of such land.

7(31) For greater certainty, the sand and gravel deposits within Inuvialuit lands, known collectively as the Ya Ya Lakes eskers, shall be dedicated to sand and gravel development, subject to normal pit development, restoration measures and laws of general application.

7(32) The right to remove sand and gravel from Inuvialuit lands requires a licence or concession obtained from the Inuvialuit Land Administration. A licence or concession may stipulate the required payment of a royalty to the Inuvialuit Land Administration, not exceeding \$0.75 per cubic yard multiplied by  $b/a$ , where “a” means the Gross National Product of Canada in current dollars for the year 1982 and “b” means the Gross National Product of Canada in current dollars for the year previous to the year in which the royalties are being charged.

7(33) For the purposes of subsection (32):

(a) a licence is a non-exclusive right to remove a certain volume of sand and gravel for a specific purpose during a period not exceeding one (1) year from a specific sand and gravel pit; and As amended January 15, 1987 (b) a concession is the exclusive right to explore, develop and produce sand and gravel from an area for a period specified in the concession.

7(34) A licence or concession may stipulate payments to cover reasonable administrative costs and, where they are applicable and justified, reasonable land reclamation costs in relation to the sand and gravel deposit for which the licence or concession has been granted.

7(35) In granting a licence, the Inuvialuit Land Administration shall, to the extent of its legal capability, ensure that sand and gravel is made available to interested parties at reasonable prices.

7(36) Before issuing a licence, the Inuvialuit Land Administration shall require the applicant to establish that the proposed project has been approved by the appropriate level of government and that a contract has been awarded.



7(37) Notwithstanding subsection (36), the Inuvialuit Land Administration shall, subject to reasonable rules of pit management, issue a licence to any person for personal use in amounts not exceeding 50 cubic yards annually.

7(38) Any concession granted by the Inuvialuit Land Administration to the Inuvialuit Development Corporation shall contain the specific provision that the Inuvialuit Development Corporation shall make sand and gravel available at reasonable prices to interested parties bearing in mind the priorities set out in subsections (27) to (29). Reasonable prices shall not exceed levels that would result in a rate of return in excess of 20%, after tax, on the capital employed by the holder in his sand and gravel business.

7(39) The rate of return referred to in subsection (38) shall be determined in accordance with generally acceptable accounting principles on the basis of actual data for past years and reasonable forecasts for future years with the aim of averaging the rate of return over the life of the concession. For the purpose of determining reasonable prices, the concession holder shall not take into account any general annual overhead and management costs in excess of 15% of total costs.

7(40) Any concession referred to in subsection (38) shall establish that the Inuvialuit Development Corporation maintains for inspection by the Inuvialuit Land Administration and the appropriate government officials the necessary financial records related to the royalty payments, profits and rate of return of the operations.

7(41) Where the Minister is of the opinion that the Inuvialuit Development Corporation, under a concession, is providing sand and gravel in an unreliable or inefficient manner or at excessive prices, he may notify the Inuvialuit Land Administration in writing whereupon it shall terminate the concession and offer it on a competitive bid basis. Neither Canada, the concession holder nor any third party shall have any right, claim or recourse against the Inuvialuit arising from alleged damage or loss resulting from such termination.

7(42) The provisions of this Agreement respecting sand and gravel, except subsection (41), are subject to the arbitration process set out in section 18.

### ***The Inuvialuit Land Administration Rules and Procedures***

The Inuvialuit Land Administration has adopted its own rules and procedures for how gravel use shall be permitted and the fees and royalties associated with resource extraction. The relevant sections of the ILA Rules and Procedures are included below:

### Application for a Quarry License

7(21) Every application for a Quarry License, must be accompanied by the Royalties for the volume of Surface Materials, proposed to be removed, or the first 1,000 cubic metres (1308 cubic yards), whichever is less.

Royalties shall be refunded, where the Administrator does not issue the Right applied or shall be partially refunded where the Right is issued for a volume smaller than the one applied for.

### Preliminary Plan

7(22) Every application shall be accompanied by a preliminary plan showing the intended Land Use or Land Occupancy and an estimate of their area in hectares or square kilometres.

### Area applied for in Application for a Quarry, Coal or Mineral Concession Must be Staked

Furthermore, any Application for a Quarry, Coal or Mineral Concession cannot be made unless the area has been staked in accordance with subsection 19(18) hereof, prior to the date of application.

7(23) The preliminary plan with an Application shall identify the approximate location, with coordinates, of all:

- a) Existing lines, trails, Rights of Way and cleared areas proposed to be used in the operations;
- b) New lines, trails, Rights of Way and cleared areas proposed to be used in the operations;
- c) Buildings, campsites, air landing strips, air navigations aids, fuel and supply storage sites, waste disposal sites, excavations and other works and places proposed to be constructed or used during the operations; and
- d) Bridges, dams, ditches, railroads, highways and roads, transmission lines, pipelines, survey lines and monuments, air landing strips, streams and other features, structures or works that, in the opinion of the applicant, may be affected by the operations.

## **Documents Applicable to Crown Lands**

### ***Territorial Quarrying Regulations***

The Territorial Quarrying Regulations apply to granular resource development on Crown land within the Inuvialuit Settlement Region, and as such are used by Indian and Northern Affairs Canada to guide their quarry permitting process. These regulations are currently being reviewed which may bring substantial changes to this document upon completion. It should also be noted that although there are provisions to stake and lease granular resources, the NWT Region has taken the policy position to not proceed on the application of either activity in consideration of the general, local scarcity of the resource.

#### **APPLICATION**

3. These Regulations apply only to territorial lands under the control, management and administration of the Minister.

#### **STAKING**

4. (1) A person who desires to obtain a lease of territorial lands for the purpose of taking limestone, granite, slate, marble, gypsum, marl, gravel, loam, sand, clay, volcanic ash or stone therefrom, shall stake such lands in the manner prescribed in this section.

(2) In the case of loam, the area shall not exceed 20 acres, and in the case of any other material mentioned in subsection (1), the area shall not exceed 160 acres; and the length of any area shall not exceed twice the breadth.

(3) The area staked shall be rectangular in form except where a boundary of a previously staked tract is adopted as common to both areas.

(4) The land shall be marked by the applicant with posts firmly fixed in the ground, one at each corner; in areas where there is no timber, rock cairns may be used in lieu of posts.

(5) Each post shall be at least four inches square and when firmly planted shall be not less than four feet above the ground.

(6) Each post shall bear markings showing the number of the post, the name of the applicant, the date of staking and the kind of material which it is desired to remove.

(7) When rock cairns are used, they shall be well constructed, be not less than two feet high and two feet in diameter at the base, a metal container shall be built into the cairn, and a notice bearing the number of the cairn, the name of the applicant, the date of staking and the kind of material which it is desired to remove shall be placed therein.



(8) In a timbered area the lines between the posts shall be clearly marked, and in treeless areas mounds of earth or rock not less than two feet high and two feet in diameter at the base may be used to mark the lines between the cairns.

(9) The applicant shall post a written or printed notice on a post or in a cairn setting out his intention to apply for a lease within the time prescribed by these Regulations.

(10) If two or more persons apply for the same area, the person who first staked the area in accordance with these Regulations shall be entitled to priority in respect of the issuance of a lease.

#### LEASES

5. Territorial lands containing limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay, volcanic ash or stone may be leased by the Minister for the sole purpose of quarrying out or removing therefrom any such substances or materials.

6. (1) An application for a lease shall be filed with the territorial land agent of the land district in which the land is situated within 30 days from the date upon which it was staked.

(2) Every lease application shall be accompanied by the application fee set out in Schedule I and the rental for the first year of the lease at the rate set out in Schedule II.

(3) Every application for a lease shall be in duplicate and shall contain

(a) a description by metes and bounds of the land applied for;

(b) the name of the materials that the applicant desires to remove from the area;

(c) a sketch showing clearly the position of the parcel in relation to a survey monument, prominent topographical feature or other known point and showing in its margin, copies of the markings on the posts or cairns; and

(d) an affidavit by the applicant setting forth

(i) that he has complied with all the provisions of these Regulations, and

(ii) that the land contains material of the kind applied for in merchantable quantities.

SOR/96-112, s. 1.

7. The term of a lease shall not exceed 10 years.

8. A lessee shall, within such time from the date of the lease as the Minister may fix, commence the removal of the material or materials in merchantable quantities from the area under lease and shall continue the removal of materials to an extent and in a manner satisfactory to the Minister.

#### RENEWAL OF LEASE

9. Where, in the opinion of the Minister, the lessee has complied with the terms of his lease and these Regulations, the Minister may renew the lease for a further term not exceeding 10 years.

#### SAND, GRAVEL AND STONE FOR RESIDENTS

10. Any person resident in the Northwest Territories may take, without a permit or payment of any fees or dues, not more than 50 cubic yards of sand, gravel or stone from territorial lands in any calendar year for his own use but not for barter or sale, but no sand, gravel or stone shall be taken from any territorial lands if any interest in the surface rights of such lands has been licensed, leased or otherwise disposed of by the Crown.

SOR/2003-116, s. 18.

#### LOAM FOR USE OF RESIDENTS

11. (1) A territorial land agent may issue to any person resident in the Northwest Territories, without the payment of any fee or royalty, a permit authorizing him to take not more than 15 cubic yards of loam from territorial lands in any calendar year for his own use, but not for barter or sale.

(2) No person shall take loam from any territorial lands unless he is the holder of a permit.

SOR/2003-116, s. 19.

#### PERMITS

12. (1) A territorial land agent, on receipt of the permit application fee set out in Schedule I and the applicable royalties payable under section 14, may issue a permit to the applicant authorizing the applicant to take the quantity of material specified in the permit from the lands described in the permit.

(2) A territorial land agent may issue a permit, without the payment of any fees or dues, to take such quantities of the materials named in the permit from the land described in the permit, to any of the following:

- (a) a department of the Government of Canada;
- (b) the Commissioner of the Northwest Territories;
- (c) [Repealed, SOR/2003-116, s. 20]
- (d) any municipal district in the Northwest Territories; and
- (e) any educational, religious or charitable institution or hospital in the Northwest Territories.

(3) Permits shall expire when the quantity of material or substance mentioned in the permit has been quarried or removed, or on the expiry of one year from the date of issue of the permit, whichever is the earlier.

(4) A permit shall not be assigned.

(5) If a permittee has not complied with these Regulations or the conditions of his permit, the Minister may cancel the permit.

SOR/96-112, s. 2; SOR/2003-116, s. 20.

#### RESERVATIONS

13. (1) Where the area under a lease or permit issued pursuant to these Regulations is subject to an oil and gas permit or lease, or a recorded mineral claim, the lease or permit shall not authorize entry upon such area without first obtaining the permission of the Minister.

(2) The Minister may grant such permission subject to such conditions for the protection of the holder of the terminable grant as may be considered necessary.

#### FEES AND ROYALTIES

14. Except as provided in these Regulations, material taken by a lessee or permittee from lands described in a permit or lease is subject to the payment of royalties at the rates set out in Schedule II.

SOR/96-112, s. 3.

15. The fee set out in column II of an item of Schedule I is payable for the service set out in column I of that item.

#### ***Territorial Land Use Regulations***

While a prospective proponent may be granted the rights to the resource (ie: a specified volume of granular material), he/she may remain in need of a Land Use Permit should quarrying the material require the use of equipment which triggers such an authorization. Triggers important to keep in mind are as follows:

No person shall, without a Class A Permit, carry on any work or undertaking on territorial lands that involves

- (a) the use, in any 30-day period, of more than 150 kg of explosives;
- (b) the use, except on a public road or trail maintained wholly or in part by federal funds, of any vehicle that exceeds 10 t net vehicle weight;
- (c) the use of any power driven machinery for earth drilling purposes whose operating weight, excluding the weight of drill rods or stems, bits, pumps and other ancillary equipment, exceeds 2.5 t;
- (d) the establishment of any campsite that is to be used for more than 400 man-days;
- (e) the establishment of any petroleum fuel storage facility exceeding 80 000 l capacity or the use of a single container for the storage of petroleum fuel that has a capacity exceeding 4 000 l;

- (f) the use of any self-propelled power driven machine for moving earth or clearing land of vegetation;
- (g) the use of any stationary power driven machine for hydraulic prospecting, moving earth or clearing land, other than a power saw; or
- (h) the levelling, grading, clearing, cutting or snowploughing of any line, trail or right-of-way exceeding 1.5 m in width and exceeding 4 ha in area.

9. No person shall, without a Class B Permit, carry on any work or undertaking on territorial lands that involves

- (a) the use, in any 30-day period, of more than 50 kg but less than 150 kg of explosives;
- (b) the use, except on a public road or trail maintained wholly or in part by federal funds, of any vehicle that is more than 5 t but less than 10 t net vehicle weight, or the use of any vehicle of any weight that exerts pressure on the ground in excess of 35 k pa;
- (c) the use of any power driven machinery for earth drilling purposes whose operating weight, excluding the weight of drill rods or stems and bits, pumps and other ancillary equipment, is more than 500 kg but less than 2.5 t;
- (d) the establishment of any campsite that is to be used by more than two people for more than 100 but less than 400 man-days;
- (e) the establishment of any petroleum fuel storage facility that has a capacity of more than 4 000 l but less than 80 000 l or the use of a single container for the storage of petroleum fuel that has a capacity of more than 2 000 l but less than 4 000 l; or
- (f) the levelling, grading, clearing, cutting or snowploughing of any line, trail or right-of-way exceeding 1.5 m in width but not exceeding 4 ha in area.

### **NWT Waters Act**

In addition to the land authorizations, should any activities related to the quarrying of materials fall within the triggers of a water licence, there may be a requirement for a licence issued by the NWT Water Board as well. Generally this is not a necessity, however, to be aware the triggers are as follows:

8. (1) Except as authorized pursuant to the *Dominion Water Power Act*, and subject to subsection (2), no person shall use, or permit the use of, waters in a water management area except

- (a) in accordance with the conditions of a licence; or

(b) as authorized by regulations made under paragraph 33(1)(m).

**9. (1)** Except in accordance with the conditions of a licence or as authorized by regulations made under paragraph 33(1)(n), no person shall, subject to subsection (2), deposit or permit the deposit of waste

(a) in any waters in a water management area; or

(b) in any other place under conditions in which the waste, or any other waste that results from the deposit of that waste, may enter any waters in a water management area.

## **Documents Applicable to Commissioner's Land**

### ***Commissioner's Land Act***

3.(1) Subject to this Act, the Commissioner may authorize the sale, lease or other disposition of Commissioner's land, including:

(b) a permit authorizing the removal of granular materials from a quarry on Commissioner's land.

(1.1) For greater certainty, the Commissioner may, under subsection (1), authorize a lease or an administration agreement that provides for the establishment, operation and restoration of a quarry on Commissioner's land and for the issuance of a permit referred to in paragraph 3(1)(b).

12. The Commissioner, on the recommendation of the Minister, may make regulations

(b.1) respecting the establishment, operation and restoration of a quarry on Commissioner's land;

(b.2) respecting the removal and use of granular materials from Commissioner's land generally;

### ***Commissioner's Land Regulations***

#### **Quarrying Leases**

**22.** (1) A person who desires to obtain a lease of Commissioner's land for the purpose of quarrying and taking limestone, granite, slate, marble, gypsum, marl, gravel, loam, sand, clay, volcanic ash or stone from the Commissioner's land shall make application as provided by section 10 and shall stake lands in the manner prescribed in this section.

(2) In the case of loam the area of a quarrying lease shall not exceed 8 ha, and in the case of any other material mentioned in subsection (1) the area shall not exceed 65 ha, and the length of any area shall not exceed twice the breadth.

(3) Land staked for a quarrying lease shall be rectangular in form except where a boundary of a previously staked tract is adopted as common to both areas.

(4) The Deputy Minister shall not issue a quarrying lease to an applicant unless, in the Deputy Minister's opinion, the materials to be quarried are to be used or marketed immediately, the land contains such materials in economic quantities, and use of the land applied for quarrying purposes is not significantly detrimental to the surrounding area. R-085-92,s.3.

**23.** (1) The term of a quarrying lease shall not exceed 10 years.

(2) A quarrying lease must provide that the lessee shall pay a royalty in the amount set out in Schedule A. R-085-92,s.9.

**24.** A lessee shall pay an annual rental fee for a quarrying lease in the amount set out in Schedule A. R-012-2002,s.3.

**25.** A lessee shall, within such time from the date of the quarrying lease as the Deputy Minister may fix, commence the removal in merchantable quantities of the material or materials from the area under the quarrying lease and shall continue the removal to an extent and in a manner satisfactory to the Deputy Minister. R-085-92,s.3.

**26.** Where in the opinion of the Deputy Minister the lessee has complied with the terms of his or her quarrying lease and the regulations, the Deputy Minister may grant another lease for a term not exceeding 10 years subject to such terms and conditions as he or she deems fit. R-085-92,s.3.

#### Quarrying Permits

**31. (1)** The Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement may, on the application of any person and on the payment of the fee for a quarrying permit, the royalty and the fees for quarry restoration, road maintenance and quarry administration set out in Schedule A and, where applicable, any fee charged under subsection (1.1), issue a quarrying permit in Form 8 of Schedule B authorizing such person to take, subject to any conditions specified in the permit, such granular materials in such quantities as are specified in the permit from the land described in the permit.

(1.1) The Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement shall, in addition to the fees set out in Schedule A, charge a quarry development fee determined under subsection (1.2) to an applicant for a quarrying permit where one or more of the following activities has been carried out at a quarry in order to facilitate the sale or supply of granular materials under the authority of the permit:

- (a) drilling;
- (b) blasting;
- (c) crushing;
- (d) stockpiling;
- (e) loading;
- (f) hauling;
- (g) any other development activity.

(1.2) The Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement shall, in accordance with subsection (1.3) and before March 31 each year, determine the quarry development fee that may be charged during the period

beginning on April 1 in that year and ending on March 31 in the following year for each cubic meter of granular materials to be developed for sale or supply at a quarry during that period.

(1.3) The quarry development fee that may be charged in a period referred to in subsection

(1.2) must be equal to

$$\frac{A}{B}$$

where

- (a) A is the total estimated cost of developing the granular materials estimated to be required for sale or supply during the period; and
- (b) B is the total estimated number of cubic meters of granular materials estimated to be required for sale or supply during the period.

(1.4) Before the commencement of the period in respect of which a quarry development fee is determined under subsection (1.3), the Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement shall

- (a) publish the amount of the quarry development fee for each cubic meter of granular materials, in a newspaper or any other publication circulating in the region or place where the quarry is located; or
- (b) post the amount of the quarry development fee that will be charged for each cubic meter of granular materials, in various conspicuous locations within the region or place where the quarry is located and at the site of the quarry.

(2) On application and without the payment of any fees or royalties, the Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement may issue a quarrying permit authorizing any of the following applicants to take such materials in such quantities as are specified in the permit from the land described in the permit:

- (a) the Government of Canada;
- (b) the Government of the Northwest Territories;
- (c) a municipal corporation;
- (d) an educational, religious or charitable institution or hospital.

(3) A quarrying permit expires when the quantity of material specified in the permit has been quarried or removed or on the day specified in the permit, whichever occurs first.

(4) The day specified in the permit must not be more than 12 months after the date of issue of the permit.



(5) A quarrying permit is not assignable and any assignment of it is of no effect. R-085-92,s.12; R-053-97,s.2.

**31.1. Repealed, R-053-97,s.3.**

**31.2.** (1) Where a permittee is required by a quarry permit to restore a quarry, the fee for quarry restoration paid under subsection 31(1) shall be refunded to the permittee if the permittee restores the quarry and the quarry is restored to a condition acceptable to the Deputy Minister on the expiration of the quarry permit.

(2) Where a permittee is required by a quarry permit to maintain an access road to a quarry, the fee for road maintenance paid under subsection 31(1) shall be refunded to the permittee if the permittee has maintained the road and it is in a condition acceptable to the Deputy Minister on the expiration of the quarry permit. R-085-92,s.12.

**32.** Any person may take, without a quarrying permit or payment of any fees or dues, not more than 40 m<sup>3</sup> of sand, gravel or stone from Commissioner's land in any year for his or her own use but not for barter or sale.

**33.** (1) The Deputy Minister or a municipal corporation or any other person that has entered into a quarry administration agreement may issue to any person resident in the Territories, without the payment of any fee or royalty, a quarrying permit authorizing him or her to take not more than 12 m<sup>3</sup> of loam from Commissioner's land in any year for his or her own use, but not for barter or sale.

(2) No person shall take loam from any Commissioner's land unless he or she is the holder of a quarrying permit. R-053-97,s.4.

**Quarry Administration Agreements**

**33.1.** (1) The Deputy Minister may enter into a quarry administration agreement with a municipal corporation or any other person providing for the establishment, operation and restoration of a quarry on Commissioner's land.

(2) A municipal corporation or any other person that has entered into a quarry administration agreement under subsection (1), may, if authorized to do so by the agreement,

- (a) issue quarrying permits in accordance with section 31;
- (b) collect any royalty or fee set out in Schedule A to these regulations;
- (c) where appropriate, determine, charge and collect a quarry development fee in accordance with subsections 31(1.1) to (1.3); and
- (d) retain any fee, but not any royalty, collected under paragraph (b) or (c). R-053-97,s.5.

## **LIMITATIONS OF THE GRANULAR RESOURCES MANAGEMENT PLAN**

As with all projections and forecasts, a certain amount of uncertainty and a number of assumptions have been incorporated into this management plan. Most significantly, the plan is based on a limited number of historical analyses, most of which were undertaken in the 1970s and 1980s and have for the most part focused on the Mackenzie Delta region. Therefore this contemporary management plan is based on dated information which may not accurately reflect quality and quantity of materials remaining in the identified gravel sources, and does not include other possible sources yet to be identified. The existing data often discusses probable and prospective resources, since few existing reports contain sufficient data to identify proven quantities of granular materials.

Demand forecasts play a key role in this management plan in the speculative allocation of resources from identified sources. The demand for granular resources may change in respect to public requirements as well as for major private sector developments, and significant variations from the 20 year forecast may result. For example, there are a number of pending projects in the Inuvialuit Settlement Region which may, or may not come to fruition in the forecasted period. Both the Mackenzie Gas Project as well as the potential Tuktoyaktuk-Inuvik highway present major challenges for demand prediction, as these projects would not only use tremendous quantities of granular resources, but likely spur population growth and further increase community granular resource requirements.

With respect to the reservation of granular resources on Inuvialuit Private Land, based on the requirements of the Inuvialuit Final Agreement, it should be recognized that geology, development costs, existing infrastructure and geotechnical limitations will all affect a user's decision in the selection of an aggregate source. Future inventory and evaluation of granular resources will improve our strategic approach to resource development.

Finally there is an existing and substantial price differential with respect to gravel fees and royalty rates on Inuvialuit lands and on Government of Canada Crown lands. As a result it may be difficult to assign specific gravel sources on Inuvialuit Private Land for community or private sector development if adjacent federal sources are available at a much lower cost. This issue will be further reviewed by ILA and the Federal Government to determine whether rates can be harmonized to ensure that management plan objectives coincide with the economic realities of development activities in the far north.

## ENVIRONMENTAL MANAGEMENT

The ISR gravel management plan will be a framework from which both Regulators and proponents can draw from to apply current day best management practices related to the planning, extraction and reclamation of granular resources. It lends itself to progressive land stewardship objectives pertaining to pit development. The ISR Granular Resource Management Plan, along with the site specific quarry management plan and the project specific development plans will work in concert with the necessary land use authorizations to ensure adequate mitigation of the potential impacts resulting from the quarrying and its associated development activities occurs

In addition to terms and conditions on Inuvialuit Private Land, the ILA also utilizes Environmental Monitors throughout the gravel extraction and road construction to ensure that the proponent adheres to the terms and conditions of the licence. While INAC has no legislative ability to compel operators to hire Environmental Monitors for projects occurring on Crown land, it fully supports the program and recognizes the many benefits of having a local representative who can provide objective observations related to the development activities.

Both ILA and INAC undertake inspections before, during, and after the development activity to ensure the proponent is operating in accordance with the permit conditions and environmental accountability. Both security deposits and signed legal agreements may be required which bind the proponent legally to restore the site after the completion of the development activity.

