MINISTRY OF TRANSPORTATION

NORTHERN REGION

Geotechnical and Materials Engineering

GRAVEL INVESTIGATION

BERYL PRAIRIE EXTENSION
PEACE DISTRICT

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EXECUTIVE SUMMARY

A subsurface gravel investigation of the Beryl Prairie Pit and the extension area was carried out in November 2007 to assess the quantity, quality, and suitability of the granular materials. This site is located approximately 8.5km west of Hudson's Hope. An application to convert the portion of the extension area in to a Section 16 Map Reserve is pending with Integrated Land Management Bureau.

Based on the results of the investigation, one granular area – Area A – was identified. The proven granular volume of Area A is 2,623,075 cubic meters. Additional volumes within the investigated area may exist at depth. The total combined topsoil and overburden volume for Area A is over 380,500 cubic meters.

The gravel in Area A is generally poorly graded and sandy with an average fine content of 3.2% and sand content at 22.2%. There is a greater percent of fine gravel (38.7%) than coarse gravel (35.7%). The average oversize content is 13.1%. Crushing the oversized rock during gravel production will likely improve the quality of the aggregates and will ensure full use of the pit. Some test pits ended in gravel at depth and some in sand, while the whole area contained primarily clean gravel.

The durability test results indicate that the gravel quality in Area A is generally good. The granular material appears suitable for pit run Bridge End Fill and SGSB and crushed WGB, IGB (25mm), Asphalt Mixes, Asphalt Base Course Mix, and Graded Aggregate Seals A-D.

Area A will require logging as well as clearing, grubbing, and stripping of topsoil and overburden. Ground water was not encountered in Area A.

All miming activities must be carried out according to the Health, Safety, & Reclamation code for Mines in British Columbia, Standard Specifications for Highway Construction, and the pit development plan. Progressive reclamation should be carried out of the depleted areas to return the land to productivity.

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1.0 Introduction

A subsurface gravel investigation was completed at the proposed Beryl Prairie Gravel Pit Extension in November of 2007 at the request of Gerry Hofmann, Gravel Resources Manager, Geotechnical and Materials Engineering, Northern Region. The purpose of this investigation was to assess the quantity, quality, and suitability of the granular materials within the boundaries of the existing reserve and notation of interest.

1.1 Location

The Beryl Prairie Gravel Pit is located approximately 8.5km west of Hudson's Hope, BC. Access to the site is gained by traveling on Canyon Drive west approximately 8.5km from the intersection of Canyon Drive and Highway 29 in Hudson's Hope and turning left to the pit entrance across from Beryl Prairie Road. It is located on the National Topographic Series map sheet 94 B/ 01 – Butler Ridge. The location of the site is shown in Figure 1.

1.2 Background Information

This site falls within both a Section 16 Reserve and a Notation of Interest (NOI) held by the Ministry of Transportation. An application for the establishment of a Section 16 Reserve over a portion of the NOI has been sent to the Integrated Land Management Bureau for their approval. Previous subsurface investigations have been carried out on the existing Section 16 Reserve, but not in the NOI.

A study was completed on the existing Section 16 in 1982 with field investigation and lab testing. A total of 27 test pits were excavated identifying one granular area with a proven quantity of 2,623,075 cubic meters. This aggregate was suitable for pit run bridge end fill and SGSB, and crushed WGB, IGB (20-50mm), Hot Asphalt Mix, Asphalt Base Coarse Mix, and Graded Aggregate Seals A-D.

1.3 2007 Geotechnical Investigation

The 2007 geotechnical investigation comprised of test pitting and laboratory testing of retrieved samples. Eight days in November were spent in the field with a John Deere 200LC excavator from Quigley Contracting Ltd. Investigation was completed by Tim Woolnough of MoT.

A total of 65 test pits were excavated with depths ranging from 3.5 to 5.9m. While test pitting, the soils were visually identified and logged. Where appropriate, granular material was sampled for laboratory testing to determine durability and gradational characteristics. The locations of the test pits are shown in Figure 2 and a summary of the test pit data can be found in Appendix A.

Laboratory testing of the samples was carried out by Henry Nagasaka of AMEC Earth and Environmental, Prince George. Laboratory testing included wet sieve analysis for assessing grain size distribution (according to the Modified USCS), presence or absence of plastic fines (sand equivalent), absorption, abrasion loss (micro-deval testing), and bulk relative density (specific gravity).

Based on the results of the field investigation and laboratory testing, one granular area – Area A – has been defined as shown in Figure 3. Test Pits excavated outside of Area showed little or no potential for granular materials.

2.0 Granular Characteristics

The following sections discuss the granular characteristics of material that was sampled and tested in the laboratory.

2.1 Pit Run Gradation

Pit run gradations were assessed from the results of the wet sieve analysis carried out on the materials passing the 75mm sieve. Table 1 shows the average pit run gradation results and the average pit run gradation corrected for the estimated oversize content. The pit run gradation summaries and charts are supplied in Appendix B and selected photographs of pit run material are provided in Appendix C.

Table 1
Average Pit Run Gradation and Average Pit Run Gradation with Oversize
(percent by weight of the minus 75mm fraction and of the entire deposit)

Material	Fines (%) (<0.075 mm)	Sand (%) (0.075 - 4.75mm)	Gravel		Estimated Small Boulders (%) (75-300mm)	Estimated Large Boulders (%) (>300mm)	USC
			Fine (4.75 - 25mm)	Coarse (25-75mm)			
Pit Run	3.2	22.2	38.7	35.8			GP
Corrected	2.8	19.5	33.6	31.1	13.1	0.0	GP

The gravel in Area A is classified as GP with an average gradation of 3.2% fines, 22.2% sand, 38.7% fine gravel, and 35.8% coarse gravel. The average oversize content of this area is 13.1% small boulders (Appendix B), and had an estimated maximum size of 280mm. Large boulders were not encountered in any of the pits.

2.2 Durability

Durability test results of the tested samples are summarized in Table 2.

Both the Micro Deval and the Sand Equivalent test results are well within the MoT specifications. The results for absorption tests on the coarse fraction are <2 and meet the requirements for asphalt mix aggregate. The absorption results for the fine fraction (1.4 & 1.3) meet the specifications for seal coating aggregates, but only one of the two results for the coarse fraction meets this requirement. The other result on the coarse fraction is only marginally high at 1.1; the specification requires <1.0. The Bulk Relative Density test results of both the coarse and fine fraction are slightly below the preferred value of 2.65, with the exception of one which is at this value. The durability characteristics may improve somewhat if more durable oversized rock is crushed with the gravel.

Table 2
Laboratory Durability Results

Test Pit	Area A				MoT Specifications
	TP07-17	TP07-20	TP07-25	TP07-26	
Micro Deval (%) (Coarse)	6			5	<30 for granular sub-base (coarse) <25 for granular base (coarse) <17 for asphalt aggregates (coarse)
Sand Equivalent	54			71	>20 for sub-base and surfacing aggregates >40 for asphalt aggregates
Absorption (Coarse/Fine)		1.1/1.4	1.0/1.3		<2% for asphalt aggregates (coarse) <1.0/<1.5 for seal coating aggregates
Bulk Relative Density (Coarse/Fine)		2.63/2.62	2.65/2.63		~2.65 for all aggregate products

3.0 Granular Quantity

3.1 Proven Quantity

Table 3 provides the proven volumes of topsoil, overburden, and gravel in Area A. These volumes are based on the results of the test-pitting program.

Table 3
Proven Top Soil, Overburden and Gravel Quantities

Area A	Average Thickness (m)	Area (m^2)	Proven Volume (m^3)	Overburden* to Gravel Ratio
Top Soil	0.05	746,250	37,325	
Overburden	0.46	746,250	343,275	
Gravel	3.515	746,250	2,623,075	1:7

* Includes Topsoil

3.2 Probable Quantity

Some test pits bottomed out in gravel suggesting that there is potential for more gravel at depth in Area A. A drilling program will be required to prove if additional volumes exist.

4.0 Gravel Suitability

Based on the lab results for gradation and durability, the gravel is anticipated to meet the MoT specifications for a number of different aggregate products (summarized in Table 4). Some products may require additional processing such as blending and/or rejecting of materials to meet specification. For specific requirements for each product see Sections 202, 501, and 531 in 2006 Standard Specifications for Highway Construction. Gradation plots and the gradation specification for the different aggregate products are presented in Appendix D.

The granular materials from Areas A and B can be used as pit run Bridge End Fill and pit run Select Granular Sub Base.

Table 4
Gravel Suitability

Pit Run	Crushed
Bridge End Fill	Well Graded Base 25-75mm
Select Granular Sub-Base	Intermediate Graded Base 25-50mm
	Hot Asphalt Mixes
	Asphalt Base Course Mix
	Graded Aggregate Seals A-D

Materials from Area A can be used for the production of crushed products including bases, seal coats, and asphalt mixes.

5.0 Pit Development

All mining activities must be carried out in accordance with the Health, Safety and Reclamation Code for Mines in British Columbia, 2006. The Pit Development Plan must be followed as outlined in Figure 3. Also, when the pit has been depleted, the disturbed areas must be returned to productive land as soon as possible.

5.1 Development Considerations

5.1.1 Vegetation

Area A contains vegetation as both mature coniferous and deciduous trees that will require logging before granular removal takes place. Both areas will require clearing, grubbing and disposal which should be carried out according to Section 200 of the 2006 Standard Specifications for Highway Construction. All slash is to be burned according to the provisions of the Forest Act and Regulations, and the remaining ashes are to be mixed with the top soil for nutrient enrichment.

5.1.2 Topsoil and Overburden Stripping

Top Soil and Overburden must be stripped and stockpiled separately as shown on the development plan. Only six test pits contained overburden while all test pits had 0.05m thick topsoil. The overburden in each pit was sand with no gravel and some fines, and depths ranged from 0.65 – 2.45m.

5.1.3 Water Table

Water table was not encountered in any of the test pits. However, the gravel at the bottom of TP07-06 appeared wet indicating that the water table may be present at this location. If a water table is encountered during mining, the gravel removal should be at least 0.5m above the water table. If gravel extraction is to take place below the water table, the water will have to be drained. The water draining plan will have to be designed by a professional geoscientist/engineer in consultation with the environmental agencies.

5.1.4 Access

Access to the development area (Area A) can be gained by extending the existing pit face into the new area. The access to the pit is off Canyon Drive and via the pit access road located at the northwest corner of the existing reserve (Figure 3).

6.0 Gravel Extraction

Gravel extraction into Area A will be from the existing pit face located just north of Area A (Figure 3). The extraction is to be directed towards the south and then east. Crusher set up, staging and stockpiling can be located on the existing pit floor. No new pit face needs to be developed.

