MINE INFRASTRUCTURE, RELOCATED RAIL ARNAUD MINE, SEPT-ILES, QUEBEC

GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

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Société générale de financement du Québec

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1 INTRODUCTION

Mine Arnaud Inc. is considering developing an open pit mine in the Sept-Îles-Pointe Noire area of Quebec to process an apatite ore. The Roche Ausenco Sandwell joint venture mandated JOURNEAUX ASSOC. to perform the geotechnical and hydro-geological investigation over a large area north of the Hydro-Quebec transmission lines where the crushing and concentrating of the ore will be carried out.

The field investigation was carried out during the spring melt season, between March 10 and March 17, 2011 and between April 6 and April 21, 2011.

2 FIELD INVESTIGATION

The following table summarizes the number of test locations for each of the main plant structures. These were probed on the property as follows:

Table 2-1: Test Locations

LOCATION	NO. OF TEST LOCATIONS
General plant site	27
Original ore storage dome	3
Crusher site	3
Proposed bridge site over the Des Rapides River for west bound waste rock trucks	2
Railway	23
Load out silos	5
Waste rock dump site	5 (4 on north side of creek and 1 on south side of creek)
Tailings storage area	9
Original port silo location	2

The original tests were carried out in March and April 2011 when the ground was still frozen, although melt water was found in many of the local depressions. The boreholes where carried out in April 2011 when the water table was high because of the melt season. The test locations are shown on the site drawing in Appendix A.

Standpipes were installed in all boreholes and six (6) monitoring wells were installed throughout the plant site as shown in the following table:

Table 2-2: Monitoring Wells

MONITORING WELL LOCATIONS	GROUND ELEVATION (m)	WELL TIP ELEVATION (m)
R-7	63.59	55.34
R-11	70.67	67.67
R-13	77.15	74.15
R-13E	81.50	78.50
R-15	73.50	70.50
U-22	73.70	66.08

3 LABORATORY TESTING

Laboratory testing was carried out on most samples recovered. This included:

- Water content tests on nearly all samples 231
- Atterberg limits on split spoon and Shelby tube samples 43
- Wet unit weight tests on all representative Shelby tube samples 119
- Consolidation tests on representative Shelby tube samples 13
- Grain size analysis on granular soils 14

The results of these tests are summarized in a table in Appendix C. The individual test reports are also presented at the end of this same appendix.

4 GROUND SURVEY

A survey of the ground elevation at the location of test locations was carried out by Groupe Cadoret, Arpenteurs-Géomètres from Sept-Îles. The measurements, done with GPS equipment, are tabulated on the location plans in Appendix A. It is noted that a difference exists between the elevations found with the GPS and the contours from satellite topography on the drawings provided. As seen on the cross sections in appendix A the GPS elevations were systematically a few meters below the contours (L1411-03 to L1411-07, and L1411-09). This discrepancy must be rectified.

5 GROUND WATER SAMPLING AND TESTING

Water sampling was done between November 22 and November 24 2011. Six (6) samples were taken at various locations. Samples 1 to 5 were taken from surface water near the wells (frozen monitoring well). Sample 6 was taken from monitoring well R-11. The following table summaries the test results.

Figure 5-1: Summary table of chemical analyses

				Samples					
				1	2	3	4	5	6
Parameter	Unit	G / S	RDL	R-07	Upstream of T-03A	T-03A	R-10	R-11	R-11
Petroleum hydrocarbons C10 - C50	µg/L		100	<100	<100	<100	<100	<100	1670
Alcalinity	mg/L		5.0	<5.0	<5.0	<5.0	<5.0	9.4	1300
Fluoride	mg/L	1.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phosphorous (WW)	mg/L		0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Total Phosphorus (DW&SW)	mg/L		0.02						101
Arsenic (dissoved)	µg/L	25	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.4
Cadmium (dissolved)	µg/L	5	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chromium (dissolved)	µg/L	50	10	<10	<10	<10	<10	<10	<10
Copper (dissolved)	µg/L	1000	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Iron (dissolved)	µg/L		300	995	630	924	570	928	<300
Nickel (dissolved)	µg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.8
Lead (dissolved)	µg/L	10	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium (dissolved)	µg/L		2000	<2000	<2000	<2000	<2000	<2000	31200
Zinc (dissolved)	µg/L		3.0	5.0	7.5	4.4	5.3	6.1	<3.0
Chloride	mg/L	250	1	2	2	2	2	2	19
Conductivity	umhos/cm		10	23	22	21	21	31	597
pH	pH		NA	5.42	5.05	5.18	5.68	6.16	6.94
Sulfate (WW)	mg/L		20	<20	<20	<20	<20	<20	
Sulfate (DW&SW)	mg/L		2						26

RDL - Reported Detection Limit; G / S - Guideline / Standard

It is observed that Petroleum hydrocarbon, alkalinity, sodium and conductivity counts in monitoring well R-11 are higher than in the other samples and it is suspected that they may have been caused by lubricants and drilling fluids used. It is recommended that a new sampling program be undertaken in the spring.

The complete report is presented in Appendix C.

6 TERRAIN ANALYSIS AND GEOMORPHOLOGY

The main plant is located in mountainous terrain north of the Hydro-Quebec transmission lines and about 3 km north of Highway 138. At the present time, the area is heavily wooded and cut lines had to be made to access the test locations. Some short bridges had to be constructed to cross drainage channels and particularly Clet Creek.

6.1 Topography of the Heavily Wooded Area

The area is bedrock controlled with a high plateau at about elevation 100 to 110 m. It is dissected by deep, well defined, fault and joint controlled valleys which drain the many small ponds in the area. The major principal joints or fault systems trend northeast-southwest and a secondary family, perpendicular to the major fault lines, trends northwest-southeast. These valleys are at their deepest at about 25 to 30 metres at the northwest-southeast trending Clet Creek and the wider west branch of the Des Rapides River which drains north-eastward.

During glaciations, the softer and weaker rocks in the area were eroded and the surface shaped by the overriding glaciers which left a thin layer of glacial outwash sand and gravel or glacial till on the bedrock surface.

The weaker rock of major fault and joints zones was deepened with respect to the more resistant and solid bedrock formations between the fracture patterns. During the period of glacial retreat, the area was inundated by the sea and saline marine clays were deposited over the area in the inland bays and other depressions on the land. In the uplands, the clay deposits are relatively thin in the depressions but the clays are much thicker at elevations below about 80 m. After the land emerged from the sea, many water filled depressions appeared as ponds and lakes and, over the centuries, peat deposits accumulated in some of these areas.

In general, peat deposits surround the plant site on three (3) sides. They were found generally below elevation 75 along the railway and at elevation 77 to 80 on the north-western side of the bedrock ridge. The deepest accumulations of peat are located on the north-eastern part of the property near the waste road bridge crossing, where 5 metres or more of peat have been identified. At the extreme south-western end of the plant site, the peat bog is at approximately elevation 82. On the southern part of the property, considerable thicknesses of sand or sand and gravel have been deposited over the marine clays. These represent coarser outwash deltas and sand beaches.

With the continued uplifting of the land mass and the lowering of the water table, the sands, with a high content of iron minerals, oxidized and turned into a dark reddish brown cemented sand or tuff similar to a weak sandstone. This feature is quite extensive of the western part of the railway, from chainage 0+00 to the east side of Clet Creek (R-10 ch. 3+000). The cemented sand layer was also encountered in the ridge on the eastern end of the proposed new railway line at chainage 6+500.

6.2 Description of the Plant Site

The plant site is located between chainages 3+600 and 3+900 along the railway on an elevated (El. 85) elongated bedrock ridge surrounded on three (3) sides by deep peat deposits. The south side of the rock ridge drops down steeply to a peat zone where the proposed railway line is to be built, while the north end of the rock ridge slopes down beneath the clays and ultimately beneath the deep peat deposits extending northward to chainage 4+600 (haul road bridge).

6.3 Sitting of Structures

The original plan involved relocating of the Wabush Mines main line railway on a gently sloping terrain northwest of the Hydro-Quebec transmission lines and along a long shallow a fault controlled trench-like valley that parallels the eastern side of the bedrock ridge. The Arnaud Mine loadout spur line is planned to be built generally at the foot of this steep rock slope.

The main plant buildings were located on the relatively flat ground on the north-eastern end of the site. The rock crusher and ore storage shed were located on bedrock ridges further to the north of the plant site and across the deep peat bog surrounding the original plant site. The waste rock dumps and tailings storage area were located to the northwest of the plant site and across the deep ravine of the west branch of the Des Rapides River.

Soil testing at the original plant site established that bedrock was overlain by a variable thickness of clay not suitable for the heavy structures to be built.

The large area of bedrock outcrops on the southern end of the elongated ridge provided ideal foundation conditions once levelled and all the plant related structures, except the crusher, were relocated to the bedrock outcrop. Only the ore storage shed will be relocated on the bedrock on the northwest part of the original plant site, it being relocated from its original position on the north-eastern edge of the deep peat bog.

7 SOIL DESCRIPTION

The soils and bedrock conditions encountered on the property varied according to their location with respect to ground elevations. In general, on the high terrain of the mine tailings storage area and the waste rock dumps further north, bedrock outcrops frequently or is at relatively shallow depths in local depressions on the plateau.

Shallow marine clay and sand layers are found in the bottom of the shallow depressions. Thicker clay deposits are found in the deep fault zones

At the plant site, deep peat deposits are encountered below elevation 80 m along the railway and elevation 77 on the western side of the site and surround the elongated bedrock ridge in the northwest, north and northeast sides of the ridge.

All the laboratory information obtained on soil samples for each soil layer is given in the tables of Appendix C and is summarised below.

7.1 Topsoil and Peat

The property is heavily wooded and topsoil up to 300 to 400 mm in thickness is found everywhere, except in the wide open peat bogs. Deep peat deposits surround the bedrock ridge of the plant site and also in some depressions in the high plateau for the tailings and waste rock dumps. The peat deposits in the bogs are characterised by high water content (up to 400%) in the upper part of the layer. Numerous tree roots were encountered in the first metre but a more fibrous, spongy material was encountered at depth.

During the investigation, the 400 mm of frozen peat at the surface was capable of safely carrying the heavy excavator, although some shaking was noted when excavating the test pits.

The shear strength in the upper layer with tree roots is estimated to be 30 kPa and drops to less than 10 kPa at depth.

This layer is very compressible and will result in high settlements under the railway fill.

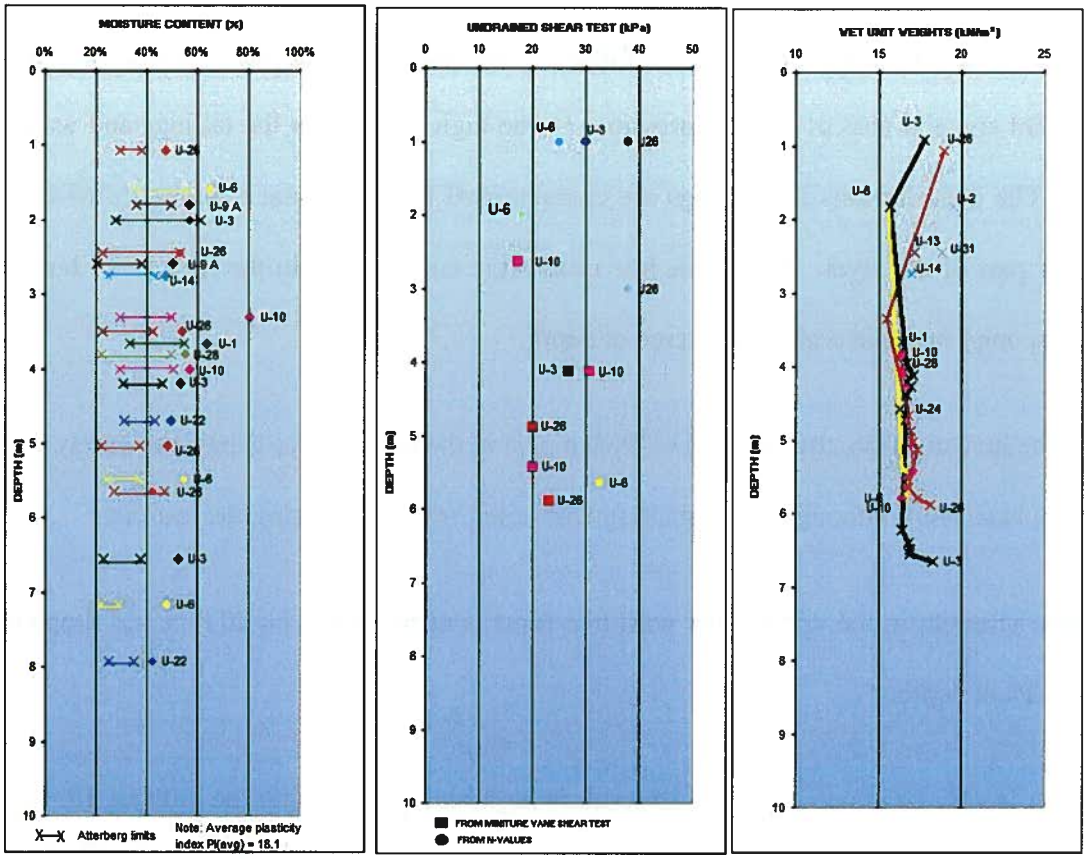
7.2 Clay Deposits

7.2.1 Plant Site

The clay deposits on the high, well drained ground at the plant site are usually more desiccated, of a lower water content and higher strength than the permanently submerged clays. It is only under the peat deposits that the clay is of higher water content above the liquid limit, lower unit weights and lower shear strength. Plasticity indices averaged 18.1.

Figure 7-1 below presents a summary of the test data for the plant site (U-series).

Figure 7-1: Summary of Laboratory Test Data - Plant

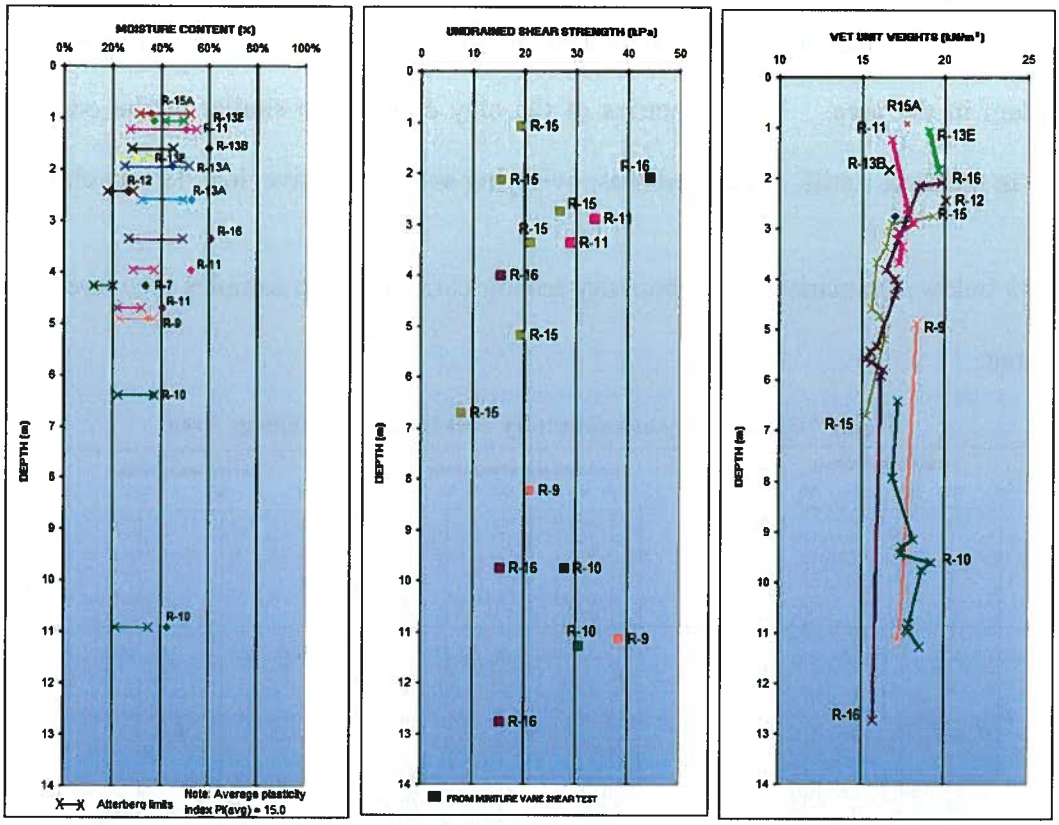


7.2.2 Railway

Deep clay deposits were found beneath the sand and tuff in the south-western section of the railway line between chainages 0+00 and 3+700, and under the peat deposits between chainage 3+700 and the bridge site at chainage 4+600. Elsewhere, a stiffer, denser clay was found directly under the topsoil.

Table 7-2 below summarises the laboratory testing carried out on samples recovered mostly from the deep peat areas.

Figure 7-2: Summary of Laboratory Test Data – Railway



In general, the water content values below the desiccated crust were higher and usually above the liquid limit, while wet unit weights were higher when compared to those of the plant site.

Undrained shear strengths ranged between 18 and 30 kPa and were similar to the shear strengths found in the deep clays at the plant site.

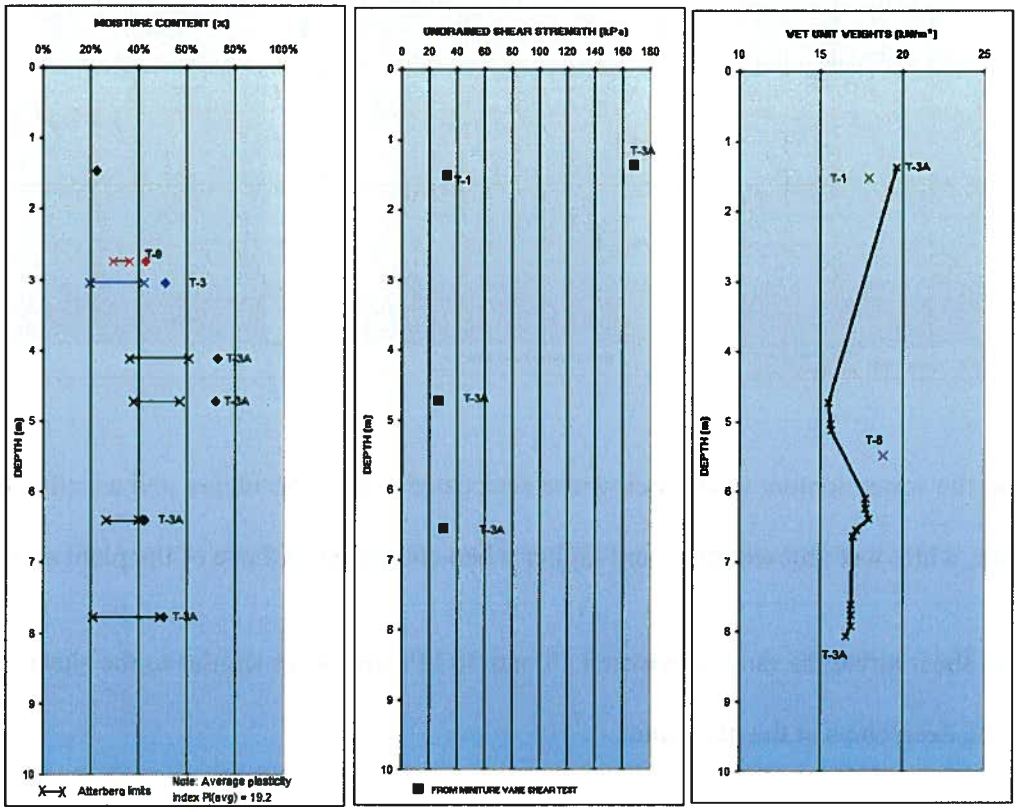
Atterberg limits ranged about 20% for the plastic limit and between 40 and 50% for the liquid limit. Plasticity indices were relatively consistent at about 15 and typical of medium plasticity clays.

7.2.3 Tailings Area

The clays in the tailings area were sampled in Borehole T-3A at the proposed location for the highest dam in the area. The properties of the clay deposit are similar to the ones at other locations in the area; a stiff, desiccated crust overlying softer, sensitive, low density clays.

Figure 7-3 below summarises the laboratory testing carried out on samples recovered from the tailings area.

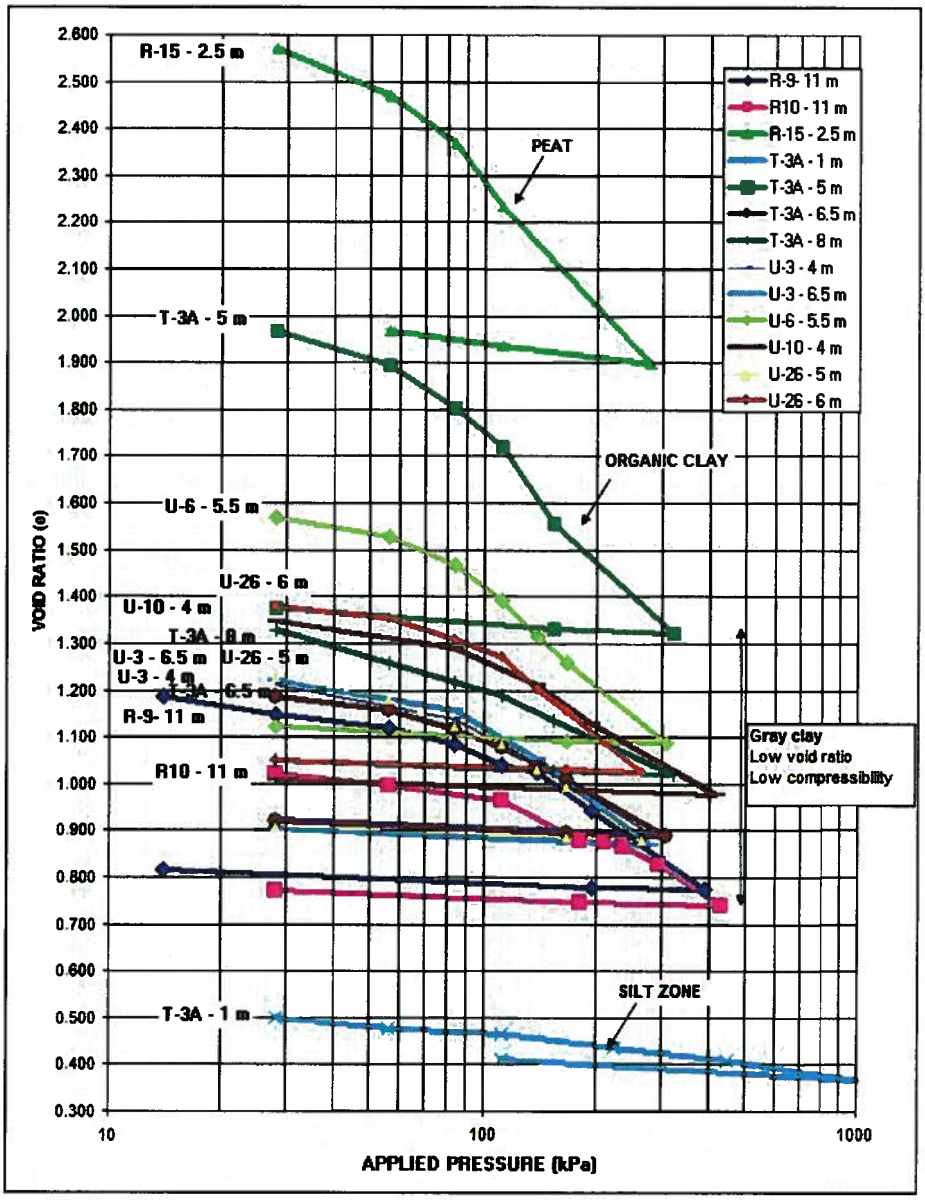
Figure 7-3: Summary of Laboratory Test Data T-3 – Tailings Area



7.2.4 Summary of Consolidation Tests

All the consolidation tests show similar compression properties in the different regions of the site. The softer clay layers tend to consolidated more than the over consolidated, desiccated clays in the high part of the site.

Figure 7-4: Consolidation Test Results



7.3 Sand and Sand with Gravel

A thick layer of cemented sand (tuff) followed by a normal sand and sand with gravel was encountered along the south-western part of the railway up to chainage 2+500 (R-8).

A similar sand deposit was encountered at the northern end of the railway under the Hydro-Quebec transmission lines. The clean sand deposits consist primarily of uniform, fine to coarse sand, but did contain varying amounts of gravel and occasionally some cobbles and boulders.

The surficial sand layer was usually underlain by the marine clay and heavy seepage conditions were encountered in the pits at or above the sand-clay contact.

The following graphs illustrate the general grain size of the minus 35 mm material.

Figure 7-5: Grain size graph for sands at the south-western end of the railway (0+000 to 1+150)

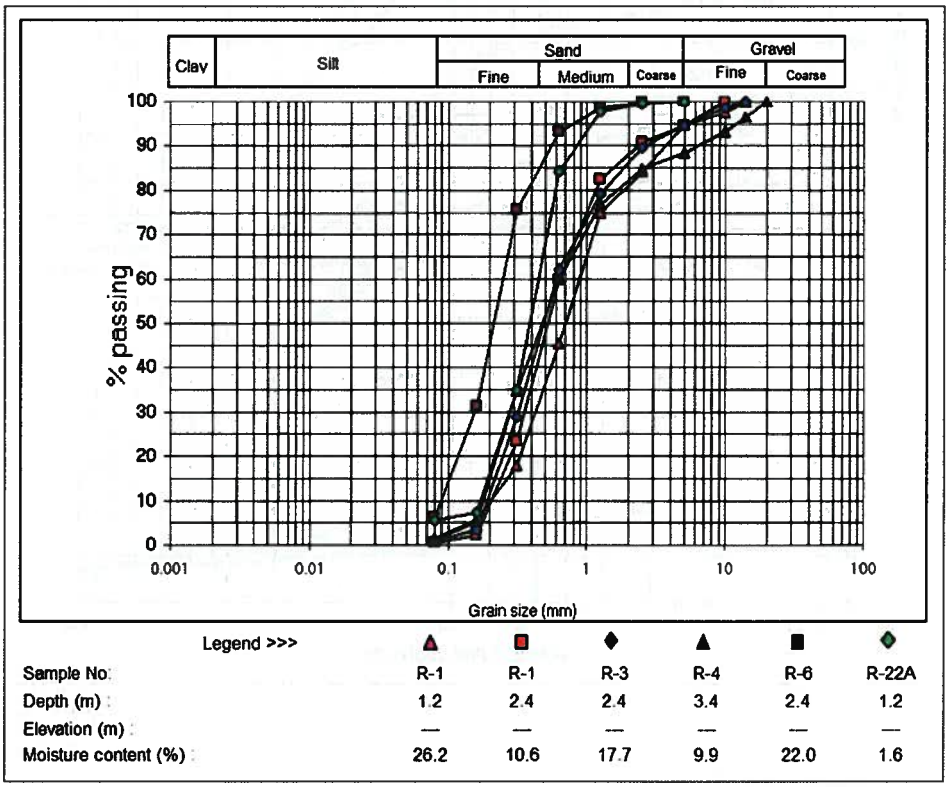
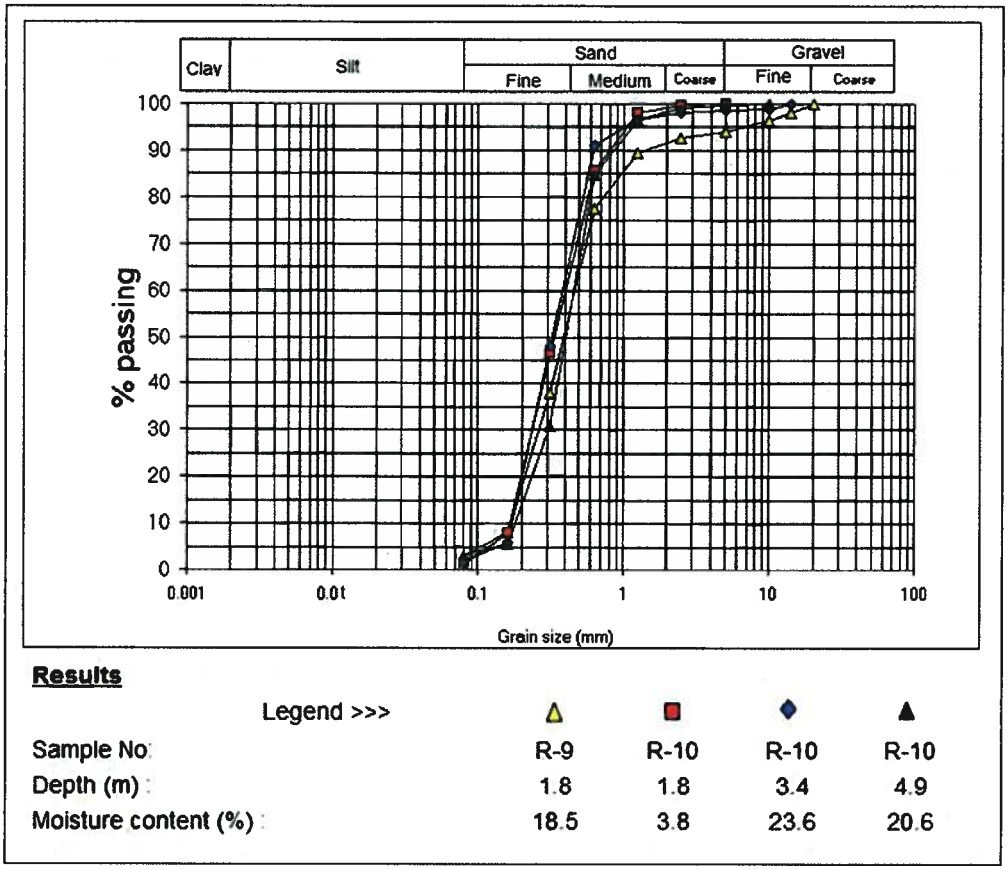


Figure 7-6: Grain size graph for sands at the south-western end of the railway (1+150 to 3+000)



7.4 Cemented sand or Tuff

The upper 1 to 1.5-metre sand layer was usually oxidised and cemented in to a hard layer which was difficult to excavate with the heavy shovel, particularly in the frozen layer. It is estimated that the compression strength of this material is a minimum of 200 kPa.

The grain size distribution for the material is shown on Figure 6-6 above and indicated that the material is a uniform, fine to medium sand, similar to the sand encountered elsewhere on the railway.

7.5 Bedrock

The bedrock encountered in the borehole consists of a medium to coarse, grey to black, crystalline rock with a very well defined cleavage. The rock is slightly magnetic, which gives it a high density. Specific gravity values average at about 3.1.

8 DISCUSSION

8.1 Plant Site

The plant site has now been relocated to the south-western end of the elongated bedrock ridge which can be levelled to elevation 80 or 2 metres above the spur line railway and railway loadout silos at elevation 78. This new platform will provide space for all the structures associated with the concentrator. Large volumes of blasted rock will be available for general backfilling on site for outside storage areas. It can also be used for construction of roads and the railway.

For the foundations of the plant, thickener, garages, warehouses and administration building carried on bedrock, an allowable bearing value of 2,000 kPa can be used in the design.

8.2 Ore Storage Shed

The ore storage shed as presently located will be in an area where bedrock is at a shallow depth but drops off steeply at the south-eastern edge of the peat bog at elevation 75 on the west side of the site. Toward the east, the bedrock is overlain by a deep peat and clay blanket.

It is important to have the ring foundation for the unheated ore storage shed on bedrock. To satisfy this condition, the site of the building should be levelled to about elevation 80 so that the western edge of the shed will be on rock at a level about 2.5 metres above the peat bog.

To ensure that the complete structure will be carried on bedrock, the building should be moved about 10 metres towards the railway. At this location, the centre of the storage pile will be on solid bedrock and settlements will be minimal (see Drawing L1411-07, Appendix A).

If the floor level is selected at a higher elevation where the foundations for the perimeter ring wall will be above bedrock, they should be carried on compacted crushed stone (engineered fill) carried on bedrock. A design bearing value of 200 kPa can be used for the footing carried on engineered fill.

If loads are small, it is considered that the ring wall or the footings can be carried on the stiff upper clay. A design bearing value of 75 kPa maximum can be used for the desiccated clay in this case.

In general, it is considered that the upper desiccated clay in the excavation zone dried out during the hot summer months and can be used for grading purposes or in the impervious zone in the tailings dikes.

The 4-metre deep conveyor tunnel will be in bedrock. Blasting should be done using presplitting techniques to minimise overbreak along the perimeter walls. Presplitting involves using closely spaced drill holes along the excavation line. In an effort to cut a near vertical wall with a minimum of rock variation from the theoretical excavation line, the holes should be spaced at no more than 400 mm. Preshearing the rock before general blasting of the core is carried out to provide a uniform, vertical rock face into which the concrete can be poured.

This option will require only one set of formwork and will eliminate the need for backfill behind the wall. This will then avoid lateral earth pressures. Ground water pressures can also be eliminated by having weep holes at the bottom of the wall, all leading to a sump and pumping system.

During construction, the 4-metre deep drawdown conveyor tunnel excavation, however, will be below the ground water table and water infiltration may be a problem. This can be handled by pumping from sumps.

It is considered that the conveyor supports between the ore storage building and plant site can be carried on the stiff clay below the topsoil. This will avoid surface waters ponding in deep excavations and the associated frost heaving problems. Frost protection can be provided with insulation or mounding around and over the footings. An allowable bearing value of 100 kPa can be used for the design of footings on stiff, desiccated, intact clay.

8.3 Electrical Substation

The electrical substation should be located on the clay terrace at about elevation 86 (see drawing L1411-06). In this area, the clay is usually desiccated and stiff near the surface, but softer at depth in the northern part of the site.

Cutting into the higher clay on site to prepare a platform for the electrical substation is not recommended. Instead, local sand and gravel, compacted to 95% of the modified Proctor, can be used to raise the low sections of the site. This should be capped with a 200 mm thick crushed gravel or stone to provide for a suitable working surface.

Because the plant site will be lower than the electrical platform, cut slopes of 2.5H:1V into the stiff clay overburden should used to avoid sloughing during the spring thaw. Also all cut slopes should be protected with a geotextile and 150 mm of gravel or minus 150 crushed rock to prevent surface erosion during the spring thaw.

To minimise surface erosion from run-off, it is suggested that the complete substation platform be sloped at about 0.5% towards northeast and away from the plant site.

8.4 Loadout Silos and Conveyor Foundations

The loadout silos along the spur line are located at about chainage 4+000 where bedrock was found at about the 3-metre depth and closest to the ground surface. Because this location is also at the high point in the ground surface, surface waters either flow south-westward toward the Clet Creek or north-eastward to the large peat bog between chainages 4+100 and 4+550, which ultimately drains into the west branch of the main Des Rapides River.

Closely spaced borings were done along the main line railway alignment only since wood cutting giving access to the individual silo locations on the spur line was not possible. On the section of the main line, the bedrock was found to be closest to the ground surface, around chainages 3+900 and 4+100, being generally at the 2.5 to 3-metre depth below the topsoil, peats and local marine clays (see boreholes R-13C, R-13C and R-13F in Appendix B). Additional holes or soundings along the actual Arnaud spur line, to better define the bedrock level at the actual location of the silos should be carried out.

The loadout silos are about 10 metres in diameter and 45 metres high and should be founded on bedrock. The relatively shallow depth to bedrock and the natural drainage divide suggest that an excavation to bedrock can be completed without any serious water problems. An allowable bearing value of 2,000 kPa can be used for the design of footings on solid bedrock.

Because of the shallow depth to bedrock, excavation slopes of 2H:1V should be used, and protected against erosion by surface water.

Permeable sand and gravel layers, if encountered above the bedrock, will be unstable under the water pressure, particularly during the wet season. A geotextile and a 1-metre thick rock fill (0 - 300 mm) berm 2 metres wide will be required to stabilise the toe of the excavation slope. Seepage trough the berm can be handled by pumping from sumps installed at the bottom of the excavation.

There is no information on the spacing of the loadout conveyor supports but the majority of the line will be on the firm to stiff clay layer overlying the bedrock at a shallow depth, except perhaps for a short section over the peat bog as it approaches the silo. The recommendations for the ore storage conveyor foundation design apply equally here.

8.5 Mine Truck Haulage Bridge over Railway and West Branch of Des Rapides River

Borings 15A drilled at chainage 4+590 on the railway line, near the proposed location of the new bridge, encountered bedrock at about the 2-metre depth. No soil data is available for the northwest abutment located across the creek. However, it is located near the foot of the steep slope which, in our opinion, may also represent bedrock.

This should be checked before the material is ordered for this abutment. Based on this information, it appears that the two (2) abutments can be supported on bedrock with only shallow excavations involved.

For the central support pillar near the creek, the design should consider the worst case and the cost estimate prepared on the assumption that piles driven to bedrock at a depth of about 20 metres (based on the depth of clay in this area) will be required.

8.6 Crusher, Tunnel, Retaining Walls and Conveyor

The testing at the location of the crusher indicated bedrock near the surface on the higher ground with deep, soft clays at the south end of the tunnel structure (see drawing L1411-08 in Appendix A). An additional test hole was done at the base of the rock slope to confirm the depth to rock. This was found to be slightly above the level of the clay filled depression or peat bog further to the south.

To ensure that the complete structure would be on bedrock, it is suggested that the crusher be relocated a minimum 20 metres further up the slope to the northeast which is certainly a bedrock ridge. This would place the complete structure on bedrock. At this location, the crusher and accompanying retaining wall for the mine truck approach fills to the crusher should all be on bedrock for which a design bearing value of 2,000 kPa can be used.

In order to benefit from the advantages of vertical rock cuts, excavations into bedrock for the crusher building and tunnels should be done using presplitting or preshearing techniques as suggested for the tunnel under the ore storage building.

At this new location, it is suggested that the elevation of the conveyor tunnel floor can be fixed at between about elevation 78 to 80 if excavating below the water level in the nearby peat bog at elevation 80 is to be avoided. Seepage into the excavation can be handled by pumping from sumps.

The peat and clay deposits in the vicinity of the crusher, tunnel, electrical room and conveyor leading across the bog to the ore storage building are generally located below elevation 80. Therefore, the conveyor alignment and spacing of supports should be selected to avoid foundations being placed below elevation 80 since this will require shallow excavation of peat and clay below the water table to reach bedrock or alternatively, piles if bedrock is beyond a reasonable depth.

Naturally, additional soundings will be required once the location of all conveyor supports is known.

For shallow foundations, the conveyor can designed as suggested for the ore storage concentrator building.

8.7 Relocation of Wabush Main Line Railway

The southern take-off point for the new railway line from the existing Wabush Mines main line (El. 46.5 m) will be just east of the existing MTQ underpass bridge on Highway 138. The new line will continue in a north-easterly direction with a gradually increasing grade separation from the existing railway as it crosses under the Hydro-Quebec transmission line right-of-way and the relatively deep (chainage 10+011) Clet Creek valley.

Beyond the Clet Creek valley, the railway follows the northeast trending narrow valley floor, at the foot of the bedrock ridge where the plant will be built. Near km 7+000, the railway turns eastward and again crosses under the Hydro-Quebec power lines to rejoin the existing Wabush Mines main line at elevation 72 m.

All along this 7-kilometre section of line, the ground rises gradually from the MTQ Highway 138 connection at a gentle slope (1%) to the plant site.

Beyond the plant site, the line follows the now southward sloping valley floor over a major peat bog and clay plain. This rather level 3-km section drops from elevation 80 m to about elevation 75 m at chainage 4+500 near the proposed waste haul road bridge across the west branch of the Des Rapides River. In this section, the rail line crosses peat deposits and can be up to 6 metres deep.

North of the peat bog, the line crosses a low bedrock outcrop (Km 5 to KM 5.7) and then drops into a deep valley between high bedrock outcrops as it crosses under the Hydro-Quebec power lines and then rejoins the Wabush Mines main line.

From the south-western connection with Wabush Railway near the Highway 138 underpass to the plant site, the soils consists generally of a relatively deep (1 to 2.5 metres) sand deposit with gravel and cobbles overlying marine clays. In many of these locations, the upper sands have been transformed by oxidation into dark reddish-brown, hard, cemented sand, usually up to 1.5 metres thick (see Test Pit Summary Table Appendix B).

Bedrock is deepest along the railway at the Clet Creek crossing and at 16 metres beneath the peat and clays in the peat bog. It only outcrops between chainages 5+000 and 5+600 where it will be about 3 to 4 metres above the track bed.

8.7.1 Railway Grade and Drainage

From the GPS elevations taken at the test locations, it appears that the railway will be carried everywhere on an embankment built over the existing ground level. It is only between chainages 5+000 and 5+600 that a shallow 3 to 4-metre cut will be required.

Under these conditions, the critical areas along the line will be the high fill at the Clet Creek valley and the building across the peat bog between chainages 4+200 and 4+500.

The drainage along the western section of the railway from Wabush Junction to Clet Creek is toward the Sept-Îles Bay via several small seasonal drainage channels. Ditches will be required mostly on the western side of the track leading to culverts under the embankment in the fill area.

East of Clet Creek, from the mine site all the way to the eastern connection with the Wabush main line, the primary surface drainage is generally westward from the higher Hydro-Quebec right-of-way and towards the narrow valley at the foot of the elongated bedrock ridge. In this section of track, ditches will be required mostly on the east side of the main line track, leading to culverts draining westward under the embankment.

8.7.2 Clet Creek Crossing

The stream crossing at 6-metre deep Clet Creek valley (El. 66 m) will require a fill about 6 metres high and can be done using twin 1,500 mm diameter corrugated ARMTEC culverts placed on a suitable bedding at the creek bottom.

Using side slopes of 1.75H:1V, the total length of the culverts will be less than 30 metres long. Construction should follow standard MTQ standards with a proper bedding and side wall support. The stream bottom must be protected with a thick rip-rap bottom extending at least 15 metres beyond the outlet to avoid scour and erosion of the clay layers in the bottom of the creek. A stilling basin in this zone is highly recommended.

Although no borings were put down at the exact culvert location for the Clet Creek crossing, the boring nearest to the creek on the north side of the valley encountered bedrock at about elevation 60 or about 6 metres below the creek bottom. The soils in this borehole indicated sands to elevation 70 (typically cemented in the top 1.5 metres) followed by the usual sensitive marine clays down to the bedrock.

Because of the down cutting of the creek through the upper sands and the clay at the bottom of Clet Creek between elevations 76± and 65, the clay in its present state is over consolidated by about 100 kPa.

The 6-metre high embankment fill for the railway will impose a load of about 120 kPa on the clay layer at the bottom of the creek, neglecting any arching effects because of the nearby valley walls.

Therefore, the new embankment will add a net load of about only 20 kPa to the 6-metre thick clay layer below the culverts. Under train loaded ore cars, this will increase only slightly because of the depth of fill below the track. Settlement of the culvert should therefore be small and less than 100 mm if placed on a properly prepared base.

To compensate for these movements, the culverts should be provided with an overall 1% slope and it should be placed with a distinct camber, at least 150 mm higher under the centreline of the railway.

Stability analyses confirm that the embankment can be built safely and will have an acceptable safety factor against sliding under E60 train loads (see Figures 8-1 and 8-2 below).

Figure 8-1: Stability Analysis without Train – Clet Creek Culvert and Fill

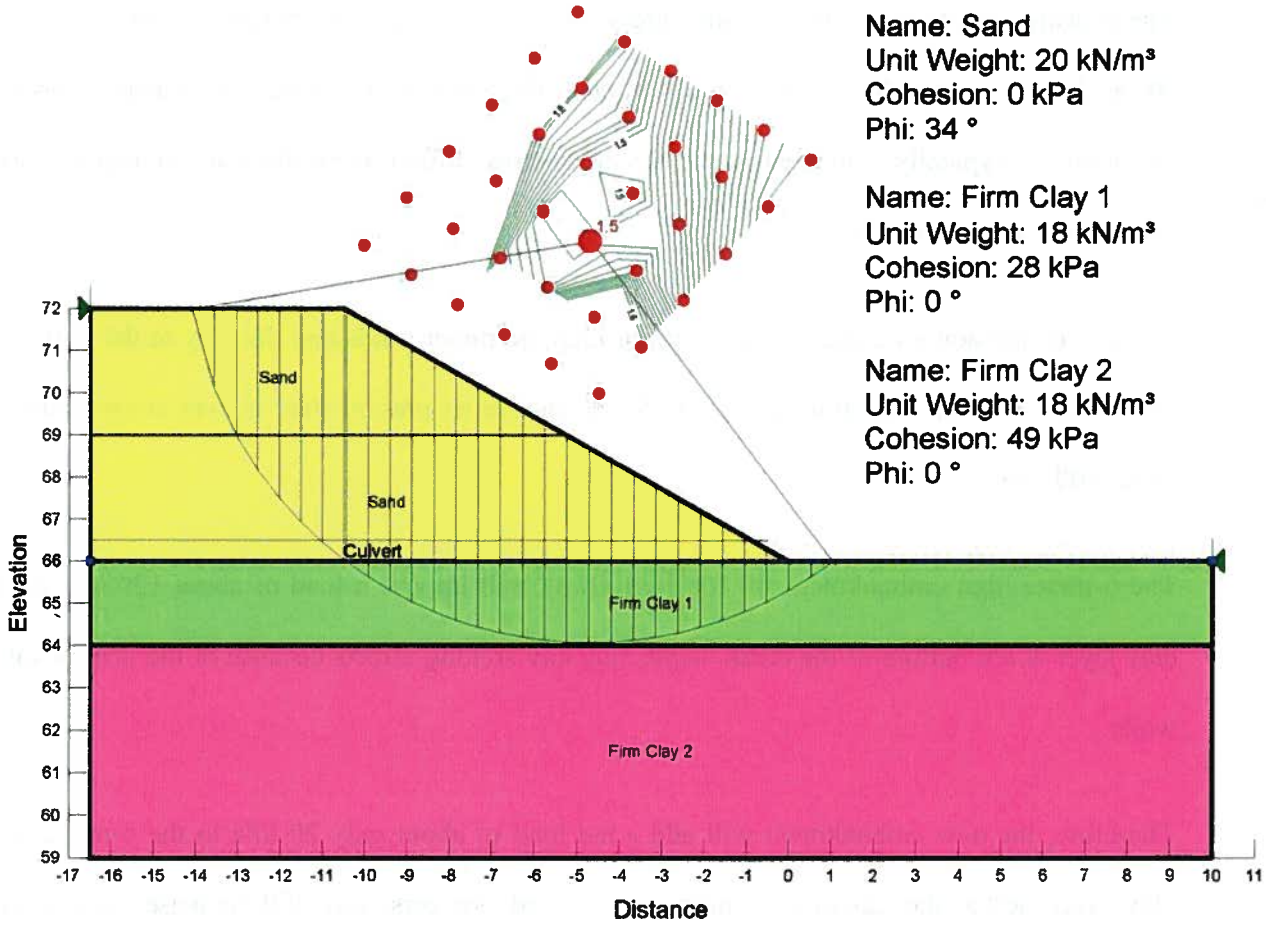
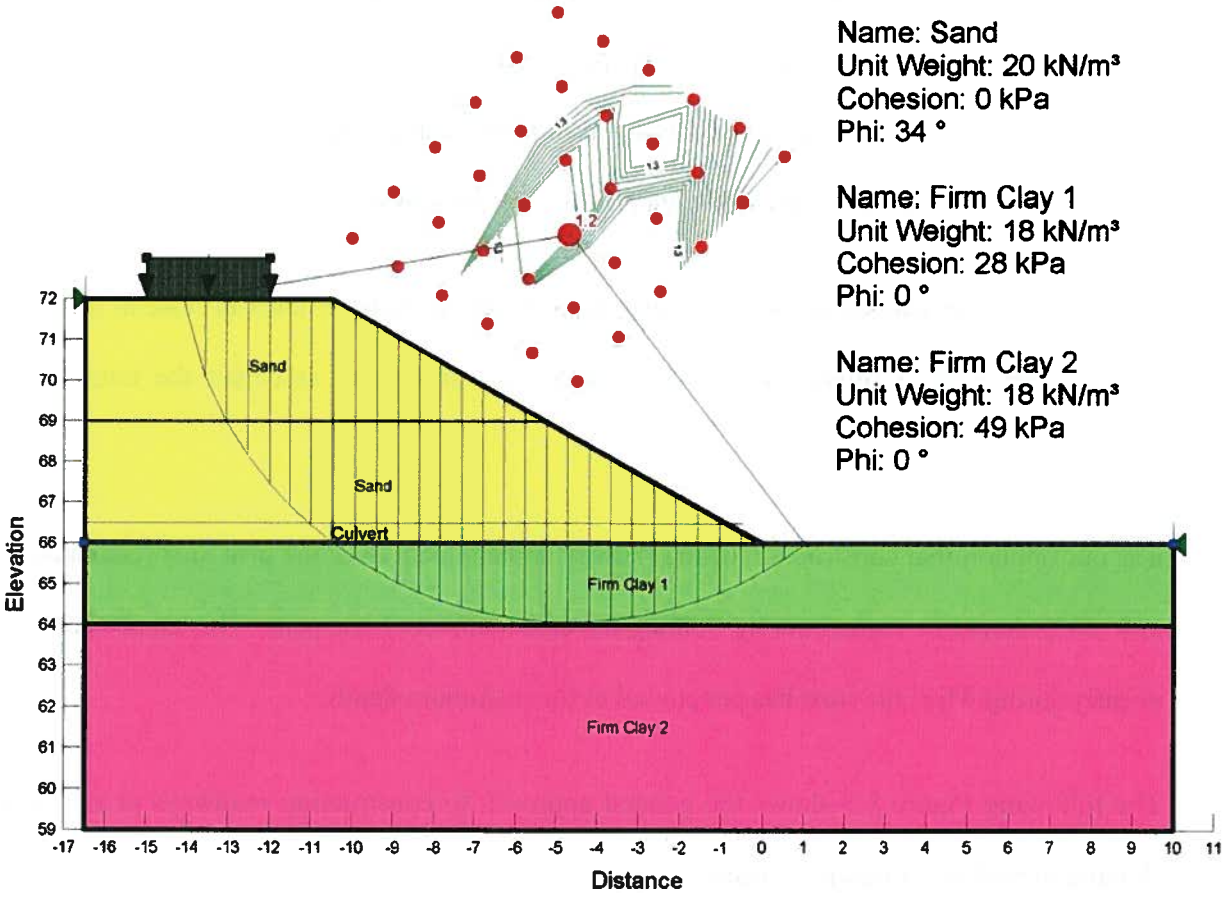


Figure 8-2: Stability Analysis with E-60 Train – Clet Creek Culvert and Fill



8.7.3 Peat Bog

The peat deposits over which the track must be built present the greatest challenge to construction, particularly in the zone at the foot of the bedrock escarpment where the peat is deepest and can be more than 5 metres deep. Naturally, moving the Wabush Mines main line alignment further up the slope towards the Hydro-Quebec property has a distinct advantage since the deep peat deposits are located usually below elevation 75.

