

## **Waitabit Pit #1103**

### **2023 Technical Information Report**



**Image 1:** Oblique aerial view of Waitabit Pit map reserve (red) upslope of Waitabit Creek near Donald, B.C.

### **INTRODUCTION:**

Sitkum Consulting Ltd. (SCL) was requested by the Ministry of Transportation & Infrastructure (MoTI) to re-evaluate Waitabit Pit as an ongoing suitable source of maintenance, construction, and paving aggregates for long term use along TransCanada Highway 1.

Waitabit Pit has been investigated in the past for potential suitability of various materials, including in 1999, 2009, 2013, and most recently in 2022 and 2023. It has been extensively used by MoTI for paving, maintenance & construction purposes. As a result of the extensive glaciofluvial terrace on which the map reserve is situated, there is significant opportunity to expand and investigate beyond the tested areas. Based on the 2022 and 2023 investigations, SCL has presented the feasibility of expanding the existing pit to the northeast for further development of viable aggregate, as well as presented two smaller areas within the existing pit floor for designated PAG.

**LOCATION:**

Waitabit Pit is located approximately 29 km north of Golden, B.C. (as the crow flies) near the community of Donald. Access is off Highway 1, Donald Road or Big Bend Highway, then Log Dump Road (aka Bush FSR); refer to Figures 1 and 2. Mapsheet no. 82N.055.

Geographic position: Latitude 51/502006 N / Longitude -117.179631W

UTM Zone11: 487456.78 m E / 5705833.27 m N

**LEGAL DESCRIPTION:**

The map reserve covers those portions of Sections 21 and 28 and that part of Legal Subdivision 14 of Section 21, Township 29, Range 23, West of the Fifth Meridian, together with that part of Section 28, Township 29, Range 23, West of the Fifth Meridian, and all un-surveyed Crown Land, Kootenay District for an area of +/- 35.35 ha. Lands File no. 0228188.

**RESULTS:**

A total of 41 samples from 35 test pits across the map reserve were submitted for laboratory analysis following the November 2022 field investigation by SCL. Field sampling and laboratory analysis indicate more than half of the area tested is suitable for further development; as a result, one suitability area is suggested (Area A). For sake of area and volume calculations, the suitability area includes Test Pits 22-01, -02, -03, -04, -05, -11, -12, -13, -14, -15, -16.

A further 10 test pits were dug in the central part of the map reserve in August 2023 by MoTI; samples from these test pits were put through laboratory testing and helped delineate a blending area described below.

Refer to the updated Pit Development Plan (Figure 2), Field Logs, and Laboratory Results in the Appendices.

## SUITABILITY AREA A

**Test Pits 22-01, -02, -03, -04, -05, -11, -12, -13, -14, -15, -16**

**GRADATION** - Suitability Area A is considered the northeastern portion of the map reserve that has been harvested (including the 'LP Golden Cutblock'). The average and range of gradations for samples obtained from the suitability area identified from the selected 2022 Test Pits are as follows:

### Laboratory Samples:

Classification	Average (%)	Range (%)
Gravel (4.75-75mm)	63	54 to 72
Sand (0.075-4.75mm)	32.5	25.5 to 43
Fines (<0.075mm)	4.6	2.2 to 11

### Oversize Field Estimates:

Classification	Average (%)	Range (%)
Boulders (>375 mm)	0	0
Cobbles (150-375 mm)	0.9	0-2
Cobbles (75-150 mm)	2.7	1-3

The maximum size rock was 320 mm (in TP 22-14). Due to the low percentage of oversized observed, a primary crusher is not expected to be needed during development.

### Aggregate Quality – Suitability Area A:

Quality laboratory tests were performed on an average sample(s) from test pits within the suitability area. A summary of aggregate quality tests performed on samples obtained from within the suitability area are as follows:

TEST	AVERAGE	RANGE
Micro-Deval (combined) (% loss)	18.7	18.1 to 19.2
Sand Equivalent	61.2	43.2 to 72.3
Specific Gravity (coarse fraction)	2.625	2.612 to 2.648
Specific Gravity (fine fraction)	2.619	2.587 to 2.639
Absorption (coarse fraction)	1.44	1.23 to 1.56
Absorption (fine fraction)	1.45	1.05 to 1.96
TEST	Sample #	RESULT
MgS04-coarse (% weighted mass loss)	22-02 and 22-08b	0.8
MgS04-fine (% weighted mass loss)	22-02 and 22-08b	0.1
Soluble sulphate content (% by mass)	22-11a	0.07
Soluble chloride content (% by mass)	22-11a	0.0001

The Micro-Deval had an average test result of 18.7% loss, so it meets standard specifications for Class 2 asphalt mix durability. The coarse absorption failed for Graded Aggregate Seal (>1.0%) but passed for the fine absorption (<1.5%), whereas the sand equivalent and specific gravity values meet standard specifications for some paving products, as shown below.

**Suitability Area A products:**

The following products are considered viable within this area based upon aggregate gradation and quality results:

1. **Class 2 Asphalt Mix**
2. **25 to 50 mm Well Graded Base (WGB)** – sand rejection may be required.
3. **Selected Granular Sub-base (SGSB)** – sand rejection may be required.

**GRANULAR VOLUME – Suitability Area A:**

Minimum quantities of aggregate evaluated are based on average depth of aggregate (6.1 m) across Suitability Area A with 1.5H:1V pit faces and an approximate area of 47,700 m<sup>2</sup> (refer to PDP). For test pits 22-02, -05, and -12 only the top sample (a) was considered for these estimates, as deeper than 4.7 to 6 m (depending on the test pit & location; refer to stick logs in Appendix), materials were not considered suitable. However, these are likely isolated silt layers that likely have underlying aggregate of higher quality and will just need to be excavated and separated out. Based on topography, the mapped deposit, and the lower front pit face, a maximum aggregate depth of 13 m is estimated within Suitability Area A.

<b>VOLUMES: SUITABILITY AREA A</b>	
<b>Minimum Evaluated Aggregate</b>	292,400 m <sup>3</sup>
<b>Maximum Estimated Aggregate</b>	620,100 m <sup>3</sup>
<b>Estimated Topsoil</b>	14,500 m <sup>3</sup>

Overlying topsoil/overburden is an average of 0.3 m thick.

**Designated PAG Blending Area B (0.9 ha)**

**Includes TPs 23-01, -02, -03, -04, -06, -07, and TPs 22-15, 22-16, and TP 09-12**

**GRADATION** – Designated PAG Blending Area B is considered the triangular shaped area in the northeastern portion of the existing pit floor (mostly within Suitability Area A) with a relatively small volume of calcites that could be used to blend into the rest of the pit run material. Refer to neon polygon shown on Figure 2 – PDP.

The average and range of gradations for samples obtained from the suitability area identified from the 2022 and 2023 Test Pits are as follows:

**Laboratory Samples:**

<b>Classification</b>	<b>Average (%)</b>	<b>Range (%)</b>
Gravel (4.75-75mm)	53.75	37-63
Sand (0.075-4.75mm)	47.6	32-58
Fines (<0.075mm)	4.22	1.8-6.3

**GRANULAR VOLUME – Designated PAG Blending Area B:**

Quantities of aggregate evaluated are based on average depth of aggregate (3.0 m) across *Designated PAG Blending Area B* with an approximate area of 9,000 m<sup>2</sup> / 0.9 ha (refer to PDP).

<b>VOLUMES: DESIGNATED PAG BLENDING AREA B</b>	
<b>Evaluated Aggregate</b>	27,000 m <sup>3</sup>

**Designated PAG Blending Area A (0.27 ha)**  
**Includes TP 22-25 (SCL)**

**GRADATION** – Designated PAG Blending Area A is considered the small area in the western portion of the existing pit floor which is covered in processed rock (refer to Images 1 and 2) with a volume of buried crush that could be used to blend into the rest of the pit run material.



**Image 1:** view of material within Designated PAG Blending Area A (Aug. 2023)



**Image 2:** view of material within Designated PAG Blending Area A (TP 22-25, Nov. 2022)

The gradation for the single sample obtained from TP 22-05 within the Designated PAG Blending Area A is as follows:

**Laboratory Samples:**

Classification	Average (%)
Gravel (4.75-75mm)	54
Sand (0.075-4.75mm)	40
Fines (<0.075mm)	5.6

**GRANULAR VOLUME – Designated PAG Blending Area A:**

Quantity of aggregate evaluated is based on the measured depth of crushed material overlying buried OB in TP 22-25, which is approx. 5.5 m across Designated PAG Blending Area A with an approximate area of 2,700 m<sup>2</sup> / 0.27 ha (refer to PDP).

VOLUMES: Designated PAG Blending Area A	
Evaluated Aggregate	14,850 m <sup>3</sup>

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**PIT DEVELOPMENT DISCUSSION & RECOMMENDATIONS:**

The 2022 and 2023 investigations focused on assessing the material in the existing pit floors across the reserve, as well as towards the proposed development in the east. Refer to Test Pit Logs with lab results from wash sieves and quality testing, as well as the Pit Development Plan (PDP) and Stick Logs in the Appendices. Note: *the contour lines as shown on the PDP do not reflect the latest topography on site, as development has changed the profile of the pit floor since that data was collected.*

**General Recommendations:**

1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operators Best Management Practices Handbook for BC.
2. The contractor must ensure that all materials passing through the 375 mm x 450 mm slotted openings shall be used in the production of the crushed aggregates.
3. Pit excavations must not take place to within a minimum of 2 m from the edge of clearing and stripped areas.
4. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H:1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
5. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

**Specific Recommendations:**

1. **Suitability Area A** (which includes a portion of **Designated PAG Blending Area B**) has been partially cleared, but still needs to be grubbed and stripped; refer to Image 2. It is recommended to place stripped topsoil and overburden from the suitability area along the eastern boundary of Suitability Area A, adjacent to the private land (refer to PDP, Figure 2), reserved for reclamation. Development should commence from the existing pit face and be directed towards the northwest, north, and northeast.
2. There is a stockpile of overburden impeding development to the north of the existing pit face; this material will need to be relocated and is recommended to be stockpiled (along with the stripped overburden mentioned above) along the eastern boundary of Suitability Area A, adjacent to the private land (as shown on the PDP, Figure 2).
3. Private land is directly adjacent to the map reserve in the east, which must be avoided; a 5 m setback from the boundary is required to meet HSRC.
4. Some isolated silt layers may be encountered within the Suitability Area A material during development; these will need to be excavated and stockpiled separately.
5. **Designated PAG Blending Area A** does not require any clearing or stripping as it falls within the existing pit floor.



**CLOSURE**

Discussions and recommendations presented above are based on a field investigation, laboratory analysis, and on additional information provided by Ministry of Transportation & Infrastructure, which was reviewed at the time of this assessment. This report has been prepared for use by Ministry of Transportation & Infrastructure, which includes distribution as required for purposes for which the assessment was commissioned. The assessment has been carried out in accordance with generally accepted geotechnical practice. Geotechnical judgment has been applied in developing the recommendations in this report. No other warranty is made, either expressed or implied.

Sitkum trusts that the information presented above meets your current requirements. If you have any questions, or require further information, please do not hesitate to contact the undersigned.

Respectfully submitted,

**Sitkum Consulting Ltd.**

EGBC Permit to Practice no. 1000441

Prepared by:

Reviewed by:

A handwritten signature in blue ink, appearing to read 'Wayne Miller', is written over the 'Reviewed by:' line.

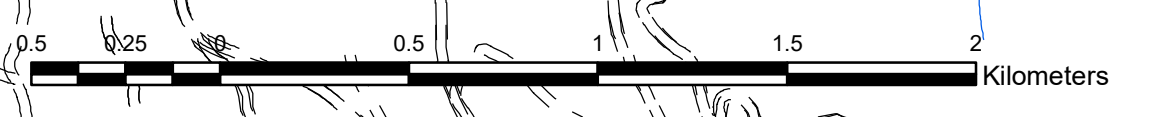
Jennifer Sabeau, P.Geo.  
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Wayne Miller, P.Geo. P.L. Eng.  
Engineering Geologist - Principal

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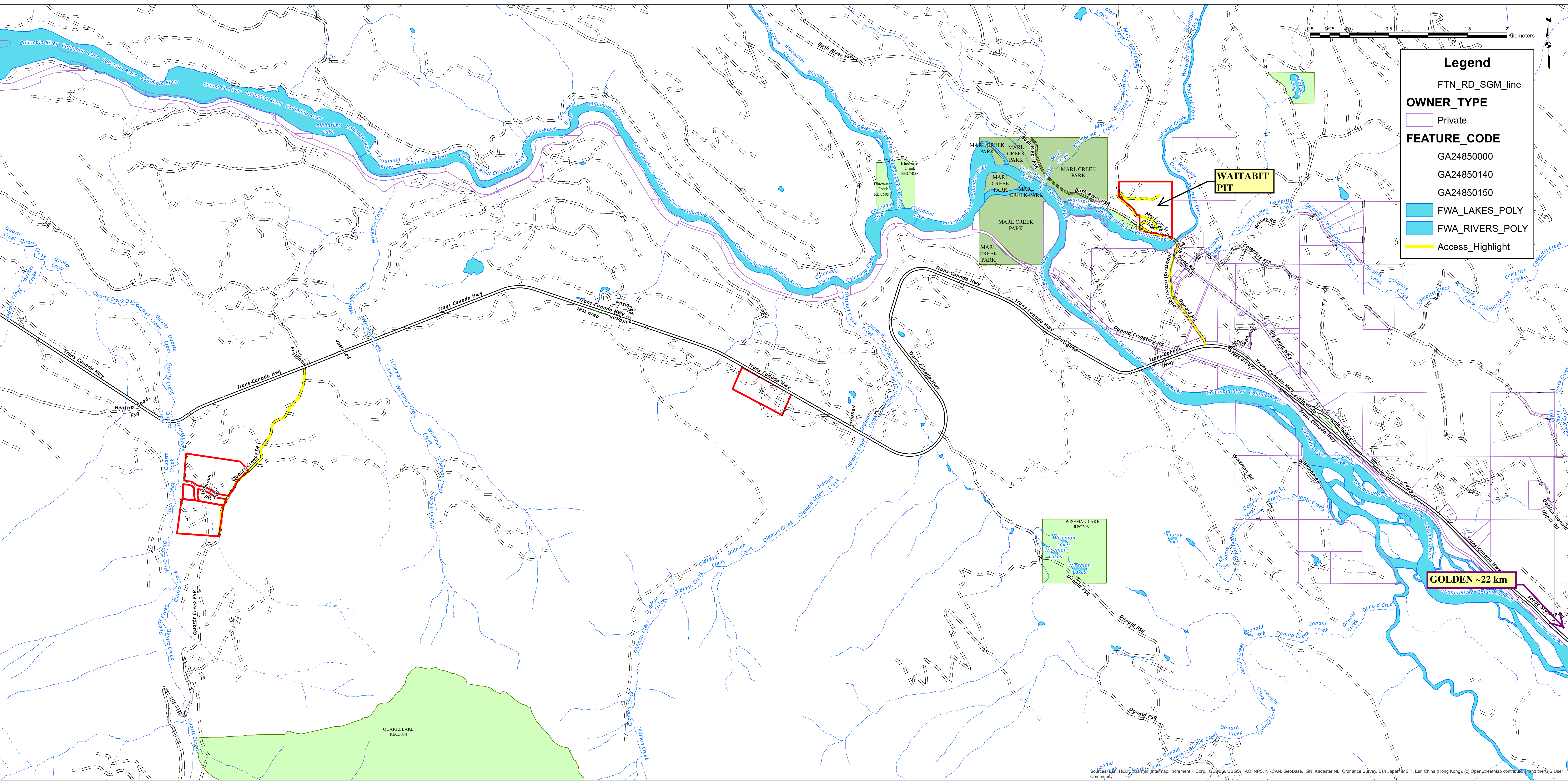
# Appendix A

## Figures



**Legend**

- FTN\_RD\_SGM\_line
- OWNER\_TYPE**
  - Private
- FEATURE\_CODE**
  - GA24850000
  - GA24850140
  - GA24850150
  - FWA\_LAKES\_POLY
  - FWA\_RIVERS\_POLY
  - Access\_Highlight