7.0 Pit Reclamation

Progressive pit reclamation of the disturbed and depleted areas must be carried out to return the areas to productive land, without interfering with future gravel extraction and pit development.

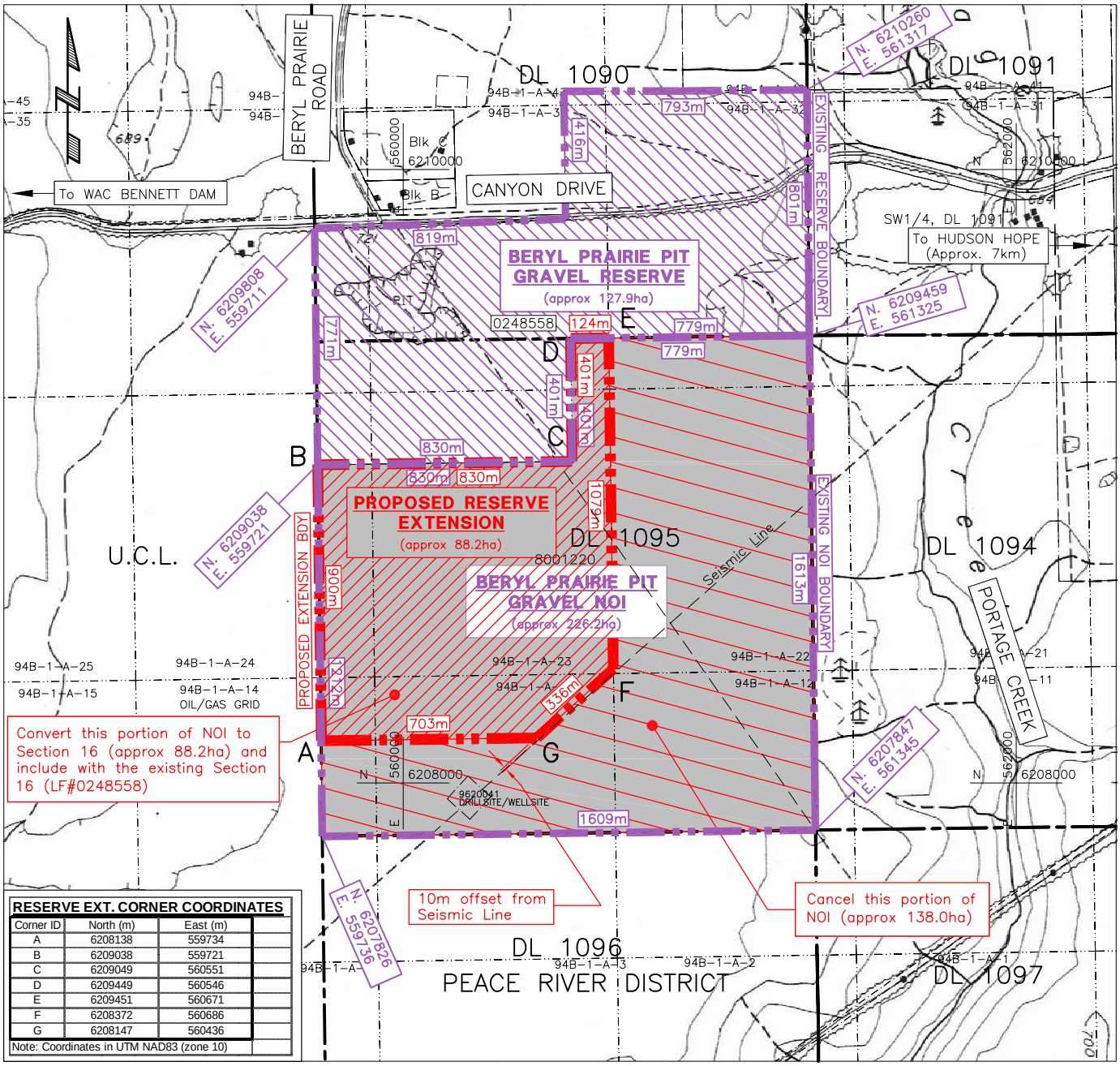
The minimum reclamation procedure should consist of:

i) Re-sloping of the pit face to no steeper than 2H:1V
ii) Spreading subsoil over the reclamation area. The subsoil should consist of silt or clay available from the overburden stockpiles.
iii) Spreading topsoil over the subsoil.
iv) Seeding the topsoil with appropriate vegetation.

A pit reclamation plan should be prepared and approved before proceeding with the reclamation.

Figure 1

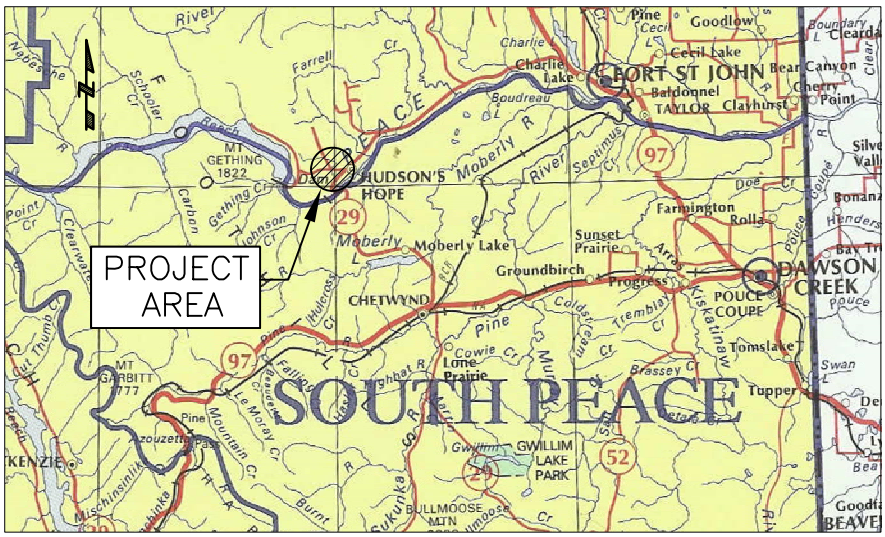
Location Map



RESERVE EXT. CORNER COORDINATES

Corner ID	North (m)	East (m)
A	6208138	559734
B	6209038	559721
C	6209049	560551
D	6209449	560546
E	6209451	560671
F	6208372	560686
G	6208147	560436

Note: Coordinates in UTM NAD83 (zone 10)



KEY MAP

Map No. – Hwy 1JV

Scale – 1:2,000,000

TRIM map: 94B.010

LEGEND

- denotes existing Gravel NOI
- denotes Proposed Reserve Ext within NOI
- denotes Cancel portion of NOI

Scale – 1:20,000

0 0.5km 1.0km

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Figure 1

LOCATION MAP (2008)

BERYL PRAIRIE PIT

PEACE HIGHWAY DISTRICT

Drawn: drb/SP	Date: Jan /08	Scale: As Shown
File No.: 94B/1-004		ACAD File: gravel/beryl cBery-lo08.dwg

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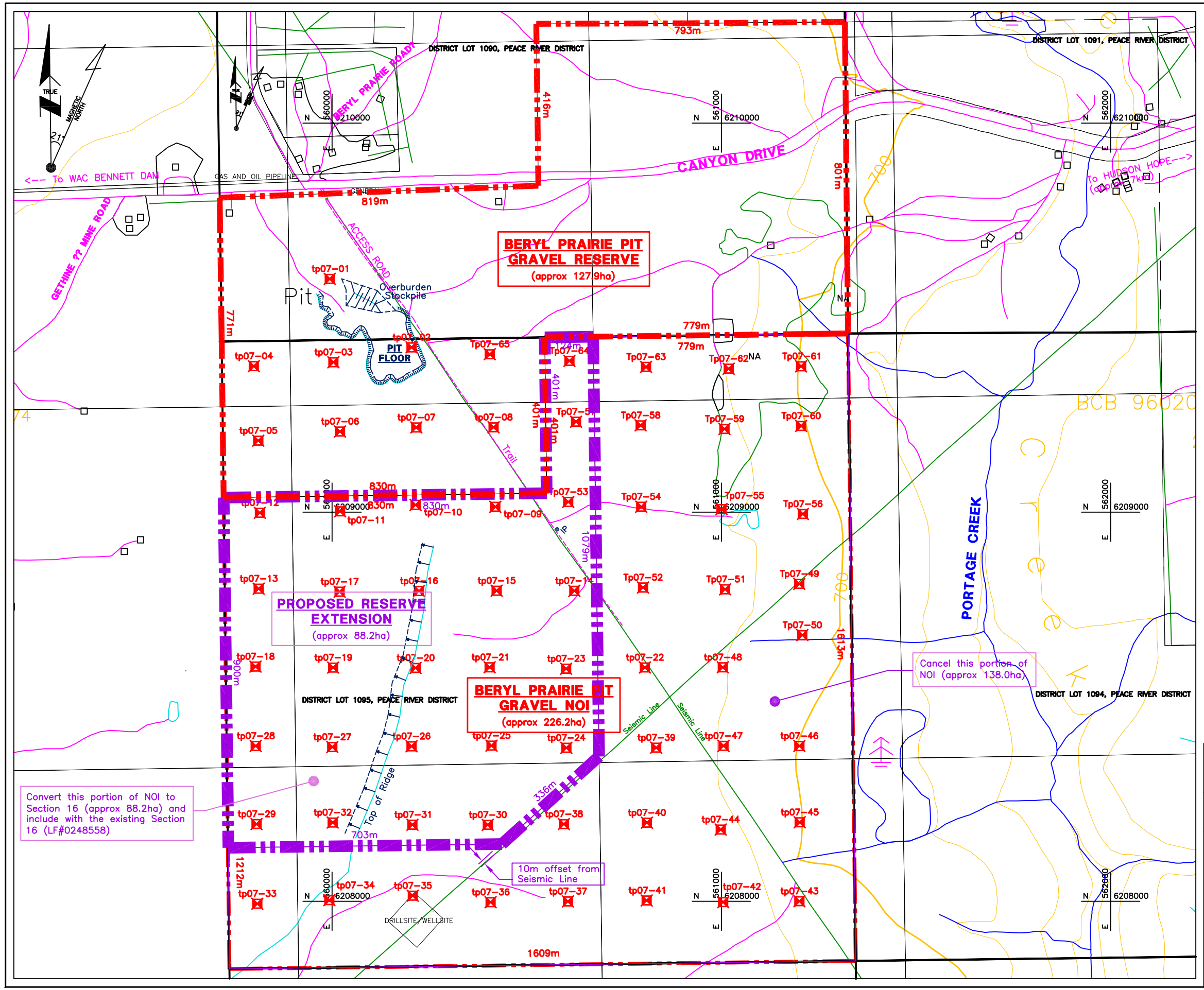
Figure 2

Pit Plan



PIT LEGEND

- NATURAL EMBANKMENT
- PIT FACE
- TEST PIT
- TEST HOLE
- PAVED ROAD
- GRAVEL ROAD
- TRAIL
- TREELINE
- DISTRICT LOT LINE
- MONUMENT
- IRON PIN
- SWAMP
- CREEK
- BUILDING (symbolic)
- FENCE
- SIGN POST
- UTILITY POLE
- GRAVEL RESERVE BOUNDARY
- Contour Line (100m interval)
- Contour Line (20m interval)

T.R.I.M. NOTE :

1) Contour Interval @ 20 metres
2) Base Map derived from
   T.R.I.M. Digital Map Data:
   –Map No.: 94B.010
   –Flown: TRIM2(~1996)
   –Datum/Zone: UTM NAD83(10)

LEGAL NOTE :

1) District Lot lines are derived from digital Crown Cadastral reference mapping supplied by CROWN LAND REGISTRY, Victoria

DRAWING NOTES:

1) Updated pit topography derived from MoT Geotech DGPS (Beryl.cor), surveyed Nov 2007.
2) 2007 testpit locations derived from MoT Geotech DGPS (Beryl nov*.cor), surveyed Nov 2007.
3) Testpits (Tp07–49 – Tp07–65) are approx location only.