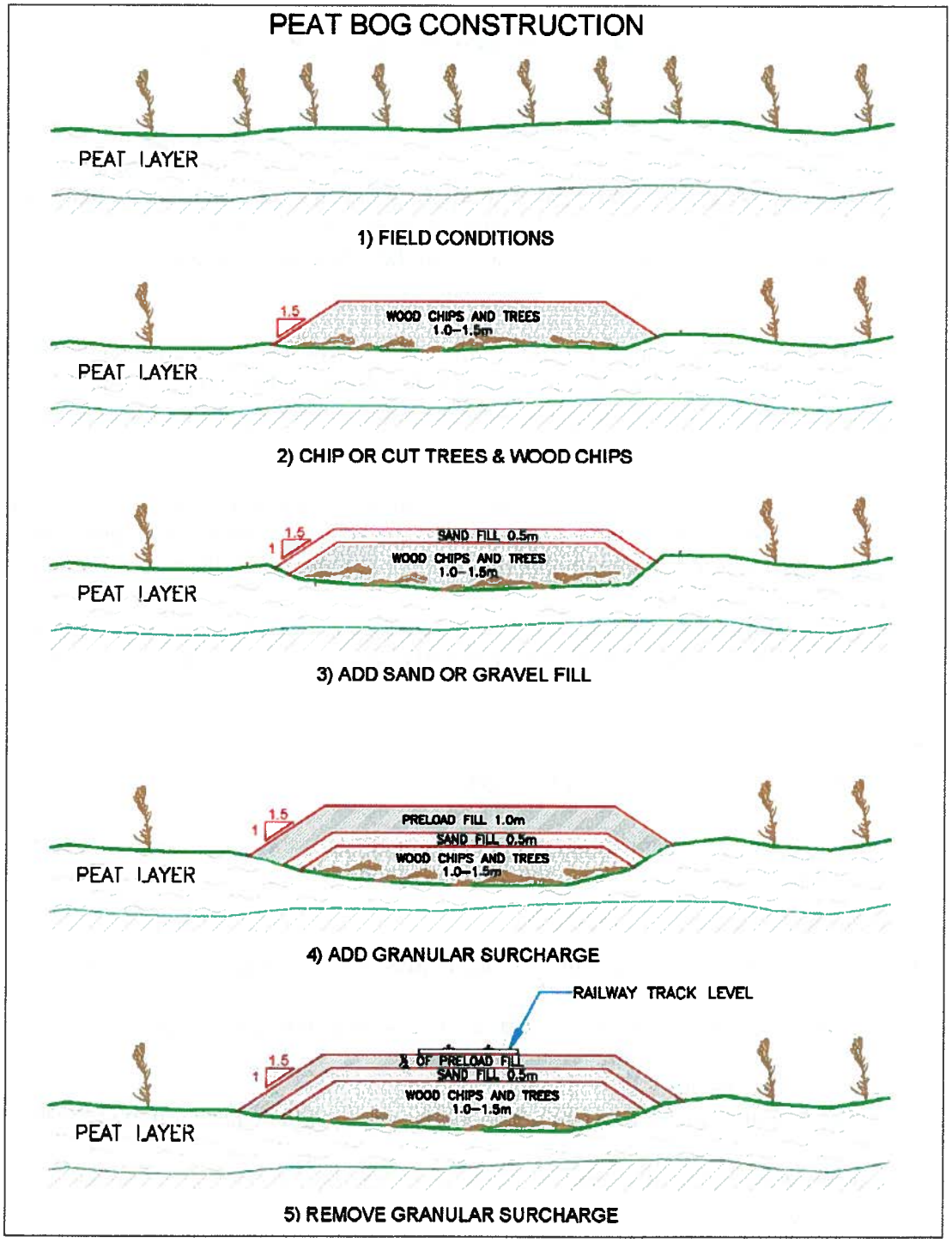
For the Mine Arnaud spur line, the closer it is to the eastern edge of the bog the better since this will provide for a smoother settlement transition from the clay overburden to the peat zone. General excavation of the peat and replacement with new fill is not recommended because of excavation costs, excavation slope stability problems, water conditions and future settlement problems from the thick, compressible underlying organic clays.

Excavation of the peat should only be done in areas where the track level is close to the top of a shallow peat layer (<1metre) and an excavation is necessary to construct the track bed and ballast.

It is our opinion that construction of the railway embankment over the peat area (chainage 4+00 to 4+600) should be carried out by floating the embankment on the peat. This can be carried out in early spring when the frost has penetrated to the maximum depth.

The following Figure 8-3 shows the general approach to constructing roadways or railways by floating the fill over organic deposits.

Figure 8-3: Typical Preloading Technique for Railway on Peat



Apart from sinking a heavy rock fill to the bottom of the peat, the following summarises the construction procedures suggested: the cheapest means of constructing on peat using light equipment:

- Constructing over the frozen peat can begin by laying down the trees or chipping the trees on the bog. A geotextile is then placed over the chipped trees and other chipped material from trees cut on the plant site can be imported to provide for up to 1 metre of lightweight fill extending at least 5 metres beyond the toe of the future embankment. A thicker layer of wood chips may be required in the deepest part of the bog.

- Following the placing of the lightweight fill, a 500 m thick layer of granular fill is placed and extends at least 4 metres beyond the shoulder of the roadbed. This material will serve a berm for stability reasons and confinement of the underlying peat when the surcharge load is added.

- To reduce long term settlements, the area should be surcharged with about 1.5 metres of granular fill, part of which will compensate for the additional future settlements produced in the peat and underlying clays due to the extra loads imposed by the moving train loads.

- Drainage wicks can be used to accelerate settlements in the thick clay layer but their costs are not justified because of the depth of the layer and the presence of the overlying more compressible peat layer.

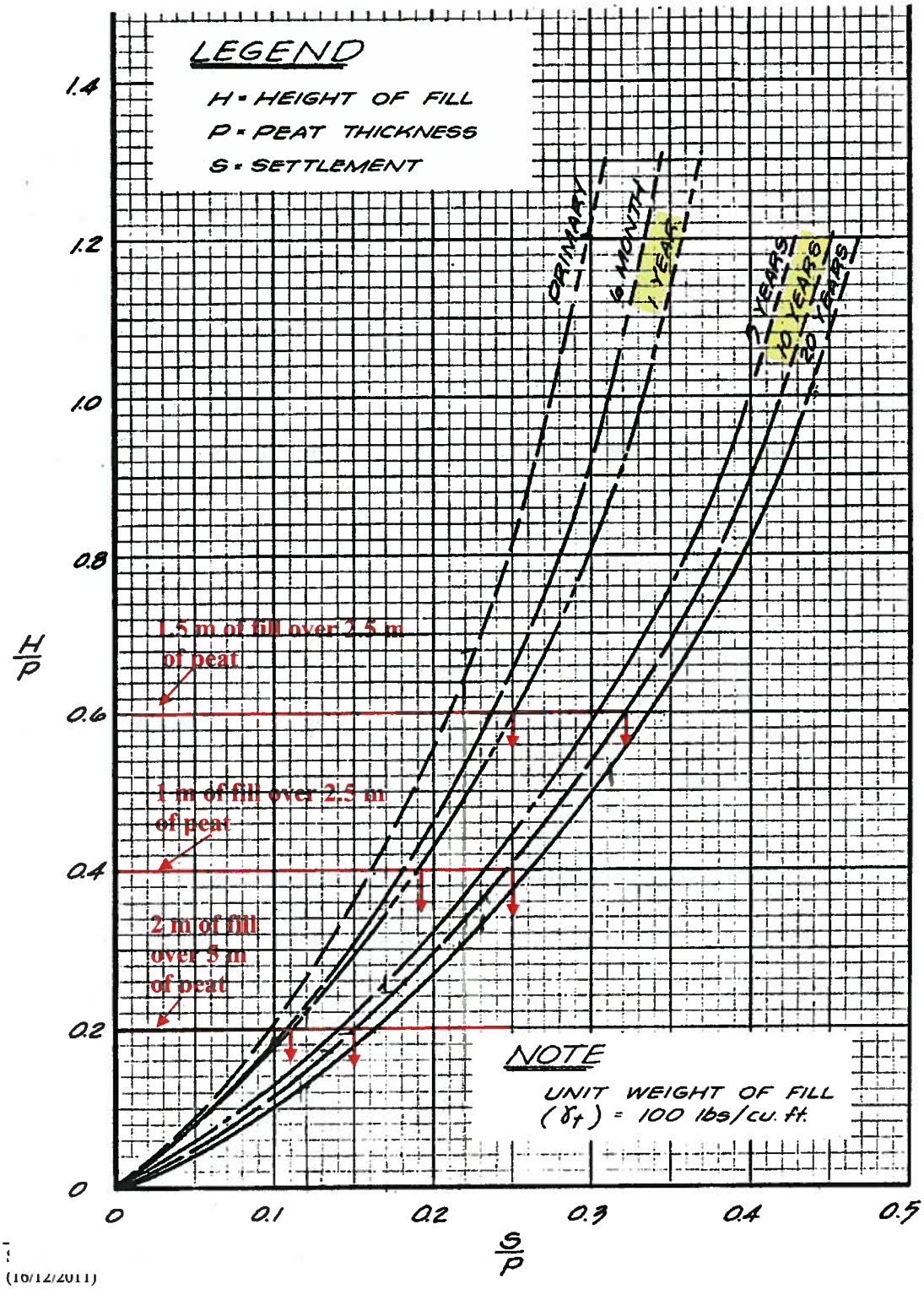
- Pore pressure measurements are necessary to monitor water pressures and to control the height of the fill that can be added in stages.

- To spread loads and reduce stresses on the peat and soft clay layer at depth, extra long "swamp ties" should be used instead of standard ties.

Settlement of the railway embankment will occur over the full length of the peat areas. The greatest settlements will occur under the deepest part and then diminish towards the edges.

The following graph indicates the magnitude of settlement anticipated according to the thickness of the peat layers and the height of the fill added.

Figure 8-4: Graph of Settlements versus Thickness of Peat



(16/12/2011)

From the graph, it is estimated that, for a 1 metre granular fill placed over about 2.5 metres of peat, settlements of about 500 mm are to be expected, this increasing to about 700 mm in 10 years.

To reduce the settlements in the peat bog resulting from train loadings, it is suggested that only unloaded ore cars be pushed all the way from the port to the end of the spur line. Loading can then be carried out as the locomotives move towards Clet Creek. In this manner, only the unloaded cars will be over the deep compressible peat deposits, and locomotives and loaded cars will be on better ground to the southwest of the silos. If loaded in the opposite direction, additional settlements of about 250 to 400 mm over a 1-year and 10-year period respectively are to be expected.

8.8 Waste dumps

The proposed waste dump area is located on high bedrock plateau, usually at elevation 90 to 100 m. The four (4) test pits put down in this large area indicated bedrock at surface or at shallow depth. It is only in the level open areas that bedrock was usually much deeper.

These areas represent shallow glacially eroded depressions in the bedrock surface covered with thin, granular outwash or till deposits. During submergence by the sea, marine clays were deposited in these depressions. A shallow topsoil cover was found over the complete area.

Construction of the waste dumps in this area does not present any serious stability problems since any local, deeper, soft clay accumulations will simply be displaced in front of the slowly advancing high waste rock fill or, if stiffer, incorporated into the coarse open voids of the rock fill at the toe of the dump slope.

When crossing the deep west branch of the Des Rapides River, it will be necessary to proceed from the lowest part of the valley and fill in the upstream direction and this, to confine the soft soils and ensure that displacement will occur uphill and eventually will be under the rock waste. Verification of the soils in the stream bottom will be required to determine the permissible height of the initial layer of fill that can be used to cross the creek to avoid instabilities in the downstream direction.

8.9 Tailings

8.9.1 Clet Creek Tailings Dam

The tailings storage area is located on the western part of the property in an area of deep, fault controlled, ravines cutting through the bedrock plateau generally at elevation 95 to 100 m, similar to what was encountered in the waste dump area. In the higher elevations, bedrock outcrops or is at shallow depth in local depressions in the plateau.

However, in the water courses at the bottom of the deep ravine, deeper clay deposits were encountered as indicated by the 8-metre thick clay layer encountered in the boring log for BH-T-03A which is located at the intersection of two (2) major rock faults or fractures in the area.

Although rock was found at the 13-metre depth in this hole, it is interesting to note that a test pit put down within 20 metres of this borehole confirmed bedrock at about the 1-metre depth. At a second test pit located within 10 metres of a nearby 4-metre high near vertical bedrock cliff, the clay was about 2.6 metres thick. This confirms the considerable variation in the bedrock depth and the thickness of clay deposits in the vicinity of the deep fault controlled crevasses. Because of this wide variation in the depth to bedrock, it is suggested that the Clet Creek Dam be, if possible, relocated about 80 metres further upstream to the narrowest part of the deep valley walls. If this is possible, constructing on the thick clays at the bottom of the major northeast-southwest striking fault valley will be avoided. At this upstream location, bedrock will probably be at a much shallower depth, but this would need confirmation with additional probe testing.

In addition, only Borehole BH-T-03A was put down at the centreline of the proposed tailings dam site. Once the location is fixed, additional probing and testing along the new centreline must be done to ensure that no deeper clay zone exists which could invalidate the stability analysis results.

Laboratory test results for samples from boreholes BH-T-01 and BH-T-03A indicate the nature of the clay deposit at the bottom of the valley is composed of an initial desiccated clay layer with moisture contents ranging between 23 and 54% and shear strengths ranging between 80 and 170 kPa. This layer is underlain by a softer clay layer with moisture contents of up to 73% and shear strengths values ranging between 27 and 33 kPa. These values are consistent with the void ratios and wet unit weights measured on the test samples.

It is understood that the tailings are inert and non-toxic and it is proposed to build a pervious dam with the coarse portion of the sand tailings as shown on Drawing L1411-12 in Appendix D. Seepage through the dam will be collected in the downstream polishing pond before being released into Clet Creek.

The dam will be built with yearly raises to a maximum height of about 30 metres in 6 years or about 5 metres per year and filled with tailings. This is a rather rapid raising of the dam which will be built over the relatively deep, soft, sensitive marine clay.

Stability calculations indicate that construction of successive lifts beyond the second lift in Year 3 will depend on the consolidation and strength gain in the soft clay layer under the weight of the initial compacted coarse tailing lifts. This requires rapid dissipation of pore pressures which will develop in the clay layer under the weight of the coarse tailings. This can be achieved by the installation of a vertical drainage system involving the insertion of the synthetic wick drains into the clay layer. Wicks should be installed to the bottom of the clay layer, on a pattern of 1.5 metres by 1.5 metres. This will provide rapid drainage of pore pressures with a corresponding increase of the undrained shear strength. The treated area should be relocated under the downstream slope of the dam (see Drawing L1411-12 in Appendix D) and extend laterally until the thickness of the soft, grey, sensitive clay is less than 2 metres thick (to be confirmed by additional probing).

It will be very important to install piezometers throughout the artificially drained clay zone to confirm that the pore pressures are in fact decreasing and the gain in strength can be evaluated and the stability checked with the actual strength gain obtained.

It is with this successive gain in strength that the yearly lifts can be built in combination with a wide downstream berm. The waste rock fill can be built with a 4H:1V slope up to the second level only, as this provides for the maximum counterweight effect in the analysis.

For higher rock fill levels, the fill act as driving force and safety factors decrease. It is only by widening the toe of the waste rock fill by 20 metres with a 6-metre berm that the dam can be permitted, as shown in Table 8-1 below.

Table 8-1: Stability Analysis of Clet Creek Tailings Dam

YEAR		Stages of Construction	F.O.S
1	a	Place 3 metres of blasted rock and upstream clay blanket	2.3
	b	Spigot with tailings	2.3
2	a	Place 6 metres of compacted coarse tailings	2.2
	b	Spigot with tailings	1.7
	c	Place 6 metres of rock fill on downstream slope	1.7
3	a	Place 6 metres of compacted coarse tailings	1.9*
	b	Spigot with tailings	1.9*
	c	Place 6 metres of rock fill on downstream slope	1.4*
4	a	Place 6 metres of compacted coarse tailings	1.3*
	b	Spigot with tailings	1.3*
5	a	Place 6 metres of compacted coarse tailings	1.3*
	b	Spigot with tailings	1.3*
	c	Extend rock fill at downstream slope by 20 m wide and 6 m height	1.5*
6	a	Place 6 metres of compacted coarse tailings	1.4*
	b	Spigot with tailings	1.3*

* The factor of safety calculated are based on undrained shear strength measured at borehole T-3 and increased to reflect strength gain with time for each following yearly lift of 6 m. This must be checked with pore pressure measurement during construction.

The starter dike will be built of gravel or waste rock to a height of 3 metres with an upstream impervious clay blanket. This granular material will act as a drainage blanket and must be placed over the full footprint of the dam (see Drawings L1411-12 and L1411-13 in Appendix D). The safety factor against slope failure at this stage will be about 1.6. Subsequent 6-metre high lifts will be built with compacted rock fill, once a geotextile has been placed over the drainage layer. With this type of construction, the underlying rock fill must act as a drainage layer to drawdown the phreatic water line in the main dam constructed of compacted coarse tailings.

Between each successive lift of compacted coarse tailings, a 300 mm layer of clean coarse sand and gravel will be placed to act as a drainage layer for the next overlying tailings lift. This 300 mm thick sand and gravel layer will be extended down the tailing slope to minimise surface erosion.

Overall stability analyses for a 30-metre high dam are shown in Figures 7-5, 7-6 and 7-7 below. Overall construction to final elevation depends on the increase in shear strength of the underlying soft clay during construction. This must be followed by pore pressure measurements and inclinometers.

Figure 8-5: Stability Analysis for Construction with One 6-metre Dike Lift

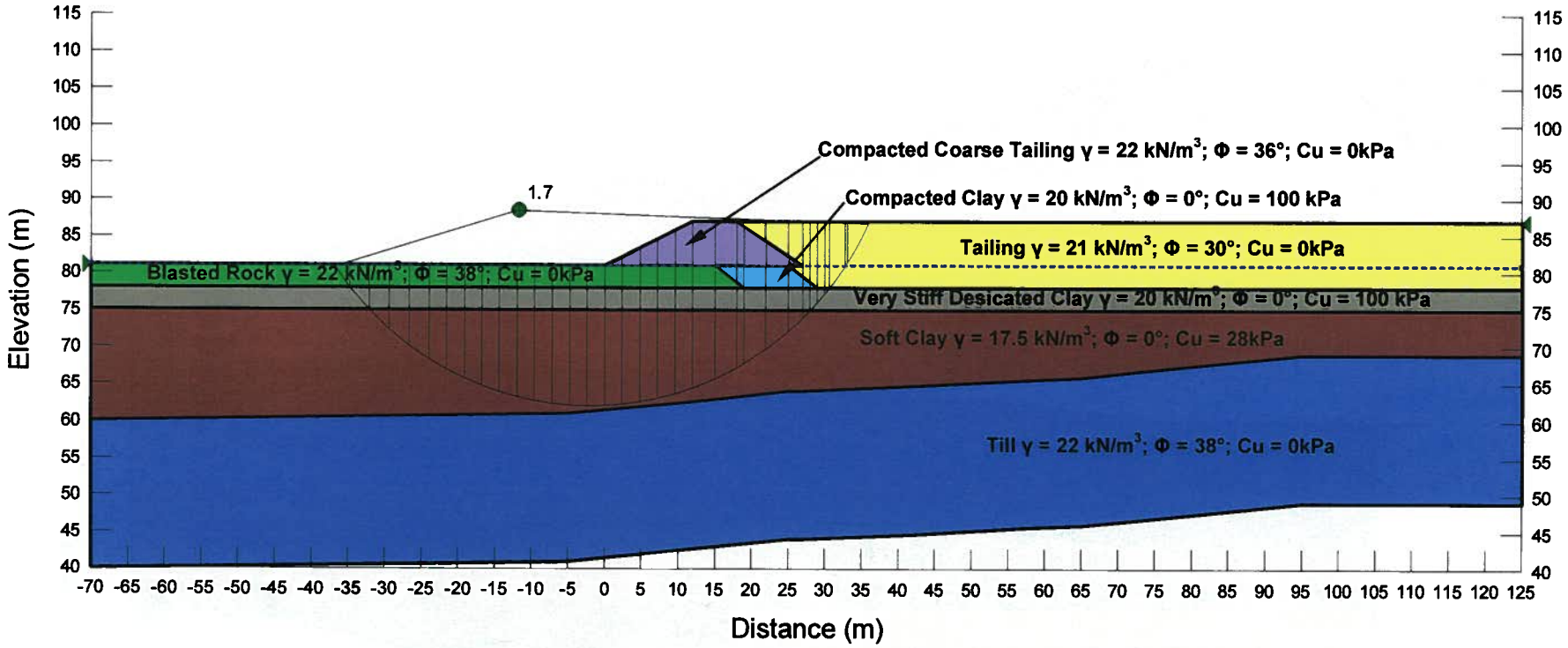


Figure 8-6: Stability Analysis for Construction with Two 6-metre Dike Lifts

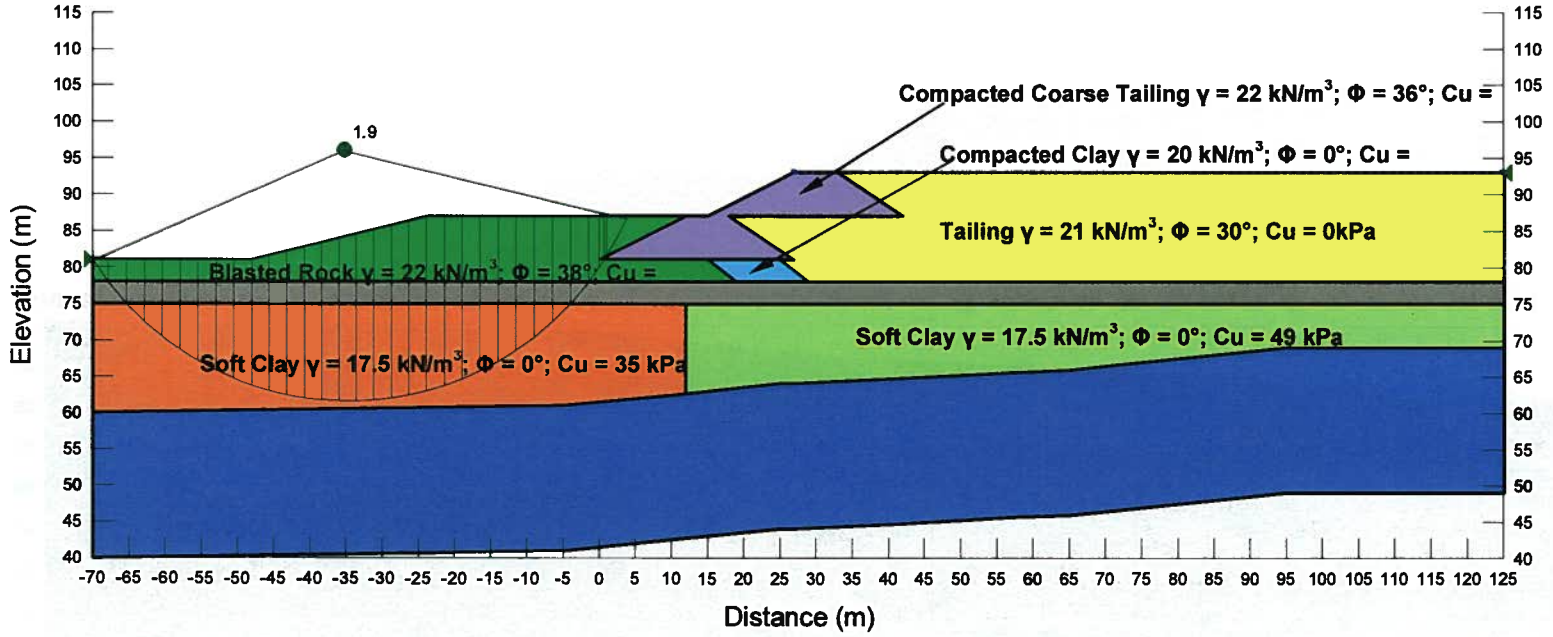
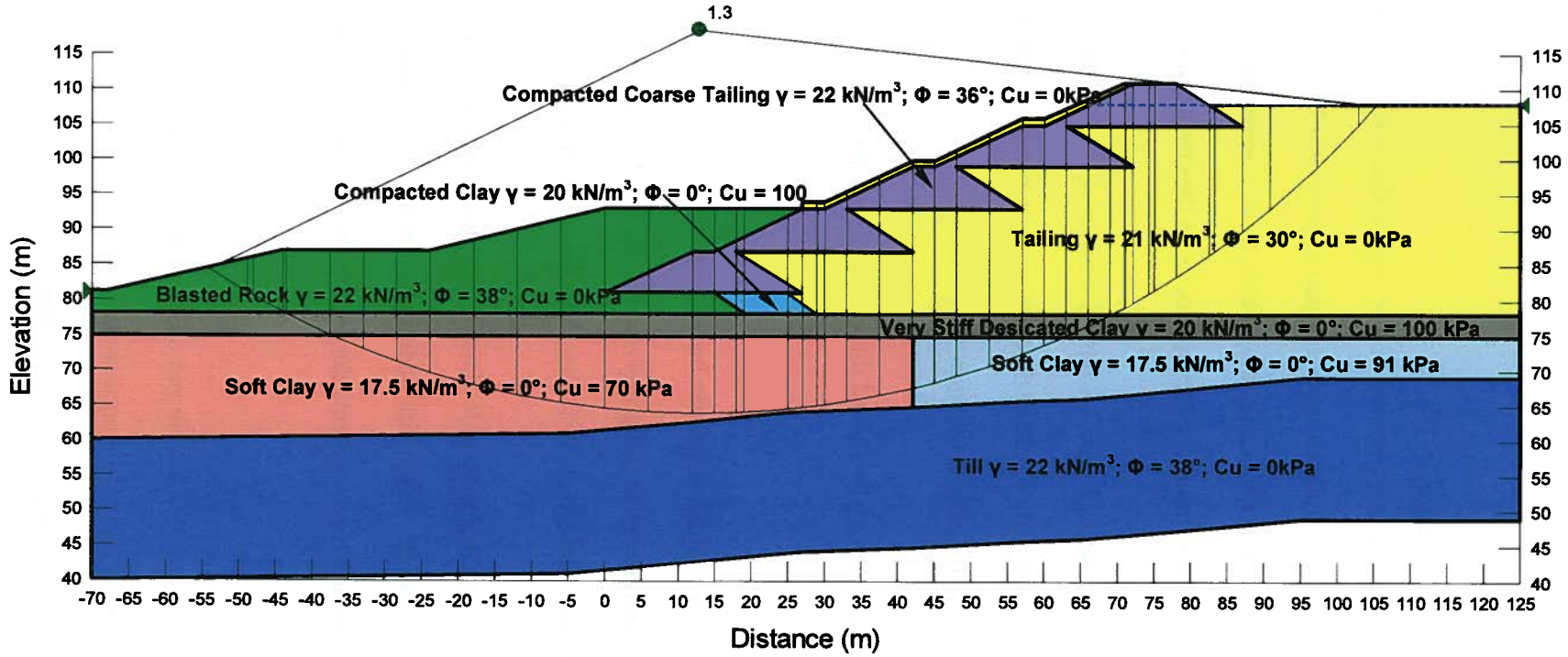


Figure 8-7: Stability Analysis for Construction with 5th Lift and Widened Rock Berm



8.9.2 Secondary Perimeter Dikes

In the general tailings storage area, several lower saddle dikes will be required where these perimeter dikes cross the low drainage channels and depressions between the bedrock knobs. Since these ponds will contain non-toxic process water, there is apparently no need to provide an impervious layer in the dams to minimise seepage losses to the environment.

Drawing L1411-13 in Appendix D shows a typical section of such a perimeter dike. However, few borings were done in the valleys at the dike crossings to measure strength and depth of clay deposits. This will be required should the project proceed.

In the case of low dikes, they can be carried directly on till or desiccated clay without a stability problem.

Stability analyses indicate that the dikes can be built safely in areas where the dike is carried on the deeper clay filled depressions by progressively raising the dike, as discussed for the main 30-metre high tailings dam at Clet Creek, to follow the level of tailings and process water.

In the unlikely case of encountering soft clays in the deep crevasses, downstream berms and stage loading may be required. Only with additional probing to determine the depth to bedrock combined with pore pressure measurements during the construction can this be determined.

8.10 Port Silos

Two (2) boreholes (P-01 and P-02) were put down at the original site for the silos; one at the centre of the group and a second on the northern extremity of the row.

These boreholes penetrated 8.2 metres and 7 metres of blasted rock fill respectively before encountering the marine clay and then the bedrock at 9.6 metres and 8.8 metres respectively.

We understand that the location of the silos has been moved toward the south where bedrock is much higher and probably at the level of the blasted rock pad.

The foundations for the silos, supported on solid bedrock, can be designed using a bearing value of 3,000 kPa.

9 CONCLUSIONS

The following conclusions have been reached from the geotechnical study:

1. The soil tests confirm that the southwest end of the higher bedrock ridge west of the railway is the best site to build the plant.
2. Once the site is levelled, all foundations will be carried on bedrock except for the electrical substation. This structure can be carried on the desiccated clay overlying the bedrock.
3. The loadout silo foundations at about chainage 4+100 can be carried on bedrock, after making a shallow excavation. An allowable design bearing value of 2,000kPa can be used for solid bedrock.
4. The crusher and ore storage building should be carried on bedrock. A design bearing value of 2,000 kPa is recommended. Presplitting techniques should be used for rock excavation to permit pouring the concrete directly against the rock face.

5. Construction of the railway embankment should be done by floating the fill on the bog as discussed in the report. For economic reasons, deep excavations to replace the peat with granular material are not recommended.
6. Moving the alignment of the main line towards the Hydro-Quebec right-of-way would minimise the depth of peat below the embankment.
7. Stage loading of the fill layers on the peat will require piezometers and inclinometers to control the filling rate and avoid instability.
8. Rock waste dumps can be safely built without instability problems. It is only at the bottom of the deep east-west trending crevasses where instability problems may be encountered. In these areas, the compressible peats and soft clays will be overridden or displaced at the toe of the slowly advancing waste dump slope. The direction of filling over deep valleys should be done from the deepest point and moving upstream to confine the soft foundation soils.
9. The 30-metre high tailings dam at Clet Creek should be located at the narrowest part of the northwest-southeast trending bedrock crevasse, a distance of about 60 metres further up the valley from the borehole location. At this location, bedrock is probably at a shallow depth.
10. A 3-metre high sand and gravel or rock fill starter berm with upstream geotextile and an impervious upstream zone can be constructed without any stability problems. To act as a drainage blanket, the layer should be extended the full width of the dam.

11. Construction of subsequent lifts using coarse spigotted tailing sand is acceptable provided downstream slopes of a minimum of 4H:1V are used combined with stage loading technique.
12. Surface drainage from the plant site and waste rock and tailings areas will be towards Sept-Îles Bay via either the Clet Creek crevasse on the south-western part of the property or other crevasses further to the west. The eastern part of the plant site drains or via the northeast flowing branches of the Des Rapides River, on both sides of the eastern half of the plant site.
13. It is important to note that the elevation of the test locations, obtained by Groupe Cadoret, Arpenteurs-Géomètres, do not correspond to the topography obtained from Lidar measurements. This discrepancy will have to be resolved so that the cut levels along the railway particularly can be established.
14. Once the project goes to construction, additional soundings are suggested to finalise the design as follows:
    - At the plant loadout silos to complete the bedrock profile along the Clet Creek tailings dam and crevasse.
    - To determine the depth of peat in the bog along the final locations of the railway.
    - To investigate the soils in the high perimeter dikes where they cross other deep crevasses.
    - To confirm the thickness and strength of the clay below the culverts at Clet Creek.

SOCIÉTÉ GÉNÉRALE DE FINANCEMENT DU QUÉBEC

Geotechnical and Hydrogeological Investigation
Mine Infrastructure, Relocated Rail
Arnaud Mine, Sept-Iles, Quebec

Prepared by:

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APPENDIX A

Location Plans and Cross Sections

APPENDIX B

Borehole and Test Pit Logs

APPENDIX C

Laboratory Test Results Summary
- Grain Size Analyses
- Atterberg Limits
- Consolidations

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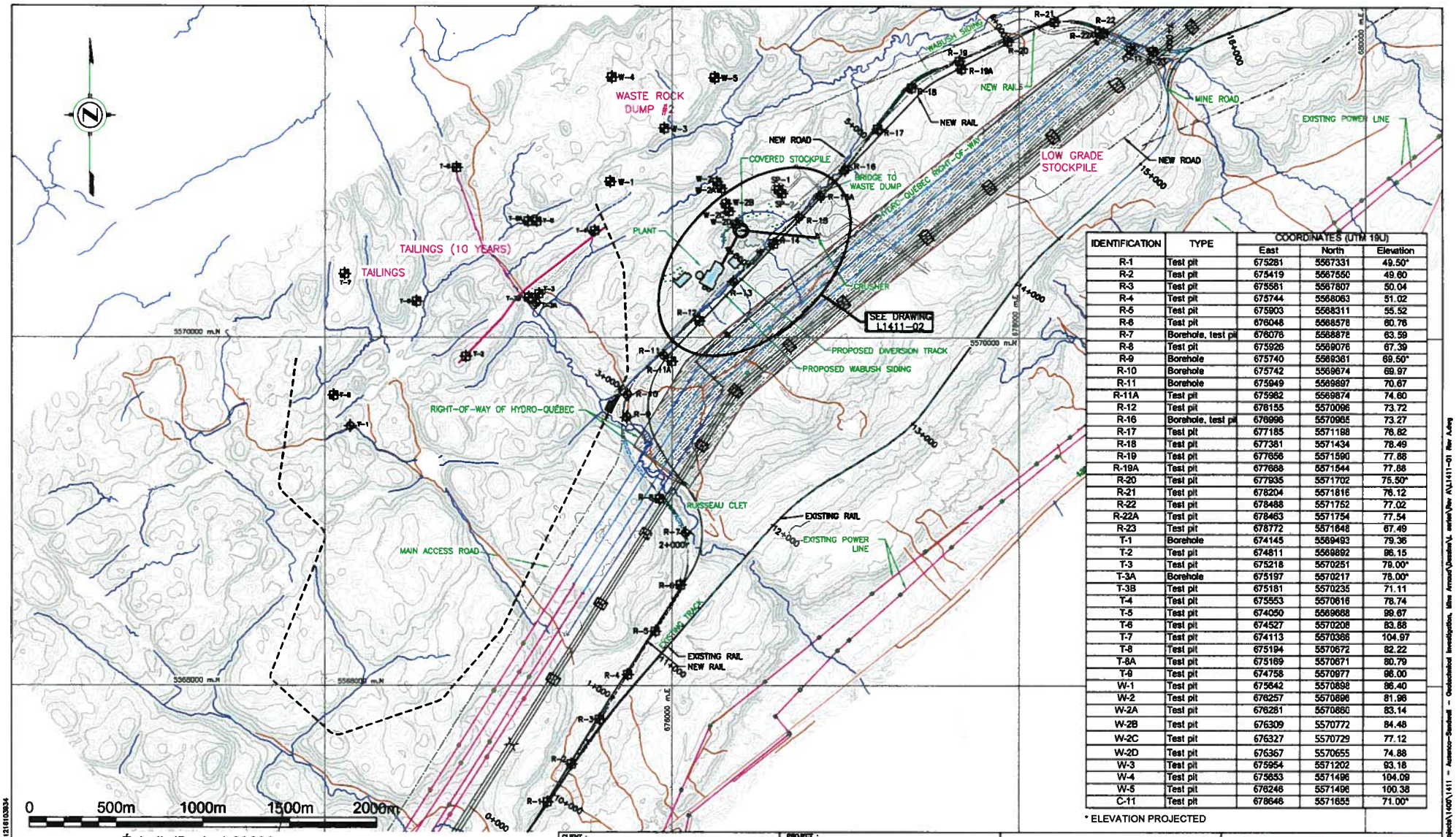
Borehole Location Plans and Various Profiles and Cross Sections (August 2011)

L1411-01 rev.A – Test Location Plan
L1411-02 rev.A – Test Location Plan
L1411-03 rev.A – Railway Profile
L1411-04 rev.A – Railway Profile
L1411-05 rev.A – Railway Profile
L1411-06 rev.A – Bedrock Profile Plant and Electrical Sub-Station
L1411-07 rev.A – Bedrock Profiles Ore Storage Shed
L1411-08 rev.A – Bedrock Profiles Crusher
L1411-09 rev.A - Cross Sections Clet Creek Dam



IDENTIFICATION	TYPE	COORDINATES (UTM 18U)		
		East	North	Elevation
R-1	Test pit	675281	5567331	49.50*
R-2	Test pit	675419	5567550	49.60
R-3	Test pit	675581	5567807	50.04
R-4	Test pit	675744	5568063	51.02
R-5	Test pit	675903	5568311	55.52
R-6	Test pit	676048	5568578	60.76
R-7	Borehole, test pit	676076	5568878	63.59
R-8	Test pit	675926	5569076	67.39
R-9	Borehole	675740	5569361	69.50*
R-10	Borehole	675742	5569674	69.97
R-11	Borehole	675949	5569897	70.67
R-11A	Test pit	675982	5569874	74.60
R-12	Test pit	676155	5570096	73.72
R-16	Borehole, test pit	676998	5570985	73.27
R-17	Test pit	677185	5571188	76.82
R-18	Test pit	677381	5571434	78.49
R-19	Test pit	677656	5571590	77.88
R-19A	Test pit	677688	5571644	77.88
R-20	Test pit	677935	5571702	75.50*
R-21	Test pit	678204	5571816	76.12
R-22	Test pit	678488	5571752	77.02
R-22A	Test pit	678463	5571754	77.54
R-23	Test pit	678772	5571648	67.49
T-1	Borehole	674145	5569493	79.36
T-2	Test pit	674811	5569892	96.15
T-3	Test pit	675218	5570251	79.00*
T-3A	Borehole	675197	5570217	78.00*
T-3B	Test pit	675181	5570235	71.11
T-4	Test pit	675553	5570616	78.74
T-5	Test pit	674050	5569668	99.67
T-6	Test pit	674527	5570208	83.88
T-7	Test pit	674113	5570366	104.97
T-8	Test pit	675194	5570672	82.22
T-8A	Test pit	675169	5570671	80.79
T-8	Test pit	674758	5570977	96.00
W-1	Test pit	675842	5570898	86.40
W-2	Test pit	676257	5570896	81.96
W-2A	Test pit	676281	5570860	83.14
W-2B	Test pit	676309	5570772	84.48
W-2C	Test pit	676327	5570729	77.12
W-2D	Test pit	676367	5570655	74.88
W-3	Test pit	675954	5571202	93.18
W-4	Test pit	675653	5571496	104.09
W-5	Test pit	676246	5571496	100.38
C-11	Test pit	678646	5571655	71.00*

* ELEVATION PROJECTED

BACKGROUND PLAN : ACAD-121848-Rail-Diversion-Detailed
UNLESS OTHER WISE SPECIFIED, ALL DIMENSIONS ARE IN METERS

CLIENT : Ausenco Sandwell / ROCHE

PROJECT : TEST LOCATION PLAN
FEASIBILITY STUDY
FINAL LAYOUT PLAN
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:20000
DRAWN BY :	SE
PROJECTED BY :	MH
APPROVED BY :	NJ

DATE : 18-08-2011 | PROJECT No. : L-10-1411

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DRAWING No. : L1411-01 | FIGURE No. : | REV. : A - AUGUST 16/11

PRINTED DATE: 20111216103834

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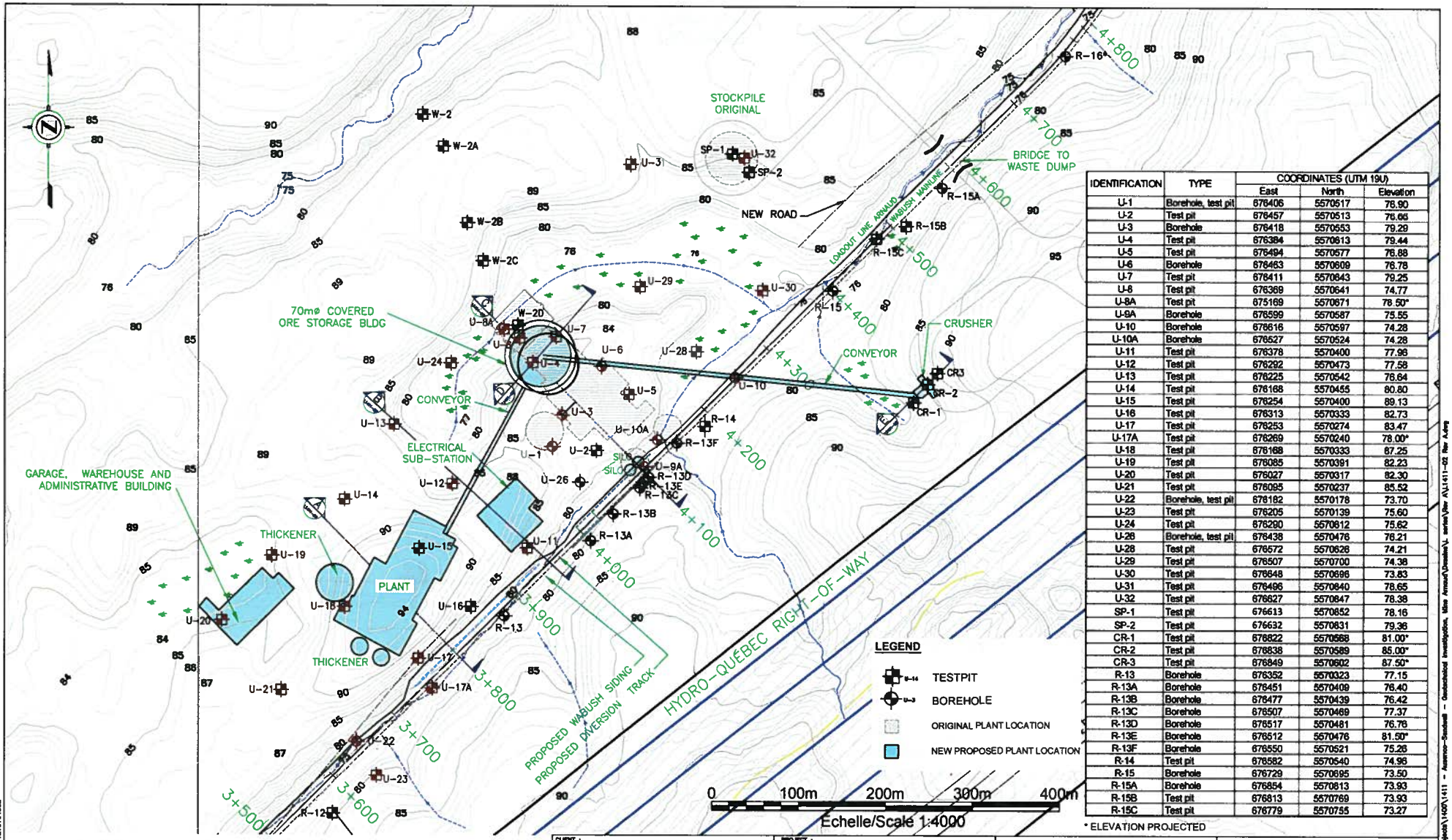

IDENTIFICATION	TYPE	COORDINATES (UTM 19U)		
		East	North	Elevation
U-1	Borehole, test pit	676406	5570517	76.90
U-2	Test pit	676457	5570513	76.66
U-3	Borehole	676418	5570553	79.29
U-4	Test pit	676384	5570613	79.44
U-5	Test pit	676494	5570577	76.88
U-6	Borehole	676463	5570609	76.78
U-7	Test pit	676411	5570643	79.25
U-8	Test pit	676369	5570641	74.77
U-8A	Test pit	675169	5570671	78.50*
U-9A	Borehole	676599	5570587	75.55
U-10	Borehole	676616	5570597	74.28
U-10A	Borehole	676527	5570524	74.28
U-11	Test pit	676378	5570400	77.98
U-12	Test pit	676292	5570473	77.58
U-13	Test pit	676225	5570542	76.64
U-14	Test pit	676168	5570455	80.80
U-15	Test pit	676254	5570400	89.13
U-16	Test pit	676313	5570333	82.73
U-17	Test pit	676253	5570274	83.47
U-17A	Test pit	676269	5570240	78.00*
U-18	Test pit	676168	5570333	87.25
U-19	Test pit	676085	5570391	82.23
U-20	Test pit	676027	5570317	82.30
U-21	Test pit	676095	5570237	85.52
U-22	Borehole, test pit	676182	5570178	73.70
U-23	Test pit	676205	5570139	75.60
U-24	Test pit	676290	5570612	75.62
U-26	Borehole, test pit	676438	5570476	76.21
U-28	Test pit	676572	5570626	74.21
U-29	Test pit	676507	5570700	74.38
U-30	Test pit	676648	5570696	73.83
U-31	Test pit	676496	5570840	78.65
U-32	Test pit	676627	5570847	78.38
SP-1	Test pit	676613	5570852	78.16
SP-2	Test pit	676632	5570831	79.36
CR-1	Test pit	676822	5570668	81.00*
CR-2	Test pit	676838	5570589	85.00*
CR-3	Test pit	676849	5570602	87.50*
R-13	Borehole	676352	5570323	77.15
R-13A	Borehole	676451	5570409	76.40
R-13B	Borehole	676477	5570439	76.42
R-13C	Borehole	676507	5570469	77.37
R-13D	Borehole	676517	5570481	76.76
R-13E	Borehole	676512	5570476	81.50*
R-13F	Borehole	676550	5570521	75.26
R-14	Test pit	676582	5570540	74.96
R-15	Borehole	676729	5570695	73.50
R-15A	Borehole	676854	5570813	73.93
R-15B	Test pit	676813	5570769	73.93
R-15C	Test pit	676779	5570755	73.27

* ELEVATION PROJECTED

BACKGROUND PLAN : ACAD-121848-Rail-Diversion-Detailed
NEW PROPOSED PLANT LOCATION TAKEN FROM DRAWINGS
1848-01-DR-GE-004-REV-C.PDF (IN PREPARATION), DATED: 11-06-01
1848-05-DR-GE-001-Rev-F.PDF, DATED: 11-04-19
UNLESS OTHER WISE SPECIFIED, ALL DIMENSIONS ARE IN METERS

CLIENT : ROCHE Ausenco Sandwell

DATE : 19-08-2011

PROJECT No. : L-10-1411

PROJECT :
TEST LOCATION PLAN
FEASIBILITY STUDY
FINAL LAYOUT PLAN
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:4000
DRAWN BY :	SE
PROJECTED BY :	MH
APPROVED BY :	NJ

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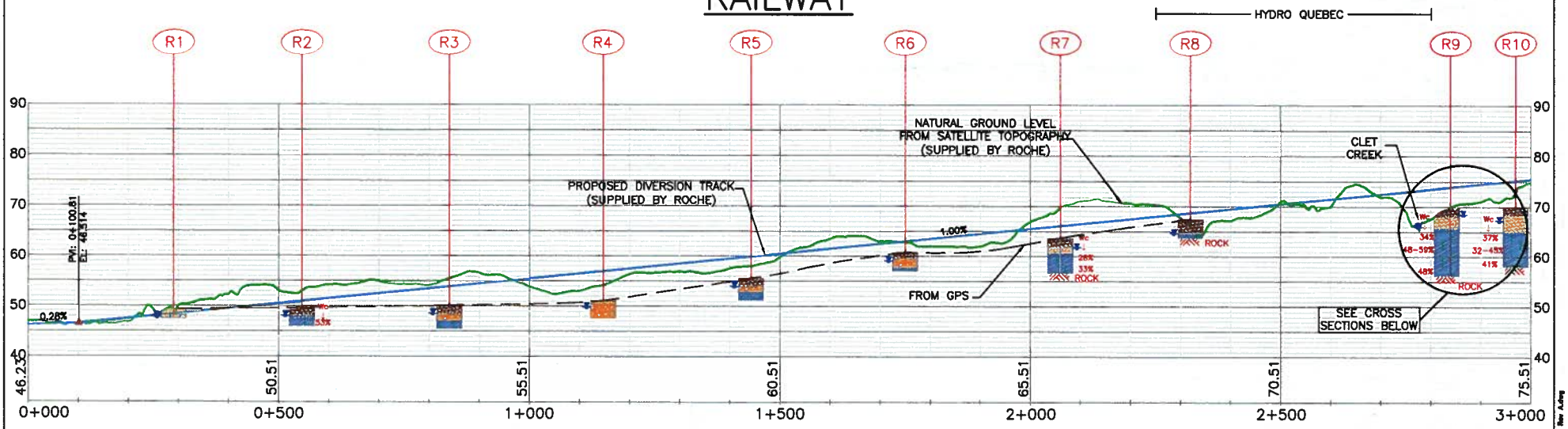
DRAWING No. : L1411-02
FIGURE No. : -
REV. : A - AUGUST 19/11