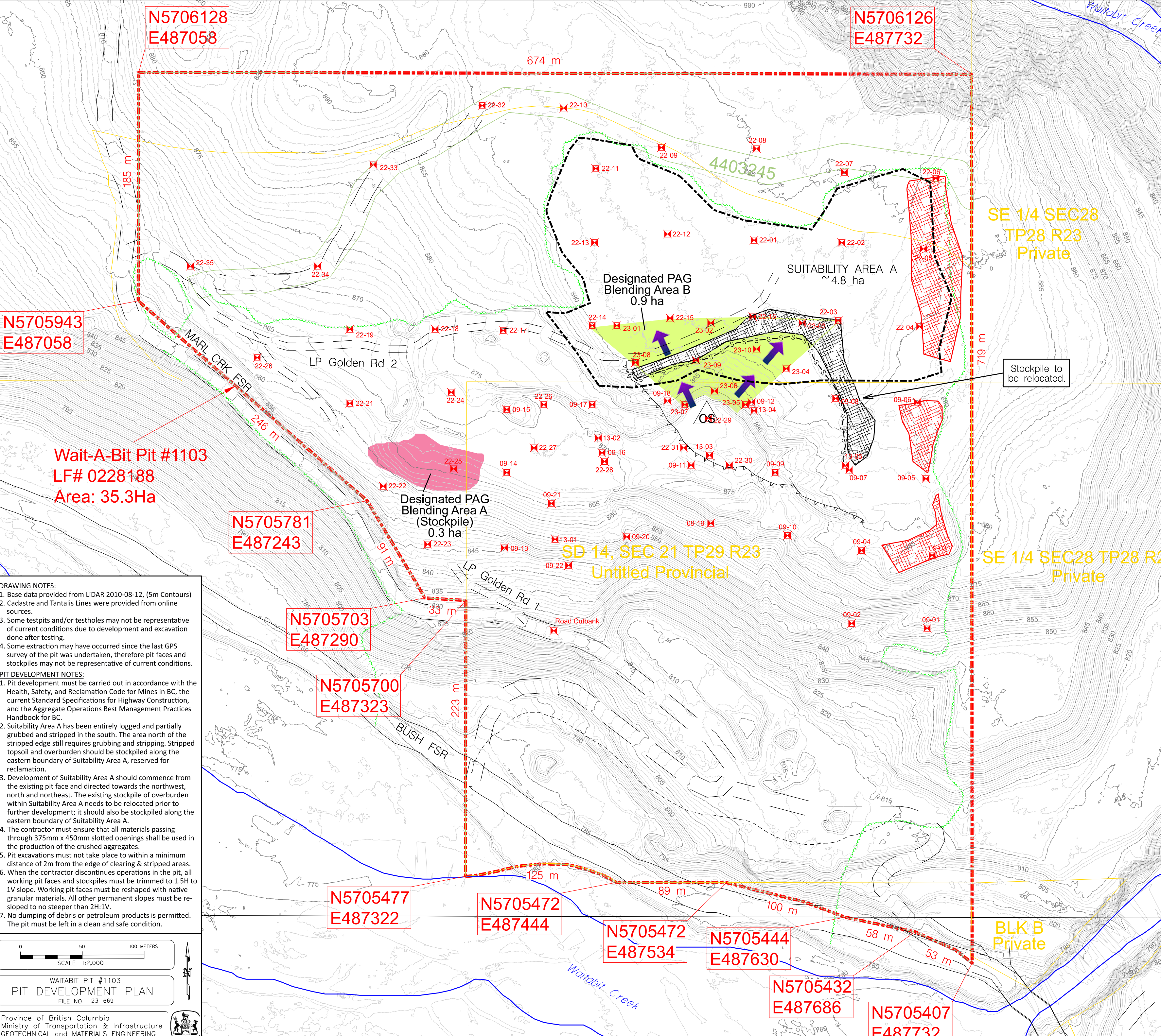


**WAITABIT PIT**

**Quartz Creek FSR**

**WISEMAN LAKE REC2061**

**GOLDEN ~22 km**



**LEGEND**

- GRAVEL RESERVE BOUNDARY (MoTI) / 2023 SUITABILITY AREA
- BRIDGE / LEGACY TRAIL or ROAD
- EXISTING ROAD: PAVED / GRAVEL
- CADASTRE / TANTALIS
- WATER BODY
- CREEK / NON-CLASSIFIED DRAINAGE (DataBC)
- CRUSHER LOCATION / DEVELOPMENT DIRECTION
- STRIPPED EDGE
- STOCKPILE - OVERBURDEN (PDP): EXISTING / PROPOSED
- DESIGNATED PAG BLENDING AREA A (MoTI)
- DESIGNATED PAG BLENDING AREA B (MoTI) \*only to a depth of 3.0 m
- TEST PITS 2009, 2013, 2022 & 2023
- TREELINE (BING ortho) / SLOPE BREAK (2013)
- LIDAR CONTOURS (2021 MoTI): 5m INDEX / 1m INTERMEDIATE

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**FIGURE 2a Topo**

**DRAWING NOTES:**

- Base data provided from LiDAR 2010-08-12, (5m Contours)
- Cadastre and Tantalus Lines were provided from online sources.
- Some testpits and/or testholes may not be representative of current conditions due to development and excavation done after testing.
- Some extraction may have occurred since the last GPS survey of the pit was undertaken, therefore pit faces and stockpiles may not be representative of current conditions.

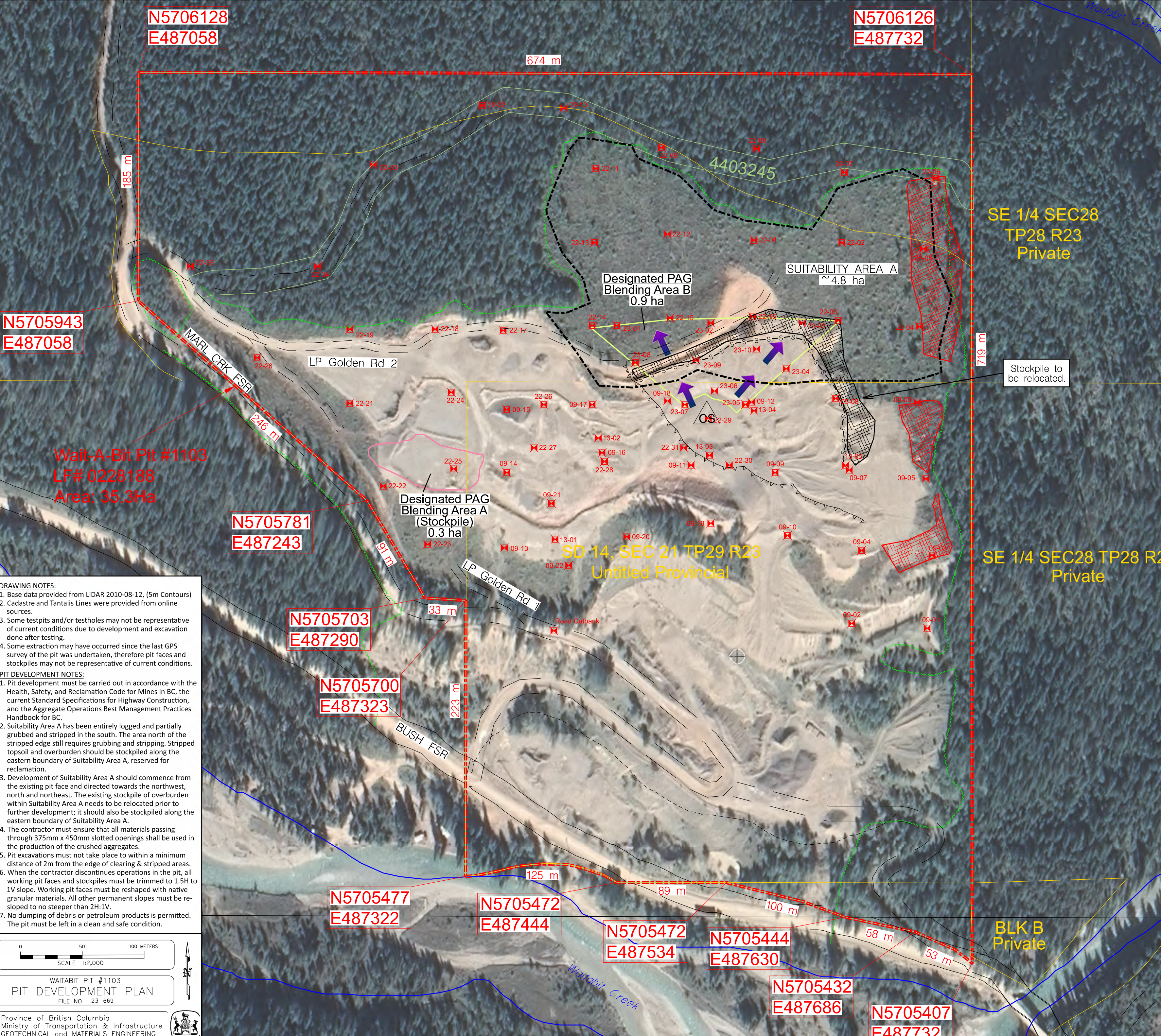
**PIT DEVELOPMENT NOTES:**

- Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC.
- Suitability Area A has been entirely logged and partially grubbed and stripped in the south. The area north of the stripped edge still requires grubbing and stripping. Stripped topsoil and overburden should be stockpiled along the eastern boundary of Suitability Area A, reserved for reclamation.
- Development of Suitability Area A should commence from the existing pit face and directed towards the northwest, north and northeast. The existing stockpile of overburden within Suitability Area A needs to be relocated prior to further development; it should also be stockpiled along the eastern boundary of Suitability Area A.
- The contractor must ensure that all materials passing through 375mm x 450mm slotted openings shall be used in the production of the crushed aggregates.
- Pit excavations must not take place to within a minimum distance of 2m from the edge of clearing & stripped areas.
- When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
- No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.

0 50 100 METERS  
 SCALE 1:2,000

WAITABIT PIT #1103  
**PIT DEVELOPMENT PLAN**  
 FILE NO. 23-669

Province of British Columbia  
 Ministry of Transportation & Infrastructure  
 GEOTECHNICAL and MATERIALS ENGINEERING



**LEGEND**

- GRVEL RESERVE BOUNDARY (MoTi) / 2023 SUITABILITY AREA
- BRIDGE / LEGACY TRAIL or ROAD
- EXISTING ROAD: PAVED / GRAVEL
- CADASTRE / TANTALIS
- WATER BODY
- CREEK / NON-CCLASSIFIED DRAINAGE (DataBC)
- CS / --- CRUSHER LOCATION / DEVELOPMENT DIRECTION
- S-S-S-S- STRIPPED EDGE
- STOCKPILE - OVERBURDEN (PDP): EXISTING / PROPOSED
- DESIGNATED PAG BLENDING AREA A (MoTi)
- DESIGNATED PAG BLENDING AREA B (MoTi) \*only to a depth of 3.0 m
- X-23-01 TEST PITS 2009, 2013, 2022 & 2023
- TREELINE (BING ortho) / SLOPE BREAK (2013)

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GEOTECHNICAL SERVICES

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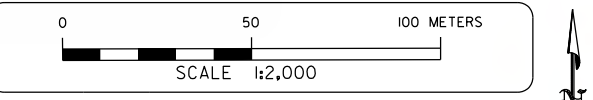
**FIGURE 2b Ortho - GE**

**DRAWING NOTES:**

1. Base data provided from LiDAR 2010-08-12, (5m Contours)
2. Cadastre and Tantalus Lines were provided from online sources.
3. Some testpits and/or testholes may not be representative of current conditions due to development and excavation done after testing.
4. Some extraction may have occurred since the last GPS survey of the pit was undertaken, therefore pit faces and stockpiles may not be representative of current conditions.

**PIT DEVELOPMENT NOTES:**

1. Pit development must be carried out in accordance with the Health, Safety, and Reclamation Code for Mines in BC, the current Standard Specifications for Highway Construction, and the Aggregate Operations Best Management Practices Handbook for BC.
2. Suitability Area A has been entirely logged and partially grubbed and stripped in the south. The area north of the stripped edge still requires grubbing and stripping. Stripped topsoil and overburden should be stockpiled along the eastern boundary of Suitability Area A, reserved for reclamation.
3. Development of Suitability Area A should commence from the existing pit face and directed towards the northwest, north and northeast. The existing stockpile of overburden within Suitability Area A needs to be relocated prior to further development; it should also be stockpiled along the eastern boundary of Suitability Area A.
4. The contractor must ensure that all materials passing through 375mm x 450mm slotted openings shall be used in the production of the crushed aggregates.
5. Pit excavations must not take place to within a minimum distance of 2m from the edge of clearing & stripped areas.
6. When the contractor discontinues operations in the pit, all working pit faces and stockpiles must be trimmed to 1.5H to 1V slope. Working pit faces must be reshaped with native granular materials. All other permanent slopes must be re-sloped to no steeper than 2H:1V.
7. No dumping of debris or petroleum products is permitted. The pit must be left in a clean and safe condition.



WAITABIT PIT #1103  
**PIT DEVELOPMENT PLAN**  
 FILE NO. 23-669

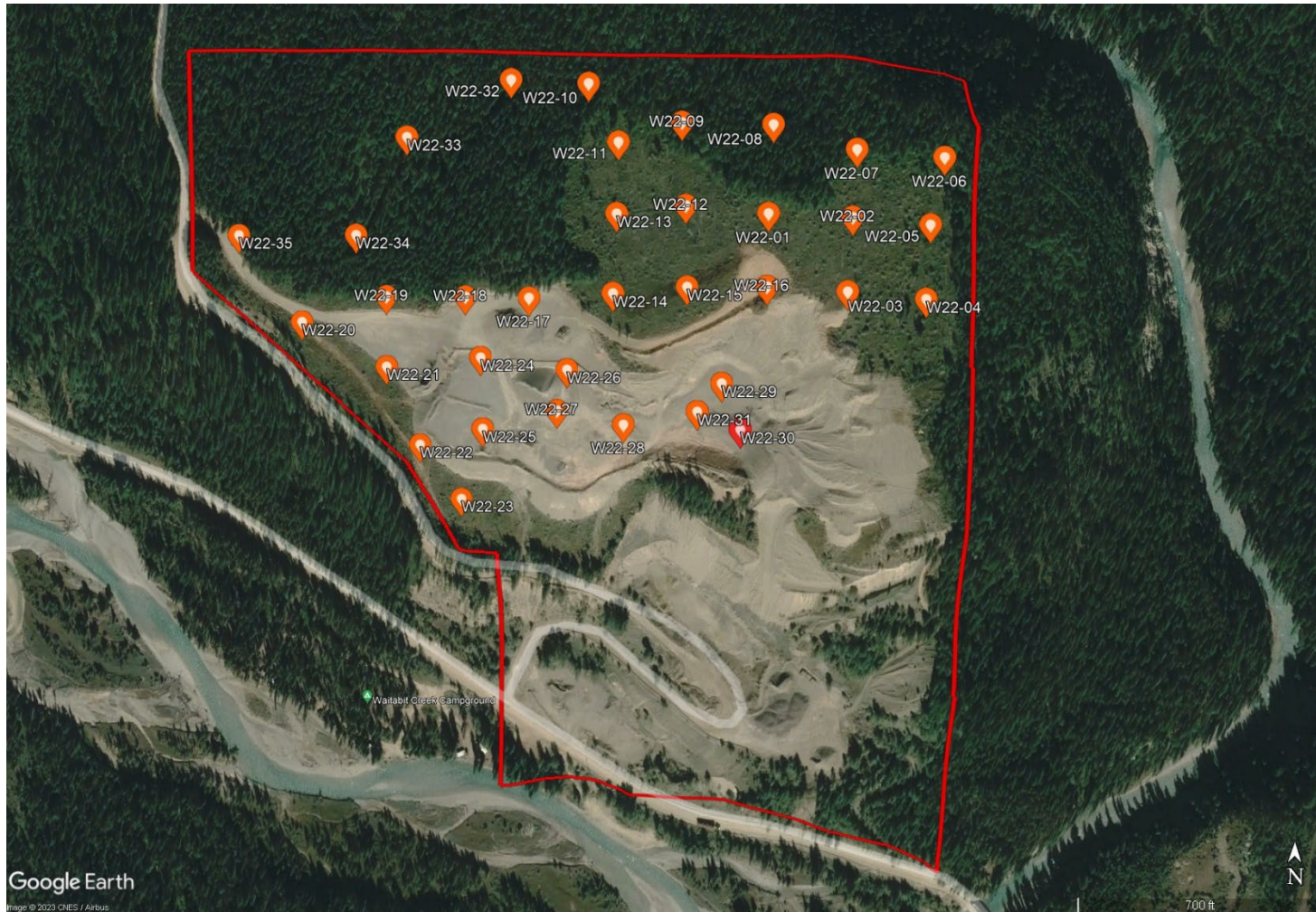
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# Appendix B

## Test Pit Photographs

# 2022 INVESTIGATION PHOTOGRAPHS – SUITABILITY AREA A

(refer to Figure 2 – PDP for Test Pit locations)