Scale – 1:10,000

0m 250 500m

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Figure 2

PIT PLAN (2008)

(w/ Proposed Reserve Extension)

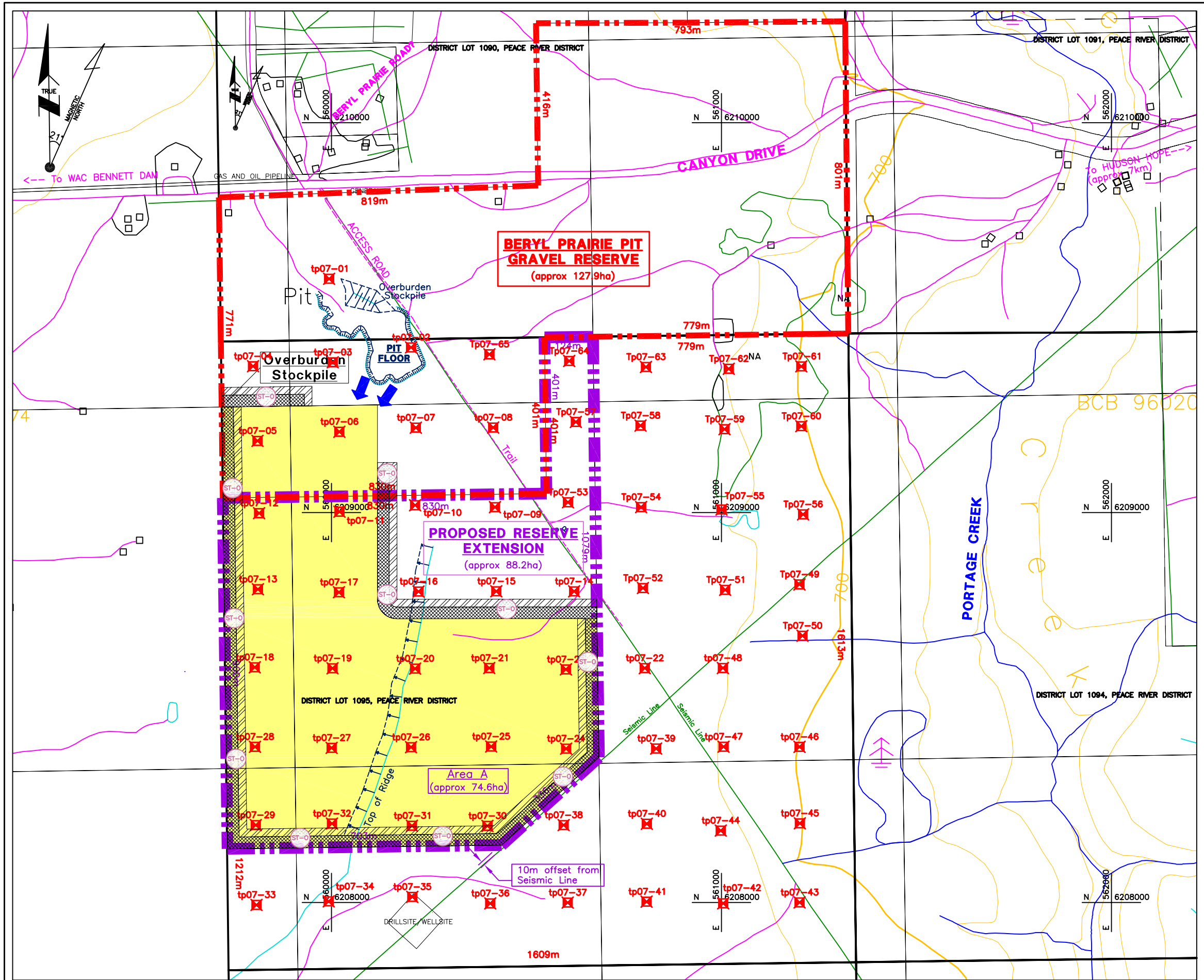
BERYL PRAIRIE PIT & NOI

PEACE HIGHWAY DISTRICT

Drawn: drb/SP	Date: Jan /08	Scale: As Shown
File No.: 94B/1–004		ACAD File: geotech\beryl Beryl pit plan.dwg

Figure 3

Proposed Development Plan



PIT LEGEND

NATURAL EMBANKMENT		SWAMP	
PIT FACE		CREEK	
TEST PIT		BUILDING (symbolic)	
TEST HOLE		FENCE	
PAVED ROAD		SIGN POST	
GRAVEL ROAD		UTILITY POLE	UP
TRAIL		GRAVEL RESERVE BOUNDARY	
TREELINE		Contour Line (100m interval)	800m
DISTRICT LOT LINE		Contour Line (20m interval)	
MONUMENT	Mon.	OVERBURDEN STOCKPILE	ST-O
IRON PIN	IP	DEVELOPMENT DIRECTION	

T.R.I.M. NOTE :

1) Contour Interval @ 20 metres
2) Base Map derived from
   T.R.I.M. Digital Map Data:
   –Map No.: 94B.010
   –Flown: TRIM2(~1996)
   –Datum/Zone: UTM NAD83(10)

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3) Testpits (Tp07–49 – Tp07–65) are approx location only.

Scale – 1:10,000

0m 250 500m

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Figure 3

PIT DEVELOPMENT PLAN (2008)

BERYL PRAIRIE PIT & EXTENSION

PEACE HIGHWAY DISTRICT

Drawn: drb&TW/SP	Date: Nov /07	Scale:	As Shown
File No.: 94B/1–005		ACAD File:	geotech\beryl development.dwg

Appendix A

Test Pit Summary

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS												
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-01	1	0.0	1.7	1.7	GW-GM	6	38	56	5	8		250														
		1.7	4.4	2.7	SP-SM	6	94																			
07-02		0.0	0.1	0.1	GW-GM	6	40	54	1	1		200														
		0.1	4.9	4.8	SP-SM	7	93																			
07-03		0.0	0.1	0.1	TS																					
		0.1	4.9	4.8	SP	2	98																			
		4.9	5.1	0.2	GW-GM	5	33	62	2			130														
07-04		0.0	0.1	0.1	TS																					
		0.1	5.0	4.9	SP	3	97																			
07-05		0.0	0.1	0.1	TS																					
		0.1	1.7	1.6	SP	2	98																			
	1	1.7	4.6	2.9	GW	3	40	57	8	9		230		GP-GM	6	28	66									
07-06		0.0	0.1	0.1	TS																					
	1	0.1	1.8	1.7	GP-GM	5	30	65	10	16		280														
	2	1.8	4.8	3.0	GW-GC	7	35	58	4	6		160		GP	4	18	78									
07-07		0.0	0.1	0.1	TS																					
		0.1	4.2	4.1	SP	3	97																			
07-08		0.0	0.1	0.1	TS																					
		0.1	5.1	5.0	SP	2	98																			
07-09		0.0	0.1	0.1	TS																					
	1	0.1	1.5	1.4	GW	4	41	55	6	3		180														
		1.5	1.8	0.3	CH	100																				
	1	1.8	4.8	3.0	GW	4	41	55	7	3		180														
07-10		0.0	0.1	0.1	TS																					
		0.1	4.7	4.6	SC1	15	85																			

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS												
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-11		0.0	0.1	0.1	TS																					
	1	0.1	3.8	3.7	GW-GC	8	40	52	6	9		250		GP	2	20	78									
07-12		0.0	0.1	0.1	TS																					
		0.1	0.7	0.6	SP	3	97																			
		0.7	1.4	0.7	GW	4	42	54	2			120														
		1.4	5.0	3.6	SP	3	87	10																		
07-13		0.0	0.1	0.1	TS																					
		0.1	1.7	1.6	GW-GM	10	40	50	8	12		260														
		1.7	4.5	2.8	SP-SM	5	73	22	5			100														
07-14		0.0	0.1	0.1	TS																					
		0.1	1.4	1.3	GW-GM	6	45	49	3	5		180														
		1.4	3.8	2.4	SP	2	85	13																		
07-15		0.0	0.1	0.1	TS																					
	1	0.1	4.8	4.7	GW	3	45	52	3	3		180														
07-16		0.0	0.1	0.1	TS																					
		0.1	2.9	2.8	SP	4	96																			
		2.9	4.3	1.4	GW	4	45	51	4	4		170														
		4.3	5.3	1.0	SP	4	83	13																		
07-17		0.0	0.1	0.1	TS																					
	1	0.1	4.4	4.3	GW	5	35	60	10	12		280		GP	4	15	81				54	6				
07-18		0.0	0.1	0.1	TS																					
	1	0.1	2.3	2.2	GW	4	40	56	3	2		160		GP	2	35	63									
		2.3	2.7	0.4	SP	2	98																			
	2	2.7	4.7	2.0	GW	3	40	57	9	16		280														
07-19		0.0	0.1	0.1	TS																					
	1	0.1	3.5	3.4	GW	3	37	60	7	8		200		GP	3	23	74									