Finally, the ILA utilizes gravel checkers to ensure that the quantity of gravel extracted from the pit equates to what was indicated in the proponent's original land application. This ensures that ILA can accurately determine the amount of gravel extracted from the pit, and update the quantity of gravel remaining in the source at the completion of extraction activities. The use of gravel checkers also ensures that the proponent is invoiced according to the true value of extracted materials taken.

In support of the regulatory approach to gravel management, the management plan also proposes a generic pit management plan (see Section 4), and pit operation plan (see Section 5) that will be developed for active or future sites. Preparation by the proponent of this site plan will ensure that development activities are reflective of the existing Granular Resource Management Plan and the Pit Management Plan, as appropriate. The INAC publication *ISR Pits & Quarries Guidelines* has been adapted to reflect some of the unique characteristics related to quarry operations in the Inuvialuit Settlement Region (see Section 3), and is designed to provide information related to best management practices for granular resource extraction activity in

the ISR. This guideline document will assist proponents and operators with the regulatory approval process as well as the actual gravel extraction process.

## SECTION 2: SUPPLY AND DEMAND

### SUPPLY

Granular resources, like all resources, are often described as being either a proven resource, meaning there is certainty that the resource exists, a probable resource, meaning it is likely that the resource exists, or a prospective resource, meaning it is possible the resource exists. Although there have been many regional inventories of granular resources in the Inuvialuit Settlement Region, there is still uncertainty about the quantity and quality of resources in the area. This is due to the fact that inventories have been largely focussed on the Mackenzie Delta, leaving the eastern ISR communities with few geotechnical studies. Furthermore, within the regional inventories, the method of calculating the amounts and types of gravel may be tenuous at best (using air photo interpretation only, for example), resulting in inaccuracies in the granular resource estimates presented in the report. Despite this, work has been done by the Inuvialuit Land Administration to compile information from any geotechnical studies and resource inventories that have been done in the region to come up with a general idea of the quantity and quality of resources available in the region. Based on this compilation of information, it is estimated that the total volume of granular resources in the ISR is 4.9 billion cubic meters, consisting of 65.8 million cubic meters of proven reserves, 517.5 million cubic meters of probable reserves and 4.3 billion cubic meters of prospective reserves. Maps showing the locations of the granular resource sites mentioned throughout this section can be found in Appendix D.

The quality of a granular resource is also commonly classified on a scale of 1 to 5. Throughout the ISE Granular Resources management plan, Department of Indian Affairs and Northern Development (DIAND) classification system is used to describe the quality of granular material. Class 1 is considered to be excellent quality material, class 2 is good quality material, class 3 is fair quality material, class 4 is poor quality material and class 5 is solid rock material which must be crushed and worked to produce a desired gravel size.

<b>CLASS 1</b>	Excellent Quality Material	Excellent quality material consisting of clean, well graded, structurally-sound sands and gravels suitable for use as high quality surfacing materials, or as high quality asphalt or concrete aggregate, with a minimum of processing.
<b>CLASS 2</b>	Good Quality Material	Good quality material generally consisting of well-graded sands and gravels with limited quantities of silt. This material will provide good quality base and surface course aggregates or structure-supporting fill. Production of concrete aggregate may be possible with extensive processing, except where deleterious materials are present.
<b>CLASS 3</b>	Fair Quality Material	Fair quality material consisting generally of poorly-graded sands and gravels with or without substantial silt content. This material will provide fair quality general fill for roads, foundation pads or lay-down yards.
<b>CLASS 4</b>	Poor Quality Material	Poor quality material generally consisting of silty, poorly-graded, fine-grained sand with minor gravel. These deposits may also contain weak particles and deleterious materials. These materials are considered suitable for marginal general (non-structural) fill.
<b>CLASS 5</b>	Bedrock, Felsenmeer and Talus	Bedrock of fair to good quality, felsenmeer or talus. Potentially excellent sources of construction material, ranging from general fill to concrete aggregate or building stone if quarried and processed. Also includes erosion control materials such as rip-rap or armour stone.

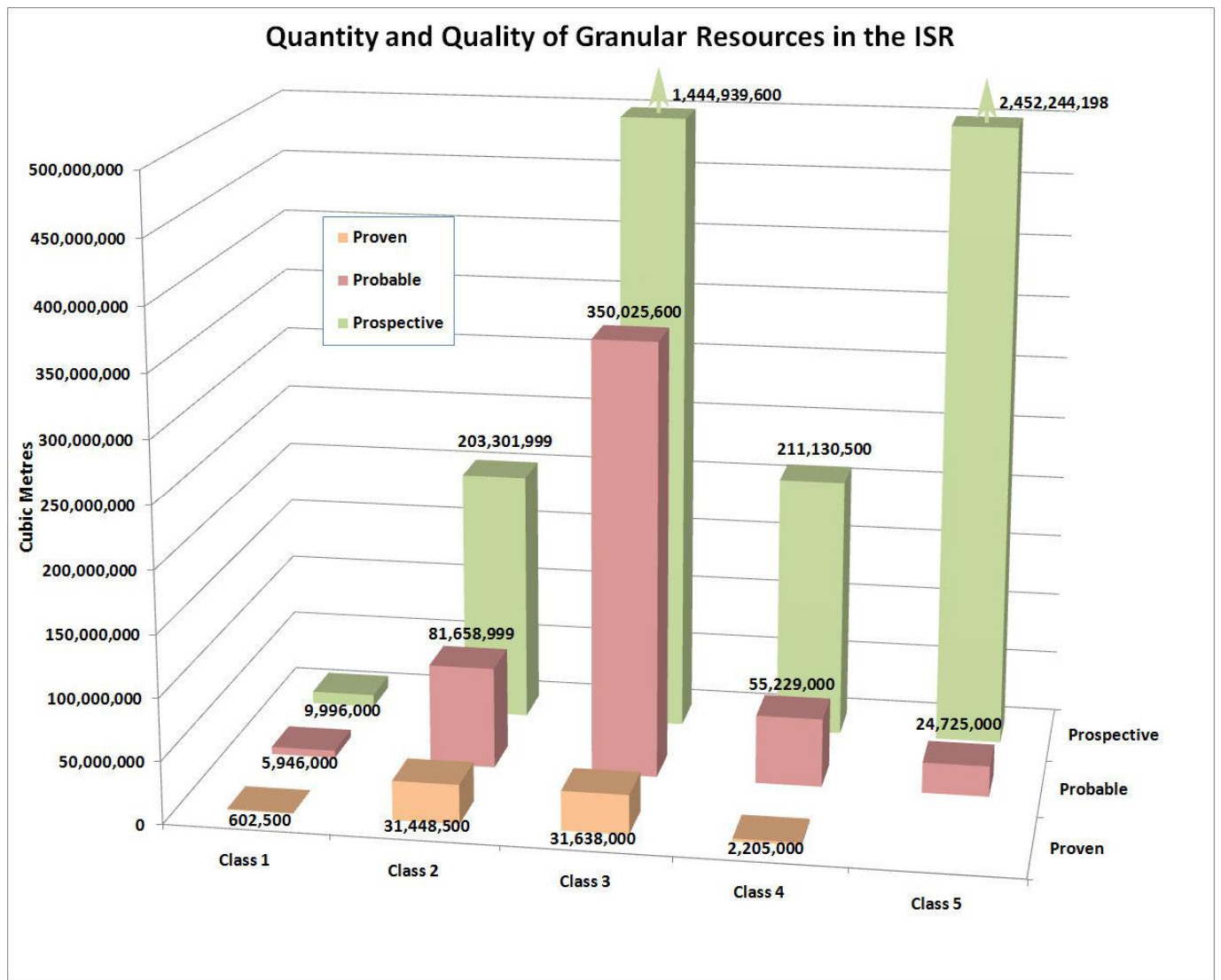
**Table 1- DIAND Classification of Granular Resources (EBA Engineering Consultants, December, 1986)**

Of the 6.5 million cubic meters of proven granular resources in the ISR, 0.6 million is class 1, 31.4 million is class 2, 31.6 million is class 3 and 2.2 million is class 4. Within the regional granular resource inventories and geotechnical reports, there is no mention of proven class 5 granular resources within the ISR.

Of the 517.5 million cubic meters of probable granular resources in the ISR, 5.9 million is class 1, 81.6 million is class 2, 350.0 million is class 3, 55.2 million is class 4 and 24.7 million is class 5.

Finally, of the 4.3 billion cubic meters of prospective granular resources, 9.9 million is class 1, 203.3 million is class 2, 1.4 billion is class 3, 211.1 million is class 4 and 2.4 billion is class 5.

A chart displaying the quantity and quality of the proven, probable and prospective granular resources in the ISR can be seen in Figure 2 below.



**Figure 2- Estimated Granular Resource Supply in the ISR**

## DEMAND

In March 2007, Alpha Corporation prepared a report for the Department of Indian Affairs and Northern Development to summarize the previous demand forecasts that have been completed for the Inuvialuit Settlement Area. Below is an excerpt from Alpha Corporation's report, which serves as a summary of the demand forecasts that have been completed for the region since the signing of the Inuvialuit Final Agreement in 1984.

### Historical Demand Forecasts

#### *1987 Forecast*

The 1987 forecast consisted of six reports completed by EBA Engineering Consultants Ltd., one for each Inuvialuit Settlement Region Community.

The first regional inventory and demand forecast for the ISR was completed in 1987 by EBA Engineering Consultants Ltd. and covered the 20 year period of 1987 to 2006. The scope of these reports (EBA Engineering Consultants Ltd., 1987) included:

- Development of granular resource supply models for each of the six communities by examination of all existing reports describing granular material deposits.
- Development of a granular resource demand model for each community through consultation with private and public sector users.
- Development of a recommended resource development scenario for each community to ensure reserves are established according to the priorities outlined in the IFA.
- Preparation of appropriate development recommendations for those sources with the best development prospects.
- Development of a geotechnical data base consisting of historic borehole information from the study area.

In order to obtain granular demand information a questionnaire was sent to all levels of government and contractors that were potential users of granular material in the ISR. The questionnaire was used to determine volumes and grades of material required, as well as the most probable source of the material. The 20 year projection was presented in four blocks covering five years each. Following the distribution of the questionnaire EBA representatives made site visits to assess local conditions. Follow up phone calls were made to answer questions and obtain more detailed information. All collected data was entered into a database to facilitate the forecasting. A considerable component of these reports was the evaluation of granular supply and recommendations for development for specific deposits in an attempt to match existing supply with the projected demand for each community.



Demand of granular material was classified using the classification system developed by DIAND in 1983 whereby material is graded into one of five classifications based on the quality. The GNWT classification system was cross referenced to the DIAND system to provide for consistency. Furthermore, demand was categorized into the three broad areas of planned capital projects, speculative capital projects and maintenance requirements and presented as either “Public” or “Other”. The total demand for all the ISR was forecast to be 17,400,000 m<sup>3</sup> of which 92% was for speculative projects, 5% for planned capital projects and 3% for general maintenance requirements.

### *1991 Forecast*

In 1991 Hardy BBT Limited completed a granular resource demand summary of the Mackenzie Delta which updated some of the 1987 EBA forecast figures for the period of 1990 to 2009. This scope of this report (Hardy BBT, 1991) included only the communities of Aklavik, Inuvik and Tuktoyaktuk and included the revision of only granular demand, not supply. Prior to obtaining new granular demand information the previous EBA forecast figures were discussed during workshops held in the three communities in 1988. Any community concerns with the demand figures were noted at that time, but in general the figures were found to be acceptable. This forecast was generated using the 1987 EBA demand forecast and incorporating only new or changed projects to extend the time period to 2009.

Updated demand information was requested via a letter sent in March of 1990, with a second mailing and follow up phone calls four months later. The EBA demand figures from the previous forecast were included with the letter for reference in order to make adjustments. A very low response rate of 38% was achieved, primarily from the Oil and Gas sector and the Federal Government. Therefore this demand forecast relied primarily on the previous EBA figures as they were presented in the forecast. The original raw survey data was not made available for this forecast.

Adjustments were made to the 1987 community demand tables by shifting the onshore oil and gas production demand from Tuktoyaktuk to Inuvik. It was felt that Inuvik was closer to where the proposed gas pipeline development would occur. This pipeline proposal was not considered at the time of the 1987 forecast.

The initial 1987 forecast was presented in five year periods. This forecast does not follow that format and no attempt was made to reconcile the time periods with the previous forecast, or to be consistent with the time periods that were used. This forecast used the same classification and categorization of material as the 1987 report.

Overall demand for the 20 year period was forecasted to be approximately 26,000,000 m<sup>3</sup> for the three communities of Aklavik, Inuvik and Tuktoyaktuk. This is a considerable increase from the 1987 forecast.

### *1995 Forecast*

In 1995 North of 60 Engineering Ltd. completed the third demand forecast for the period of 1995 to 2015 (North of 60 Engineering Ltd., 1995). The scope of this forecast was to:

- collect, review and consolidate information from previous forecasts as a starting point for creating the new short and long term forecasts,
- assist the Inuvialuit Land Administration to implement the “Granular Resource Demand Forecast Model” to capture historical usage and
- to develop both short term (5 year) and long term (20 year) granular demand forecasts for the Inuvialuit Settlement Region.

In 1994 North of 60 Engineering developed a “Granular Resource Demand Forecast Model”, which was a database designed to record depletion of granular resource sources within the ISR. ILA used this model to record all depletion information from permits issued during the period of 1985 to 1994. This provided historical usage information that was compared to forecasted demand. Actual volume of granular material used over the 10 year period was 480,000 m<sup>3</sup>, although this does not capture any depletion of granular sources not under ILA jurisdiction. This was considerably lower than both of the previous demand forecasts had anticipated.

The discrepancy is due to the demand for speculative projects, such as the Tuktoyaktuk highway and Oil and Gas development that did not come to fruition. The demand for these speculative projects also included the related expectation of an increase in community growth and infrastructure. Therefore, demand at the community level was also forecast to be substantially higher than the actual usage.

The comparisons of the previous forecasts determined that the majority of demand is in the communities of Inuvik and Tuktoyaktuk comprising 96 -98% of the demands forecast in 1987 and 1991. Historical usage clearly demonstrates a significant decline coinciding with the reduction in oil and gas exploration activity in the region. The data shows a clear link between the exploration and development activity and the demand for granular material.

The demand information from previous forecasts was reviewed as a starting point for this report then compared to the historical usage data to determine the accuracy of the previous forecasts. Updated information was sourced from the Hamlets, the GNWT 1995/96 Capital Plan, ILA, DIAND, GNWT and other concurrent studies. Finally, the historical data, the previous forecast data and new information gathered was used to develop the new short and long term forecasts. The five year periods used in previous forecasts were averaged to provide data for each year for comparison purposes.

The previous forecast categories and classifications were used to develop new short term demands. Public demand was based primarily on the GNWT capital plan with capital expenditures being converted into equivalent granular requirements. Private demand was based on long term oil and gas exploration and development. Various oil and gas development scenarios were presented along with associated volumes and classes of required material. The total demand forecast for the 20 year period of 1995 to 2015 was approximately 4,000,000 m<sup>3</sup> for all the communities. This projection was dependant for the most part on the level and timing of activity in the Oil and Gas exploration sector in the region. This forecast did not attempt to match demand with supply availability.

### *2001 Forecast*

The most recent demand forecast was completed in 2001 by North of 60 Engineering Ltd. covering the period of 2000 to 2020 (North of 60 Engineering Ltd., 2001). The scope of this forecast was to:

- collect, review and consolidate information from previous forecasts and incorporate recent information not included in the existing model
- modify and update the “Granular Resource Demand Forecast Model” to improve performance, flexibility and compatibility with current DIAND systems, and
- to review historical usage and develop both short term (5 year) and long term (20 year) granular demand forecasts for the Inuvialuit Settlement Region.

The “Granular Resources Demand Forecast Model” was updated and migrated from Microsoft Excel to Microsoft Access to make it more user friendly. The previous five year granular usage data was captured and entered into the database. Comparisons of actual usage were made with the previous forecasts to provide a foundation for the new forecast.

This forecast continued the use of the same categories and classifications as in all previous forecasts. The data was presented on a yearly basis. The short term demand was determined with the use of the GNWT 1999 Capital Plan, community input, GNWT, DND and Federal Government departments. The gas exploration sector provided information for the short and long term demands. The long term demand focused on gas exploration and development and provided various in depth granular demands based on a number of scenarios including the proposed gas pipeline and an oil pipeline.

Actual granular resource usage since the last forecast five years earlier was determined to have been 274,174 m<sup>3</sup>, with approximately 15% consumed by the Inuvik Gas Project. This was considerably higher than projected for this period. The total 20 year demand forecast in this report was for 5,372,000 m<sup>3</sup>, an increase of 30% due to the resurgence in gas exploration in the region.

The continuation of gas exploration, development and associated activities was predicted to consume 4,600,000 m<sup>3</sup> of granular material over the 20 year forecast period. Of this 66% was allocated towards onshore gas development. As in the previous forecast there was no attempt made to allocate or reserve any particular granular borrows as sources for supply. Historical usage information was obtained only from ILA and for granular material coming from Inuvialuit lands only.

### **Demand Forecast Methodology**

The IFA stipulates that regular periodic granular demand forecasting be performed and that granular resources be reserved based on the forecasted demands. There is also a necessity to prioritize different areas, as not all gravel reserves will be equally cost effective to use.

It should be noted that, in order to be effective, any granular resource demand forecast for the ISR must consider all potential demands on both public (Crown) and private (Inuvialuit-owned) lands. If this exercise was undertaken by either party, in isolation, there would be no way to consider the potential impact on the resources that might be supplied by other parties. Therefore, it is essential that the forecasting exercise be undertaken jointly by the ILA and DIAND.

The 2009-2029 granular resource forecast for the ISR was compiled by the Inuvialuit Land Administration, drawing upon various sources of information. These sources included the 2007 *Territorial Granular Resources Forecast*, and its October 2008 and May 2009 updates, as well as community consultation with the Hamlet and Community Corporation of each community, and projections for private projects (such as the Mackenzie Gas Project).

A detailed forecast was produced for the five years between 2009 and 2014, and a more general forecast was completed for the remaining fifteen years beyond 2014. The demand forecast was formatted to reflect the three prioritizations of gravel reservation under the *Inuvialuit Final Agreement*, as well as an “other” category.

The first priority section of the forecast includes information about gravel demand related to community maintenance and development, including operation and maintenance, road resurfacing and protection, Community Capital Plan Projects, housing construction and maintenance, runway expansion and maintenance, etc. The gravel users accounted for in the “Community Use” category include the Hamlet, NWT Housing Corporation, and the Government of the Northwest Territories. Demand information for this section was derived from the three versions of the *Territorial Granular Resources Forecast*. For each of the potential uses of gravel, the most recent information available was used for the forecast. In instances where demand was not forecasted in the *TGRF*, demand was projected by calculating the average amount of gravel demanded during years that were forecasted for in the *TGRF*.

Within the demand forecast tables, values that were taken directly from the 2007 *Territorial Granular Resources Forecast* are recorded without any further demarcation. Values within the tables followed by a “~” indicate gravel demand that was forecasted by the more recent May 2009 version of the *TGRF*. Finally, values that are followed by a “\*” are those that have been projected as an average of previous years’ forecasted demand from the *TGRF*.

A ten percent contingency volume was added to the 20 year forecast for Priority 1 (Community Use) demands, due to the fact that many volumes within the forecast were projected based on one or two years worth of data, and could in fact be underestimates of the actual volumes of gravel required.

Forecasting demand for individual private use in the Inuvialuit Settlement Region was carried out using statistics from the Government of the Northwest Territories Bureau of Statistics *NWT Community Profiles* (2007) and from the Inuvialuit Regional Corporation. The *NWT Community Profiles* contain population projections for the years 2012, 2017 and 2022. The percent population change between these five year intervals, and was used to project the population numbers for the remaining years between 2009 and 2029. In order to calculate the number of Inuvialuit beneficiaries each year between 2009 and 2029, the number of enrolled beneficiaries (enrolled beneficiaries are aged 18 and over) for each Community Corporation for 2009 was projected based upon the population growth rates as outlined previously. The number of non-Inuvialuit residents over the age of 18 was calculated by subtracting the number of enrolled Inuvialuit beneficiaries from the total number of residents over the age of 18 in the community.

The personal gravel allotment allowance from Inuvialuit Private land and Crown land is 50 cubic yards (38.2277m<sup>3</sup>). Thus the yearly demand for personal gravel allotment was calculated by multiplying the number of eligible applicants by 38.2277 cubic metres.

### **Prioritization of Gravel Sources**

In addition to the above form of forecasting demand the IFA has stipulated priorities of access to granular resources within the ISR on private lands. First priority is given to public community needs, second priority for private and corporate needs of the Inuvialuit, and third priority for any project approved by an appropriate government agency. To clarify, “any project approved” would include privately (non-Inuvialuit) owned and funded projects as long as approved by an “appropriate governmental agency”. Table 1 details these priorities with excerpts from the IFA.

<b>Section 7.(27) First Priority</b>
With respect to sand and gravel on Inuvialuit lands, as a first priority the Inuvialuit shall reserve supplies of sand and gravel of appropriate quality and within reasonable transport distances on Inuvialuit lands in order to meet public community needs in the Western Arctic Region and in Inuvik, based on reasonable twenty (20) year forecasts of the volumes required from Inuvialuit lands. The forecasts shall be prepared jointly by the Inuvialuit and the appropriate levels of government on the basis of community estimates of requirements, and shall be revised from time to time as required but, in any event, not less frequently than once every five (5) years.
<b>Section 7.(28) Second Priority</b>
As a second priority, the Inuvialuit shall reserve adequate supplies of sand and gravel of appropriate quality on Inuvialuit lands for the direct private and corporate needs of the Inuvialuit and not for sale, based on reasonable twenty (20) year forecasts of required volumes prepared by the Inuvialuit Land Administration.
<b>Section 7.(29) Third Priority</b>
As a third priority, the Inuvialuit shall make available sand and gravel for any project approved by an appropriate governmental agency.

***Table 2: Priority of Access to Sand and Gravel on Inuvialuit lands***

## 2009 Community Demand Forecasts

## Aklavik

Table 3- Aklavik 20 Year Demand Forecast

Aklavik						
<b>Priority 1- Community Use</b>	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	Future 2014- 2029
Capital/O&M						
O&M	4000	4000*	4000*	4000*	4000*	60000*
Road Erosion Protection	500	500*	500*	500*	500*	7500*
Capital Plan/Projects	9500~	2000~	2500~	4667*	4667*	70005*
NWTHC						
Housing Corporation	400~	0~	400~	267*	267*	4005*
O&M Private Housing	300	300*	300*	300*	300*	4500*
GNWT						
General	500~	300~	0~	267*	267*	4005*
DOT Runway Maintenance	-	-	-	-	-	TBD~
<b>Totals</b>	<b>15,200</b>	<b>7,100</b>	<b>7,700</b>	<b>10,001</b>	<b>10,001</b>	<b>150,015</b>
				20 Year Total		200,017
				10% Contingency		220,019
<b>Priority 2- Inuvialuit Private Use</b>						
Beneficiary Personal Allotment (IPL)	9557	9480	9404	9328	9328	135670
				20 Year Total		182,767
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						
Non Beneficiary Allotment (Crown)	7072	7034	6957	6919	6881	100,577
*Indicates values which have been projected based on the 2007 Territorial Granular Resources Forecast				20 Year Total		135,441

~Indicates forecasted values from the May 2009 Update of the  
Territorial Granular Resources Forecast

20 Year Total Demand

538,226

### *Aklavik Gravel Demand Summary*

The total amount of gravel demand for Aklavik between 2009 and 2029 is estimated to be 538,226m<sup>3</sup>. It is estimated that 200,017m<sup>3</sup> of granular material will be required by the community of Aklavik for community use, a total that increases to 220,019m<sup>3</sup>, if a ten percent contingency is added. There are annual requirements for granular resources for the purposes of operation and maintenance of community infrastructure, as well as road erosion protection. The amount of gravel required for Community Capital Plan projects varies by year, but these projects are likely to require the most gravel of any of the community uses. Other gravel uses for Aklavik that fall under community use (or Priority 1 demand under the IFA) include NWT Housing Corporation construction and maintenance, private housing operation and maintenance, and other departments of the GNWT general gravel requirements.