**Image 1: Aerial overview of Waitabit Pit Map Reserve (red) with 2022 test pit locations**



**Image 2: Test Pit 22-01**



**Image 3: Test Pit 22-01 material**





**Image 4: Test Pit 22-02**



**Image 5: Test Pit 22-02 material**



**Image 6: Test Pit 22-03 pit**



**Image 7: Test Pit 22-03 material**



**Image 8: Test Pit 22-04**



**Image 9: Test Pit 22-04 material**



**Image 10: Test Pit 22-05**



**Image 11: Test Pit 22-05 material**



**Image 12: Test Pit 22-11**



**Image 13: Test Pit 22-11 material**



**Image 14: Test Pit 22-12**



**Image 15: Test Pit 22-12 material**



**Image 16: Test Pit 22-13**



**Image 17: Test Pit 22-13 material**



**Image 16: Test Pit 22-14**



**Image 17: Test Pit 22-14 material**





**Image 16: Test Pit 22-15**



**Image 17: Test Pit 22-15 material**



**Image 16: Test Pit 22-16**



**Image 17: Test Pit 22-16 material**

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# Appendix C

## Field Test Pit Logs and Stick Log Diagrams (with Lab Results)

## AGGREGATE LOG

**PROJECT:** Waitabit Pit  
**PIT #:** 1103  
**DISTRICT:** Rocky Mountain

**SAMPLED BY:** WM/SCL  
**METHOD:** EXCAVATOR (John Deere 345c)  
**DATE:** 2-Nov

TH / TP	DEPTH (m)		SAMPLE BAG No.	SOILS CLASS	ESTIMATED GRADUATION			ESTIMATED ROCK 75mm				SAND TYPE F M C	REMARKS
	FROM	TO			G	S	F	MAX SIZE	75mm - 150mm	150mm - 375mm	375mm		
W22-01	0.0	0.3		OB									
	0.3	6.2	W22-01a	GP	51	45	4	210	3	1	0	M	
			Lab: GW	GW	60.3	25.3	4.3						
		End											
W22-02	0.0	0.3		OB									
	0.3	6.1	W22-02a	GP-GM	50	45	5	150	2	0	0	M-C	
			Lab: GW	GW	70.4	26.1	3.6						
	6.1	6.5	W22-02b	SM1	14	74	12	75	0	0	0	F	sand with some silt
			Lab: SM1	SM1	24	56.3	19.7						
		End											
W22-03	0.0	0.3		OB									
	0.3	6.2	W22-03a	GP-GM	50	45	5	310	3	2	0	M	calcite coatings
			Lab: GW	GW	65.4	30.9	3.7						
	6.2	6.6	N.S	SM3	5	75	20	0	0	0	0	F	silty sand
		End											
W22-04	0.0	0.3		OB									
	0.3	6.4	W22-04a	GP-GM	50	45	5	320	3	1	0	M	calcite coatings & calcite cement
			Lab: GW	GW	71.7	25.5	2.8						
		End											
W22-05	0.0	0.3		OB									
	0.3	1.1	N.S.	SM3									silty sand
	1.1	5.3	W22-05a	GP-GM	50	45	5	310	3	1	0	M	sandy gravel with a trace to some silt
			Lab: GW-GM	GW-GM	61.6	32.6	5.8						
	5.3	6.5	W22-05b	SP-SM	40	53	7	150	2	0	0	F	gravelly sand with some silt
			Lab: SP-SM	SP-SM	39.4	53.1	7.5						
		End											calcite coatings & calcite cement
W22-06	0.0	0.3		OB									
	0.3		W22-06a	SM2									Interbedded layers of sand & gravel
			W22-06a	GP				150					silty sand lenses - variable measurements
		6.4	W22-06a	SP-SM									
		6.5	W22-06a	SM2									
			Lab: SP-SM	SP-SM	30	60	10						
		End											
W22-07	0.0	0.3		OB									
	0.3	6.5	W22-07a	GP-GM	50	45	5	210	2	0	0	M	calcite coatings & calcite cement
			Lab: GW	GW	65.9	30.1	4						
		End											silty sand lenses below 6.1m
W22-08	0.0	0.3		OB									
	0.3	6.4	W22-08a	GP-GM	50	45	5	290	2	1	0	C	gravelly sand with some silt
			Lab: GW	GW	72.6	26.4	1						
	6.4	6.7	W22-08b	SP-SM									calcite coatings
			Lab: SP	SP	6.7	90.3	3						
		End											
W22-09	0.0	0.3		OB									
	0.3	6.2	W22-09a	GP-GM	50	45	5	150	2	0	0	M-C	calcite coatings & calcite cement
			Lab: GW	GW	62.8	34.4	2.8						
		End											
W22-10	0.0	0.3		OB									calcite coatings & calcite cement samples
	0.3	4.1	W22-10a	GP	55	42	3	100	2	0	0	M	mixing. sandy gravel trace of silt
	4.1	6.2	W22-10a	GP-GM	49	45	6	370	7	5	0	C	sandy gravel some silt & cobbles
			Lab: GW	GW	66.2	31.1	2.7						
W22-11	0.0	0.3		OB									
	0.3	6.4	W22-11a	GP	51	45	4	100	2	0	0	M-C	cleaner & smapper gravel
			Lab: GW	GW	66.5	30.9	2.6						
		End											calcite coatings & calcite cement





SOIL CLASSIFICATION LEGEND

MAJOR DIVISIONS	SYMBOL	SOIL TYPE	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
		GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
		GM*	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES
		SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES
		SM*	SILTY SANDS SAND-SILT MIXTURES
		SC*	CLAYEY SANDS SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS W <sub>i</sub> < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS W <sub>i</sub> > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, PLASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
ORGANIC SOILS	Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	
TOPSOIL	TS	TOPSOIL WITH ROOTS, ETC.	
COBBLES	SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75mm TO 300mm	
BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300mm	

FOR SOILS HAVING 5 - 12% PASSING .075 SIEVE, USE DUAL SYMBOL

*GM1; GC1; SM1; SC1; 12 - 20%	} PASSING .075mm SIEVE
GM2; GC2; SM2; SC2; 20 - 30%	
GM3; GC3; SM3; SC3; 30 - 40%	
GM4; GC4; SM4; SC4; 40 - 50%	

REV. 89-07-17

KEY

LABORATORY SIEVE ANALYSIS :

58,36,6  
G ,S, F

FIELD GRADATION ESTIMATE :

(G, S, F)

MAX. 600= MAX. ROCK SIZE IN mm.  
DEPTH IS IN METERS

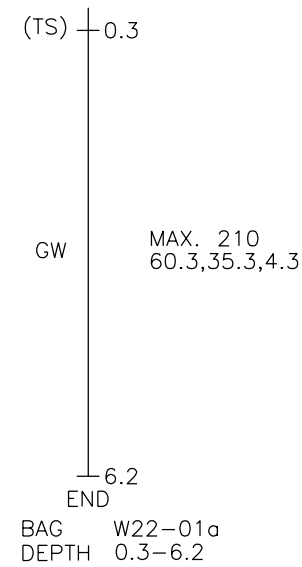


Ministry of Transportation and Infrastructure

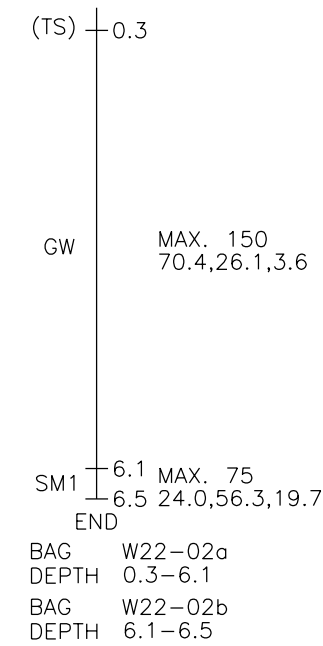
TEST PIT LOGS  
WAITABIT PIT

ROCKY MOUNTAIN DISTRICT	MAP 1 of 4
DRAWN KA	DATE JAN. 31, 2023
FILE NO. WaitabitPit_StickLogs	SCALE 1:100

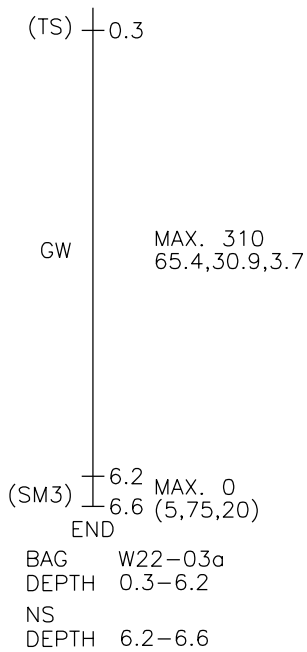
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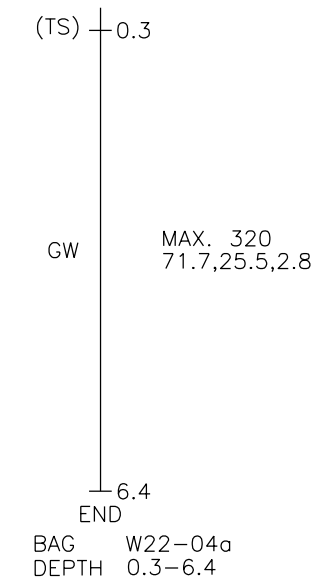
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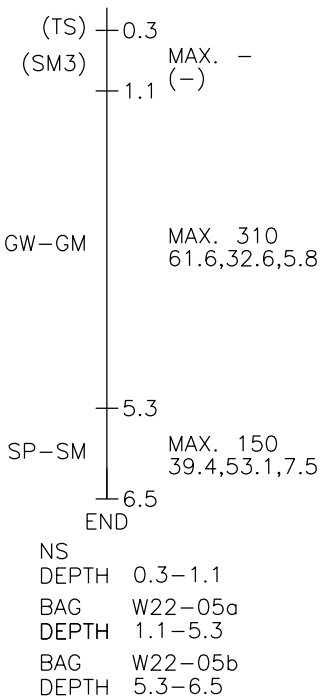
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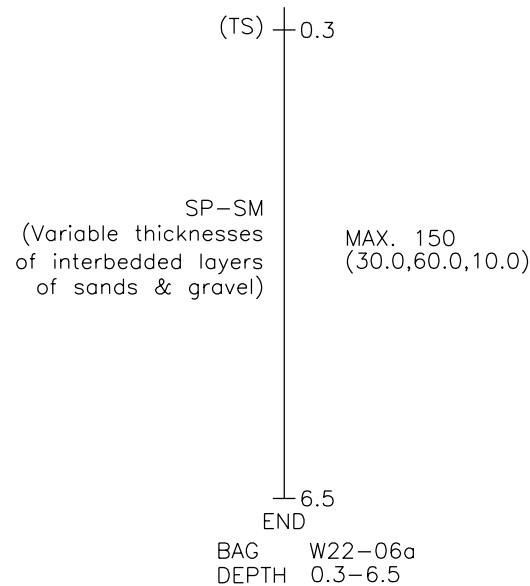
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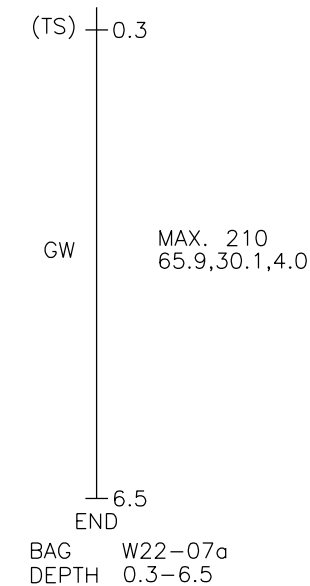
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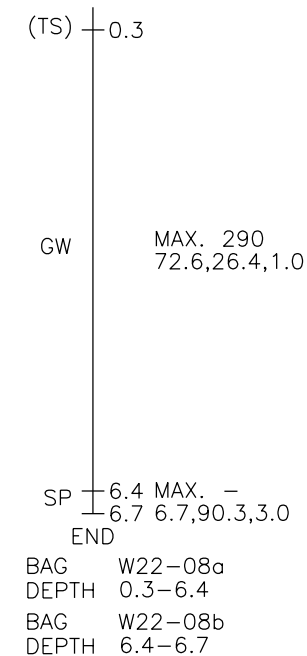
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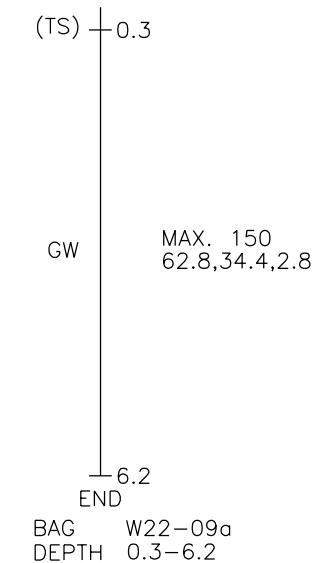
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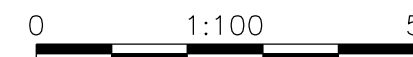
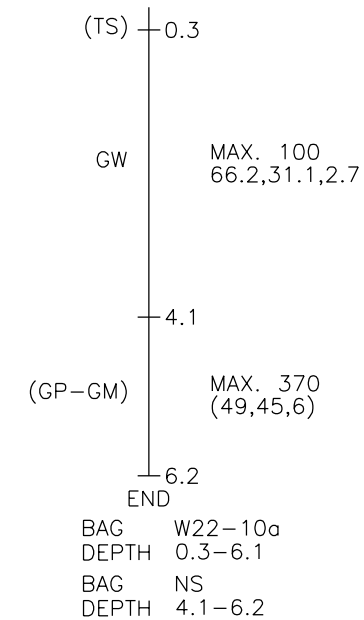
TP22-08



TP22-09



TP22-10



SOIL CLASSIFICATION LEGEND

MAJOR DIVISIONS	SYMBOL	SOIL TYPE	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
		GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
		GM*	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES
		SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, < 5% FINES
		SM*	SILTY SANDS SAND-SILT MIXTURES
		SC*	CLAYEY SANDS SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND SILTS AND CLAYS W/ <50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS W/ >50	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, PLASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
ORGANIC SOILS	Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	
TOPSOIL	TS	TOPSOIL WITH ROOTS, ETC.	
COBBLES	SB	ROCK FRAGMENTS AND COBBLES, PARTICLE SIZE 75mm TO 300mm	
BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300mm	

FOR SOILS HAVING 5 - 12% PASSING .075 SIEVE, USE DUAL SYMBOL

*GM1; GC1; SM1; SC1; 12 - 20%	} PASSING .075mm SIEVE
GM2; GC2; SM2; SC2; 20 - 30%	
GM3; GC3; SM3; SC3; 30 - 40%	
GM4; GC4; SM4; SC4; 40 - 50%	

REV. 89-07-17

KEY

LABORATORY SIEVE ANALYSIS :

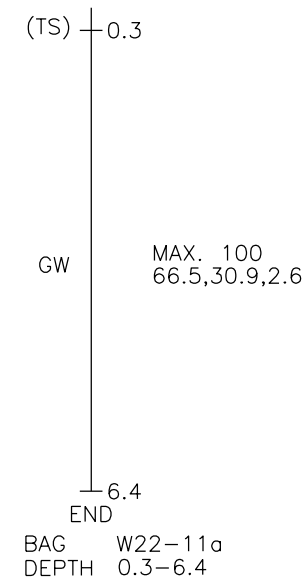
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G ,S, F

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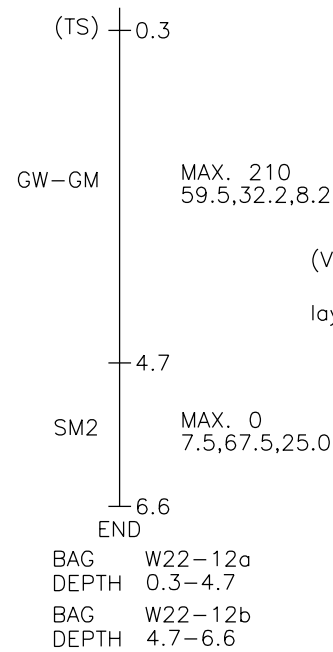
(G, S, F)