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS													
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-20		0.0	0.1	0.1	TS																						
	1	0.1	4.4	4.3	GW	4	40	56	6	9		230		GP	3	24	73									2.63/2.62	1.1/1.4
07-21		0.0	0.1	0.1	TS																						
		0.1	2.5	2.4	SP	4	96																				
	1	2.5	5.0	2.5	SW	3	50	47	3	2		190															
		5.0	5.2	0.2	GW-GM	5	38	57	3	2		170															
07-22		0.0	0.1	0.1	TS																						
		0.1	4.4	4.3	SP	1	99																				
07-23		0.0	0.1	0.1	TS																						
		0.1	1.5	1.4	SP	3	97																				
	1	1.5	2.9	1.4	GW	3	40	57	5			150		GP	1	30	69										
		2.9	4.8	1.9	SP	2	78	20																			
07-24		0.0	0.1	0.1	TS																						
	1	0.1	2.8	2.7	GW	4	40	56	4	5		170															
		2.8	4.3	1.5	SP	2	86	12																			
07-25		0.0	0.1	0.1	TS																						
	1	0.1	4.2	4.1	GW	4	40	56	7	6		200		GP	2	22	76									2.65/2.63	1.0/1.3
07-26		0.0	0.1	0.1	TS																						
	1	0.1	5.2	5.1	GW	4	35	61	8	12		220		GP	2	19	79				71	5					
07-27		0.0	0.1	0.1	TS																						
		0.1	2.3	2.2	SP	2	98																				
	1	2.3	4.0	1.7	GP	4	25	71	7	2		170		GP	4	13	83										
07-28		0.0	0.1	0.1	TS																						
	1	0.1	5.5	5.4	GP	4	28	68	8			150															

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS												
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-29		0.0	0.1	0.1	TS																					
	1	0.1	5.1	5.0	GW	4	31	65	5	7		200														
07-30		0.0	0.1	0.1	TS																					
	1	0.1	2.3	2.2	GW	4	45	51	4	3		170														
	2	2.3	4.5	2.2	GW	2	40	58	4			150														
07-31		0.0	0.1	0.1	TS																					
		0.1	1.5	1.4	GW	4	46	50	7			150														
	1	1.5	4.3	2.8	GW	2	43	55	5	3		170														
07-32		0.0	0.1	0.1	TS																					
		0.1	0.8	0.7	SP-SM	6	94																			
	1	0.8	3.5	2.7	GW-GM	5	40	55	6	5		200		GP-GM	6	21	73									
07-33		0.0	0.1	0.1	TS																					
		0.1	4.7	4.6	SP-SC	12	88																			
		4.7	5.0	0.3	CH	100																				
07-34		0.0	0.1	0.1	TS																					
		0.1	1.7	1.6	SP	4	96																			
		1.7	2.1	0.4	GW	3	40	57	6			150														
		2.1	3.8	1.7	SP	3	97																			
		3.8	5.3	1.5	SP	3	75	22	18	7		220														
07-35		0.0	0.1	0.1	TS																					
		0.1	0.8	0.7	SP	4	96																			
		0.8	1.3	0.5	SP	4	73	23																		
		1.3	5.2	3.9	SP	4	77	20	2			100														
07-36		0.0	0.1	0.1	TS																					
		0.1	5.3	5.2	SP	1	99																			

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS													
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-37		0.0	0.1	0.1	TS																						
		0.1	1.3	1.2	SP	2	98																				
	1	1.3	4.7	3.4	GW	3	42	55	3	3		180															
07-38		0.0	0.1	0.1	TS																						
		0.1	1.0	0.9	GW	3	40	57	3			130															
		1.0	5.5	4.5	SP	2	98																				
07-39		0.0	0.1	0.1	TS																						
		0.1	5.6	5.5	SP	4	96																				
07-40		0.0	0.1	0.1	TS																						
		0.1	4.2	4.1	SP	3	97																				
07-41		0.0	0.1	0.1	TS																						
		0.1	5.2	5.1	SP	3	96	1																			
07-42		0.0	0.1	0.1	TS																						
		0.1	4.1	4.0	SP	4	96																				
07-43		0.0	0.1	0.1	TS																						
		0.1	4.4	4.3	SP	2	98																				
07-44		0.0	0.1	0.1	TS																						
		0.1	4.7	4.6	SP	4	96																				
07-45		0.0	0.1	0.1	TS																						
		0.1	4.8	4.7	SP-SM	5	95																				
07-46		0.0	0.1	0.1	TS																						
		0.1	5.9	5.8	SP-SM	5	95																				
07-47		0.0	0.1	0.1	TS																						
		0.1	5.3	5.2	SP	2	98																				

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS												
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-48		0.0	0.1	0.1	TS																					
	1	0.1	5.2	5.1	SP	4	96																			
07-49		0.0	0.1	0.1	TS																					
		0.1	5.2	5.1	SP	4	96																			
07-50		0.0	0.1	0.1	TS																					
		0.1	5.0	4.9	SP	2	98																			
07-51		0.0	0.1	0.1	TS																					
		0.1	5.1	5.0	SP	3	97																			
07-52		0.0	0.1	0.1	TS																					
		0.1	0.7	0.6	GW	3	45	52																		
		0.7	3.0	2.3	SP	2	98																			
		3.0	5.1	2.1	SP	2	83	15																		
07-53		0.0	0.1	0.1	TS																					
		0.1	1.0	0.9	GW	4	40	56	3			130														
		1.0	2.1	1.1	SP	4	96																			
		2.1	3.6	1.5	ML	97	3																			
	1	3.6	5.0	1.4	GW-GM	6	40	54	4			130														
07-54		0.0	0.1	0.1	TS																					
		0.1	4.0	3.9	SP	2	98																			
07-55		0.0	0.1	0.1	TS																					
		0.1	4.8	4.7	SP	3	97																			
07-56		0.0	0.1	0.1	TS																					
		0.1	5.2	5.1	SP	4	96																			

TEST PIT SUMMARY

PROJECT	BERYL PRAIRIE PIT AND NOI	**TEST METHOD**	TRACKED EXCAVATOR
DISTRICT	PEACE	**DATE**	NOVEMBER 20-23 AND 27-30, 2007

TEST PIT NUMBER	SAMPLE NUMBER	DEPTH (m)		LAYER THICKNESS (m)	FIELD VISUAL IDENTIFICATION									LABORATORY TEST RESULTS													
									OVERSIZE					PIT RUN				CRUSH			DURABILITY						
		From	To		SOIL CLASSIFICATION	FINES	SAND	GRAVEL	75-150mm (%)	150-300mm (%)	>300mm (%)	MAX SIZE (mm)	WATERTABLE (m)	SOIL CLASSIFICATION	FINES	SAND	GRAVEL	FINES	SAND	GRAVEL	SAND EQUIVALENT	MICRO DEVAL	DEGRADE	MgSO4 %coarse/ %fine	FRACTURE A/B	B.R.D coarse/fines	ABSORPTION %coarse/%fines
07-57		0.0	0.1	0.1	TS																						
		0.1	0.8	0.7	SP-SM	8	92																				
		0.8	1.0	0.2	GW-GM	7	40	53																			
		1.0	2.2	1.2	SW	4	61	35																			
	1	2.2	4.3	2.1	GW	3	42	55	5			150															
07-58		0.0	0.1	0.1	TS																						
		0.1	2.3	2.2	SP	4	96																				
	1	2.3	4.8	2.5	GW	3	37	60	6			150															
07-59		0.0	0.1	0.1	TS																						
		0.1	4.1	4.0	SP	2	98																				
07-60		0.0	0.1	0.1	TS																						
		0.1	4.9	4.8	SP	2	98																				
07-61		0.0	0.1	0.1	TS																						
		0.1	5.2	5.1	SP	3	97																				
07-62		0.0	0.1	0.1	TS																						
		0.1	5.0	4.9	SP	2	98																				
07-63		0.0	0.1	0.1	TS																						
		0.1	5.1	5.0	SP	4	96																				
07-64		0.0	0.1	0.1	TS																						
		0.1	5.3	5.2	SP	3	97																				
07-65		0.0	0.1	0.1	TS																						
		0.1	0.9	0.8	SP	2	98																				
	1	0.9	3.6	2.7	GW	3	37	60	7	5		180															
		3.6	4.1	0.5	SP	3	82	15																			
		4.1	4.9	0.8	GW	3	45	52	2			130															