Over the next 20 years, the estimated maximum demand for Inuvialuit private use (Priority 2 demand under the IFA) is 182,767m<sup>3</sup>. The total enrolled Inuvialuit beneficiary population of Aklavik in 2009 is 569, and is projected to decrease to 487 by 2028. Due to an overall population decline trend in Aklavik, the yearly beneficiary personal demand is forecasted to decrease over the next 20 years. Non-beneficiary personal allotment of gravel from Crown sources in the vicinity of Aklavik is forecasted to be 135,441m<sup>3</sup> between 2009 and 2029. In 2009, the total non-Inuvialuit population over the age of 18 is 53, a number that is projected to decrease to 46 by 2029. It must be noted that the aforementioned values for personal gravel allotment are calculated such that every person eligible takes their personal gravel allotment each year.

There are no forecasted Priority 3 other government approved projects that will require granular resources for the 2009-2029 forecast period.

### *Aklavik Gravel Supply and Source Reservation on Inuvialuit Private Land*

Currently the Hamlet of Aklavik is using Source 467, which is located on Gwich'in Private Land, to meet its demand for granular resources. Although this source will doubtlessly continue to be used by the Hamlet in the future, as it is the cheapest, closest source of materials, the IFA requires that the Inuvialuit Land Administration designate resources on Inuvialuit Private Land for Inuvialuit use.

The Hamlet of Aklavik is in the unique position of having no Inuvialuit Private Land within 12km of the community boundary. As a result of this situation, the nearest identified potential gravel source on Inuvialuit Private Land is over 40km away. This source, identified as 464SE, is classified entirely as material class 5, meaning significant crushing and possibly blasting would



need to be undertaken to convert the deposit into class 1, 2, or 3 materials. The total volume of granular resources in 464SE has been estimated to be 625,000m<sup>3</sup> and is classified as entirely probable class 5 (Kiggiak-EBA Consulting Inc., 2002). The next two closest deposits on Inuvialuit Private Land, Sources 463 and 464, are also considered to be class 5 deposits. As a result of this situation it is clear that there is no known easily accessible, low-cost source of granular resources on Inuvialuit Private Land for Aklavik residents. Despite this situation the Inuvialuit Land Administration must still designate sources 464SE and 464 as future sources of Aklavik gravel due to their relative attractiveness as sources and their proximity to the Peel Channel of the Mackenzie River, which would allow for Aklavik access via a potential future ice road. In the meantime, ILA will continue to investigate other potential sources of granular materials on Inuvialuit Private Lands in the vicinity of Aklavik. If, in the future, a more appropriate source is identified then the gravel management plan will be revised accordingly.

For the purpose of meeting the requirements of section 7.(27) of the IFA, a volume of 220,019m<sup>3</sup> of source 464SE granular materials is hereby designated as reserved for Aklavik public community needs (Priority 1). This volume must not be depleted by either private Inuvialuit use or for any other government approved projects.

For the purpose of meeting the requirements of 7.(28) of the IFA, an additional volume of 182,767m<sup>3</sup> of source 464SE granular materials is hereby designated as reserved for direct Inuvialuit private and corporate needs (Priority 2). This volume must not be used for any government approved projects.

## Inuvik

Table 4- Inuvik 20 Year Demand Forecast

<b>Inuvik</b>						
<b>Priority 1-</b>						<i>Future 2014- 2029</i>
<b>Community Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	
<b>Capital/O&amp;M</b>						
Roads	5000	5000*	5000*	5000*	5000*	75000*
O&M	45000	45000*	45000*	45000*	45000*	675000*
Community Plan/Projects	9450~	7250~	8100~	8267**	8267**	124005**
<b>NWTHC</b>						
Housing Corporation	450~	875~	1000~	775**	775**	11625**
O&M Private Housing	3500	3500	3500	3500	3500	52500
<b>GNWT</b>						
General	11,150~	7175~	3675~	7333**	7333**	109995**
DOT Maintenance Garage	-	-	-	-	-	1100
DOT Apron Expansion	-	-	-	-	-	3500
O&M 19mm (Highway & Airport)	2000	2000	2000	2000	2000	30000
EC&E Schools	2000	-	-	-	-	-
Aurora College Gym	-	-	900	-	-	-
H&SS Group Home	-	-	-	-	-	1000
IT&I Park Development	-	-	5000!	-	-	-
Justice Courthouse Expansion	-	-	-	-	-	1200
PWS Garage	-	-	-	-	-	1000
<b>Totals</b>	<b>78,550</b>	<b>70,800</b>	<b>74,175</b>	<b>71,875</b>	<b>71,875</b>	<b>1,085,925</b>
! Park Development to occur between 2011-2017				<b>20 Year Total</b>		<b>1,453,200</b>
				<b>10% Contingency</b>		<b>1,598,520</b>
<b>Priority 2-</b>						<i>Future 2014- 2029</i>
<b>Inuvialuit Private Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	

Beneficiary Personal Allotment (IPL)	37616	38113	38648	39107	39527	636071
				20 Year Total		829,082
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						
Non Beneficiary Allotment (Crown)	58068	58871	59673	60400	61011	981993
*Indicates values which have been projected based on the 2007 Territorial Granular Resources Forecast				20 Year Total		1,280,016
~Indicates forecasted values from the May 2009 Update of the Territorial Granular Resources Forecast				20 Year Total Demand		3,707,618

### *Inuvik Gravel Demand Summary*

Being the Inuvialuit Settlement Region's largest community, Inuvik has the greatest 20 year forecasted gravel demand for the 2009-2029 period. The total 20 year demand for the community including public community use and personal gravel allotments is 3,707,618m<sup>3</sup>. It is estimated that 1,453,200m<sup>3</sup> will be required by the community of Inuvik for public use, and with a 10% contingency added, this number increases to 1,598,520m<sup>3</sup> for the 20 year period. The Town of Inuvik requires 5000m<sup>3</sup> of granular material per year for road maintenance, and another 45,000m<sup>3</sup> per year for operation and maintenance of community infrastructure. The volume of gravel required for Community Capital Plan projects varies greatly by year, and ultimately totals 157,072m<sup>3</sup> over the 20 year forecast period. Other users of gravel that fall under the community use (Priority 1) demand category include the NWT Housing Corporation, and departments of the GNWT including Education, Culture and Employment (EC&E), Department of Transportation, Industry, Tourism and Investment (IT&I), Health and Social Services, Public Works and Services, and general GNWT maintenance. The Government of the Northwest Territories is forecasted to require 146,661m<sup>3</sup> of granular material between 2009 and 2029 for general purposes.

The total potential demand forecasted for Inuvialuit Private use, including personal beneficiary allotments for the 2009-2029 period is calculated as 829,082m<sup>3</sup>. The number of beneficiaries in 2009 enrolled with the Inuvik Community Corporation was 984, and Inuvik is experiencing population growth. Non-beneficiary personal allotment for Inuvik, which could be obtained from Crown land for the twenty year period is calculated to be 1,280,016m<sup>3</sup>. It must be noted that the personal allotment calculations assume that every eligible person will require their personal allotment each year, which is unlikely.

*Inuvik Gravel Supply and Source Reservation on Inuvialuit Private Land*

The town of Inuvik is actively quarrying three sources of granular materials within the town's boundaries in order to meet the demands of the community; Navy Road Pit, Old Baldy Pit (I400) and Airport Pit (I402). The quantity of granular materials or the lifespan of all three deposits is unknown as the community does not track their rates of extraction.

The nearest source of granular materials on Inuvialuit Private Land to Inuvik is source I401A, which is located approximately 4km northeast of the community. According to the available data on source I401A it has 20,000m<sup>3</sup> of proven class 4 granular materials, 250,000m<sup>3</sup> of probable class 4 granular materials and 750,000m<sup>3</sup> of prospective class 4 granular materials (Hardy BBT, Ltd., 1991). Due to the poor quality of granular materials (class 4) this source has been described in several consultant reports as unsuitable for development.

More suitable sources for granular materials have been identified 45km to the north of Inuvik, in deposits 323A and 324A. Both of these deposits are classified as class 2 quality and contain millions of cubic meters of probable and prospective materials. Specifically, source 323A contains 10,000m<sup>3</sup> of proven, 1,000,000m<sup>3</sup> of probable and 45,000,000m<sup>3</sup> of prospective Class 2 granular resources, and source 324A contains 120,000m<sup>3</sup> of proven, 12,000,000m<sup>3</sup> of probable and 35,000,000m<sup>3</sup> of prospective Class 2 materials (Hardy BBT, Ltd., 1991).

In addition to the aforementioned sources is another source, I407, which is moderately more distant but containing granular materials of equally high quality and quantity. Source I407 is also an attractive source, as significant geotechnical work has already been completed at the site resulting in reliable data. According to a 1990 geotechnical investigation by Hardy BBT Ltd., source I407 is mainly composed of material classes 2 to 3 and divided between 655,500m<sup>3</sup> in proven reserves, 3,556,000m<sup>3</sup> of probable reserves and 9,055,000m<sup>3</sup> of prospective reserves (Hardy BBT, Ltd., 1990).

Since Inuvik has three equally as attractive sources of granular materials on IPL, I407, 323A and 324A, the Inuvialuit Land Administration cannot at this time predict or prescribe which source will be developed next. However under the IFA, ILA is required to reserve an appropriate volume of quality granular materials from a reasonably accessible site for all ISR communities. Therefore, whichever of the three aforementioned sources is developed next, it shall be the source containing the reserved materials as required by the IFA.

## Paulatuk

Table 5- Paulatuk 20 Year Demand Forecast

<b>Paulatuk</b>						
<b>Priority 1- Community Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	<i>Future 2014- 2029</i>
Capital/O&M						
O&M	3000	3000	3000	3000	3000	45000
Capital Plan/Projects	6000~	1100~	5500~	4500**	4500**	67500**
NWTHC						
Housing Corporation	400~	400~	ND~	267**	267**	4005**
O&M Private Housing	600	600	600	600	600	9000
GNWT						
General	ND~	ND~	4200~	1400**	1400**	21000**
DOT Runway Improvements	-	-	-	-	TBD	-
O&M 16mm	100	100	100	100	100	1500
EC&E School	-	-	-	-	-	1000
<b>Totals</b>	<b>10,100</b>	<b>5,200</b>	<b>13,400</b>	<b>9,867</b>	<b>9,867</b>	<b>149,005</b>
				20 Year Total		<b>197,439</b>
				10% Contingency		<b>217,183</b>
<b>Priority 2- Inuvialuit Private Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	<i>Future 2014- 2029</i>
Personal Allotment	7340	7378	7416	7416	7493	115218
				20 Year Total		<b>144,848</b>
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						
Non Beneficiary Allotment	1185	1185	1185	1185	1223	18540

*Indicates values which have been projected based on the 2007 <i>Territorial Granular Resources Forecast</i> ~Indicates forecasted values from the May 2009 Update of the <i>Territorial Granular Resources Forecast</i> **Indicates values which have been projected based on the May 2009 Update of the <i>Territorial Granular Resources Forecast</i>	20 Year Total	24,504
	20 Year Total Demand	386,535

### *Paulatuk Gravel Demand Summary*

The total 20 year demand for gravel for Paulatuk is estimated to be 365,152m<sup>3</sup>. Based on forecasted demands, 197,439m<sup>3</sup> of granular material will be required for community use (Priority 1 of the IFA). When a 10% contingency is added, the volume increases to 217,183m<sup>3</sup>. Each year, 3,000m<sup>3</sup> of granular material are required for operation and maintenance of community infrastructure. The amount of gravel required for Community Capital Plan projects varies by year, for a total requirement of 89,100m<sup>3</sup> over the 20 year period between 2009 and 2029. Other users that require gravel on a yearly basis include the NWT Housing Corporation, private housing, and the Department of Transportation for runway improvements. It should be noted that there was no data available for GNWT general demand requirements for gravel for 2009-2011. Thus, the future demand could not be predicted, and it is hoped that the 10% contingency volume will account for any future GNWT demand.

The total forecasted demand that falls under Priority 2 of the IFA, for Inuvialuit beneficiary personal allotment is forecasted to be 144,848m<sup>3</sup> between 2009 and 2029. The total number of beneficiaries enrolled with the Paulatuk Community Corporation in 2009 is 192, and this number is expected to increase, as the population of Paulatuk is also increasing. The total forecasted gravel demand for personal allotments from non-beneficiaries over the next 20 years is 18,540m<sup>3</sup>.

There are no forecasted gravel demands that fall under Priority 3, projects approved by government agencies.

### *Paulatuk Gravel Supply and Source Reservation on Inuvialuit Private Land*

The community of Paulatuk has recently completed the construction of an access road to the 87-P-12 (Rat Lake) gravel source on Inuvialuit Private Land. The source, studied by EBA Engineering Consultants, Ltd. in April, 1987 is estimated to have 1.2 million cubic metres of prospective Class 2 material. Along the Rat Lake access road is another gravel source, 87-P-11, which is estimated to have 1.5 million cubic metres of prospective Class 3 granular material. Because these two sources are now easily accessible by the community, it they will serve as reserves for Priority 1 and 2 gravel uses under the Inuvialuit Final Agreement.

The Inuvialuit Land Administration will reserve 217,183m<sup>3</sup> of granular material for community use (Priority 1) between 2009 and 2029 from Source 87-P-12. Another 144,848m<sup>3</sup> will be reserved for Inuvialuit beneficiary personal allotments (Priority 2) during the same 20 year time period. Any further gravel demands in Paulatuk that fall under Priority 3 will likely be approved for extraction from the 87-P-12 gravel source, due to the large volume of materials available, and the relative low demand for gravel in the community.



Sachs Harbour

Table 6- Sachs Harbour 20 Year Demand Forecast

<b>Sachs Harbour</b>						
<b>Priority 1- Community Use</b>	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>	<b>2012/2013</b>	<b>2013/2014</b>	<b>Future 2014-2029</b>
Capital/O&M						
O&M	2500	2500	2500	2500	2500	37500
Capital Projects	1100~	ND~	1150~	750**	750**	11250**
NWTHC						
Housing Corporation	ND~	ND~	ND~	150	150	2250
O&M Private Housing	100	100	100	100	100	1500
GNWT						
General GNWT	600~	1100~	2000~	1233**	1233**	18495**
Unspecified	500	-	-	-	-	-
DOT Runway Improvements	-	-	-	-	-	TBD
O&M 16mm	40	40	40	40	40	600
EC&E School	-	-	-	-	-	1000
H&SS Health Centre	-	-	-	-	-	1100
<b>Totals</b>	<b>4,840</b>	<b>3,740</b>	<b>5,790</b>	<b>4,773</b>	<b>4,773</b>	<b>73,695</b>
				<b>20 Year Total</b>		<b>97,611</b>
				<b>10% Contingency</b>		<b>107,372</b>
<b>Priority 2- Inuvialuit Private Use</b>	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>	<b>2012/2013</b>	<b>2013/2014</b>	<b>Future 2014-2029</b>
Personal Allotment	2523	2523	2523	2485	2485	40521
				<b>20 Year Total</b>		<b>53,060</b>
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						

Non Beneficiary Allotment	726	726	726	726	726	11965
*Indicates values which have been projected based on the 2007 <i>Territorial Granular Resources Forecast</i>	20 Year Total					15,597
~Indicates forecasted values from the May 2009 Update of the <i>Territorial Granular Resources Forecast</i>	20 Year Total Demand					176,029

### *Sachs Harbour Gravel Demand Summary*

The community of Sachs Harbour has a twenty year forecasted gravel demand of 176,029m<sup>3</sup>. It is forecasted that 97,611m<sup>3</sup>, or 107,372m<sup>3</sup> including a 10% contingency, of granular resources will be required for community use between 2009 and 2029. Each year, 2,500m<sup>3</sup> of gravel is required for operation and maintenance of infrastructure within Sachs Harbour. It is estimated that 15,000m<sup>3</sup> of gravel will be required for Community Capital Plan projects over the twenty year period. The *Territorial Granular Resources Forecast* (2007) predicts that in 150m<sup>3</sup> of gravel will be required by the NWT Housing Corporation in 2012 and 2013, however, makes no forecasts for 2009-2011. Based upon the forecasted demand for 2009-2014, it is estimated that an additional 2,250m<sup>3</sup> of gravel will be required by the NWT Housing Corporation between 2015 and 2029. The *TGRF* also estimates that 100m<sup>3</sup> of gravel will be required on a yearly basis for operation and maintenance of private housing. Gravel will also be required for general purposes by the Government of the Northwest Territories, and for runway operation and maintenance.

Priority 2 demands for gravel for enrolled Inuvialuit beneficiaries are forecasted to be 53,060m<sup>3</sup> over the twenty year forecast period. There were 63 Inuvialuit beneficiaries enrolled with the Sachs Harbour Community Corporation in 2009, and the population of Sachs Harbour is projected to stay relatively even over the twenty year period. No Priority 3 demands for gravel have been identified for Sachs Harbour for the twenty year forecast period.

The non-beneficiary demand for granular resources for Sachs Harbour is forecasted to be minimal, with only 19 non- Inuvialuit community members over the age of 18. The maximum demand for individual non-beneficiary use over the twenty year period is forecasted to be 15,597m<sup>3</sup> of granular material.

### *Sachs Harbour Gravel Supply and Source Reservation on Inuvialuit Private Land*

The Hamlet of Sachs Harbour is currently using sources 87-SH-4 and 87-SH-5 for its community's gravel requirements. An older source, 87-SH-1, was recently depleted and is no longer in use. Both deposits, 87-SH-4 and 87-SH-5, are partially on Commissioner's Land and partially on Inuvialuit Private Land. The portion of the deposit that is currently being quarried by the Hamlet is located on Commissioner's Land but in the future the portion of the quarry on IPL may also be required. According to EBA Engineering Consultants' 1987 report on Sachs

Harbour granular materials, Source 87-SH-4 was depleted and the portion of Source 87-SH-5 on Commissioner's Land was nearly depleted. The report does not state whether the portion of Source 87-SH-5 that is located on IPL had been quarried. During a recent community consultation the Hamlet indicated that the portion on IPL is not currently being used by the Hamlet. Since both sources of granular resources currently used by the Hamlet are nearly depleted, and future sources of materials will need to come from IPL, a plan for the development of gravel resources on IPL in the vicinity of Sachs Harbour must be developed. This plan will include a volume of gravel that is reserved as per the IFA.

A review of the granular material resources in the vicinity of Sachs Harbour reveals that several sources of materials are either already depleted (87-SH-1, 87-SH-4), or unusable due to environmental conditions (87-SH-9, 87-SH-10, 87-SH-11). Other nearby sources of granular materials (87-SH-2, 87-SH-3, 87-SH-6) contain low volumes of materials and would not satisfy the community's needs for long. Rather than develop several small deposits (87-SH-2, 87-SH-3, 87-SH-6), which will be costly and cause widespread environmental damage, the Hamlet should develop one larger deposit thereby concentrating the environmental damage and reducing the cost of site development and ultimate remediation. The most attractive future source of granular materials for Sachs Harbour is 87-SH-8. This source is located 4km east of the hamlet, contains 200,000m<sup>3</sup> of prospective class 3 materials, and has not been identified as being in an environmentally sensitive area (EBA Engineering Consultants, Ltd., 1987).

For the purpose of meeting the requirements of section 7.(27) of the IFA, a volume of 107,372m<sup>3</sup> of source 87-SH-8 granular materials is hereby designated as reserved for Sachs Harbour public community needs (priority 1). This volume must not be used by either private Inuvialuit use or for any other government approved project unless adequate quantities above the reserved amount are proven.

For the purpose of meeting the requirements of 7.(28) of the IFA, an additional volume of 53,060m<sup>3</sup> of source 87-SH-8 granular materials is hereby designated as reserved for direct Inuvialuit private and corporate needs (priority 2). This volume must not be used for any government approved projects unless adequate quantities above the reserved amount are proven.

## Tuktoyaktuk

Table 7- Tuktoyaktuk 20 Year Demand Forecast

<b>Tuktoyaktuk</b>						
<b>Priority 1-</b>						<i>Future 2014- 2029</i>
<b>Community Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	
Capital/O&M						
O&M	10000	10000	10000	10000	10000	150000
Capital Plan/Projects	5600~	6500~	8000~	6700**	6700**	100500**
NWTHC						
Housing Corporation	1600~	2000~	ND~	1200**	1200**	18000**
O&M Private Housing	600	600	600	600	600	9000
GNWT						
General	100500~	107000~	101600~	-	-	-
DOT Runway Improvements	-	-	TBD	-	-	-
DOT Maintenance Garage	-	-	-	-	-	1000
O&M 16mm	100	100	100	100	100	1500
IT& I Interpretive Centre	-	-	-	-	-	800
EC&E School	-	-	-	-	-	1000
<b>Totals</b>	<b>118,400</b>	<b>126,200</b>	<b>120,300</b>	<b>15,700</b>	<b>15,700</b>	<b>238,300</b>
				<b>20 Year Total</b>		<b>634,600</b>
				<b>10% Contingency</b>		<b>698,060</b>
<b>Priority 2- Inuvialuit Private Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	<i>Future 2014- 2029</i>
Personal Allotment	21752	21637	21522	21408	21255	298,902
				<b>20 Year Total</b>		<b>363,316</b>
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-
<b>Other</b>						
Non Beneficiary Allotment	2026	2026	2026	1988	1988	27,944
*Indicates values which have been projected based on the 2007 Territorial Granular Resources Forecast				<b>20 Year Total</b>		<b>35,972</b>

~Indicates forecasted values from the May 2009 Update of the *Territorial Granular Resources Forecast*

\*\*Indicates values which have been projected based on the May 2009 Update of the *Territorial Granular Resources Forecast*

20 Year Total Demand **1,097,348**

### *Tuktoyaktuk Gravel Demand Summary*

Between 2009 and 2029, it is estimated that Tuktoyaktuk will require 1,097,348 cubic metres of granular resources. Over the twenty year period, Tuktoyaktuk is forecasted to require 634,600m<sup>3</sup> of gravel for community use (Priority 1 under the IFA), or 698,060m<sup>3</sup> with the addition of a ten percent contingency volume. According to the *Territorial Granular Resources Forecast* (2007), the community will require 10,000m<sup>3</sup> of granular material per year for operation and maintenance of community infrastructure. Furthermore, for Community Capital Plan projects, the Hamlet of Tuktoyaktuk will require a total of 134,000m<sup>3</sup> of granular material over the twenty year period.

The NWT Housing Corporation in Tuktoyaktuk requires on average, 1200m<sup>3</sup> of gravel per year, while the operation and maintenance of private dwellings has a yearly demand of 600m<sup>3</sup>. There are other demands for gravel by the Government of the Northwest Territories, including a large project for a road to gravel Source 177. This project will require 309,100m<sup>3</sup> of granular material between 2009 and 2012, according to the May 2009 update of the *Territorial Granular Resources Forecast*. Because the forecasted gravel demand that falls under general GNWT demand was inflated due to the road to Source 177 project, it was not possible to forecast the average yearly demand for the remaining 17 years between 2012 and 2029. Therefore, the forecasted gravel demand for Tuktoyaktuk may be under estimated, however this would likely be covered by the ten percent contingency volume that is calculated for each community.

In 2009, there were 569 enrolled Inuvialuit beneficiaries with the Tuktoyaktuk Community Corporation. The population of Tuktoyaktuk is forecasted to decline, thus the amount of gravel required for beneficiary personal allotments is expected to decrease as well over time. The forecasted demand for gravel by beneficiaries for 2009 is 21,752m<sup>3</sup>, and 406,475m<sup>3</sup> over the next twenty years. It must be noted that the forecast for beneficiary demand is likely over estimated, because it is calculated as though each beneficiary will use their personal allotment each year, which is not likely. Non beneficiary demand is calculated to be 27,944 for the period of 2009-2029.

At the time of the forecast there were no priority 3 projects known for Tuktoyaktuk.