MAX. 600= MAX. ROCK SIZE IN mm.  
DEPTH IS IN METERS

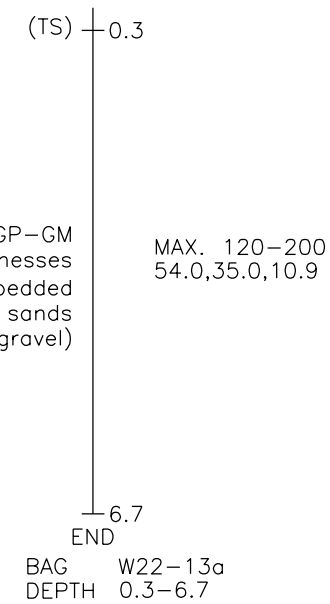
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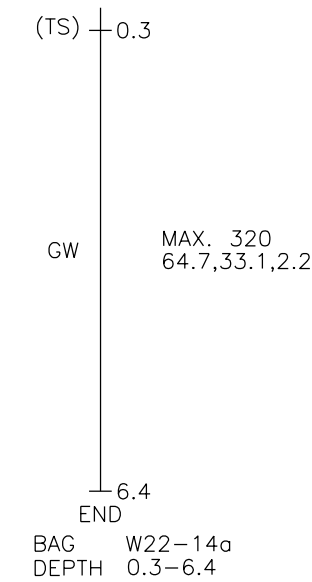
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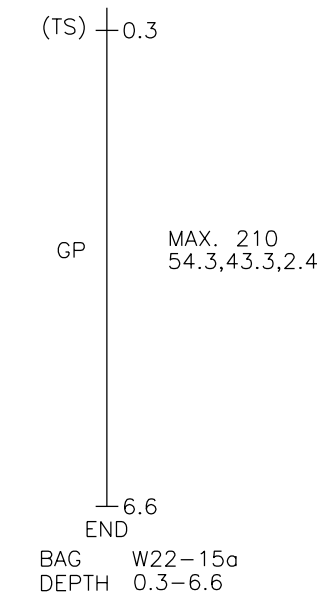
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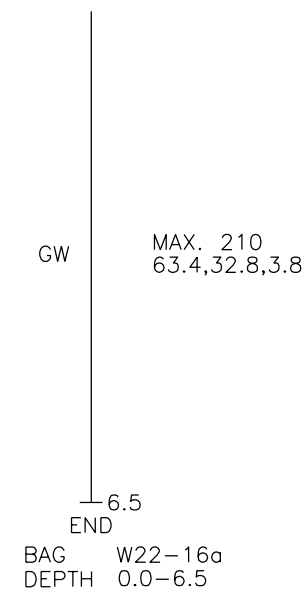
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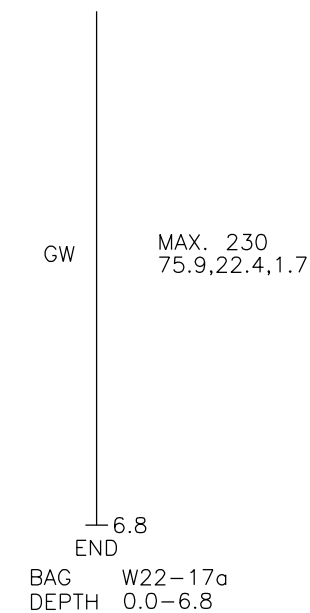
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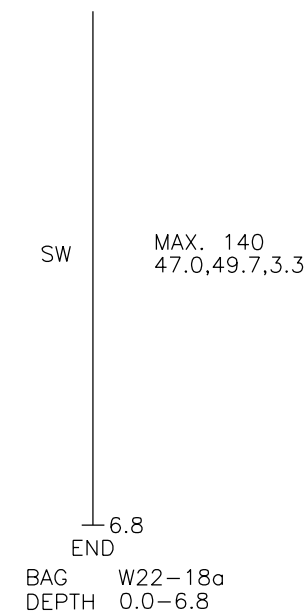
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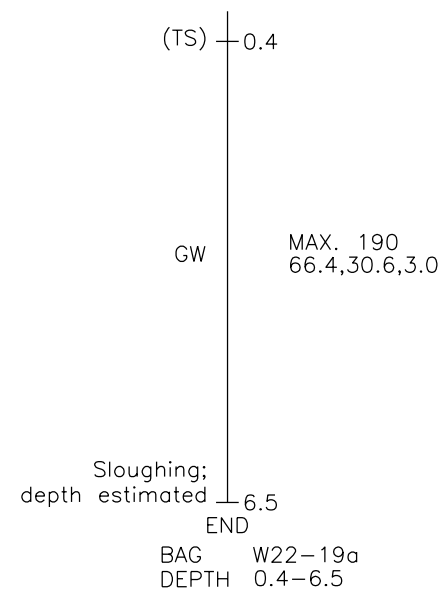
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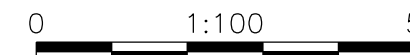
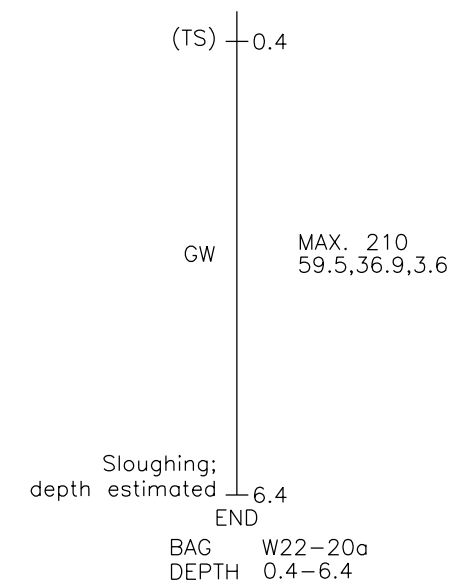
TP22-18



TP22-19



TP22-20



Ministry of  
Transportation  
and Infrastructure

TEST PIT LOGS  
WAITABIT PIT

ROCKY MOUNTAIN DISTRICT	MAP 2 of 4
DRAWN KA	DATE JAN.31, 2023
FILE NO. WaitabitPit_StickLogs	SCALE 1:100



SOIL CLASSIFICATION LEGEND

MAJOR DIVISIONS	SYMBOL	SOIL TYPE	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
		GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
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		GC*	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
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		SC*	CLAYEY SANDS SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS WI < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS WI > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, PLASTIC SILTS
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FOR SOILS HAVING 5 - 12% PASSING .075 SIEVE, USE DUAL SYMBOL  
 \*GM1; GC1; SM1; SC1; 12 - 20%  
 GM2; GC2; SM2; SC2; 20 - 30%  
 GM3; GC3; SM3; SC3; 30 - 40%  
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REV. 89-07-17

KEY

LABORATORY SIEVE ANALYSIS :

58,36,6  
G ,S, F

FIELD GRADATION ESTIMATE :

(G, S, F)

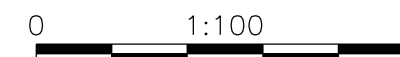
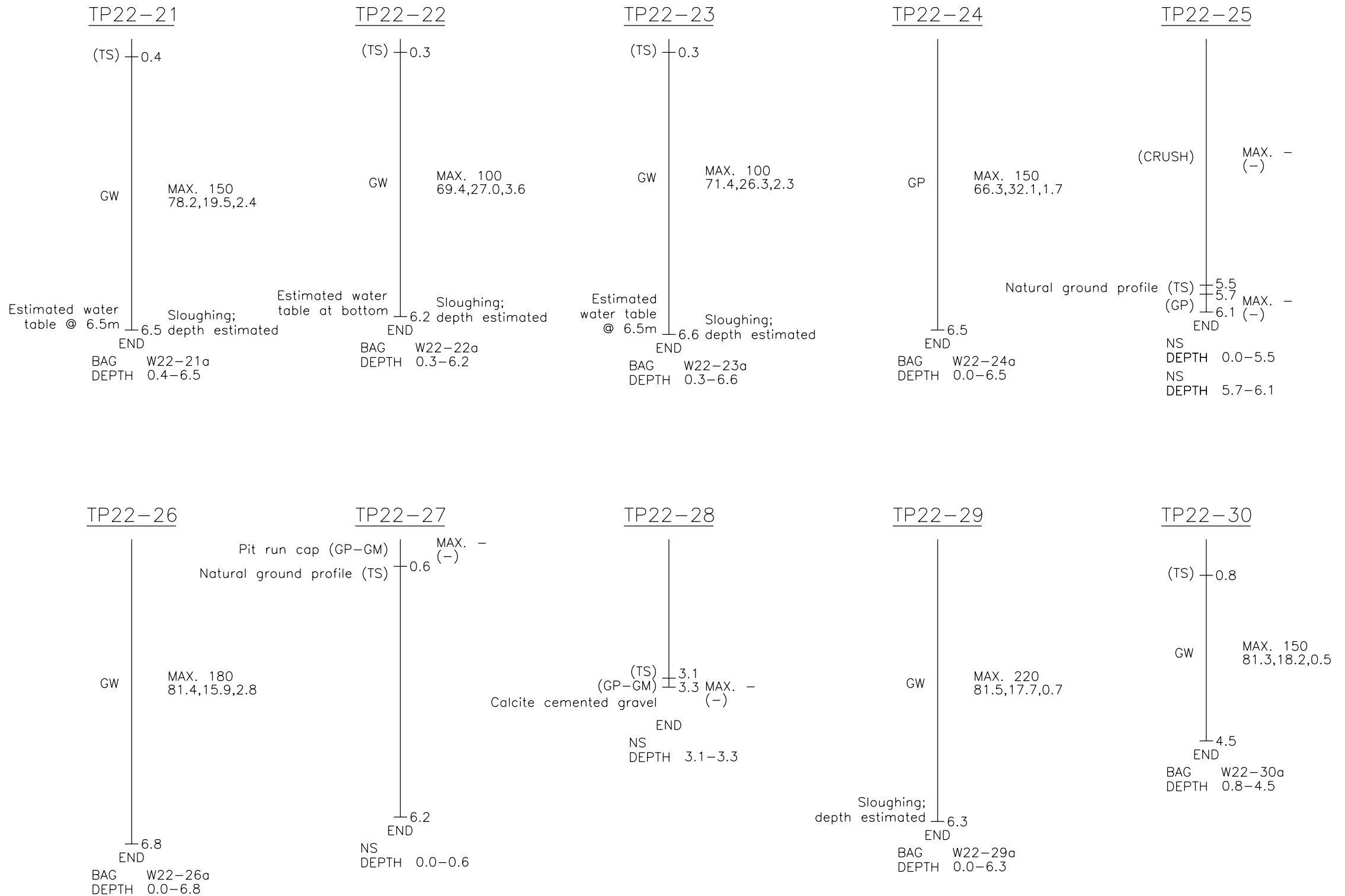
MAX. 600= MAX. ROCK SIZE IN mm.  
DEPTH IS IN METERS



Ministry of Transportation and Infrastructure

TEST PIT LOGS  
WAITABIT PIT

ROCKY MOUNTAIN DISTRICT	MAP 3 of 4
DRAWN KA	DATE JAN.31, 2023
FILE NO. WaitabitPit_StickLogs	SCALE 1:100



SOIL CLASSIFICATION LEGEND

MAJOR DIVISIONS	SYMBOL	SOIL TYPE	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, < 5% FINES
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		SM*	SILTY SANDS SAND-SILT MIXTURES
FINE GRAINED SOILS	SILTS AND SILTS AND CLAYS Wt < 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS Wt > 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOM-ACEOUS FINE SANDY OR SILTY SOILS, PLASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
ORGANIC SOILS	Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	
TOPSOIL	TS	TOPSOIL WITH ROOTS, ETC.	
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BOULDERS	LB	BOULDERS, PARTICLE SIZE OVER 300mm	

FOR SOILS HAVING 5 - 12% PASSING .075 SIEVE, USE DUAL SYMBOL

*GM1; GC1; SM1; SC1; 12 - 20%	} PASSING .075mm SIEVE
GM2; GC2; SM2; SC2; 20 - 30%	
GM3; GC3; SM3; SC3; 30 - 40%	
GM4; GC4; SM4; SC4; 40 - 50%	

REV. 89-07-17

KEY

LABORATORY SIEVE ANALYSIS :

58,36,6  
G ,S, F

FIELD GRADATION ESTIMATE :

(G, S, F)

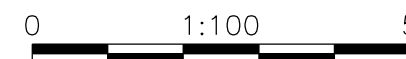
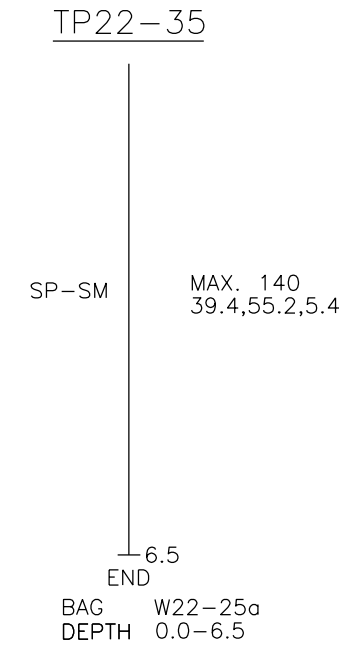
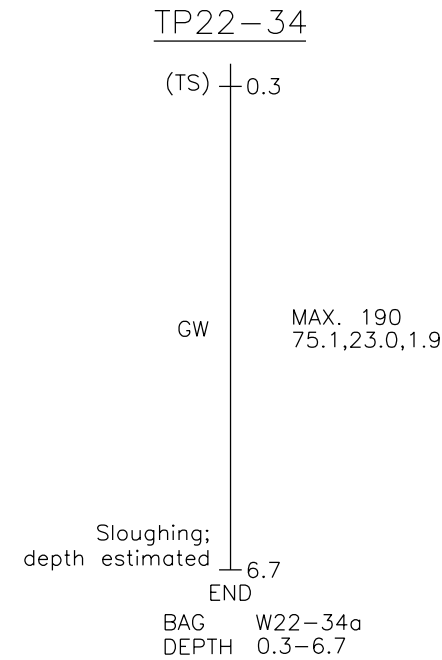
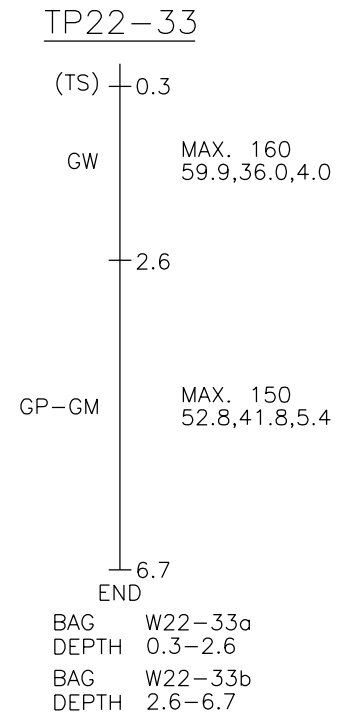
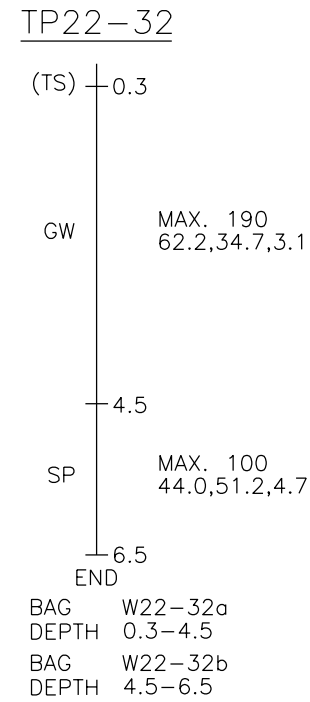
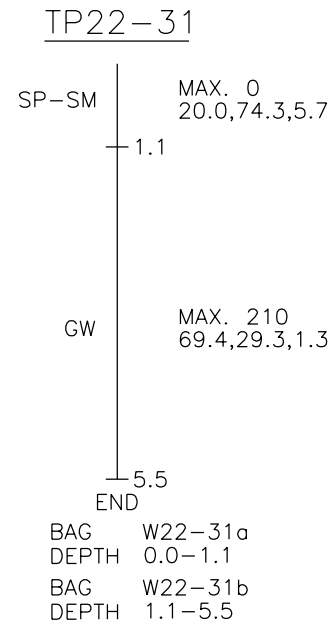
MAX. 600= MAX. ROCK SIZE IN mm.  
DEPTH IS IN METERS



Ministry of Transportation and Infrastructure

TEST PIT LOGS  
WAITABIT PIT

ROCKY MOUNTAIN DISTRICT		MAP 4 of 4
DRAWN KA	DATE JAN.31, 2023	SCALE 1:100
FILE NO. WaitabitPit_StickLogs		



# AGGREGATE LOG

**PROJECT:** Waitabit Pit  
**PIT #:** 1102  
**DISTRICT:** SA12 Selkirk

**SAMPLED BY:** Steven Lee  
**METHOD:** Excavator  
**DATE:** 2-Aug-23

TEST PIT NO.	DEPTH		SAMPLE BAG NO.	SOILS CLASS	ESTIMATED GRADATION			ESTIMATED ROCK 75mm				SAND TYPE			REMARKS
	FROM	TO			G	S	F	MAX SIZE	75mm - 150mm	150mm - 375mm	>375mm	F	M	C	
TP23-01	0	0.4		OB											Minor presence of calcites on oversize rock Sample 1 @ 1.2m; 42.5/52.5/5.5 Sample 2 @ 3.0m; 32.7/62.9/4.4
	0.4	4.3		GP	55	40	5	600	3	2	1		M		
TP23-02	0	0.5		OB											Calcites are not easily visible on the subsurface rock, but it is abundant on surface rock and exposed pit run Sample 1 @ 1.5m; 52.7/40.9/6.4 Sample 2 @ 3.0m; 50.3/45.1/4.6
	0.5	4		GP	50	38	3	400	2	1	1		M		
TP23-03	0	0.5		OB											Sample 1 @ 1.5m; 59.5/33.2/7.3 Sample 2 @ 3.5m; 50.3/45.5/4.3
	0.5	4		GP	50	47	3	300	1	1	0		M		
TP23-04	0	2.5		GP	52	44	4	100	1	0	0		M	Sample 1 @ 1.3m; 44.0/48.7/7.3 Sample 2 @ 3.5m; 62.6/34.2/3.2	
	2.5	3.3		SM	10	82	8								
	3.3	4.5		GP	52	44	4								
TP23-05	0	1		SP	40	54	6							Trace calcites visible in this layer 71.3/26.5/2.2	
	1	5		GP	60	38	2	320	5	3	0		M		
TP23-06	0	3		GP	58	40	2	200	2	1	0		M	Dug in floor of toe of main pit face Sample 1 @ 1.0m; 55.1/42.4/2.5 Sample 2 @ 3.0m; 63.4/35.5/1.1	
TP23-07	0	2.9		GP	50	48	3	140	1	0	0		M	Sample 1 @ 1.0m; 49.0/48.5/2.5 Sample 2 @ 2.5m; 60.4/37.6/2.0	
TP23-08	0	0.4		OB										Sample 1 @ 1.0m; 51.2/44.1/4.7 Sample 2 @ 3.0m; 44.3/52.2/3.5	
	0.4	4.2		GP	50	47	3	300	2	1	0		M		