Appendix B

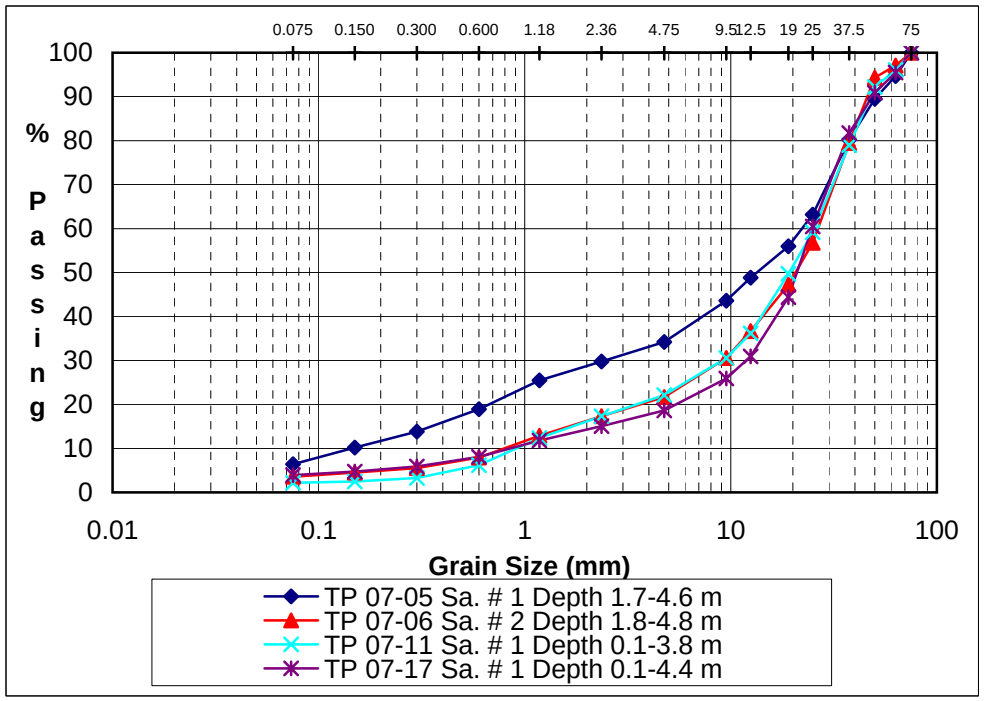
Pit Run Gradation Summary and Plots

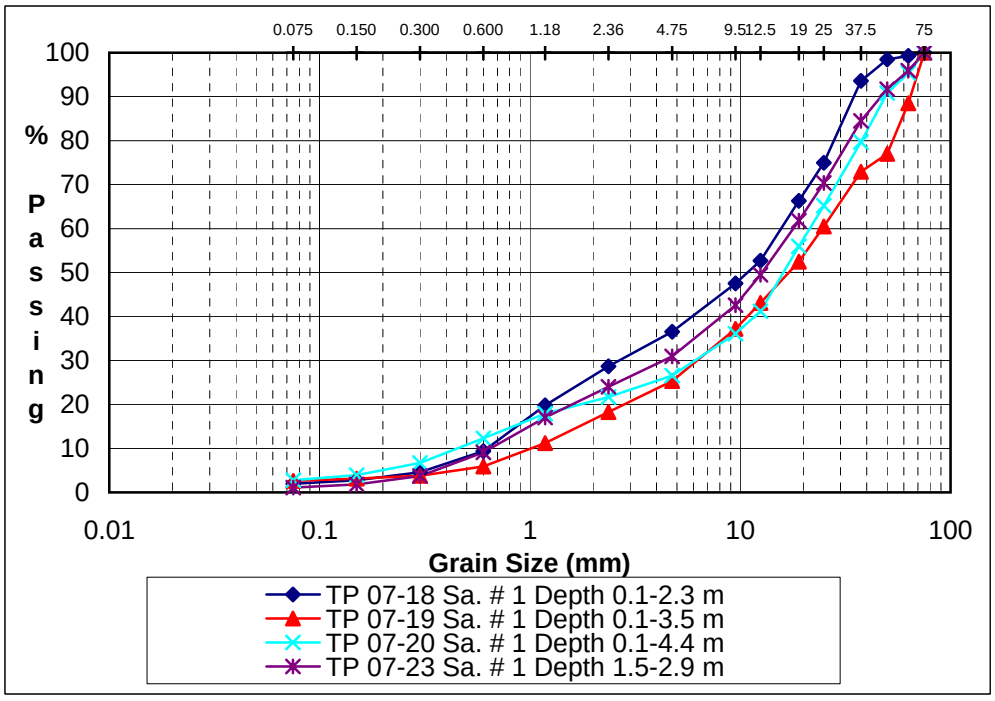
Laboratory Pit Run Gradation Results

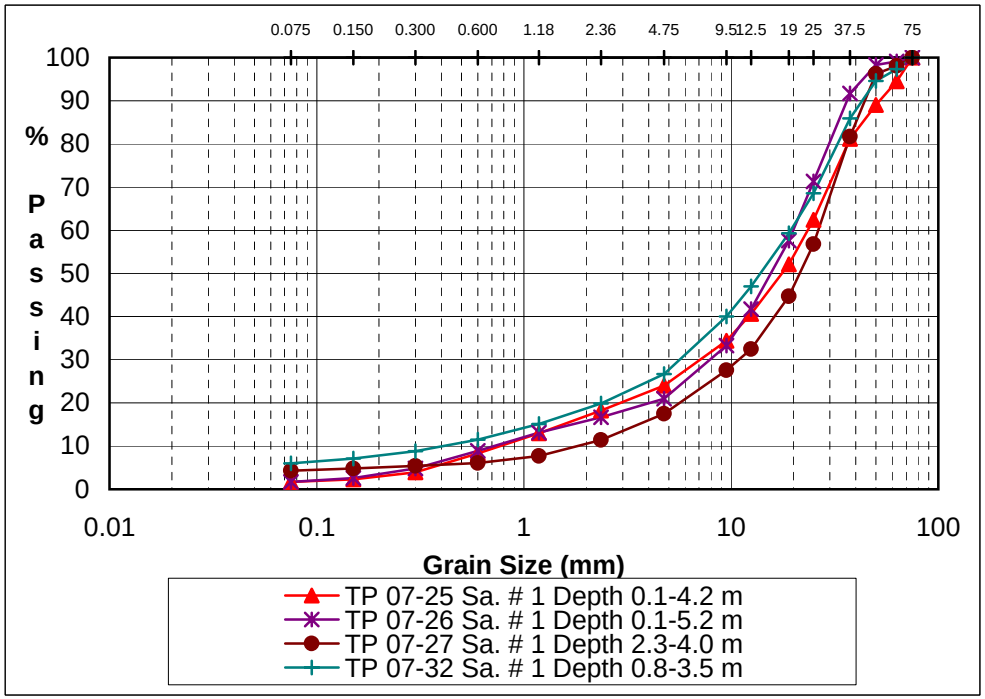
Area	Test Pit TP07- #	Depth		Fines (%) (<0.075 mm)	Sand (%) (0.075 - 4.75mm)	Gravel		USC
		From	To			Fine (4.75 - 25mm)	Coarse (25-75mm)	
A	5	1.7	4.6	6.4	27.8	29.0	36.8	GP-GM
	6	1.8	4.8	3.6	18.1	35.1	43.2	GP
	11	0.1	3.8	2.2	19.9	37.1	40.8	GP
	17	0.1	4.4	3.9	14.7	41.9	39.5	GP
	18	0.1	2.3	2.0	34.5	38.5	25.0	GW
	19	0.1	3.5	2.6	22.7	35.2	39.5	GP
	20	0.1	4.4	2.8	23.8	38.6	34.8	GP
	23	1.5	2.9	1.1	29.8	39.5	29.6	GP
	25	0.1	4.2	1.7	22.3	38.4	37.6	GP
	26	0.1	5.2	1.7	19.3	50.3	28.7	GP
	27	2.3	4.0	4.3	13.2	39.3	43.2	GP
	32	0.8	3.5	6.0	20.7	41.9	31.4	GP-GM
Mean				**3.2**	**22.2**	**38.7**	**35.8**	**GP**

Laboratory Pit Run Gradation Results Corrected to Include Oversized Estimates

Area	Test Pit TP07- #	Fines (%) (<0.075 mm)	Sand (%) (0.075 - 4.75mm)	Gravel		Estimated Small Boulders (%) (75-300mm)	Estimated Large Boulders (%) (>300mm)	Max Size (mm)
				Fines (%) (<0.075 mm)	Coarse (%) (0.075 - 4.75mm)			
A	5	5.3	23.1	24.1	30.5	17.0		230
	6	3.2	16.3	31.6	38.9	10.0		160
	11	1.9	16.9	31.5	34.7	15.0		250
	17	3.0	11.5	32.7	30.8	22.0		280
	18	1.9	32.8	36.6	23.8	5.0		160
	19	2.2	19.3	29.9	33.6	15.0		200
	20	2.4	20.2	32.8	29.6	15.0		230
	23	1.0	28.3	37.5	28.1	5.0		150
	25	1.5	19.4	33.4	32.7	13.0		200
	26	1.4	15.4	40.2	23.0	20.0		220
	27	3.9	12.0	35.8	39.3	9.0		170
	32	5.3	18.4	37.3	27.9	11.0		200
Mean		**2.8**	**19.5**	**33.6**	**31.1**	**13.1**	**0.0**	


0.075 0.150 0.300 0.600 1.18 2.36 4.75 9.5 12.5 19 25 37.5 75
100 90 80 70 60 50 40 30 20 10 0
% Passing
0.01 0.1 1 10 100
Grain Size (mm)
TP 07-05 Sa. # 1 Depth 1.7-4.6 m
TP 07-06 Sa. # 2 Depth 1.8-4.8 m
TP 07-11 Sa. # 1 Depth 0.1-3.8 m
TP 07-17 Sa. # 1 Depth 0.1-4.4 m


0.075 0.150 0.300 0.600 1.18 2.36 4.75 9.5 12.5 19 25 37.5 75
100 90 80 70 60 50 40 30 20 10 0
% Passing
0.01 0.1 1 10 100
Grain Size (mm)
TP 07-18 Sa. # 1 Depth 0.1-2.3 m
TP 07-19 Sa. # 1 Depth 0.1-3.5 m
TP 07-20 Sa. # 1 Depth 0.1-4.4 m
TP 07-23 Sa. # 1 Depth 1.5-2.9 m


0.075 0.150 0.300 0.600 1.18 2.36 4.75 9.5 12.5 19 25 37.5 75
100 90 80 70 60 50 40 30 20 10 0
% Passing
0.01 0.1 1 10 100
Grain Size (mm)
TP 07-25 Sa. # 1 Depth 0.1-4.2 m
TP 07-26 Sa. # 1 Depth 0.1-5.2 m
TP 07-27 Sa. # 1 Depth 2.3-4.0 m
TP 07-32 Sa. # 1 Depth 0.8-3.5 m