PRINTED DATE: 20111216104302

S:\1-JAVS-Projects\1400\1411 - Ausenco-Sandwell - Geotechnical Investigation, Mine Arnaud\Dessins\L_series\Rev A\L1411-02 Rev A.dwg

RAILWAY

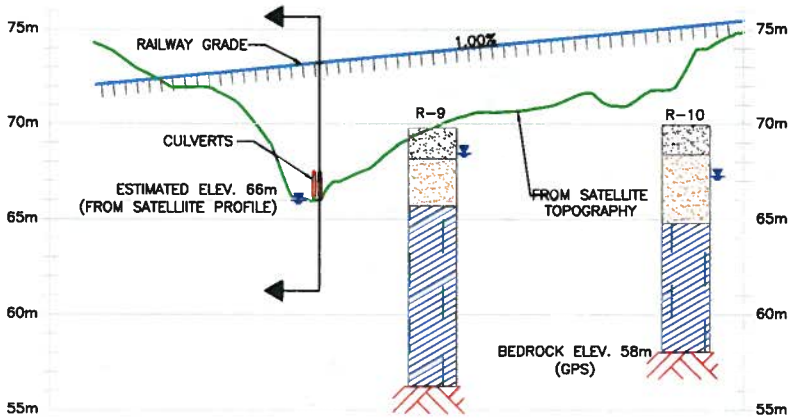


PROPOSED WABUSH MINES MAINLINE DIVERSION TRACK STA. 0+000 TO STA. 3+000

H – 1:7500 V – 1:750

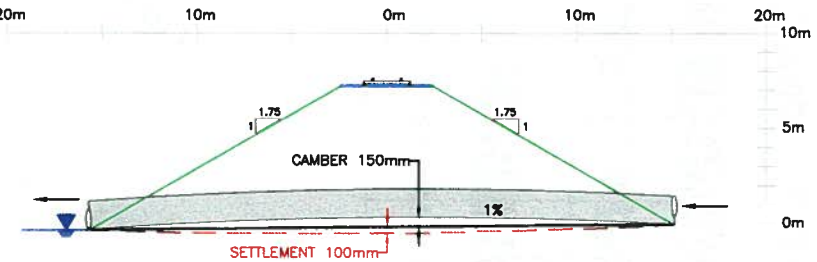
0 200m 400m 600m

Échelle/Scale 1:7500



CULVERTS AT CLET CREEK

H– 1:2500 V– 1:250



CULVERTS AT CLET CREEK

0 50m 100m 150m 200m 250m

Échelle/Scale 1:2500

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

NATURAL GROUND LEVEL AND RAILWAY GRADE SUPPLIED BY MINES ARNAUD PLAN : ACAD-121848-Rail-Diversion-Detailed, DATED 10-11-12

CLIENT : ROCHE Ausenco Sandwell

DATE : 23-08-2011 | PROJECT No. : L-10-1411

PROJECT : RAILWAY PROFILE
R-1 (CH 0+000) TO R-10 (CH 3+000)
GEOTECHNICAL INVESTIGATION
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	AS INDICATED
DRAWN BY :	SE
PROJECTED BY :	NJ
APPROVED BY :	NJ

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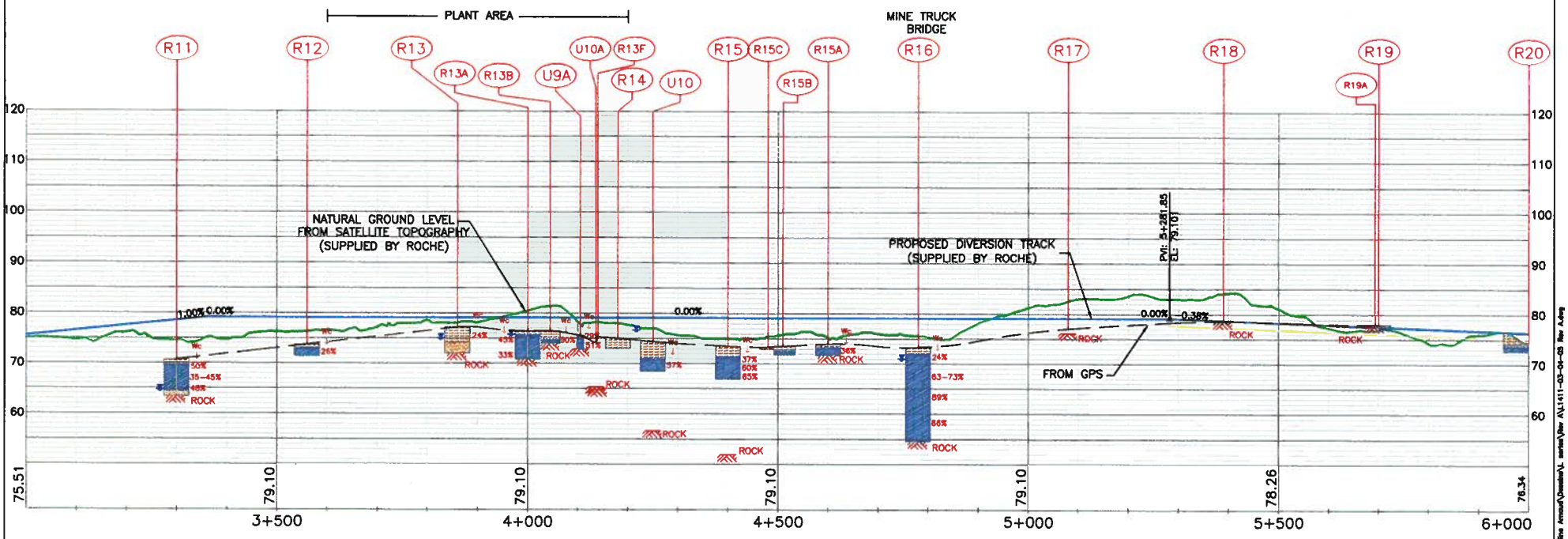
DRAWING No. : L1411-03 | FIGURE No. : - | REV. : A - AUGUST 23/11

PRINTED DATE: 2011/12/16/05:16

S:\1-JOBS\Projects\1400\1411 - Ausenco-Sandwell - Geotechnical Investigation, Mine Arnaud\Dossiers\L series\Rev A\L1411-03-04-05 Rev A.dwg

RAILWAY



PROPOSED WABUSH MINES MAINLINE DIVERSION TRACK STA. 3+000 TO STA. 6+000

H – 1:7500 V – 1:750

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

0 200m 400m 600m

Échelle/Scale 1:7500

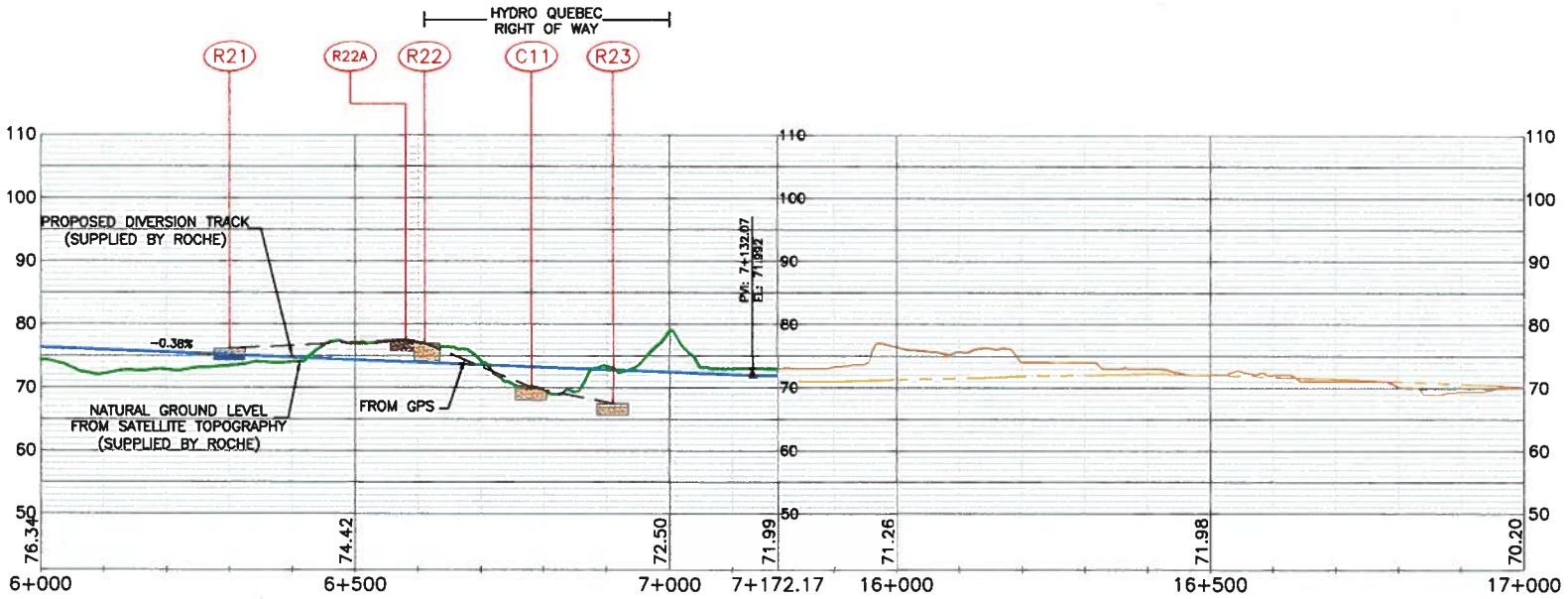
NATURAL GROUND LEVEL AND RAILWAY GRADE SUPPLIED BY MINES ARNAUD PLAN : ACAD-121848-Rail-Diversion-Detailed, DATED 10-11-12

CLIENT : ROCHE Ausenco Sandwell	PROJECT : RAILWAY PROFILE R-11 (CH 3+000) TO R-20 (CH 6+000) GEOTECHNICAL INVESTIGATION FEASIBILITY STUDY ARNAUD MINE SEPT-ILES, QUEBEC	SCALE : 1:7500	JOURNEAUX ASSOC. 901, Bancroft, Pointe-Claire, QC H9R 4L6 T 514.630.4997 • F 514.630.8937 info@journeauxassoc.com
DATE : 18-08-2011	PROJECT No. : L-10-1411	DRAWN BY : SE	DRAWING No. : L1411-04
		PROJECTED BY : NJ	FIGURE No. : -
		APPROVED BY : NJ	REV. : A - AUGUST 18/11

PRINTED DATE: 2011/12/16 16:55:02

S:\1-JOBS-Projects\1400\1411 - Ausenco-Sandwell - Geotechnical Investigation, Mine Arnaud\Dossiers\L. series\Rev A\L1411-03-04-05 Rev A.dwg

RAILWAY



PROPOSED WABUSH MINES MAINLINE DIVERSION TRACK
STA. 6+000 TO STA. 7+172.17
H – 1:7500 V – 1:750

WABUSH MINES MAINLINE
STA. 15+809.82 TO STA. 17+000
H – 1:7500 V – 1:750

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

0 200m 400m 600m
Échelle/Scale 1:7500

NATURAL GROUND LEVEL AND RAILWAY GRADE SUPPLIED BY MINES ARNAUD PLAN :
ACAD-121848-Rail-Diversion-Detailed, DATED 10-11-12

CLIENT : ROCHE Ausenco Sandwell
DATE : 15-06-2011
PROJECT No. : L-10-1411

PROJECT :
RAILWAY PROFILE
R-21 (CH 6+000) TO R-23 (CH 7+000)
GEOTECHNICAL INVESTIGATION
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:7500
DRAWN BY :	SE
PROJECTED BY :	NJ
APPROVED BY :	NJ

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DRAWING No. : L1411-05
FIGURE No. : -
REV. : A - AUGUST 18/11

PRINTED DATE: 20111218105537

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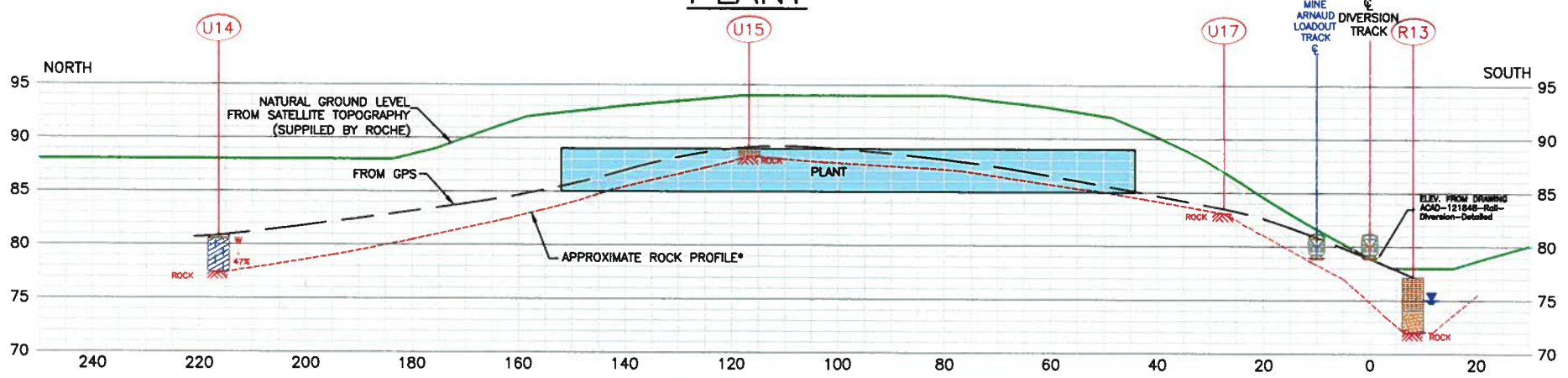
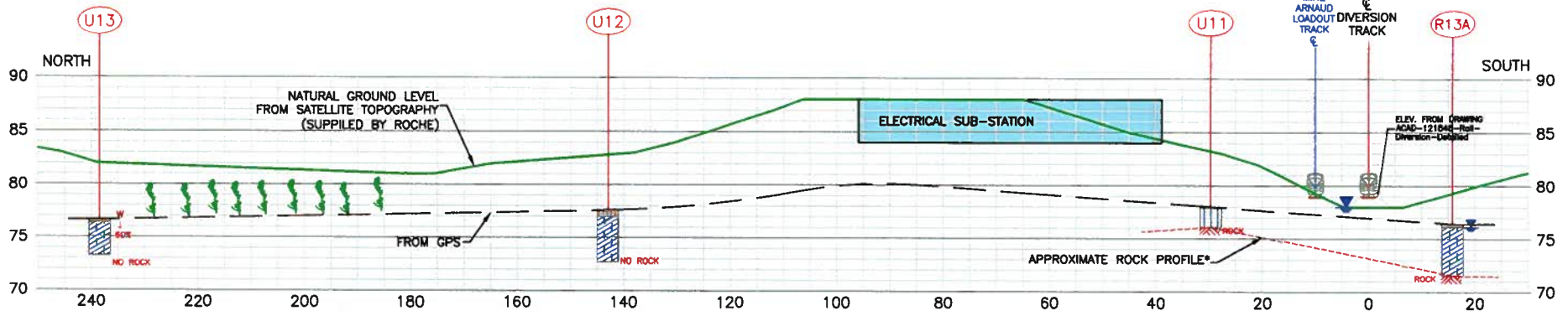
PLANT



SECTION A – PLANT (OPPOSITE CH 3+800 ON MAINLINE)

ELECTRICAL SUB–STATION



SECTION B – ELECTRICAL SUBSTATION (OPPOSITE CH 3+950 ON MAINLINE)

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

0 20m 40m 60m

Échelle/Scale 1:750

SATELLITE TOPOGRAPHY (WORLDVIEW-2, 50cm COLOR, STEREO) SUPPLIED BY MINES ARNAUD PLAN : ACAD-121848-Rail-Diversion-Detailed, DATED 10-11-12
NEW PROPOSED PLANT LOCATION TAKEN FROM DRAWING 1848-01-DR-GE-004-REV-C.PDF (IN PREPARATION), DATED: 11-06-01
* EXISTING ROCK PROFILE ON THIS DRAWING IS INTERPOLATED FROM BETWEEN BOREHOLES AND TESTPITS

CLIENT : ROCHE Ausenco Sandwell

DATE : 19-08-2011

PROJECT No. : L-10-1411

PROJECT : BEDROCK PROFILES
PLANT AND ELECTRICAL SUB-STATION
GEOTECHNICAL INVESTIGATION
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	HOR. 1 :750 - VERT. 1:375
DRAWN BY :	SE
PROJECTED BY :	MH
APPROVED BY :	NJ

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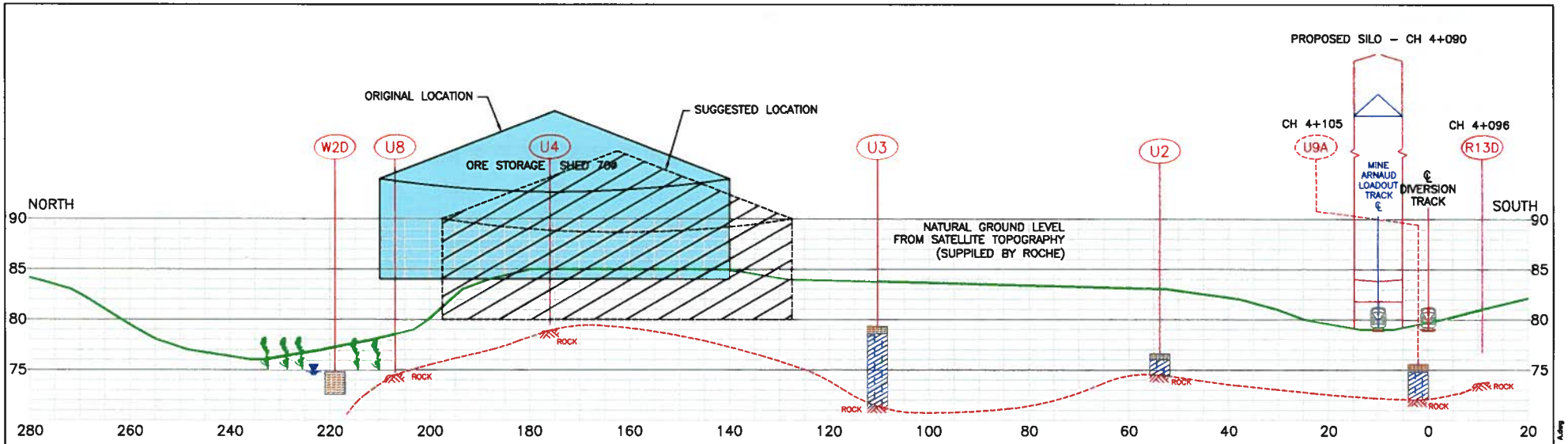
DRAWING No. : L1411-06

FIGURE No. :

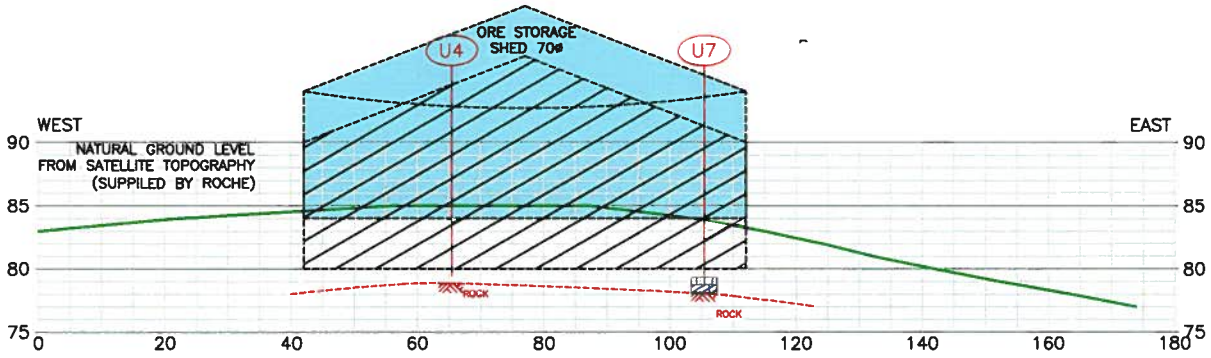
REV. : A - AUGUST 19/11

PRINTED DATE: 2011/12/19 10:45:53

S:\1-JOBS\2-Projects\1400\1411 – Ausenco-Sandwell – Geotechnical Investigation, Mine Arnaud\Drawing\L. series\Rev A\L1411-06-07-08 Rev A.dwg



SECTION C – ORE STORAGE SHED



SECTION D – ORE STORAGE SHED

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

0 20m 40m 60m

Échelle/Scale 1:750

SATELLITE TOPOGRAPHY (WORLDVIEW-2, 50cm COLOR, STEREO) SUPPLIED BY MINES ARNAUD PLAN : ACD-121848-Rail-Diversion-Detailed, DATED 10-11-12
NEW PROPOSED PLANT LOCATION TAKEN FROM DRAWING 1848-01-DR-GE-004-REV-C.PDF (IN PREPARATION), DATED: 11-06-01
* EXISTING ROCK PROFILE ON THIS DRAWING IS INTERPOLATED FROM BETWEEN BOREHOLES AND TESTPITS

CLIENT : ROCHE Ausenco Sandwell
DATE : 12-06-2011
PROJECT No. : L-10-1411

PROJECT :
BEDROCK PROFILES
ORE STORAGE SHED
GEOTECHNICAL INVESTIGATION
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE : HOR. 1:750 - VERT 1:375
DRAWN BY : SE
PROJECTED BY : MH
APPROVED BY : NJ

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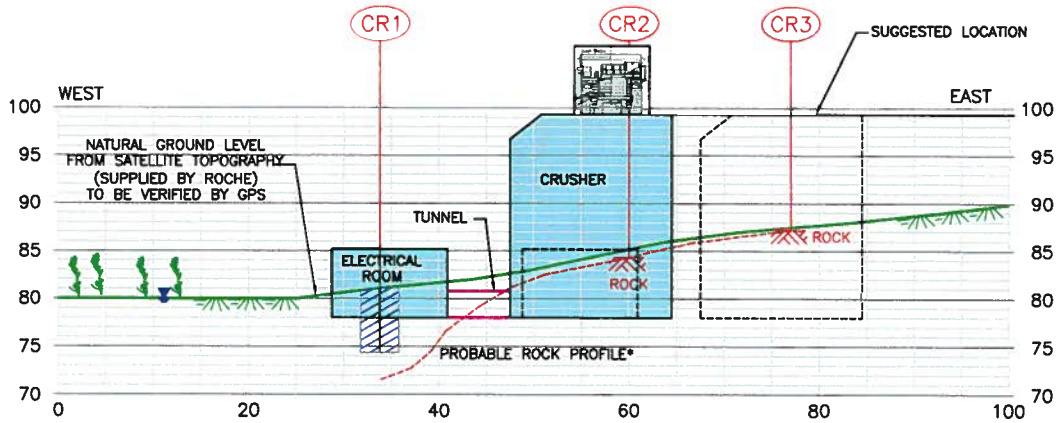
DRAWING No. : L1411-07
FIGURE No. : -
REV. : A - AUGUST 12/11

PRINTED DATE: 2011/12/16 10:48:45

S:\1-JOBS\Projects\1400\1411 – Ausenco-Sandwell – Geotechnical Investigation, Mine Arnaud\Dessins\L series\Rev A\L1411-06-07-08 Rev A.dwg

CRUSHER



SECTION E – CRUSHER STATION

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

0 10m 20m 30m 40m 50m

Échelle/Scale 1:500

SATELLITE TOPOGRAPHY (WORLDVIEW-2, 50cm COLOR, STEREO) SUPPLIED BY MINES ARNAUD PLAN : ACD-121848-Rail-Diversion-Detailed, DATED 10-11-12
CRUSHER LOCATION TAKEN FROM DRAWING 1848-05-DR-GE-001-REV-F.PDF, DATED: 11-04-19
* EXISTING ROCK PROFILE ON THIS DRAWING IS INTERPOLATED FROM BETWEEN BOREHOLES AND TESTPITS

CLIENT : ROCHE Ausenco Sandwell

DATE : 19-08-2011 | PROJECT No. : L-10-1411

PROJECT : BEDROCK PROFILES
CRUSHER
GEOTECHNICAL INVESTIGATION
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:500
DRAWN BY :	SE
PROJECTED BY :	MH
APPROVED BY :	NJ

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DRAWING No. : L1411-08 | FIGURE No. : - | REV. : A - AUGUST 19/11

PRINTED DATE: 20111216104734

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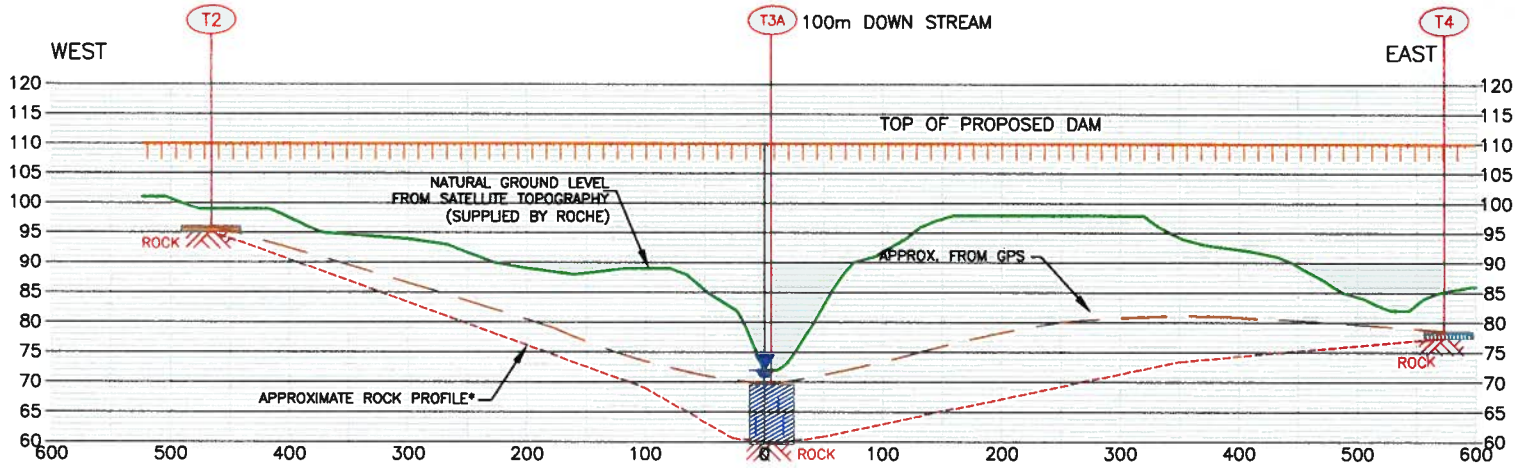
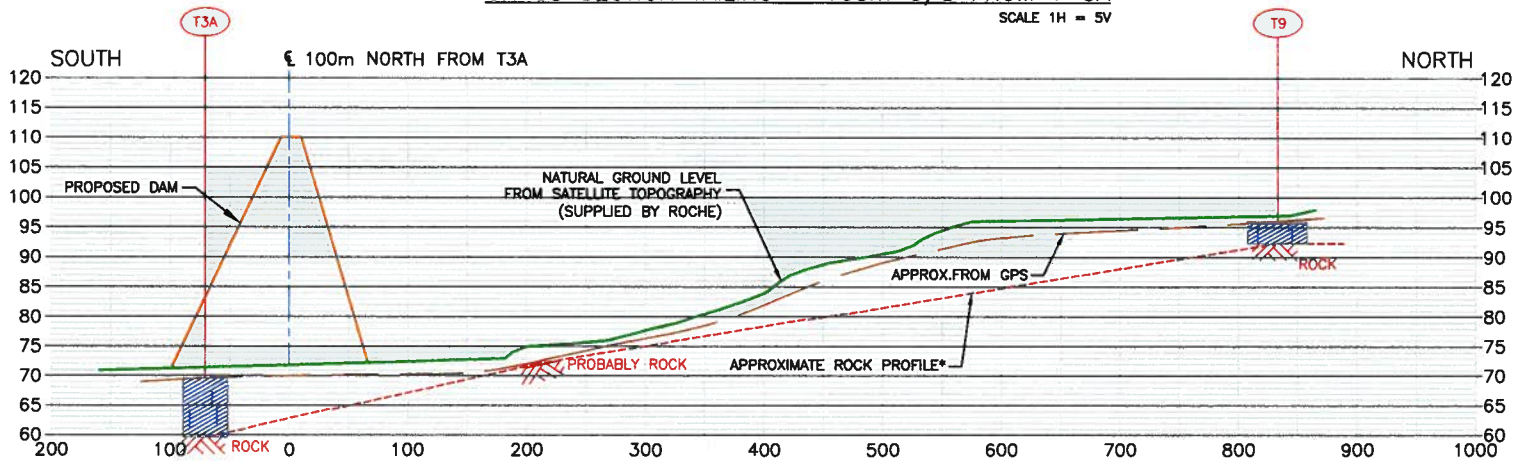
TAILING DAM CLET CREEK



CROSS SECTION TAILING – 100m U/S FROM T-3A

SCALE 1H = 5V



STREAM BED CROSS SECTION

SCALE 1H = 5V

0 100m 200m 300m 400m

Échelle/Scale 1:4000

LEGEND

- PEAT
- CEMENTED SAND–TUFF
- SAND WITH GRAVEL
- CLAY
- SILT
- BEDROCK
- SEEPAGE LEVEL

SATELLITE TOPOGRAPHY (WORLDVIEW-2, 50cm COLOR, STEREO) SUPPLIED BY MINES ARNAUD PLAN : ACAD-121848-Rail-Diversion-Detailed, DATED 10-11-12

* EXISTING ROCK PROFILE ON THIS DRAWING IS INTERPOLATED FROM BETWEEN BOREHOLES AND TESTPITS

CLIENT :	Ausenco Sandwell / ROCHE
PROJECT :	CROSS SECTIONS CLET CREEK TAILING DAM (T3A) PROPOSED ARNAUD MINE SEPT-ILES, QUEBEC
SCALE :	HOR 1 :4000 - VERT 1:800
DRAWN BY :	SE
PROJECTED BY :	NJ
APPROVED BY :	NJ
DATE :	19-08-2011
PROJECT No. :	L-10-1411
DRAWING No. :	L1411-09
FIGURE No. :	-
REV. :	A - AUGUST 19/11

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PRINTED DATE: 20111216104603

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Borehole Logs and Test Pit Summary Table

Railway borehole logs

R-07
R-09
R-10
R-13
R-13A
R-13B
R-13C
R-13D
R-13E
R-13F
R-15
R-15A
R-16

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 13TH 2011	BOREHOLE NO: R-07
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 20TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 63.46 m	ELEVATION: 63.59 m

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
62.98				TOP SOIL FROZEN		SS1	2, 3, 5, 4	79		354.4	
0.61				SAND red cemented (tuff).		SS2	4, 5, 3, 4	13		82.5	
62.37	1.0			CLAY Grey, satured.		SS3	1, 1-12", 1	75		28.2	
1.22	2.0					SS4	WOR	42		29.3	
	3.0										
	4.0					SS5	2, 2, 1, 1	100		33.8	
	5.0										
	6.0										
57.11											
6.48				BOULDER		RC6		100			
56.68	7.0			BEDROCK Sub-Horizontal to horizontal fractures between 6.9 and 7.5m. Slightly magnetic.		RC7		97	97		
6.91	8.0										
55.34											
8.25				END OF BOREHOLE							
	9.0										
	10.0										
	11.0										
	12.0			**NOTE :** Seepage noted inside testpit at 1.83m depth (march 17,2011)							
	13.0										
	14.0						WOR=Weight of rode.				
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

12. 20

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

LAB JOURNEAUX INC. 801 Bancroft, Pointe-Claire, QC H9R 4L6	LOGGED BY : JB/MH	COMPLETION DEPTH: 8.26 m
	REVIEWED BY : NJ	COMPLETE:
	Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: R-09
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 9TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : -1.52m	ELEVATION:

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
				TOPSOIL FROZEN							
-0.91	0.91		-1.52m	SAND Red, medium to fine loose to compact.							
	1.0				X	SS1	2, 3, 5, 5	58		18.5	G
	2.0										
-3.05	3.05			CLAY Grey, sandy soft, becoming silty and firm at 10m.							
	3.0										
	4.0										
	5.0				X	SS2	2-24"	100		34.6	g_w = 17.9 kN/m³
	6.0										
	7.0										
	8.0					ST3		100		51.8	Su = 21kPa
	9.0										
	10.0										
	11.0					ST4		100		48.6	g_w = 17.6 kN/m³ P_c = 110 kPa Su = 49kPa
	12.0										
	13.0										
-13.56	13.56			BEDROCK Sub-horizontal fractures at 13.6 and 14.2m.		RC1		97	85		
-14.76	14.76			END OF BOREHOLE							
	14.0										
	15.0										

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

22.7 37

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 14.76m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 8TH 2011	BOREHOLE NO: R-10
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 8TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 67.23m	ELEVATION: 69.97

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
				SAND Red cemented (tuff)							
68.45	1.52										
				SAND Brown, compact to loose, medium to fine.	X	SS1	2, 9, 7, 7	71		3.8	G
			2.44m		X	SS2	2, 2, 3, 3	50		23.6	G
64.79	5.18				X	SS3	1, 3, 2, 2	100		20.6	G
				CLAY Grey, wet, firm.	X	SS4	WOR	75		36.6	g_w =17.2 kN/m³
					X	SS5	WOR	100		38.4	g_w =16.9 kN/m³
					◢	ST6		100		38.0	g_w =18.2 kN/m³ Su =28kPa
					◢	ST7		100		42.8	g_w =18.1 kN/m³ P_c = 150 kPa Su = 31kPa
58.06	11.91			END OF BOREHOLE REFUSAL, PROBABLE BEDROCK							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

22.0 37.0

21. 35.

WOR=Weight of rode.

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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	REVIEWED BY : NJ	COMPLETE:
	Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 21ST 2011	BOREHOLE NO: R-11
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 70.67m

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
69.98	0.69			TOPSOIL FROZEN							
	1.0			CLAY Brown, firm, sandy, silty, boulder at 4m		SS1	1, 1, 1, 2	58		43.6	
	2.0					SS2		42		49.8	
	3.0					ST3		100		45.9	g_w =17.9 kN/m³ Su = 34kPa
	4.0					ST4		100		48.7	g_w =17.3 kN/m³ Su = 29kPa
						SS5	2-24"	100		52.6	
	5.0					SS6	2-24"	100		40.7	
	6.0										
64.27	6.40			SAND AND GRAVEL		SS7	1, 10, 20, 28	100		10.8	
63.35	7.32			END OF BOREHOLE REFUSAL ON PROBABLE BEDROCK							
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0			**NOTE :** Sample taken in testpit at 1.2m (W= 50%, g_w = 17kN/m³ PL = 27%, LL = 55%)							
	13.0										
	14.0										
	15.0										

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 7.32m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: R-13
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 13TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 75.02m	ELEVATION: 77.15m

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
74.10	0.0			PEAT Brown, woody soft.							
	1.0				X	SS1	5, 2, 1 -12"	50		281.7	
	2.0		2.13m		X	SS2	1, 1, 1, 1	33		474.5	
71.97	3.0			SAND AND GRAVEL with cobbles and boulders, dense.	X	SS3	4, 46, 6, 12	21		24.0	
	5.0			END OF BOREHOLE ON PROBABLE BEDROCK							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 5.18m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: R-13A
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 12TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 76.12m	ELEVATION: 76.42m

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILROAD COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
76.12	0.30		▼	?????????							
				CLAY Grey, silty.	X	SS1	2, 2, 1, 1	42		64.9	
	1.0				X	SS2	1, 2, 2, 2	100		44.7	
	2.0				X	SS3	3-24"	100		52.6	
	3.0				X	SS4	2-24"	100		46.4	
	4.0										
71.54	4.88				X	SS5	4, 10, 50-1"	42		32.5	
	5.0			END OF BOREHOLE REFUSAL, PROBABLE BEDROCK							
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

25.0 51.

31.8 49.0

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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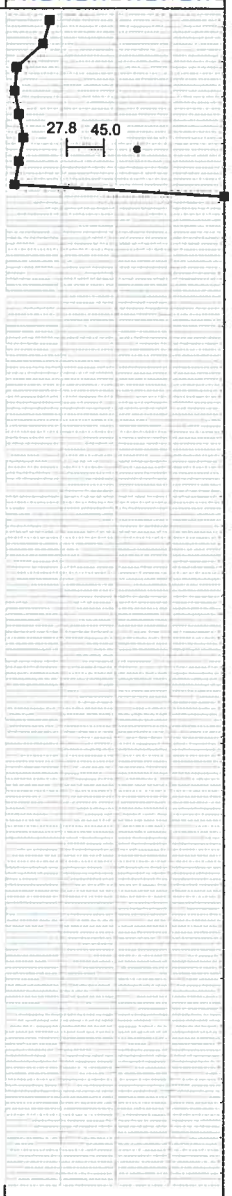
LOGGED BY : JB/MH	COMPLETION DEPTH: 4.88m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: R-13B
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 76.42

SAMPLE TYPE: TUBE SHELBY ◪ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
75.51	0.91			CLAY Moist.							
	1.0			CLAYEY SILT							
	2.0				X	SS1		30		59.8	g_w =16.6 kN/m^3
73.98	2.44			END OF BOREHOLE REFUSAL, PROBABLE BEDROCK							
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 2.44m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: R-13C
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ILES	WATER LEVEL :	ELEVATION: 77.37m

SAMPLE TYPE: TUBE SHELBY CORE SAMPLE SPT SAMPLE GRAB SAMPLE

SITE: COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
74.63	0			????							
2.74	3.0			END OF TEST ON PROBABLE BEDROCK							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 3.05m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: R-13D
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 76.76

SAMPLE TYPE: TUBE SHELBY CORE SAMPLE SPT SAMPLE GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
73.76	3.00			END OF TEST ON PROBABLE BEDROCK							

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 3.00m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 13TH 2011	BOREHOLE NO: R-13E
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION:

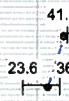
SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
-0.61	0.61			TOPSOIL FROZEN							
	1.0			CLAY Grey.		SS1	3, 3, 5, 5	100		37.1	g_w =19.0 kN/m^3
						SS2	5, 6, 50-4"	100		29.9	g_w =19.6 kN/m^3
-1.93	1.93			BEDROCK		RC3		67	67		
	2.0			Sub-horizontal fracture at 2.4m and sub-vertical fracture at 2.9m, slightly magnetic.		RC4		100	100		
-3.22	3.22			END OF BOREHOLE							
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 3.22m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: R-13F
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 75.26m

SAMPLE TYPE: TUBE SHELBY CORE SAMPLE SPT SAMPLE GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
	0			??????							
	1.0										
	2.0										
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
67.69	7.57			END OF TEST ON PROBABLE BEDROCK							
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 7.57m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 10TH 2011	BOREHOLE NO: R-15
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 73.5m

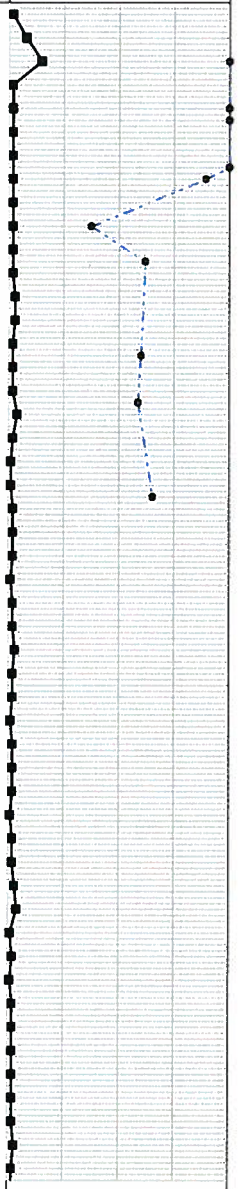
SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
		PEAT Brown, clayey.							
	1.0			ST1		90		229.5 143.6	Su = 19kPa
	2.0			ST2		90		175.7 94.8	Su = 15kPa
70.91 2.59		CLAY Grey, soft becomming dark grey and very soft at 6m.		ST3		90		89.3 37.4	g_w =16.4 kN/m³ P_c = 70 kPa Su = 27kPa
	3.0			ST4		100		61.8	g_w =16.4 kN/m³ Su = 21kPa
	4.0								
	5.0			ST5		100		58.5	g_w =16.1 kN/m³ Su = 19kPa
	6.0								
66.79 6.71				ST6		100		63.1	Su = 8kPa
	7.0	PROBABLE CLAY							
	8.0								
	9.0								
	10.0								
	11.0								
	12.0								
	13.0								
	14.0								
	15.0								

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 21.56m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 3

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 10TH 2011	BOREHOLE NO: R-15
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 73.5m

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯ SPT SAMPLE ☒ GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
51.94	21.56			END OF BOREHOLE ON PROBABLE BEDROCK							

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 21.56m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 2 of 3

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 10TH 2011	BOREHOLE NO: R-15A
PROJECT: L-10-1411	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 73.93m

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
73.32	0.61			TOPSOIL FROZEN		SS1	3, 2, 1, 2	25		401.1	
	1.0			CLAY Grey/brown.		SS2	1, 2, 2, 2	100		35.7	g_w =17.7 kN/m^3
71.64	2.29			END OF BOREHOLE ON PROBABLE BEDROCK		SS3	50 - 1"	0			
	2.0										
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 2.29m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: R-16
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 9TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 69.87m	ELEVATION: 72.00m

SAMPLE TYPE: TUBE SHELBY CORE SAMPLE SPT SAMPLE GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
		PEAT							
70.83	1.17								
	1.0	CLAY Grey, firm becoming soft to very soft at 3m		SS1	3-24"	100		77.4	
	2.0			ST2		95		24.6	g_w =19.1 kN/m^3 Su = 44kPa
	3.0			SS3	5-24"	21		34.9	
				SS4	WOR	100		60.6	
	4.0			ST5		100		51.0	g_w =16.9 kN/m^3 Su = 15kPa
	5.0								
	6.0			ST6		100		72.1	g_w =15.8 kN/m^3 Su = 11kPa
65.00	7.00	CLAY Dark gray, shells, very softt becoming soft at 11m.							
	8.0								
	9.0			ST7		90		89.1	Su = 5kPa
	10.0								
	11.0								
	12.0			ST8		100		65.7	g_w =15.7 kN/m^3 Su = 15kPa
59.20	12.80	PROBABLE CLAY							
	13.0								
	14.0								
	15.0								

WATER LEVEL (m): 2.13m

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

26.7 49.0

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LOGGED BY : JB/MH	COMPLETION DEPTH: 18.75m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 2

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: R-16
PROJECT: L-10-1411	DATE OF WATER LEVEL: APRIL 9TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 69.87m	ELEVATION: 72.00m

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: RAILWAY COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
53.25	18.75			END OF BOREHOLE REFUSAL, PROBABLE ROCK							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

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LOGGED BY : JB/MH	COMPLETION DEPTH: 18.75m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 2 of 2

Borehole Logs and Test Pit Summary Table

Plant area borehole logs

U-01
U-03
U-06
U-09A
U-10
U-10A
U-22
U-26

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: U-1
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 76.90

SAMPLE TYPE: TUBE SHELBY ◪ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
75.99	0.91			TOPSOIL FROZEN							
	1.0			CLAY							
	2.0										
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
65.70	11.0										
11.20				END OF TEST ON PROBABLE BEDROCK							
	12.0										
	13.0			**NOTE :** Sample taken in testpit at 3.7m (W= 64%, g_w = 16kN/m³ PL = 33%, LL = 55%)							
	14.0										
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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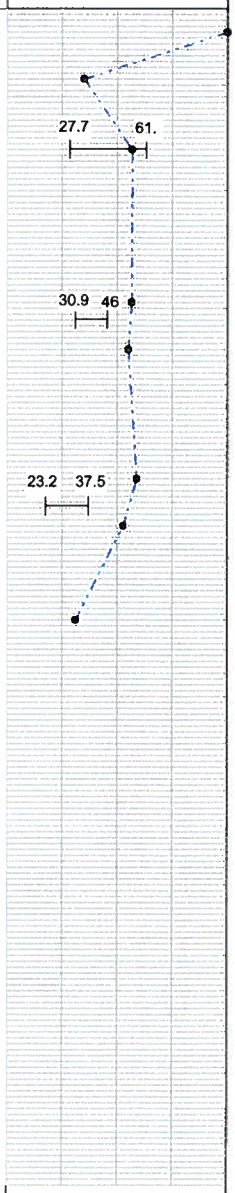
LOGGED BY : JB/MH	COMPLETION DEPTH: 11.20m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: U-03
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 79.29

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
78.68	0.61	TOPSOIL		SS1	1, 1, 1, 1	50		258.8	
	1.0	CLAY Grey, sandy, silty, firm at 4m.		SS2	1, 2, 2, 3	100		35.1	g_w =17.8 kN/m^3
	2.0			SS3	2, 1, 1, 1	100		56.7	g_w =15.7 kN/m^3
	3.0								
	4.0			ST4		100		53.6	g_w =16.8 kN/m^3 P_c = 90 kPa Su = 27kPa
	5.0								
	6.0			ST5		90		52.6 47.6	g_w =17.0 kN/m^3 P_c = 100 kPa Su = 34kPa
	7.0								
71.34	7.95			SS6	7, 8, 50 -1"	100		31.2	
	8.0	END OF BOREHOLE ON PROBABLE BEDROCK							
	9.0								
	10.0								
	11.0								
	12.0								
	13.0								
	14.0								
	15.0								



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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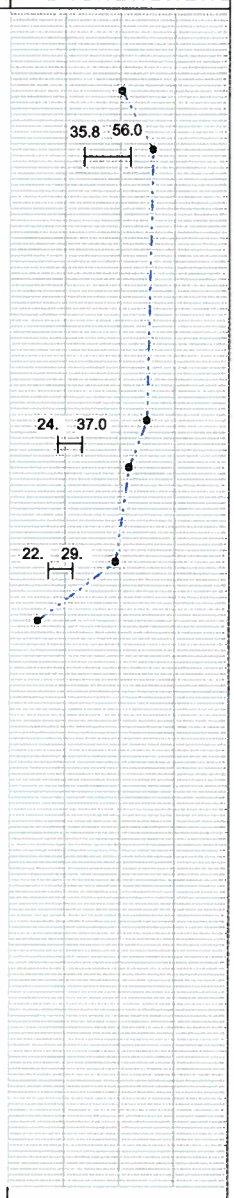
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: U-06
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 76.78

SAMPLE TYPE: TUBE SHELBY ◪ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
76.17	0.61			TOPSOIL FROZEN							
				CLAY Grey, silty, firm.	X	SS1	2, 2, 2, 2	75		50.8	
					X	SS2	1, 1, 1, 1	100		65.0	g_w =15.6 kN/m^3
					◪	ST3		100		54.1	g_w =16.6 kN/m^3 P_c = 75 kPa Su = 33kPa
					X	SS4	2-24"	100		48	
					X	SS5	5, 7, 8, 5	50		12.9	
68.55	8.23			END OF BOREHOLE							



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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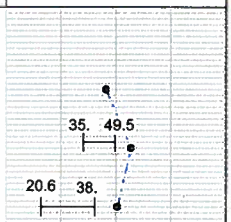
	REVIEWED BY : NJ	COMPLETE:
	Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 12TH 2011	BOREHOLE NO: U-09 A
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 75.55

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯▯ SPT SAMPLE GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
				????????							
74.79	0.76			CLAY Grey, sandy.	X	SS1	4-24"	75		45.5	
	1.0				X	SS2	4-24"	100		56.8	
	2.0				X	SS3	3-24"	100		50.5	
72.86	2.69			CLAY Grey, saturated.							
72.04	3.51			END OF BOREHOLE REFUSAL, PROBABLE BEDROCK							
	3.0										
	4.0										
	5.0										
	6.0										
	7.0										
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0										
	15.0										



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: U-10
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 74.28

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
				PEAT Clayey							
	1.0				SS	SS1	WOR	13		400	
	2.0				ST	ST2		90			Su = 9 kPa
	3.0				ST	ST3		95		85.1	Su = 17 kPa
70.98 3.30				CLAY Grey, firm.	SS	SS4	WOR	100		80.4	
	4.0				ST	ST5		100		56.8	g_w =16.5 kN/m^3 P_c = 100 kPa Su = 31 kPa
	5.0										
	6.0				ST	ST6		100		56.7	g_w =16.7 kN/m^3 Su = 20 kPa
	7.0			END OF BOREHOLE							
	8.0										
	9.0										
	10.0										
	11.0										
	12.0										
	13.0										
	14.0						WOR=Weight of rode.				
	15.0										

Blowcount- Cone Test
25 50 75

Water Content
25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH:
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Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: U-10 A
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ILES	WATER LEVEL :	ELEVATION:

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
-0.30	0.30			TOPSOIL							
-9.14	9.14			END OF BOREHOLE ON PROBABLE BEDROCK							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 13TH 2011	BOREHOLE NO: U-22
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION: 73.7

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
				PEAT Brown							
	1.0				X	SS0	2, 1, 1, 1	0			
					X	SS1	1, 1, 2-12"	25		282.7	
71.41	2.0										
2.29				?????	X	SS2	1-12", 6, 4	21		28	
	3.0				X	SS2A	3, 2, 3, 2	0			
	4.0										
69.13											
4.57	5.0			CLAY grey, sandy, silty, saturated.	X	SS3	WOR	100		49.5	
	6.0				X	SS4	WOR	100		40.7	
	7.0										
	8.0				X	SS5	WOR	100		42.1	
	9.0										
	10.0				X	SS6	2-24"	0			
	11.0										
	12.0										
	13.0			END OF BOREHOLE ON PROBABLE ROCK							
	14.0						WOR=Weight of rode.				
	15.0										

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75

31. 43.0

25. 35.