---

# Appendix D

## Aggregate Gradation Charts & Laboratory Results





## WAITABIT PIT - SUITABILITY AREA A

### PROJECT REPORT OF SIEVE ANALYSIS SUMMARIES

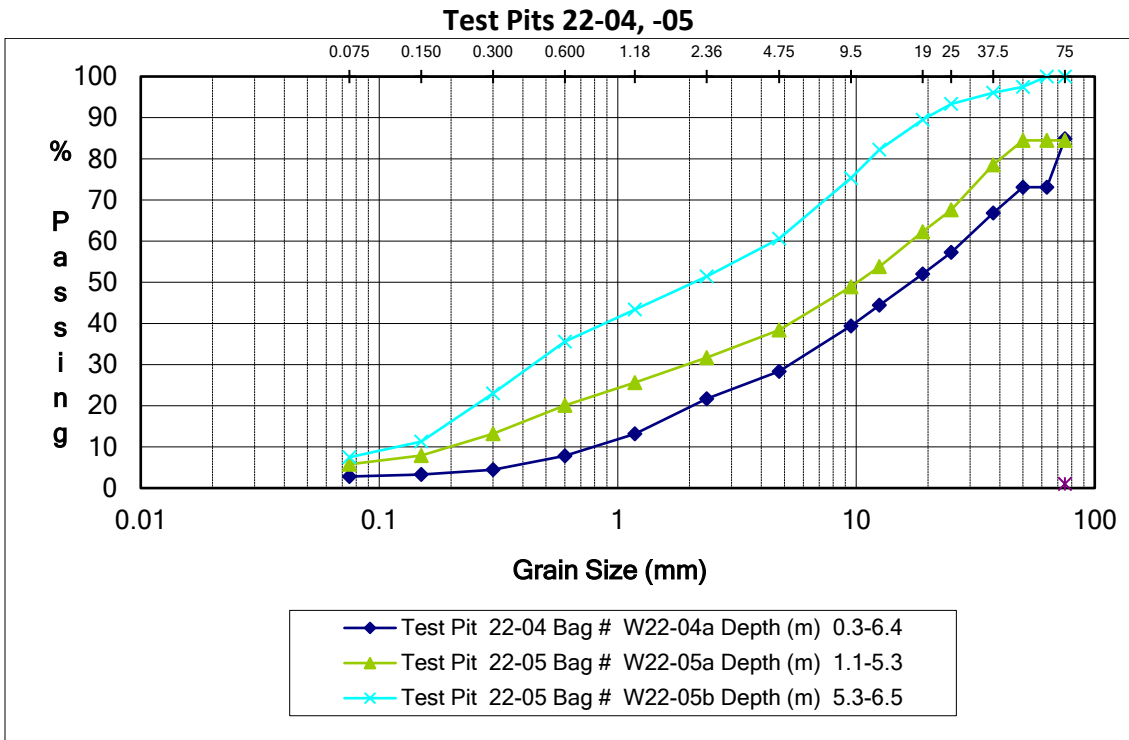
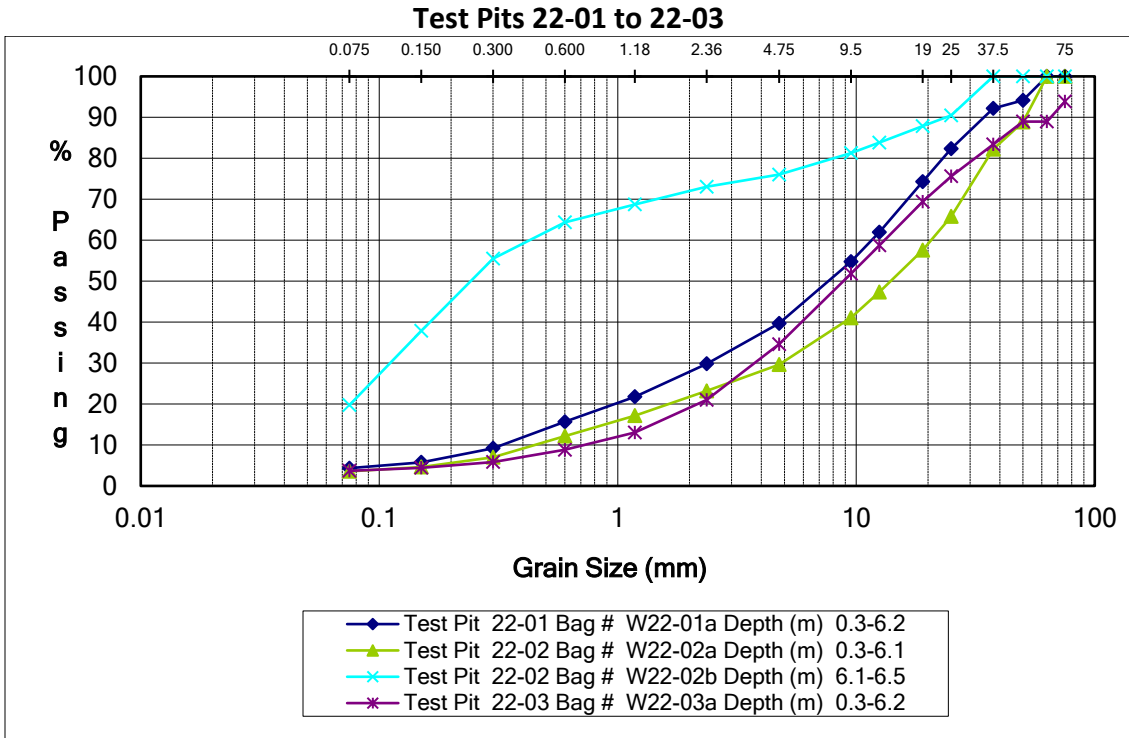
### CLASSIFICATION

Project: Wait - a - Bit Pit Investigation  
 Sample Source: Test Pits  
 Material: Pit Run

Project No.:  
 Client:  
 Date:

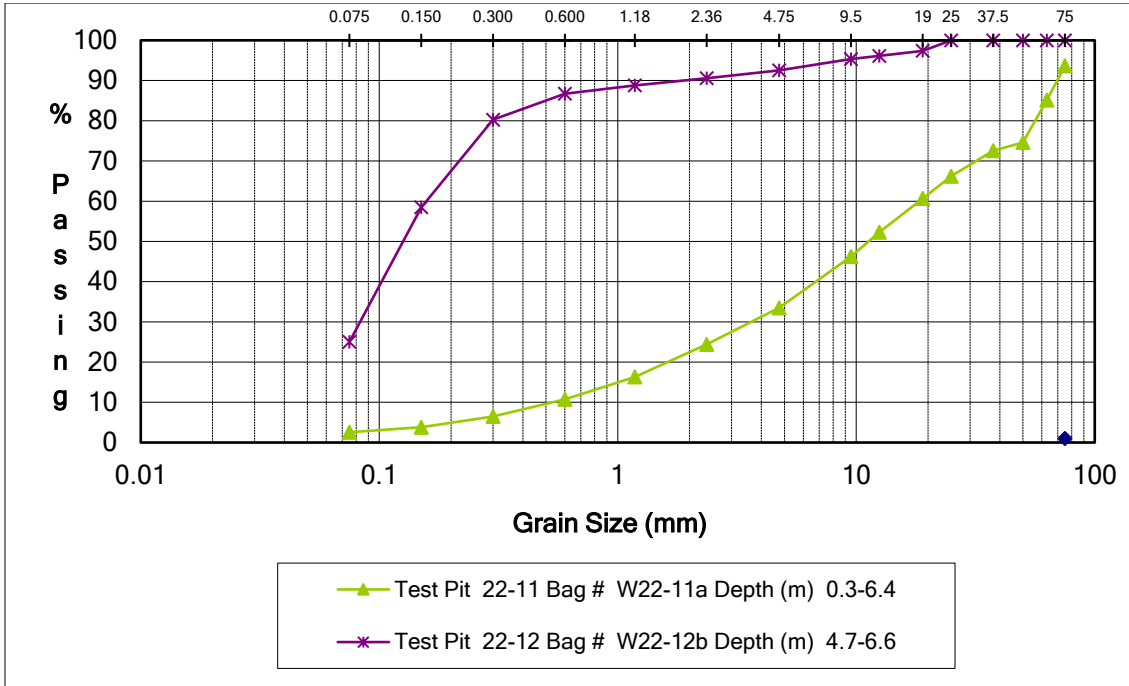
Sample Information			% GRAVEL	% SAND	% FINES	USCS CLASS	MICRO DEVAL	SAND EQUIV.	SPEC. GRAV. C/F	ABSOR C/F	MAG SULF MgSO4 C/F
Test Pit	Bag #	Depth (m)									
22-01	W22-01a	0.3-6.2	60.3	35.3	4.3	GW	18.71	68.14	2.626	1.28	
22-02	W22-02a	0.3-6.1	70.4	26.1	3.6	GW					
22-03	W22-03a	0.3-6.2	65.4	30.9	3.7	GW					
22-04	W22-04a	0.3-6.4	71.7	25.5	2.8	GW	19.18	43.17	2.599	1.76	
22-05	W22-05a	1.1-5.3	61.6	32.6	5.8	GW-GM					
22-11	W22-11a	0.3-6.4	66.5	30.9	2.6	GW					
22-12	W22-12a	0.3-4.7	59.5	32.2	8.2	GW-GM					
22-13	W22-13a	6.1-6.5	54.0	35.0	10.9	GP-GM	18.13	72.3	2.64	1.28	
22-14	W22-14a	0.3-6.4	64.7	33.1	2.2	GW					
22-15	W22-15a	0.3-6.6	54.3	43.3	2.4	GP					
22-16	W22-16a	0.0-6.5	63.4	32.8	3.8	GW					
MAX			71.7	43.3	10.9		19.2	72.3			
MIN			54.0	25.5	2.2		18.1	43.2			
MEAN			62.9	32.5	4.6	GW	18.7	61.2			

**WAITABIT PIT 2022 TESTED AREA – AGGREGATE GRADATION CHARTS (CUSTOM)**  
**(Based on 2022 Test Pits)**

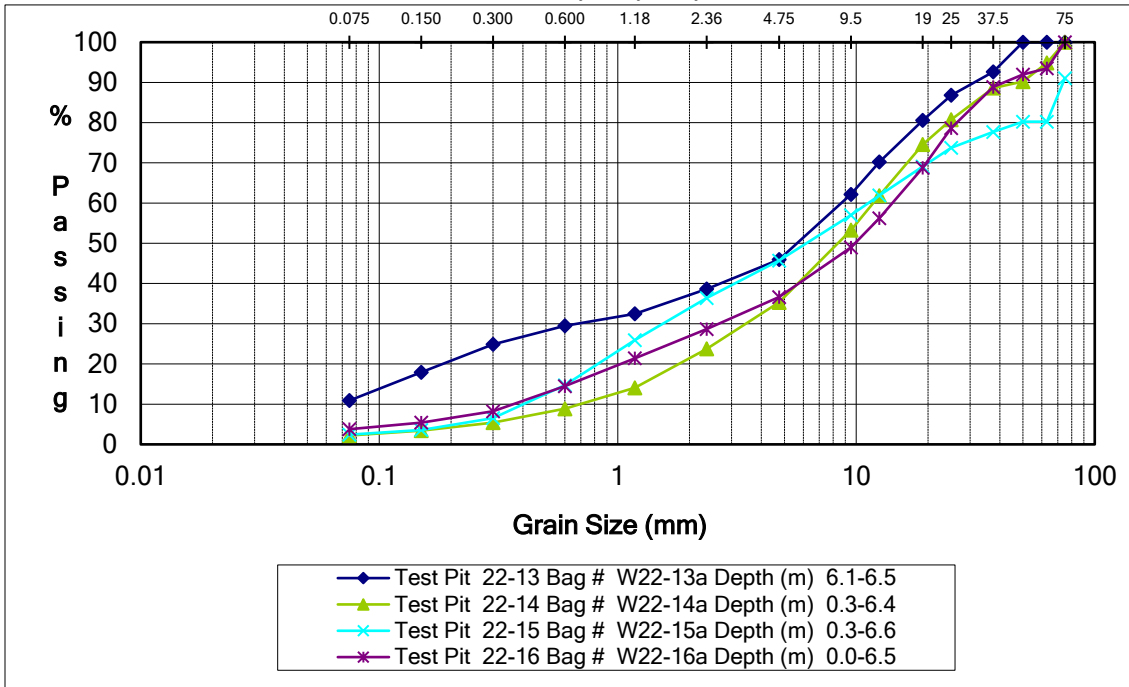




### Test Pits 22-11 and -12



### Test Pits 22-13, -14, -15, -16



# WALGREN SOILS TESTING

## BULK RELATIVE DENSITY OF AGGREGATE

Contract No. \_\_\_\_\_  
 Pit Name Wait a Bit Pit Investigation  
 Location Kootenay  
 Test Hole 22 - 01

Tested by WST  
 Performed by WST  
 Date Dec. 13 - 31/22

### COARSE AGGREGATE (RETAINED ON 4.75mm SIEVE)

		No. of Test			Avg
		1	2	3	
Dry mass in air	(A <sub>c</sub> )	748.5	723.3	740.8	g
Saturated surface dry in air	(B)	758.9	734.1	753.3	g
Saturated surface dry mass in water	(C)	472.3	457.4	470.0	g
Bulk relative density =	$\frac{A_c}{B-C}$	2.612	2.614	2.615	<b>2.614</b>
% absorption =	$\frac{B-A_c}{A_c} \times 100$	1.39	1.49	1.69	<b>1.52</b>

### FINE AGGREGATE (PASSING 4.75mm SIEVE)

		No. of Test			
		1	2	3	
Mass of water required to calibrate flask	(W <sub>c</sub> )	499.4	499.3	498.7	g
Mass of flask	(X)	172.0	163.4	151.2	g
Mass of flask & saturated surface dry aggregate & water	(Z)	962.6	975.2	932.6	g
Mass of flask plus saturated surface dry aggregate	(Y)	637.8	663.3	603.6	g
Mass of added water (Z- Y)	(W <sub>a</sub> )	324.8	311.9	329.0	g
Mass of oven dry aggregate in air	(A <sub>f</sub> )	461.3	494.9	447.2	g
Bulk relative density =	$\frac{A_f}{W_c - W_a}$	2.642	2.641	2.635	<b>2.639</b>
% water absorption =	$\frac{Y - X - A_f}{A_f} \times 100$	0.98	1.01	1.16	<b>1.05</b>

#### Average Bulk Relative Density

- Let M<sub>1</sub> = per cent by mass of aggregate retained on 4.75mm sieve.
- Let M<sub>2</sub> = per cent by mass of aggregate passing 4.75mm sieve.
- Let M<sub>3</sub> = per cent by mass of blend aggregate
- Let RD<sub>1</sub> = bulk relative density of aggregate retained on 4.75 mm sieve.
- Let RD<sub>2</sub> = bulk relative density of aggregate passing 4.75mm sieve.
- Let RD<sub>3</sub> = bulk relative density of blend aggregate

Average bulk relative density =  $\frac{100}{\frac{M_1}{RD_1} + \frac{M_2}{RD_2}}$  = #####

# WALGREN SOILS TESTING

## BULK RELATIVE DENSITY OF AGGREGATE

Contract No. \_\_\_\_\_  
 Pit Name Wait a Bit Pit Investigation  
 Location Kootenay  
 Test Hole 22 - 04

Tested by WST  
 Performed by WST  
 Date Dec. 13 - 31/22

### COARSE AGGREGATE (RETAINED ON 4.75mm SIEVE)

		No. of Test			Avg
		1	2	3	
Dry mass in air	(A <sub>c</sub> )	735.6	724.1	707.9	g
Saturated surface dry in air	(B)	746.5	735.3	719.5	g
Saturated surface dry mass in water	(C)	465.4	458.0	448.0	g
Bulk relative density =	$\frac{A_c}{B-C}$	2.617	2.611	2.607	<b>2.612</b>
% absorption =	$\frac{B-A_c}{A_c} \times 100$	1.48	1.55	1.64	<b>1.56</b>