Appendix C

Selected Photographs of Pit Run Material

Photo # 1. Pit Run Materials – TP07-06

Photo # 2. Pit Run Materials – TP07-11

Photo # 3. Pit Run Materials – TP07-17

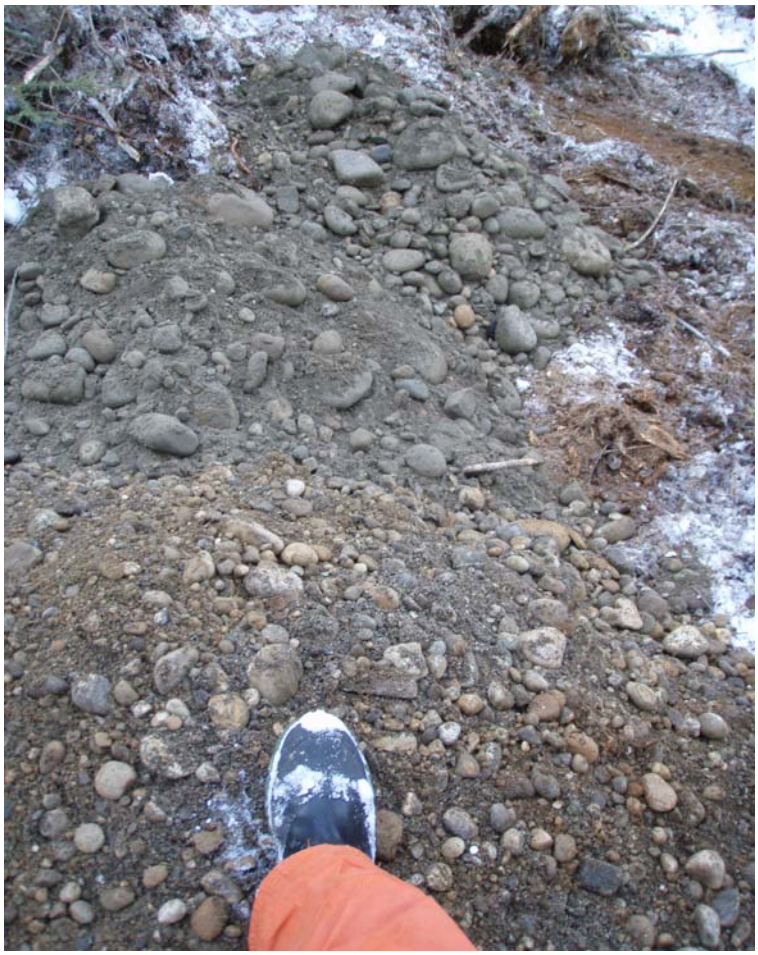


Photo # 4. Pit Run Materials – TP07-18

Photo # 5. Pit Run Materials – TP07-19

Photo # 6. Pit Run Materials – TP07-20

Photo # 7. Pit Run Materials – TP07-21

Photo # 8. Pit Run Materials – TP07-23

Photo # 9. Pit Run Materials – TP07-24

Photo # 10. Pit Run Materials – TP07-25

Photo # 11. Pit Run Materials – TP07-26

Photo # 12. Pit Run Materials – TP07-27

Photo # 13. Pit Run Materials – TP07-28

Photo # 14. Pit Run Materials – TP07-29

Photo # 15. Pit Run Materials – TP07-30

Photo # 16. Pit Run Materials – TP07-31

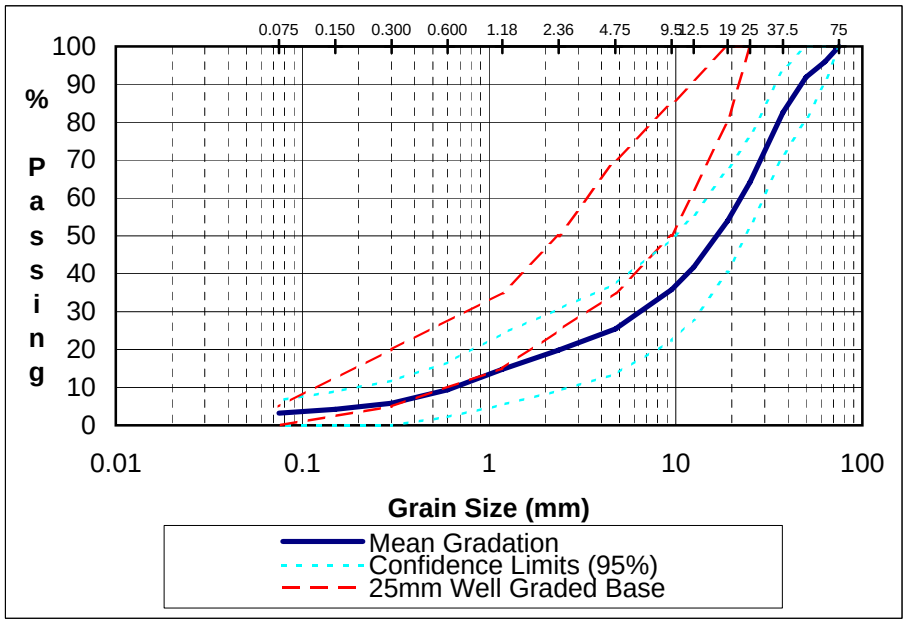
Appendix D

Pit Run and Material Specification Gradations

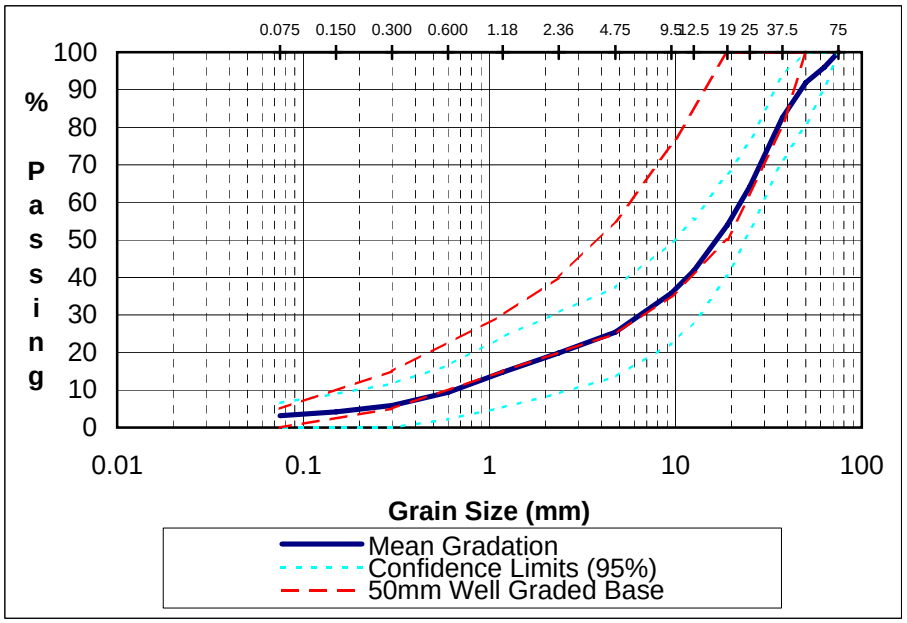
Sample Information							Sieve Sizes (mm) Percent Passing													
Test Pit #	Sample #	Depth (m)	USC	GRAVEL %	SAND %	FINES %	75	63	50	37.5	25	19	12.5	9.5	4.75	2.36	1.18	0.6	0.3	0.15	0.08
07-05	1	1.7-4.6	GW	66	28	6	100	89.5	80.2	63.2	56.0	48.8	43.6	34.2	29.8	25.5	18.9	13.8	10.2	6.4	6.4
07-06	2	1.8-4.8	GP	78	18	4	100	97.1	94.3	79.5	56.8	47.2	36.7	30.6	21.7	17.3	12.9	7.9	5.5	4.5	3.6
07-11	1	0.1-3.8	GP	78	20	2	100	96.1	92.2	79.0	59.2	49.7	36.2	30.6	22.1	17.3	12.4	6.2	3.3	2.5	2.2
07-17	1	0.1-4.4	GP	81	15	4	100	95.5	90.9	81.7	60.5	44.4	30.9	25.9	18.6	15.1	11.8	8.1	5.9	4.7	3.9
07-18	1	0.1-2.3	GP	64	35	2	100	99.3	98.5	93.6	75.0	66.3	52.7	47.5	36.5	28.7	19.8	9.4	4.6	2.8	2.0
07-19	1	0.1-3.5	GW	75	23	3	100	88.5	77.0	72.9	60.5	52.5	43.1	37.2	25.3	18.3	11.2	5.9	3.8	3.1	2.6
07-20	1	0.1-4.4	GP	73	24	3	100	95.4	90.8	79.7	65.2	56.0	41.2	36.1	26.6	21.7	17.9	12.3	6.7	3.9	2.8
07-23	1	1.5-2.9	GW	69	30	1	100	95.9	91.7	84.5	70.4	61.8	49.5	42.6	30.9	24.0	17.0	9.1	3.7	1.8	1.1
07-25	1	0.1-4.2	GW	76	22	2	100	94.5	89.0	81.2	62.4	52.1	40.6	34.4	24.0	18.2	13.0	8.3	3.9	2.3	1.7
07-26	1	0.1-5.2	GP	79	19	2	100	99.1	98.3	91.7	71.3	57.6	41.7	33.3	21.0	16.7	13.1	8.9	4.8	2.6	1.7
07-27	1	2.3-4.0	GW	83	13	4	100	98.1	96.2	81.7	56.8	44.7	32.5	27.6	17.5	11.4	7.7	6.1	5.4	4.8	4.3
07-32	1	0.8-3.5	GP-GM	73	21	6	100	97.3	94.6	85.9	68.6	59.3	47.0	40.0	26.7	19.9	15.1	11.5	8.8	7.1	6.0
MAX				83	35	6	100	99.3	98.5	93.6	75.0	66.3	52.7	47.5	36.5	29.8	25.5	18.9	13.8	10.2	6.4
MIN				64	13	1	100	88.5	77.0	72.9	56.8	44.4	30.9	25.9	17.5	11.4	7.7	5.9	3.3	1.8	1.1
MEAN			GW	75	22	3	100	96.0	91.9	82.6	64.2	54.0	41.7	35.8	25.4	19.9	14.8	9.4	5.9	4.2	3.2

