

YUKON ENGINEERING SERVICES LTD.
YUKON ZINC CORP.

**DRAFT GEOTECHNICAL EVALUATION
GRANULAR AND BORROW INVESTIGATION
WOLVERINE LAKE MINE ACCESS ROAD
km 190 ROBERT CAMPBELL HIGHWAY
YUKON**

EBA File: 1200197

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TABLE OF CONTENTS

	PAGE
1.0 INTRODUCTION.....	2
2.0 PROJECT BACKGROUND.....	2
3.0 RESULTS AND DISCUSSION	2
4.0 BORROW SOURCES.....	3
Primary 1	3
Primary 2	3
Primary 3	4
Primary 4	4
Secondary 3.....	5
Secondary 7.....	6

Forthcoming with Final Report:

FIGURES
TEST PIT LOGS
APPENDICES

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained to conduct a geotechnical evaluation of the proposed access road to the Yukon Zinc mining property at Wolverine Lake, Yukon. The work was requested by Yukon Engineering Services Ltd. (YES) of Whitehorse on behalf of Yukon Zinc Corp (YZC). The objective of the evaluation is to provide geotechnical recommendations for the construction of the access road.

The scope of work for this project was presented in a proposal and budget prepared by EBA and submitted to Robert Harvey, P.Eng. of YES in June 2006. During the first phase of the work in July 2006, 76 test pits were completed on the access road alignment between kilometre post (KP) 5 and KP 24 (Geotechnical Evaluation, Wolverine Lake Mine Access Road, EBA, August 2006). This report presents the results of the second phase, which assessed six borrow targets between KP 0 and KP 24, and completed testpits from KP 0 to KP 3.3 on the road alignment.

2.0 PROJECT BACKGROUND

The study area includes 24 km of a proposed access road that starts at km 190 on the Robert Campbell Highway (Yukon Highway 4) and is initially aligned south and southwest, following the valley of Light Creek past the divide at km 8 and across Bunker Creek at km 10. The alignment follows Chip Creek to km 19, where it turns northwest to eventually cross the Hawkowl Creek tributary of Money Creek, maintaining a northwest bearing to Wolverine Lake. The access road route is covered on NTS map sheets 105H/5 and 105G/8.

Part of the access road, from about km 24.5 to the Wolverine Lake Mine Site and camp at approximately km 27.5 and km 28.5 respectively, is developed as an access road to the airstrip and was not evaluated as part of this study.

3.0 RESULTS AND DISCUSSION

A trail was pioneered from km 190 on the Robert Campbell Highway to KP 3.2 on the Wolverine Lake Mine Access Road using a Hitachi EX150 excavator provided by Twilite Services Ltd. of Watson Lake. R. Harvey, P.Eng. of YES, Whitehorse supervised the trail construction. A Caterpillar 320C excavator provided by Yukon Zinc was used to excavate testpits to evaluate potential borrow sources between KP 10 and KP 24. J. Dennett, P.Geo.(BC) of EBA supervised testpit excavation for geotechnical evaluation from KP 0 to KP 3.2 and at and at the following borrow targets:

- Primary 1, KP 0.5
- Secondary 3, KP 3
- Primary 2, KP 10.5
- Secondary 7, KP 15.6
- Primary 4, KP 17.5
- Primary 3, KP 24

Figures with borrow locations are provided in Figure 1 of the YES submission.

Seventy-eight samples were collected in 29 testpits from October 3 to 7, 2006 to evaluate the access road and borrow sites. Moisture and grain size analysis was carried out at EBA's Whitehorse geotechnical laboratory on samples recovered during the excavator-supported test-pitting program. Testpit logs with the results of lab analysis used to provide recommendations for construction are appended.

4.0 BORROW SOURCES

Nine potential borrow sources were selected for possible evaluation, including three primary sites and six secondary sites. Secondary sites were identified for evaluation if the primary targets proved inadequate in terms of quantity or quality. For the program described herein, testing and evaluation of borrow sources was completed at six sites. Four of the tested sites, Primary 1, Primary 2, Primary 3 and Secondary 3, were identified as potential borrow source targets by YES in previous reports. Two additional sites tested, Primary 4 (centred about KP 17.5) and Secondary 7 (at KP 15.6), were identified during the field program as favourable borrow sources.