### FINE AGGREGATE (PASSING 4.75mm SIEVE)

		No. of Test			
		5	6	7	
Mass of water required to calibrate flask	(W <sub>c</sub> )	498.6	499.1	499.3	g
Mass of flask	(X)	150.1	168.6	176.2	g
Mass of flask & saturated surface dry aggregate & water	(Z)	969.3	949.0	952.6	g
Mass of flask plus saturated surface dry aggregate	(Y)	666.3	622.3	622.1	g
Mass of added water (Z- Y)	(W <sub>a</sub> )	303.0	326.7	330.5	g
Mass of oven dry aggregate in air	(A <sub>f</sub> )	506.5	444.8	437.3	g
Bulk relative density =	$\frac{A_f}{W_c - W_a}$	2.589	2.580	2.591	<b>2.587</b>
% water absorption =	$\frac{Y - X - A_f}{A_f} \times 100$	1.92	2.00	1.97	<b>1.96</b>

#### Average Bulk Relative Density

- Let M<sub>1</sub> = per cent by mass of aggregate retained on 4.75mm sieve.
- Let M<sub>2</sub> = per cent by mass of aggregate passing 4.75mm sieve.
- Let M<sub>3</sub> = per cent by mass of blend aggregate
- Let RD<sub>1</sub> = bulk relative density of aggregate retained on 4.75 mm sieve.
- Let RD<sub>2</sub> = bulk relative density of aggregate passing 4.75mm sieve.
- Let RD<sub>3</sub> = bulk relative density of blend aggregate

Average bulk relative density =  $\frac{100}{(M_1/RD_1) + (M_2/RD_2)}$  = #####

# WALGREN SOILS TESTING

## BULK RELATIVE DENSITY OF AGGREGATE

Contract No. \_\_\_\_\_  
 Pit Name Wait a Bit Pit Investigation  
 Location Kootenay  
 Test Hole 22 - 13

Tested by WST  
 Performed by WST  
 Date Dec. 13 - 31/22

### COARSE AGGREGATE (RETAINED ON 4.75mm SIEVE)

		No. of Test			Avg
		1	2	3	
Dry mass in air	(A <sub>c</sub> )	732.6	727.0	727.4	g
Saturated surface dry in air	(B)	744.3	733.2	736.5	g
Saturated surface dry mass in water	(C)	468.8	458.8	460.4	g
Bulk relative density =	$\frac{A_c}{B-C}$	2.659	2.649	2.635	<b>2.648</b>
% absorption =	$\frac{B-A_c}{A_c} \times 100$	1.60	0.85	1.25	<b>1.23</b>

### FINE AGGREGATE (PASSING 4.75mm SIEVE)

		No. of Test			
		1	2	3	
Mass of water required to calibrate flask	(W <sub>c</sub> )	499.4	499.3	498.7	g
Mass of flask	(X)	172.0	163.4	151.2	g
Mass of flask & saturated surface dry aggregate & water	(Z)	964.0	960.5	956.0	g
Mass of flask plus saturated surface dry aggregate	(Y)	640.9	639.4	640.5	g
Mass of added water (Z- Y)	(W <sub>a</sub> )	323.1	321.1	315.5	g
Mass of oven dry aggregate in air	(A <sub>f</sub> )	462.9	469.6	482.9	g
Bulk relative density =	$\frac{A_f}{W_c - W_a}$	2.626	2.635	2.636	<b>2.632</b>
% water absorption =	$\frac{Y - X - A_f}{A_f} \times 100$	1.30	1.36	1.33	<b>1.33</b>

#### Average Bulk Relative Density

- Let M<sub>1</sub> = per cent by mass of aggregate retained on 4.75mm sieve.
- Let M<sub>2</sub> = per cent by mass of aggregate passing 4.75mm sieve.
- Let M<sub>3</sub> = per cent by mass of blend aggregate
- Let RD<sub>1</sub> = bulk relative density of aggregate retained on 4.75 mm sieve.
- Let RD<sub>2</sub> = bulk relative density of aggregate passing 4.75mm sieve.
- Let RD<sub>3</sub> = bulk relative density of blend aggregate

Average bulk relative density =  $\frac{100}{\frac{M_1}{RD_1} + \frac{M_2}{RD_2}}$  = #####

# Walgreen Soils Testing Ltd.

## Sand Equivalent / Micro Deval Testing

District: S. Koot.  
 Pit: Wait a bit

Project: Wait a bit Pit Investigation  
 Tested by: WST Date Tested: Dec-22  
 Sampled by: WM Date Sampled: Nov. 2022

<b>Test Hole</b> <u>22 - 01a</u>	<b>Sample #:</b> <u>1</u>	<b>Depth:</b> <u>0.3 - 6.2</u>					
<b>Sand Equivalent</b>		<b>Micro - Deval Test</b>					
Trial #	1	2	3		Retained	Before	After
Reading	20 min	20 min			16.0 mm	374.8	329.9
Ht. Clay	45.00	46.00			12.5 mm	376.4	340
Ht. Sand	31.00	31.00			9.5 mm	750.3	550.7
S.E.	68.89	67.39				1501.5	1220.59
<b>Ave.</b>		<b>68.14</b>					<b>18.71 %</b>

<b>Test Hole</b> <u>22 - 04a</u>	<b>Sample #:</b> <u>1</u>	<b>Depth:</b> <u>0.3 - 6.4</u>					
<b>Sand Equivalent</b>		<b>Micro - Deval Test</b>					
Trial #	1	2	3		Retained	Before	After
Reading	20 min	20 min			16.0 mm	376.4	320.2
Ht. Clay	69.00	70.00			12.5 mm	374.8	279.1
Ht. Sand	30.00	30.00			9.5 mm	750.1	614.1
S.E.	43.48	42.86			Totals	1501.3	1213.4
<b>Ave.</b>		<b>43.17</b>					<b>19.18 %</b>

<b>Test Hole</b> <u>22 - 7a</u>	<b>Sample #:</b> <u>1</u>	<b>Depth:</b> <u>0.3 - 6.5</u>					
<b>Sand Equivalent</b>		<b>Micro - Deval Test</b>					
Trial #	1	2	3		Retained	Before	After
Reading	20 min	20 min			16.0 mm	377	318.8
Ht. Clay	47.00	45.00			12.5 mm	375.1	230.8
Ht. Sand	30.00	30.00			9.5 mm	751.8	656.2
S.E.	63.83	66.67				1503.9	1205.8
<b>Ave.</b>		<b>65.25</b>					<b>19.82 %</b>

<b>Test Hole</b> <u>22 - 10a</u>	<b>Sample #:</b> <u>1</u>	<b>Depth:</b> <u>0.3 - 4.1</u>					
<b>Sand Equivalent</b>		<b>Micro - Deval Test</b>					
Trial #	1	2	3		Retained	Before	After
Reading	20 min	20 min			16.0 mm	377	328.5
Ht. Clay	42.00	42.00			12.5 mm	375.9	267.6
Ht. Sand	31.00	31.00			9.5 mm	749.5	612.3
S.E.	73.81	73.81				1502.4	1208.4
<b>Ave.</b>		<b>73.81</b>					<b>19.57 %</b>

<b>Test Hole</b> <u>22 - 13a</u>	<b>Sample #:</b> <u>1</u>	<b>Depth:</b> <u>6.1 - 6.5</u>					
<b>Sand Equivalent</b>		<b>Micro - Deval Test</b>					
Trial #	1	2	3		Retained	Before	After
Reading	20 min	20 min			16.0 mm	375.1	309.1
Ht. Clay	42.00	41.00			12.5 mm	375.0	283.1
Ht. Sand	30.00	30.00			9.5 mm	749.7	635.7
S.E.	71.43	73.17				1499.8	1227.9
<b>Ave.</b>		<b>72.30</b>					<b>18.13 %</b>

<b>Maximum</b> <u>73.81</u>	<b>Maximum</b> <u>19.82</u>
<b>Minimum</b> <u>42.86</u>	<b>Minimum</b> <u>18.13</u>
<b>Average</b> <u>64.53</u>	<b>Average</b> <u>19.08</u>

# Walgren Soils Testing

ASTM C88

Soundness of Aggregates

Project: Wait a Bit Pit Test Hole 22-02 Tested by: WST  
 District: \_\_\_\_\_ Sample #: 22-02a Date Tested: Mar. 27 - April 4/23  
 Date Sampled: 22-Dec Depth: 0.3 - 6.1 m  
 Aggregate Size: 37.5 mm

<b>Soundness Test of Coarse Aggregate</b>									
Sieve Size		Grading of		Mass Before		After 5 Cycles		Weighted	
Passing	Original % Retained	Orgnl Smpl (%)		Test (g)		Mass Remaining	Loss (%)	% Mass loss	
	37.5	0	0.0	0.0					
37.5	25.0	1021.1	36.0	54.1	1535.6	1536	1512.6	1.50	0.8
25.0	19.0	514.5	18.1						
19.0	12.5	670	23.6	35.3	1003	1003	1018.2	-1.5	-0.5
12.5	9.5	333	11.7						
9.5	4.75	300	10.6	10.6	300	300	298.2	0.6	0.1
	<b>Total</b>	<b>2838.6</b>	<b>Total:</b>	<b>100</b>				<b>Total:</b>	<b>0.3</b>

<b>Soundness Test of Fine Aggregate</b>									
9.5	4.75							0	
4.75	2.36	100	16.7		100		100	0	0.0
2.36	1.18	100	16.7		100		99.8	0.2	0.0
1.18	0.600	100	16.7		100		99.4	0.6	0.1
0.600	0.300	100	16.7		100		100	0	0.0
0.300	0.150	100	16.7		100		100	0	0.0
0.150	Pan	100.0	16.7		100		100	0	0.0
	<b>Total</b>	<b>600</b>	<b>100</b>					<b>Total:</b>	<b>0.1</b>

This fraction is not used when sample contains both Coarse and Fine Portions, % of initial sample passing the 4.75 mm Sieve = 29.7 %

# Walgren Soils Testing

ASTM C88

Soundness of Aggregates

Project: Wait a Bit Pit Test Hole 22-08 Tested by: WST  
 District: \_\_\_\_\_ Sample #: 22-08b Date Tested: Mar. 27 - April 4/23  
 Date Sampled: 22-Dec Depth: 6.4 - 6.7 m  
 Aggregate Size: 37.5 mm

<b>Soundness Test of Coarse Aggregate</b>									
Sieve Size			Grading of		Mass Before		After 5 Cycles		Weighted
Passing	Original % Retained		Orgnl Smpl (%)		Test (g)		Mass Remaining	Loss (%)	% Mass loss
	37.5	0	0.0	0.0					
37.5	25.0	1019.5	36.0	53.9	1525.3	1525	1505.9	1.27	0.7
25.0	19.0	505.8	17.9						
19.0	12.5	672.1	23.8	35.5	1004	1004	1001.3	0.2	0.1
12.5	9.5	331.4	11.7						
9.5	4.75	300.1	10.6	10.6	300.1	300	299.7	0.1	0.0
	<b>Total</b>	<b>2828.9</b>	<b>Total:</b>	<b>100</b>				<b>Total:</b>	<b>0.8</b>
<b>Soundness Test of Fine Aggregate</b>									
9.5	4.75							0	
4.75	2.36	100	16.7		100		99.9	0.1	0.0
2.36	1.18	100	16.7		100		99.8	0.2	0.0
1.18	0.600	100	16.7		100		99.4	0.6	0.1
0.600	0.300	100	16.7		100		100	0	0.0
0.300	0.150	100	16.7		100		100	0	0.0
0.150	Pan	100.0	16.7		100		100	0	0.0
	<b>Total</b>	<b>600</b>	<b>100</b>					<b>Total:</b>	<b>0.1</b>

This fraction is not used when sample contains both Coarse and Fine Portions, % of initial sample passing the 4.75 mm Sieve = \_\_\_\_\_ %

## SOLUBLE SULPHATE ION CONTENT OF SOIL

(CSA Designation A23.2-2B & A23.2-3B)

Project: 2023 Materials Testing Date Tested: April 12, 2023  
 Project No.: 704-ENG.CMCS03044-01 Tested By: EM  
 Client: Walgren Soils Testing Sample Source: 22-01  
 Location: Wait-a-Bit Pit Laboratory: 110, 140 Quarry Park Blvd. S.E.,  
Calgary, AB T2C 3G3

Sample Number	L-1				
Borehole Number	22-01				
Depth (m)	-				
Total Soluble Sulphate Content, %	0.07				
Degree of Exposure (Class)	Negligible (neg)				

Class of exposure	Degree of exposure	Water-soluble sulphate (SO <sub>4</sub> ) <sup>†</sup> in soil sample, %	Sulphate (SO <sub>4</sub> ) in groundwater samples, mg/L <sup>‡</sup>	Water soluble sulphate (SO <sub>4</sub> ) in recycled aggregate sample, %	Cementing materials to be used <sup>§</sup>
S-1	Very severe	> 2.0	> 10 000	> 2.0	HS or HSb
S-2	Severe	0.20–2.0	1500–10 000	0.60–2.0	HS or HSb
S-3	Moderate	0.10–0.20	150–1500	0.20–0.60	MS, MSb, LH, HS, or HSb

*\*For sea water exposure, see Clause 4.1.1.5.*

*†In accordance with CSA A23.2-3B.*

*‡In accordance with CSA A23.2-2B.*

*§Cementing material combinations with equivalent performance may be used (see Clauses 4.2.1.2, 4.2.1.3, and 4.2.1.4). Type HS cement shall not be used in reinforced concrete exposed to both chlorides and sulphates. Refer to Clause 4.1.1.6.3.*

**Limitations:**

- i) The degree of exposure class included herein are valid only if drainage and weeping systems meet the requirements of the site conditions.
- ii) The degree exposure class should be re-verified if backfill soils for foundation walls originate from an unknown source.

Remarks: Client Sample ID Sa# 11a

Reviewed By: P.Eng.



## WATER SOLUBLE CHLORIDE ION CONTENT IN CONCRETE

CSA Designation A23.2-4B (Clause 5.2.A-Direct Measurement Method)

Project: 2023 Materials Testing Date Tested: April 12, 2023 By: EM  
 Project No.: 704-ENG.EMCS03044-01 Date Received: April 3, 2023  
 Client: Walgren Soils Testing Laboratory: Suite 110, 140 Quarry Park Blvd. S.E., Calgary, AB T2G 3G3

Sample No.	<b>L-1 (Client Sa #11a)</b>				Sample No.				
Sample Location	<b>Wait a-Bit-Pit (22-01)</b>				Sample Location				
Depth (mm):	-	-			Depth (mm):				
Chloride Content (ppm by Mass of Sample)	14				Chloride Content (ppm by Mass of Sample)				
Chloride Content (% by Mass of Sample)	0.001				Chloride Content (% by Mass of Sample)				

Sample No.					Sample No.				
Sample Location					Sample Location				
Depth (mm):					Depth (mm):				
Chloride Content (ppm by Mass of Sample)					Chloride Content (ppm by Mass of Sample)				
Chloride Content (% by Mass of Sample)					Chloride Content (% by Mass of Sample)				

Sample No.					Sample No.				
Sample Location					Sample Location				
Depth (mm):					Depth (mm):				
Chloride Content (ppm by Mass of Sample)					Chloride Content (ppm by Mass of Sample)				
Chloride Content (% by Mass of Sample)					Chloride Content (% by Mass of Sample)				

**Remarks:** \_\_\_\_\_  
 \_\_\_\_\_

Reviewed By:  P.Eng.