BASE COURSE AGGREGATE-
WELL GRADED

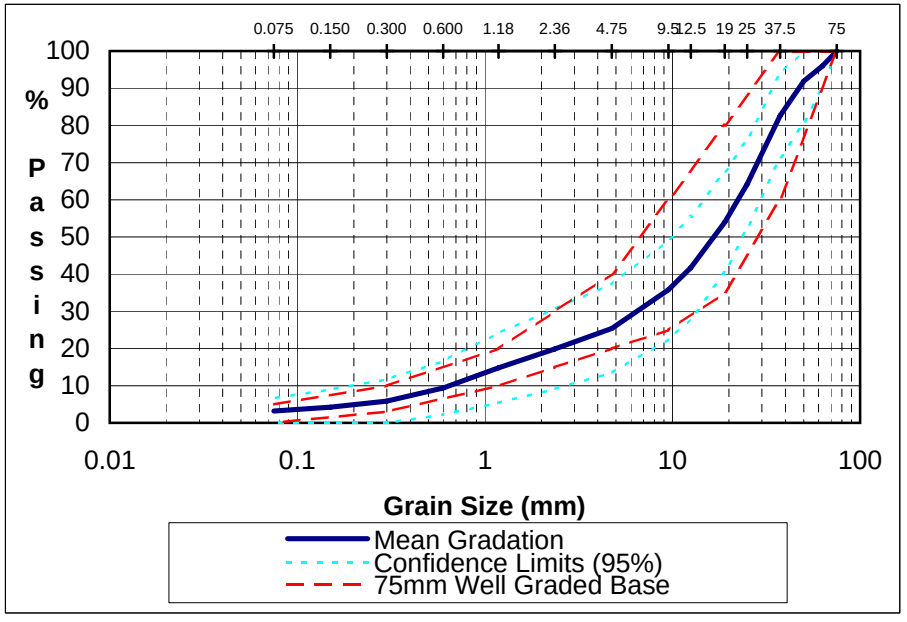
25mm



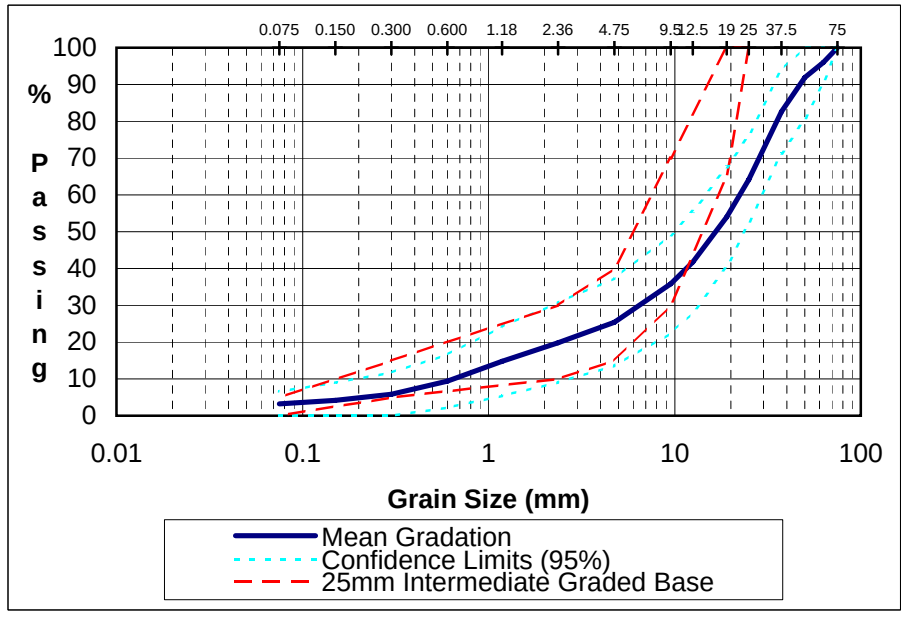
50mm



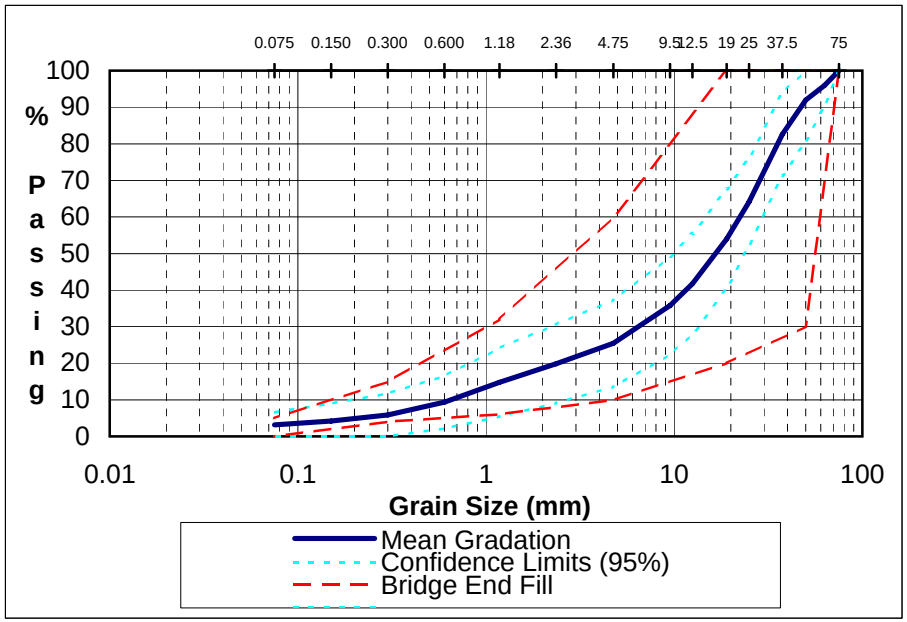
75mm



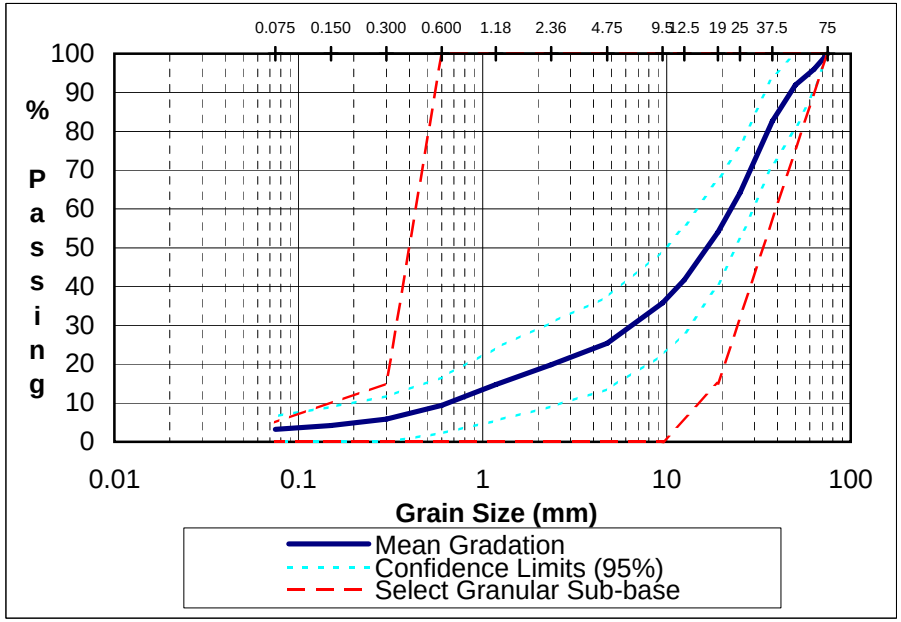
BASE COURSE AGGREGATE-
INTERMEDIATE GRADE 25mm