*Tuktoyaktuk Gravel Supply and Source Reservation on Inuvialuit Private Land*

In 2009-2010 the Hamlet of Tuktoyaktuk and Government of the Northwest Territories Department of Transportation are constructing a road to gravel Source 177 using materials quarried from Source 177. A 1991 report by Hardy BBT Limited estimates that there are approximately 19 million cubic metres of prospective granular material, which are classified as “good,” or Class 2 (Hardy BBT, Ltd., 1991b). During the last twenty years quarrying has taken place at Source 177 intermittently. The total volume of known granular resources extracted from Source 177 prior to 2009 totals 40,091m<sup>3</sup>. According to the quarry licence application for the project, the construction of the road to Source 177 is expected to use a further 450,000m<sup>3</sup> of granular materials resulting in a remaining volume of approximately 18.5 million cubic metres in the gravel source. This remaining volume, if in fact present, is sufficient to cover the remaining needs of Tuktoyaktuk for granular resources during the 20 year forecast period, and for many years beyond the forecast period. Furthermore, if there is 19 million cubic metres of granular material in the source, there will be enough gravel to designate to priority two and three demands for gravel resources as well. A secondary source has been designated for Tuktoyaktuk in the event that the source does not contain as much gravel as was estimated in the 1991 Hardy BBT Limited report, or if the gravel source becomes depleted. Furthermore, Tuktoyaktuk is in a region of higher potential for development, so there could be high demands for gravel.

The next best source of granular materials for Tuktoyaktuk, based on accessibility, quantity of granular materials present, quality of granular materials present and environmental impacts, is Source 159. This gravel source is located 4km east of Tuktoyaktuk and has a probable volume of 3,500,000m<sup>3</sup> of granular materials respectively (Hardy BBT, Ltd., 1991b). ILA has no record of Source 159 ever having been used in the past meaning a quarry would need to be developed prior to use. Source 159 is composed of class 1 and class 3 materials and has been rated as a good prospect for granular resources by EBA Engineering Consultants in a report prepared for Indian and Northern Affairs Canada (EBA Engineering Consultants, Ltd., 1987).

In the event that Source 159 is deemed to be insufficient in volume, or unusable then another source would need to be utilized. Other prospective sources near Tuktoyaktuk include 157, 160A, 160B, 160D, 161C, 161E and 161F. These sources have all been rated as favourable and are all located within a few kilometres of Tuktoyaktuk. Sources 160A, 160B and 160D have the additional benefit of having been already developed in the past meaning the environmental disturbance and cost associated with developing these quarries is reduced.

For the purpose of meeting the requirements of Section 7.(27) of the IFA, a volume of 698,060m<sup>3</sup> of Source 177 granular materials is hereby designated as reserved for Tuktoyaktuk public community needs (priority 1). This volume must not be depleted by either private Inuvialuit use or for any other government approved project.

For the purpose of meeting the requirements of 7.(28) of the IFA, an additional volume of 363,316m<sup>3</sup> of Source 177 granular materials is hereby designated as reserved for direct Inuvialuit private and corporate needs (priority 2). This volume must not be used for any government approved projects.

## Ulukhaktok

Table 8- Ulukhaktok 20 Year Demand Forecast

<b>Ulukhaktok</b>						
	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	<i>Future 2014- 2029</i>
<b>Capital/O&amp;M</b>						
O&M	3500	3500	3500	3500	3500	52500
Capital Plan/Projects	1000~	4875~	4700~	3525**	3525**	52875**
<b>NWTHC</b>						
Housing Corporation	400~	400~	ND~	267**	267**	4005**
O&M Private Housing	100	100*	100*	100*	100*	1500*
<b>GNWT</b>						
General	500~	ND~	ND~	167**	167**	2505**
GNWT Unspecified	400	-	-	-	-	-
DOT Runway Improvements	-	-	-	-	-	TBD
O&M 16mm	30	30	30	30	30	450
ENR Office Building	-	500	-	-	-	-
EC&E School	-	-	-	-	-	1000
<b>Totals</b>	<b>5,930</b>	<b>9,405</b>	<b>8,330</b>	<b>7,589</b>	<b>7,589</b>	<b>114,835</b>
*Indicates values which have been projected based on the 2007 Territorial Granular Resources Forecast				<b>20 Year Total</b>		<b>153,678</b>
				<b>10% Contingency</b>		<b>169,046</b>
<b>Priority 2- Inuvialuit Private Use</b>	<i>2009/2010</i>	<i>2010/2011</i>	<i>2011/2012</i>	<i>2012/2013</i>	<i>2013/2014</i>	<i>Future 2014- 2029</i>
Personal Allotment	8410	8448	8487	8525	8525	128522
				<b>20 Year Total</b>		<b>170,916</b>
<b>Priority 3- Projects Approved by Government Agencies</b>						
	-	-	-	-	-	-



<b>Other</b>						
Non Beneficiary Allotment	1988	1988	2026	2026	2026	30467
*Indicates values which have been projected based on the 2007 <i>Territorial Granular Resources Forecast</i>				20 Year Total		40,521
~Indicates forecasted values from the May 2009 Update of the <i>Territorial Granular Resources Forecast</i>				20 Year Total Demand		380,483
**Indicates values which have been projected based on the May 2009 Update of the <i>Territorial Granular Resources Forecast</i>						

### *Ulukhaktok Gravel Demand Summary*

According to numbers provided in the various versions of the *Territorial Granular Resources Forecast* and population projections, the community of Ulukhaktok is forecasted to require 380,483m<sup>3</sup> of granular resources between 2009 and 2029. It is estimated that 153,678m<sup>3</sup> of gravel will be required for community demands (priority 1 under the IFA). This number increases to 169,046m<sup>3</sup> if a ten percent contingency volume is added. The Hamlet requires 3500m<sup>3</sup> of gravel each year for operation and maintenance of community infrastructure. Furthermore, Community Capital Plan projects are forecasted to require 70,500m<sup>3</sup> of granular material over the twenty year period. The NWT Housing Corporation requires granular material on a yearly basis, and is forecasted to require 5339m<sup>3</sup> between 2009 and 2029. Furthermore, 100 cubic metres of gravel is required per year for private housing operation and maintenance requirements. Forecast data from the *Territorial Granular Resources Forecast* (May 2009 update) is only available for 2009 for Government of the Northwest Territories demands, while data for 2010 and 2011 is unavailable. Thus, an average was taken of the three years, estimating that 167m<sup>3</sup> of gravel would be used by GNWT on a yearly basis. Thirty cubic metres of 16mm material is required by the Department of Transportation for runway operation and maintenance each year.

In 2009, there were 220 Inuvialuit beneficiaries enrolled with the Ulukhaktok Community Corporation. The population of Ulukhaktok is increasing, and as such, the number of people eligible for personal gravel allotments will also increase over the 20 year forecast period. It is estimated that 170,916m<sup>3</sup> could be required to meet Inuvialuit beneficiary demand for personal allotments between 2009 and 2029. It must be noted that the forecasted number assumes that each beneficiary would claim a personal allotment every year, which is not likely.

There were no known Priority 3, other government approved projects for Ulukhaktok at the time of the forecast. There are however, approximately 52 non-Inuvialuit community members over the age of 18 in the community of Ulukhaktok who may desire to obtain a personal

allotment of gravel. Over the 20 year period, approximately 40,521m<sup>3</sup> of granular material could be required by non-Inuvialuit residents of Ulukhaktok.

*Ulukhaktok Gravel Supply and Source Reservation on Inuvialuit Private Land*

The Hamlet of Ulukhaktok is currently using source 87-H-7, located directly north of the community on Commissioner's Land acquired as part of a municipal land transfer, for its source of granular materials. Source 87-H-7 was originally estimated to contain 75,000m<sup>3</sup> of probable class 2 materials and 75,000m<sup>3</sup> of prospective class 2 materials. The remaining volume of materials in source 87-H-7 is currently unknown however based on reports from the community it is likely the remaining volume in the quarry is substantial. Due to the fact that Source 87-H-7 is located on Commissioner's Land, and the fact that the Inuvialuit Land Administration is required to reserve granular material in gravel sources on Inuvialuit Private Land, two sources on IPL will be reserved for community and Inuvialuit private use. Source 87-H-4 will be reserved as a gravel source for community use if 87-H-7 becomes depleted, or unavailable to the community of Ulukhaktok. This source is located 5.5km northwest of Ulukhaktok, and contains 150,000m<sup>3</sup> of prospective class 2 granular material. Source 87-H-10 will serve as an alternate source, and is located 5km southeast of the Hamlet. The source has 75,000m<sup>3</sup> of prospective class 3 granular material. All of the materials in both of these sources would need to be reserved for community and Inuvialuit private use in order to meet the criteria set forth in the IFA.

From these two gravel source options, a total of 169,046m<sup>3</sup> must be reserved for Priority 1 needs (community use). Another 170,916m<sup>3</sup> must be reserved for Priority 2 (Inuvialuit private use). There are no anticipated Priority 3 gravel demands for other approved government projects.

### Priority 3 Demand Forecast

Priority 3 under the *Inuvialuit Final Agreement* is defined as “any project approved by an appropriate government agency.” As of 2009, there are two pending Priority 3 projects within the Inuvialuit Settlement Region, and these are the Mackenzie Gas Project and the Inuvik-Tuktoyaktuk Highway. Each of these projects will require significant amounts of granular material, placing additional strain on the gravel supply in the Mackenzie Delta.

#### *The Mackenzie Gas Project*

According to the November 2005 *Mackenzie Gathering System Mackenzie Valley Pipeline Project Update*, which was submitted to the National Energy Board and the Joint Review Panel, the Mackenzie Gas Project will require a total volume of 2.154 million cubic metres of granular material from sources within the Inuvialuit Settlement Region. Table 12 below, is taken from the project update report (Imperial Oil Resources Ventures Limited, May, 2007).

Source	Source Type	Existing	Estimated Supply	Volume Required	Ownership	Borrow Use
1.002 P	Granular	No	230,000	34,000	Crown	Pipeline
1.004 P	Granular	Yes	7,500,000	265,000	Private	Infrastructure
1.008 P	Granular	Yes	4,200,000	536,000	Private	Anchor field, pipeline, infrastructure
1.009 P	Granular	Yes	1,900,000	100,000	Private	Anchor field, pipeline, infrastructure
2.020 P	Granular	No	500,000	10,000	Crown	Infrastructure, pipeline
2.028 P	Granular	Yes	1,500,000	1,271,000	Crown	Anchor field, pipeline, infrastructure
2.029 P	Granular	Yes	10,000,000	33,000	Crown	Pipeline
2.029 PB	Granular	Yes		20,000		
20.038 P	Quarry	No	Not Available	10,000	Crown	Pipeline
				2,279,000		

**Table 9- Primary Borrow Sites for the Inuvialuit Settlement Region Source: Imperial Oil Resources Ventures Limited, May, 2007**

There are three potential primary borrow sources on Inuvialuit Private Land (IPL) and six on Crown Land. The total volume of gravel required from IPL is 901,000m<sup>3</sup>, while the total volume required from Crown Land is 1.378 million cubic metres. Imperial Oil Resources Ventures Limited has also identified five secondary potential borrow sources within the Inuvialuit Settlement Region, however the estimated supply and demand of these sources is undisclosed at this time.

### *Inuvik-Tuktoyaktuk Highway*

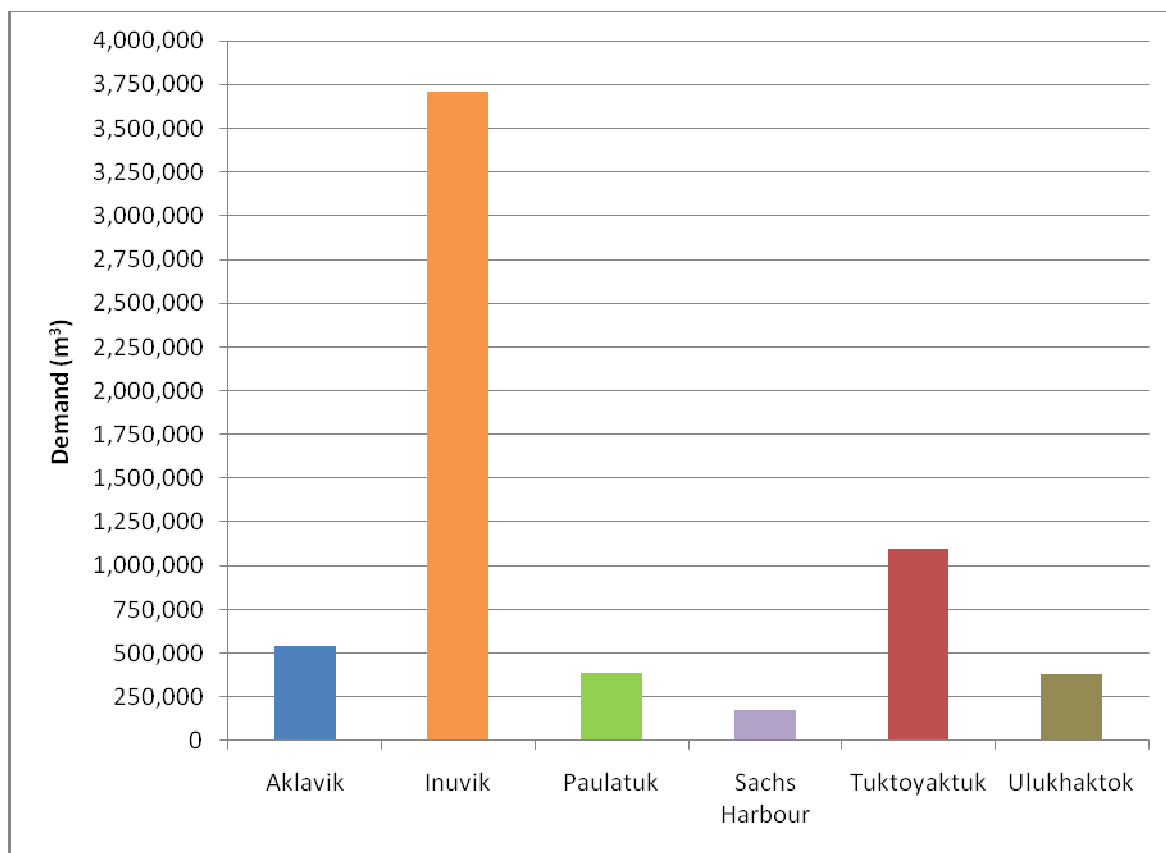
A feasibility study for a potential Inuvik-Tuktoyaktuk highway is currently underway, and if it is decided that construction of the highway will begin, there will be significant demand for granular resources along the highway corridor. The most recent estimate of how much granular material will be required for the highway is found within an EBA Engineering Consultants, Ltd. (1987) report, which states that 3.30 million cubic metres will be required.

### **2009 Demand Survey Revisions**

The quantity and location of the reserved materials within the 2009 Demand Survey will be revised, from time to time, to reflect changes in granular resource supply and demand. As per the IFA, the location and quantity of these reserved materials shall be reviewed at minimum once every five years.

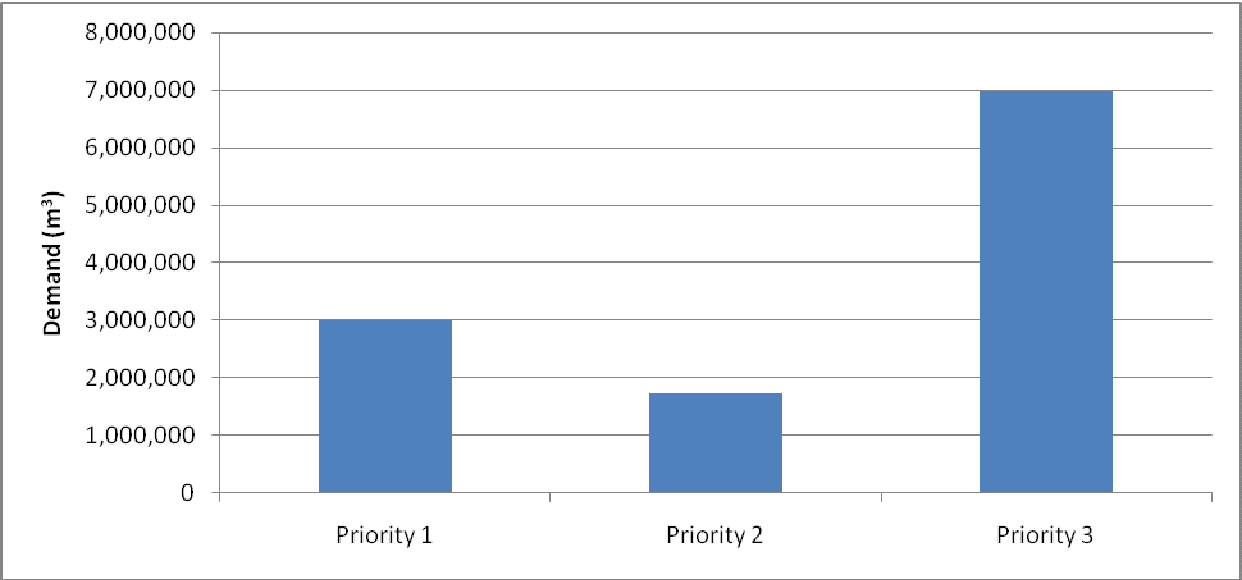
### 2009 Community Demand Forecast Summary

The estimated twenty year demand for gravel in the Inuvialuit Settlement Region for Priorities 1, 2, and 3 (non-beneficiary personal allotments only) under the *Inuvialuit Final Agreement* is forecasted to be 6,286,239 cubic metres. A comparison of the demand by community is presented in Table 9, below.



**Table 10- 20-Year Priority 1 and 2 Demand for ISR Communities**

An additional 5,454,000 cubic metres of gravel may be required within the region for Priority 3 demands. There are two major potential projects that fall under Priority 3, the Mackenzie Gas Project and the Inuvik-Tuktoyaktuk Highway. Neither has been approved, however, they have the potential to stress the supply of resources in the region, specifically in the Mackenzie Delta. These demands cannot be associated to one community, as they will impact several of the communities (namely Tuktoyaktuk, Inuvik and Aklavik) nearby the projects. A breakdown of demand by IFA prioritization is depicted in the table below.



**Table 11- 20-Year ISR Granular Resource Demand by IFA Priority**

## **Community Concerns**

During the creation of the ISR Granular Resources Management Plan, the Inuvialuit Land Administration undertook a series of community consultations with six primary objectives:

- a) To introduce the upcoming granular resources management plan that is being co-operatively worked on by ILA and INAC.
- b) To show and discuss the granular resource maps and gravel database, and how they can be used by the community to determine to whom to apply for a quarry permit, and the characteristics and quantity of gravel within the gravel sources.
- c) To inform the Community Corporation of gravel tenure and to reinforce the necessary application process for obtaining granular resources.
- d) To determine upcoming demand for gravel within the community from public and private entities.
- e) To determine whether gravel is being taken by any entities without a permit.
- f) To determine whether there are any concerns within the community about the gravel supply.

ILA attended Community Corporation and Hamlet meetings in each community, with the exception of Inuvik. The following is a summary of community concerns that were voiced during community consultation sessions, and that should be taken into consideration by ILA and INAC when managing gravel in the ISR.

The results of the Inuvialuit Land Administration's community consultation sessions are available in Appendix B of Section 2 of this document.

### **Aklavik**

The community of Aklavik is highly concerned about the fact that there are only several identified sources of gravel on Inuvialuit Private land. Currently, the community of Aklavik obtains its gravel from Source 467, which lies on Gwich'in Private Land. As such, there is no source on IPL within the vicinity of Aklavik from which enrolled Inuvialuit residents can obtain their yearly personal allotment of gravel. The Community Corporation directors pointed out that a gravel reconnaissance mission had been conducted in the past, but no further gravel sources were identified by the Inuvialuit Land Administration. The directors identified ten

potential sources of gravel within the Aklavik 7(1)(a), and the Inuvialuit Land Administration conducted a gravel sampling program at each of the sites in June 2009. Specific notes from the community consultation meetings with the Aklavik Community Corporation and Hamlet of Aklavik can be found within Appendix E.

### **Paulatuk**

The community of Paulatuk has relatively good access to granular resources, and has recently completed an access road to what is referred to as the “Rat Lake” gravel source, or the lower part of 87-P-23. Generally, the community feels that there is low demand for granular material, due to a small population. However, there are concerns throughout the community about gravel royalties under the ILA fee structure, which are seen to be prohibitive to ensuring community wellbeing.

### **Sachs Harbour**

During community consultations, the residents of Sachs Harbour communicated the fact that Sachs Harbour is a small community located in an area with lots of granular material. The gravel sources on Commissioner’s land which are used by the Hamlet are said to be becoming depleted, and this may cause the community to require gravel from a source on Inuvialuit Private land. Generally, the community requires gravel for community infrastructure, including resurfacing roads, new buildings, and also a cleanup on the beach near the RCMP station. There are no major concerns regarding granular resource supply in Sachs Harbour.

### **Tuktoyaktuk**

In the past, the community of Tuktoyaktuk has had to travel great distances to obtain granular material for public use, including infrastructure development as well as protection from shoreline erosion. Several different sites within the Tuktoyaktuk vicinity have been utilized, depending on the type of material that is required. However, the completion of the road to gravel Source 177, south of Tuktoyaktuk, in winter 2010 is expected to alleviate some of the concerns about the scarcity of granular material for the community.

### **Ulukhaktok**

The community of Ulukhaktok does not have high demand for granular resources, and tends to utilize one gravel source when it does require gravel. At this time, there are no major concerns regarding gravel supply or quality within the community. The primary concern about gravel



within the community is to ensure that enough gravel is reserved for community use before it is barged out for third priority uses (i.e. site remediations).

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## **APPENDIX A**

### **Memorandum of Understanding**

**between**

**Inuvialuit Regional Corporation (IRC)**

**and the**

**Department of Indian Affairs and Northern Development (DIAND)**

**Regarding**

**Granular Resource Management Planning  
in the Inuvialuit Settlement Region**

### **INTRODUCTION**

Historically, management of granular resources in the Inuvialuit Settlement Region (ISR) was the responsibility of the Department of Indian Affairs and Northern Development. As a result of the Inuvialuit Final Agreement (IFA) in 1984 the Inuvialuit now own a significant portion of the granular resources in the ISR. Management of the resource is now divided between two Land Managers - the Inuvialuit Land Administration (ILA) in the case of the Inuvialuit owned lands and DIAND in the case of Crown lands.

The upswing in hydrocarbon exploration within the region during the past three years has resulted in a significant increase in the demand for granular resources to support drilling and camp facilities. On January 7, 2002 the Mackenzie Delta Producers Group and the Aboriginal Pipeline Group announced that they were proceeding to undertake the project definition stage of a Mackenzie Valley Pipeline. The public consultation, technical study and environmental fieldwork elements of this phase are already underway. Strongly supported by market demand and political leadership, there is every reason to believe that this project will move towards reality within the next few years. This will result in a major escalation in the demand for granular resources as producers construct production platforms, gathering lines and other support facilities.

It is critical that this demand be provided for in a manner that conforms to the requirements and priorities outlined in the Inuvialuit Final Agreement (IFA) and meets sound management practices and standards for the extraction of non-renewable resources.

The attached document *Preliminary Planning Framework Granular Resource Management Planning For The ISR (Schedule A)* presents a background and preliminary planning framework specific to granular resource management planning for the Inuvialuit Settlement Region (ISR).

### **PURPOSE**

The purpose of this Memorandum of Understanding (MOU) is to develop a coordinated, systematic approach to granular resources management within the Inuvialuit Settlement Region through the gathering and utilization of all existing information, the sharing of research and project data, the avoidance of duplication of effort and a commitment to joint planning, action and resource allocation. This joint management approach is supported in the IFA.

In entering this agreement the parties make the commitment to participate in a joint planning process resulting in the development and implementation of a Granular Resource Management Plan for the Inuvialuit Regional Settlement.

It should be noted that, in order to be effective, any granular resource plan for the ISR must consider all potential resources on both public (Crown) and private (Inuvialuit-owned) lands. If this exercise was undertaken by either party in isolation it would be of limited value in that it would not consider the potential impact of the resulting plan on resources that might be supplied by other parties. It is therefore essential that the planning exercise be undertaken jointly by the ILA and DIAND, and also, for areas near the southern boundary of the ISR, in collaboration with the Gwich'in Tribal Council.

### **WORK PLAN OBJECTIVES**

The objectives will be established so as to reflect the specific views of both the Inuvialuit and DIAND, as owners of granular resources, to adhere, as appropriate to either IFA or DIAND regulations, and may include resource conservation principles, equity, flexibility, optimum use of resources, and public involvement in the planning process.