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 9TH 2011	BOREHOLE NO: U-26
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL: APRIL 9TH 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 74.38	ELEVATION: 76.21

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯ SPT SAMPLE GRAB SAMPLE

SITE: PLANT SITE COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
75.60	0.61			TOPSOIL FROZEN							
			1.83m	CLAY Grey	X	SS1	2, 2, 3, 2	67		47.6	g_w =18.9 kN/m^3
					X	SS2	2, 3, 3, 2	50		54.0	g_w =15.5 kN/m^3
					◢	ST3		100		60.8 48.2	g_w =17.0 kN/m^3 P_c = 85 kPa Su =20 kPa
70.88	5.33			CLAYEY SAND	◢	ST4		95		42.0 40.0	g_w =17.4 kN/m^3 P_c = 90 kPa G Su = 23 kPa
				END OF BOREHOLE ON PROBABLE BEDROCK							

NOTE : Sample taken in testpit at 2.4m (W= 53%, PL = 23% LL = 53%)

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 6.1m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

Borehole Logs and Test Pit Summary Table

Tailings impoundment area borehole logs

T-01
T-03A

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 7TH, 2011	BOREHOLE NO: T-01
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL:	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL :	ELEVATION:

SAMPLE TYPE: TUBE SHELBY ◢ CORE SAMPLE ▯ SPT SAMPLE ☒ GRAB SAMPLE

SITE: TAILINGS AREA COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL PROFILE	WATER LEVEL (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
-0.61	0.61			TOPSOIL							
	1.0			CLAY Grey, firm with gravel	◢	ST01		100		54.0 23.9	g_w = 18.2 kN/m³ Su = 33 kPa
-2.74	2.74			SAND WITH GRAVEL	☒	SS2	4, 5, 4, 5	8		18.0	
-4.17	4.17			BEDROCK Sub-horizontal fractures at 4.4 and 4.9m	▯	RC3		63	58		
-5.61	5.61			END OF BOREHOLE ON ROCK							

Blowcount- Cone Test ■ 25 50 75

Water Content ● 25 50 75

g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test

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LOGGED BY : JB/MH	COMPLETION DEPTH: 5.61m
REVIEWED BY : NJ	COMPLETE:
Fig No:	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 7TH 2011	BOREHOLE NO: T-03 A
PROJECT: ARNAUD MINE	DATE OF WATER LEVEL: APRIL 7TH, 2011	PROJECT NO: L-10-1411
LOCATION: SEPT-ÎLES	WATER LEVEL : 68.69	ELEVATION: 69.60

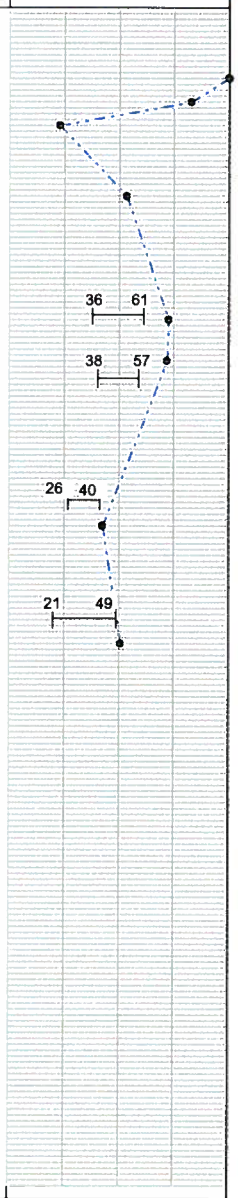
SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: TAILINGS AREA COORDINATES :

ELEVATION (m)	DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE No	SPT (BLOWCOUNTS / 15cm)	% RECOVERY	% RQD	%WATER CONTENT	TEST
68.60	0.0	TOPSOIL Peat							
		0.91m							
68.60	1.00	CLAY Very stiff, moist, grey.	ST	ST01		90		124 83 23	g_w =19.6 kN/m³ Su = 168kPa
67.70	1.90	CLAY Medium stiff, grey. with thin silt and fine sand seams. Increased water content between 3.5 and 5.5m depth and higher liquid limit.	SS	SS2		30		53.3	
			SS	SS3	1-24"	100		72.8	
			ST	ST4		90		72.1	g_w =15.6 kN/m³ P_c = 70 kPa Su = 27kPa
62.90	6.70		ST	ST5		100		42.5	g_w =17.6 kN/m³ P_c = 90 kPa Su = 30kPa
		CLAY Soft, grey, low plasticity, presence of shells, thin silt seams.	ST	ST6		100		50.7	g_w =16.8 kN/m³ P_c = 100 kPa
			SS	SS7	3-24"	0			
			SS	SS8	50-1"	0			
59.54	10.06	BEDROCK Medium grained, grey with white spots, slight magnetism very strong, weathered and fractured.	RC	RC9		95	48		d = 31kN/m³
58.02	11.58	END OF BOREHOLE							

Blowcount- Cone Test: 25 50 75

Water Content: 25 50 75



g_w = Wet unit weight
P_c = Preconsolidation stress
G = Grain size analys
Su = Undrained shear strength from vane shear test
d = unit weight

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REVIEWED BY : NJ	COMPLETE: OCTOBER 24th, 2011
Fig No:	Page: 1 of 1

Borehole Logs and Test Pit Summary Table

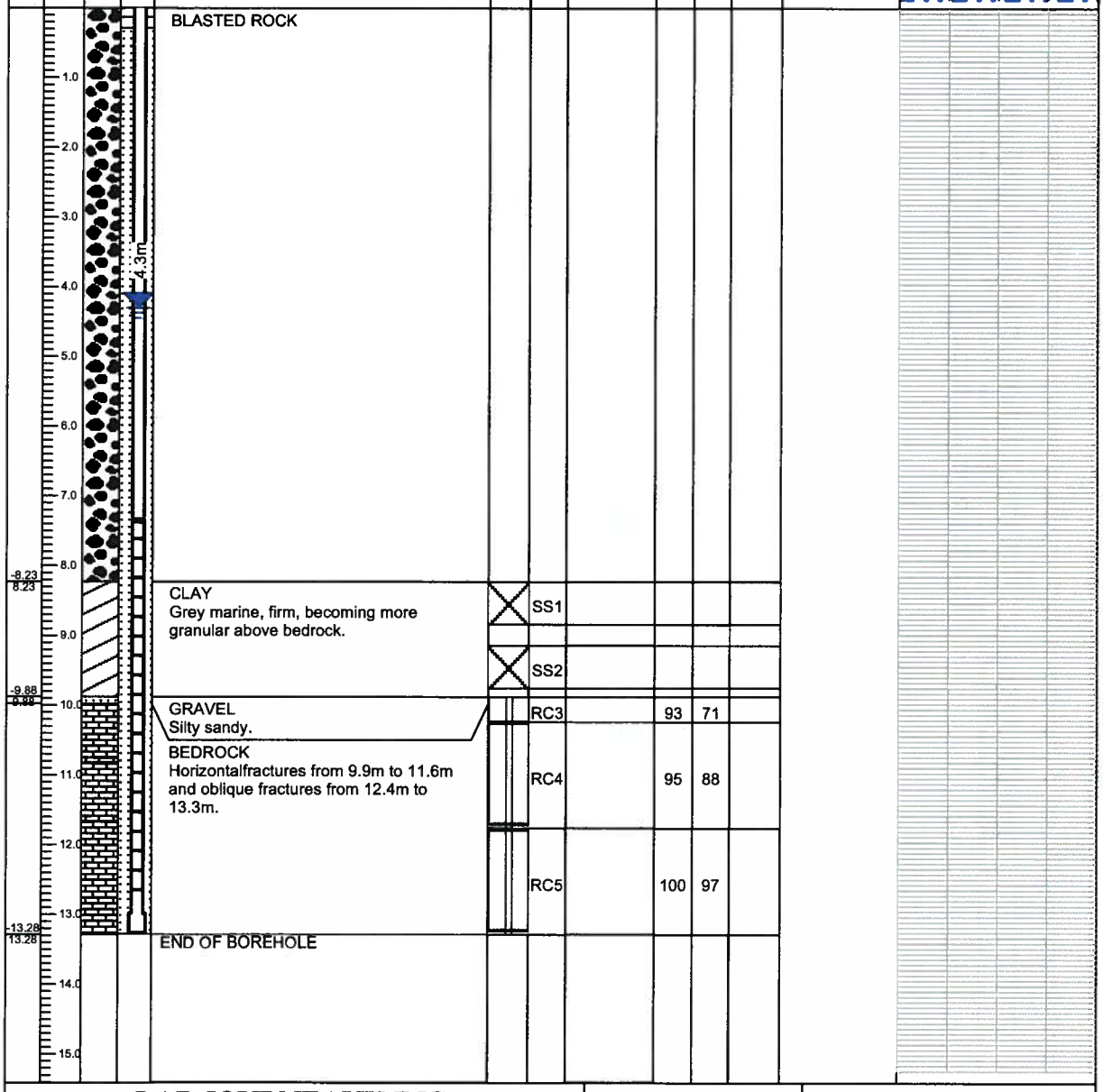
Dock Silo area borehole logs

P-01
P-02

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 22th 2011	BOREHOLE NO: P-01 (Dock silo)
PROJECT: GEOTECH	DATE OF WATER LEVEL: MAY 3rd 2011	PROJECT NO: L-10-1411
LOCATION: SILOS - PORT DE MER	WATER LEVEL : 4.3m	ELEVATION:

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: SILOS COORDINATES :



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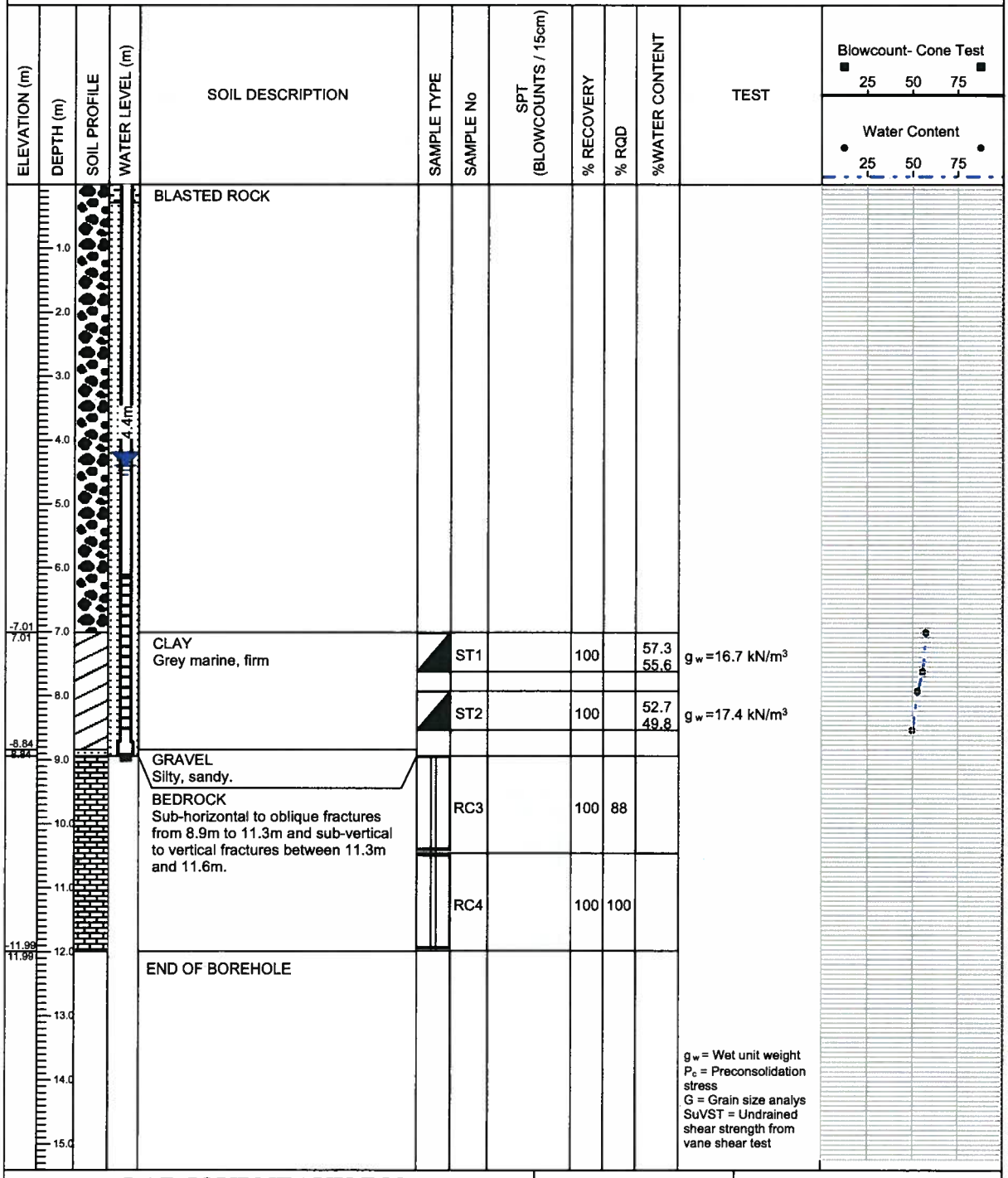
	REVIEWED BY : N.J.
	Fig No:
	COMPLETION DEPTH: 13.28m
	COMPLETE:
	Page: 1 of 1

CLIENT: AUSENCO-SANDWELL	DATE OF BORING: APRIL 22nd 2011	BOREHOLE NO: P-02 (Dock silo)
PROJECT: GEOTECH	DATE OF WATER LEVEL: MAY 3rd 2011	PROJECT NO: L-10-1411
LOCATION: SILOS - PORT DE MER	WATER LEVEL : 4.4m	ELEVATION:

SAMPLE TYPE: TUBE SHELBY | CORE SAMPLE | SPT SAMPLE | GRAB SAMPLE

SITE: SILOS (POINTE-NOIR) COORDINATES :



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	REVIEWED BY : N.J.	COMPLETE:
	Fig No:	Page: 1 of 1

Borehole Logs and Test Pit Summary Table

Test Pit Summary Table

R-01	C-11	U-01	T-02
R-02	SP-01	U-02	T-03
R-03	SP-02	U-04	T-03B
R-04	CR-01	U-05	T-04
R-05	CR-02	U-07	T-05
R-06	CR-03	U-08	T-06
R-07	W-01	U-08A	T-07
R-08	W-02	U-11	T-08
R-11A	W-02A	U-12	T-08A
R-12	W-02B	U-13	T-09
R-14	W-02C	U-14	
R-15B	W-02D	U-15	
R-15C	W-03	U-16	
R-16	W-04	U-17	
R-17	W-05	U-17A	
R-18	W-02B	U-18	
R-19	W-02C	U-19	
R-19A	W-02D	U-20	
R-20	W-03	U-21	
R-21	W-04	U-22	
R-22	W-05	U-23	
R-22A		U-24	
R-23		U-26	
		U-28	
		U-29	
		U-30	
		U-31	
		U-32	

TEST PITS SUMMARY TABLE
ARNAUD MINES

RAILWAY	
R-01	4 feet dark red, oxidised sand (tuff) with gravel, cobbles and boulders followed by grey till to 6 feet – refusal
R-02	5 feet very cemented, very hard tuff on firm clay from 5 to 9 feet, wet clay to from 9 to 12 feet
R-03	5 feet tuff followed by 5 feet coarser sand; clay at 10 feet
R-04	10 feet of sand becoming sand and gravel with cobbles and boulders
R-05	5 feet tuff; 4 feet sand and gravel; clay at 9 feet
R-06	1 foot of sand and gravel with cobbles, 4 feet tuff; 6 feet coarse stratified sand; clay at 12 feet
R-07	2 feet of topsoil, 5 feet tuff; 3 feet of sand and clay, clay at 10 feet
R-08	9 feet rusty brown tuff on clay at 9 feet; bedrock at 12 feet
R-11A	6 feet saturated clay, 6 feet saturated soft clay (soup)
R-12	2 feet top soil on 6 feet brown stiff, sandy, dry clay
R-14	Top soil zone
R-15B	2 feet top soil on stiff clay
R-15C	Ice on frozen peat
R-16	1.5 feet top soil on very dry clay
R-17	Bedrock a 1 foot
R-18	Bedrock a 1 foot
R-19	3 feet of stiff dry desiccated clay
R-19A	Bedrock on surface
R-20	1 foot sand, 4 feet clay
R-21	Dry clay under 1 feet of topsoil
R-22	8 feet dry sand with cobbles and boulders
R-22A	5 feet very hard, dark reddish, cemented sand (tuff)
R-23	2 feet frozen topsoil, 4 feet dense, very hard, blackish sand
C-11	1 foot topsoil, 6 feet blackish, humid sand (bedrock outcrops at 15 metres to the south)
ORIGINAL STOCKPILE	
SP-01	8 feet of very stiff brown clay on 7 feet of grey-brown clay. Bed rock at 15 feet. Hole dry
SP-02	8 feet of stiff brown clay. Saturated grey clay at 18 feet. Bedrock at 20 feet.
CRUSHER SITE	
CR-01	Brown and grey saturated clay with much water infiltration at the bottom of the test pit. No bedrock at 22 feet.
CR-02	Bedrock at 3 feet. Dry.
CR-03	Bedrock at 1 foot.
WASTE DUMP	
W-01	4 feet moist, very stiff clay followed by sand; Bedrock at 7 feet
W-02	2 feet of topsoil, bedrock near surface
W-02A	Bedrock at 1 foot

TEST PITS SUMMARY TABLE
ARNAUD MINES

W-02B	Bedrock at 1 foot
W-02C	Bedrock at 4 feet
W-02D	8 feet peat, 2 feet of clay
W-03	6 feet of black earth and silt and sand, compact
W-04	Bedrock at surface
W-05	1 foot topsoil, bedrock at 1 foot beside rock escarpment
W-02B	Bedrock at 1 foot
W-02C	Bedrock at 4 feet
W-02D	8 feet peat, 2 feet of clay
W-03	6 feet of black earth and silt and sand, compact
W-04	Bedrock at surface
W-05	1 foot topsoil, bedrock at 1 foot beside rock escarpment
PLANT SITE	
U-01	3 feet peat on brown, very stiff clay to 12 feet, no bedrock
U-02	2 feet top soil on very stiff, dry clay, bedrock at 7 feet
U-04	Bedrock at 2 feet
U-05	12 feet very stiff, greyish clay, 4 feet of wet clay, bedrock at 16 feet
U-07	2 feet of silt, 2 feet of clay, bedrock at 4 feet
U-08	Bedrock at 1 foot
U-08A	8 feet dry peat on silty, very stiff, dry clay
U-11	Bedrock at 6 feet below hard, dry silt
U-12	2 feet top soil, 12 feet stiff clay followed by grey, saturated clay to 16 feet, no bedrock
U-13	10 feet stiff clay, blocky, vertical walls, no bedrock found
U-14	10 feet stiff clay, no bedrock found
U-15	3 feet of peat on stiff clay, bedrock close to surface
U-16	2 feet of gravel and sand, bedrock at 3 feet
U-17	Bedrock at 1 foot
U-17A	8 feet peat, bedrock at 8 feet
U-18	Bedrock at 2 feet
U-19	2 feet of topsoil, 2 feet of sand, bedrock at 4 feet
U-20	3 feet of peat, bedrock at 4 feet
U-21	Bedrock at 1 foot
U-22	4 feet peat on stiff clay to 16 feet – no bedrock
U-23	10 feet stiff clay followed by grey, saturated clay, bedrock at 14 feet
U-24	8.5 feet of peat, stiff clay to 14 feet – no bedrock
U-26	2 feet top soil on 6 feet of very stiff clay, no bedrock at 8 feet
U-28	8 feet peat on 12 feet of grey-blue clay, no bedrock at 20 feet
U-29	14 feet of peat on 6 feet of grey-blue clay, no bedrock at 20 feet

TEST PITS SUMMARY TABLE
ARNAUD MINES

U-30	1.5 feet of water - 8 feet peat minimum
U-31	Brown, stiff, low humidity clay, bedrock at 9 feet
U-32	2 feet of sand, bedrock at 4 feet
TAILINGS IMPOUNDMENT AREA	
T-02	Bedrock at surface
T-03	Bedrock at 1 foot
T-03B	5 feet stiff clay followed by grey, firm clay, bedrock at 12 feet
T-04	1 foot top soil, 3 feet brown, very dense silt, bedrock at 4 feet
T-05	Bedrock at surface
T-06	Bedrock at 1 foot
T-07	Bedrock at surface
T-08	2 feet top soil on stiff clay to 14 feet becoming firm with shells, no bedrock at 22 feet
T-08A	Bedrock at 3 feet below brownish, firm clay
T-09	1 foot top soil, 10 feet clay layer very rich in shells, 1 foot silt layer, bedrock at 12 feet

Laboratory Test Results

Summary Table

R-Series – Railway
U-Series – Plant site
T-Series – Tailings impoundment area
W-Series – Waste dump
CR – Crusher Site
P-Series – Dock Silos

JOURNEAUX ASSOC.
DIVISION LAB JOURNEAUX INC
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

LABORATORY AND FIELD TEST RESULTS

Project No: L-10-1411
Date: Septembert 2011

Client : Mine Arnaud (Sept-Îles, Qc) **Project : Geotechnical study**

						ATTERBERG LIMITS					GRAIN SIZE ANALYSIS (% of)								
BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	ELEVATION (m)	WATER CONTENT (%)	WET UNIT WEIGHT γ (kN/m³)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	MINITURE VANE SHEAR TEST (kPa)	PRECONSOLIDATION PRESSURE (kPa)	BOULDERS	COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT (passing 0.08mm)	CLAY
No	No			W	γ_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
R-1	GS1	1.22	50.8	10.6%										5.4	3.9	67.4	22.9	0.4 (<0.08)	
	GS2	1.52	50.5	20.6%										5.3	10.6	66.3	16.5	1.3 (<0.08)	
R-2	GS1	2.74	46.9	53.1%	17														
R-3	GS1	2.44	47.6	17.7%										5.2	5.1	60.9	28	0.9 (<0.08)	
R-4	GS1	3.35	47.67	9.9%										11.7	3.6	49.9	33.9	1.0 (<0.08)	
R-6	GS1	2.44	58.32	22.0%											0.2	24.1	69.5	6.2 (<0.08)	
R-7	SS1	0.30	63.29	354.4%															
	SS2	0.91	62.68	82.5%															
	SS3	1.83	61.76	28.2%															
	SS4	2.59	61.00	29.3%															
	SS5	4.27	59.32	33.8%		20.0	12.2	7.8											
R-9	SS1	1.83	66.92	18.5%										5.9	1.3	54.7	35.1	3 (<0.08)	
	SS2	4.88	63.87	34.6%	18	37.0	22.7	14.3											
	ST3	7.62	61.13	51.5%															
		7.77	60.98	59.1%															
		7.83	60.92	50.5%															
		7.92	60.83	48.1%															
		8.08	60.67	49.3%															
		8.14	60.61	51.8%					21										
	ST4	10.82	57.93	57.7%															
		10.97	57.78	46.1%	17				49	130									
		11.13	57.62	48.6%	17														
R-10	SS1	1.83	68.14	3.8%											0.2	53.3	45	1.4 (<0.08)	
	SS2	3.35	66.62	23.6%										1.5	0.5	50.2	46	1.8 (<0.08)	
	SS3	4.88	65.09	20.6%										0.2	0.5	68.4	27.7	3.1 (<0.08)	
	SS4	6.40	63.57	36.6%	17	37.0	22.2	14.8											
	SS5	7.92	62.05	38.4%	17														
	ST6	9.14	60.83	33.0%	18														
		9.30	60.67	32.1%	17														
		9.45	60.52	45.0%	17														
		9.60	60.37	43.9%	19														
		9.66	60.31	38.0%	19				28										
	ST7	10.82	59.15	41.4%	18														
		10.91	59.06	42.8%	18	35.0	21.3	13.7		160									
		10.97	59.00	41.3%	18														
		11.13	58.84	41.3%	19				31										
R-11	SS1	0.91	69.76	43.6%															
	SS2	1.83	68.84	49.8%															
	ST3	2.29	68.38	41.9%															
		2.41	68.26	41.3%															
		2.59	68.08	34.4%	18														
		2.71	67.96	37.8%	18														
		2.77	67.90	45.9%	18				34										
	ST4	3.05	67.62	47.4%	17														
		3.20	67.47	47.5%	17														
		3.35	67.32	48.7%	17				29										
		3.51	67.16	47.6%	17														
	SS5	3.96	66.71	52.6%		37.0	28.3	8.8											
	SS6	4.88	65.79	40.7%		32.0	21.9	10.1											
	SS7	6.40	64.27	10.8%															
R-11A	GS1	1.22		50.3%	17	54.5	27.2	27.3											

NOTES:
GRAIN SIZE ANALYSIS PERFORMED ON MINUS 20mm, COBBLE AND BOULDER CONTENT NOT EVALUATED
GS: GRAB SAMPLE (FROM TEST PITS), SS: SPLIT SPOON AND ST: SHELBY TUBE (FROM BOREHOLES)

JOURNEAUX ASSOC.
DIVISION LAB JOURNEAUX INC
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

LABORATORY AND FIELD TEST RESULTS

Project No: L-10-1411
Date: Septembert 2011

Client : Mine Arnaud (Sept-Îles, Qc) **Project : Geotechnical study**

						ATTERBERG LIMITS					GRAIN SIZE ANALYSIS (% of)								
BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	ELEVATION (m)	WATER CONTENT (%)	WET UNIT WEIGHT γ (kN/m³)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	MINITURE VANE SHEAR TEST (kPa)	PRECONSOLIDATION PRESSURE (kPa)	BOULDERS	COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT (passing 0.08mm)	CLAY
No	No			W	g_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
R-12	GS1	2.44	71.28	26.1%	20	28.5	17.9	10.6											
R-13	SS1	1.07	76.08	281.7%															
	SS2	1.83	76.08	474.5%															
	SS3	3.35	76.08	24.0%															
R-13A	SS1	1.07	75.35	64.9%															
	SS2	1.83	74.59	44.7%		51.5	25.0	26.5											
	SS3	2.59	73.83	52.6%		49.0	31.8	17.2											
	SS4	3.35	73.07	46.4%															
	SS5	4.72	71.70	32.5%															
R-13B	SS1	1.83	74.59	59.8%	17	45.0	27.8	17.2											
	GS0	2.44	73.98																
R-13E	SS1	1.07		37.1%	19	49.5	41.3	8.1											
	SS2	1.83		29.9%	20	36.0	23.6	12.4											
R15	ST1	0.76	72.74	229.5%															
		1.07	72.43	143.6%					19										
	ST2	1.52	71.98	132.2%															
		1.68	71.82	175.7%															
		1.83	71.67	103.3%															
		1.98	71.52	94.8%					15										
	ST3	2.29	71.21	417.5%															
		2.35	71.15	89.3%															
		2.44	71.06	127.1%	13														
		2.74	70.76	37.4%	19				27										
		2.80	70.70	31.3%	17														
	ST4	3.05	70.45	50.9%	17														
		3.35	70.15	61.8%	16				21										
		3.51	69.99	62.4%	16														
	ST5	4.57	68.93	60.4%	16														
		4.72	68.78	56.9%	16														
		4.88	68.62	59.9%	16														
		5.03	68.47	58.5%	16				19										
	ST6	6.10	67.40	68.5%															
		6.40	67.10	65.2%															
		6.55	66.95	63.1%	15				8										
R15A	SS1	0.30	73.63	401.1%															
	SS2	0.91	73.02	35.7%	18	52.0	31.0	21.0											
	SS3	2.59	71.34																

NOTES:
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JOURNEAUX ASSOC.
DIVISION LAB JOURNEAUX INC
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

LABORATORY AND FIELD TEST RESULTS

Project No: L-10-1411
Date: Septembert 2011

Client : Mine Arnaud (Sept-Îles, Qc) **Project : Geotechnical study**

						ATTERBERG LIMITS					GRAIN SIZE ANALYSIS (% of)								
BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	ELEVATION (m)	WATER CONTENT (%)	WET UNIT WEIGHT γ (kN/m³)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	MINITURE VANE SHEAR TEST (kPa)	PRECONSOLIDATION PRESSURE (kPa)	BOULDERS	COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT (passing 0.08mm)	CLAY
No	No			W	γ_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
R-16	SS1	1.07	70.93	77.4%															
	ST2	1.77	70.23	43.0%															
		1.89	70.11	89.3%															
		1.95	70.05	24.6%	20				44										
		2.04	69.96	29.5%	18														
	SS3	2.59	69.41	34.9%															
	SS4	3.35	68.65	60.6%		49.0	26.7	22.3											
	ST5	3.81	68.19	56.6%	16														
		3.99	68.01	51.0%	17				15										
		4.11	67.89	53.9%	17														
		4.30	67.70	50.2%	17														
	ST6	5.33	66.67	63.0%	16														
		5.43	66.57	72.6%	15														
		5.58	66.42	72.1%	15				11										
		5.64	66.36	65.6%	16														
		5.79	66.21	63.0%	16														
		5.88	66.12	61.2%	16														
	ST7	9.14	62.86	97.7%															
		9.30	62.70	80.0%															
		9.45	62.55	89.1%					5										
		9.60	62.40	89.0%															
	ST8	12.28	59.72	66.8%															
		12.44	59.56	67.5%															
		12.59	59.41	65.3%															
		12.74	59.26	65.6%	16														
		12.77	59.23	65.7%					15										
		12.80	59.20	42.7%															
U-1	GS1	3.66	73.25	63.5%	16	54.5	33.3	21.2											
U-2	GS1	1.83	74.83	27.9%	19														
U-3	SS1	0.30	78.98	285.8%															
	SS2	0.91	78.37	35.1%	18														
	SS3	1.83	77.46	56.7%	16	61.0	27.7	33.3											
	ST4	3.81	75.48	69.4%															
		3.96	75.32	56.5%	17														
		4.11	75.17	53.6%	17	46.0	30.9	15.1	27	95									
		4.21	75.08	54.6%	17														
		4.27	75.02	55.6%	17														
		4.39	74.90	55.0%	17														
	ST5	6.10	73.19	72.2%															
		6.22	73.07	58.8%	16														
		6.40	72.88	56.0%	17														
		6.49	72.79	52.9%	17														
		6.55	72.73	52.6%	17	37.5	23.2	14.3											
		6.64	72.64	47.6%	18				34	90									
	SS6	7.92	71.36	31.2%															
U-5	GS1	1.52	75.36	48.7%	16	39.4	22.3	18.0											
	GS2	3.66	73.22	45.1%	17	45.0	22.3	22.8											

NOTES:
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JOURNEAUX ASSOC.
DIVISION LAB JOURNEAUX INC
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

LABORATORY AND FIELD TEST RESULTS

Project No: L-10-1411
Date: September 2011

Client : Mine Arnaud (Sept-Îles, Qc) **Project : Geotechnical study**

						ATTERBERG LIMITS					GRAIN SIZE ANALYSIS (% of)								
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No	No			W	g_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
U-6	SS1	1.07	75.71	50.8%															
	SS2	1.83	74.95	65.0%	16	56.0	35.8	20.2											
	ST3	5.33	71.45	62.3%	16														
		5.49	71.29	54.7%	17	37.0	24.3	12.7											
		5.64	71.14	54.1%	17				33	75									
		5.79	70.99	51.9%	17														
	SS4	7.16	69.62	48.0%		29.0	22.1	6.9											
	SS5	7.92	68.86	12.9%															
U-7	GS1	0.91	78.34	100.6%															
U-9 A	SS1	1.07	73.07	45.5%															
	SS2	1.83	72.31	56.8%		49.5	35.8	13.7											
	SS3	2.59	71.55	50.5%		38.0	20.6	17.5											
U-10	SS1	1.07	73.21	400.0%															
	ST2	1.83	72.45						9										
	ST3	2.29	71.99	100.0%															
		2.38	71.90	68.4%															
		2.62	71.66	85.1%					17										
		2.77	71.51	62.9%															
		2.80	71.48	205.5%															
	SS4	3.35	70.93	80.4%		49.5	29.3	20.2											
	ST5	3.81	70.47	55.7%	16														
		3.87	70.41	57.6%	16														
		4.02	70.26	56.8%	16	50.5	29.5	21.0											
		4.11	70.17	58.2%	16				31	100									
		4.27	70.01	55.6%	17														
	ST6	5.33	68.95	57.5%															
		5.43	68.85	56.7%	17				20										
		5.52	68.76	61.1%	17														
		5.64	68.64	55.3%	17														
		5.79	68.49	59.5%	16														
U-13	GS1	2.44	74.20	50.0%	17														
U-14	GS1	2.74	78.06	47.3%	17	43.0	24.6	18.4											
U-16	GS1	0.61	82.12	14.2%									24.8	32.4	10.8	21.2	8.6	2.1 (<0.08)	
U-19	GS1	1.07	81.16	28.8%										1.5	4.8	45	30.7	18 (<0.08)	
U-22	SS0	1.07	72.63																
	SS1	1.83	71.87	282.7%															
	SS2	2.59	71.11	28.0%															
	SS2A	3.35	70.35																
	SS3	4.88	68.82	49.5%		43.0	31.3	11.8											
	SS4	6.40	67.30	40.7%															
	SS5	7.92	65.78	42.1%		35.0	25.0	10.0											
	SS6	9.45	64.25																
U-24	GS1	2.44	73.18	430.5%															
	GS2	4.57	71.05	58.2%	16														

NOTES:
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No	No			W	g_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
U-26	GS0	2.44	73.77	52.9%		53.0	22.5	30.6											
	SS1	1.07	75.14	47.6%	19	38.0	29.4	8.6											
	SS2	3.35	72.86	54.0%	15	42.5	22.7	19.8											
	ST3	4.57	71.64	46.1%															
		4.66	71.55	48.2%	17														
		4.72	71.49	55.5%	17														
		4.88	71.33	60.8%	17				20										
		5.03	71.18	48.2%	17	37.0	22.2	14.8		95									
		5.12	71.09	44.5%	17														
	ST4	5.33	70.88	15.5%									6.7	5.6	3.4	24.7	22.3	37.3 (<0.08)	
		5.49	70.72	42.5%															
		5.64	70.57	42.1%	17	47.0	27.3	19.7											
		5.79	70.42	42.0%	17														
		5.88	70.33	40.0%	18				23	95									
U-28	GS1	0.61	73.60	184.4%															
	GS2	3.96	70.25	55.2%	16	49.5	22.3	27.3											
U-30	GS1	2.44	71.39	380.6%															
U-31	GS1	2.44	76.21	36.0%	19														
U-32	GS1	0.91	77.47	27.2%															
T-1		1.37		54.0%	16														
	ST1	1.52		23.9%	18				33										
		1.62		28.5%	20														
	SS2	3.05		18.0%															
T-3B	GS	3.05		51.0%		42.0	19.5	22.5											
T-3A		1.22	68.38	124.0%															
	ST1	1.37	68.23	83.4%	20				168										
		1.46	68.13	22.5%															
	SS2	2.44	67.16	53.3%															
	SS3	4.11	65.48	72.8%		61.0	36.4	24.6											
		4.57	65.03	72.1%															
	ST4	4.72	64.87	72.1%	15	57.0	38.0	19.0	27										
		5.03	64.57	68.8%	16					70									
		5.12	64.48	71.5%	16														
		6.10	63.50	131.2%	18														
		6.25	63.35	42.1%	18														
	ST5	6.40	63.20	42.5%	18	40.0	26.2	13.8		90									
		6.55	63.04	33.1%	17				30										
		6.64	62.95	49.1%	17														
		7.62	61.98	51.4%	17														
	ST6	7.77	61.82	50.7%	17	49.0	20.7	28.3											
		7.92	61.67	51.5%	17														
		8.08	61.52	53.0%	17					100									
	SS7	9.45	60.15																
	SS8	10.06	59.54																
T-4	GS	1.22	77.52	24.2%															
T-8	GS	5.49	76.73	76.7%	19														
T-8A	GS	0.91	79.88	57.9%											3.5	33.5	43.7	19.4 (<0.08)	
T-9	GS	1.52	94.48	45.1%															
	GS	2.74	93.26	42.8%		36.0	29.2	6.8											
	GS	3.66	92.35	22.7%															

NOTES:
GRAIN SIZE ANALYSIS PERFORMED ON MINUS 20mm, COBBLE AND BOULDER CONTENT NOT EVALUATED
GS: GRAB SAMPLE (FROM TEST PITS), SS: SPLIT SPOON AND ST: SHELBY TUBE (FROM BOREHOLES)

JOURNEAUX ASSOC.
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LABORATORY AND FIELD TEST RESULTS

Project No: L-10-1411
Date: September 2011

Client : Mine Arnaud (Sept-Îles, Qc) **Project : Geotechnical study**

						ATTERBERG LIMITS					GRAIN SIZE ANALYSIS (% of)								
BOREHOLE / TESTPIT	SAMPLE	DEPTH (m)	ELEVATION (m)	WATER CONTENT (%)	WET UNIT WEIGHT γ (kN/m³)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	MINITURE VANE SHEAR TEST (kPa)	PRECONSOLIDATION PRESSURE (kPa)	BOULDERS	COBBLES	COARSE GRAVEL	FINE GRAVEL	COARSE SAND	MEDIUM SAND	FINE SAND	SILT (passing 0.08mm)	CLAY
No	No			W	g_w	w_L	w_P	I_P	Cu	Pc	≥200	200 - 75	75 - 20	20 - 5	5 - 2.5	2.5-.315	0.315-0.08	0.08-0.002	≤0.002
W-1	GS	2.13	84.27	6.1%										16.1	5.6	55.1	20.5	2.7 (<0.08)	
CR-1	GS	6.71	80.29	40.2%															
P-02 (pointe-noir)	ST1	6.71		55.6%															
		6.86		51.1%	17														
		7.01		57.3%	17														
		7.32		53.9%	17														
	ST2	7.62		52.7%															
		7.77		50.4%	17														
		7.92		44.9%															
		8.23		49.8%	18														

NOTES:
GRAIN SIZE ANALYSIS PERFORMED ON MINUS 20mm, COBBLE AND BOULDER CONTENT NOT EVALUATED
GS: GRAB SAMPLE (FROM TEST PITS), SS: SPLIT SPOON AND ST: SHELBY TUBE (FROM BOREHOLES)

Laboratory Test Results

Grain Size Analysis Reports

R-01
R-03
R-04
R-06
R-22A
R-09
R-10
U-16
U-19
U-26
U-31
T-08
W-01

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GRAIN SIZE ANALYSIS

CSA A23.2-2A

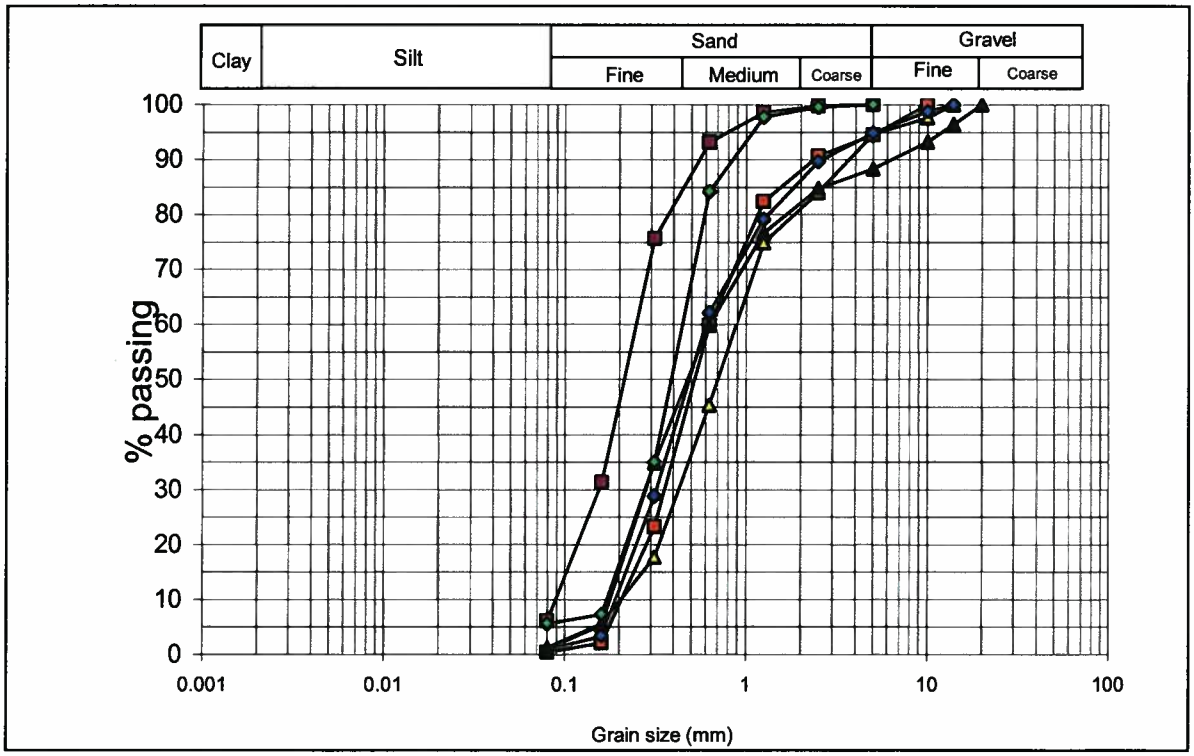
Project No: L-10-1411
Borehole No:
Elevation (m) :
LJA No :

Client : Mine Arnaud (Sept-Îles, Qc)
Project : Geotechnical study

Results

Legend >>>	△	■	◆	▲	■	◆
Sample No:	R-1	R-1	R-3	R-4	R-6	R-22A
Depth (m) :	1.2	2.4	2.4	3.4	2.4	1.2
Elevation (m) :	---	---	---	---	---	---
Moisture content (%) :	26.2	10.6	17.7	9.9	22.0	1.6

Sieve (mm)	% Passing					
80						
56						
40						
28						
20				100.0		
14	100.0		100.0	96.5		
10	97.6	100.0	98.7	93.2		
5	94.7	94.6	94.8	88.3	100.0	100.0
2.5	84.1	90.7	89.7	84.7	99.8	99.6
1.25	74.8	82.4	79.1	76.6	98.6	97.8
0.630	45.3	59.8	62.1	60.0	93.2	84.1
0.315	17.8	23.3	28.9	34.9	75.6	35.1
0.160	5.7	2.1	3.4	5.4	31.3	7.3
0.080	1.3	0.4	0.9	1.0	6.2	5.6



Signature : _____

Sampled by : N.Journeaux Date : ---- Analyzed by : A.Mills Date : ----

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GRAIN SIZE ANALYSIS

CSA A23.2-2A

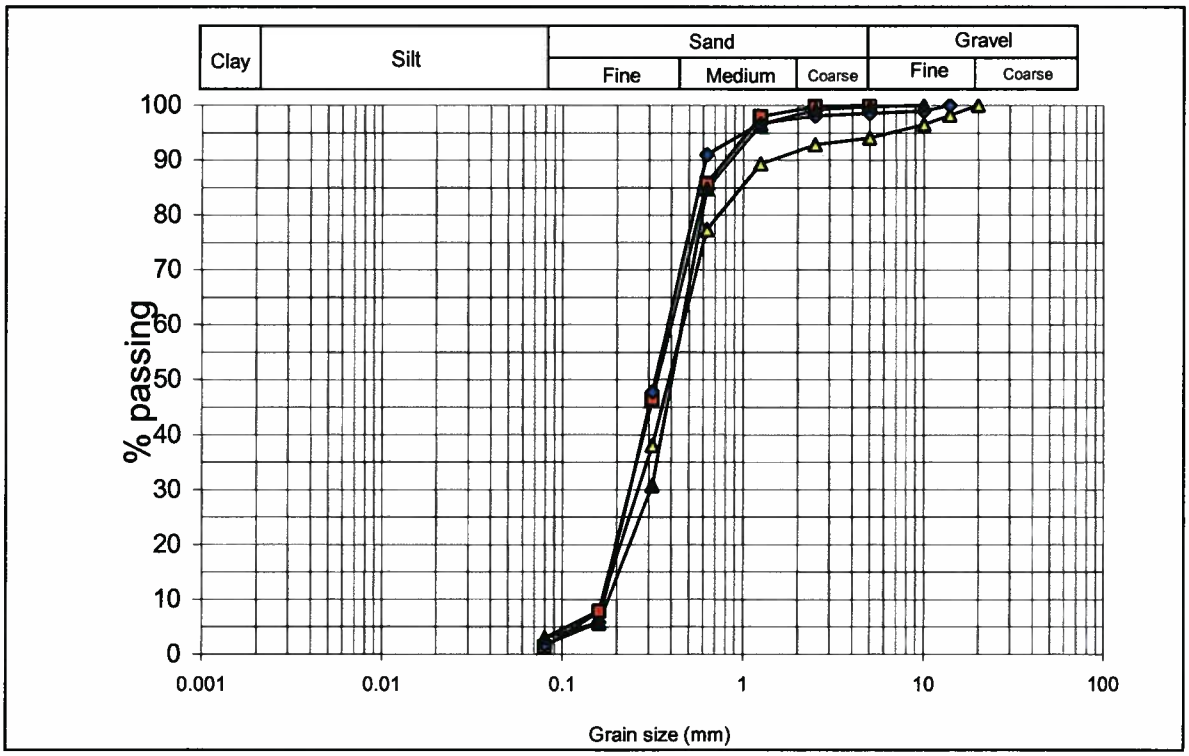
Project No: L-10-1411
Borehole No:
Elevation (m) :
LJA No :

Client : Mine Arnaud (Sept-Îles, Qc)
Project : Geotechnical study

Results

Legend >>>	△	■	◆	▲	■	◆
Sample No:	R-9/SS1	R-10/SS1	R-10/SS2	R-10/SS3		
Depth (m) :	1.8	1.8	3.4	4.9	---	---
Elevation (m) :	---	---	---	---	---	---
Moisture content (%) :	18.5	3.8	23.6	20.6	---	---

Sieve (mm)	% Passing			
80				
56				
40				
28				
20	100.0			
14	98.2		100.0	
10	96.5		99.0	100.0
5	94.1	100.0	98.5	99.8
2.5	92.8	99.8	98.1	99.2
1.25	89.4	98.0	96.8	96.6
0.630	77.4	85.7	91.1	84.9
0.315	38.1	46.4	47.8	30.8
0.160	8.0	7.9	5.8	5.7
0.080	3.0	1.4	1.8	3.1



Signature : _____

Sampled by : J.Breton Date : --- Analyzed by : A.Mills Date : ---

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GRAIN SIZE ANALYSIS

CSA A23.2-2A

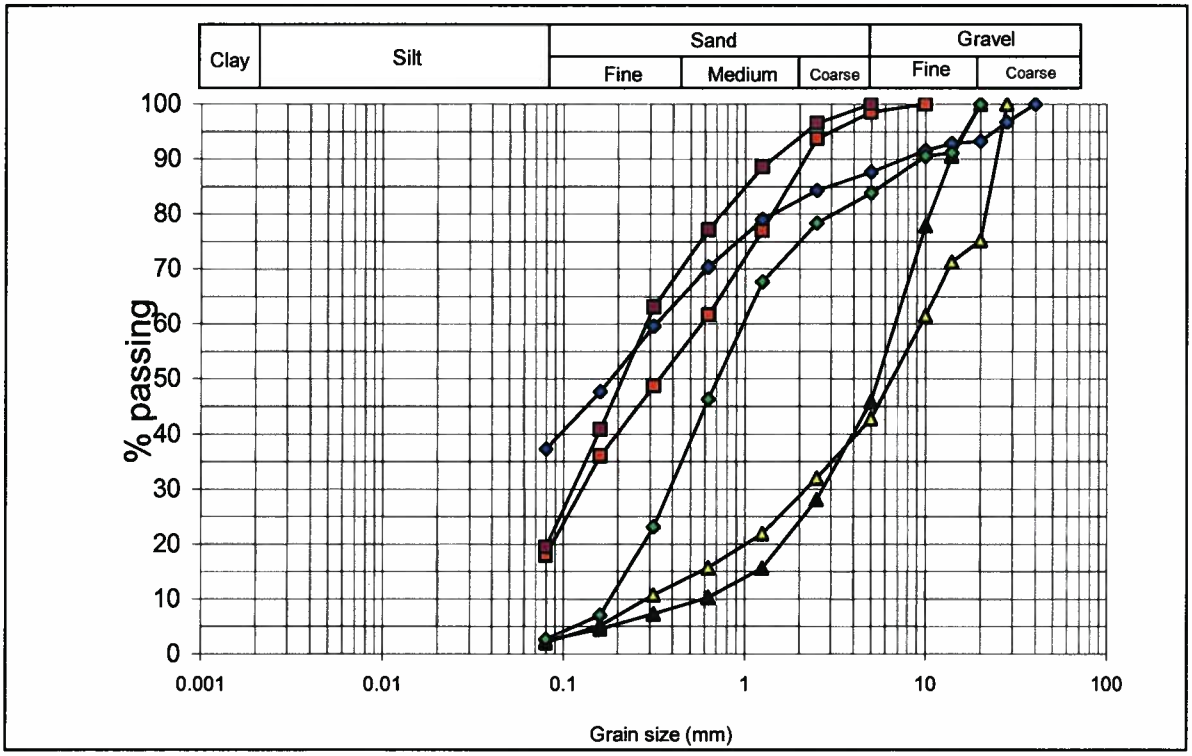
Project No: L-10-1411
Borehole No:
Elevation (m) :
LJA No :

Client : Mine Arnaud (Sept-Îles, Qc)
Project : Geotechnical study

Results

Legend >>>	△	■	◆	▲	■	◆
Sample No:	U-16	U -19	U-26/ST4	U -31	T-8	W-1
Depth (m) :	0.6	1.1	5.6	2.4	0.9	2.1
Elevation (m) :	---	---	---	---	---	---
Moisture content (%) :	14.2	28.8	15.5	27.2	57.9	6.1

Sieve (mm)	% Passing					
80						
56						
40			100.0			
28	100.0		96.7			
20	75.2		93.3	100.0		100.0
14	71.2		92.8	90.6		91.1
10	61.5	100.0	91.6	77.9		90.6
5	42.8	98.5	87.7	45.8	100.0	83.9
2.5	32.0	93.7	84.3	28.1	96.5	78.3
1.25	21.9	77.0	79.0	15.6	88.6	67.7
0.630	15.7	61.6	70.4	10.4	77.2	46.4
0.315	10.8	48.7	59.6	7.3	63.1	23.2
0.160	5.2	36.0	47.7	4.6	40.9	7.0
0.080	2.1	18.0	37.3	2.5	19.4	2.7