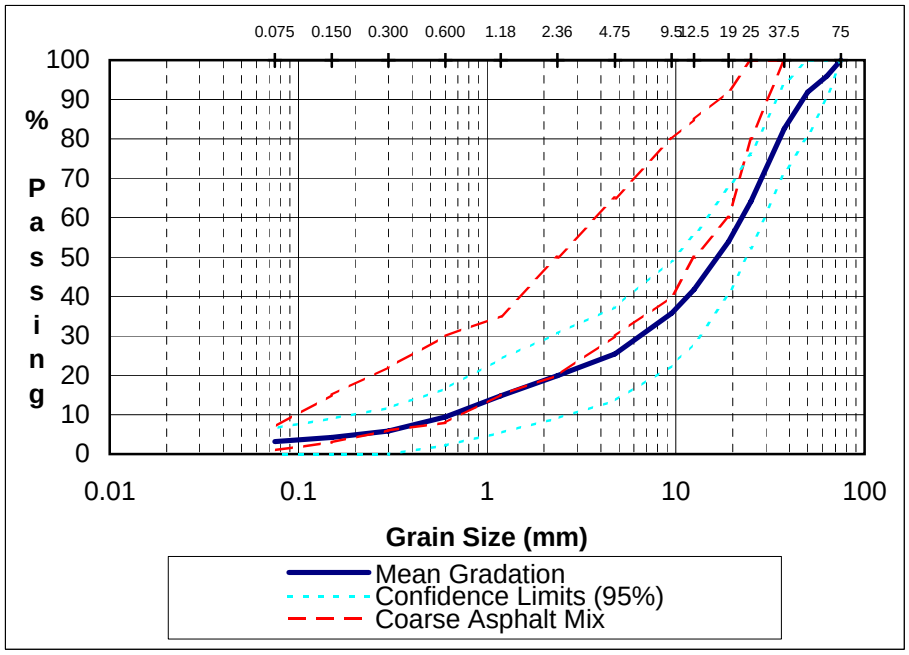
REQUIREMENTS FOR EMBANKMENT MATERIAL
BRIDGE END FILL

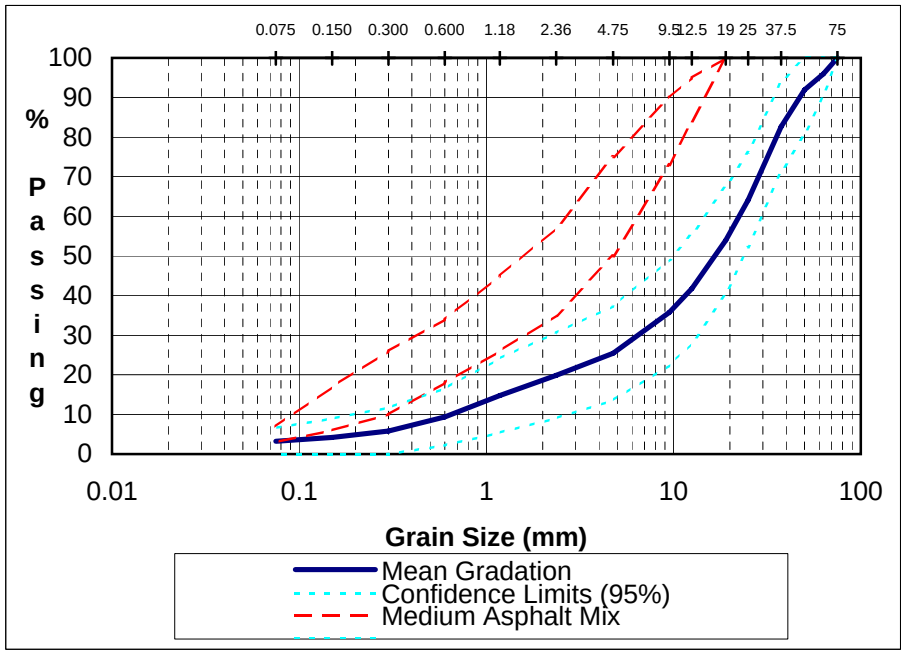


REQUIREMENTS FOR SELECT
GRANULAR SUB-BASE



GRADATION LIMITS FOR AGGREGATES
HOT MIXED ASPHALT PAVEMENT





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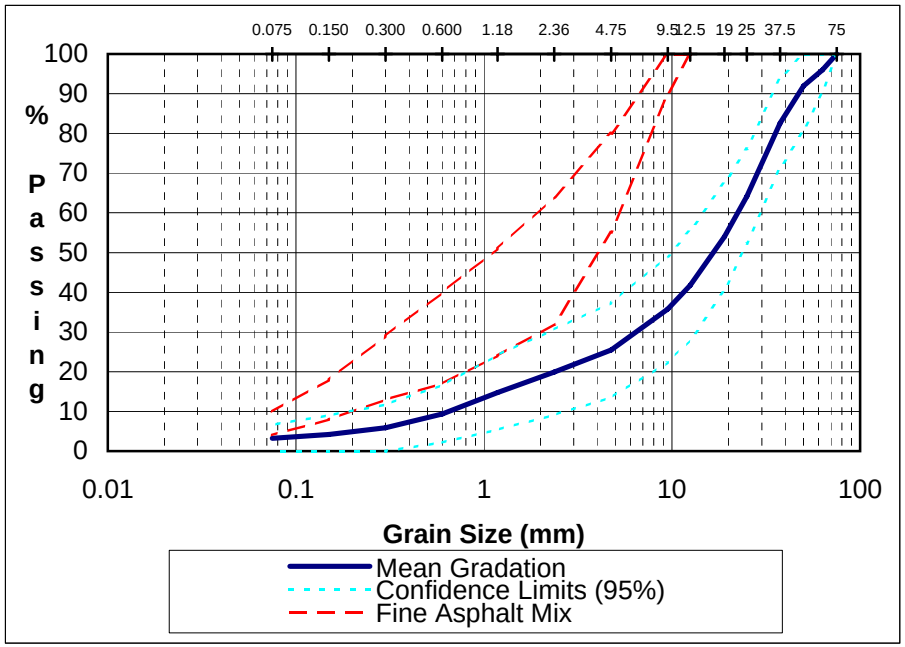
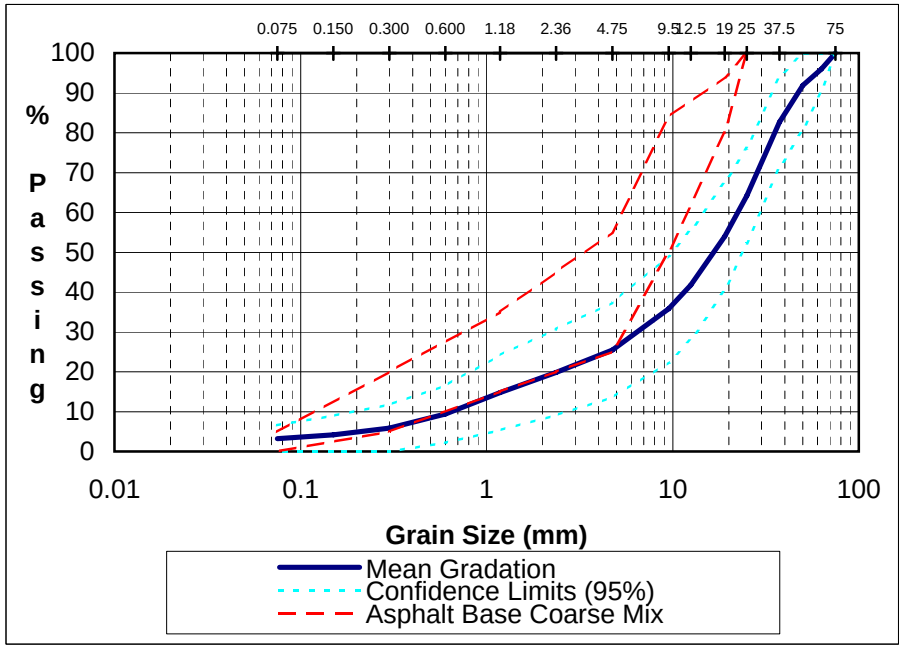
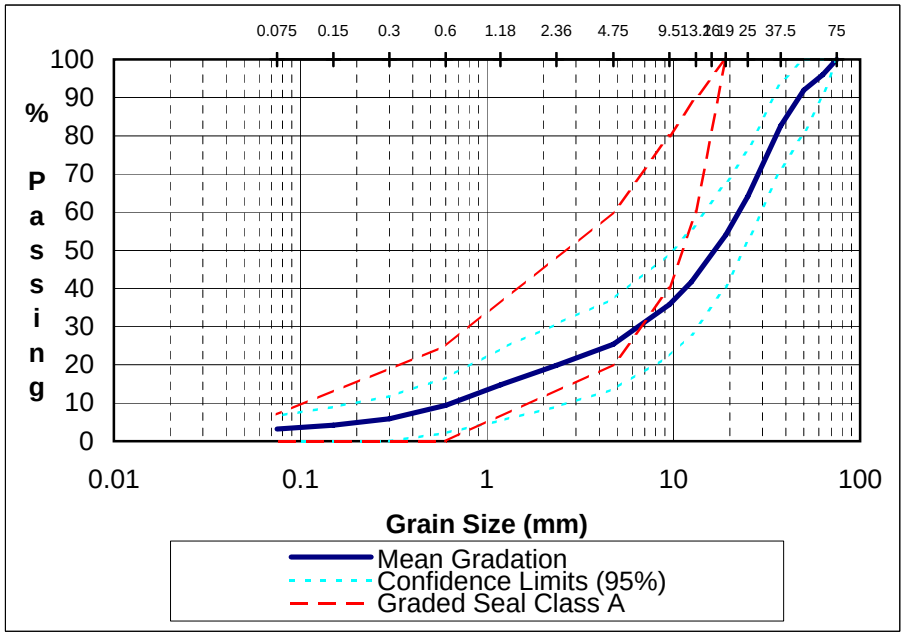


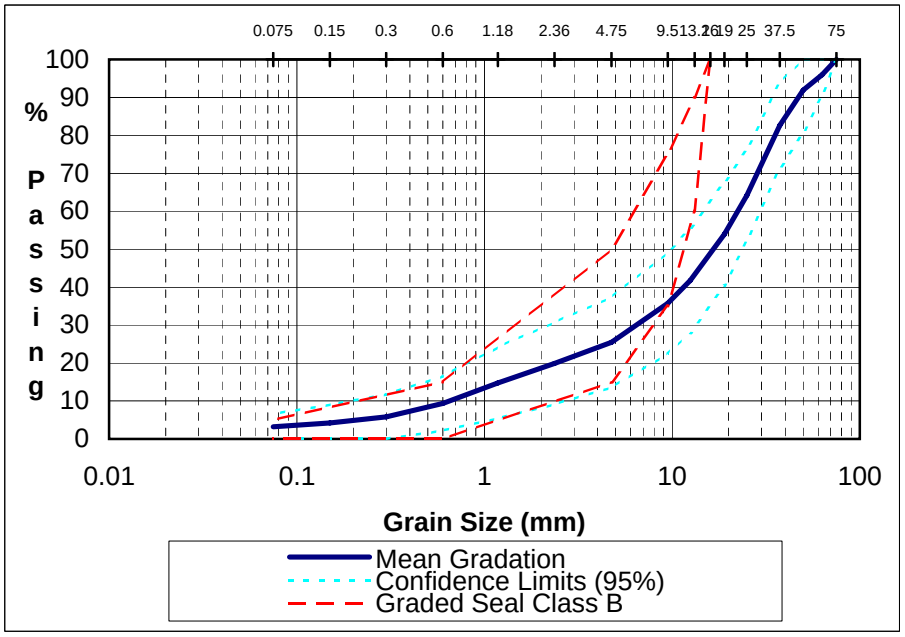


GRADATION LIMITS FOR GRADED AGGREGATE SEAL

A

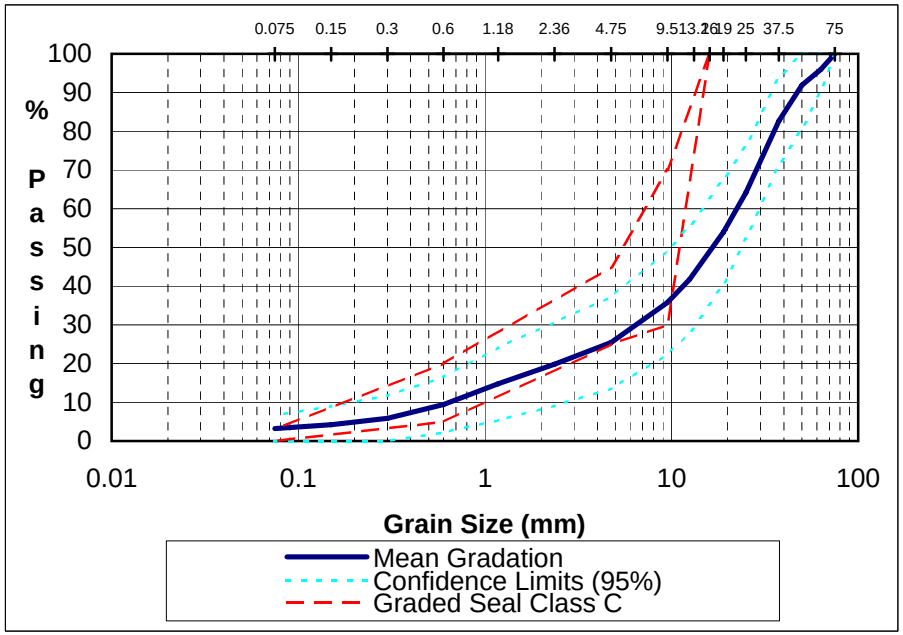


B

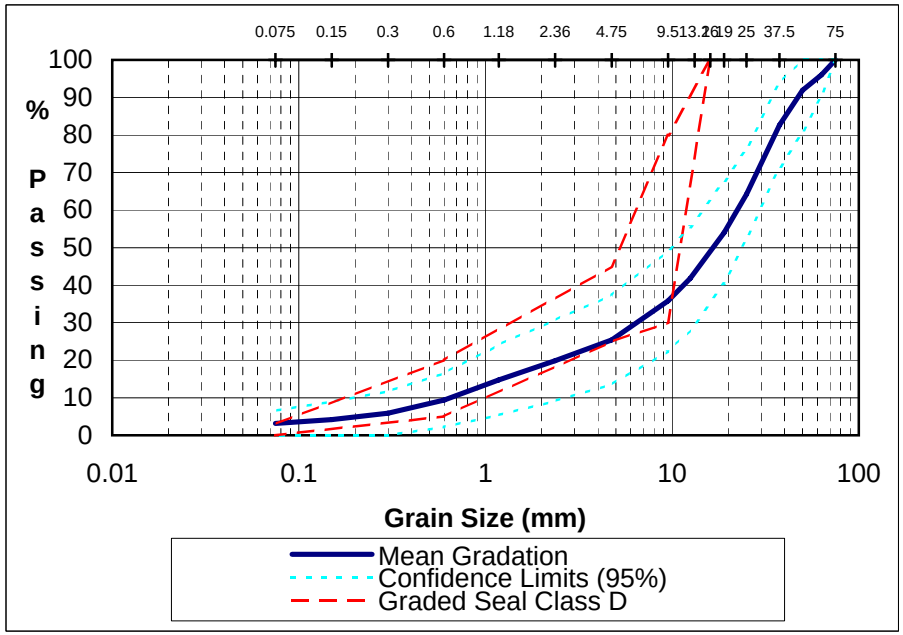


GRADATION LIMITS FOR GRADED
AGGREGATE SEAL - Continued

C



D



GRADATION REQUIREMENTS FOR
AGGREGATE (Asphalt Mix)