Primary 1

Primary 1 Borrow Site is located along the west side of the access road between KP 0 and KP 1 near the Robert Campbell Highway. Four test pits completed at the Primary 1 site intersected a blanket of gravelly sand. The proposed borrow area is on a glaciofluvial terrace about 11 ha in area. A short slope separates the tested terrace from a western extension of the terrace with an additional 13 ha. The texture and thickness of granular material is consistent. With an average depth of 3.0 m, the 11 ha terrace could yield a prospective volume of over 0.4 million m³ of granular fill. Testpit results are summarized in Table 6.1.

Table 6.1 Primary 1 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
JD-10-4-1	SAND, gravelly, trace silt (7%)	3 – 9.8	3.4	massive, well-graded [till]
JD-10-4-2	SAND, gravelly, trace silt	9 – 13.3	3.0	massive, well-graded [till]
JD-10-4-3	SAND, gravelly, trace silt	4.6 - 8	3.1	[till] refusal at bedrock
JD-10-4-4	SAND, gravelly, trace silt	5.8 – 9.4	3.3	[till] refusal at bedrock

Primary 2

Primary 2 Borrow Site is located along the west side of the access road between about KP10.2 and KP11.7. Sand with variable gravel was observed in the six test pits excavated in the area. Relic channels, stepped terraces and ridges of a large glaciofluvial deposit shape the topography. The area covers over 40 ha and no lower limit to the thickness of granular material was intersected. Grain size analysis completed at the EBA materials testing laboratory in Whitehorse indicates that the material in Testpit JD-10-5-3 is suitable for use as concrete aggregate. Similar granular textures were intersected in other testpits in this area. Testpit results are summarized in Table 6.2.

Table 6.2 Primary 2 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
JD-10-4-5	SAND, gravelly, trace silt to silty	7.2 – 9.6	3.9	massive, well-graded [till]
JD-10-4-6	SAND, trace gravel	2.2 – 8.1	5.4	bedded, poorly-graded [FG]
JD-10-5-1	SAND and GRAVEL (0 – 0.8m)	5.9	5.3	bedded, poorly-graded [FG]
	SAND, some gravel (0.8m-end)	2.1 – 3.6		
JD-10-5-2	SAND and GRAVEL	5.3	4.8	bedded, poorly-graded [FG]
	SAND, trace gravel	3.7 – 10.6		
JD-10-5-3	GRAVEL and SAND, trace boulders	1.8 – 8.7	5.1	bedded, well-graded [FG]
JD-10-5-4	SAND, gravelly, trace boulders	3.5 – 9.5	4.5	bedded, well-graded [FG]

FG = glaciofluvial

Primary 3

Primary 3 Borrow Site is located along the west side of the access road between about KP24 and the Wolverine Lake airstrip. Two test pits excavated in the area intersected a blanket of gravelly sand till that should provide good quality fill for road construction. The testpits were located next to the access road on a low relief ridge. There is considerable potential for a large quantity of this material in the area, but further exploration and testing is required to prove volumes. Testpit results are summarized in Table 6.3.

Relic glaciofluvial meltwater channels were observed in this area and to the southeast along the access road. If a granular source is required in this area, the prospect of glaciofluvial granular deposits is good and further exploration is warranted.

Table 6.3 Primary 3 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
JD-10-7-1	SAND and GRAVEL, trace silt	2.6 – 8.6	4.3	massive, well-graded [till]
JD-10-7-2	SAND, gravelly, trace silt	5.3 – 7.7	2.2	massive, well-graded [till]

Primary 4

Primary 4 Borrow Site is located along the west side of the access road between about KP16.6 and KP18. Eight test pits excavated in the area indicate that a veneer to blanket of glaciofluvial sand and gravel covers an irregular surface of underlying bedrock. The area tested is on a broad terrace about 80 ha in area. Thickness of granular material is variable. Test pits intersected from 1.2 m to greater than 3.6 m of mainly gravel and sand. With an average depth of 2.0 m, the overall terrace area could yield a prospective volume of over 1.0 million m³ of granular fill. Testpit results are summarized in Table 6.4.