# PARTICLE SIZE DISTRIBUTION ASTM C136 Method B

Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-01
Source:	Waitabit Pit	Sample No.:	2
Soil Description:		Type:	GS
		Depth (m):	3.00 -

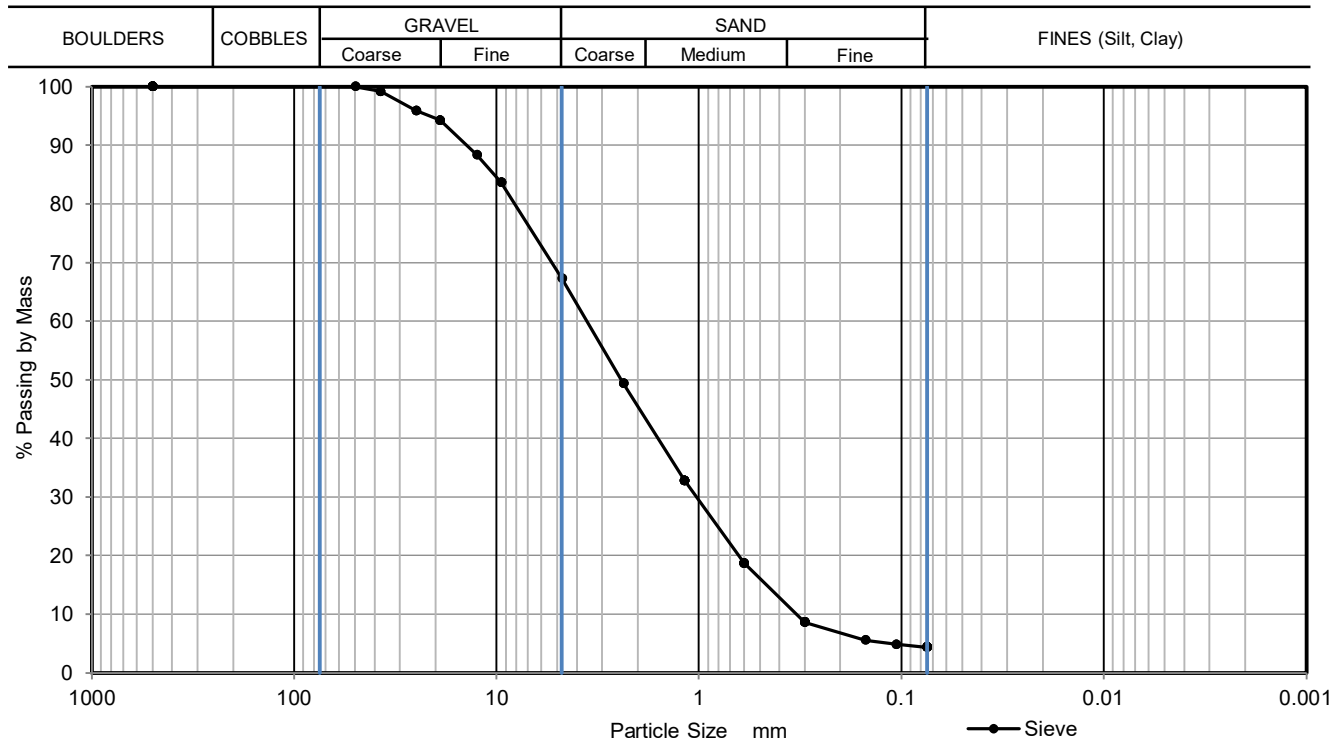
Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	28 Aug 2023
Specimen Description	NA				

### Grain Size Distribution (%)

32.7

62.9

4.4



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
2"	50	100.0		
1 1/2"	37.5	99.2		
1"	25	95.9		
3/4"	19	94.3		
1/2"	12.5	88.4		
3/8"	9.5	83.7		
#4	4.75	67.3		
#8	2.36	49.4		
#16	1.18	32.8		
#30	0.6	18.7		
#50	0.3	8.6		
#100	0.15	5.5		
#140	0.106	4.8		
#200	0.075	4.4		
D60	D30	D10	Cu	Cc
3.57	1.03	0.33	11.00	0.90

Notes: Gravels were cemented together.

### Disclaimer:

The laboratory testing services reported herein have been performed in accordance with the terms of a contract with WSP's client, and with the recognized standards indicated in this report, or local industry practice. This laboratory testing services report is for the sole use of WSP's client, relates only to the sample(s) tested and does not represent any (actual or implied) interpretation or opinion regarding specification compliance or materials suitability for any specific purpose.

Tested by: JSingh      Date: 28 Aug 2023      Checked by: JSingh      Date: 06 Sep 2023      Reviewed by: JStotz      Date: 06 Sep 2023

WSP Canada Inc.  
590 McKay Avenue, Suite 300 Kelowna, British Columbia, V1Y 5A8  
Canada



# PARTICLE SIZE DISTRIBUTION ASTM C136 Method B

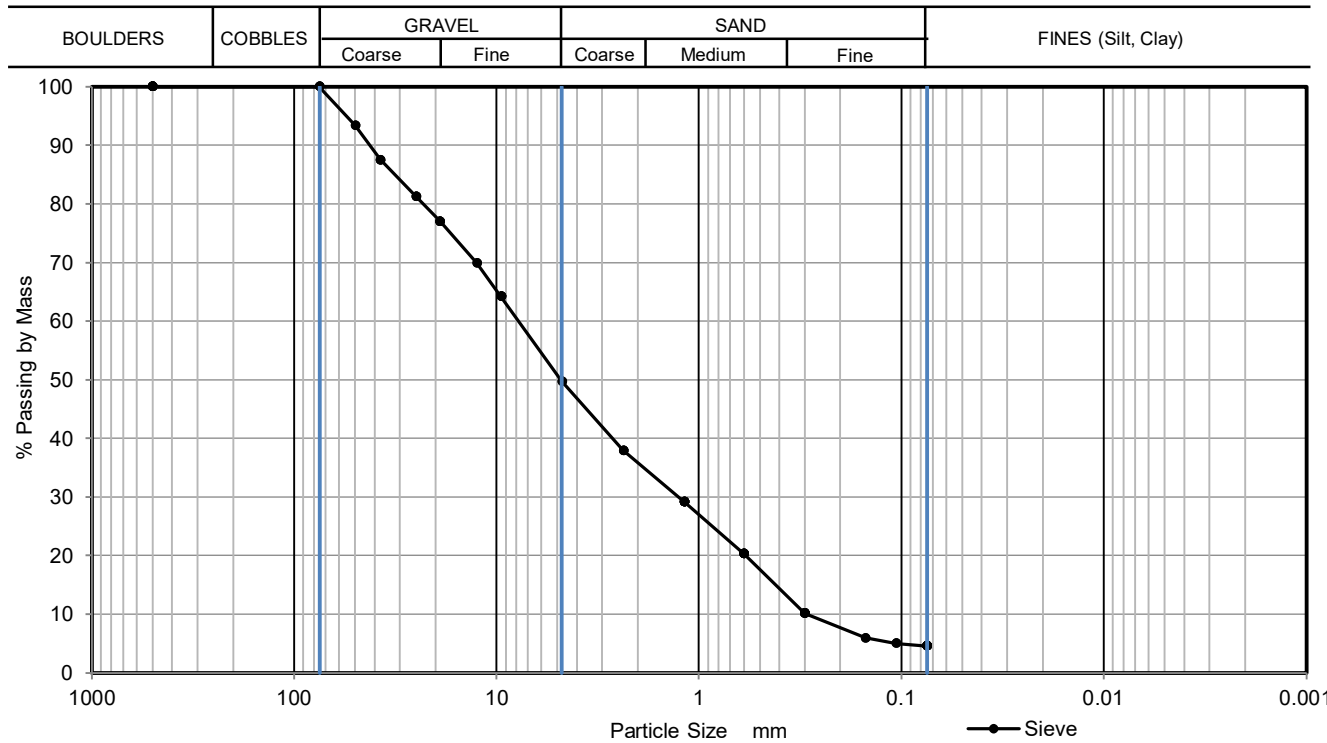
Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-02
Source:	Waitabit Pit	Sample No.:	2
Soil Description:		Type:	GS
		Depth (m):	0.00 -
Specimen Reference	NA	Specimen Depth (m):	NA
		Date of Test	28 Aug 2023
Specimen Description	NA		

### Grain Size Distribution (%)

50.3

45.1

4.6



Sieve			Material Specification	
			Lower	Upper
Sieve No.	Particle Size mm	% Passing		
3"	75	100.0		
2"	50	93.4		
1 1/2"	37.5	87.5		
1"	25	81.3		
3/4"	19	77.0		
1/2"	12.5	69.9		
3/8"	9.5	64.2		
#4	4.75	49.7		
#8	2.36	37.9		
#16	1.18	29.1		
#30	0.6	20.3		
#50	0.3	10.1		
#100	0.15	5.9		
#140	0.106	5.0		
#200	0.075	4.6		
D60	D30	D10	Cu	Cc
7.77	1.27	0.30	26.00	0.70

**Notes:** Gravels were cemented together.

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**Tested by:** JSingh    **Date:** 28 Aug 2023    **Checked by:** JSingh    **Date:** 06 Sep 2023    **Reviewed by:** JStotz    **Date:** 06 Sep 2023

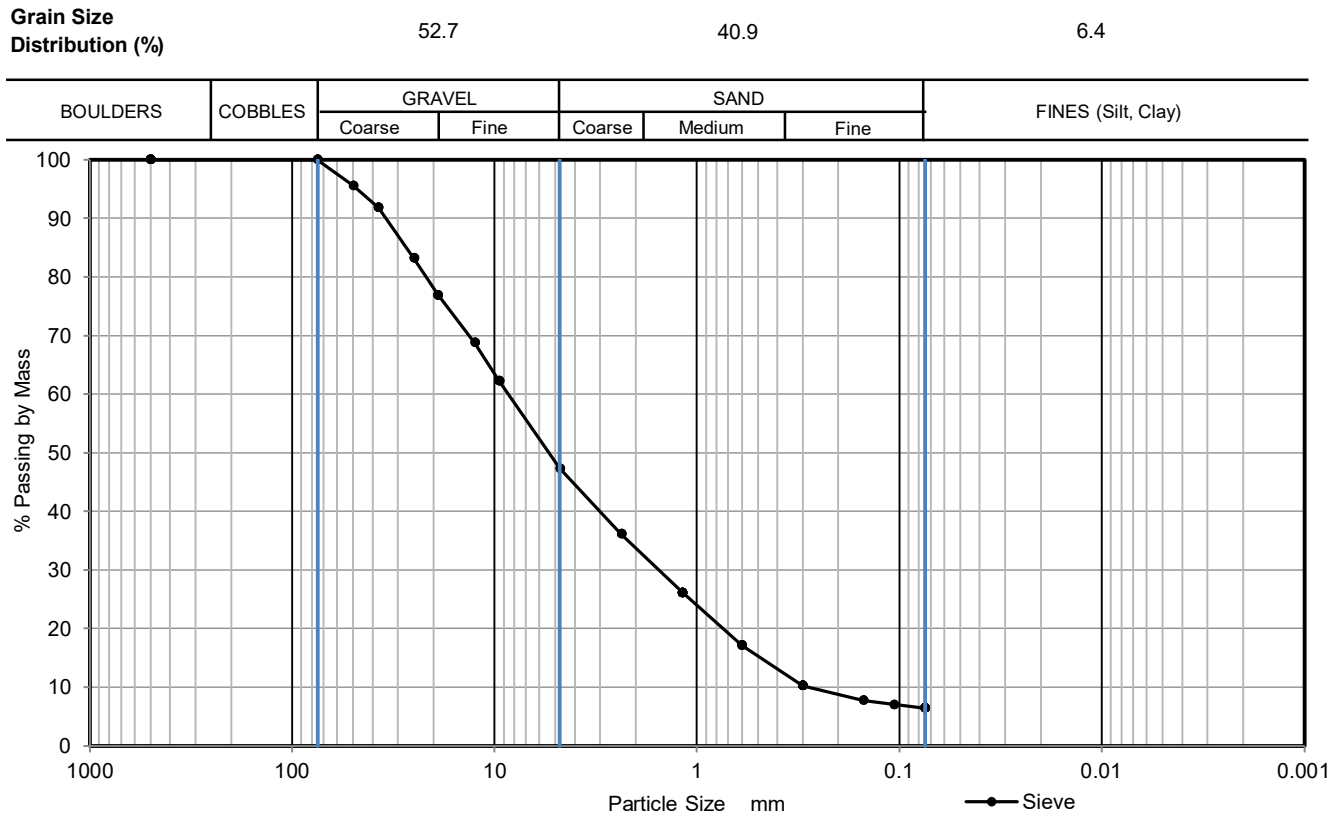
WSP Canada Inc.  
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Canada



**PARTICLE SIZE DISTRIBUTION  
ASTM C136 Method B**

Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-02
Source:	Waitabit Pit	Sample No.:	1
Soil Description:		Type:	GS
		Depth (m):	1.50 -

Specimen Reference: NA    Specimen Depth (m): NA    Date of Test: 28 Aug 2023  
Specimen Description: NA



Sieve			Material Specification	
			Lower	Upper
Sieve No.	Particle Size mm	% Passing		
3"	75	100.0		
2"	50	95.6		
1 1/2"	37.5	91.8		
1"	25	83.2		
3/4"	19	76.9		
1/2"	12.5	68.8		
3/8"	9.5	62.3		
#4	4.75	47.3		
#8	2.36	36.1		
#16	1.18	26.1		
#30	0.6	17.1		
#50	0.3	10.2		
#100	0.15	7.7		
#140	0.106	7.0		
#200	0.075	6.4		
D60	D30	D10	Cu	Cc
8.54	1.55	0.28	30.00	0.99

**Notes:** Gravels were cemented together.

**Disclaimer:**

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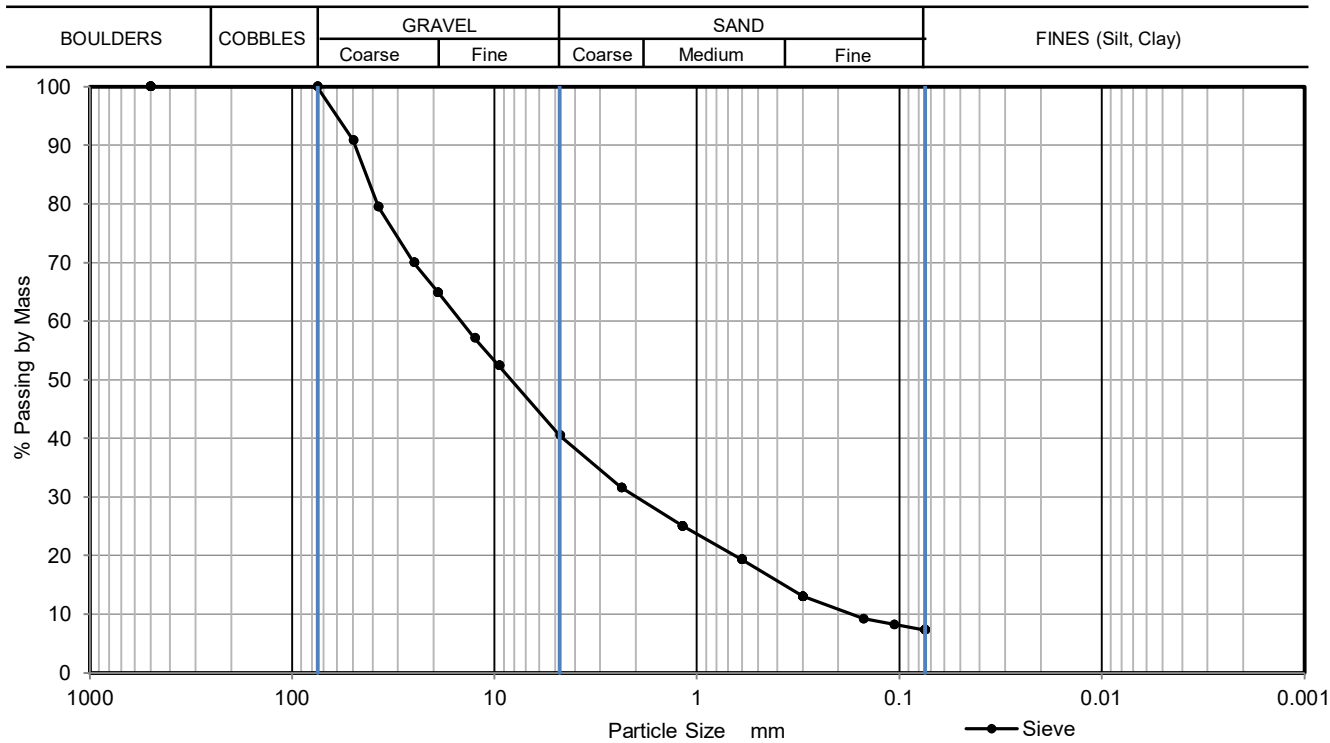
**Tested by:** JSingh                          **Date:** 28 Aug 2023                          **Checked by:** JSingh                          **Date:** 06 Sep 2023                          **Reviewed by:** JStotz                          **Date:** 06 Sep 2023

WSP Canada Inc.  
590 McKay Avenue, Suite 300 Kelowna, British Columbia, V1Y 5A8  
Canada

Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-03
Source:	Waitabit Pit	Sample No.:	1
Soil Description:		Type:	GS
		Depth (m):	1.50 -

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	28 Aug 2023
Specimen Description	NA				

Grain Size Distribution (%)      59.5                                  33.2                                  7.3



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
3"	75	100.0		
2"	50	90.9		
1 1/2"	37.5	79.5		
1"	25	70.0		
3/4"	19	64.9		
1/2"	12.5	57.1		
3/8"	9.5	52.4		
#4	4.75	40.5		
#8	2.36	31.6		
#16	1.18	25.0		
#30	0.6	19.3		
#50	0.3	13.0		
#100	0.15	9.2		
#140	0.106	8.2		
#200	0.075	7.3		
D60	D30	D10	Cu	Cc
14.60	1.99	0.17	84.00	1.60

**Notes:** Gravels were cemented together.

**Disclaimer:**

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Tested by: JSingh      Date: 28 Aug 2023      Checked by: JSingh      Date: 06 Sep 2023      Reviewed by: JStotz      Date: 06 Sep 2023