Signature : _____

Sampled by : N.Journeaux Date : ---- Analyzed by : A.Mills Date : ----

Laboratory Test Results

Consolidation Test Reports

R-09
R-10
R-15
U-03
U-06
U-10
U-26
T-03A

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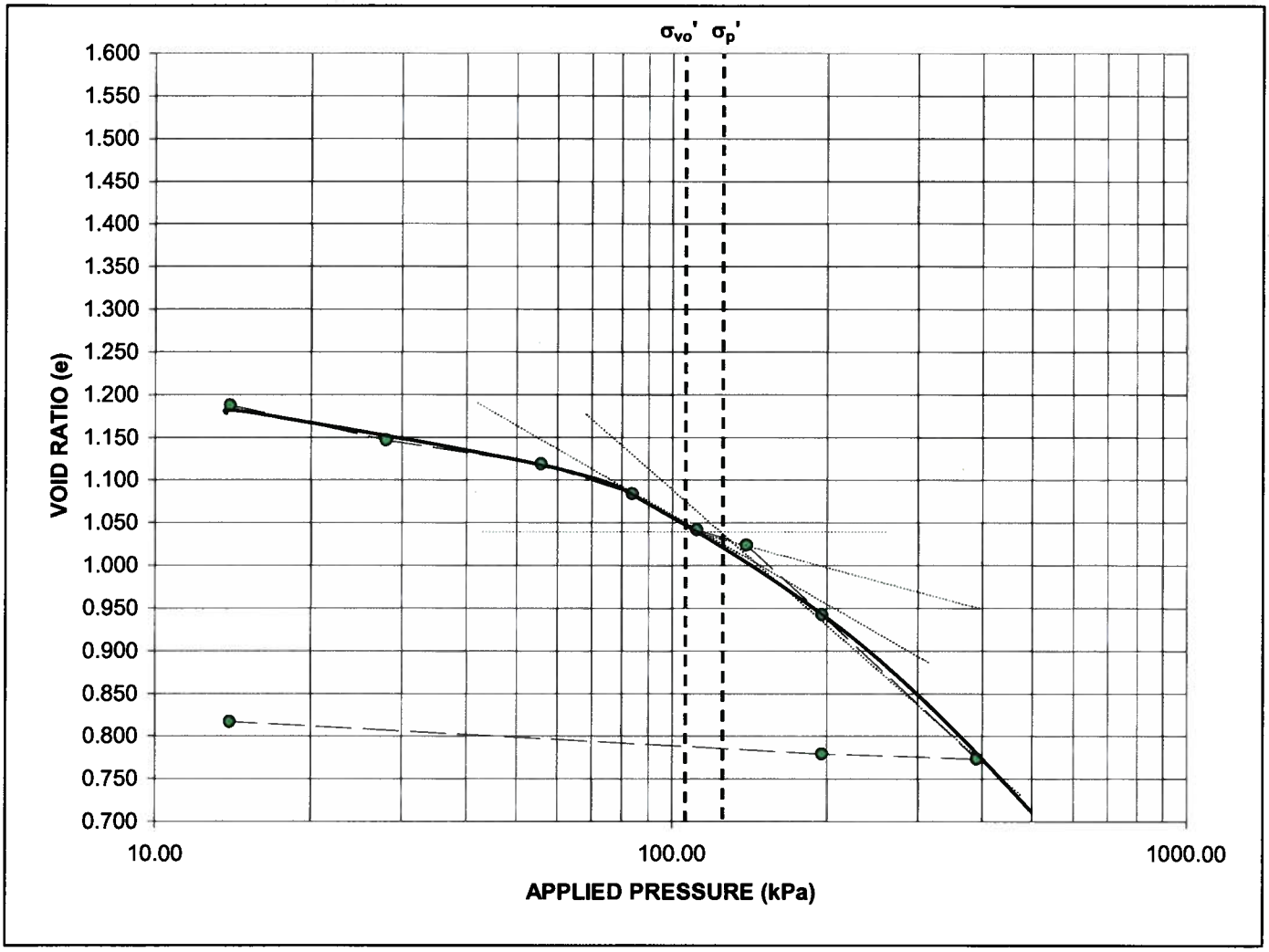
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6
Tel.: (514) 630-4997 Fax.: (514) 630-8937

ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **02/06/2011**

Borehole: **R-09** Sample: **ST4** Drilling date: **09/04/11**
Test depth: **11.0 m** Description: **CLAY**



LL : **35** Cu : **49 kPa**
PI : **14**

TEST SUMMARY

	SAMPLE CHARACTERISTICS	
	INITIAL STATE	FINAL STATE
w	**48.86** %	**34.36** %
γ	**18.03** kN/m³	**19.87** kN/m³
γd	**12.11** kN/m³	**14.79** kN/m³
Sr	%	%
e	**1.187**	**0.817**
Dr	estimated	mesured

DIMENSIONS: Dia. (cm) **6.350** Height (cm) **1.905**

COMPRESSIBILITY PROPERTIES	
σ_p' : Consolidation pressure	**130** kPa
σ_{vo}' : Vertical effective stress	**100** kPa
$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**30** kPa
Cv: Coefficient of consolidation	. m²/s
Cmv: Coefficient of compressibility	kPa^{-1}
COMPRESSION INDEX	
Cc: compression	**0.55**
Cr: re-compression	**0.12**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-01

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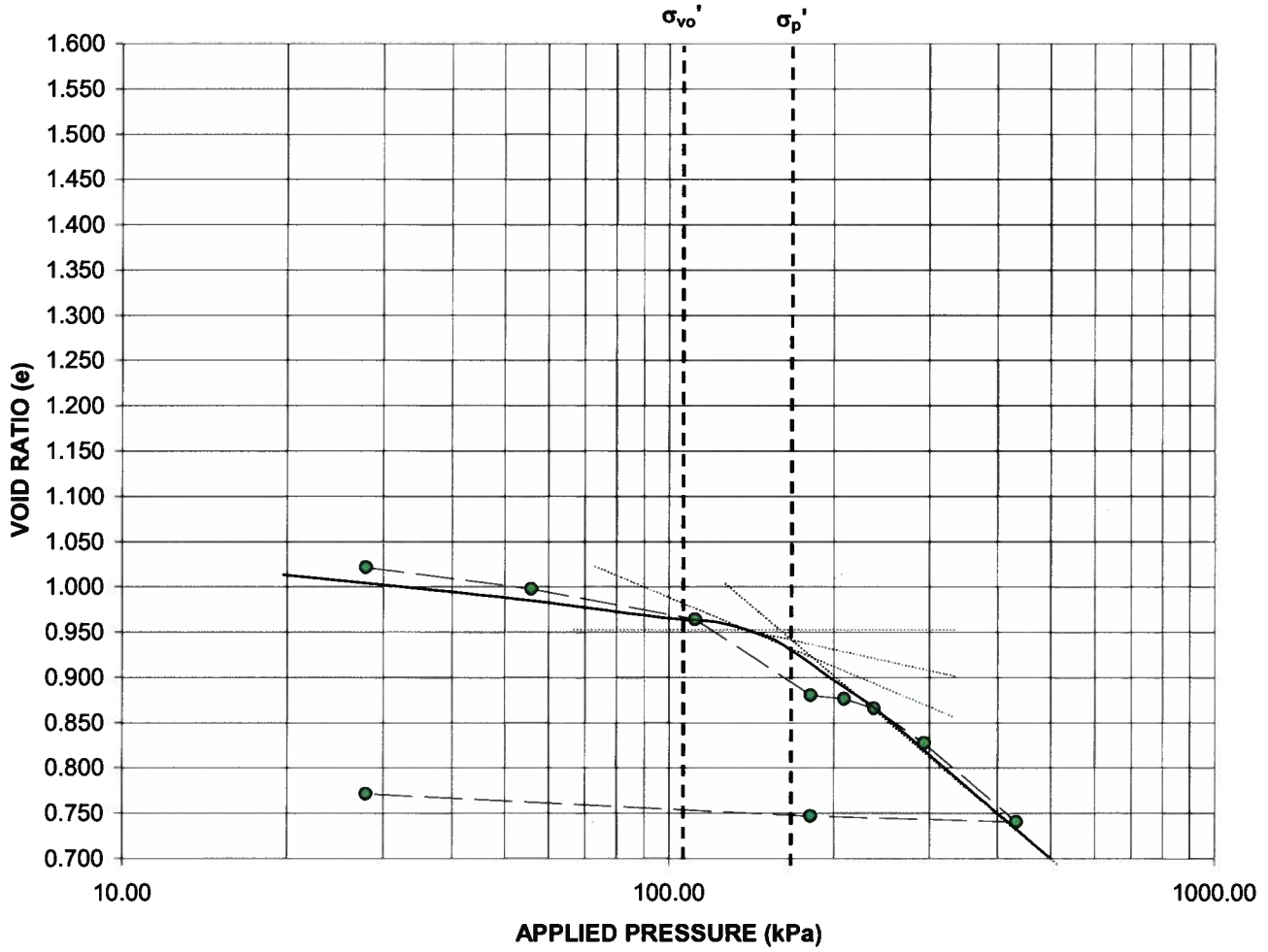
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **14/06/2011**

Borehole:	**R-10**	Sample:	**ST7**	Drilling date:	**08/04/11**
Test depth:	**11.0 m**	Description:	**CLAY**		



LL :	**35**	Cu :	**31 kPa**
PI :	**14**		

TEST SUMMARY

	SAMPLE CHARACTERISTICS	
	INITIAL STATE	FINAL STATE
w	**39.58** %	**31.89** %
γ	**18.29** kN/m³	**20.09** kN/m³
γd	**13.10** kN/m³	**15.23** kN/m³
Sr	%	%
e	**1.022**	**0.770**

Dr estimated mesured

DIMENSIONS

Dia. (cm) **6.350** Height (cm) **1.905**

COMPRESSIBILITY PROPERTIES	
σ_p' : Preconsolidation stress	**160** kPa
σ_{vo}' : Vertical effective stress	**100** kPa
$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**60** kPa
Cv: Coefficient of consolidation	. m²/s
Cmv: Coefficient of compressibility	kPa^{-1}
COMPRESSION INDEX	
Cc: compression	**0.54**
Cr: re-compression	**0.06**

Sampled by: J.Breton Date: 11-04-08 Analysed by : A.Mills Date: 11-06-13

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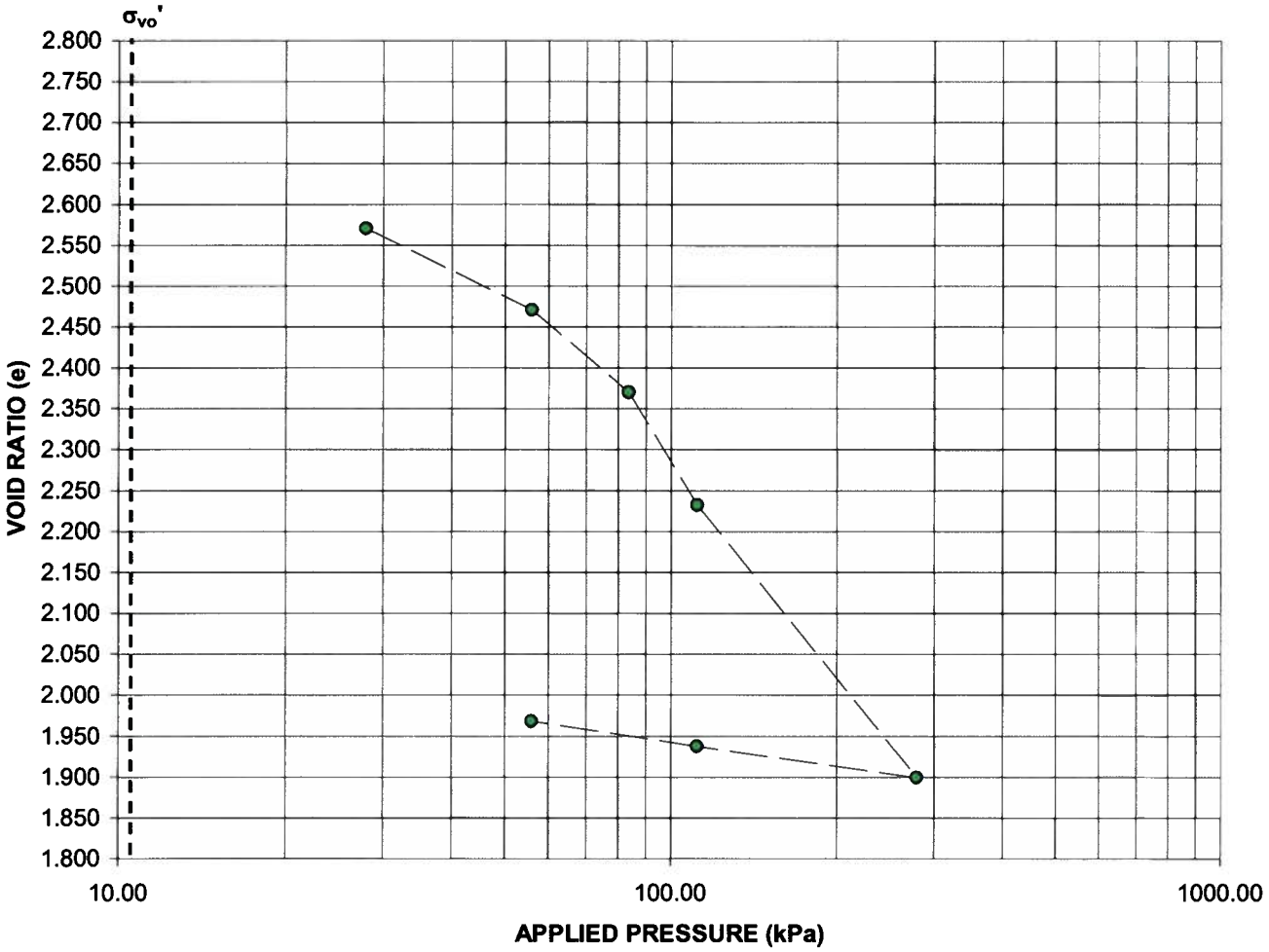
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **18/06/2011**

Borehole:	**R-15**	Sample:	**ST3**	Drilling date:	**13/04/11**
Test depth:	**2.6 m**	Description:	**PEAT**		



LL :
PI :
Cu : **kPa**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES		
	INITIAL STATE	FINAL STATE	σ_p' :	Preconsolidation stress	kPa
w	**85.23** %	**54.56** %	σ_{vo}' :	Vertical effective stress	kPa
γ	**13.74** kN/m³	**16.06** kN/m³	$\sigma_p' - \sigma_{vo}'$:	Overconsolidation difference	kPa
γd	**7.42** kN/m³	**10.39** kN/m³	Cv:	Coefficient of consolidation	. m²/s
Sr	%	%	Cmv:	Coefficient of compressibility	kPa^{-1}
e	**2.570**	**1.968**		COMPRESSION INDEX	
Dr	estimated	mesured			
	DIMENSIONS		Cc: compression		**#DIV/0!**
	Dia. (cm) **6.350**	Height (cm) **1.905**	Cr: re-compression		**#DIV/0!**

Sampled by: J.Breton Date: 11-04-13 Analysed by : A.Mills Date: 11-06-17

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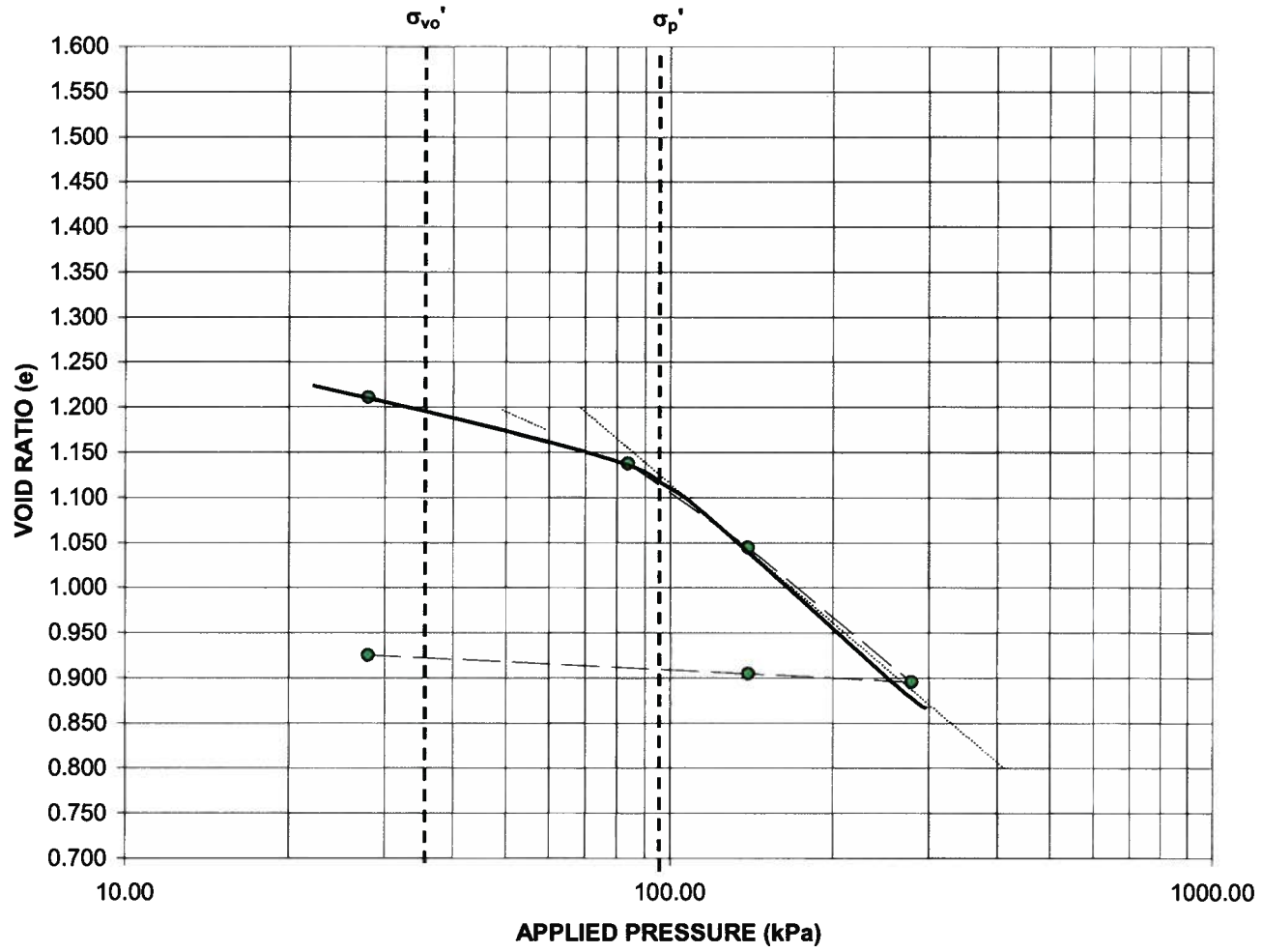
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **25/06/2011**

Borehole: **U-03** Sample: **ST4** Drilling date: **09/04/11**
Test depth: **4.1 m** Description: **CLAY**



LL : **46** Cu : **27 kPa**
PI : **15**

TEST SUMMARY

	SAMPLE CHARACTERISTICS	
	INITIAL STATE	FINAL STATE
w	**41.66** %	**29.72** %
γ	**16.97** kN/m³	**18.32** kN/m³
γd	**11.98** kN/m³	**14.13** kN/m³
Sr	%	%
e	**1.211**	**0.925**

Dr estimated mesured

DIMENSIONS

Dia. (cm) **6.350** Height (cm) **1.905**

COMPRESSIBILITY PROPERTIES	
σ_p' : Consolidation pressure	**95** kPa
σ_{vo}' : Vertical effective stress	**35** kPa
$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**60** kPa
Cv: Coefficient of consolidation	. m²/s
Cmv: Coefficient of compressibility	kPa^{-1}
COMPRESSION INDEX	
Cc: compression	**0.54**
Cr: re-compression	**0.15**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-24

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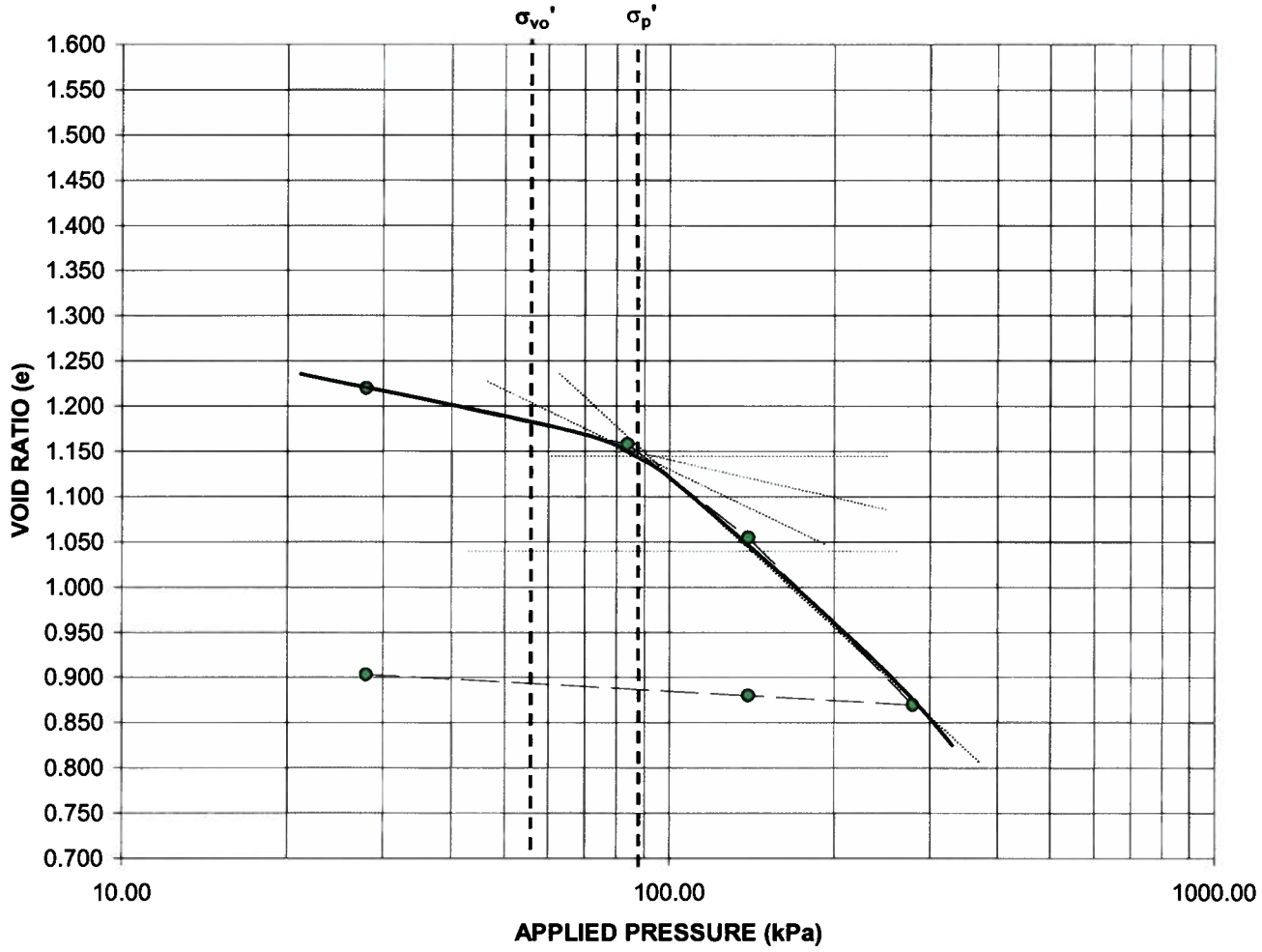
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **25/06/2011**

Borehole:	**U-03**	Sample:	**ST5**	Drilling date:	**09/04/11**
Test depth:	**6.4 m**	Description:	**CLAY**		



LL : **38** Cu : **34 kPa**
PI : **14**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**43.46** %	**30.79** %	σ_p' : Consolidation pressure	**90** kPa
γ	**17.12** kN/m³	**18.52** kN/m³	σ_{vo}' : Vertical effective stress	**55** kPa
γd	**11.93** kN/m³	**14.16** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**35** kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**1.220**	**0.903**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.58**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.14**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-24

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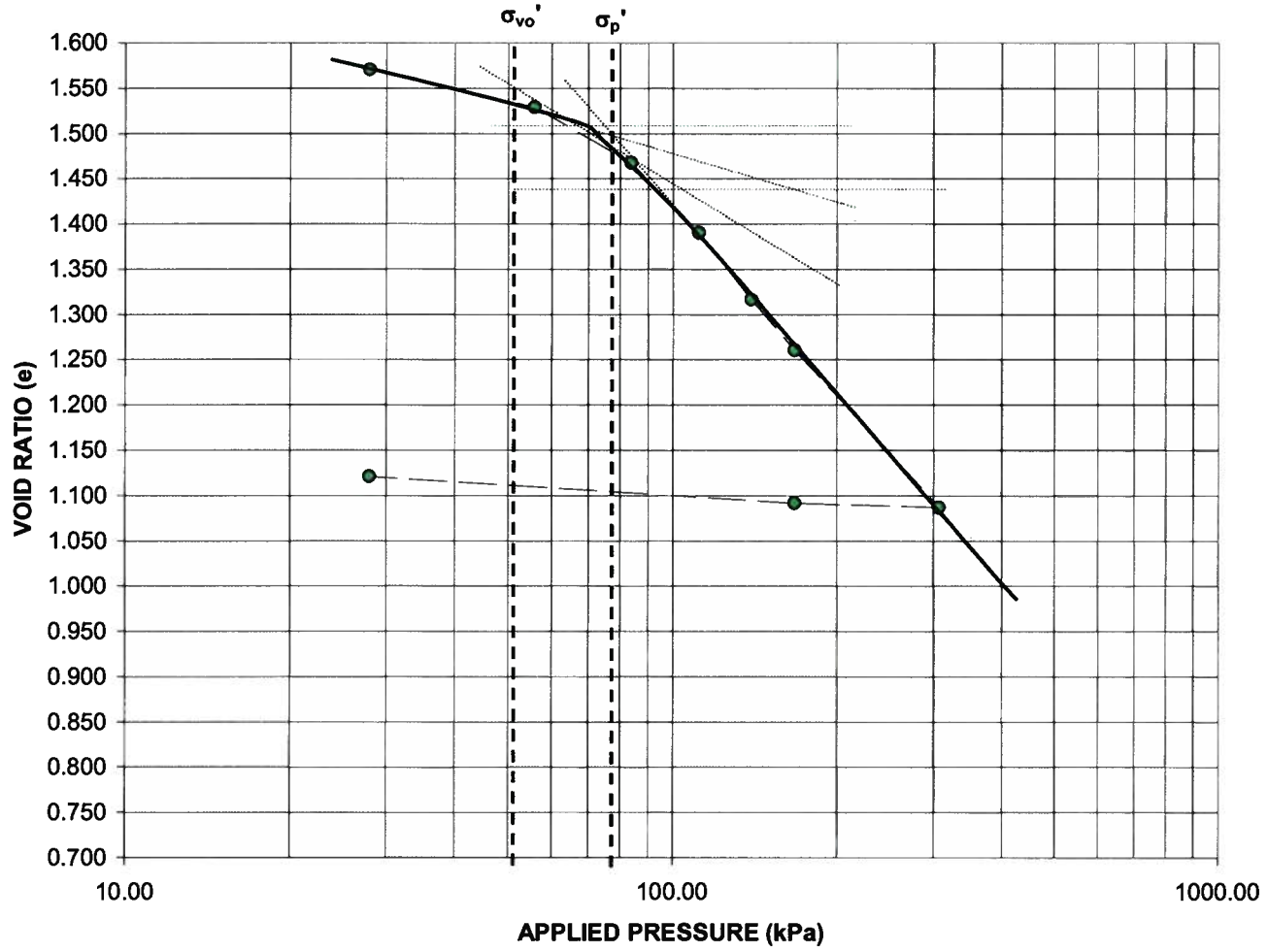
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **29/06/2011**

Borehole:	**U-06**	Sample:	**ST3**	Drilling date:	**12/04/11**
Test depth:	**5.6 m**	Description:	**CLAY**		



LL :	**37**	Cu :	**33 kPa**
PI :	**13**		

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**57.89** %	**42.74** %	σ_p' : Consolidation pressure	**75** kPa
γ	**16.27** kN/m³	**18.22** kN/m³	σ_{vo}' : Vertical effective stress	**50** kPa
γd	**10.31** kN/m³	**12.76** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**25** kPa
Sr	%	%	Cv: Coefficient of consolidation	m²/s
e	**1.570**	**1.121**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.67**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.17**

Sampled by: J.Breton Date: 11-04-12 Analysed by : A.Mills Date: 11-06-28

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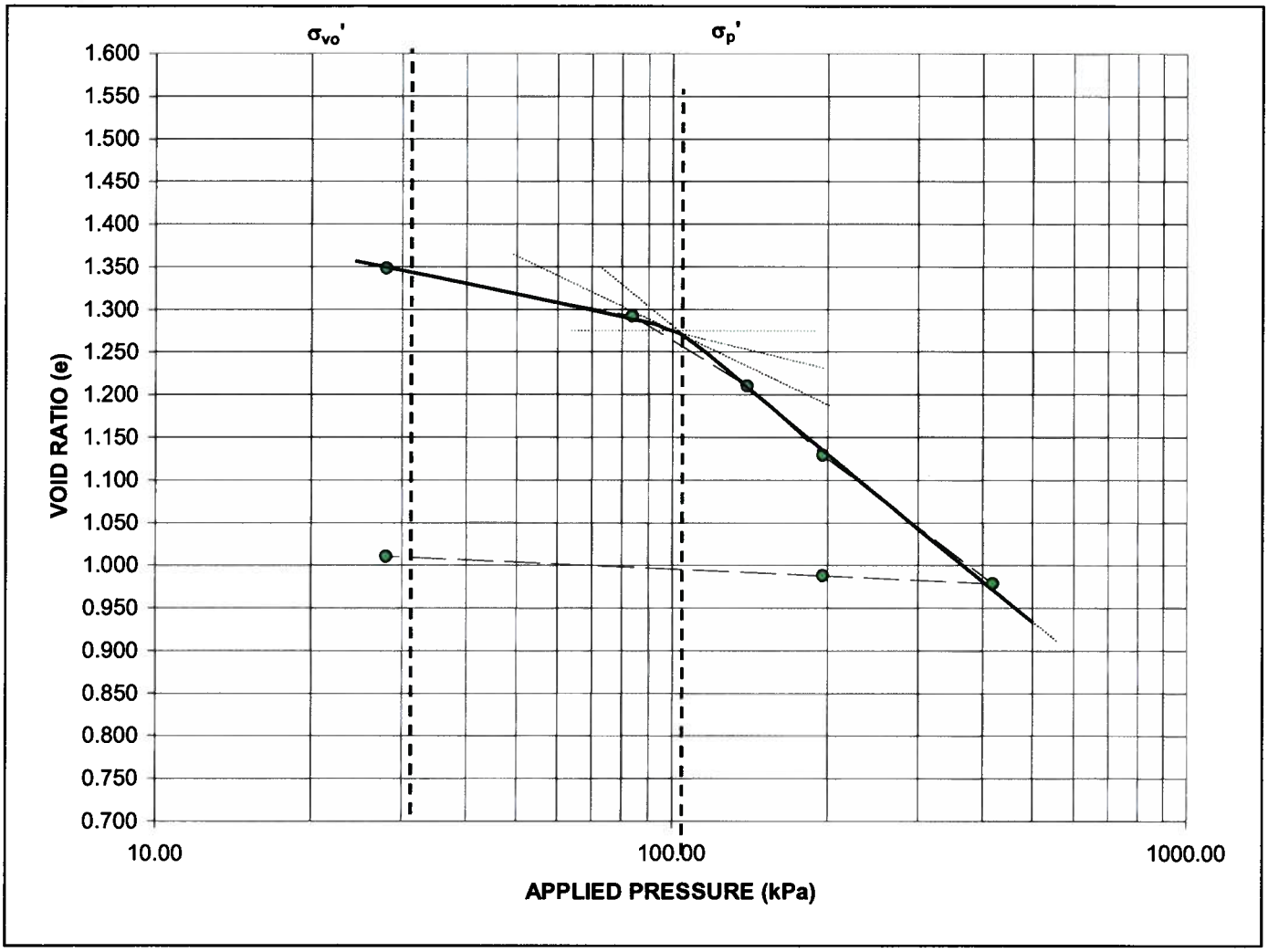
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **18/06/2011**

Borehole:	**U-10**	Sample:	**ST5**	Drilling date:	**09/04/11**
Test depth:	**4.1 m**	Description:	**CLAY**		



LL : **51** Cu : **31 kPa**
PI : **21**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**48.85** %	**33.29** %	σ_p' : Consolidation pressure	**100** kPa
γ	**16.79** kN/m³	**22.40** kN/m³	σ_{vo}' : Vertical effective stress	**30** kPa
γd	**11.28** kN/m³	**16.80** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**70** kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**1.348**	**1.010**	Cmv: Coefficient of compressibility	kPa^{-1}
Dr	estimated	mesured	COMPRESSION INDEX	
DIMENSIONS			Cc: compression	**0.50**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.14**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-17

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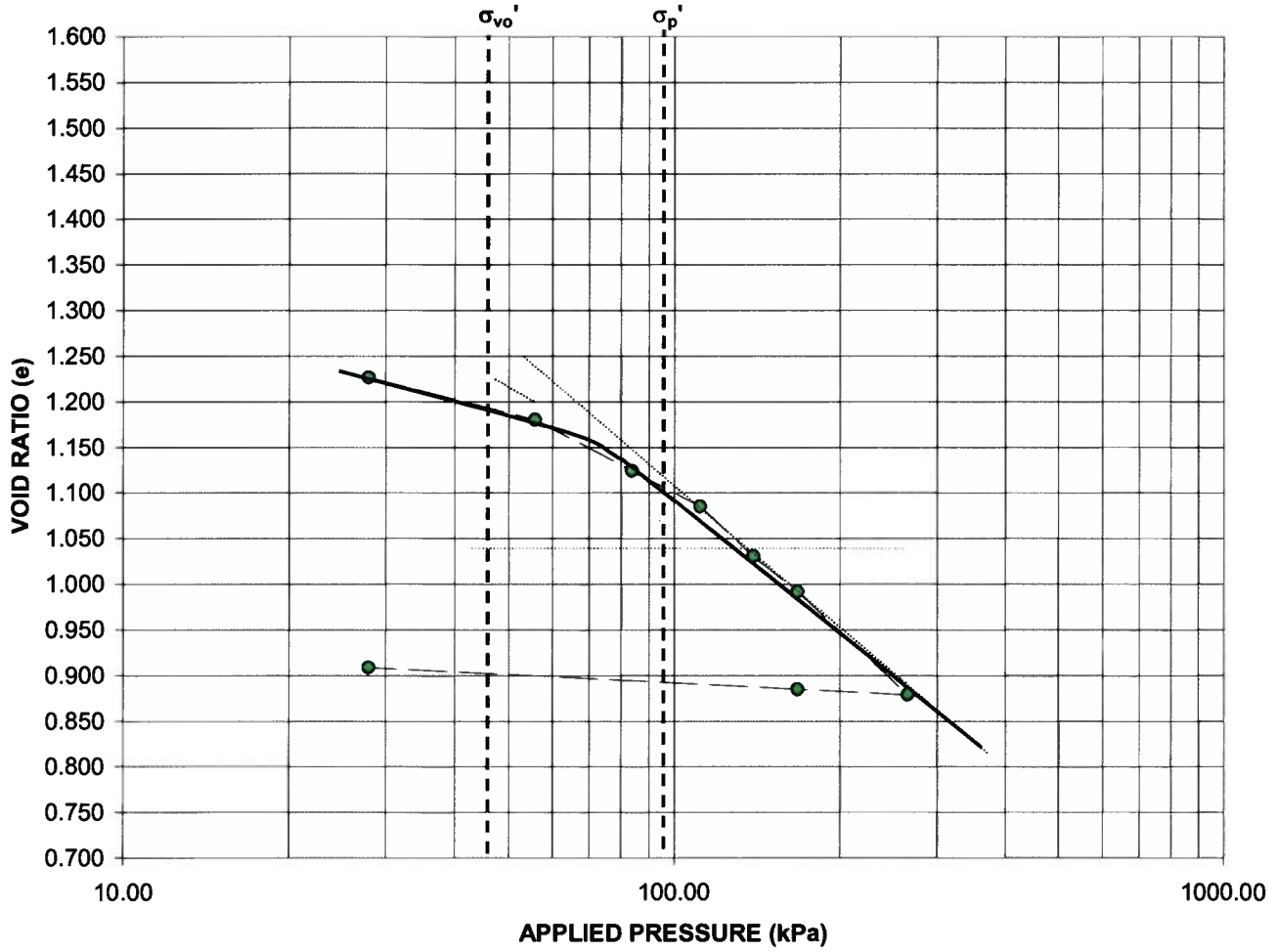
DIVISION LAB JOURNEAUX INC.
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6
Tel.: (514) 630-4997 Fax.: (514) 630-8937

ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **21/06/2011**

Borehole:	**U26**	Sample:	**ST3**	Drilling date:	**09/04/11**
Test depth:	**4.8 m**	Description:	**CLAY**		



LL : **37** Cu : **20 kPa**
PI : **15**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**50.14** %	**37.57** %	σ_p' : Consolidation pressure	**95** kPa
γ	**17.86** kN/m³	**19.91** kN/m³	σ_{vo}' : Vertical effective stress	**45** kPa
γd	**11.90** kN/m³	**14.47** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**50** kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**1.226**	**0.908**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
	DIMENSIONS		Cc: compression	**0.54**
	Dia. (cm) **6.350**	Height (cm) **1.905**	Cr: re-compression	**0.20**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-20

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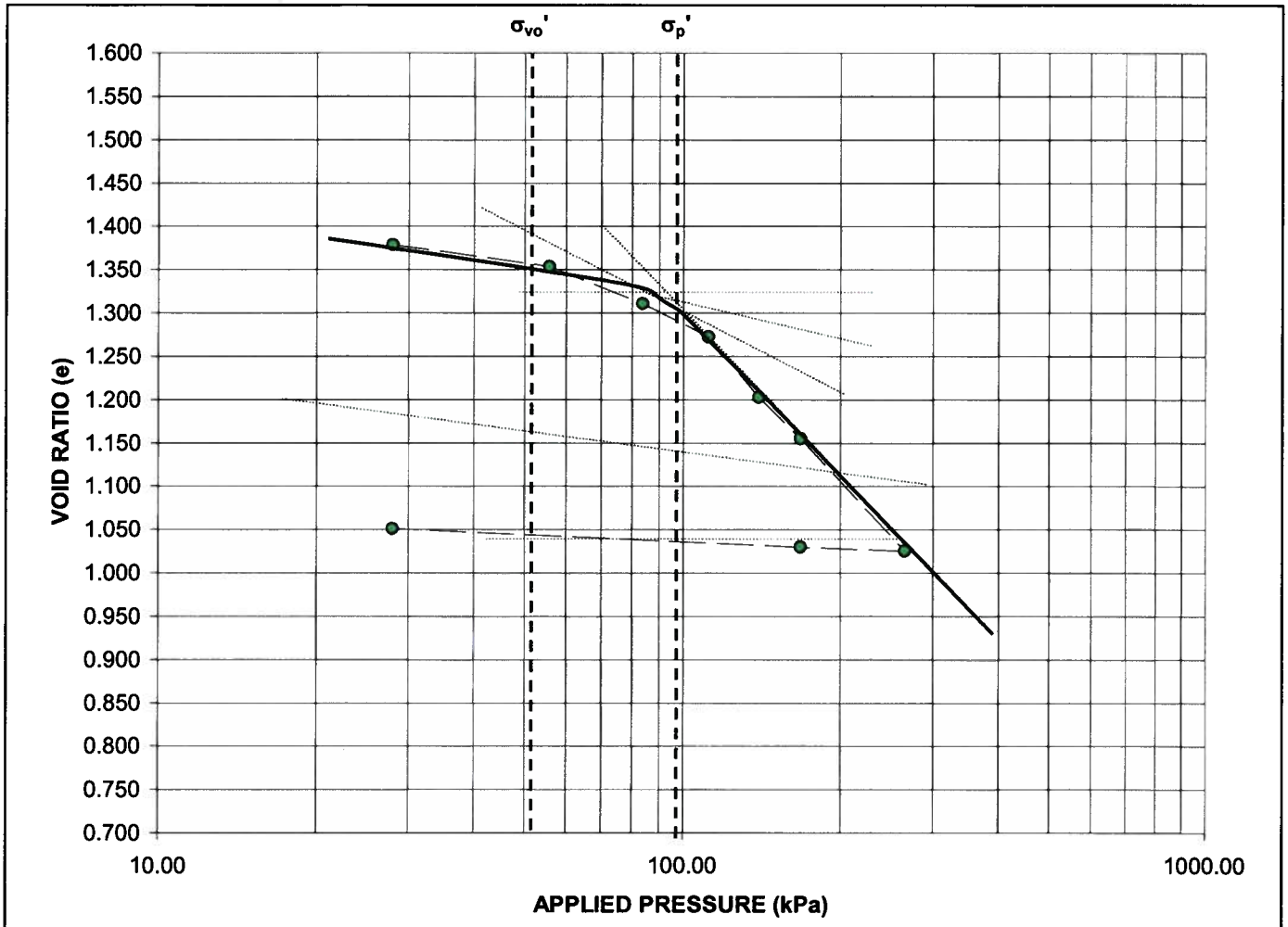
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **21/06/2011**

Borehole:	**U-26**	Sample:	**ST4**	Drilling date:	**09/04/11**
Test depth:	**5.6 m**	Description:	**CLAY**		



LL : **47** Cu : **23 kPa**
PI : **20**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**48.91** %	**36.20** %	σ_p' : Consolidation pressure	**95** kPa
γ	**16.58** kN/m³	**17.86** kN/m³	σ_{vo}' : Vertical effective stress	**50** kPa
γd	**11.13** kN/m³	**13.11** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**45** kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**1.379**	**1.051**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.64**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.11**

Sampled by: J.Breton Date: 11-04-09 Analysed by : A.Mills Date: 11-06-20

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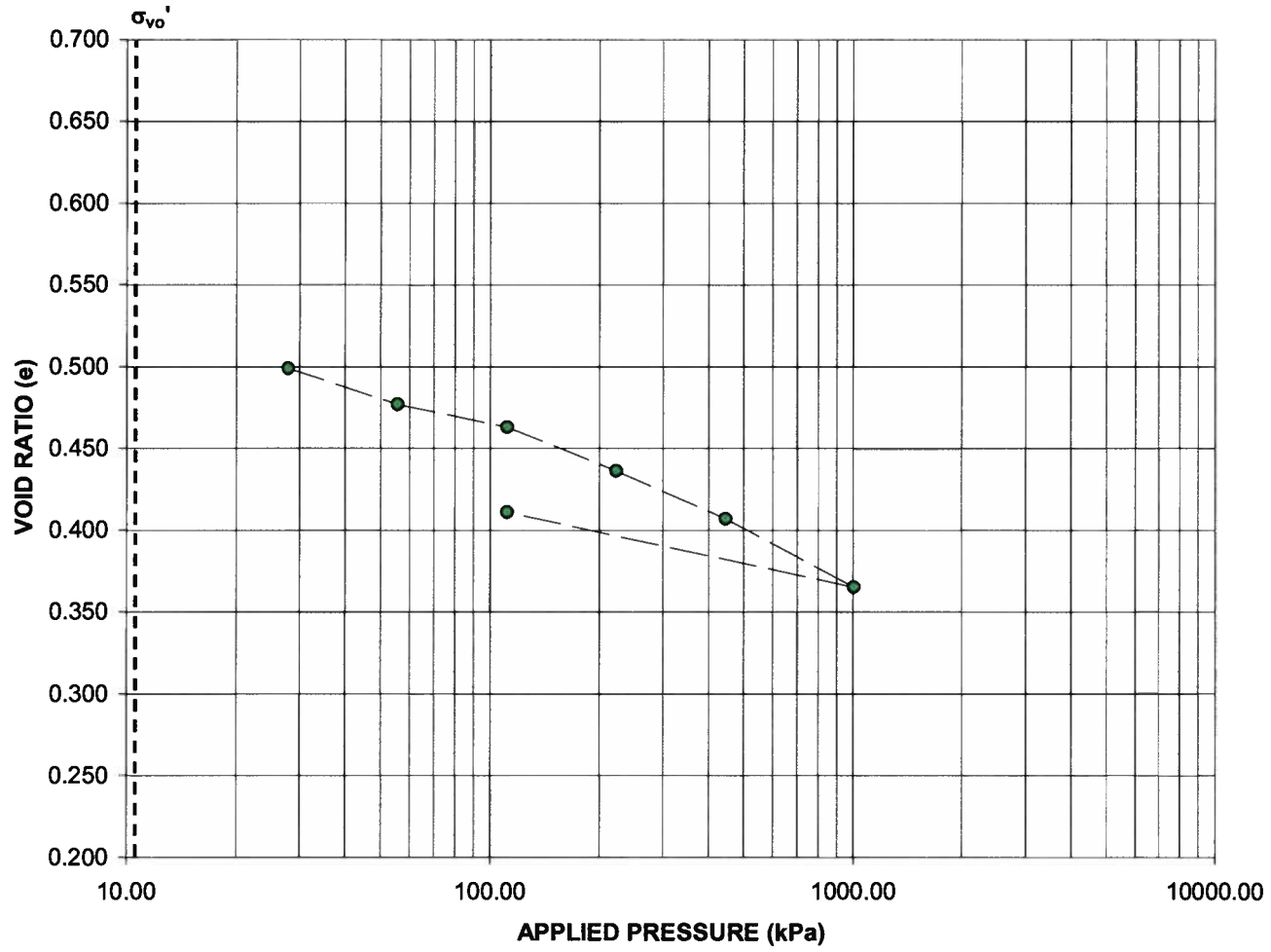
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **09/07/2011**

Borehole:	**T-03A**	Sample:	**ST1**	Drilling date:	**07/04/11**
Test depth:	**1.2 m**	Description:	**CL**		



LL :
PI :
Cu : **kPa**

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**21.80** %	**19.14** %	σ_p' : Consolidation pressure	kPa
γ	**21.52** kN/m³	**22.98** kN/m³	σ_{vo}' : Vertical effective stress	**10** kPa
γd	**17.67** kN/m³	**19.29** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**0.499**	**0.411**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**#DIV/0!**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**#DIV/0!**

Sampled by: J.Breton Date: 11-04-07 Analysed by : A.Mills Date: 11-07-08

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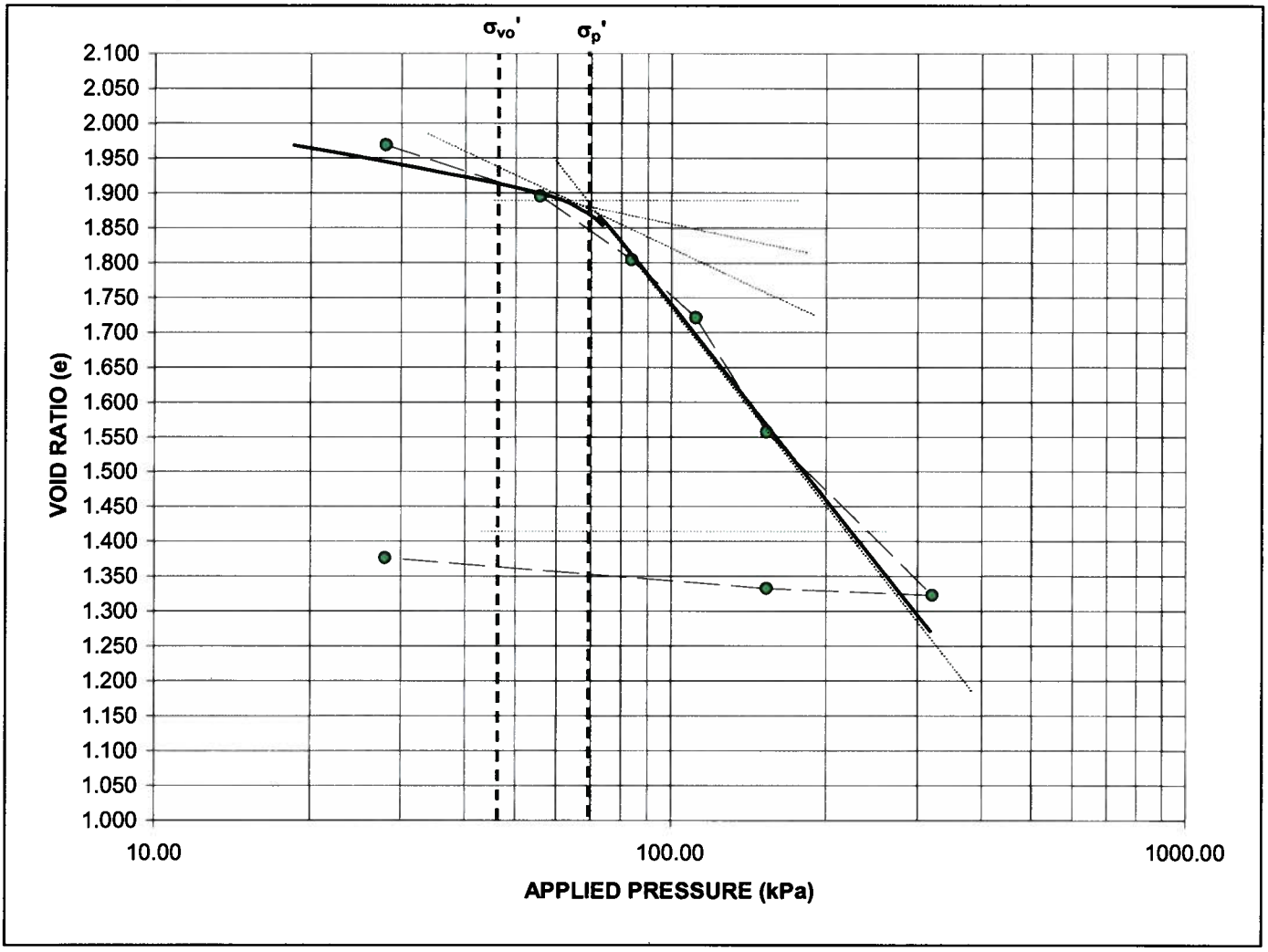
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **09/07/2011**