Table 6.4 Primary 4 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
TP 43 (KP15.650)	GRAVEL, some sand, trace silt	4.5	2.2	FG blanket (>2.2 m thick);
TP 44 (KP15.925)	GRAVEL and SAND, trace silt	4.5	1.1	FG veneer (>1.1 m thick);
TP 46 (KP16.775)	GRAVEL and SAND, trace silt	8	1.2	FG veneer over bedrock
TP 47 (KP16.950)	SAND and GRAVEL, trace silt	8	1.5	FG blanket (>1.5 m thick)
	SAND, some silt (0.8m to end)	19		
TP 48 (KP17.250)	GRAVEL, some sand, trace silt	4.5	2.0	FG blanket (>2.0 m thick)
	SAND, silty, gravelly	7.5		
TP 49 (KP17.525)	GRAVEL, sandy, trace silt	4.5	2.2	FG blanket (>2.2 m thick)
JD-10-6-10 (50m NW of KP17.5)	GRAVEL, some sand	3.3 – 4.9	3.6	well-bedded moderately graded [FG]
	GRAVEL, some silt, some sand	10.2		
	GRAVEL, sandy, some silt	10.8		
	sub-crop (greenstone bedrock)	-		
TP 50 (KP17.750)	SAND, silty, trace gravel	6.5	1.3	refusal in bedrock
	0.4m SAND, gravelly, silty			

Secondary 3

Secondary 3 Borrow Site is located at the confluence of two streams and is bisected by the road alignment between KP2.7 and KP3.0. Six test pits excavated in the area indicate that a blanket of glaciofluvial sand and gravel forms the two small ridges crossed by the road alignment in this area. North of the road alignment the ridges are well-drained and the granular sub-surface material is unfrozen. South of the road alignment the terrain is flat to gentle and the soils are frozen. This area appears to be a source of good quality granular material, however the extent of the deposit is limited and development may be constrained by close proximity to streams and a perched aquifer near KP 2.8. Assuming a 35 m riparian protection zone, borrow pits may be developed next to the road within two areas of about 1.3 ha and 1.9 ha respectively. At an average thickness of 2 m, this area represents over 50,000 m³ of granular borrow material. The developable area may need to be reduced to avoid drainage issues from the perched aquifer identified near KP 2.8. Test pit results are summarized in Table 6.5.

Table 6.5 Secondary 3 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
JD-10-6-1	SAND, gravelly, trace silt	5.0 – 6.6	3.3	massive, moderately-graded [FG]
	SAND, gravelly	6.0		
JD-10-6-2	SILT, trace gravel, trace sand	29	1.2	frozen cryoturbidic organic soil; possibly overlying frozen granular.
JD-10-6-4	SAND and GRAVEL	4.9 – 6.2	2.3	massive, well-graded [FG]; perched water table at 0.7m
JD-10-6-5	SAND, some gravel, trace silt	4.6 – 6.7	2.7	bedded, well-graded [FG]
JD-10-6-6	SILT, trace gravel, trace sand;	–	1.0	frozen cryoturbidic organic soil;
JD-10-6-7	silty organic soil	–	0.6	frozen

Secondary 7

Secondary 7 Borrow Source is located adjacent to the road alignment in the area of about KP 14 to KP 15.6. Five test pits completed along the Secondary 7 area indicate a thick blanket of sandy gravel colluvium. In this area the road alignment traverses a moderate gradient slope. It may be practical to develop borrow pits to exploit this material within the road right-of-way. Testpit results are summarized in Table 6.6.

Table 6.6 Secondary 7 Borrow Source - Summary of Test Results

TESTPIT	TEXTURE (field estimate)	MOISTURE (%)	PIT DEPTH (m)	DESCRIPTION
TP38	GRAVEL, sandy, silty		2.5	(KP14.600)
TP39	GRAVEL, sandy, some silt		2.5	(KP14.825)
TP40	GRAVEL, sandy, some silt		2.0	(KP15.075)
TP41	GRAVEL, sandy, silty		2.5	bedrock at 1.8m; (KP15.325)
JD-10-6-9 (50m west of KP15.600)	SAND, gravelly, some silt	3.9		massive, well-graded [till]
	GRAVEL and SAND, some silt	6.5 - 7.3	3.3	massive, well-graded [colluvium]
	bedrock	–		
TP43 (KP15.650)	GRAVEL, some sand, trace silt		2.2	probably ends in bedrock