The objectives guiding this planning exercise are as follows:

- Conservation of aggregate for the most appropriate use to which it is suited is a priority in order to minimize “high grading” and limit the continuing requirements to locate new sources of high quality material.
- Planning should to be based on specific area and regional needs giving highest priority to areas where shortages of granular material exist and to areas where a significant increased in future demand is anticipated.
- Logical and orderly development of individual sources (from preliminary exploration through extraction to site restoration) is essential, so that the extraction of different classes of material from any particular source is maximized.
- Supply-demand conflicts within management areas and competition for sources and aggregate classes should be minimized.
- Utilization of the concrete aggregate resources that are available in the region should be optimized.
- Restoration and rehabilitation of depleted sources should take place on a continuing basis as resource development proceeds.
- Adequate reserves of suitable material for specific community uses should be assured giving public use priority over private use.

## PROVISIONS

It is mutually agreed and understood that:

- Periodic meetings between IRC and DIAND will be held to assess, plan and problem solve during the development and implementation of the Granular Resource Management Plan.
- Consistent with available resources, IRC and DIAND will develop integrated services to the extent possible, in bringing together resources of program, staff, and/or funding respectively.
- IRC and DIAND will determine costs and payment responsibilities, by consensus.
- Opportunities for cost sharing with industry will be considered and pursued.
- The work plan and initial cost estimates are outlined in the Preliminary Planning Framework: Granular Resource Management Planning for the ISR dated March 4, 2002 as attached in Schedule A of this MOU.
- The effective date of the Interim Granular Resource Management Plan for the ISR (attached in Schedule B) is the immediate on signing this MOU by both DIAND and IRC.
- Time is of the essence in the preparation of the Granular Resource Management Plan.

## **TRANSFER OF INFORMATION**

The parties agree to the principles of common reporting, technology and shared information. Exchanges of information will generally include any supporting documentation gathered during this collaboration, or other sources of information.

## **AGREEMENT**

The provisions of this Memorandum of Understanding may be reviewed and jointly modified as appropriate when it is determined by IRC and DIAND that such review and modification is in the interest of their respective responsibilities.

The parties hereto have entered into this Memorandum of Understanding as evidenced by their signatures below. The Memorandum of Understanding is effective upon the date signed.

## **INUVIALUIT REGIONAL CORPORATION**

\_\_\_\_\_  
Nellie J. Cournoyea  
Chair and Chief Executive Officer

Date\_\_\_\_\_

## **DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT**

\_\_\_\_\_  
Bob Overvold  
Regional Director-General

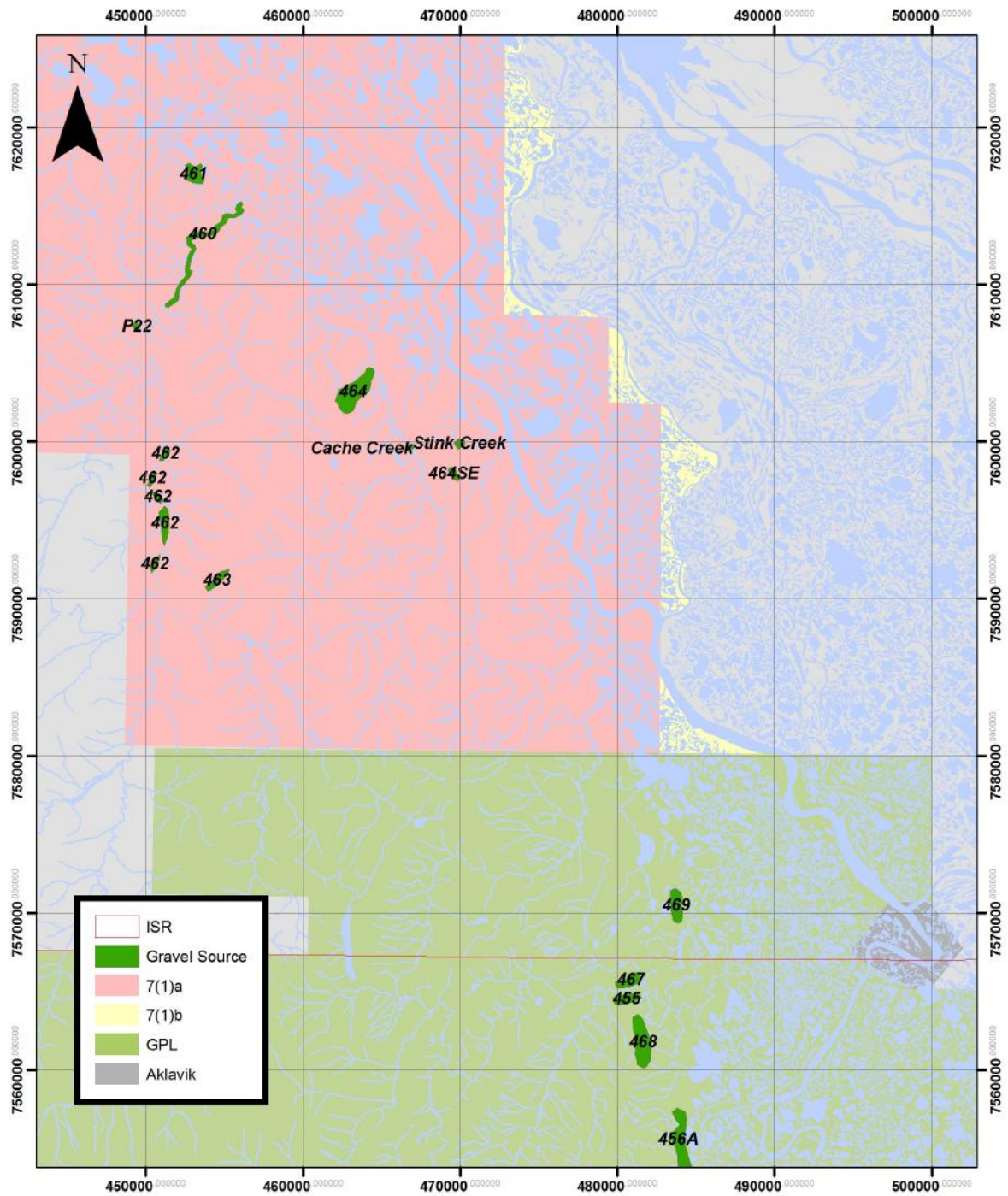
Date\_\_\_\_\_

## **Appendix B**

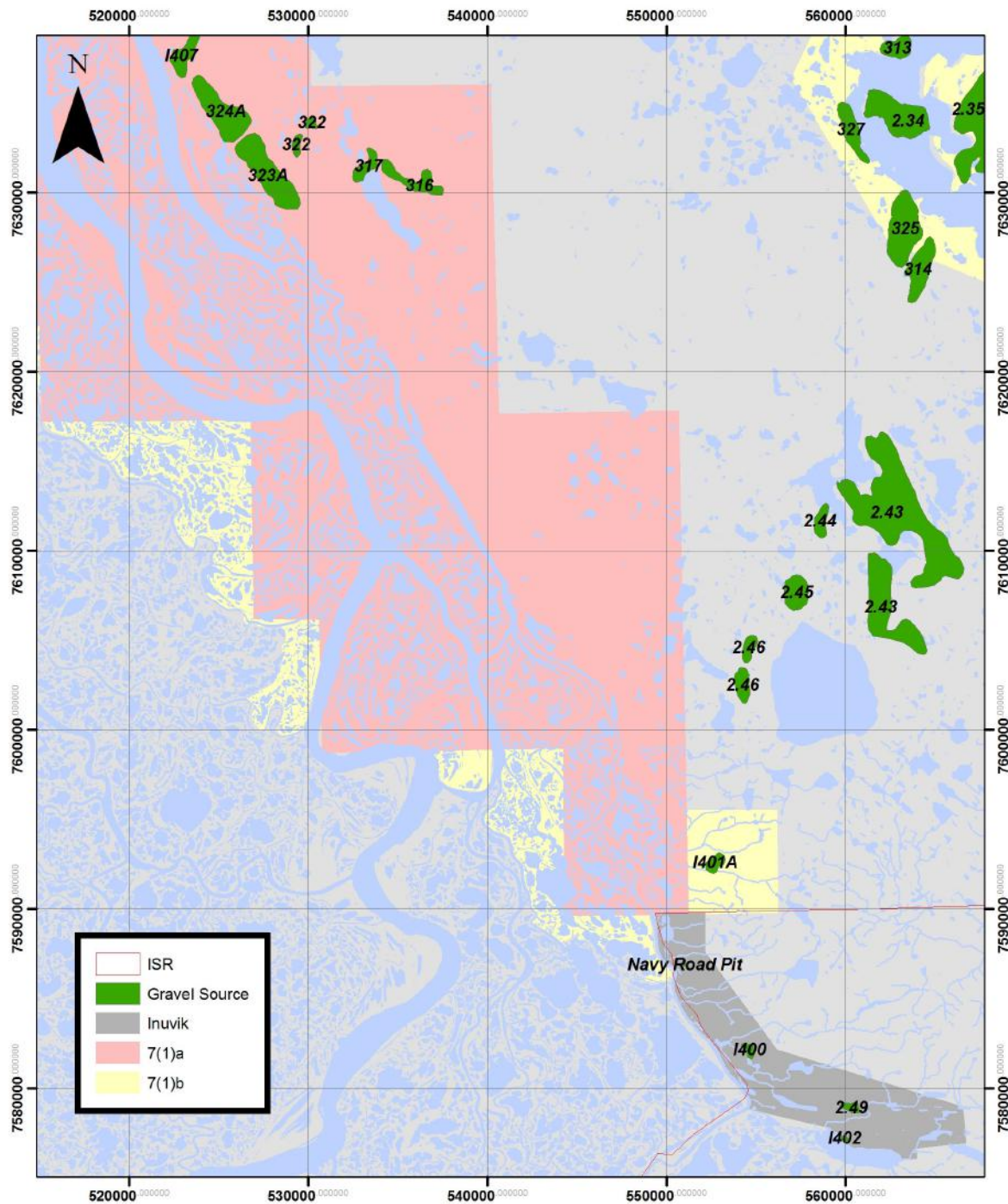
### **Granular Resource Supply Maps**



## Granular Resources in the Vicinity of Aklavik

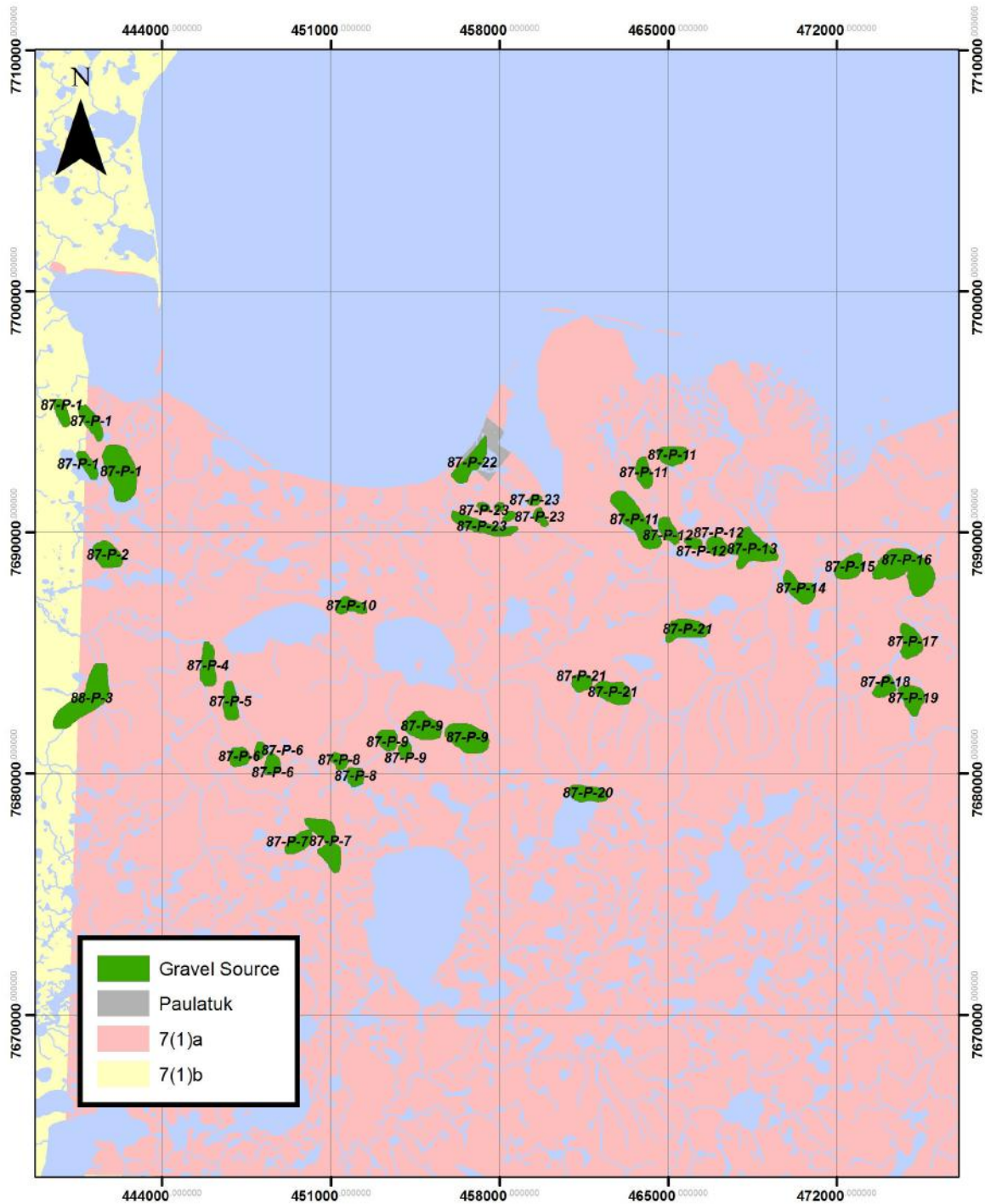


## Granular Resources in the Vicinity of Inuvik

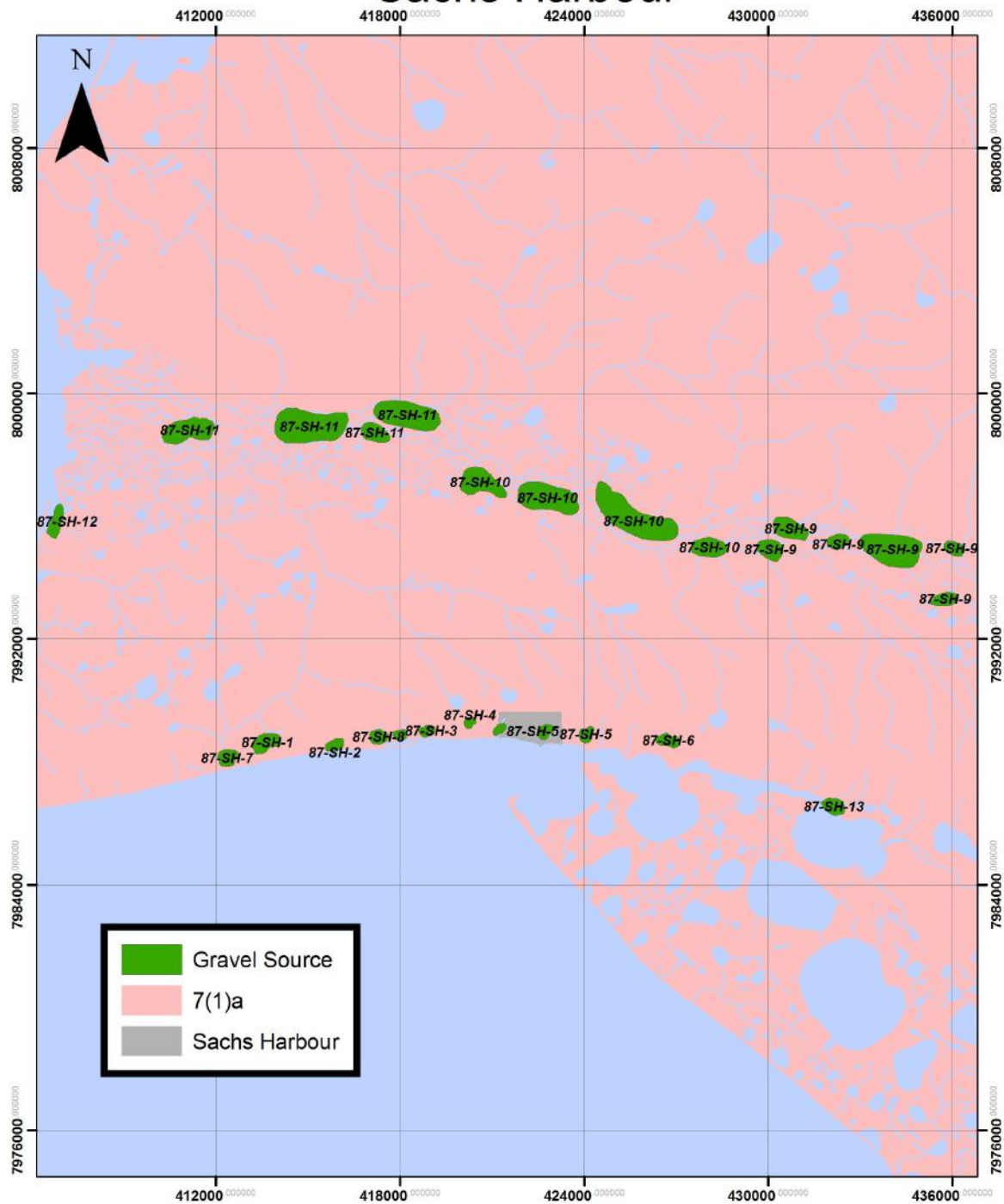




## Granular Resources in the Vicinity of Paulatuk



## Granular Resources in the Vicinity of Sachs Harbour







## APPENDIX C

### Community Consultation Meeting Notes

#### *Aklavik Community Corporation:*

- The Aklavik Community Corporation meeting date was changed to the night before, and ILA was not notified in time, thus the meeting was missed. We travelled to Aklavik the following day to meet with Carol Arey, who then called in other community members with interests in the gravel industry.
- Alex Illasiak flew up to some sources with ILA in the past, and found some really good gravel, northwest of Aklavik
- Would like to know more information about Source 469, it is right on the potential route to Source 467, and is near the site where Aklavik would like to move its dump
- Gravel currently comes from Source 467 (Gwich'in), a winter road is put in every few years to do a haul and stockpile in town
- Billy Storr and Dennis Arey remember that there are areas where gravel is visible on the surface near stream known locally as Stink Creek
- Billy thinks the Geological Survey of Canada has maps with borehole data that might be useful for the areas around Aklavik
- Carol would like ILA to locate maps that were made during Calvin Pokiak's time at ILA, which identify some potential sources, and to do further reconnaissance on these sources. She thinks there should be about 3 maps of gravel sources northwest of Aklavik.
- There have been obstacles to developing Source 464 in the past—DFO thinks there are fish in the creek nearby, and will not allow development near a creek that has "life"
- Billy suggested that ILA look into ground penetrating radar (GPR) costs and methodology for locating/assessing gravel in the Aklavik area. Department of Transportation has one.
- Some of the meeting attendees pointed out that although the gravel database says that the gravel in source 469 is Class 5, that might be an over generalization. They pointed out that in many pits, there is good and bad gravel, and perhaps there is good gravel to be found within that source.
- There used to be a crusher that rotated between the communities, and this would be useful for some of the rock that is NW of Aklavik
- Foster Arey wanted to know if there would be any way ILA could check out Source 464 this spring on snowmobiles, and perhaps we could do a cost-share on this initiative
- There is lots of gravel around NW of Aklavik, it can easily be seen from a skidoo when travelling along the river
- The town is in need of gravel right away, for new developments (garage, Housing Corp. building lot, power corporation lot). Lots of fill is needed
- When a stockpile is built, usually 2500 cubic metres is for housing, 1500 for the Hamlet, and 3000 for the power corporation
- The community would be willing to travel longer distances for gravel if it was available on Inuvialuit Private Lands, rather than taking gravel from the Gwich'in pit (467) in the Gwich'in Settlement Area

- Other suggested places where gravel might be found: Deep Creek, Beaver House, and Willow Creek
- There are also some creeks that have dried up and have not had water run through them in several years that could be utilized as gravel sources
- Aklavik feels that it needs to start pressuring IRC for better access to gravel sources
- Contact Dave McLeod (867-978-2792) for any details necessary if ILA is looking at setting up some ground reconnaissance in the spring (ie// costs of renting snowmobile, etc)
- The meeting attendees pointed out on the map areas where they have noticed gravel on the surface, as well as a cutoff line that would be the furthest distance that would be feasible for Aklavik to haul gravel from

### *Hamlet of Aklavik*

- Currently there is a feasibility study for the access road to Source 467, which is on Gwich'in Private Lands
- Members of the Gwich'in Tribal Council, Hamlet and Community Corporation will be contributing information to the feasibility study
- The Council mentioned that they would like more details on Source 469, which is also on crown land, including how much gravel is there and what the quality is. Council members suggested that this might be an alternate source of gravel to Source 467. However, the database indicates that the gravel in this source is Class 5.
- The SAO, Evelyn Storr asked how the ILA will be working with the GNWT to facilitate easier access to granular resources.
- A council member had questions about gravel royalty fees, and how ILA tracks the amount of gravel leaving the pits. He also had questions about who is responsible for the cost of the EM/Gravel Checker, and where they would come from.

### *Paulatuk Community Corporation Notes:*

- The Community Corporation members present confirmed what was said at the Hamlet meeting, that the Rat Lake source, and the two sources along the Rat Lake road are the sources that have been used by the community in the past.
- The Community Corporation thinks that it will be expensive to build the housing pads and other infrastructure with the cost of gravel royalties from Inuvialuit Private Land.
- The Community Corporation would like ILA to send out a reminder about how the community can apply for gravel from IPL, so that compliance can be encouraged in the future.
- Overall, there are no concerns in the community about access to gravel sources of good quality and quantity.
- The Community Corporation requested a map of the gravel sources, and appreciated the ILA Gravel Supply Database that corresponds with the map.
- Paulatuk Community Corporation was appreciative of seeing ILA staff in Paulatuk to talk about land use issues, and looks forward to the final presentation of the ISR Draft Gravel Management Plan.

### *Hamlet of Paulatuk Notes:*

- The Hamlet of Paulatuk is currently using the Rat Lake gravel source, which is the lower part of 87-P-23 on the ILA maps.
- The Hamlet has constructed an 11km gravel road from town to the gravel source on Inuvialuit Private Land, using gravel from along the road route, and gravel from the actual Rat Lake source.
- The Hamlet foreman believes that the source will have a long lifetime, of at least 20 years for the community.
- The Rat Lake source is recontoured after each time gravel is extracted, and will be thoroughly recontoured after each season.
- The community hopes to haul and stockpile gravel each summer now that the road construction is completed.
- The same Rat Lake gravel source was also used to build the new airstrip in Paulatuk.
- There are two stockpile locations along the road that were used for reaching the final source. These need to be levelled off.
- This year, gravel is needed for the pad of a duplex, as well as a youth centre.
- In the 1980s, gravel sampling was conducted on the hills by DOT for the road to Rat Lake.
- Overall, the community of Paulatuk does not have high demand for gravel.
- The Hamlet meeting attendees feel that the cost of gravel is too high, and that it should be lower if the gravel contributes to community wellbeing.
- The Hamlet indicated that high gravel costs combined with non-compliance they have heard about in other communities has encouraged them to avoid ILA's application process.
- Source 87-P-22 has been used in the past for getting sand for the community's beach volleyball court.
- The Hamlet members were hesitant to give information about historical use of gravel, because they didn't want to be invoiced for sand and gravel taken in the past.