Borehole:	**T-03A**	Sample:	**ST4**	Drilling date:	**07/04/11**
Test depth:	**4.9 m**	Description:	**CLAY**		



LL :	**38**	Cu :	**27 kPa**
PI :	**19**		

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE	σ_p' : Consolidation pressure	**70** kPa
w	**74.13** %	**58.11** %	σ_{vo}' : Vertical effective stress	**45** kPa
γ	**15.54** kN/m³	**18.17** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**25** kPa
γd	**8.92** kN/m³	**11.49** kN/m³	Cv: Coefficient of consolidation	. m²/s
Sr	%	%	Cmv: Coefficient of compressibility	kPa^{-1}
e	**1.968**	**1.376**	COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.89**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.14**

Sampled by: J.Breton Date: 11-04-07 Analysed by : A.Mills Date: 11-07-08

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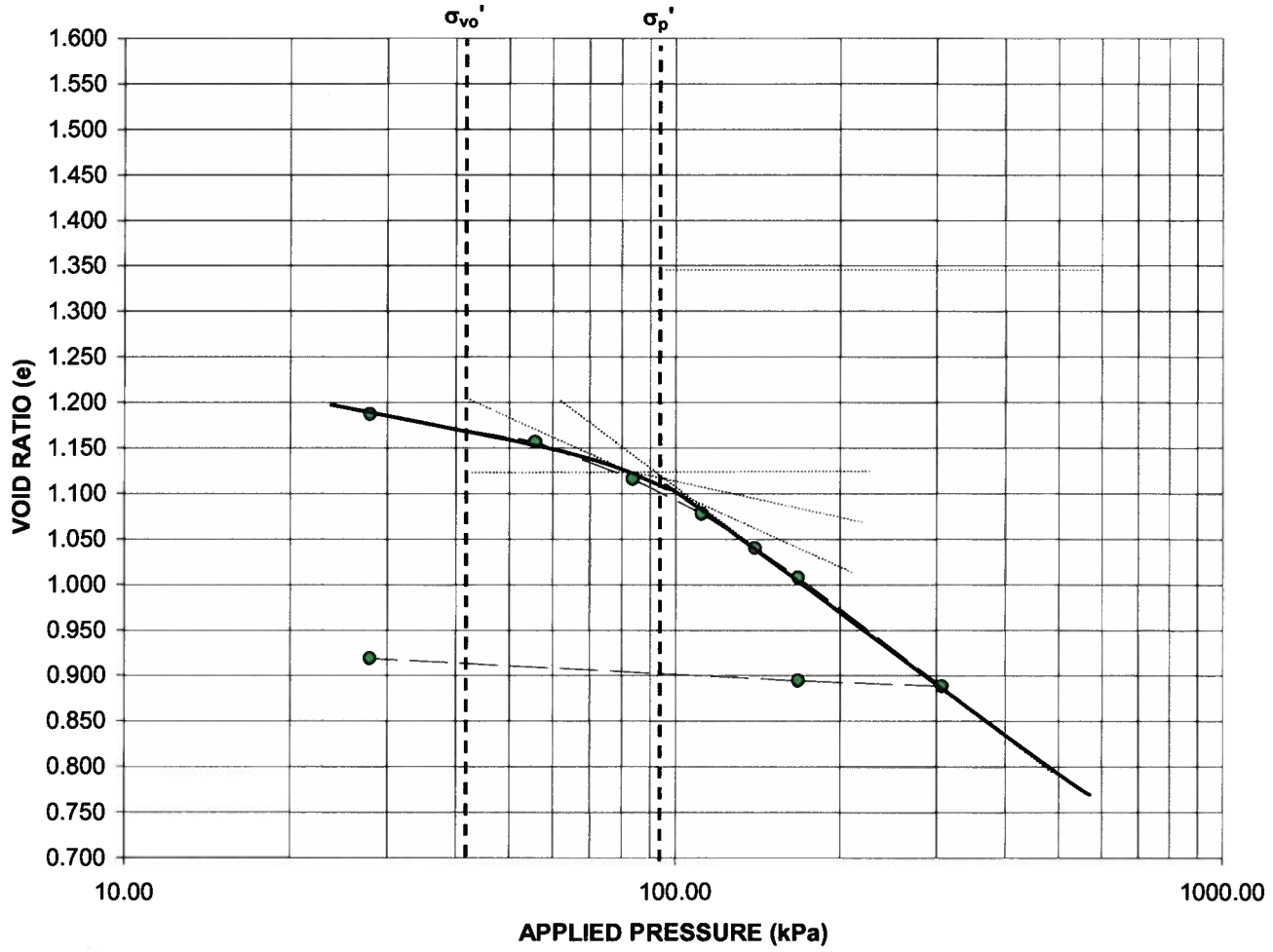
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **05/07/2011**

Borehole:	**T-03A**	Sample:	**ST5**	Drilling date:	**07/04/11**
Test depth:	**6.4 m**	Description:	**CLAY**		



LL :	**40**	Cu :	**13 kPa**
PI :	**14**		

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE		
w	**44.03** %	**37.58** %	σ_p' : Consolidation pressure	**90** kPa
γ	**17.44** kN/m³	**19.55** kN/m³	σ_{vo}' : Vertical effective stress	**40** kPa
γd	**12.11** kN/m³	**14.21** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**50** kPa
Sr	%	%	Cv: Coefficient of consolidation	. m²/s
e	**1.187**	**0.919**	Cmv: Coefficient of compressibility	kPa^{-1}
			COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.45**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.13**

Sampled by: J.Breton Date: 11-04-07 Analysed by : A.Mills Date: 11-07-04

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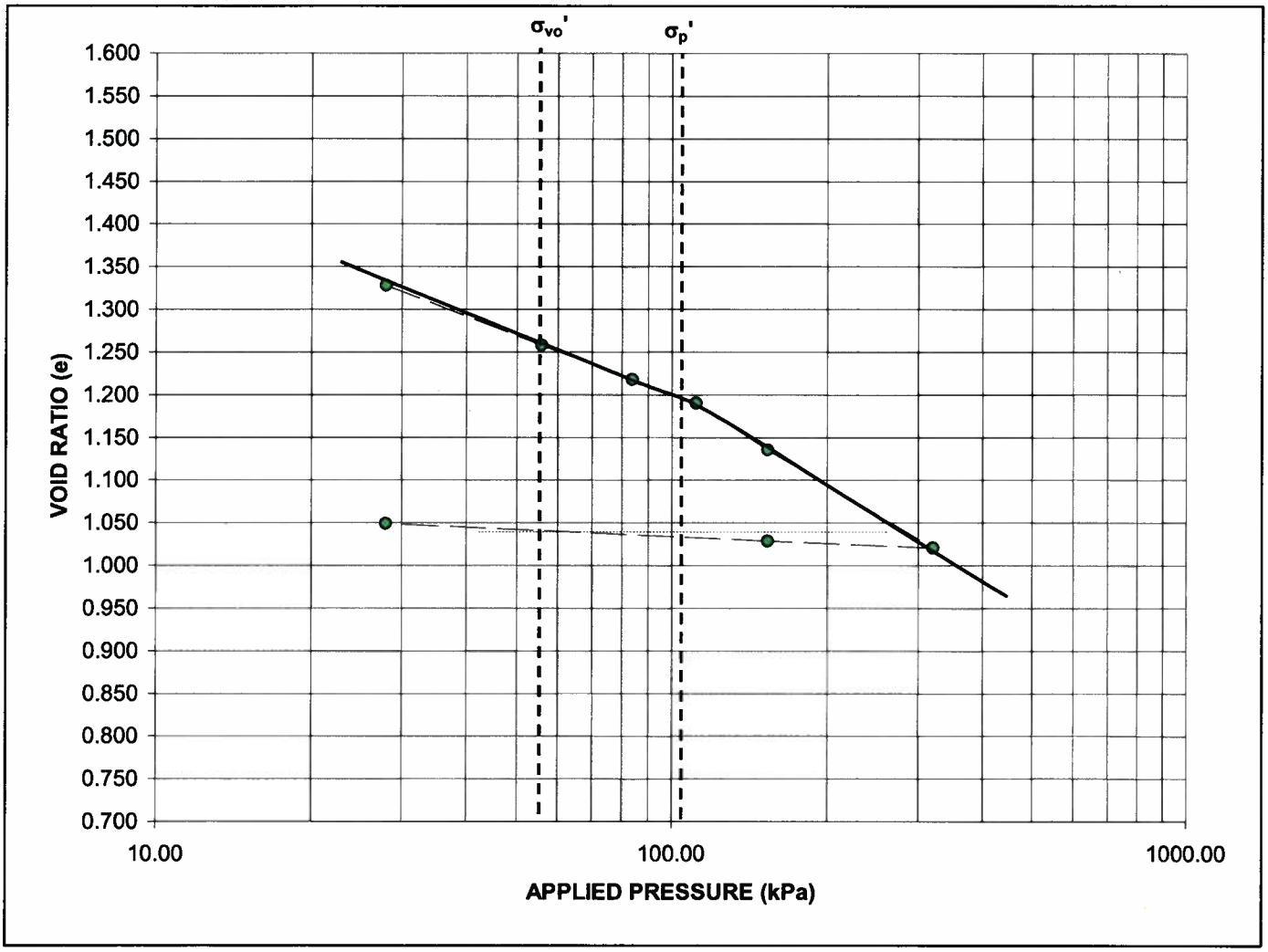
ONE DIMENSIONAL CONSOLIDATION TEST

Client: **Mine Arnaud (Sept-Îles, Qc)**
Project No.: **L-10-1411**
Project : **Geotechnical study**
Date: **05/07/2011**

Borehole:	**T-03A**	Sample:	**ST6**	Drilling date:	**07/04/11**
Test depth:	**7.9 m**	Description:	**CLAY**		



LL :	**49**	Cu :	**15 kPa**
PI :	**28**		

TEST SUMMARY

	SAMPLE CHARACTERISTICS		COMPRESSIBILITY PROPERTIES	
	INITIAL STATE	FINAL STATE	σ_p' : Consolidation pressure	**100** kPa
w	**52.71** %	**43.14** %	σ_{vo}' : Vertical effective stress	**65** kPa
γ	**17.38** kN/m³	**19.89** kN/m³	$\sigma_p' - \sigma_{vo}'$: Overconsolidation difference	**35** kPa
γd	**11.38** kN/m³	**13.90** kN/m³	Cv: Coefficient of consolidation	. m²/s
Sr	%	%	Cmv: Coefficient of compressibility	kPa^{-1}
e	**1.328**	**1.048**	COMPRESSION INDEX	
Dr	estimated	mesured		
DIMENSIONS			Cc: compression	**0.38**
Dia. (cm)	**6.350**	Height (cm) **1.905**	Cr: re-compression	**0.26**

Sampled by: J.Breton Date: 11-04-07 Analysed by : A.Mills Date: 11-07-04

Laboratory Test Results

Atterberg Limit Reports

R-03	T-03A
R-07	T-09
R-09	U-01
R-10	U-03
R-11	U-05
R-12	U-06
R-13A	U-09A
R-13B	U-10
R-13E	U-14
R-15	U-22
R-16	U-26
T-03	

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R3
Depth	8'
Date	15/04/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

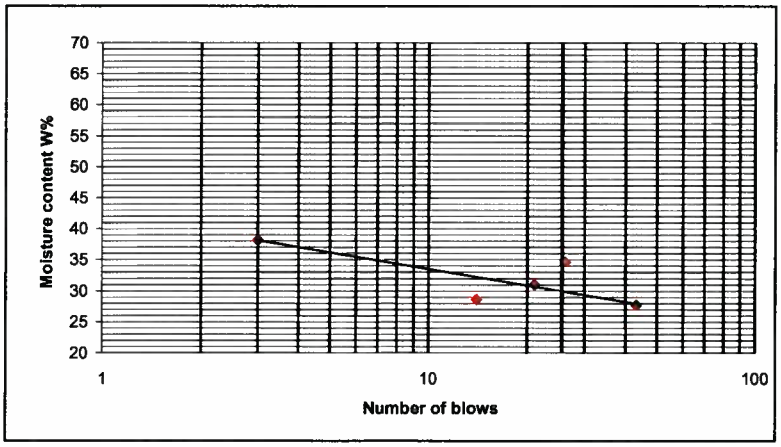
Project : Geotechnical study

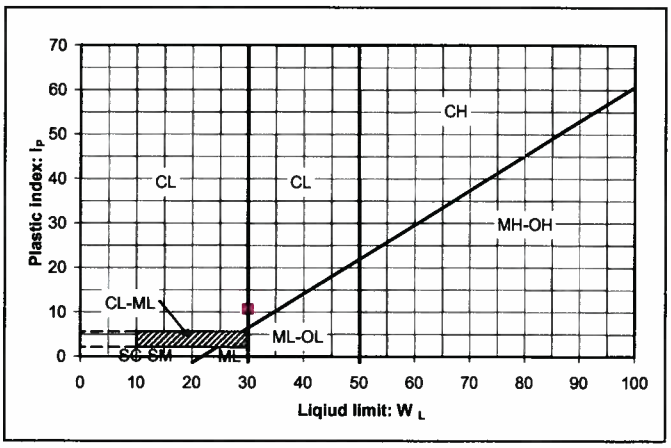
Method		Results			
Not dried:	☐	Natural moisture content:		17.70	W%
Air dried:	■	Liquid limit:		30.00	W_L
Oven dried:	☐	Plastic limit:		19.44	W_P
		Plasticity index:	$I_P = W_L - W_P =$	10.56	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	-0.1653	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.30	4.60	4.30
Total mass dry:	4.10	4.40	4.00
Mass container:	2.90	3.20	2.80
Mass of dry soil:	1.20	1.20	1.20
Moisture content:	16.67	16.67	25.00
Average:			19.44%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		17.70%

Liquid Limit							
Number of blows	3	14	21	26	43	-	----
Total mass wet:	5.90	7.60	8.20	10.50	8.70	-	g
Total mass dry:	5.10	6.60	6.90	8.60	7.40	-	g
Mass container:	3.00	3.10	2.70	3.10	2.70	-	g
Mass of dry soil:	2.10	3.50	4.20	5.50	4.70	-	g
Moisture content:	38.10	28.57	30.95	34.55	27.66	-	%





Sampled by: : NJ	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R7
Depth	SS5 13'-15'
Date	29/04/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

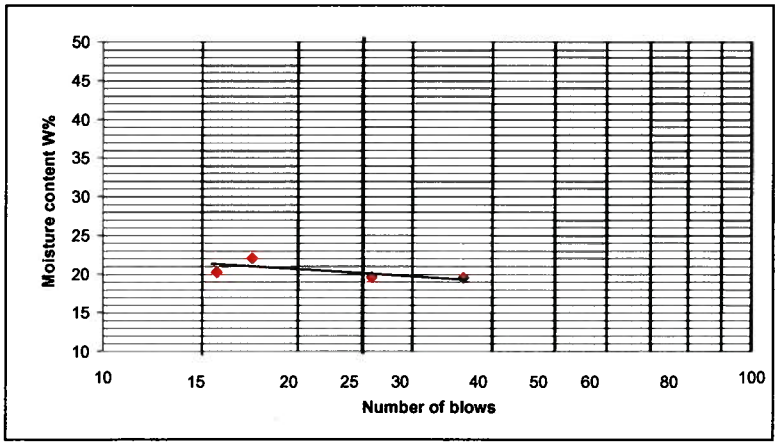
Project : Geotechnical study

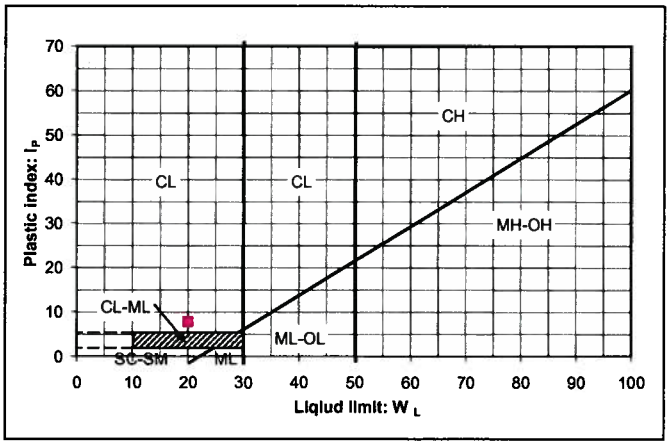
Method		Results			
Not dried:	☐	Natural moisture content:		33.80	W%
Air dried:	■	Liquid limit:		20.00	W_L
Oven dried:	☐	Plastic limit:		12.24	W_P
		Plasticity index:	$I_P = W_L - W_P =$	7.76	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.77947	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.00	5.30	-
Total mass dry:	4.76	5.06	-
Mass container:	2.80	3.10	-
Mass of dry soil:	1.96	1.96	-
Moisture content:	12.24	12.24	-
Average:			12.24%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		33.80%

Liquid Limit							
Number of blows	17	15	26	36	-	-	- - - -
Total mass wet:	7.40	6.59	7.29	8.15	-	-	g
Total mass dry:	6.57	5.97	6.54	7.31	-	-	g
Mass container:	2.80	2.90	2.70	3.00	-	-	g
Mass of dry soil:	3.77	3.07	3.84	4.31	-	-	g
Moisture content:	22.02	20.20	19.53	19.49	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R9
Depth	SS2 15'-17'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

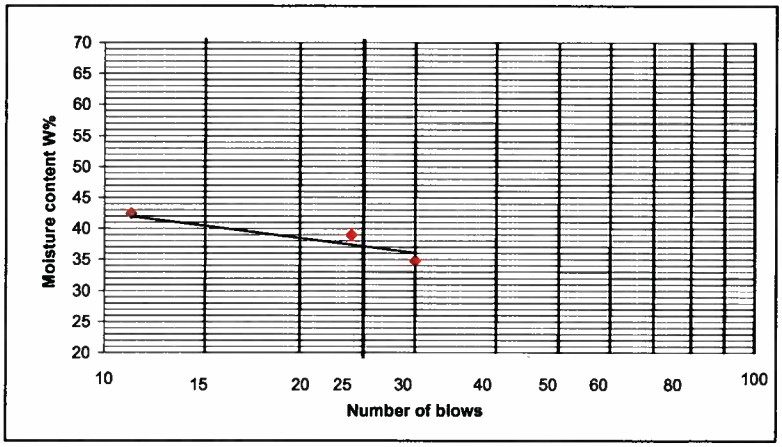
Project : Geotechnical study

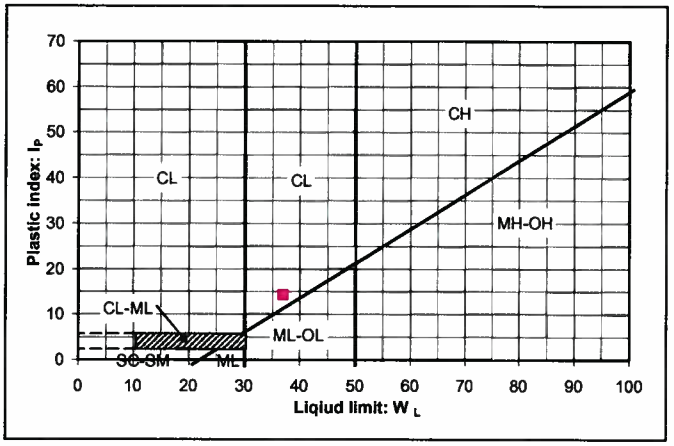
Method		Results			
Not dried:	☐	Natural moisture content:		34.60	W%
Air dried:	■	Liquid limit:		37.00	W_L
Oven dried:	☐	Plastic limit:		22.73	W_P
		Plasticity index:	$I_P = W_L - W_P =$	14.27	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.83185	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.00	4.00	-
Total mass dry:	3.50	3.50	-
Mass container:	1.30	1.30	-
Mass of dry soil:	2.20	2.20	-
Moisture content:	22.73	22.73	-
Average:			22.73%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		34.60%

Liquid Limit							
Number of blows	24	11	30	-	-	-	- - - -
Total mass wet:	10.80	12.40	15.60	-	-	-	g
Total mass dry:	8.70	9.60	12.30	-	-	-	g
Mass container:	3.30	3.00	2.80	-	-	-	g
Mass of dry soil:	5.40	6.60	9.50	-	-	-	g
Moisture content:	38.89	42.42	34.74	-	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R10
Depth	SS4 20'-22'
Date	---
JA No.	---

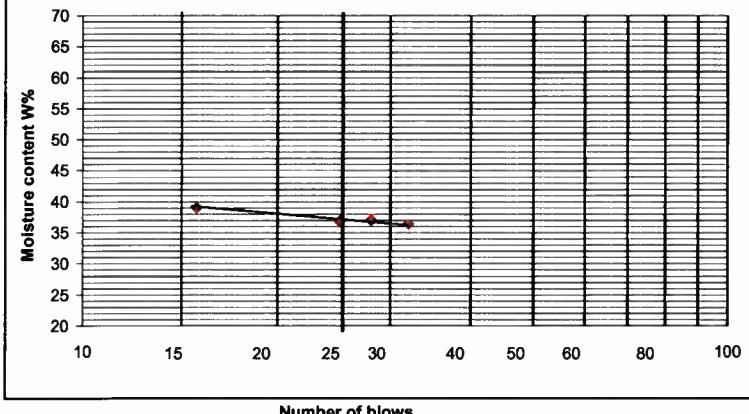
Client : Mine Arnaud (Sept-Îles, Qc)

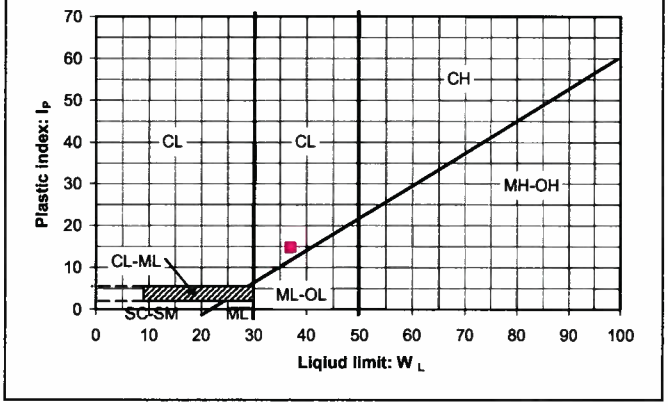
Project : Geotechnical study

Method		Results			
Not dried:	☐	Natural moisture content:		36.60	W%
Air dried:	■	Liquid limit:		37.00	W_L
Oven dried:	☐	Plastic limit:		22.22	W_P
		Plasticity index:	$I_P = W_L - W_P =$	14.78	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.97293	I_L

Plastic Limit				Natural Moisture Content		
Contenant No.:	1	2	3	4	5	6
Total mass wet:	4.10	4.10	-	-	-	-
Total mass dry:	3.70	3.70	-	-	-	-
Mass container:	1.90	1.90	-	-	-	-
Mass of dry soil:	1.80	1.80	-	-	-	-
Moisture content:	22.22	22.22	-	-	-	-
Average:			22.22%	Average:		36.60%

Liquid Limit							
Number of blows	28	32	25	15	-	-	- - - -
Total mass wet:	11.50	11.90	10.70	13.70	-	-	g
Total mass dry:	9.50	9.50	8.60	10.70	-	-	g
Mass container:	4.10	2.90	2.90	3.00	-	-	g
Mass of dry soil:	5.40	6.60	5.70	7.70	-	-	g
Moisture content:	37.04	36.36	36.84	38.96	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R10
Depth	ST7
Date	29/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

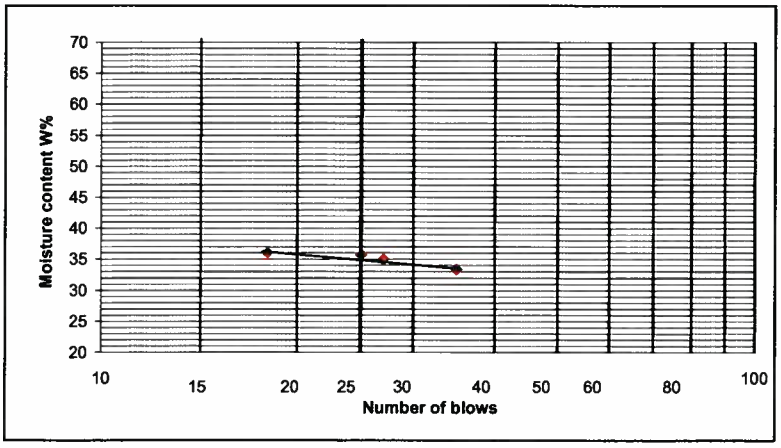
Project : Geotechnical study

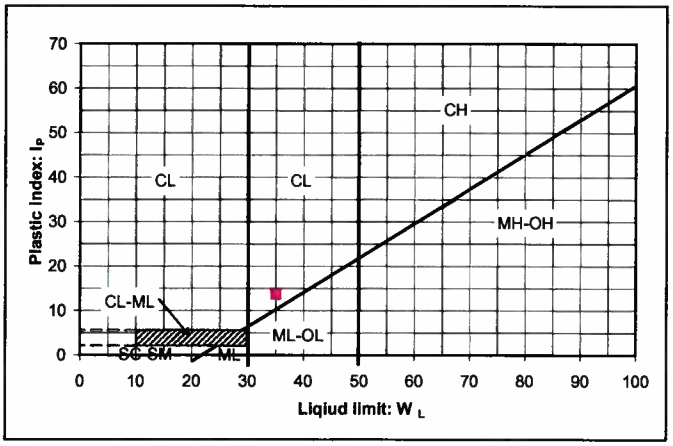
Method		Results			
Not dried:	☐	Natural moisture content:		41.70	W%
Air dried:	■	Liquid limit:		35.00	W_L
Oven dried:	☐	Plastic limit:		21.32	W_P
		Plasticity index:	$I_P = W_L - W_P =$	13.68	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.48978	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.00	3.90	-
Total mass dry:	2.70	3.55	-
Mass container:	1.30	1.90	-
Mass of dry soil:	1.40	1.65	-
Moisture content:	21.43	21.21	-
Average:			21.32%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		41.70%

Liquid Limit							
Number of blows	25	27	35	18	-	-	- - - -
Total mass wet:	10.80	9.80	12.60	11.50	-	-	g
Total mass dry:	8.30	7.60	9.80	8.80	-	-	g
Mass container:	1.30	1.30	1.40	1.30	-	-	g
Mass of dry soil:	7.00	6.30	8.40	7.50	-	-	g
Moisture content:	35.71	34.92	33.33	36.00	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-11
Depth	4'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

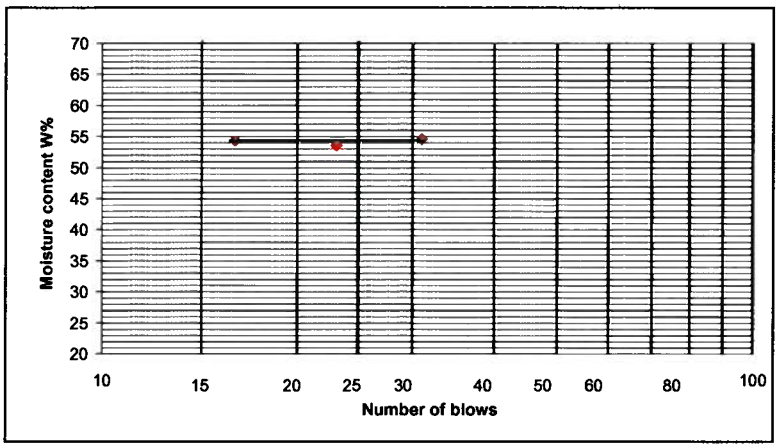
Project : Geotechnical study

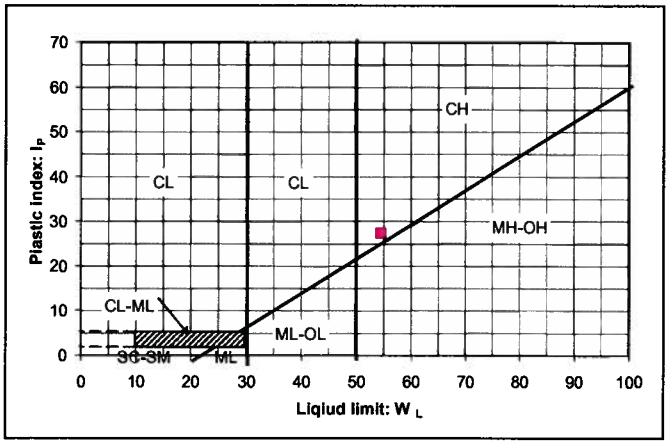
Method		Results			
Not dried:	☐	Natural moisture content:		50.30	W%
Air dried:	■	Liquid limit:		54.50	W_L
Oven dried:	☐	Plastic limit:		27.17	W_P
		Plasticity index:	$I_P = W_L - W_P =$	27.33	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.84631	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.30	4.20	4.20
Total mass dry:	4.00	4.00	3.90
Mass container:	3.10	2.90	2.90
Mass of dry soil:	0.90	1.10	1.00
Moisture content:	33.33	18.18	30.00
Average:			27.17%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		50.30%

Liquid Limit							
Number of blows	31	23	16	-	-	-	- - - -
Total mass wet:	4.70	5.60	6.70	-	-	-	g
Total mass dry:	3.50	4.10	4.80	-	-	-	g
Mass container:	1.30	1.30	1.30	-	-	-	g
Mass of dry soil:	2.20	2.80	3.50	-	-	-	g
Moisture content:	54.55	53.57	54.29	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R11
Depth	SS5 12.5'-14.5'
Date	28/04/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

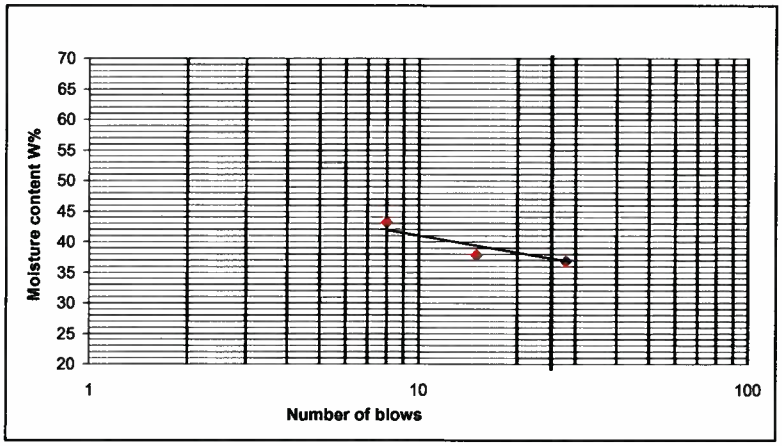
Project : Geotechnical study

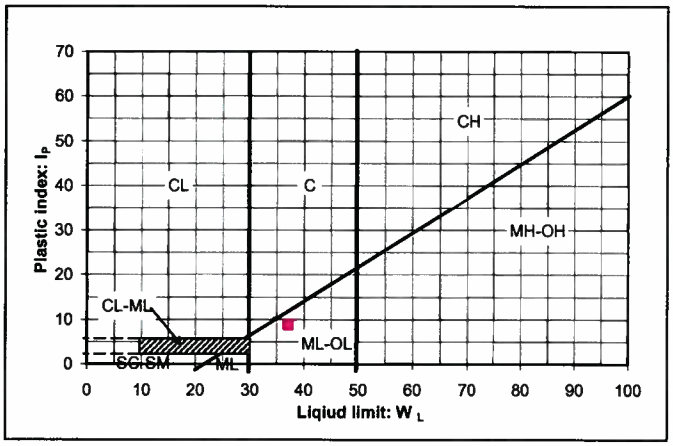
Method		Results			
Not dried:	☐	Natural moisture content:		52.60	W%
Air dried:	■	Liquid limit:		37.00	W_L
Oven dried:	☐	Plastic limit:		28.25	W_P
		Plasticity index:	$I_P = W_L - W_P =$	8.75	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.78285	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.24	4.53	6.09
Total mass dry:	4.90	4.17	5.61
Mass container:	3.70	2.90	3.90
Mass of dry soil:	1.20	1.27	1.71
Moisture content:	28.33	28.35	28.07
Average:			28.25%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		52.60%

Liquid Limit							
Number of blows	8	15	28	-	-	-	- - - -
Total mass wet:	7.35	5.87	6.88	-	-	-	g
Total mass dry:	6.01	5.11	5.81	-	-	-	g
Mass container:	2.90	3.10	2.90	-	-	-	g
Mass of dry soil:	3.11	2.01	2.91	-	-	-	g
Moisture content:	43.09	37.81	36.77	-	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R11
Depth	SS6 15'-17'
Date	29/04/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

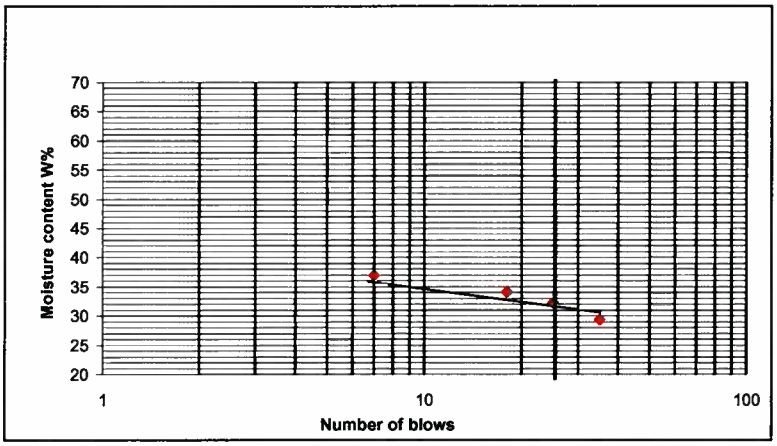
Project : Geotechnical study

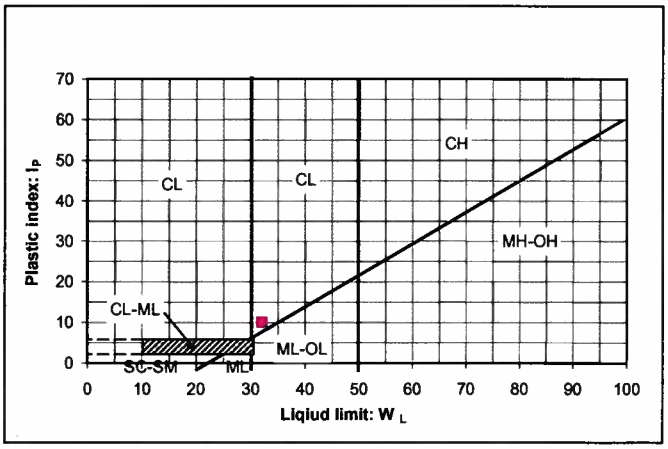
Method		Results			
Not dried:	☐	Natural moisture content:		40.70	W%
Air dried:	■	Liquid limit:		32.00	W_L
Oven dried:	☐	Plastic limit:		21.92	W_P
		Plasticity index:	$I_P = W_L - W_P =$	10.08	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.86322	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.47	4.18	-
Total mass dry:	4.99	3.77	-
Mass container:	2.80	1.90	-
Mass of dry soil:	2.19	1.87	-
Moisture content:	21.92	21.93	-
Average:			21.92%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		40.70%

Liquid Limit							
Number of blows	7	18	25	35	-	-	- - - -
Total mass wet:	8.50	7.09	9.23	8.07	-	-	g
Total mass dry:	7.10	6.00	7.76	6.90	-	-	g
Mass container:	3.30	2.80	3.20	2.90	-	-	g
Mass of dry soil:	3.80	3.20	4.56	4.00	-	-	g
Moisture content:	36.84	34.06	32.24	29.25	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-12
Depth	8'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

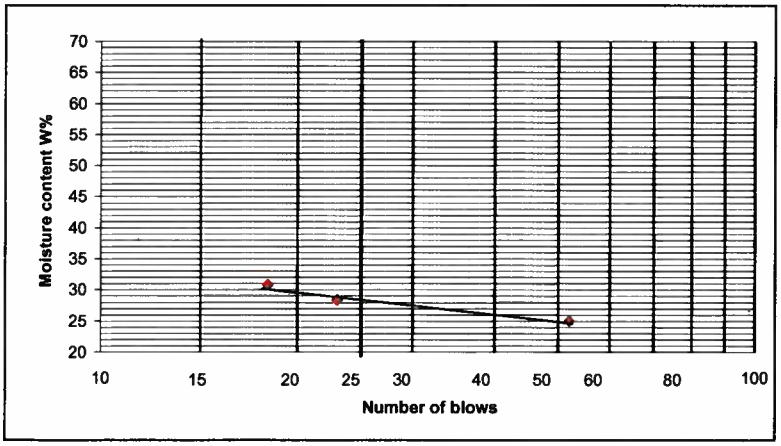
Project : Geotechnical study

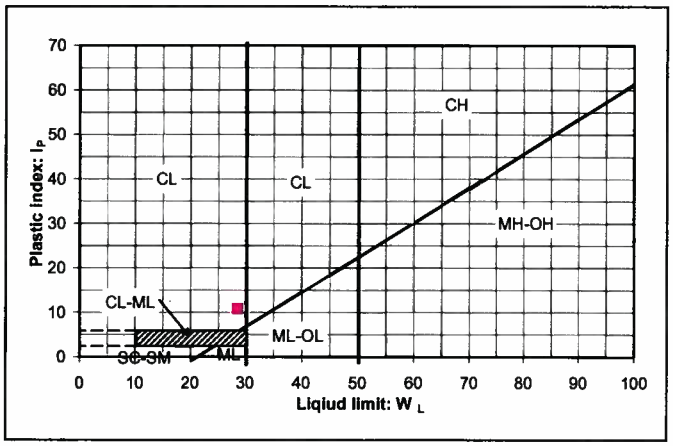
Method		Results			
Not dried:	☐	Natural moisture content:		26.10	W%
Air dried:	■	Liquid limit:		28.50	W_L
Oven dried:	☐	Plastic limit:		17.86	W_P
		Plasticity index:	$I_P = W_L - W_P =$	10.64	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.77453	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.00	4.30	4.20
Total mass dry:	4.70	4.10	4.00
Mass container:	3.20	2.80	2.90
Mass of dry soil:	1.50	1.30	1.10
Moisture content:	20.00	15.38	18.18
Average:			17.86%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		26.10%

Liquid Limit							
Number of blows	52	18	23	-	-	-	- - - -
Total mass wet:	6.80	6.40	8.10	-	-	-	g
Total mass dry:	5.70	5.20	6.60	-	-	-	g
Mass container:	1.30	1.30	1.30	-	-	-	g
Mass of dry soil:	4.40	3.90	5.30	-	-	-	g
Moisture content:	25.00	30.77	28.30	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-13A
Depth	SS2 2.5'-7'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

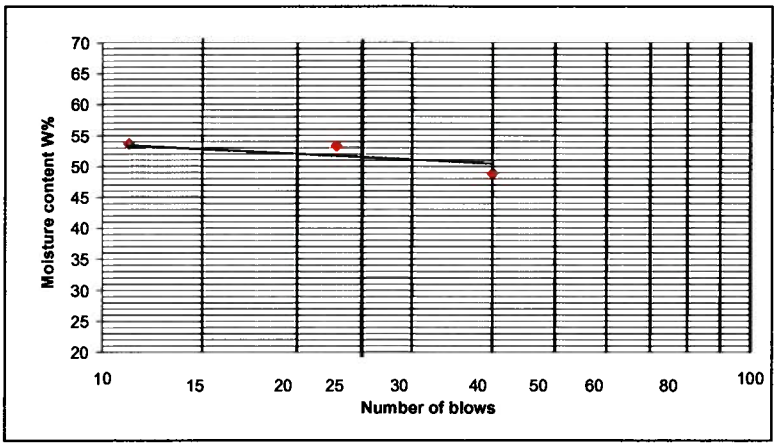
Project : Geotechnical study

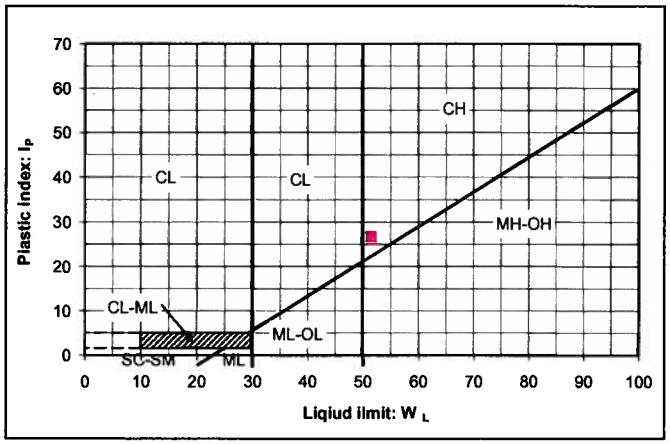
Method		Results			
Not dried:	☐	Natural moisture content:		44.70	W%
Air dried:	■	Liquid limit:		51.50	W_L
Oven dried:	☐	Plastic limit:		25.00	W_P
		Plasticity index:	$I_P = W_L - W_P =$	26.50	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.7434	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.00	4.80	-
Total mass dry:	3.58	4.10	-
Mass container:	1.90	1.30	-
Mass of dry soil:	1.68	2.80	-
Moisture content:	25.00	25.00	-
Average:			25.00%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		44.70%

Liquid Limit							
Number of blows	23	40	11	-	-	-	- - - -
Total mass wet:	12.50	9.00	12.70	-	-	-	g
Total mass dry:	9.20	7.00	9.70	-	-	-	g
Mass container:	3.00	2.90	4.10	-	-	-	g
Mass of dry soil:	6.20	4.10	5.60	-	-	-	g
Moisture content:	53.23	48.78	53.57	-	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-13A
Depth	SS3 7.5'-9.5'
Date	06/05/2011
JA No.	---

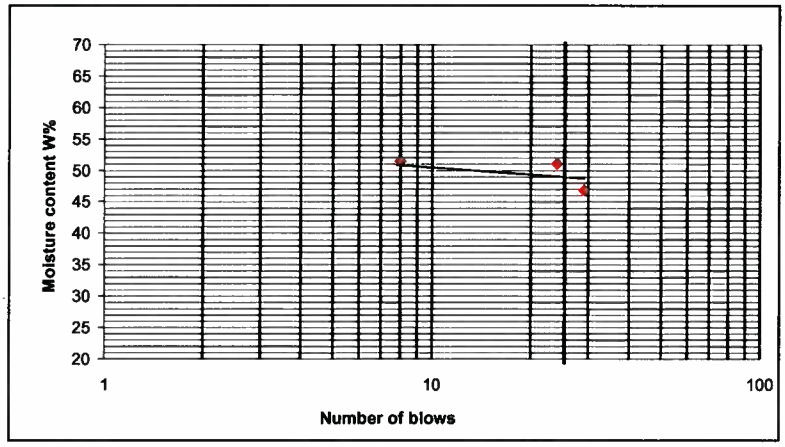
Client : Mine Arnaud (Sept-Îles, Qc)

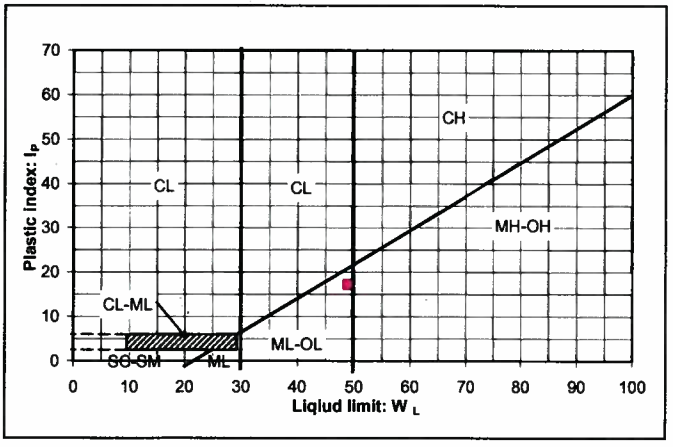
Project : Geotechnical study

Method		Results			
Not dried:	☐	Natural moisture content:		52.60	W%
Air dried:	■	Liquid limit:		49.00	W_L
Oven dried:	☐	Plastic limit:		31.82	W_P
		Plasticity index:	$I_P = W_L - W_P =$	17.18	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.20952	I_L

Plastic Limit				Natural Moisture Content			
Contenant No.:	1	2	3	4	5	6	
Total mass wet:	5.00	5.00	-	-	-	-	
Total mass dry:	4.30	4.30	-	-	-	-	
Mass container:	2.10	2.10	-	-	-	-	
Mass of dry soil:	2.20	2.20	-	-	-	-	
Moisture content:	31.82	31.82	-	-	-	-	
Average:			31.82%	Average:			52.60%

Liquid Limit							
Number of blows	24	29	8	-	-	-	----
Total mass wet:	10.20	9.70	13.20	-	-	-	g
Total mass dry:	7.70	7.50	9.70	-	-	-	g
Mass container:	2.80	2.80	2.90	-	-	-	g
Mass of dry soil:	4.90	4.70	6.80	-	-	-	g
Moisture content:	51.02	46.81	51.47	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-13B
Depth	SS1 5'-7'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

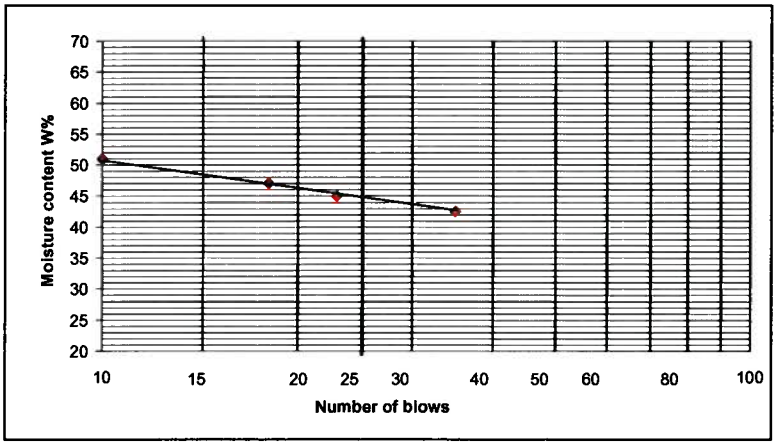
Project : Geotechnical study

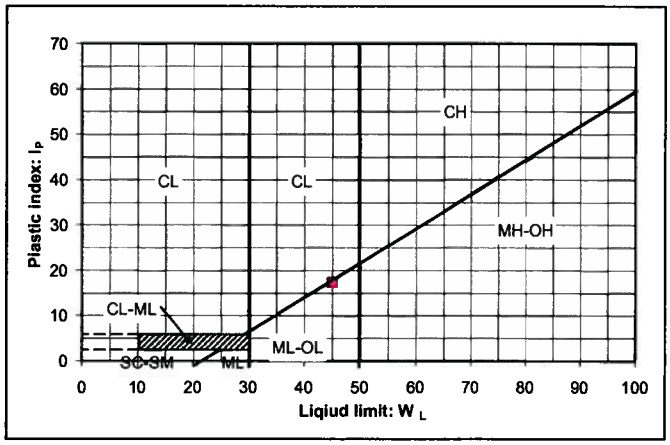
Method		Results			
Not dried:	☐	Natural moisture content:		59.80	W%
Air dried:	■	Liquid limit:		45.00	W_L
Oven dried:	☐	Plastic limit:		27.78	W_P
		Plasticity index:	$I_P = W_L - W_P =$	17.22	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.85935	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.60	3.60	-
Total mass dry:	3.10	3.10	-
Mass container:	1.30	1.30	-
Mass of dry soil:	1.80	1.80	-
Moisture content:	27.78	27.78	-
Average:			27.78%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		59.80%

Liquid Limit							
Number of blows	6	10	18	23	35	-	- - - -
Total mass wet:	14.90	11.30	10.40	11.70	12.30	-	g
Total mass dry:	10.60	8.50	8.00	9.00	9.50	-	g
Mass container:	3.20	3.00	2.90	3.00	2.90	-	g
Mass of dry soil:	7.40	5.50	5.10	6.00	6.60	-	g
Moisture content:	58.11	50.91	47.06	45.00	42.42	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-13E
Depth	SS1 2.5'-4.5'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