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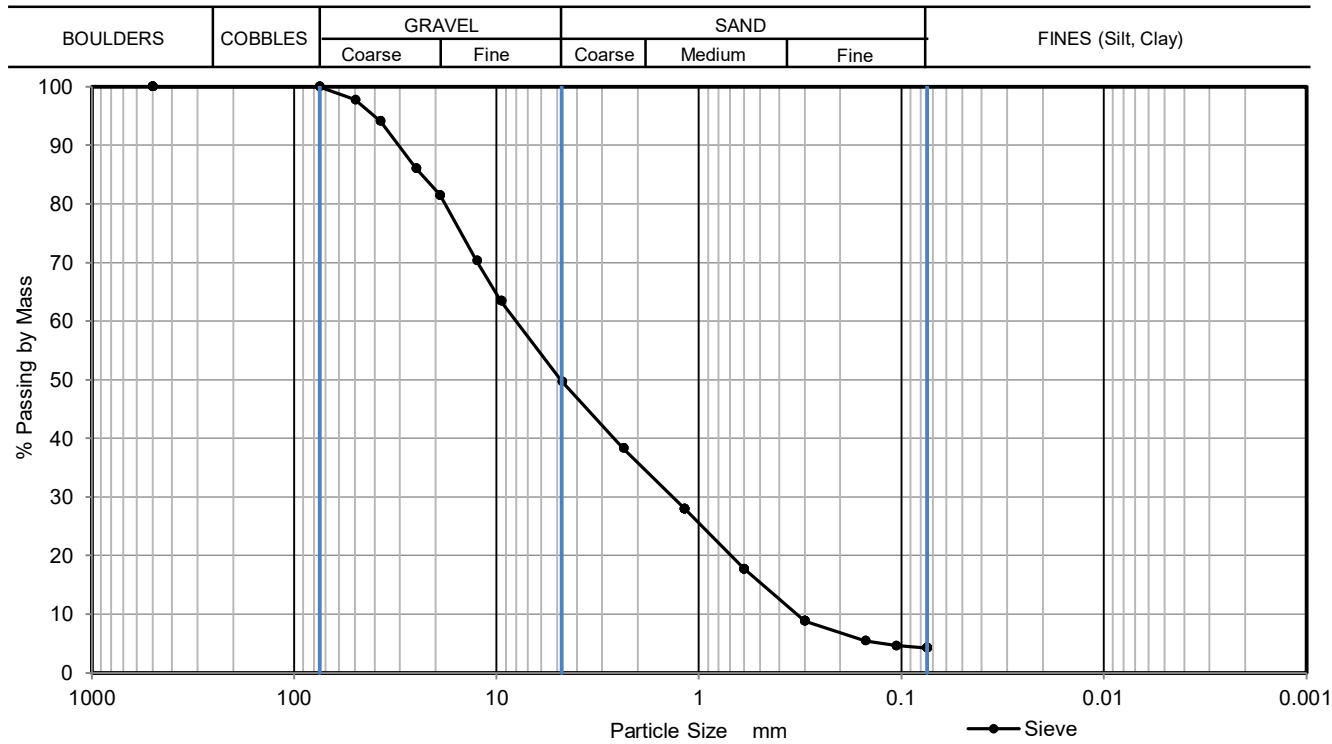
Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-03
Source:	Waitabit Pit	Sample No.:	2
Soil Description:		Type:	GS
		Depth (m):	3.50 -
Specimen Reference	NA	Specimen Depth (m):	NA
		Date of Test	28 Aug 2023
Specimen Description	NA		

### Grain Size Distribution (%)

50.3

45.5

4.2



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
3"	75	100.0		
2"	50	97.8		
1 1/2"	37.5	94.1		
1"	25	86.1		
3/4"	19	81.5		
1/2"	12.5	70.3		
3/8"	9.5	63.4		
#4	4.75	49.7		
#8	2.36	38.3		
#16	1.18	28.0		
#30	0.6	17.7		
#50	0.3	8.8		
#100	0.15	5.4		
#140	0.106	4.6		
#200	0.075	4.2		
D60	D30	D10	Cu	Cc
8.00	1.35	0.33	24.00	0.69

**Notes:** Gravels were cemented together.

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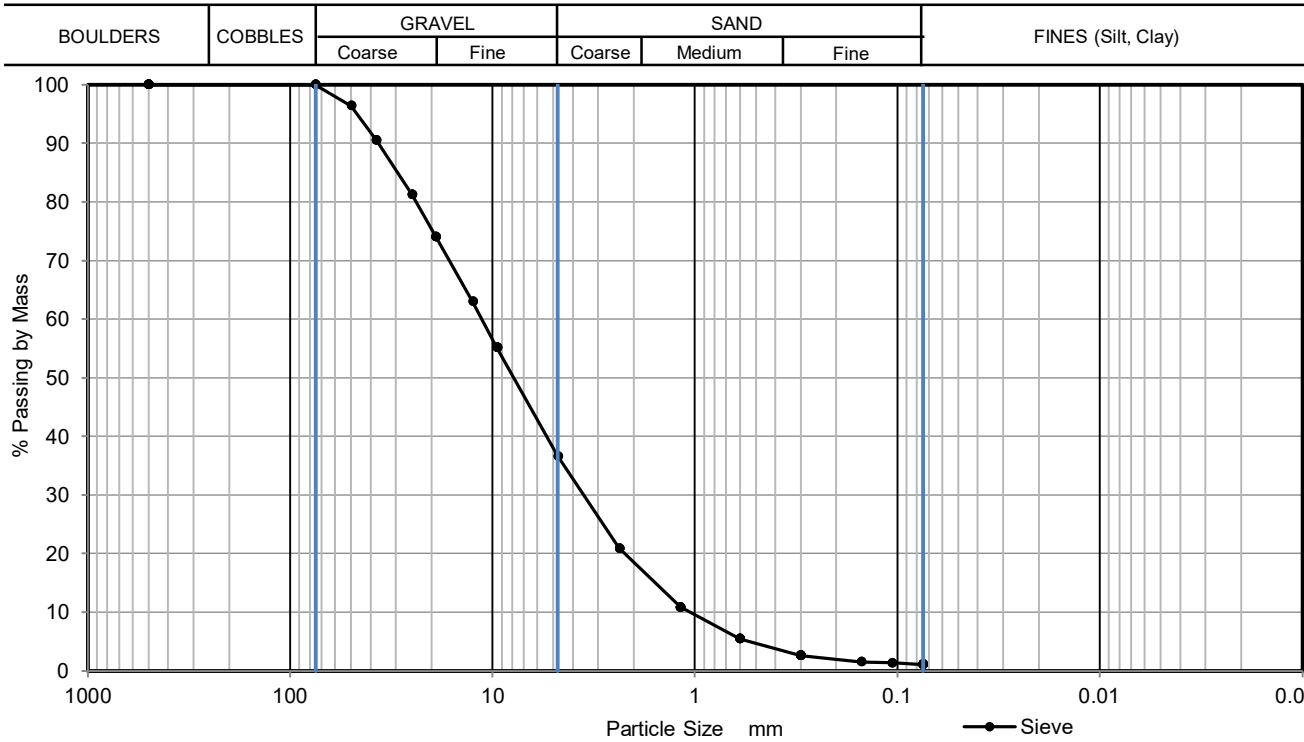
**PARTICLE SIZE DISTRIBUTION  
ASTM C136 Method B**

Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-06
Source:	Waitabit Pit	Sample No.:	2
		Type:	GS
Soil Description:		Depth (m):	3.00 -

Specimen Reference	NA	Specimen Depth (m):	NA	Date of Test	29 Aug 2023
Specimen Description	NA				

**Grain Size  
Distribution (%)**

63.4                                      35.5                                      1.1



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
3"	75	100.0		
2"	50	96.4		
1 1/2"	37.5	90.5		
1"	25	81.3		
3/4"	19	74.0		
1/2"	12.5	63.0		
3/8"	9.5	55.1		
#4	4.75	36.6		
#8	2.36	20.9		
#16	1.18	10.8		
#30	0.6	5.4		
#50	0.3	2.6		
#100	0.15	1.5		
#140	0.106	1.3		
#200	0.075	1.1		
D60	D30	D10	Cu	Cc
11.30	3.54	1.07	11.00	1.00

**Notes:**

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Tested by: JSingh      Date: 29 Aug 2023      Checked by: JSingh      Date: 06 Sep 2023      Reviewed by: JStotz      Date: 06 Sep 2023

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# PARTICLE SIZE DISTRIBUTION ASTM C136 Method B

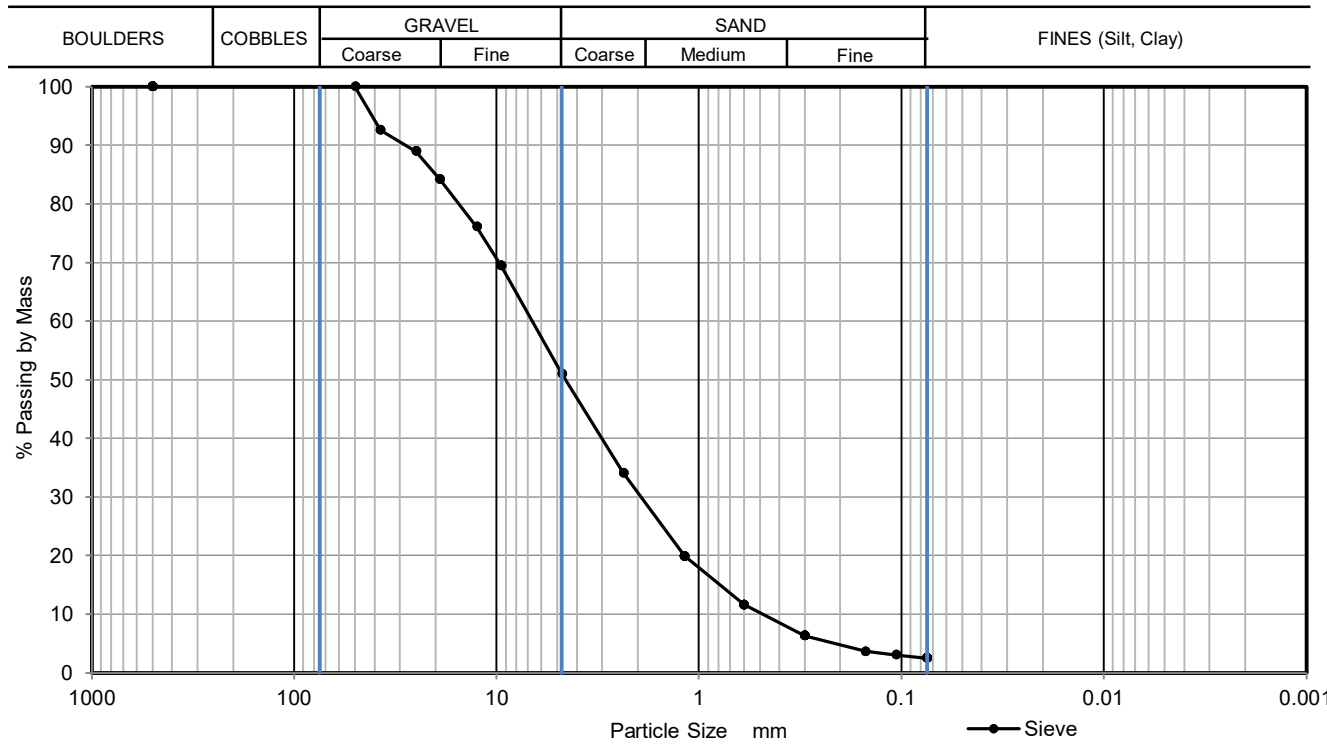
Test Request #	K23-121	Project Number:	KX13866.100
Client:	Ministry of Transportation and Infrastructure	Project Location:	
Project Name:	Waitabit Pit	Sample Location:	TP23-07
Source:	Waitabit Pit	Sample No.:	1
Soil Description:		Type:	GS
		Depth (m):	1.00 -
Specimen Reference	NA	Specimen Depth (m):	NA
		Date of Test	29 Aug 2023
Specimen Description	NA		

### Grain Size Distribution (%)

49.0

48.5

2.5



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
2"	50	100.0		
1 1/2"	37.5	92.6		
1"	25	89.0		
3/4"	19	84.2		
1/2"	12.5	76.1		
3/8"	9.5	69.5		
#4	4.75	51.0		
#8	2.36	34.1		
#16	1.18	19.9		
#30	0.6	11.6		
#50	0.3	6.3		
#100	0.15	3.6		
#140	0.106	3.0		
#200	0.075	2.5		
D60	D30	D10	Cu	Cc
6.65	1.93	0.49	14.00	1.20

### Notes:

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### PARTICLE SIZE DISTRIBUTION ASTM C136 Method B

Test Request # K23-121 Project Number: KX13866.100  
 Client: Ministry of Transportation and Infrastructure Project Location:  
 Project Name: Waitabit Pit Sample Location: TP23-07  
 Source: Waitabit Pit Sample No.: 2  
 Soil Description: Type: GS  
 Depth (m): 2.50 -

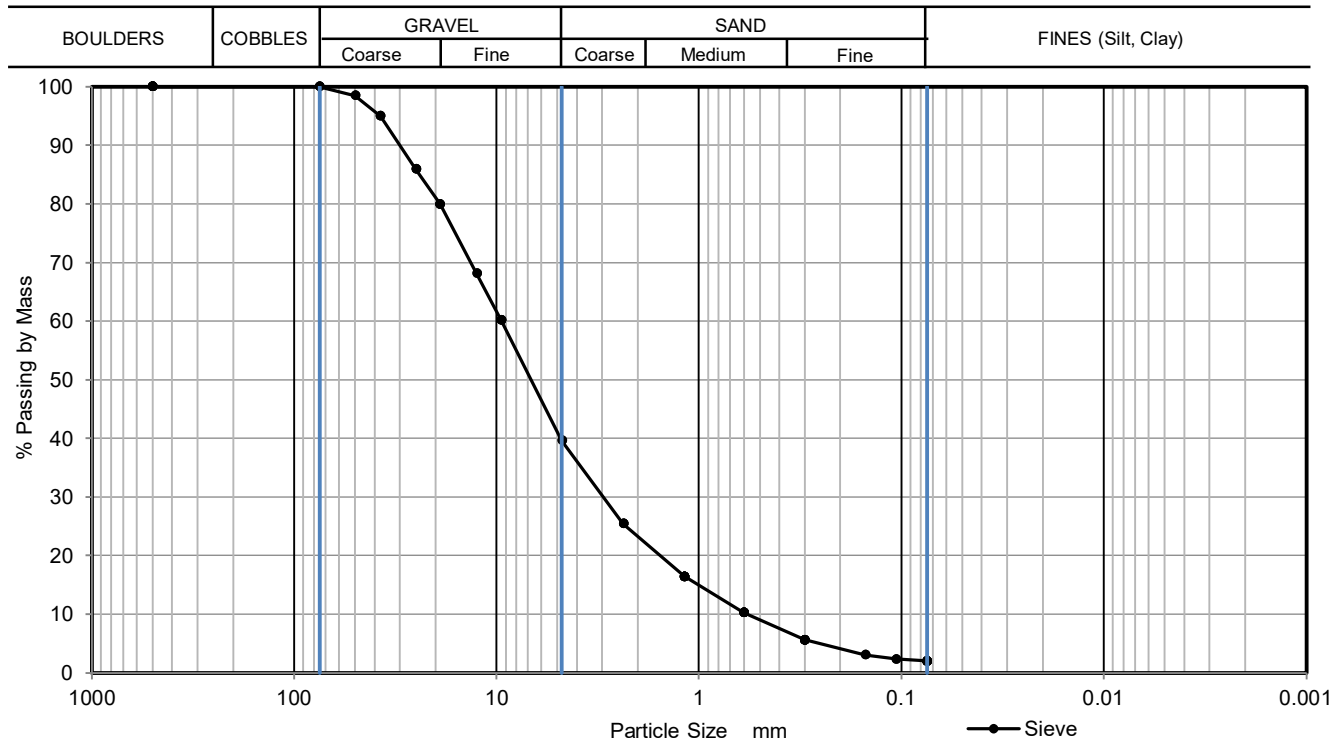
Specimen Reference NA Specimen Depth (m): NA Date of Test 29 Aug 2023  
 Specimen Description NA

**Grain Size Distribution (%)**

60.4

37.6

2.0



Sieve			Material Specification	
Sieve No.	Particle Size mm	% Passing	Lower	Upper
3"	75	100.0		
2"	50	98.5		
1 1/2"	37.5	95.0		
1"	25	85.9		
3/4"	19	80.0		
1/2"	12.5	68.1		
3/8"	9.5	60.2		
#4	4.75	39.6		
#8	2.36	25.4		
#16	1.18	16.4		
#30	0.6	10.2		
#50	0.3	5.6		
#100	0.15	3.0		
#140	0.106	2.3		
#200	0.075	2.0		
D60	D30	D10	Cu	Cc
9.44	2.96	0.58	16.00	1.60

**Notes:**  
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