### *Sachs Harbour Community Corporation Notes:*

- The Community Corporation members looked over the ILA gravel supply maps and database. They noted that source 87-SH-5 should be noted as 1/8 km out of town and on Commissioner's land
- 87-SH-4 was noted to be located 1km W of the community, not south of the community as the database says
- Community Corporation suggested that 87-SH-1 was used for the airport, and has basically nothing left in it
- There are gravel sources that lie on Commissioner's land that are listed as being on Inuvialuit Private land
- The major gravel-consuming project for this year will be the resurfacing of all the roads within the hamlet
- It was noted that there is plenty of gravel surrounding the community, and that access to granular resources won't likely be a problem for many years



- If the community expands, it will need to be expanded further north on the hill, therefore more gravel could be required for new homes and access to these homes.
- Some homes are being relocated due to shoreline erosion, and these homes will likely need new gravel pads as well
- There is some gravel on the beach near the RCMP that is contaminated with diesel, and it is currently being aired out. More gravel could be required to cover up the contaminated site once it is cleaned up
- Community Corp members noted that it would cost \$360 for a loader and dump truck if someone wanted to acquire their personal allotment of gravel for the year

*Hamlet of Sachs Harbour Notes:*

- Council members suggested that the Hamlet Foreman (Richard Carpenter) would be the best source of information regarding gravel in the community.
- The hamlet needs gravel for a new parking garage, firehall and to resurface the roads within the next several years.
- Gravel may also be needed for reclamation of several contaminated areas around town.
- The short road to the water pumping site might need to be rebuilt in the next year.
- Ahmad Alkhalaf in Inuvik who works for the Department of Public Works & Services is a project manager and knows a bit more information about how much gravel precisely would be needed for some of these projects.
- The community feels that there is enough gravel to meet their needs in at least the short term. Sachs Harbour is built on and surrounded by gravel, and the community thinks most of the gravel is of good quality to sustain infrastructure development.
- Sachs Harbour feels that the security deposit for using gravel from Inuvialuit Private land is too steep, and although it will be returned, it is too unaffordable for the Hamlet to put out that money.
- In the past, Sachs Harbour has thought about using gravel from IPL, but in the end decided against it due to the security deposit. As such, they have been using gravel from Commissioner's land within the Hamlet boundaries exclusively.
- Adella inquired about whether there was some sort of deal the community could make to exchange some land for a gravel source (the answer given was no, as we do not want IPL broken up into piecemeal).
- Within the town boundaries, the gravel supply is getting low and soon the community might need to utilize a gravel source on Inuvialuit Private land.
- Development projects within the near future include: new firehall, parking garage, resurfacing roads. Roads are resurfaced almost every year in Sachs Harbour.
- People within the community sometimes want gravel for personal use, but personal allotments are not allowed from gravel sources within the Hamlet boundaries. As such, residents could buy gravel from the Hamlet. However, it is generally too expensive for people to do so, and Hamlet gravel equipment is often too busy in the summer months.

- The community would like to upgrade the road to Mary Sachs, and would like to know if they could get free gravel because it would be for the benefit of the entire community, and on Inuvialuit Private land.

### *Tuktoyaktuk Community Corporation Notes:*

- The community of Tuk has used several gravel sources in the past, including Tootsie Bay, Ya Ya Lakes and Water Creek
- At Water Creek, the past gravel users never recontoured the land, and ponding is occurring. There is still gravel left at this source.
- The meeting attendees feel that Tuk's concerns about gravel availability will be alleviated if Source 177 is used to meet community needs
- Gravel may be required within the next five years for several potential projects including experimental wind turbines, a hotel building, and a new 9-plex. Gravel will also be required for regular road upgrades
- There are concerns within the community about the royalty rate that E. Gruben's Transport will be charged for stockpiling gravel for community member's use
- TCC would like to know what gravel sources near Parson's Lake have been reserved for the Mackenzie Gas Project

### *Hamlet of Tuktoyaktuk Notes:*

- Source 161 is heavily utilized, as well as Ya Ya Lakes, and Source 168.
- The last gravel haul for the community was from Sandy Hills (Source 1407?).
- A haul occurred from Ya Ya Lakes approximately 4 years ago for gravel for the airstrip and roads.
- Gravel was acquired for the dump about 10 years ago.
- Rip rap for shoreline erosion was brought from Inuvik on the Ice Road (10 years ago), at a cost of \$100,000
- Hamlet has been taking some gravel from the DEW line for use on roads, after permission was obtained from DND.
- There is some crushed rock at the airport.
- Hamlet is in desperate need of clay material for the dump, however, there is no nearby source that hasn't already been exhausted.
- There are plans to move the solid waste site, sewage lagoon and cemetery to locations along the road to Source 177. There will be large gravel requirements if this occurs.
- Currently, the roads are in good shape and there is not huge demand for gravel for their maintenance.
- There is a lot of demand from the public for driveways that are sinking, and for underneath houses. It is too cost prohibitive for home owners to get gravel required for their lots, the transportation is too expensive.
- Some houses are being built without a layer of gravel underneath, and in the summer the ground becomes muddy because there is no insulating layer. Some houses haven't been built because it would be too expensive to get the gravel.
- The access road to Source 177 may help with this problem.

- The Hamlet in the past has tried to figure out what private home owners require gravel, and has suggested that a group goes together to pay for a truck load of gravel, but there has been little interest because people know that they won't be able to afford it.
- Debbie Raddi gave ILA a copy of the October 2008 update to the Territorial Granular Resource Forecast .
- Jim Stevens noted that the Hamlet is in charge of infrastructure development now due to the *New Deal*, and as such, the Territorial Granular Resource Forecast may not be accurate- the Hamlet can only construct as much as they are able to, and therefore the forecast numbers may be high.
- Source 155 is now closed as it has been depleted, and the Hamlet now takes gravel from wherever ILA tells them.
- Tuktoyaktuk needs access to a good source of clay as well as rock.
- There is a strong opinion that the Parson's Lake airstrip will use too much gravel that should be reserved for Inuvialuit and community use.
- Residents are hesitant to have gravel allotted to Conoco before knowing whether there will be enough for the community to sustain itself.
- Concerns that the airstrip proposed for Parson's requires way too much gravel.
- It was noted that it would be ideal to do an overall assessment of the quantity and quality of gravel in the area before Conoco is allowed gravel for the airstrip.
- The council was pleased to have gravel maps made available as well as the database, and were surprised at the locations of some gravel sources.
- Quite a bit of interest in more details for feasibility of utilizing Source 158 (dredge only accessibility).

### *Ulukhaktok Community Corporation Notes:*

- 87-H-7 is the most commonly used gravel source for Ulukhaktok
- There was another gravel source used a few years ago that is unidentified in the ILA gravel database. It is located slightly southeast of 87-H-7, and the UCC marked its location on the gravel map ILA provided.
- There are not many worries about quality or quantity of granular resources available to the community.
- There is concern regarding gravel being barged out of the community for non-community uses (i.e. Johnson's Point cleanup).
- Until last year Ulukhaktok did not realize that 87-H-7 is on Inuvialuit Private land, and the situation that occurred last fall highlights the necessity of ILA informing the communities about gravel ownership, and the process for applying for quarry permits.
- A new community hall will be built in 2010 to replace the old community hall- this project should definitely require granular resources.
- A new duplex is also planned which will also require gravel.
- The community is thinking of closing the current garbage dump and opening a new dump at a different location. If this were to occur, gravel would be required for closing the old dump, as well as building the new dump and access to the new dump.

- The community would like to see the gravel management plan prioritize gravel such that gravel won't be leaving the community before community demand is known, and community use is put before private use.

*Hamlet of Ulukhaktok Notes:*

- The Hamlet council members confirmed that Source 87-H-7 is the only gravel source utilized by the Community of Ulukhaktok at this time.
- The council members said that there are no concerns in the community about gravel supply at this time. They feel that there is adequate supply, and that the community has very small demand for gravel.
- The community would like clarification about where the IPL/Hamlet boundary is within source 87-H-7.
- Ulukhaktok is without a hamlet foreman at this time, and as such there was not much information to be obtained about forecasted gravel use for Ulukhaktok.

## SECTION 3:

# INUVIALUIT SETTLEMENT REGION PITS AND QUARRIES GUIDELINES



**Inuvialuit Land Administration**  
Leaders in Aboriginal Land Management



**Indian and Northern  
Affairs Canada**

**Affaires indiennes  
et du Nord Canada**

## PREFACE

This document is an amended version of the INAC's pits and quarries guidelines, which is part of the land-use guidelines series. This set of guidelines serves as a supporting document to the Inuvialuit Settlement Region Granular Resources Management Plan which is a joint initiative by Indian and Northern Affairs Canada (INAC) and the Inuvialuit Land Administration (ILA).

The ISR Pits and Quarries Guidelines gives prospective users of granular resources information about the methods that should be used for obtaining gravel within the ISR, as well as about the permitting processes for Crown and Inuvialuit Private Land. These guidelines apply only to Inuvialuit Private land and Crown land within the Inuvialuit Settlement Region in the Northwest Territories. Resources on Commissioner's land require direction from the appropriate agency. The contact information for these agencies is found in Appendix A.

For further information concerning the subject matter contained in these guidelines please contact:

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## SECTION 1: ACKNOWLEDGEMENTS

In the 1980s, Indian and Northern Affairs Canada published a series of six land-use guidelines in a handbook format, intended to help operators of small to medium-scale projects carry out activities in northern Canada in an environmentally sensitive manner. These handbooks, commonly called “The Blue Books,” have been widely distributed and quoted. Their success is a tribute to the efforts of the original authors and contributors, and to the departmental steering committee that guided their preparation.

This new series of northern land-use guidelines is, in part, an update of the earlier series. This work was directed by a steering committee made up of Northern Affairs Program staff in Ottawa and Northern Regional Office staff.

Further edits were made by the Granular Resources Management Plan Working group within the Inuvialuit Settlement Region to create this document, which is specific to the ISR.

## SECTION 2: INTRODUCTION

The purpose of this volume is to provide guidance to pit and quarry operators when operating on Crown land or Inuvialuit Private land in the Inuvialuit Settlement Region. If you are not operating on Crown land or Inuvialuit Private land, it is your responsibility to contact the appropriate landowner for any land-use guidelines that may be in place. Resources on Commissioner's land require direction from the appropriate agency. The contact information for these agencies is found in Appendix A.

Granular resources are a strategic and valuable resource, and it is important that they are used in a sustainable way. This volume presents specific land-use techniques for quarrying within the Inuvialuit Settlement Region, and best practices that can be used by operators to minimize land disturbances and environmental impacts.

## SECTION 3: NORTHERN GRANULAR RESOURCES

Granular resources is a term that describes a wide range of materials from silts to sands, gravel and cobbles that are vital for the construction of a wide range of northern developments such as roads, pipelines, mines, and community infrastructure. Access to granular materials is often a challenge in the north because development activities are commonly located in remote areas with limited infrastructure. The availability of granular resources is often an important factor in determining how and if a proposed development can proceed. In order to minimize their environmental effects, and prevent any wastage of granular resources, proper land-use techniques and extraction methods should be used. The information presented in this volume reflects current industry best practices that apply to both pits and quarries. The guidelines are general in nature and should be supplemented, on a site specific basis, by engineering and other expertise.

### 3.1 Definitions

Pits and quarries are used to extract granular resources, as defined in Table 3-1. Granular materials are often used for construction, but some materials have other uses, such as carving.

Type	Definition
Quarry	Extraction of rock materials by digging, cutting or blasting.  Quarries usually yield large stone that may then be crushed. Commonly quarried materials include limestone and granite.
Sand or Gravel Pit	Extraction of unconsolidated earth materials, such as sand or gravel by digging a pit.
Borrow Pit	Excavation of low-quality fill, such as silt, clay and topsoil.  Material is usually removed for use at a nearby site.

***Table 3-1 Definitions for Pits and Quarries***

### 3.2 Granular Deposits

Different types of granular resources have specific uses. The proponent must evaluate the source material to ensure it has the characteristics required for the intended use. Each material and deposit has unique characteristics which will require a slightly different approach to development. Site investigations and testing should be conducted on the source material to verify:

- type, extent and geology of the granular deposit
- grade and quality of the deposit
- structural and chemical properties of rock
- extent of ground-ice in the material

If results from these investigations show that the granular material is suitable for its intended use, then the proposed development is ready to proceed through the four phases of land-use activity:

Phase 1 - Planning and Design

Phase 2 - Site Development

Phase 3 - Operations

Phase 4 - Reclamation

### 3.3 Quarry Permit and Lease Requirements

In the Inuvialuit Settlement Region, pit or quarry developments require a quarry permit, under the Territorial Quarrying Regulations on Crown land, or a quarry licence under the Inuvialuit Inuvialuit Final Agreement on Inuvialuit Private land. If activities include the use of equipment that exceeds the thresholds of the applicable land-use regulations, a land-use permit will be required. Quarry and land use permits will include terms and conditions specifying how operations must be conducted.

Applications for quarry permits/licences are assessed by INAC or ILA to determine:

- whether an existing pit can meet the demands or whether there is a requirement for the development of an undisturbed site
- if the proposed application is an appropriate use of the resource
- if potential reserves of the granular material are adequately identified
- if the development plan will maximize resource recovery
- if the proposed extraction and use of granular resources is consistent with the prioritization of materials outlined in the Inuvialuit Final Agreement (on Inuvialuit Private land only)

Aboriginal rights must be respected when planning and conducting land-use activities, including pits and quarries. Proponents should contact the local Community Corporation and Hunters and Trappers Committee to discuss their proposed development. INAC and ILA strongly encourage community engagement as part of the permitting process. Proponents should contact the applicable land-use regulator, depending on ownership of the land on which the granular resources lie, for more information on their requirements. Once permits are issued, INAC and ILA are responsible for ensuring compliance of their terms and conditions in the Inuvialuit Settlement Region. INAC resource management officers conduct regular inspections of quarry operations on Crown land, and the ILA requires the presence of an environmental monitor and

gravel checker at all times during quarry operations, and periodic inspections by the ILA Inspector.

Under Section 10 of the Territorial Quarrying Regulations, residents of the Northwest Territories are allowed to take up to 38.23 cubic metres (50 cubic yards) of sand, gravel or stone from Crown land per calendar year for their own personal use without having to obtain a quarry permit or pay any fees. A land use permit may be required, depending on the type of equipment required to extract and haul the resources. The personal allotment cannot be obtained from areas where any interest in the surface rights of lands has been licensed, leased or otherwise disposed of by the Crown. On Inuvialuit Private land, enrolled Inuvialuit beneficiaries are entitled to a personal gravel allotment of 38.23 cubic metres (50 cubic yards) per year. Any person wishing to obtain their personal gravel allotment must notify ILA prior to extraction, and a quarry license will be issued, if the proposed source is appropriate for the extraction of personal allotments.

Other permits may be required depending on the nature of work being conducted. Quarry operations that require blasting may require regulatory approval from the Workers' Safety and Compensation Commission. Removing granular resources from riverbeds, lakeshores or ocean shorelines may require a water license from the Northwest Territories Water Board, and approval from the Department of Fisheries and Oceans. Approvals for extraction from water bodies and shorelines are not normally granted unless there are no alternatives, and include more stringent conditions to minimize environmental impacts.

Fees for quarried material on Crown land vary depending on the type, and are set out in Schedule 2 of the Territorial Quarry Regulations. Royalty fees, based on an estimate of material required, must be submitted with a Quarry Permit application, and fees will be returned if the amount of material used is less than estimated. The amount of quarry returns must be reported monthly, and a final plan is required at the end of operations. In the case of a quarry lease, fees are required as per the schedule in the lease.

On Inuvialuit Private land (for uses other than personal allotment), at the time of application, the proponent will be required to pay a quarry license application fee, land use permit application fee, and land use permit fee. During quarry development and operation, ILA will require an environmental monitor to be on site at all times, as well as a gravel checker when resources are being extracted and hauled. Periodic inspections will also be required by the ILA Inspector. The proponent is responsible for paying the costs associated with site monitoring (environmental monitors, gravel checkers and inspectors). The proponent will also pay gravel royalty fees for the volume of gravel extracted, as per the Inuvialuit Final Agreement and ILA Fee Schedule. Surveying of the pit may also be required to verify gravel extraction quantities, at the cost of the proponent.

## SECTION 4: PLANNING AND DESIGN

Proper planning is crucial in conducting an efficient and environmentally responsible pit or quarry development. The planning process and collection of detailed site information should commence in the early stages of the proposed development to gain an understanding of the site, and submit to the regulatory authorities.

Pit management plans may be available for the most commonly used granular resource sites within the Inuvialuit Settlement Region from the respective land owner. These plans contain all relevant information for proponents wishing to develop and extract resources from the gravel source. Furthermore, the Inuvialuit Settlement Region Granular Resources Management Plan contains a generic pit development plan which sets out guidelines for what a proponent's pit development plan should look like if one doesn't already exist.

The following general suggestions should be considered:

- Contact regulatory authorities early to understand regulatory requirements and timeframes necessary to obtain the required permits.
- Initiate contact and discuss plans with local Community Corporations and Hunters and Trappers Committees well in advance of submitting permit applications.
- Estimate the quantity of material required and the duration of the operation.
- Review aerial photographs or satellite imagery to identify access routes to the site and locations to investigate site conditions.
- Conduct a field reconnaissance of the site (Section 4.1) to verify aerial photograph or satellite imagery interpretations, obtain surface and shallow-depth granular samples using test pits and boreholes, and conduct geophysical surveys.
- Finalize pit or quarry design before submitting permit applications.

There are a variety of information sources outlined in Table 4-1 that can be accessed when planning and designing a pit or quarry operation.

**Table 4-1 Quarry and Pit Planning Information**

Information Category	Examples of Required Information	Information Sources (Crown)	Information Sources (Inuvialuit)
Legal	Quarry Permit Fees and Royalties	INAC Resource Management Officer and District Offices Territorial Quarrying Regulations Territorial Lands Act	Inuvialuit Land Administration Office Inuvialuit Final Agreement
	Quarry Lease Land Use Permit Blasting	Territorial Land Use Regulations Environmental Impact Screening Committee Environmental Impact Review Board Northwest Territories Waterboard Department of Fisheries and Oceans Canada Workers Safety and Compensation Commission	Inuvialuit Land Administration Rules and Procedures
Geological	Type of deposit	INAC Granular Resources Inventory	ILA Granular Resources Inventory
	Extent of deposit Grade of deposit	INAC Resource Management Officer and District Offices NWT Geoscience Centre Geological Survey of Canada Site Investigation Local operators in project area Community Corporations and Hunters and Trappers Committees Municipal and Community Affairs (MACA)/Hamlets	Inuvialuit Land Administration Office
Engineering	Slope design	INAC Source-Specific Pit Management Plan	ILA Source-Specific Pit Management Plan
	Blasting	INAC Resource Management Officer Engineers and Consultants Workers Safety and Compensation Commission Blasting Equipment Suppliers	ILA Environmental Specialist
Operations	Staking Pit wall safety and operations	INAC Resource Management Officer Territorial Quarrying Regulations Territorial Lands Act Territorial Land Use Regulations Workers Safety and Compensation Commission	ILA Environmental Specialist ILA Rules and Procedures and Pit Management Plan
	Access roads Equipment	Equipment Suppliers	
Environmental	Fish and wildlife habitat	INAC Resource Management Officer INAC Water Resource Division	ILA Environmental Specialist
	Vegetation Soil conservation Topography and drainage Permafrost	Environmental Impact Screening Committee Environmental Impact Review Board Northwest Territories Water Board Department of Fisheries and Oceans Canada Aerial photographs and maps	

	Water	Community Corporations and Hunters and Trappers Committees Territorial Environmental Departments
Archaeological/Cultural	Location of archaeological sites	<a href="#">Territorial Land Use Regulations</a> <a href="#">Inuvialuit Cultural Resources Centre</a> Community Corporations and Hunters and Trappers Committees Prince of Wales Northern Heritage Centre
Reclamation	Reclamation standards	<a href="#">INAC Resource Management Officer</a> <a href="#">INAC Source-Specific Pit Development Plan</a> <a href="#">Territorial Lands Act</a> <a href="#">Territorial Land Use Regulations</a> <a href="#">ILA Environmental Specialist</a> <a href="#">ILA Source-Specific Pit Development Plan</a> <a href="#">ILA Rules and Procedures</a> Territorial Environmental Departments Environmental Impact Screening Committee Environmental Impact Review Board Northwest Territories Water Board Department of Fisheries and Oceans Canada

## 4.1 Site Conditions

Pit or quarry development should include an assessment of site conditions since these will often dictate how a development can be conducted most efficiently and with minimal environmental impacts. Factors that should be considered when assessing site conditions include:

- Topography and drainage
- Extent and depth of permafrost and ground-ice
- Soils, particularly organic layer composition and depth, and depth of overburden
- Proximity of water bodies
- Groundwater conditions (e.g. evidence of seepage or springs)
- Surface vegetation and the conservation status of the present plant species
- Sensitive landforms (Eg. pingos, sand dunes, wildlife areas, buffer zones near water bodies)
- Wildlife or fish habitat
- Type of access required
- Extent of reclamation required (Eg. minimum overburden)
- Existence of cultural/archaeological sites

Site selection for a quarry can be more complex than for a pit because blasting and processing equipment increase the impacts and potential risks to other land-users. Dust control, noise controls, warning signs and site security are mitigation measures that should be considered when planning site development.

### 4.1.1 Permafrost



The Inuvialuit Settlement Region is located in an area of continuous permafrost. Ice-rich permafrost is prone to subsidence and slumping when thawed and is more problematic for pit and quarry operations than permafrost with low ice content or areas without permafrost. Field investigations should determine the extent, depth and ice content of permafrost at a proposed pit or quarry site before proceeding with development. This will ensure that measures can be implemented to mitigate permafrost degradation, or an alternate location could be developed to avoid problems associated with permafrost disturbance.

Measures to mitigate degradation in areas of ice-rich permafrost include conducting work during the winter, and replacing the organic layer prior to spring thaw to provide an insulating layer between the permafrost and warm air temperatures. In the summer, ice-rich material should be stockpiled in windrows and allowed to melt and drain before use. More information is available in the INAC Blue Books.

## **4.2 Exploration**

### **4.2.1 Pits and Quarries**

Advanced exploration of the granular deposit will be necessary to further understand the geological properties and size of the granular deposit. Soil and rock types and their structure can be analyzed at a laboratory to determine if the granular material is suitable for the required use. Type and thickness of vegetation, overburden and interburden must be assessed to determine the preparatory work required to access the deposit, and to ensure the deposit has adequate volume to meet user needs. If advanced exploration activities such as drilling, test pits, or trial quarries, include the use of equipment that exceeds the thresholds of the applicable land-use regulations (Crown land) or ILA Rules and Procedures (Inuvialuit Private land), a land-use permit will be required.

### **4.2.2 Armour Stone Quarries**

Quarries for large diameter armour stone require a more detailed field assessment to confirm that suitable material exists and that its extraction is feasible. The following factors should be considered:

- Stable, weather-resistant rock is required
- Deep quarries are likely to be good sources of armour stone, but the presence of groundwater will limit quarry depth
- If the deposit is within sedimentary rock, thick beds are required to yield large stone
- Secondary structures (Eg. jointing, faulting, and shearing) affect the feasibility of extracting large stone, and a drilling program may be required to delineate the deposit
- Pit layout will depend on the dominant structure
- A trial quarry to assess the feasibility of full-scale development may be necessary
- Transport of armour stone requires large, heavy equipment, which will affect access requirements, and may require that transportation be carried out during the winter

### 4.3 Pit/Quarry Development Plan

Following site exploration, a pit or quarry development plan should be created to outline the entire project life cycle, including site layout, preparation, operations, environmental concerns, and reclamation. The size and duration of the operation will determine the scope and level of detail required in the plan.

In pits or quarries with multiple users, an overall management plan may be developed by the owner. This plan will indicate where and how the proposed development can operate, and the proponent will be required to provide a development plan that shows how they will operate within the site constraints.

Generic pit management and development plans for granular sources within the ISR are available within the ISR Granular Resources Management Plan. There are a number of environmental concerns related to the development of a pit or quarry. A description and proposed mitigation for each applicable concern should be addressed in the management plan. Table 4.2 provides an overview of potential environmental concerns and related mitigation options that may be encountered in the site layout or operations phase of development. These will be described in greater detail in the following sections.