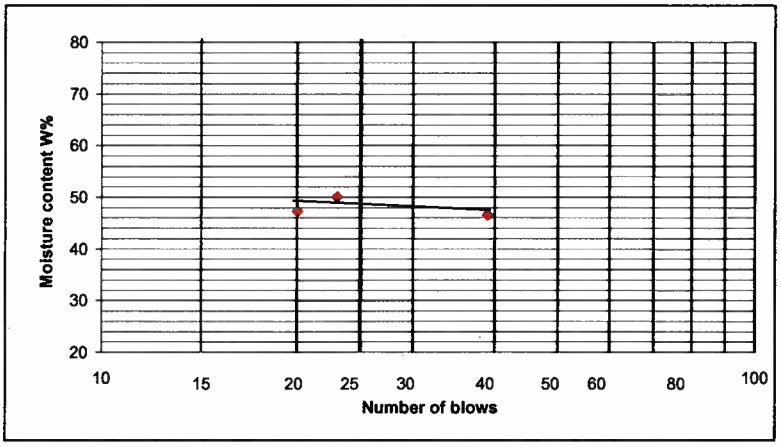
Project : Geotechnical study

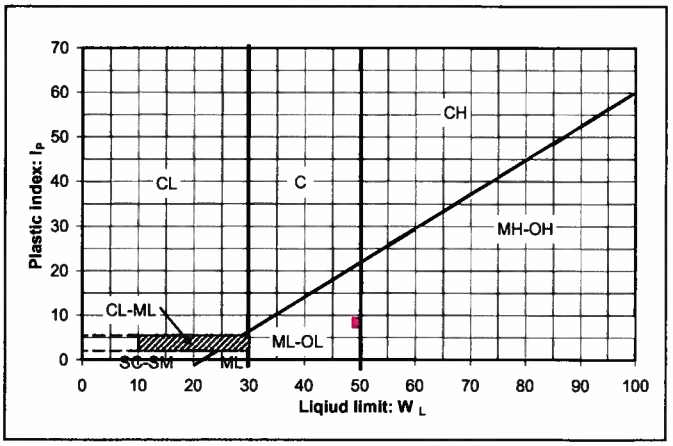
Method		Results			
Not dried:	☐	Natural moisture content:		37.10	W%
Air dried:	■	Liquid limit:		49.50	W_L
Oven dried:	☐	Plastic limit:		41.38	W_P
		Plasticity index:	$I_P = W_L - W_P =$	8.12	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	-0.5275	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.30	2.90	2.90
Total mass dry:	2.57	2.50	2.50
Mass container:	1.30	1.30	1.30
Mass of dry soil:	1.27	1.20	1.20
Moisture content:	57.48	33.33	33.33
Average:			41.38%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		37.10%

Liquid Limit							
Number of blows	39	23	20	-	-	-	- - - -
Total mass wet:	7.60	9.40	9.40	-	-	-	g
Total mass dry:	5.60	6.70	6.80	-	-	-	g
Mass container:	1.30	1.30	1.30	-	-	-	g
Mass of dry soil:	4.30	5.40	5.50	-	-	-	g
Moisture content:	46.51	50.00	47.27	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R-13E
Depth	SS2 5'-7'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

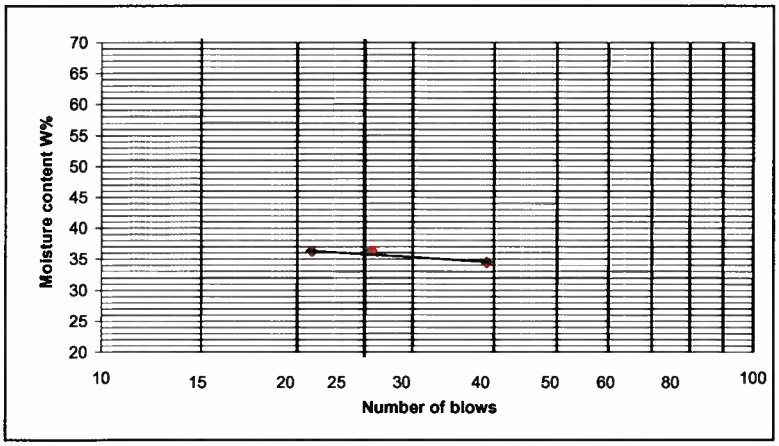
Project : Geotechnical study

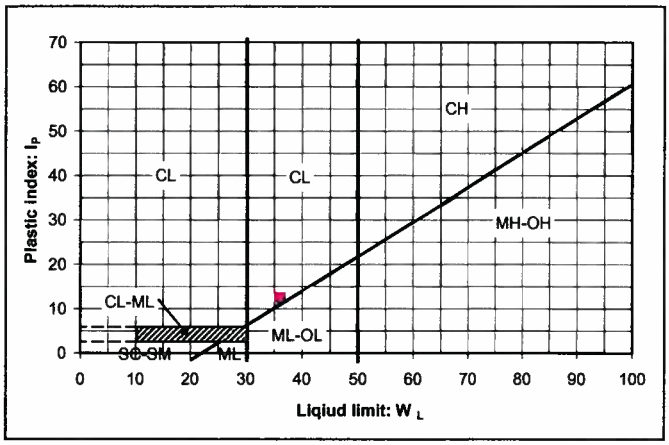
Method		Results			
Not dried:	☐	Natural moisture content:		29.90	W%
Air dried:	■	Liquid limit:		36.00	W_L
Oven dried:	☐	Plastic limit:		23.62	W_P
		Plasticity index:	$I_P = W_L - W_P =$	12.38	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.50725	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.00	4.30	-
Total mass dry:	3.60	3.84	-
Mass container:	1.90	1.90	-
Mass of dry soil:	1.70	1.94	-
Moisture content:	23.53	23.71	-
Average:			23.62%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		29.90%

Liquid Limit							
Number of blows	9	21	26	39	-	-	- - - -
Total mass wet:	9.60	9.30	8.90	9.50	-	-	g
Total mass dry:	7.30	7.20	6.90	7.40	-	-	g
Mass container:	1.50	1.40	1.40	1.30	-	-	g
Mass of dry soil:	5.80	5.80	5.50	6.10	-	-	g
Moisture content:	39.66	36.21	36.36	34.43	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R15
Depth	SS2 2'-4'
Date	28/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

Project : Geotechnical study

Method		Results			
Not dried:	☐	Natural moisture content:		35.70	W%
Air dried:	■	Liquid limit:		52.00	W_L
Oven dried:	☐	Plastic limit:		30.96	W_P
		Plasticity index:	$I_P = W_L - W_P =$	21.04	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.22526	I_L

Plastic Limit

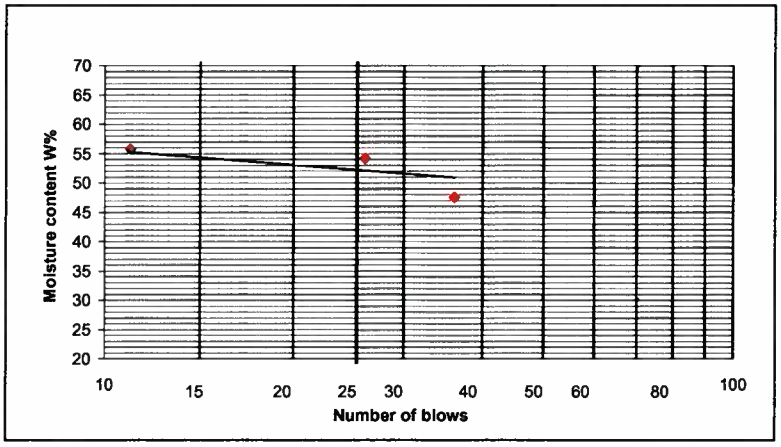
Contenant No.:	1	2	3
Total mass wet:	5.51	4.76	5.33
Total mass dry:	4.94	4.32	4.69
Mass container:	3.10	2.90	2.62
Mass of dry soil:	1.84	1.42	2.07
Moisture content:	30.98	30.99	30.92
Average:			30.96%

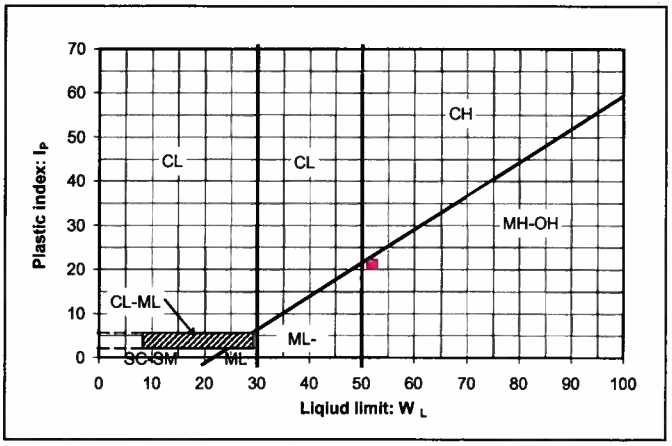
Natural Moisture Content

4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		35.70%

Liquid Limit

Number of blows	11	26	36	-	-	-	----
Total mass wet:	10.76	8.52	14.10	-	-	-	g
Total mass dry:	7.59	6.23	10.56	-	-	-	g
Mass container:	1.90	2.00	3.10	-	-	-	g
Mass of dry soil:	5.69	4.23	7.46	-	-	-	g
Moisture content:	55.71	54.14	47.45	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	R16
Depth	SS4 10'-12'
Date	02/04/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

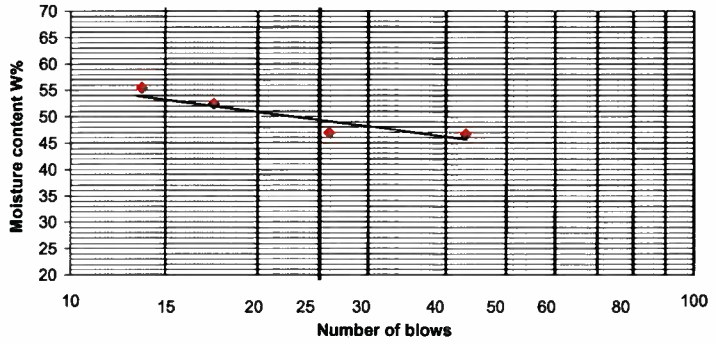
Project : Geotechnical study

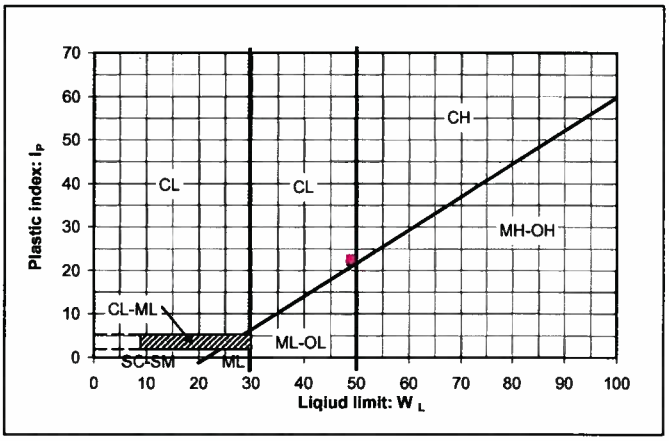
Method		Results			
Not dried:	☐	Natural moisture content:		60.60	W%
Air dried:	■	Liquid limit:		49.00	W_L
Oven dried:	☐	Plastic limit:		26.68	W_P
		Plasticity index:	$I_P = W_L - W_P =$	22.32	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.51983	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.00	4.70	4.94
Total mass dry:	4.60	4.32	4.49
Mass container:	3.10	2.90	2.80
Mass of dry soil:	1.50	1.42	1.69
Moisture content:	26.67	26.76	26.63
Average:			26.68%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		60.60%

Liquid Limit							
Number of blows	13	17	26	43	-	-	- - - -
Total mass wet:	11.90	12.50	14.80	13.70	-	-	g
Total mass dry:	8.80	9.20	11.00	10.20	-	-	g
Mass container:	3.20	2.90	2.90	2.70	-	-	g
Mass of dry soil:	5.60	6.30	8.10	7.50	-	-	g
Moisture content:	55.36	52.38	46.91	46.67	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T-3
Depth	10'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

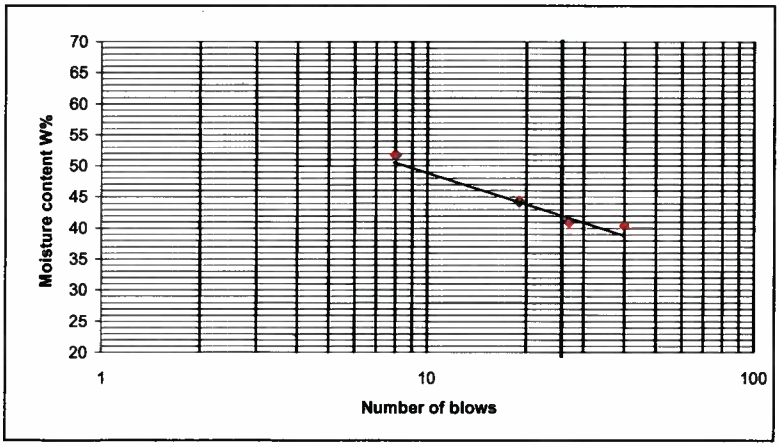
Project : Geotechnical study

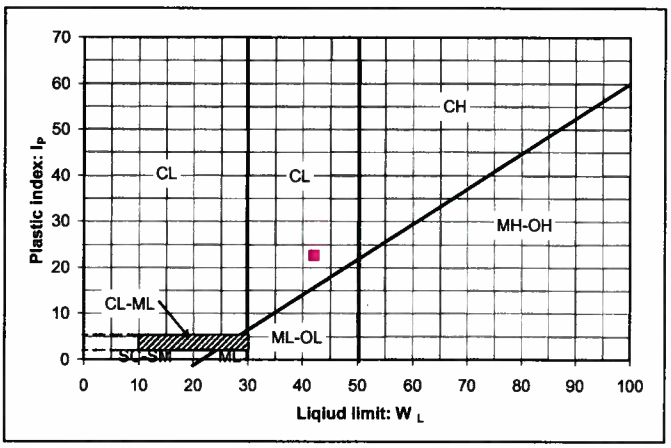
Method		Results			
Not dried:	☐	Natural moisture content:		51.00	W%
Air dried:	■	Liquid limit:		42.00	W_L
Oven dried:	☐	Plastic limit:		19.52	W_P
		Plasticity index:	$I_P = W_L - W_P =$	22.48	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.40039	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.40	4.40	4.30
Total mass dry:	4.10	4.20	4.10
Mass container:	2.90	3.10	2.80
Mass of dry soil:	1.20	1.10	1.30
Moisture content:	25.00	18.18	15.38
Average:			19.52%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		51.00%

Liquid Limit							
Number of blows	8	19	27	40	-	-	- - - -
Total mass wet:	12.00	11.20	11.50	9.30	-	-	g
Total mass dry:	8.90	8.90	9.00	7.20	-	-	g
Mass container:	2.90	3.70	2.90	2.00	-	-	g
Mass of dry soil:	6.00	5.20	6.10	5.20	-	-	g
Moisture content:	51.67	44.23	40.98	40.38	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T3-A
Depth	SS3 12.5'-14.5'
Date	06/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

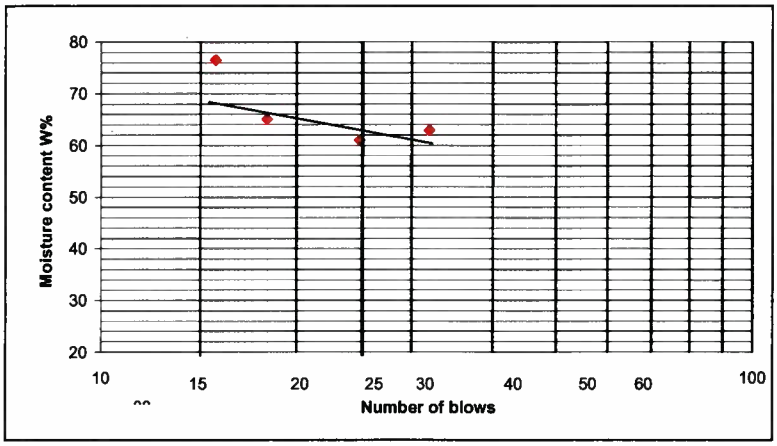
Project : Geotechnical study

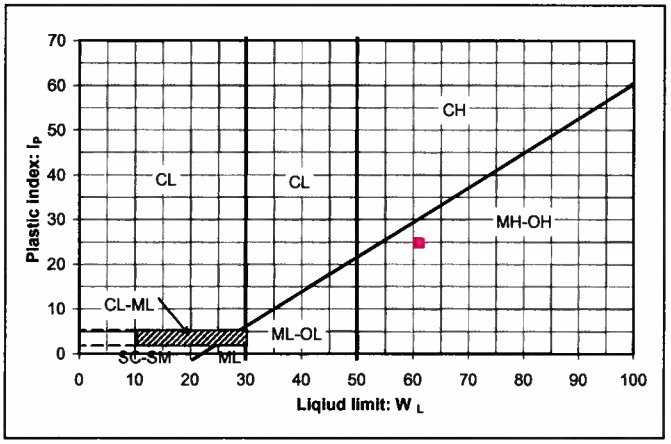
Method		Results			
Not dried:	☐	Natural moisture content:		72.80	W%
Air dried:	■	Liquid limit:		61.00	W_L
Oven dried:	☐	Plastic limit:		36.36	W_P
		Plasticity index:	$I_P = W_L - W_P =$	24.64	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.47897	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.10	2.80	2.80
Total mass dry:	2.62	2.40	2.40
Mass container:	1.30	1.30	1.30
Mass of dry soil:	1.32	1.10	1.10
Moisture content:	36.36	36.36	36.36
Average:			36.36%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		72.80%

Liquid Limit							
Number of blows	15	18	25	32	-	-	- - - -
Total mass wet:	9.80	9.70	8.70	7.00	-	-	g
Total mass dry:	7.20	7.10	5.90	4.80	-	-	g
Mass container:	3.80	3.10	1.30	1.30	-	-	g
Mass of dry soil:	3.40	4.00	4.60	3.50	-	-	g
Moisture content:	76.47	65.00	60.87	62.86	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T3A
Depth	ST4 15'-17'
Date	07/07/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

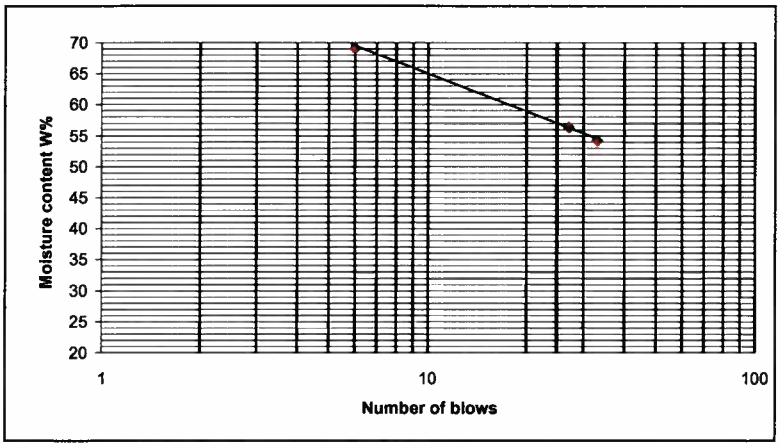
Project : Geotechnical study

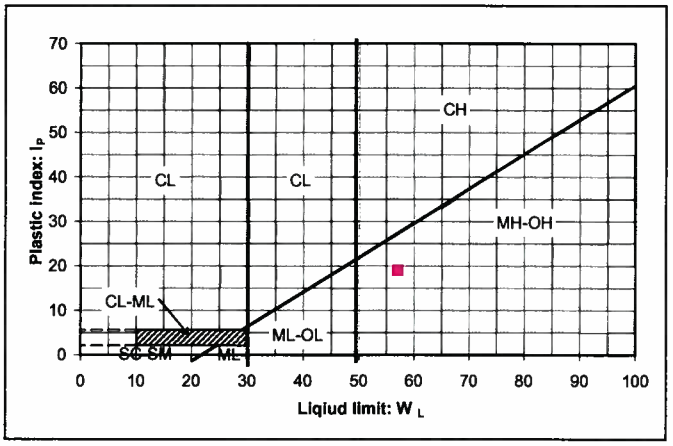
Method		Results			
Not dried:	☐	Natural moisture content:		71.10	W%
Air dried:	■	Liquid limit:		57.00	W_L
Oven dried:	☐	Plastic limit:		38.05	W_P
		Plasticity index:	$I_P = W_L - W_P =$	18.95	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.74395	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.50	4.00	4.00
Total mass dry:	4.10	3.60	3.70
Mass container:	3.00	2.70	2.80
Mass of dry soil:	1.10	0.90	0.90
Moisture content:	36.36	44.44	33.33
Average:			38.05%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		71.10%

Liquid Limit							
Number of blows	6	27	33	-	-	-	- - - -
Total mass wet:	9.90	10.30	13.90	-	-	-	g
Total mass dry:	7.00	7.60	10.00	-	-	-	g
Mass container:	2.80	2.80	2.80	-	-	-	g
Mass of dry soil:	4.20	4.80	7.20	-	-	-	g
Moisture content:	69.05	56.25	54.17	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T3A
Depth	ST5
Date	30/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

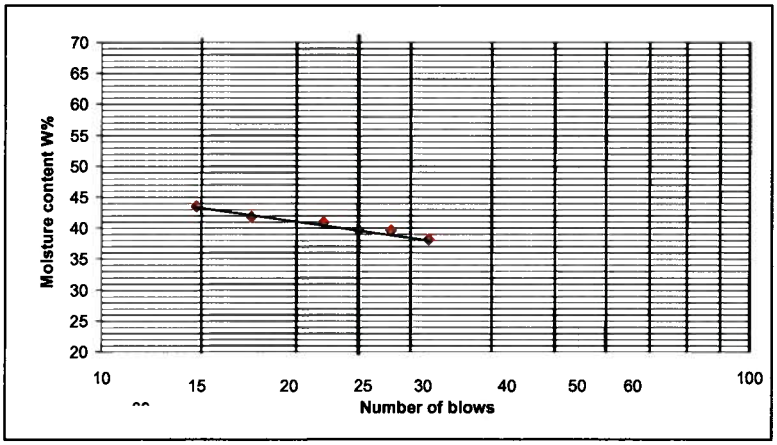
Project : Geotechnical study

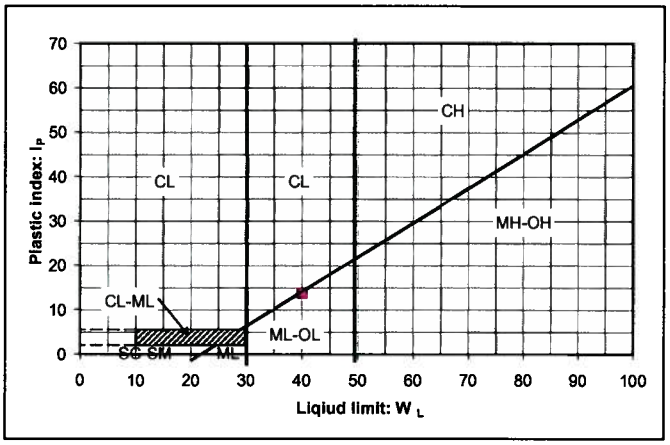
Method		Results			
Not dried:	☐	Natural moisture content:		41.70	W%
Air dried:	■	Liquid limit:		40.00	W_L
Oven dried:	☐	Plastic limit:		26.25	W_P
		Plasticity index:	$I_P = W_L - W_P =$	13.75	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.12364	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.40	3.10	-
Total mass dry:	2.80	2.90	-
Mass container:	1.30	1.30	-
Mass of dry soil:	1.50	1.60	-
Moisture content:	40.00	12.50	-
Average:			26.25%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		41.70%

Liquid Limit							
Number of blows	14	17	22	25	28	32	- - - -
Total mass wet:	7.90	7.50	7.60	11.10	8.00	8.70	g
Total mass dry:	5.90	5.70	5.80	8.80	6.10	7.10	g
Mass container:	1.30	1.40	1.40	3.00	1.30	2.90	g
Mass of dry soil:	4.60	4.30	4.40	5.80	4.80	4.20	g
Moisture content:	43.48	41.86	40.91	39.66	39.58	38.10	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T3A
Depth	ST6 25'-27'
Date	07/07/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

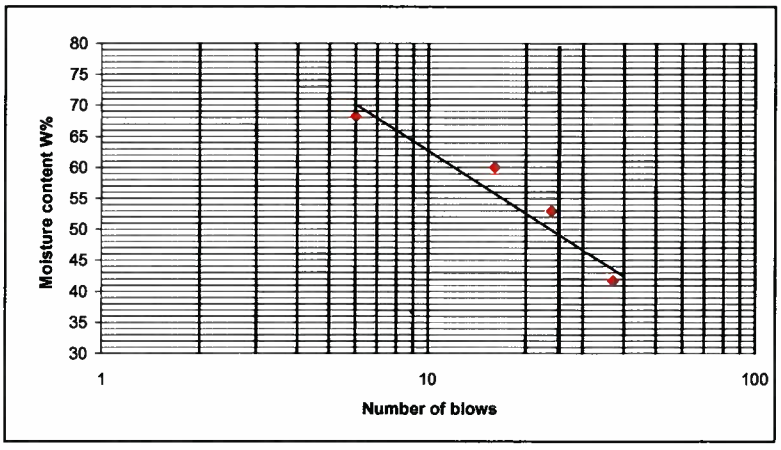
Project : Geotechnical study

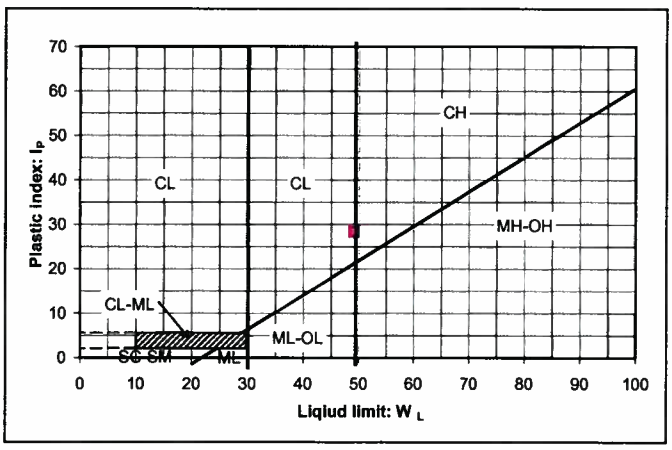
Method		Results			
Not dried:	☐	Natural moisture content:		51.70	W%
Air dried:	■	Liquid limit:		49.00	W_L
Oven dried:	☐	Plastic limit:		20.74	W_P
		Plasticity index:	$I_P = W_L - W_P =$	28.26	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.09554	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.50	6.40	5.20
Total mass dry:	5.20	6.00	5.10
Mass container:	4.20	4.20	4.10
Mass of dry soil:	1.00	1.80	1.00
Moisture content:	30.00	22.22	10.00
Average:			20.74%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		51.70%

Liquid Limit							
Number of blows	6	16	24	37	-	-	- - - -
Total mass wet:	8.20	5.30	5.50	6.40	-	-	g
Total mass dry:	6.70	4.40	4.60	5.40	-	-	g
Mass container:	4.50	2.90	2.90	3.00	-	-	g
Mass of dry soil:	2.20	1.50	1.70	2.40	-	-	g
Moisture content:	68.18	60.00	52.94	41.67	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	T-9
Depth	9'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

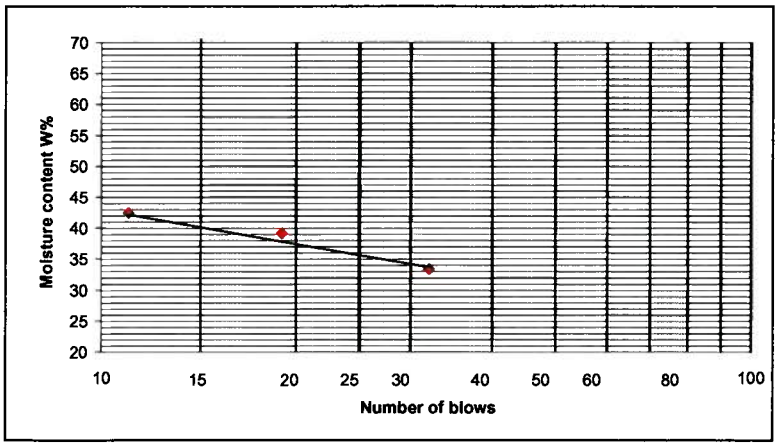
Project : Geotechnical study

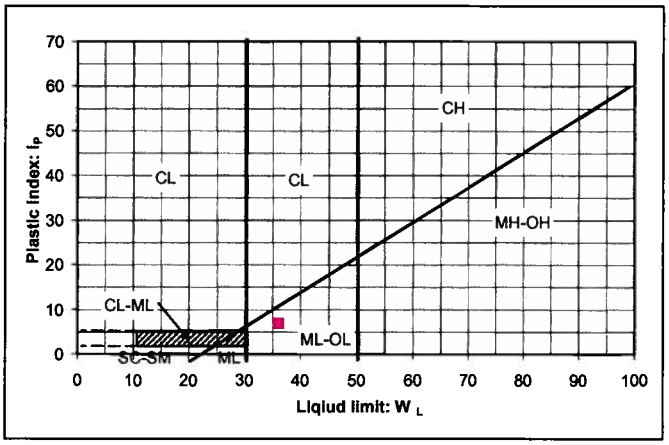
Method		Results			
Not dried:	☐	Natural moisture content:		42.80	W%
Air dried:	■	Liquid limit:		36.00	W_L
Oven dried:	☐	Plastic limit:		29.17	W_P
		Plasticity index:	$I_P = W_L - W_P =$	6.83	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.99512	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.40	4.30	4.10
Total mass dry:	4.10	4.00	3.90
Mass container:	3.10	3.20	2.90
Mass of dry soil:	1.00	0.80	1.00
Moisture content:	30.00	37.50	20.00
Average:			29.17%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		42.80%

Liquid Limit							
Number of blows	11	19	23	32	-	-	- - - -
Total mass wet:	9.70	10.10	11.60	12.20	-	-	g
Total mass dry:	7.20	8.30	9.30	9.90	-	-	g
Mass container:	1.30	3.70	7.20	3.00	-	-	g
Mass of dry soil:	5.90	4.60	2.10	6.90	-	-	g
Moisture content:	42.37	39.13	109.52	33.33	-	-	%





Sampled by: : NJ	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-1
Depth	12'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

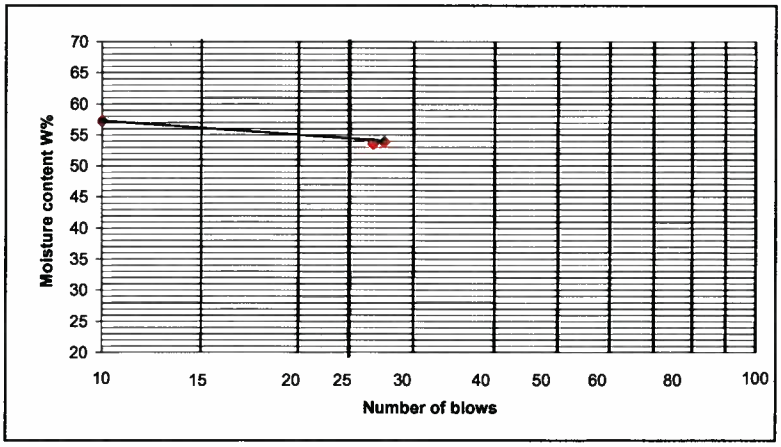
Project : Geotechnical study

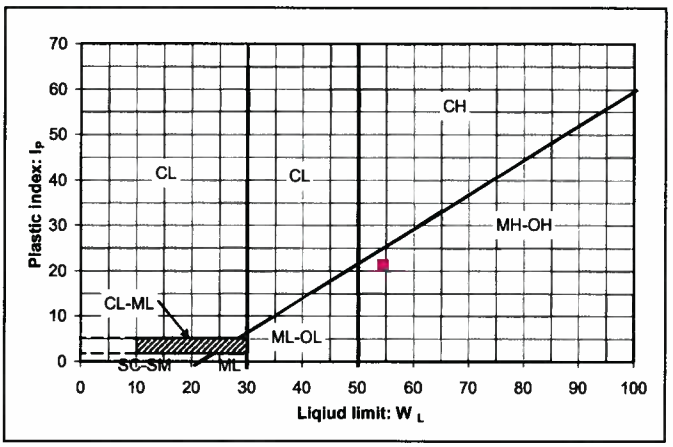
Method		Results			
Not dried:	☐	Natural moisture content:		63.50	W%
Air dried:	■	Liquid limit:		54.50	W_L
Oven dried:	☐	Plastic limit:		33.33	W_P
		Plasticity index:	$I_P = W_L - W_P =$	21.17	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.4252	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.10	4.60	4.00
Total mass dry:	3.80	4.20	3.80
Mass container:	2.90	3.30	2.90
Mass of dry soil:	0.90	0.90	0.90
Moisture content:	33.33	44.44	22.22
Average:			33.33%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		63.50%

Liquid Limit							
Number of blows	20	27	26	10	-	-	- - - -
Total mass wet:	13.10	15.00	13.90	10.50	-	-	g
Total mass dry:	9.60	10.80	10.10	7.70	-	-	g
Mass container:	7.70	3.00	3.00	2.80	-	-	g
Mass of dry soil:	1.90	7.80	7.10	4.90	-	-	g
Moisture content:	184.21	53.85	53.52	57.14	-	-	%





Sampled by: : NJ	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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DIVISION LAB JOURNEAUX INC.
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U3
Depth	SS3 5'-7'
Date	04/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

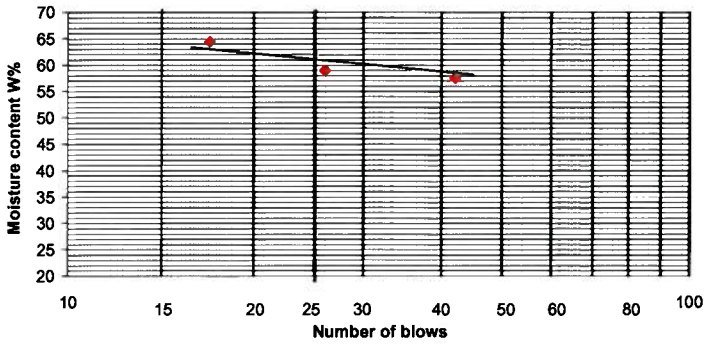
Project : Geotechnical study

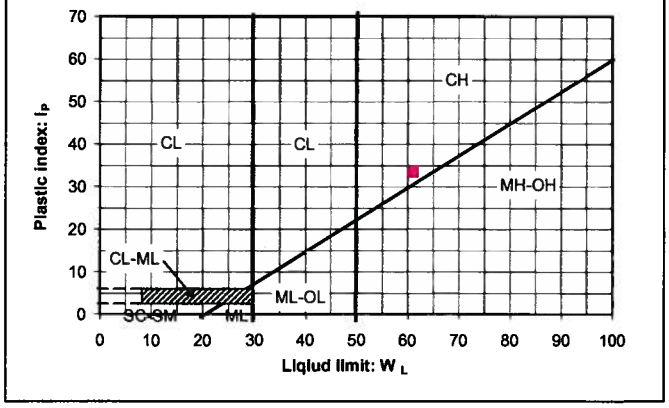
Method		Results			
Not dried:	☐	Natural moisture content:		56.70	W%
Air dried:	■	Liquid limit:		61.00	W_L
Oven dried:	☐	Plastic limit:		27.71	W_P
		Plasticity index:	$I_P = W_L - W_P =$	33.29	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.87085	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.69	3.10	2.70
Total mass dry:	3.30	2.70	2.40
Mass container:	1.87	1.30	1.30
Mass of dry soil:	1.43	1.40	1.10
Moisture content:	27.27	28.57	27.27
Average:			27.71%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		56.70%

Liquid Limit							
Number of blows	17	26	42	-	-	-	- - - -
Total mass wet:	9.40	14.80	14.50	-	-	-	g
Total mass dry:	6.50	10.50	9.90	-	-	-	g
Mass container:	2.00	3.20	1.90	-	-	-	g
Mass of dry soil:	4.50	7.30	8.00	-	-	-	g
Moisture content:	64.44	58.90	57.50	-	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U3
Depth	ST4 12.5'-14.5'
Date	30/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

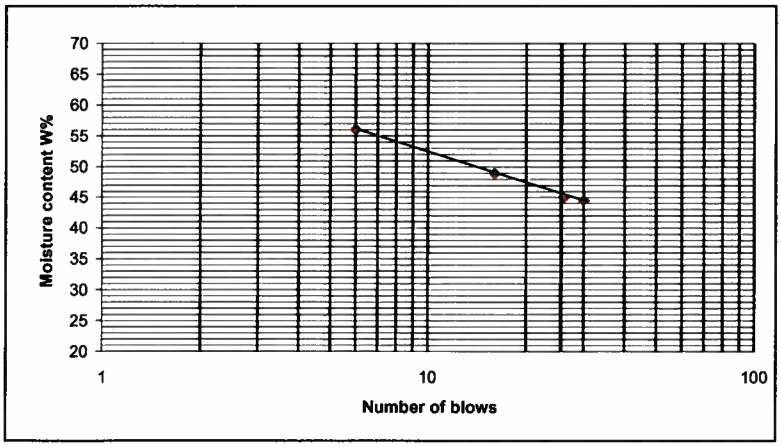
Project : Geotechnical study

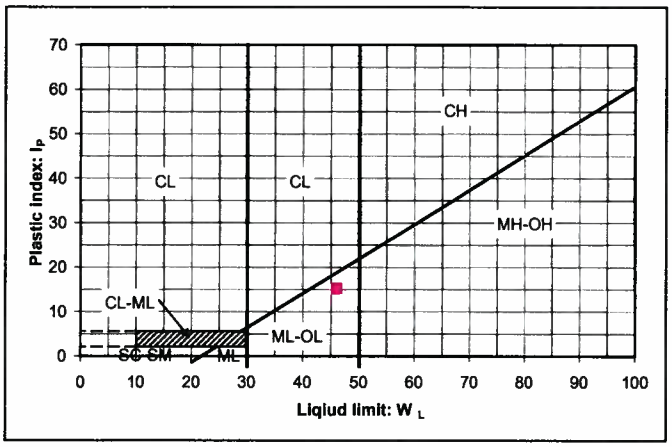
Method		Results			
Not dried:	☐	Natural moisture content:		55.00	W%
Air dried:	■	Liquid limit:		46.00	W_L
Oven dried:	☐	Plastic limit:		30.89	W_P
		Plasticity index:	$I_P = W_L - W_P =$	15.11	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.59568	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.70	4.00	5.50
Total mass dry:	4.30	3.80	5.10
Mass container:	3.10	3.10	3.80
Mass of dry soil:	1.20	0.70	1.30
Moisture content:	33.33	28.57	30.77
Average:			30.89%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		55.00%

Liquid Limit							
Number of blows	6	16	26	30	-	-	- - - -
Total mass wet:	11.90	9.40	8.70	6.80	-	-	g
Total mass dry:	9.10	7.30	6.90	5.60	-	-	g
Mass container:	4.10	3.00	2.90	2.90	-	-	g
Mass of dry soil:	5.00	4.30	4.00	2.70	-	-	g
Moisture content:	56.00	48.84	45.00	44.44	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U3
Depth	ST5 20'-22'
Date	29/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

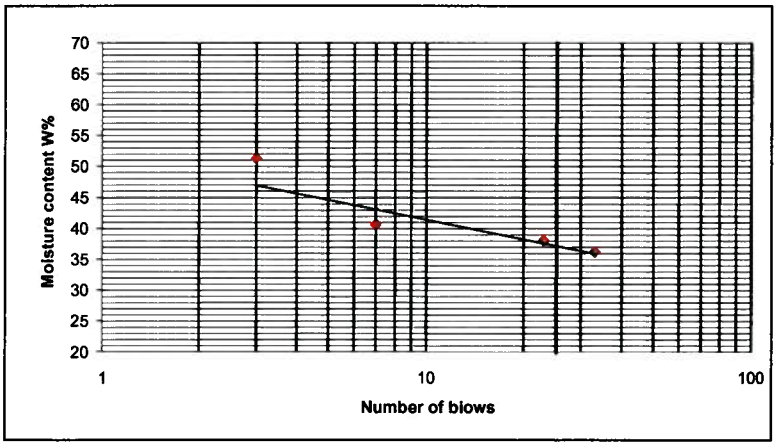
Project : Geotechnical study

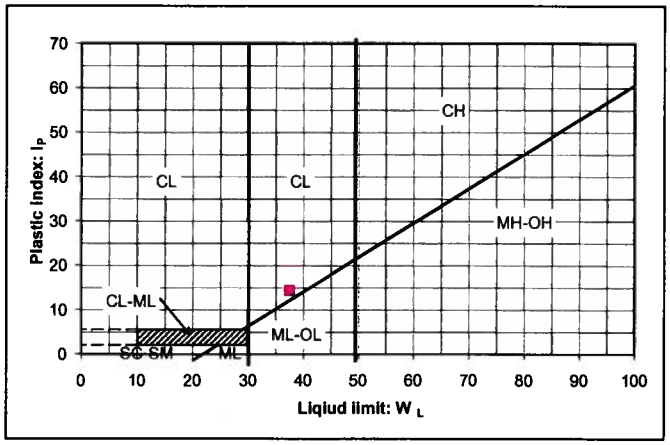
Method		Results			
Not dried:	☐	Natural moisture content:		53.60	W%
Air dried:	■	Liquid limit:		37.50	W_L
Oven dried:	☐	Plastic limit:		23.23	W_P
		Plasticity index:	$I_P = W_L - W_P =$	14.27	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.12799	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.20	3.00	-
Total mass dry:	2.84	2.70	-
Mass container:	1.30	1.40	-
Mass of dry soil:	1.54	1.30	-
Moisture content:	23.38	23.08	-
Average:			23.23%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		53.60%

Liquid Limit							
Number of blows	3	7	23	33	-	-	- - - -
Total mass wet:	7.60	6.50	9.40	9.20	-	-	g
Total mass dry:	5.50	5.00	7.20	7.10	-	-	g
Mass container:	1.40	1.30	1.40	1.30	-	-	g
Mass of dry soil:	4.10	3.70	5.80	5.80	-	-	g
Moisture content:	51.22	40.54	37.93	36.21	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-5
Depth	12'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

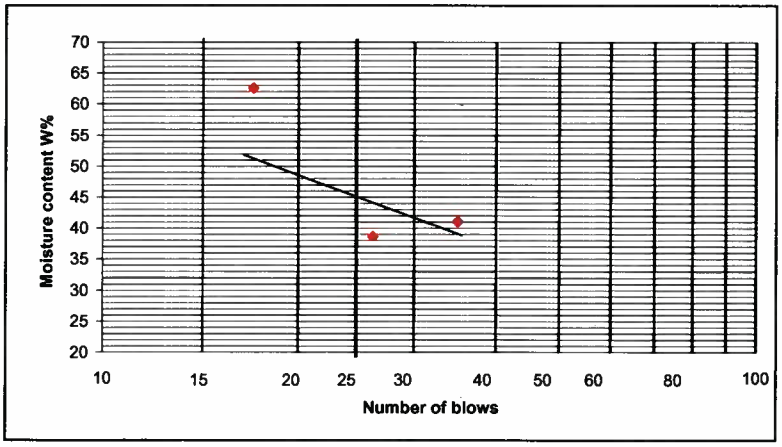
Project : Geotechnical study

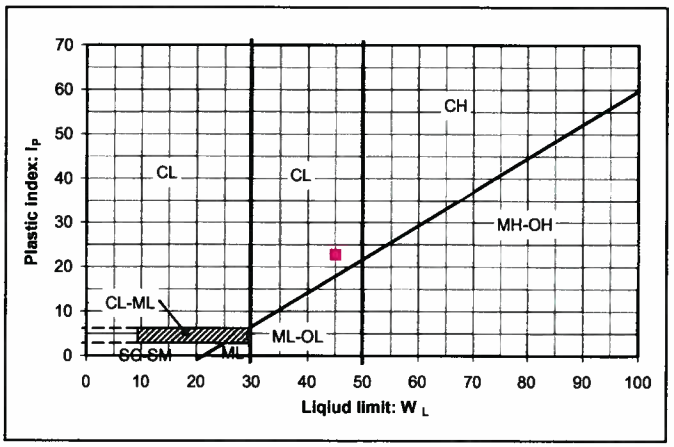
Method		Results			
Not dried:	☐	Natural moisture content:		45.10	W%
Air dried:	■	Liquid limit:		45.00	W_L
Oven dried:	☐	Plastic limit:		22.25	W_P
		Plasticity index:	$I_P = W_L - W_P =$	22.75	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.0044	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.60	5.30	-
Total mass dry:	4.30	5.00	-
Mass container:	2.90	3.70	-
Mass of dry soil:	1.40	1.30	-
Moisture content:	21.43	23.08	-
Average:			22.25%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		45.10%

Liquid Limit							
Number of blows	17	26	35	-	-	-	- - - -
Total mass wet:	10.80	9.00	8.60	-	-	-	g
Total mass dry:	7.80	7.30	7.00	-	-	-	g
Mass container:	3.00	2.90	3.10	-	-	-	g
Mass of dry soil:	4.80	4.40	3.90	-	-	-	g
Moisture content:	62.50	38.64	41.03	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U6
Depth	SS2 5'-7'
Date	04/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

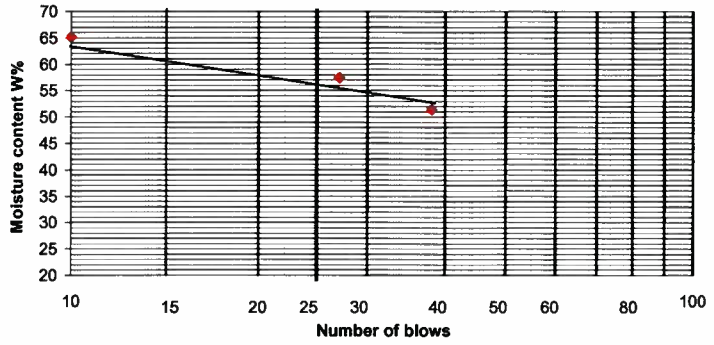
Project : Geotechnical study

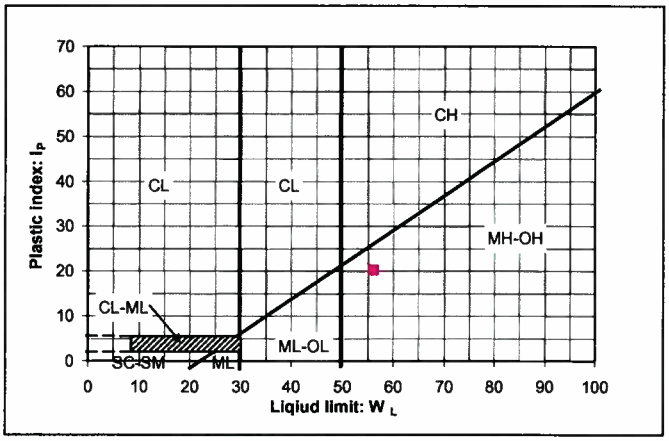
Method		Results			
Not dried:	☐	Natural moisture content:		65.00	W%
Air dried:	■	Liquid limit:		56.00	W_L
Oven dried:	☐	Plastic limit:		35.82	W_P
		Plasticity index:	$I_P = W_L - W_P =$	20.18	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.44608	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.60	5.90	5.30
Total mass dry:	3.00	5.30	4.67
Mass container:	1.30	3.66	2.90
Mass of dry soil:	1.70	1.64	1.77
Moisture content:	35.29	36.59	35.59
Average:			35.82%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		65.00%

Liquid Limit							
Number of blows	10	27	38	-	-	-	- - - -
Total mass wet:	13.30	13.80	14.00	-	-	-	g
Total mass dry:	9.20	9.90	10.20	-	-	-	g
Mass container:	2.90	3.10	2.80	-	-	-	g
Mass of dry soil:	6.30	6.80	7.40	-	-	-	g
Moisture content:	65.08	57.35	51.35	-	-	-	%





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Date :	Date :	Date :

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801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U6
Depth	SS4 22.5'-24.5'
Date	04/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

Project : Geotechnical study

Method		Results			
Not dried:	☐	Natural moisture content:		48.00	W%
Air dried:	■	Liquid limit:		29.00	W_L
Oven dried:	☐	Plastic limit:		22.06	W_P
		Plasticity index:	$I_P = W_L - W_P =$	6.94	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	3.73819	I_L

Plastic Limit

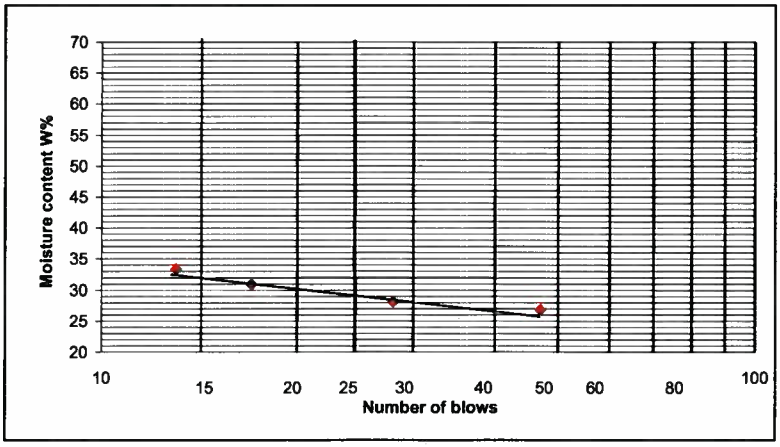
Contenant No.:	1	2	3
Total mass wet:	5.50	6.18	5.60
Total mass dry:	5.00	5.61	5.10
Mass container:	2.80	3.10	2.70
Mass of dry soil:	2.20	2.51	2.41
Moisture content:	22.73	22.71	20.75
Average:			22.06%

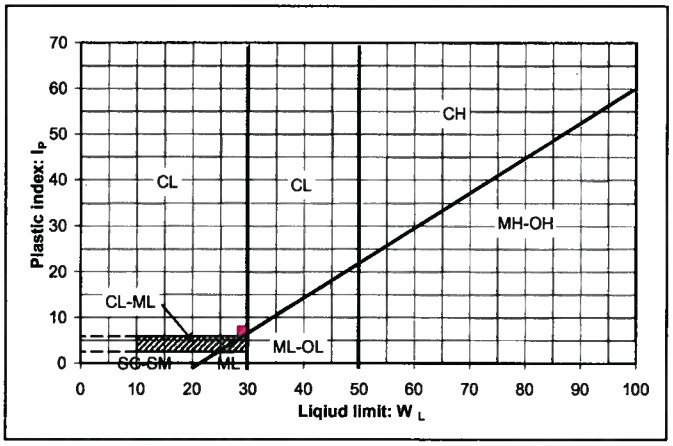
Natural Moisture Content

4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		48.00%

Liquid Limit

Number of blows	3	13	17	28	47	-	----
Total mass wet:	16.10	14.30	13.40	14.30	16.70	-	g
Total mass dry:	12.10	11.50	10.90	11.80	14.00	-	g
Mass container:	2.90	3.10	2.80	2.90	3.90	-	g
Mass of dry soil:	9.20	8.40	8.10	8.90	10.10	-	g
Moisture content:	43.48	33.33	30.86	28.09	26.73	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U6
Depth	ST3 17.5,-19.5'
Date	29/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