**Table 4-2 Pit and quarry environmental concerns and mitigation techniques**

Development Phase	Activities	Potential Environmental Effects	Mitigations Techniques
Site layout and preparation	Timber clearing	Soil erosion	Retain vegetation to maintain slope stability
	Vegetation removal Soil and overburden removal	Habitat loss	Maintain natural drainage patterns Maintain vegetation buffer zones to protect water bodies Construct ditches to direct runoff away from the site Locate the development in a well drained area Salvage and properly store organics, topsoil, and overburden for use in reclamation
Operations and monitoring	Blasting	Soil erosion and sediment deposition	Limit sediment movement using silt fences or straw bales
	Stockpiling		Use rip-rap to reinforce drainage channel corners and water discharge points
	Crushing		Revegetate where required to stabilize slopes
	Access road maintenance	Water quality impacts	Limit sediment movement or use settling ponds before discharging Use proper fuel containment and handling techniques, and have spill kits accessible Use proper explosive handling techniques to minimize wastage
		Water ponding and permafrost impacts	Minimize source of in-pit water by diverting surface water away from the development area Place ice-rich material to thaw in a location where melt water will not re-enter pit Limit pit or quarry depth
		Dust generation	Spray water and use dust skirts on conveyors to minimize dust

#### 4.4 Water

The control of water into and out of a proposed pit or quarry site should be planned prior to development to enhance the efficiency of operations, limit effects on water quality, and prevent permafrost degradation. Water from within a pit or quarry should not be discharged to surface waters without an appropriate water license. Any use of water or deposit of waste into water above thresholds within the Northwest Territories Waters Regulations requires a water license that will specify discharge limits. Proponents should avoid conducting operations below the water table. The accumulation of groundwater will impede operations, must be pumped to the surface and may require treatment.

Ponded water that rests in low-lying areas of pits or quarries can also lead to permafrost degradation. Drainage ditches or channels should be installed to prevent ponding. Measures should be taken to prevent the migration of silt into water bodies. Settling ponds or impoundments may be constructed to control surface runoff where required. Construction methods and materials that prevent exfiltration and seepage to the surrounding environment should be used. Erosion control supplies (Eg. geotextile fabrics, straw blankets) should be kept on-hand to respond to scouring or slope destabilization caused by water erosion.

#### 4.5 Fish and Wildlife

Project development and operations should aim to minimize wildlife disturbance and the loss of habitat. Caribou are a migratory species of particular concern in the north. Pit and quarry walls may attract certain bird species that prefer this type of habitat for nesting. Nesting birds should not be disturbed and the destruction of nests or bird mortalities should be immediately reported to a territorial wildlife officer and the local Hunters and Trappers Committee. Measures to minimize wildlife disturbance include:

- Reducing or stopping project operations during sensitive breeding times
- Ensuring working equipment is well maintained to minimize excessive noise
- Using proper waste disposal techniques to minimize wildlife attractants
  - o using covered containers for garbage and waste storage
  - o keeping the site clean at all times
  - o regularly removing waste from the site
- Using water management and erosion control techniques to prevent the deposition of sediment into fish-bearing water bodies (Table 5-2).

The *Species at Risk Act* protects wildlife species that may become endangered or threatened. Proponents should be aware of their special status and should minimize disturbance or contact with these species during operations. Species of special concern are listed under Schedule 1 of the *Species at Risk Act*, and more information is available from Environment Canada at [www.ec.gc.ca](http://www.ec.gc.ca).

#### 4.6 Development Timing

Development timing is an important consideration in the north as many operations utilize the winter frozen-ground season to minimize land disturbance, and to maximize transportation efficiency. Proponents should consider scheduling specific components of their pit or quarry development at the most advantageous time of the year.

Development stages and suggestions for their timing in the Inuvialuit Settlement Region are listed below:

- Exploration:
  - o Access may favour winter, but field programs may favour summer
- Access and Transportation
  - o Will require winter roads, unless all-season road construction is planned
- Operations and Processing
  - o Generally favour summer; however, in areas of ice-rich permafrost, work should be scheduled during the winter
  - o Operations may need to stop during spring break-up
  - o Washing is a summer operation
  - o Critical life stages for birds, mammals and fish may limit operations during some seasons

## SECTION 5: SITE DESIGN

Careful consideration of site design prior to development will result in an efficient operation with minimal environmental disturbance. Site design should consider all potential uses for the site, allowing for enough room to conduct all phases of development, as well as considering the eventual reclamation of the site. Design may also be affected by land-use permit conditions. This section outlines specific factors that should be considered during the planning phase of the development.

### 5.1 Site Layout

The site layout should be designed with the following considerations:

- Adequate room for all activities, including stockpiling of resources and overburden
- A refuelling station with appropriate containment, if required (Section 8.2)
- Dust or noise, particularly if other land-uses are nearby

#### 5.1.1 Quarries

Territorial mine safety legislation (Mine Safety Act) will dictate how a quarry must be developed and this will affect the layout of the quarry operation. Quarry-specific site layout considerations include:

- Orienting pit walls to take advantage of natural structure in bedrock
- Orienting walls to direct blasting and operating noises away from sensitive areas
- Using safety benches at regular intervals
- Using signage and/or fences to delineate potential safety issues
- Planning for a considerable volume of waste

### 5.2 Buffer Strips

Buffer strips are areas of land that are left untouched to provide a natural barrier between the development and an adjacent area. Buffers can be used to protect important ecosystem components such as wildlife habitat or water bodies, or they can be used to provide a visual barrier between the development and an area of human use. Buffer strips of existing vegetation at least 100 metres wide should be left around water bodies, and if trees are present, should be designed to resist damage from prevailing winds.

Direct sunshine in winter or spring can cause unsafe glare-ice conditions on access road surfaces. If possible, buffer strips should be designed to block road surfaces from direct sun exposure.

### 5.3 Visual Impacts

Minimization of visual impacts to areas of human use should be considered when designing a pit or quarry site. Land-use permits may have specific conditions regarding the appearance of a

development. The visual impacts of a pit or quarry can be reduced by using the following methods:

- Locating the development on the downhill side of a road
- Leaving a buffer strip at least 30 metres wide in place between the road and the pit
- Constructing a berm between the road and the development
- Ensuring that access roads have a 'dog-leg' to eliminate the line of sight

## **5.4 Noise and Dust**

Dust and noise from pit or quarry operations can be a nuisance in areas where other land-uses, such as recreational areas, are nearby. Excessive dust can be an occupational hazard for those working on-site. Wildlife can also be deterred by noise.

The following considerations can minimize noise and dust issues:

- Erecting a berm to block noise
- Restricting operations during certain times
- Orienting quarry faces to direct noise away from other land-uses
- Considering prevailing winds when designing the site layout
- Applying dust suppression controls such as road watering, and using a dust skirt or minimizing the drop height when releasing material from a conveyor

## SECTION 6: SITE PREPARATION

Preparation of a pit or quarry site should proceed in an orderly sequence to ensure that materials overlying the granular resource are segregated and properly stored for future use in reclamation. The following section outlines measures that should be utilized in the preparation of a pit or quarry site, if a pit management plan is not already in place.

### 6.1 Clearing

Prior to clearing, the pit and quarry site boundaries should be flagged to delineate the project area and restrict the project footprint. Since the clearing of vegetation has both a visual and environmental impact, it is good practice to avoid clearing a larger area than is necessary for the development. A site survey should be conducted to confirm the planned site layout. Global Positioning System (GPS) units can be used to survey and delineate specific project components. The timing of clearing should be chosen carefully. In areas of ice-rich permafrost, vegetation clearing in the summer can expose the soil to direct sunlight, and lead to ground-ice melting and subsidence. Clearing activities should also be avoided during sensitive nesting periods for birds. Trees larger than 12 centimetres in diameter should be saved as merchantable timber. Land-use permits may indicate conditions for saving and stacking merchantable timber. Brush should be stockpiled for future use in site reclamation as specified in the land-use permit, or as directed by an INAC resource management officer.

### 6.2 Organic Topsoil Layer

As a result of site exploration, the proponent should have a good understanding of the local soils, including the depth of surface organic topsoil. This layer should be stripped and stockpiled separately from deeper mineral soil so as to minimize mixing. Topsoil will be replaced on the surface during reclamation, to function as a natural native seed bank and promote successful revegetation. Topsoil and organics can dry out quickly and can easily blow away or erode if not covered during storage. Tarpaulins can be used to protect stockpiles from wind and water erosion. Topsoil stockpiles should be stored at a secure location that will not interfere with pit operations, will not be affected by surface runoff, and will allow drainage of melt water from ground-ice.

### 6.3 Overburden

Overburden is rock or soil of low economic value that is located above the desired granular deposit, and below the topsoil layer. It must also be removed and stockpiled for reclamation prior to accessing the granular resource. Overburden should be removed in a manner that does not reduce the stability of adjacent ground. Stockpiles should be gradually sloped and rounded to minimize erosion from wind and water. As with topsoil, overburden stockpiles should be stored at a location that will not interfere with pit operations, will not be affected by surface runoff, and will allow drainage of melt water from ground-ice. Structures to collect and treat runoff from overburden stockpiles may be required if the water has a high silt content.

## SECTION 7: OPERATIONS

Operations must be conducted in accordance with approved management plans associated with the land-use permit. These plans include a Pit/Quarry Management Plan (Section 4.3) and a Spill Response Plan (Section 8.1). Major changes in operations may require amendments to existing permits or additional permits.

### 7.1 Resource Extraction

The method used to excavate the granular material will depend on the nature of the material, the equipment available, and in permafrost terrain, the extent and nature of the permafrost. Pits and quarries should not be excavated below the water table to avoid safety concerns, additional water handling, and permafrost degradation (Section 4.4).

If excavated material contains ground-ice, it should be stored at a location within the pit where it can thaw and drain. Small stockpiles will allow frozen material to thaw and drain in one summer season, as a large surface area will be exposed to heating. Melt water from thawing stockpiles may have high silt content, and require control and treatment before being discharged to surface water. Interburden is waste material that may be encountered within the granular resource and should be stockpiled in a depleted section of the pit. It can be handled in the same way as overburden (Section 6.3).

### 7.2 Resource Processing

Processing of granular material often requires an area of intensive heavy equipment activity, and can include crushers, screens, wash plants, generators and conveyors. Each processing step requires an accessible area within the pit to carry out the operation, stockpile the processed material, and allow trucks easy access to haul material out of the pit. The crusher should be located on hard and stable ground to support intensive use by heavy equipment. Oversized materials, such as boulders that are rejected for resource use should be stored and used for future reclamation activities.

For operations that require washing of granular materials, a water license may be required to use and dispose of wash water. Treatment of water from washing operations may also be required. Screening frozen material often leads to wastage caused by the presence of large frozen blocks. Wastage can be reduced by only screening dry, thawed material. Alternatively, frozen material should be crushed before being screened.

### 7.3 Monitoring

Operations should be monitored to ensure that they are proceeding according to the Pit/Quarry Management Plan and remain in compliance with local regulations and the land-use permit. For gravel sources on Crown land, there will be periodic inspections from the INAC Resources Officer and on Inuvialuit Private land, an Environmental Monitor will be present at all times. Monitoring results should answer the following questions:

- Are site preparation measures achieving goals?
- Are water management strategies effective?



- Are pit walls safe?
- Is the granular resource still suitable for end uses?
- How much ground-ice is present in the material?
- What is the behaviour and volume loss of the material as thawing occurs?
- Are wildlife sightings and interactions being recorded?

Regular monitoring can be used to assess the performance of designed structures (Eg. a water containment dyke) and specific environmental mitigation measures (Eg. spraying water to reduce dust). Monitoring will also promote the early detection of a problem which should trigger the appropriate response or contingency plan, and notification of the INAC resource management officer or the ILA Inspector.

#### **7.4 Maintenance**

The site and access roads should be regularly maintained to minimize erosion, sediment deposition, and dust emissions. Potholes, wash boarding, and frost heaving should be promptly repaired to minimize dust generation and equipment wear.

Hydrocarbon spills from equipment are a major source of environmental damage and are completely preventable. Equipment should be properly maintained and in good working condition to minimize potential leaks from hydraulic hoses and other working components. Drip trays should be placed under equipment when it is not in use to prevent hydrocarbon staining.

#### **7.5 Site security**

For safety and security purposes, uncontrolled access to the pit or quarry site should be limited. Contact an INAC resource management officer or ILA Inspector for more information on appropriate access control strategies.

#### **7.6 Intermittent Operations**

If a pit or quarry is to be closed seasonally, the operation is considered to be inactive. The proponent should inform and obtain consent from regulatory authorities to discontinue operations. Regulatory authorities may request financial assurance from the proponent to complete the reclamation. The pit or quarry must be stabilized before the operation is shut down. Areas where extraction is complete must be reclaimed by backfilling and/or contouring. Proper drainage must be in place to prevent flooding of the pit or quarry. If site conditions do not allow for positive drainage, intermittent operations may be impractical, and this should be identified at the planning stage.

## SECTION 8: SPILLS

A spill contingency plan must be in place during all phases of pit and quarry development. Spills can involve chemicals, hydrocarbons, or process water. Unexpected spill events do occur and a plan will help operators to respond to them quickly and effectively. The spill contingency plan should be implemented immediately after a spill event. All spills must be reported immediately to the 24 hour spill line: 867-920-8130. On Inuvialuit Private land, all spills must also be reported to the ILA Environmental Monitor.

### 8.1 Spill Contingency Plan

A spill contingency plan outlines a logical order of how operators should respond to a spill, resources available on-site for spill response, and agencies and individuals who need to be notified. All personnel working on the site should be aware of and understand the plan so that they can respond effectively to a spill. The Government of the Northwest Territories has guidelines for developing a spill contingency plan that proponents should review, as a spill contingency plan is required to be submitted with the land-use permit applications on Crown and Inuvialuit Private land. The guidelines are available at: [www.enr.gov.nt.ca/eps/pdf/spill\\_contingency.pdf](http://www.enr.gov.nt.ca/eps/pdf/spill_contingency.pdf)

### 8.2 Spill Prevention

Hydrocarbon spills are a major source of contamination at northern pit and quarry operations. Proper fuel storage and handling can help to prevent these spills. A dedicated refuelling area should be constructed using impermeable ground or a liner to contain drips and spills. A well stocked spill response kit should be available in the refuelling area. All vehicles should be equipped with spill response kits and drip trays. Used oil and fuel should not be stored at the site and should be disposed of immediately at an approved hydrocarbon waste disposal facility.

### 8.3 Spill Response

Spill response includes stopping, containing, and reporting the spill event. In permafrost areas, containment dikes should only be constructed of snow since excavating soil may expose underlying permafrost, causing thawing and subsidence. Photographs should be taken of the spill area and the extent of the spill should be delineated. During the winter, removal or compression of the snow may allow spreading liquid to be more clearly seen. At all times, ensure that there is no ignition source in the vicinity of spilled flammable products. Once the spill is contained and has been reported, a clean up strategy must be developed.

## SECTION 9: RECLAMATION

The final phase of pit and quarry development is reclamation. Reclamation objectives are influenced by site conditions and the future land-use, and must be satisfactory to regulatory authorities and key stakeholders. Proponents may suggest future uses for the site, but the land-use regulator will make the determination. A closure and reclamation plan is required by the land-use permit or land lease. In some cases, INAC or ILA may already have developed a pit reclamation plan that the proponent must follow. If a reclamation plan does not already exist, a plan should be developed with input from local stakeholders, regulatory authorities, and the INAC resource management officer or the ILA Environmental Specialist, and will require approval from the appropriate regulatory authority. Land-use permits may also contain specific conditions regarding reclamation. Once a closure and reclamation plan is approved, progressive reclamation may be conducted during operations at areas of the site that are no longer used. This will reduce the amount of reclamation required when operations are completed, and could reduce reclamation costs at the end of operations.

When operations are complete, the site must be reclaimed as per the reclamation objectives outlined in the plan, and to the satisfaction of the land-use regulator. Monitoring will last for several years after reclamation has been completed to ensure that reclamation objectives are being met. If they are not, proponents will be required to return to a site for further work. Once the regulator or land owner is satisfied that the site is stable, they will issue a letter of final clearance indicating that the permit holder is no longer responsible for the pit or quarry site.

### 9.1 Clean-up

Once operations are completed, all buildings, machinery, and fuel containers must be removed from the site. All garbage, blasting materials, and material stockpiles must also be removed.

### 9.2 Landscape Reconstruction

Coarse material, overburden, and topsoil stockpiled in the pit or quarry during operations should be used for reclamation of the site upon project completion. Use of frozen materials for reconstruction activities is not recommended as ground-ice may melt and cause subsidence. Coarse material should be buried at the bottom of the pit or used for slope reconstruction. Overburden should then be used for site grading and contouring. It should not be left piled in, or adjacent to the pit. Contour the site to blend with the surrounding topography but also consider the end land-use for the site. If sufficient overburden is available, gentle slopes and rounded shapes are visually preferable to straight lines. Once site contouring is completed and the ground surface has stabilized, stored topsoil should be placed evenly on areas from which the soil was stripped. Topsoil should be spread over as much of the surface of the disturbed area, and as close to the original depth as possible. The ground surface should be roughened to provide micro-sites suitable for revegetation. If cliffs are left in place, cliff faces may require scaling to remove loose material that could pose a safety hazard. Access to the site should be restricted and warning signs installed for public safety.

### 9.3 Drainage and Erosion Control

Successful reclamation involves proper surface drainage. Contouring should not block or divert natural drainage patterns on the site as reclaimed areas are susceptible to erosion while vegetation and soil stability become re-established. Drainage ditches should have adequate grade and capacity to divert runoff from the reclaimed site without eroding adjacent material. Riprap or boulders may be required to armour drainage ditch corners and discharge areas to prevent erosion from flows. Construction and repairs of drainage ditches should be performed during dry weather to avoid adding sediment to the water. Roughening the exposed soil surface using horizontal grooves also improves drainage and minimizes ponding.

### 9.4 Revegetation

Natural revegetation is preferred as it promotes the growth of native plants, and limits the introduction of invasive plant species that may be included in seed mixes. Salvaged topsoil often contains seeds from native plants and organic matter that aid in vegetation re-establishment. When slope soil erosion is a concern, seeding may be required. Native seed mixes should be used to avoid the establishment of invasive species.

The main objectives of revegetation are to prevent soil erosion, and improve the appearance of the reclaimed site. Revegetation objectives should be discussed with the land-use regulators, and will be specified in the Closure and Reclamation Plan. The selected option should be based on the end land-use, compatibility with the surrounding landscape, as well as limiting factors such as climate, the surface material and its moisture-holding capacity.

### 9.5 End-Pit Lake

Allowing surface water or groundwater to flood a pit and create a lake may be an acceptable reclamation goal. More careful planning may be required in areas of permafrost, since the presence of a large body of water in permafrost terrain will lead to warming and subsidence of the ground. In permafrost areas, information collected during the planning phase should be used to avoid ice-bearing permafrost during operations. Positive drainage should be used to divert water away from the pit area to prevent the formation of a lake. If permafrost is not a concern and an end-pit lake is planned, all economically viable gravel should be removed from the pit before flooding. Pit walls should be contoured to provide stability.

Proponents planning an end-pit lake should discuss their plans with the Department of Fisheries and Oceans. The following questions should be considered if planning an end-pit lake:

- Is presence of a lake compatible with the surrounding landscape?
- What will be the long-term health of the lake?
- Will the lake thaw adjacent land?
- Will the shore and slopes be stable?
- Is rip-rap or armour stone required to protect the shoreline?
- Will the water level in the lake rise over time?
- Will the pit lake be connected to other water bodies?
- Will shoreline or littoral habitat be enhanced for fish and wildlife?

## **9.6 Monitoring**

Site monitoring will be required for several years to assess whether the reclamation objectives have been met. Monitoring requirements are usually specified in the land use permit. The following questions should be considered when monitoring reclamation:

- Has vegetation been re-established and has it reached predicted levels?
- Are erosion control structures performing as designed?
- Are water management techniques controlling water in and out of the pit and quarry?

Regulatory bodies and stakeholders may require additional monitoring as part of the licensing/permitting process.

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## GLOSSARY

Armour stone	Stones or broken rock of larger size than rip rap that are placed on an embankment as erosion control and protection.
Borehole	A small diameter hole drilled from the soil surface to collect soil samples.
Buffer strip	An area of land that is left untouched to provide a natural barrier between a development and an adjacent area. Buffers can be used to protect important ecosystem components such as wildlife habitat or water bodies, or they can be used to provide a visual barrier between the development and an area of human use.
Dog leg	A sharp change in the direction of a road that is designed to conceal it from view for aesthetic purposes.
Dust skirt	A sheet that surrounds the outlet of a crusher to contain and minimize dust emissions.
Exfiltration	The removal of water from an area by percolation or absorption into the surrounding soil. Used to remove sediment from water.
Granular resources	Materials ranging from silts to sands, gravel and cobbles that can be used for a wide variety of construction purposes.
Granular Resource Management Plan	An overarching plan intended to serve the purposes of providing long term guidance for managing granular resources within a defined geographical area (ie: the ISR). This plan is the responsibility of the resource/land owner and is intended to be a document which identifies the granular resources which exist and the responsible utilization of such resources.
Ground-ice	A general term referring to all types of ice contained in freezing and <i>frozen ground</i> . Ground ice occurs in pores, cavities, voids or other openings in soil or rock and includes <i>massive ice</i> . It may occur as lenses, wedges, veins, sheets, seams, irregular masses, or as individual crystals or coatings on mineral or organic particles.
GPR	Ground Penetrating Radar is a technique used to delineate subsurface features by passing electromagnetic energy into the ground and back to a receiving antenna.
Interburden	Waste material encountered within the granular resource.
Littoral	The shoreline area of streams, rivers and lakes.
Major Projects Granular Resources Development	A proponent's plan for selection, investigation, development, closure and reclamation of several or many pits and quarries associated with a major project, whether entirely on Crown lands or partially on Crown lands. The plan should indicate what factors the proponent has considered in site selection, or rejection of sites, and plans for additional investigation to confirm that the sites contain the quantity and quality of material needed



Plan	to meet the requirements of the project, and how the proponent would implement and modify this plan to accommodate changes that might occur during the course of the project. It is intended that this broad project-wide plan would be supplemented by specific Pit/Quarry Development Plans for individual sites. This plan should also demonstrate how it complies with any overarching regional Granular Resource Management Plan as well as any specific Pit/Quarry Management Plans, established by the Crown or other affected land owners within the vicinity of the major project.
Overburden	Rock or soil of little or no value that is located above the desired granular deposit, and must be removed prior to quarrying.
Pit Operations Plan	An operational plan designed by a contractor operating in the quarry site which identifies specific periods of operation (timing). It is intended that this plan defines methods of extraction, related activities and on site infrastructure. Other users of the same source need to be considered and approval by the Regulatory Authority(ies) is necessary prior to operations start up. It is short term, or seasonal in nature.
Pit/Quarry Management Plan	A plan designed to define the best management of a specific quarry related to resource extraction, expansion and reclamation of the work area. The development of this plan must adhere to the concepts and statements committed to in the Granular Resource Management Plan, and is the responsibility of the resource owner. The plan is to provide assurance that as development of the quarry occurs that the extraction of the material is appropriately managed and controlled - Particularly if the site is a multi user site. Key attributes are that the plan is site specific, spans the life of the deposit and as a result, long term in nature.
Pit/Quarry Development Plan	A plan generally drafted by the developer or contractor intending to work a specific quarry site. It must adhere to the overarching Granular Resource Management Plan as well as the Pit/Quarry Management Plan. It is intended that this plan include specific methods of extraction and related activities (including reclamation) as well as address on site infrastructure. The Development plan fulfills the regulatory obligations by describing mitigation measures of pre-determined environmental conditions contained in the higher level Management Plans and upon submission must be approved by the Regulatory Authority(ies). This is a medium to short term plan designed to apply only for the life of a specific project.
Permafrost	Ground that is frozen for at least two consecutive years. Continuous permafrost is defined as an area where at least 90% of the land area is underlain by permafrost, while in discontinuous permafrost, between 10 to 90% of the land is underlain by permafrost.
Progressive reclamation	Actions that can be taken during operations before permanent closure to take advantage of cost and operating efficiencies by using the resources available from ongoing operations. It enhances environmental protection and shortens the timeframe for achieving the reclamation objectives.
Riparian	An area of land adjacent to a stream, river, lake or wetland that contains vegetation that,

due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.

Windrow      Method of placing materials such that they are in long, continuous rows.

## APPENDIX A- HAMLET CONTACT INFORMATION

### **Aklavik**

Hamlet of Aklavik  
Box 88  
Aklavik, NT  
X0E 0A0  
Phone: 867-978-2351  
Fax: 867 978-2434

### **Sachs Harbour**

Hamlet of Sachs Harbour  
General Delivery  
Sachs Harbour, NT  
X0E 0Z0  
Phone: 867-690-4351  
Fax: 867-690-4802

### **Inuvik**

Town of Inuvik  
Box 1160  
Inuvik, NT  
X0E 0T0  
Phone: 867-777-8600  
Fax: 867-777-8601

### **Tuktoyaktuk**

Hamlet of Tuktoyaktuk  
Box 120  
Tuktoyaktuk, NT  
X0E 1C0  
Phone: 867-977-2286  
Fax: 867-977-2110

### **Paulatuk**

Hamlet of Paulatuk  
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Paulatuk, NT  
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Phone: 867-580-3531  
Fax: 867-580-3703

### **Ulukhaktok**

Hamlet of Ulukhaktok  
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Fax: 867-396-8001

## SECTION 4:

# INUVIALUIT SETTLEMENT REGION GENERIC PIT MANAGEMENT PLAN



Inuvialuit Land Administration  
Leaders in Aboriginal Land Management



Indian and Northern  
Affairs Canada

Affaires indiennes  
et du Nord Canada

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## **SECTION 1: INTRODUCTION**

### **1.1 PURPOSE**

As a result of the Inuvialuit Final Agreement, the Inuvialuit Land Administration and Indian and Northern Affairs Canada have developed a Granular Resources Management Plan for the Inuvialuit Settlement Region with the intent of setting in place responsible management criteria for granular resources. Part of this initiative is the development of pit management plans for active sources of granular resource extraction in the Inuvialuit Settlement Region.

This pit management plan provides the direction required by the Inuvialuit Land Administration or Indian and Northern Affairs Canada to quarry/borrow source (insert source name here) in an efficient and environmentally acceptable manner and to leave the area in a safe and productive condition. The pit management plan describes the aspects of managing Source (insert source name here) from the start of operations to final reclamation. The plan is complementary to the terms and conditions contained in authorizations (licences or permits).

### **1.2 PIT DESIGNATION**

This section describes the designation of the site by ILA, and is only applicable for gravel sources on Inuvialuit Private Land. This would reflect the Inuvialuit Final Agreement's requirement for gravel prioritization (community, Inuvialuit and private). The text below is an example of a pit designated for community use.

Source (insert source name here) has been designated as a priority source for community use by the Inuvialuit Land Administration. It serves as a primary source of granular resources for the community of (insert community name here). Based upon current and future demand forecasts, the Inuvialuit Land Administration will determine whether quarrying for purposes other than community use will be permitted at this source.

## SECTION 2: DESCRIPTION OF THE DEPOSIT

### 2.1 Annotated List of Deposit Geotechnical Reports and Associated Documents

This section will contain a list of all known documents containing appropriate information about the specific deposit. Information sources should be dated and properly referenced.

### 2.2 Topographic Map

Topographic maps for all areas of Canada are available freely for downloading<sup>1</sup>. Topographic maps of the gravel source can be obtained from some past geotechnical reports for many gravel sources within the Inuvialuit Settlement Region. As they become available, more detailed topographic survey will also be included. Satellite imagery, of a suitable resolution to provide similar detail, may be included in this section as a substitute for a topographic map.

### 2.3 Surface Water and Hydrogeology

This information may be available from geotechnical reports or may require further field work. This information will allow quarry users to know what water bodies are present and the way water flows at the site. Furthermore, this section will include information about what water licenses, if any, must be obtained to conduct quarry activity at this site based on existing hydrogeology characteristics. Water source location data can also be Indian and Northern Affairs Canada and Environment Canada.

### 2.4 Test Hole Locations and Descriptions

Test hole locations and descriptions of the gravel source can be obtained from geotechnical reports. Additional field work may be needed to adequately define the quantity and quality of materials, and potential hazards to development of the deposit. This section should include the coordinates of test holes, and descriptions of the areas where test holes were completed. Many geotechnical reports with test hole locations already exist for the Inuvialuit Settlement Region.

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<sup>1</sup> Index Maps of the National Topographic System of Canada ftp: <ftp://ftp.nrcan.gc.ca/ess/topo/NTSIndex-SNRCIndex/>

CanMatrix-Georeferenced, Digital Topographic Maps of Canada (zipped tiff) http: <http://ftp2.cits.nrcan.gc.ca/pub/canmatrix/> ftp: <ftp://ftp2.cits.nrcan.gc.ca/pub/canmatrix/>

CanMatrix-Print Ready, Digital Topographic Maps of Canada (tiff or PDF) http: <http://ftp2.cits.nrcan.gc.ca/pub/canmatrix2/> ftp: <ftp://ftp2.cits.nrcan.gc.ca/pub/canmatrix2/>



## **2.5 Summary of Test Hole Results**

This section details the types, quantities and qualities of materials found within the pit based on test hole results. Much of this information is available for many ISR gravel sources from previous geotechnical work.

## **2.6 Properties of Granular Materials**

This section contains laboratory test results on samples obtained from surface sampling and test holes. It should include sample classifications, particle-size distributions (grain-size curves), moisture contents, and additional information depending on intended usage. Information is available in existing geotechnical reports for many ISR gravel sources, but additional samples and testing may be required.

## **2.7 Depth of Overburden and Topsoil**

This section discusses the depth of overburden and topsoil at the gravel source. This information should also be available from geotechnical reports, but additional field work may be needed to adequately delineate these materials.

## **2.8 Ground Ice Content**

This section details the type of ground ice that is present, and its extent within the gravel source. The type and amount of ground ice may have an impact on the seasons and locations of quarry operations or in the least provide for greater certainty of methods to be employed during the operations to ensure more efficient extraction activities. Areas of massive ground ice should generally be avoided.

## **2.9 Highest and Best Use of Materials**

This section is a description of the grades of material that can be found in the gravel source, and what their best uses are for the pit designation. Therefore, each class of gravel within a deposit will have a designated end use which will maximize the efficient and responsible use of the deposit. This can also help prevent high grading, which is the use of higher quality materials than are required for a specific purpose. For example, the pit management plan can say that Class 1 granular resources within the pit are reserved for asphalt or concrete aggregate for the community that the pit serves. Information about the classes of gravel available within a gravel source can be found in existing geotechnical reports.

## **2.10 Archaeology**

This section outlines the archaeological potential of the land on which the pit lies. An archaeological survey will be compulsory by law prior to pit development, and as such the results of this survey can be made known in the pit quarry/development plan. The regulator will include any archaeological information that is available, but this section will also emphasize that the proponent will be required to conduct their own survey.

## **SECTION 3: SITE PREPARATION**

### **3.1 Access**

This section will detail how the gravel source will be accessed (i.e. ice road, winter road, barge, all weather road) and the seasonality of access. Furthermore, this section will detail how access to the gravel source will be controlled (i.e. fences, berms, posted signs, etc.). Information about how right of ways will be constructed to and at the site will be included to ensure best environmental practice. Access throughout the pit need also be included in this section. The INAC “Blue Book” for Access Roads and Trails should be consulted prior to the development of this section of the pit management plan.

### **3.2 Timber Removal**

This section discusses what timber can be removed from the site, and where the timber should be placed.

### **3.3 Vegetation Retention**

Vegetation retention will be detailed in this section.

### **3.4 Clearing and Grubbing**

Clearing and grubbing plans will be detailed in this section. The plans will include how best to minimize impacts to permafrost through these activities.

### **3.5 Salvage and Storage of Topsoil and Storage or Disposal of Overburden**

All soil should be stripped from the area to be cleared and saved for the reclamation phase. Topsoil should be stockpiled separately and not mixed with other materials.

Further instructions about the exact location of the topsoil stockpile will be included in this section.

During development of a pit, the removal and storage of overburden is a necessary activity for access to underlying granular resources. This section will contain a detailed plan for the removal and storage of overburden.

Overburden that lies above the granular resource should be removed in a manner that does not reduce the stability of adjacent ground. It should be removed ahead of pit operations to ensure that safety during removal is not compromised by proximity to the pit wall, and that thawed material does not slump and flow over the pit wall.

The overburden should be stored in a location that does not cover gravel resources or interfere with operations. The overburden stockpile should allow melt water from ground ice to flow away from the pit, and provide convenient access during site restoration. Environmental impacts should also be considered when determining a storage location.

### **3.6 Topographic Survey for Future Volume Checks**

This section will include the most recent topographic survey (as built) which will be used to estimate how much gravel has been extracted from the gravel source during the permitted quarrying activity. If it is the first time that the proponent will be operating in the pit, a survey may be required (per Inspector's direction) to provide a base-line survey. Upon completion of removal of the permitted volume, a post activity survey would then be required to verify the volume removed from the area. This section of the pit management plan will require updating each time quarry activity is completed at the gravel site.

## **SECTION 4: PIT OPERATION**

### **4.1 Sequence of Development, Extraction and Reclamation**

A sequence of extraction is necessary in order to ensure that all marketable material is removed from one area of the gravel source before moving on to other areas. This policy is in place to prevent high-grading of material, and to deter operators from taking gravel that is the easiest to acquire. This section of the document should include a map of the gravel source in which sections of the source are blocked off and labelled in terms of extraction sequence.

## **SECTION 5: PROCESSING**

### **5.1 Permits Required for Processing**

This section of the pit management plan will detail any additional permits that are required for processing materials on site. Additional heavy equipment associated with crushing may require a different land use permit.

## **SECTION 6: RECLAMATION**

### **6.1 Desired future condition of the site**

Having a closure plan prior to the development of a site helps operators and regulators to anticipate the scope of reclamation activities and post reclamation condition of the site. For most ISR sites, the ideal future condition of the site would be to return it to its natural state, or as close as possible. For multi-user pits, or for sites with a strong potential for multi-year operations, depleted areas should be restored, and active removal areas should be left in stable condition so as to minimize the risk of slope failure and granular material contamination.

Desired site conditions after closure of the quarry should be listed here by the land owner.

### **6.2 Environmental Protection**

The process of site reclamation must be ongoing and not relegated to the end of operations at the pit. As a result, progressive reclamation must be employed as areas of the pit become depleted and no longer used. All unused materials should be returned to the pit, flattened and contoured at the time of final reclamation. Displaced and stored topsoil and overburden will also need to be returned and placed on top of any remaining quarry materials. Revegetation should be encouraged.

This portion of the plan will detail not only progressive reclamation, but also final reclamation. Reducing environmental impacts should be the main focus of this section.

### **6.3 Aesthetics**

This section of the pit management plan will discuss how the quarry site should look once it is reclaimed. This will include details on whether the site should blend into the existing landscape, and how this should be carried out.

### **6.4 Wildlife Habitat Enhancement**

This section will outline if any provisions need to be made during reclamation to re-enhance wildlife habitat in the area. This may include a constructed route down into the quarry site and back out for migrating animals, or specific vegetation to encourage certain species back into the area.

## **6.5 Water Diversion or Protection**

This section should detail how drainage at the quarry site should be managed for reclamation purposes. The list below is of practices which should be required for reclamation.

The proponent should:

- re-establish natural drainage where surface water was diverted away from the pit development area. Where original channels have been altered, new ones should be constructed to handle all flow without eroding adjacent material;
- remove culverts and replace them with erosion resistant material in a stable swale configuration;
- diversion ditches should be breached and runoff allowed to flow along the pre-development channels, where possible;
- reduce erosion at discharge points by discharging water onto durable rock material;
- pumps and piping for any fresh water supply should be removed. Care should be taken to avoid disturbance of sensitive aquatic habitat at lake shores;
- positive drainage must be established to prevent ponding; and
- settlement ponds may need to be constructed to encourage settlement of particulates in runoff.

## **6.6 Sloping/Benching**

This section should include specific information about how the site should be sloped or benched and recontoured following quarry operations. The text below includes general principles regarding landscaping the site during reclamation.

The land should be shaped to create a stable landform that blends in with its surroundings. If the land use operation extends over a period of time, landscaping should be progressive. If sufficient soil is available, gentle slopes and rounded shapes are visually preferable to straight lines. In bedrock material that resists erosion, vertical cliffs may be acceptable. These features can offer nesting habitat for birds. If cliffs are to be left, there must be something in place that limits access to the cliff by casual users.

Overburden that was removed from the pit and stockpiles should be used to landscape the site upon progressive reclamation or project completion. It is unacceptable to leave overburden piled adjacent to the pit.

## 6.7 Permafrost Stabilization

This section should detail how permafrost stabilization will be ensured during pit restoration. The remediation plan for doing so will depend on the specific site. Below are some general rules for permafrost stabilization in soils with different amounts of excess ice.

The behaviour of permafrost when thawing depends on the amount of excess ice which is present. Excess ice is expressed as a percentage of the thickness of ice in the total thickness of a sample. Soils with less than 5% excess ice are generally not thaw unstable and can be simply revegetated after slopes are trimmed to a stable angle, such as 2H:1V or flatter.

Soils with moderate excess ice, 5% to 20%, will release excess water and experience minor slumping or settling upon thawing. These soils should be stabilized by providing some insulation. This may consist of ice poor granular soil placed at least 30 cm thick over the affected area. Slopes should be trimmed to 3H:1V before placing the insulating layer.

Soils with significant excess ice, greater than 20%, are prone to slumping and ongoing thawing. Where this occurs in fine grained soils such as silts or clays the excess water plus any precipitation will continually wash away the soil particles which prevent a build-up of a new insulating later. These fine-grained soils can be easily washed into streams or lakes and destroy aquatic habitat.

Stabilization may involve use of geo-textiles and special construction methods. A geotechnical engineer should be consulted in these cases, especially where slopes are involved.

In all permafrost stabilization, it should be anticipated that thawing and settlement will continue until a new permafrost regime is established. Allowance for settlement should be made. The design of reclamation measures should allow for this and incorporate features to prevent ponds from forming which could delay or prevent the establishing of stable conditions.

In general, exploration trenches in frozen ground should be backfilled, or at a minimum, sufficient backfill should be placed to provide a new insulating layer over the permafrost.

Any trees which are standing at the crest of cut slopes, such as in trenches, quarries or roads, should be cut down so that any settlement which results from thawing will be uniform and toppling trees do not expose more permafrost.

Where pits have been excavated for granular materials, a depression in the topography may result. Natural flooding may create an end-pit lake that will cause permafrost to thaw and ongoing degradation of the land surface.

Ideally, proper drainage should prevent the formation of an end-pit lake. If flooding in ice-rich ground is inevitable, however, the extent of damage to the surrounding area should be forecast and monitored. Stabilizing such an area could take a long time.

## **6.8 Vegetation**

This section will outline if any revegetation is required, and if so, what improvements will be required to encourage revegetation. The publication “Guidelines for Reclamation/Revegetation in the Yukon” can serve as a guide for determining which native plants are in the area, the seed mixture required, and the fertilizer mix for the site. Information may also be available from the Aurora Research Institute in Inuvik, regarding the various vegetation types and sources of seed that may be available for local plant varieties in the Mackenzie Delta area. All sites should be scarified.

## SECTION 5:

# GENERIC PIT/QUARRY DEVELOPMENT PLAN



Inuvialuit Land Administration  
Leaders in Aboriginal Land Management



Indian and Northern  
Affairs Canada

Affaires indiennes  
et du Nord Canada



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## SECTION 1: INTRODUCTION

### 1.1 PURPOSE

As a result of the Inuvialuit Final Agreement, the Inuvialuit Land Administration and Indian and Northern Affairs Canada have developed a Granular Resources Management Plan for the Inuvialuit Settlement Region with the intent of setting in place responsible management criteria for granular resources. Part of this initiative is the development of pit/quarry development plans for active sources of granular resource extraction in the Inuvialuit Settlement Region.

This pit/quarry development plan is submitted by the proponent/developer to describe how quarrying will occur within the parameters of the pit management plan. This development plan provides the direction required by the Inuvialuit Land Administration or Indian and Northern Affairs Canada to quarry Source (*insert source name here*) in an efficient and environmentally acceptable manner and to leave the area in a safe and productive condition. The pit/quarry development plan describes the aspects of managing Source (*insert source name here*) from the start of the project operation through completion of the project. The plan is complementary to the terms and conditions contained in authorizations (licences or permits).

## **SECTION 2: DESCRIPTION OF THE DEPOSIT**

### **2.1 TOPOGRAPHIC MAP**

Topographic maps for all areas of Canada are available freely for downloading<sup>1</sup>. Topographic maps of the gravel source can be obtained from some past geotechnical reports for many gravel sources within the Inuvialuit Settlement Region. As they become available, more detailed topographic survey will also be included. Satellite imagery, of a suitable resolution to provide similar detail, may be included in this section as a substitute for a topographic map.

### **2.2 TEST HOLE LOCATIONS AND DESCRIPTION**

Test hole locations and descriptions of the gravel source can be obtained from geotechnical reports. Additional field work may be needed to adequately define the quantity and quality of materials, and potential hazards to development of the deposit. This section should include the coordinates of test holes, and descriptions of the areas where test holes were completed. Many geotechnical reports with test hole locations exist already for the Inuvialuit Settlement Region.

### **2.3 SUMMARY OF TEST HOLE RESULTS**

This section details the types, quantities and qualities of materials found within the pit based on test hole results. Much of this information is available for many ISR gravel sources from previous geotechnical work.

## **SECTION 3: SITE PREPARATION**

### **3.1 ACCESS**

This section will detail how the gravel source will be accessed (i.e. ice road, winter road, barge, all weather road) and the seasonality of access. Furthermore, this section will detail how access to the gravel source will be controlled (i.e. fences, berms, posted signs, etc.). Information pertaining to proposed construction methods, including best construction and route selection

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practices, for the proposed access to and within the site will be described in this section. Access to multi-use areas should not be compromised. The INAC “Blue Book” for Access Roads and Trails should be consulted prior to the development of this section of the pit/quarry development plan.

### **3.2 TIMBER REMOVAL**

This section discusses what timber can be removed from the site, and where the timber should be placed. The proponent should consider consulting the local Environment and Natural Resources staff when removal of timber is contemplated.

### **3.3 VEGETATION RETENTION**

Vegetation retention will be detailed in this section.

### **3.4 CLEARING AND GRUBBING**

Clearing and grubbing plans will be detailed in this section. The plans will include how best to minimize impacts to permafrost through these activities.

### **3.5 SALVAGE AND STORAGE OF TOPSOIL AND STORAGE OR DISPOSAL OF OVERBURDEN**

All soil should be stripped from the area to be cleared and saved for the reclamation phase. Topsoil should be stockpiled separately and not mixed with other materials.

Further description about the exact location of the topsoil stockpile should be provided by the proponent in this section.

During development of a pit, the removal and storage of overburden is a necessary activity for access to underlying granular resources. This section will contain a detailed plan for the removal and storage of overburden.

Overburden that lies above the granular resource should be removed in a manner that does not reduce the stability of adjacent ground. It should be removed ahead of pit operations to ensure that safety during removal is not compromised by proximity to the pit wall, and that thawed material does not slump and flow over the pit wall.

The overburden should be stored in a location that does not cover gravel resources or interfere with operations. The overburden stockpile should allow meltwater from ground ice to flow away from the pit, and provide convenient access during site restoration. Environmental impacts should also be considered when determining a storage location.

### **3.6 BRUSH DISPOSAL**

The disposal of brush accumulated during pit development will be discussed in this section. The discussion will focus on preferred methods including, but not limited to:

- using brush for erosion control and insulation;
- lopping and scattering cleared trees; and
- windrowing brush.

### **3.7 SCALES, BUILDINGS OR OTHER FACILITIES**

This section will discuss the types of equipment used for size determination (screening), and equipment used for washing of granular materials and/or equipment, and where these facilities should be placed in order to reduce potential environmental damage. Information regarding detergents, degreasers or surfactants for equipment washing

### **3.8 TOPOGRAPHIC SURVEY FOR FUTURE VOLUME CHECKS**

This section will include the most recent topographic survey or as-built which will be used to estimate how much gravel has been or will be extracted from the gravel source during the permitted quarrying activity. If it is the first time that the proponent will be operating in the pit, a survey may be required (per Inspector's direction) to provide a base-line survey. Upon completion of removal of the permitted volume, a post activity survey would then be required to verify the volume removed from the area. This section of the pit/quarry development plan will require updating each time quarry activity is completed at the gravel site.

## **SECTION 4: PIT OPERATION**

### **4.1 SEQUENCE OF DEVELOPMENT, EXTRACTION AND RECLAMATION**

A sequence of extraction is necessary in order to ensure that all marketable material is removed from one area of the gravel source before moving on to other areas. This policy is in place to prevent high-grading of material, and to deter operators from taking gravel that is the easiest to acquire. This section of the document should include a map of the gravel source in which sections of the source are blocked off and labelled in terms of extraction sequence.

### **4.2 LIMITS ON THE TYPE OF EQUIPMENT**

Quarries of different sizes and configurations require different equipment. The information in this section will be similar to that which was included in the Land Use Permit application. This section will further detail what equipment will be used to conduct various activities at the site. The list of equipment will be based on environmental as well as logistical considerations.

### **4.3 GRADES OF THE PIT FLOOR**

In order to encourage positive drainage as well as stable pit walls and permafrost preservation, a quarry will need to be graded appropriately. This section will detail the planned grades within the pit and should include diagrams.

### **4.4 EROSION PREVENTION**

This section should detail the various techniques that must be used at the site to prevent ground erosion, while ensuring remaining resources are not contaminated with fines and organics. Requirements for recontouring the pit after each operation will also be outlined here.

### **4.5 Permafrost Degradation**

This section will contain information about how quarry operations should be carried out in order to avoid permafrost degradation. Permafrost degradation will reduce the availability of granular resources and increase the cost of pit development.

### **4.6 Local Water Management**

This section should detail how water should be managed at the quarry site. Best practice for quarry sites is to minimize water inflow and control runoff.

Some considerations of this section should include:

- Diversion of surface water away from the development area, and the construction of channels and berms to do so
- Reduction of erosion at discharge points by discharging water onto rock material
- Minimization of water in the pit by directing it out by gravity or pumping

This section should also make mention of any other permits that would be required at this source from the NWT Water Board for water discharge.

### **4.7 Grades of the Side Slopes/Benches**

In order to maintain pit stability, and reduce the likelihood of slumping and sliding, a gravel pit should be contoured at an appropriate grade. A general benchmark grade is 1:2. This section should outline which grades will be in place at what parts of the pit, and identify what the minimum grade for pit walls.

#### **4.8 Storage Area for Coarse or Fine Rejects**

During pit development, unusable materials are often encountered and as a result the plan is required to ensure orderly, and separate, storage of rejected materials. This section will define the exact locations of where rejects should be stored during quarry operations.

#### **4.9 Storage Area for Finished Products (i.e. stockpile, and permits required)**

A separate area to store usable materials will be required in most pits. This section of the plan will detail the location of stockpiles, the maximum volume of materials to be stored in the stockpiles, and any permits required by the regulatory agency for stockpiling.

## **SECTION 5: PROCESSING**

### **5.1 PROCESSING LIMITS**

Processing includes stockpiling, crushing, screening and washing. Each step requires space to carry out the operation (i.e., access to and room at the working face) and to stockpile the processed material.

Crushing and screening equipment and stockpiled material must be located in an easily accessible location within the pit, i.e., accessible from the cut face and to the access road for haulage. The crusher should be situated on hard, well-drained ground as the area around it will be heavily used. Prevailing winds should be considered for dust control.

This section should set out where exactly the processing should take place during the various stages of pit development. This section could also discuss the rates of processing and the maximum volume of each material class to be removed or stockpiled.

### **5.2 SCREENING SIZE LIMITS**



Most quarries contain some materials which are either too large or too small for use. A complete quarry pit development plan will detail what the maximum and minimum grain/rock sizes are in the project and how to treat and store rejected materials from screening. This section should focus on detailing materials which are of appropriate size and those which are not, for use.

### **5.3 CRUSHING SIZE LIMITS**

Quarries often contain materials which are too large for use without crushing. Similarly, crushing devices have a limit on the size of materials which can be processed in the device. This section will detail what size materials are appropriate for the crushing operations expected on site.