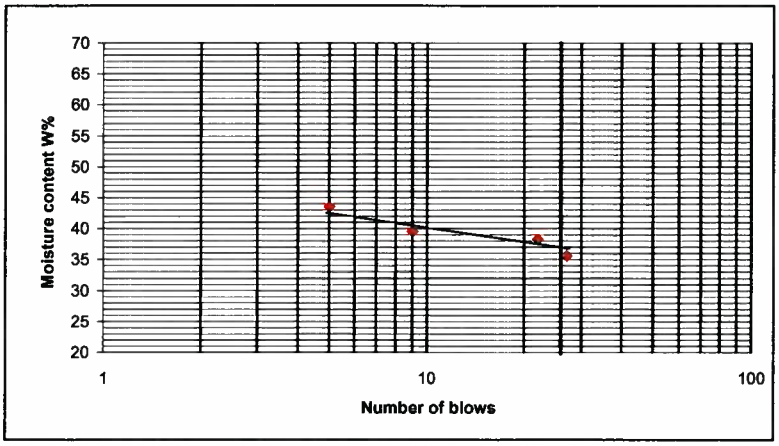
Project : Geotechnical study

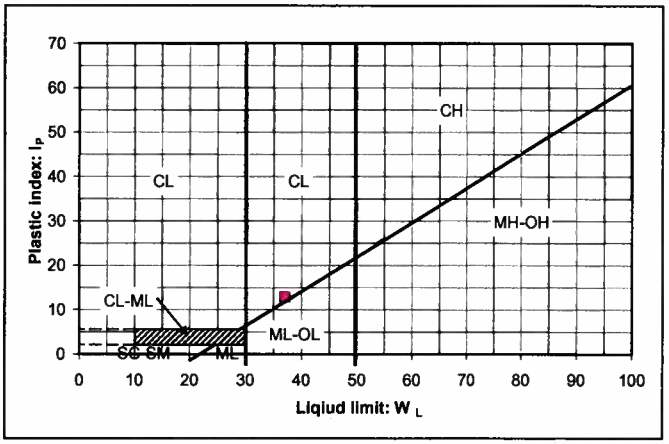
Method		Results			
Not dried:	☐	Natural moisture content:		55.80	W%
Air dried:	■	Liquid limit:		37.00	W_L
Oven dried:	☐	Plastic limit:		24.26	W_P
		Plasticity index:	$I_P = W_L - W_P =$	12.74	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.47621	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.50	3.80	-
Total mass dry:	3.10	3.30	-
Mass container:	1.40	1.30	-
Mass of dry soil:	1.70	2.00	-
Moisture content:	23.53	25.00	-
Average:			24.26%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		55.80%

Liquid Limit							
Number of blows	5	9	22	27	-	-	- - - -
Total mass wet:	7.90	7.90	6.00	11.60	-	-	g
Total mass dry:	5.90	6.20	4.70	8.90	-	-	g
Mass container:	1.30	1.90	1.30	1.30	-	-	g
Mass of dry soil:	4.60	4.30	3.40	7.60	-	-	g
Moisture content:	43.48	39.53	38.24	35.53	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-9A
Depth	SS2 5'-7'
Date	04/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

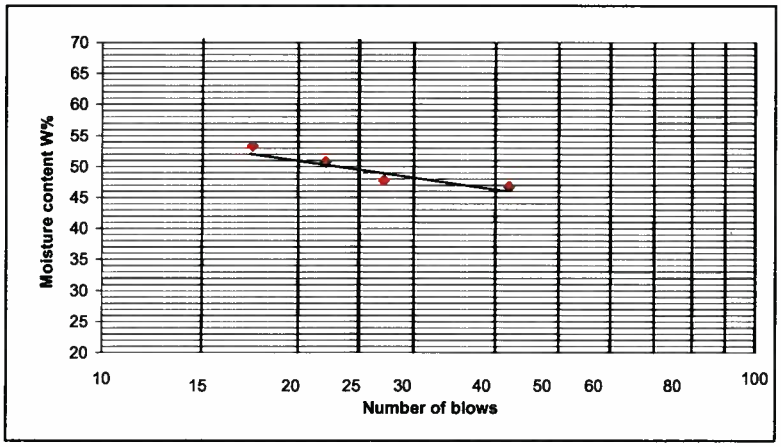
Project : Geotechnical study

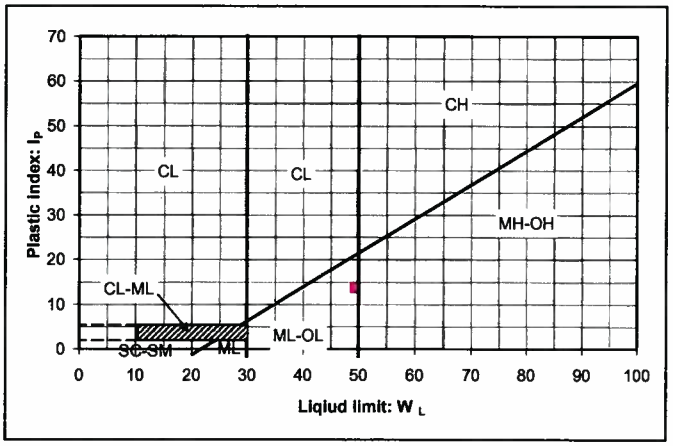
Method		Results			
Not dried:	☐	Natural moisture content:		56.80	W%
Air dried:	■	Liquid limit:		49.50	W_L
Oven dried:	☐	Plastic limit:		35.83	W_P
		Plasticity index:	$I_P = W_L - W_P =$	13.67	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.53418	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.90	5.00	5.00
Total mass dry:	4.44	4.60	4.30
Mass container:	2.83	3.20	2.91
Mass of dry soil:	1.61	1.40	1.39
Moisture content:	28.57	28.57	50.36
Average:			35.83%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		56.80%

Liquid Limit							
Number of blows	17	22	27	42	-	-	- - - -
Total mass wet:	12.30	13.60	15.90	14.10	-	-	g
Total mass dry:	9.00	10.00	11.70	10.60	-	-	g
Mass container:	2.80	2.90	2.90	3.10	-	-	g
Mass of dry soil:	6.20	7.10	8.80	7.50	-	-	g
Moisture content:	53.23	50.70	47.73	46.67	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-9A
Depth	SS3 7.5'-9.5'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

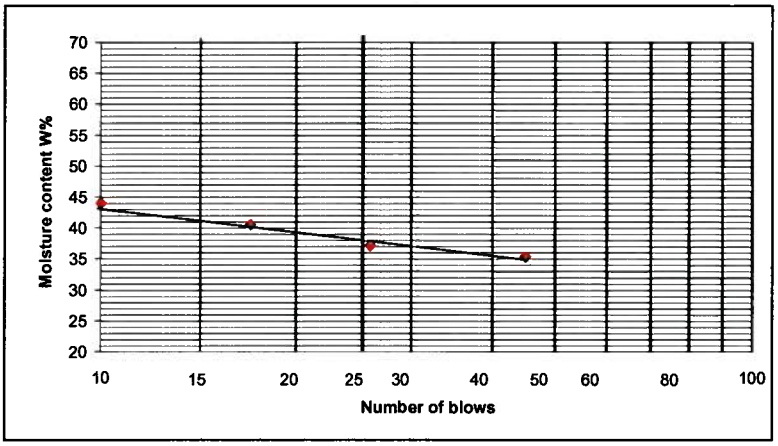
Project : Geotechnical study

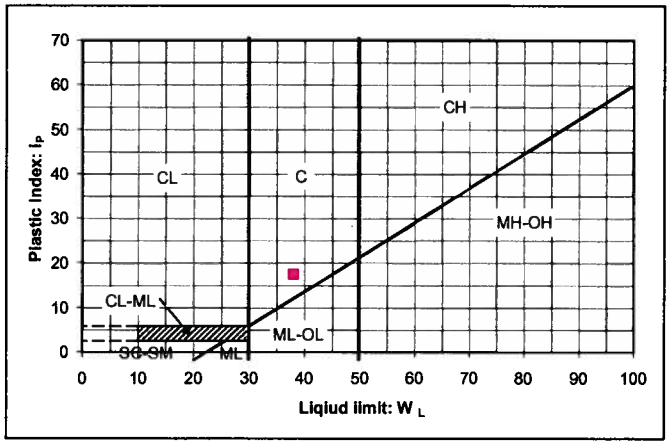
Method		Results			
Not dried:	☐	Natural moisture content:		50.50	W%
Air dried:	■	Liquid limit:		38.00	W_L
Oven dried:	☐	Plastic limit:		20.55	W_P
		Plasticity index:	$I_P = W_L - W_P =$	17.45	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.7162	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.30	2.90	0.00
Total mass dry:	3.00	2.63	0.00
Mass container:	1.50	1.35	0.00
Mass of dry soil:	1.50	1.28	0.00
Moisture content:	20.00	21.09	0.00
Average:			20.55%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		50.50%

Liquid Limit							
Number of blows	10	17	26	45	-	-	- - - -
Total mass wet:	16.80	14.10	13.60	14.10	-	-	g
Total mass dry:	12.80	10.90	10.70	11.20	-	-	g
Mass container:	3.70	3.00	2.90	3.00	-	-	g
Mass of dry soil:	9.10	7.90	7.80	8.20	-	-	g
Moisture content:	43.96	40.51	37.18	35.37	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U10
Depth	SS4 10'-12'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

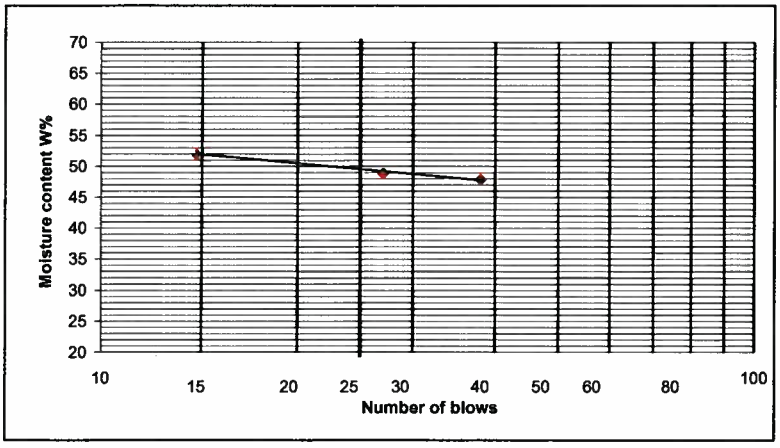
Project : Geotechnical study

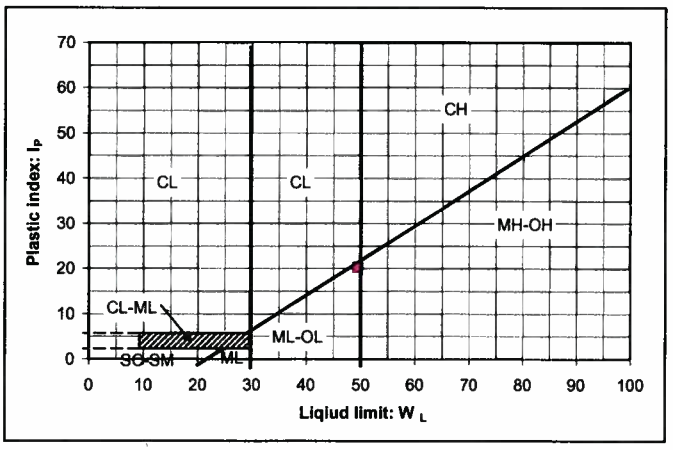
Method		Results			
Not dried:	☐	Natural moisture content:		80.40	W%
Air dried:	■	Liquid limit:		49.50	W_L
Oven dried:	☐	Plastic limit:		29.29	W_P
		Plasticity index:	$I_P = W_L - W_P =$	20.21	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.52932	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.40	3.55	3.70
Total mass dry:	2.90	3.10	3.10
Mass container:	1.20	1.31	1.30
Mass of dry soil:	1.70	1.79	1.80
Moisture content:	29.41	25.14	33.33
Average:			29.29%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		80.40%

Liquid Limit							
Number of blows	14	27	38	-	-	-	- - - -
Total mass wet:	11.60	14.80	17.70	-	-	-	g
Total mass dry:	8.70	10.90	13.30	-	-	-	g
Mass container:	3.10	2.90	4.10	-	-	-	g
Mass of dry soil:	5.60	8.00	9.20	-	-	-	g
Moisture content:	51.79	48.75	47.83	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U10
Depth	ST5 12.5'-14.5'
Date	30/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

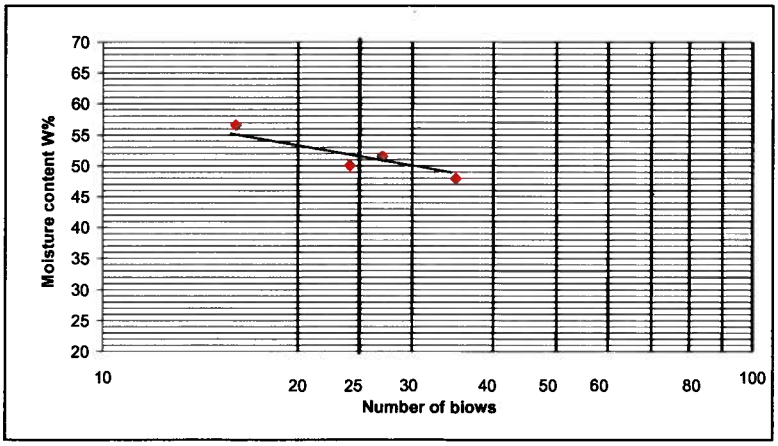
Project : Geotechnical study

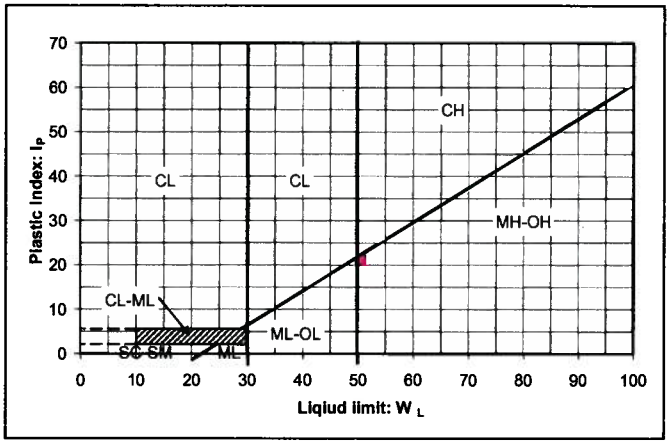
Method		Results			
Not dried:	☐	Natural moisture content:		56.80	W%
Air dried:	■	Liquid limit:		50.50	W_L
Oven dried:	☐	Plastic limit:		29.48	W_P
		Plasticity index:	$I_P = W_L - W_P =$	21.02	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.29975	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	7.20	6.30	5.90
Total mass dry:	6.50	6.00	5.50
Mass container:	4.40	4.40	4.40
Mass of dry soil:	2.10	1.60	1.10
Moisture content:	33.33	18.75	36.36
Average:			29.48%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		56.80%

Liquid Limit							
Number of blows	16	27	24	35	-	-	- - - -
Total mass wet:	7.90	9.60	5.70	10.30	-	-	g
Total mass dry:	6.60	7.80	4.30	8.00	-	-	g
Mass container:	4.30	4.30	1.50	3.20	-	-	g
Mass of dry soil:	2.30	3.50	2.80	4.80	-	-	g
Moisture content:	56.52	51.43	50.00	47.92	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-14
Depth	9'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

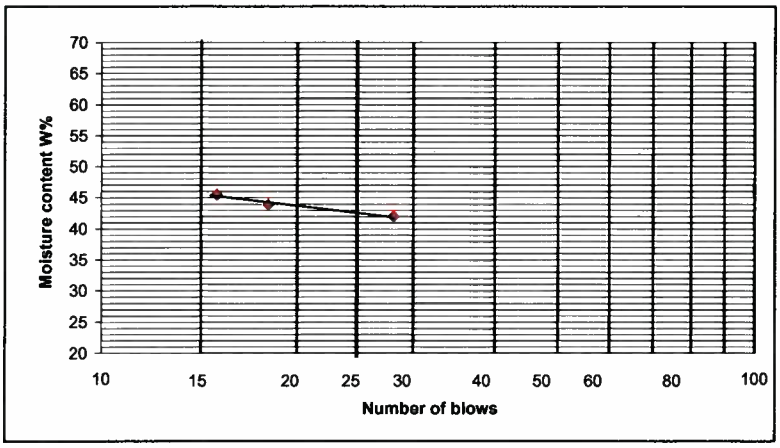
Project : Geotechnical study

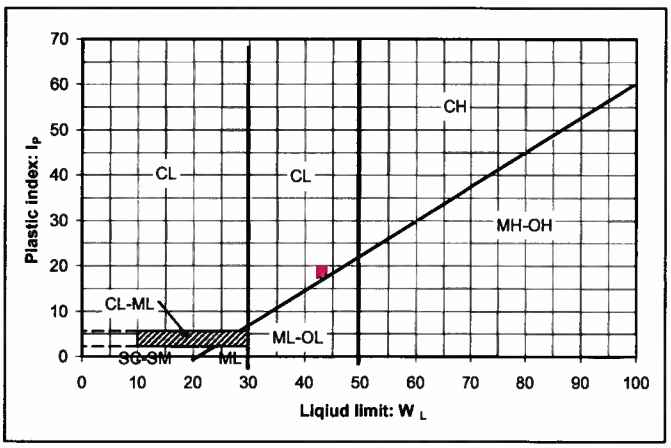
Method		Results			
Not dried:	☐	Natural moisture content:		47.30	W%
Air dried:	■	Liquid limit:		43.00	W_L
Oven dried:	☐	Plastic limit:		24.58	W_P
		Plasticity index:	$I_P = W_L - W_P =$	18.42	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.23343	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.20	4.00	4.10
Total mass dry:	3.90	3.80	3.90
Mass container:	3.00	2.90	2.80
Mass of dry soil:	0.90	0.90	1.10
Moisture content:	33.33	22.22	18.18
Average:			24.58%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		47.30%

Liquid Limit							
Number of blows	8	15	18	28	-	-	- - - -
Total mass wet:	8.80	9.40	11.10	10.10	-	-	g
Total mass dry:	6.80	7.40	8.60	8.00	-	-	g
Mass container:	2.80	3.00	2.90	3.00	-	-	g
Mass of dry soil:	4.00	4.40	5.70	5.00	-	-	g
Moisture content:	50.00	45.45	43.86	42.00	-	-	%





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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U22
Depth	SS3 15'-17'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

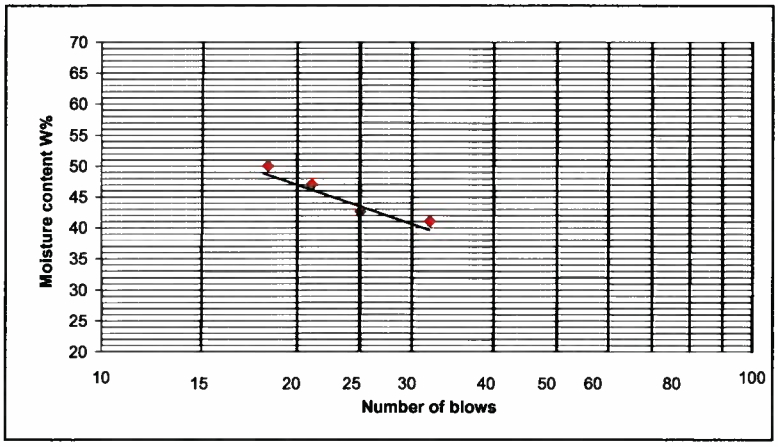
Project : Geotechnical study

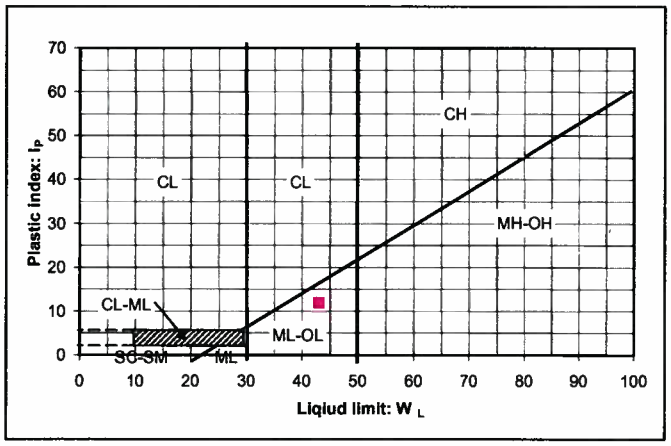
Method		Results			
Not dried:	☐	Natural moisture content:		49.50	W%
Air dried:	■	Liquid limit:		43.00	W_L
Oven dried:	☐	Plastic limit:		31.25	W_P
		Plasticity index:	$I_P = W_L - W_P =$	11.75	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.55319	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.40	3.40	0.00
Total mass dry:	2.90	2.90	0.00
Mass container:	1.30	1.30	0.00
Mass of dry soil:	1.60	1.60	0.00
Moisture content:	31.25	31.25	0.00
Average:			31.25%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		49.50%

Liquid Limit							
Number of blows	18	21	25	32	-	-	- - - -
Total mass wet:	13.20	12.80	12.50	11.70	-	-	g
Total mass dry:	9.90	9.70	9.60	9.20	-	-	g
Mass container:	3.30	3.10	2.80	3.10	-	-	g
Mass of dry soil:	6.60	6.60	6.80	6.10	-	-	g
Moisture content:	50.00	46.97	42.65	40.98	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U22
Depth	SS5 25'-30'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

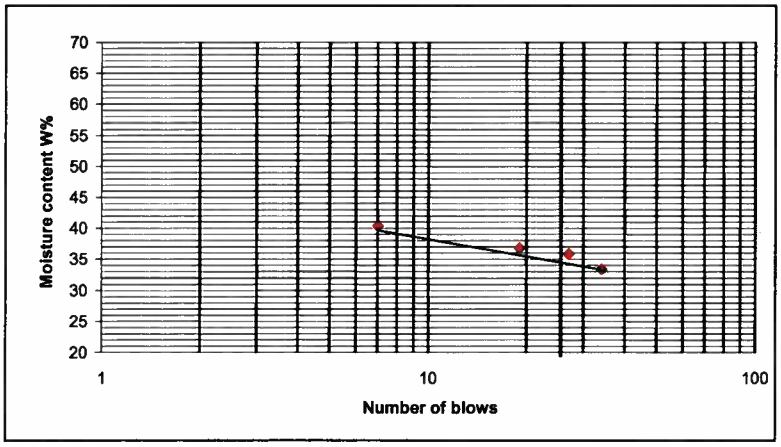
Project : Geotechnical study

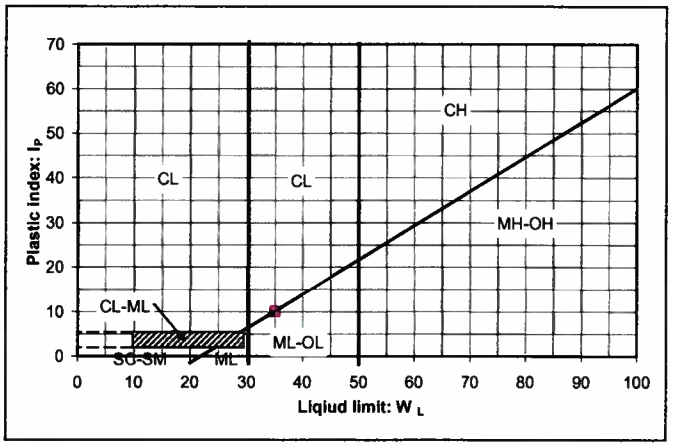
Method		Results			
Not dried:	☐	Natural moisture content:		42.10	W%
Air dried:	■	Liquid limit:		35.00	W_L
Oven dried:	☐	Plastic limit:		25.00	W_P
		Plasticity index:	$I_P = W_L - W_P =$	10.00	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.71	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.09	3.80	0.00
Total mass dry:	3.55	3.30	0.00
Mass container:	1.39	1.30	0.00
Mass of dry soil:	2.16	2.00	0.00
Moisture content:	25.00	25.00	0.00
Average:			25.00%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		42.10%

Liquid Limit							
Number of blows	7	19	27	34	-	-	- - - -
Total mass wet:	13.30	13.70	14.00	16.50	-	-	g
Total mass dry:	10.40	10.80	11.10	13.10	-	-	g
Mass container:	3.20	2.90	3.00	2.90	-	-	g
Mass of dry soil:	7.20	7.90	8.10	10.20	-	-	g
Moisture content:	40.28	36.71	35.80	33.33	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-26
Depth	8'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

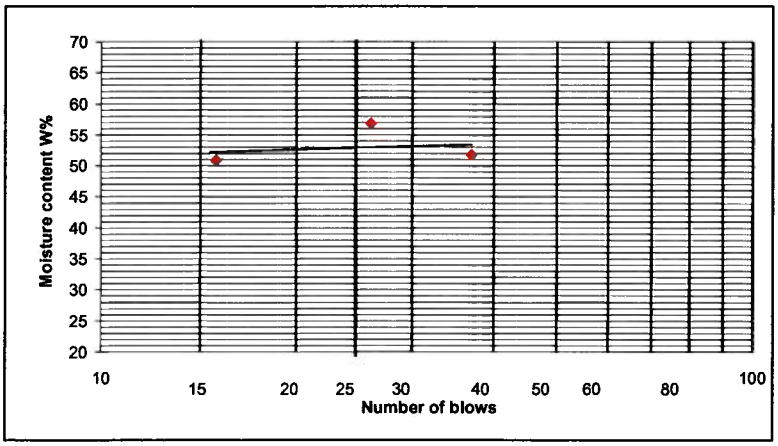
Project : Geotechnical study

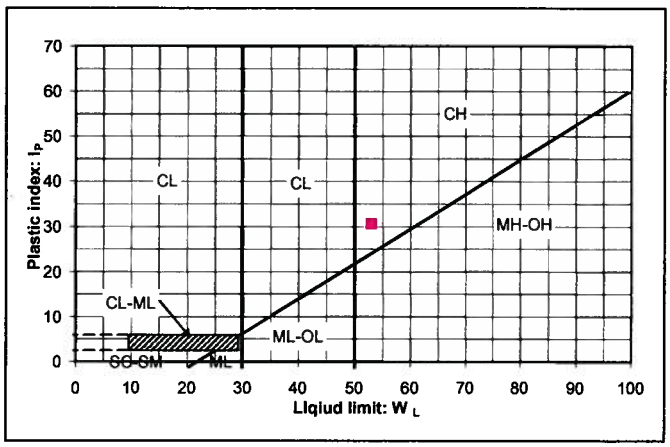
Method		Results			
Not dried:	☐	Natural moisture content:		52.90	W%
Air dried:	■	Liquid limit:		53.00	W_L
Oven dried:	☐	Plastic limit:		22.45	W_P
		Plasticity index:	$I_P = W_L - W_P =$	30.55	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.99673	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	4.40	4.50	3.40
Total mass dry:	4.10	4.20	3.20
Mass container:	3.10	2.90	1.80
Mass of dry soil:	1.00	1.30	1.40
Moisture content:	30.00	23.08	14.29
Average:			22.45%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		52.90%

Liquid Limit							
Number of blows	26	37	15	-	-	-	- - - -
Total mass wet:	7.20	5.90	12.50	-	-	-	g
Total mass dry:	5.10	4.40	9.30	-	-	-	g
Mass container:	1.40	1.50	3.00	-	-	-	g
Mass of dry soil:	3.70	2.90	6.30	-	-	-	g
Moisture content:	56.76	51.72	50.79	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U26
Depth	SS1 2.5'-4.5'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

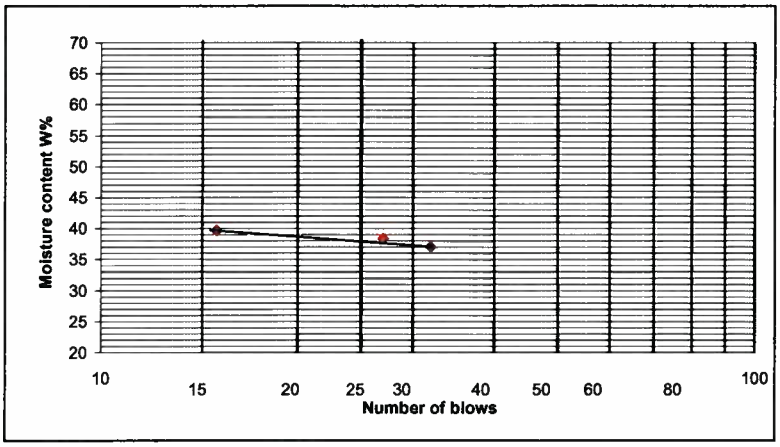
Project : Geotechnical study

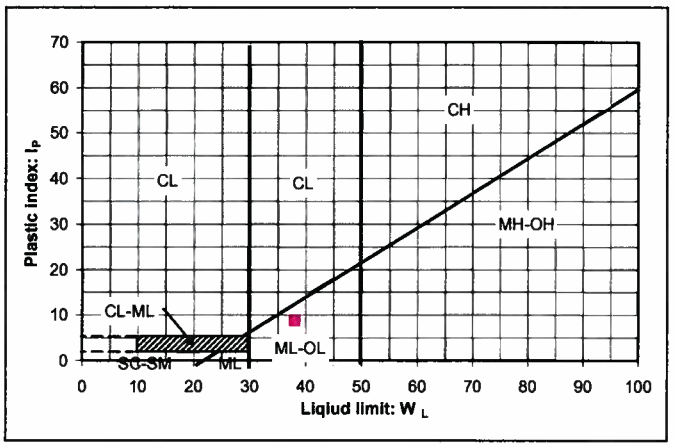
Method		Results			
Not dried:	☐	Natural moisture content:		47.60	W%
Air dried:	■	Liquid limit:		38.00	W_L
Oven dried:	☐	Plastic limit:		29.36	W_P
		Plasticity index:	$I_P = W_L - W_P =$	8.64	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	2.11162	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.40	5.20	5.00
Total mass dry:	5.04	4.70	4.50
Mass container:	3.81	3.00	2.80
Mass of dry soil:	1.23	1.70	1.70
Moisture content:	29.27	29.41	29.41
Average:			29.36%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		47.60%

Liquid Limit							
Number of blows	15	27	32	-	-	-	- - - -
Total mass wet:	11.10	13.00	10.40	-	-	-	g
Total mass dry:	8.80	10.20	8.40	-	-	-	g
Mass container:	3.00	2.90	3.00	-	-	-	g
Mass of dry soil:	5.80	7.30	5.40	-	-	-	g
Moisture content:	39.66	38.36	37.04	-	-	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U26
Depth	SS2 10'-12'
Date	05/05/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

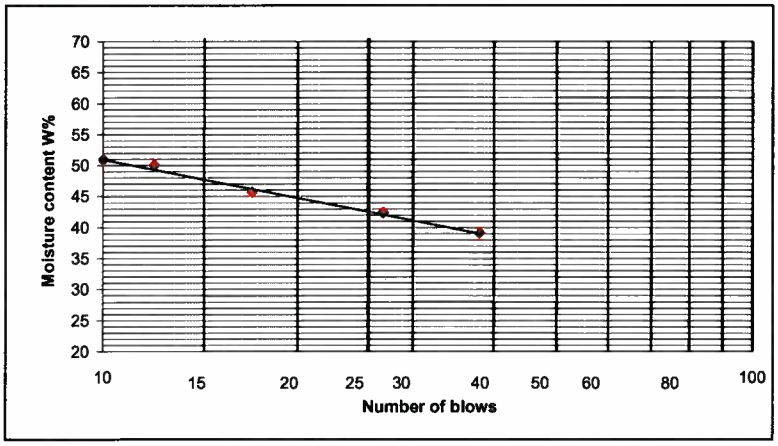
Project : Geotechnical study

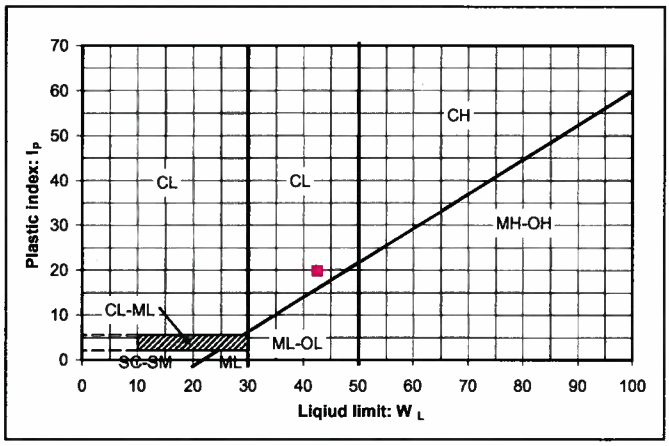
Method		Results			
Not dried:	☐	Natural moisture content:		54.00	W%
Air dried:	■	Liquid limit:		42.50	W_L
Oven dried:	☐	Plastic limit:		22.73	W_P
		Plasticity index:	$I_P = W_L - W_P =$	19.77	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.58161	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	5.40	5.50	-
Total mass dry:	4.90	5.00	-
Mass container:	2.70	2.80	-
Mass of dry soil:	2.20	2.20	-
Moisture content:	22.73	22.73	-
Average:			22.73%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		54.00%

Liquid Limit							
Number of blows	10	12	17	27	38	-	- - - -
Total mass wet:	12.30	10.10	9.70	11.40	12.50	-	g
Total mass dry:	9.40	7.80	7.60	8.90	9.80	-	g
Mass container:	3.70	3.20	3.00	3.00	2.90	-	g
Mass of dry soil:	5.70	4.60	4.60	5.90	6.90	-	g
Moisture content:	50.88	50.00	45.65	42.37	39.13	-	%





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Date :	Date :	Date :

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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U26
Depth	ST3 15'-17'
Date	29/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

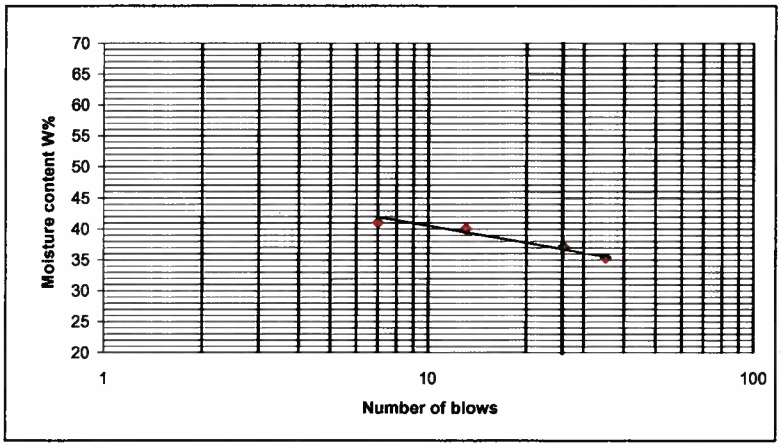
Project : Geotechnical study

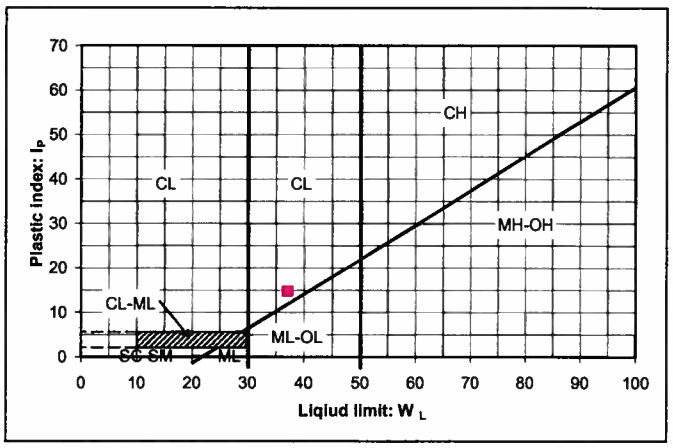
Method		Results			
Not dried:	☐	Natural moisture content:		50.60	W%
Air dried:	■	Liquid limit:		37.00	W_L
Oven dried:	☐	Plastic limit:		22.22	W_P
		Plasticity index:	$I_P = W_L - W_P =$	14.78	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.9203	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	3.60	3.60	-
Total mass dry:	3.20	3.20	-
Mass container:	1.40	1.40	-
Mass of dry soil:	1.80	1.80	-
Moisture content:	22.22	22.22	-
Average:			22.22%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		50.60%

Liquid Limit							
Number of blows	7	13	26	35	-	-	- - - -
Total mass wet:	9.90	7.60	9.80	10.60	-	-	g
Total mass dry:	7.40	5.80	7.50	8.20	-	-	g
Mass container:	1.30	1.30	1.30	1.40	-	-	g
Mass of dry soil:	6.10	4.50	6.20	6.80	-	-	g
Moisture content:	40.98	40.00	37.10	35.29	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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DIVISION LAB JOURNEAUX INC.
801 BANCROFT, POINTE-CLAIRE, QC H9R 4L6

ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U26
Depth	ST4 17.5'-19.5'
Date	29/06/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

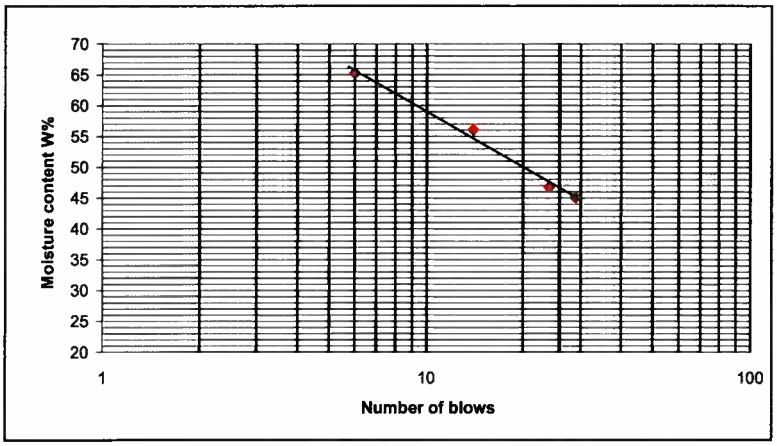
Project : Geotechnical study

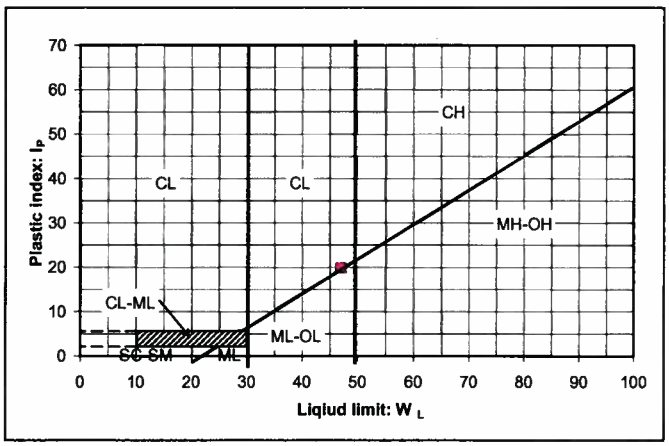
Method		Results			
Not dried:	☐	Natural moisture content:		41.60	W%
Air dried:	■	Liquid limit:		47.00	W_L
Oven dried:	☐	Plastic limit:		27.27	W_P
		Plasticity index:	$I_P = W_L - W_P =$	19.73	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	0.72627	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	2.80	2.70	-
Total mass dry:	2.50	2.40	-
Mass container:	1.40	1.30	-
Mass of dry soil:	1.10	1.10	-
Moisture content:	27.27	27.27	-
Average:			27.27%

Natural Moisture Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		41.60%

Liquid Limit							
Number of blows	6	14	24	29	-	-	- - - -
Total mass wet:	5.10	5.20	7.90	10.00	-	-	g
Total mass dry:	3.60	3.80	5.80	7.30	-	-	g
Mass container:	1.30	1.30	1.30	1.30	-	-	g
Mass of dry soil:	2.30	2.50	4.50	6.00	-	-	g
Moisture content:	65.22	56.00	46.67	45.00	-	-	%





Sampled by: : JB	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

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DIVISION LAB JOURNEAUX INC.
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ATTERBERG LIMITS

ASTM D 4318

Project No.	L-10-1411
Borehole No.	U-28
Depth	13'
Date	12/03/2011
JA No.	---

Client : Mine Arnaud (Sept-Îles, Qc)

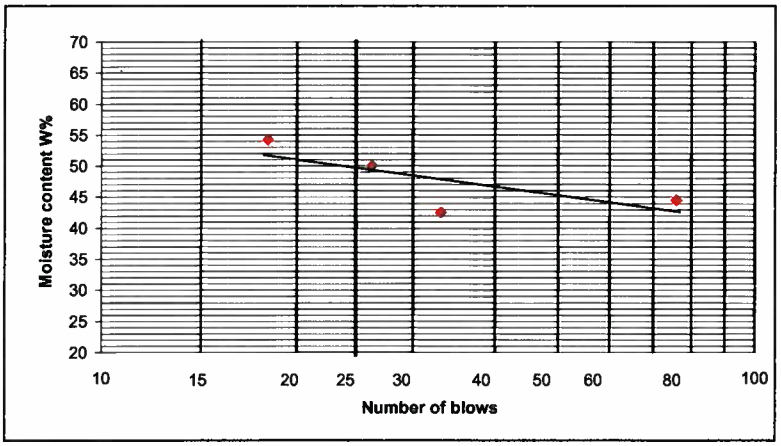
Project : Geotechnical study

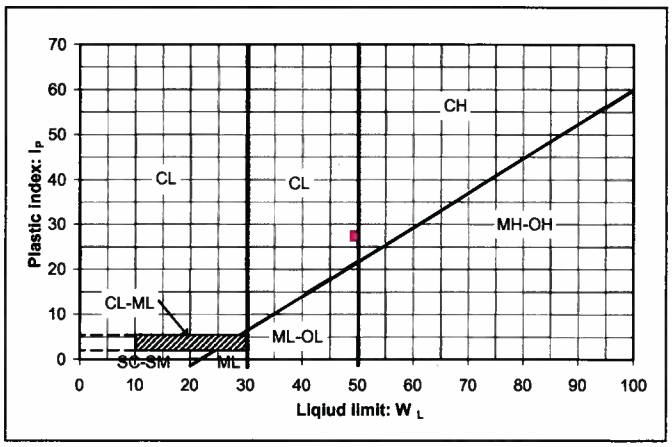
Method		Results			
Not dried:	❑	Natural moisture content:		55.20	W%
Air dried:	■	Liquid limit:		49.50	W_L
Oven dried:	❑	Plastic limit:		22.25	W_P
		Plasticity index:	$I_P = W_L - W_P =$	27.25	I_P
		Liquidity index:	$I_L = (W - W_P) / I_P =$	1.20918	I_L

Plastic Limit			
Contenant No.:	1	2	3
Total mass wet:	2.80	5.00	5.10
Total mass dry:	2.60	4.80	4.90
Mass container:	1.90	3.70	3.90
Mass of dry soil:	0.70	1.10	1.00
Moisture content:	28.57	18.18	20.00
Average:			22.25%

Natural Moistue Content		
4	5	6
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
Average:		55.20%

Liquid Limit							
Number of blows	18	26	76	33	-	-	- - - -
Total mass wet:	10.40	12.20	7.60	9.40	-	-	g
Total mass dry:	7.80	9.10	6.40	7.70	-	-	g
Mass container:	3.00	2.90	3.70	3.70	-	-	g
Mass of dry soil:	4.80	6.20	2.70	4.00	-	-	g
Moisture content:	54.17	50.00	44.44	42.50	-	-	%





Sampled by: : NJ	Analysed by: : AM	Verified by: : NJ
Date :	Date :	Date :

Laboratory Test Results

Certificate of Chemical Analyses on water samples

	Sample location
Sample 1 :	R-07
Sample 2 :	Upstream of T-03A
Sample 3 :	T-03A
Sample 4 :	R-10
Sample 5 :	R-11
Sample 6 :	R-11

AGAT Laboratories

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CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
801 RUE BANCROFT
POINT-CLAIRE, QC H9R4L6

ATTENTION TO: MARC HUBERT

PROJECT NO: L-10-1411

AGAT WORK ORDER: 11M553448

TRACE ORGANICS REVIEWED BY: Félix Brasseur, chimiste

WATER ANALYSIS REVIEWED BY: Georgi Lazarov, chimiste

DATE REPORTED: 2011-11-29

VERSION*: 1

PAGES (INCLUDING COVER): 9

Should you require any information regarding this analysis please contact your client services representative at (514) 337-1000

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 11M553448
PROJECT NO: L-10-1411

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
ATTENTION TO: MARC HUBERT
SAMPLED BY:Marc Hubert
SAMPLING SITE:Sept-Iles

Additional Inorganic analyses

DATE RECEIVED: 2011-11-28
DATE REPORTED: 2011-11-29

				SAMPLE DESCRIPTION:	1	2	3	4	5	6
				SAMPLE TYPE:	SW	SW	SW	SW	SW	Gr. Water
				DATE SAMPLED:	2011-11-22	2011-11-23	2011-11-23	2011-11-23	2011-11-24	2011-11-24
Parameter	Unit	G / S	RDL		2952228	2952229	2952230	2952231	2953753	2953758
Petroleum hydrocarbons C10 - C50	µg/L		100		<100	<100	<100	<100	<100	1670

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to QC PTC (ES cons.)

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 11M553448

PROJECT NO: L-10-1411

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

ATTENTION TO: MARC HUBERT

SAMPLED BY:Marc Hubert

SAMPLING SITE:Sept-Iles

Additional Inorganic analyses

DATE RECEIVED: 2011-11-28

DATE REPORTED: 2011-11-29

		SAMPLE DESCRIPTION:		1	2	3	4	5	6
		SAMPLE TYPE:		SW	SW	SW	SW	SW	Gr. Water
		DATE SAMPLED:		2011-11-22	2011-11-23	2011-11-23	2011-11-23	2011-11-24	2011-11-24
Parameter	Unit	G / S	RDL	2952228	2952229	2952230	2952231	2953753	2953758
Alcalinity	mg/L		5.0	<5.0	<5.0	<5.0	<5.0	9.4	1300
Fluoride	mg/L	1.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phosphorous (WW)	mg/L		0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Total Phosphorus (DW&SW)	mg/L		0.02						101

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to QC PTC (ES cons.)

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Certificate of Analysis

AGAT WORK ORDER: 11M553448
PROJECT NO: L-10-1411

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
SAMPLED BY:Marc Hubert

ATTENTION TO: MARC HUBERT
SAMPLING SITE:Sept-Iles

Dissolved metals

DATE RECEIVED: 2011-11-28

DATE REPORTED: 2011-11-29

		SAMPLE DESCRIPTION:		6
		SAMPLE TYPE:		Gr. Water
		DATE SAMPLED:		2011-11-24
Parameter	Unit	G / S	RDL	2953758
Arsenic (dissoved)	µg/L		1.0	2.4
Cadmium (dissolved)	µg/L		0.8	<0.8
Chromium (dissolved)	µg/L		10	<10
Copper (dissolved)	µg/L		3.0	<3.0
Iron (dissolved)	µg/L		300	<300
Nickel (dissolved)	µg/L		2.0	3.8
Lead (dissolved)	µg/L		1.0	<1.0
Sodium (dissolved)	µg/L		2000	31200
Zinc (dissolved)	µg/L		3.0	<3.0

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Certificate of Analysis

AGAT WORK ORDER: 11M553448

PROJECT NO: L-10-1411

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

ATTENTION TO: MARC HUBERT

SAMPLED BY:Marc Hubert

SAMPLING SITE:Sept-Iles

Inorganic analyses

DATE RECEIVED: 2011-11-28

DATE REPORTED: 2011-11-29

		SAMPLE DESCRIPTION:		1	2	3	4	5	6
		SAMPLE TYPE:		SW	SW	SW	SW	SW	Gr. Water
		DATE SAMPLED:		2011-11-22	2011-11-23	2011-11-23	2011-11-23	2011-11-24	2011-11-24
Parameter	Unit	G / S	RDL	2952228	2952229	2952230	2952231	2953753	2953758
Chloride	mg/L	250	1	2	2	2	2	2	19
Conductivity	umhos/cm		10	23	22	21	21	31	597
pH	pH		NA	5.42	5.05	5.18	5.68	6.16	6.94
Sulfate (WW)	mg/L		20	<20	<20	<20	<20	<20	
Sulfate (DW&SW)	mg/L		2						26

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to QC PTC (ES cons.)

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Certificate of Analysis

AGAT WORK ORDER: 11M553448
PROJECT NO: L-10-1411

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
SAMPLED BY:Marc Hubert

ATTENTION TO: MARC HUBERT
SAMPLING SITE:Sept-Iles

Total metals

DATE RECEIVED: 2011-11-28

DATE REPORTED: 2011-11-29

		SAMPLE DESCRIPTION:		1	2	3	4	5
		SAMPLE TYPE:		SW	SW	SW	SW	SW
		DATE SAMPLED:		2011-11-22	2011-11-23	2011-11-23	2011-11-23	2011-11-24
Parameter	Unit	G / S	RDL	2952228	2952229	2952230	2952231	2953753
Arsenic	µg/L	25	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	µg/L	5	0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Chromium	µg/L	50	10	<10	<10	<10	<10	<10
Copper	µg/L	1000	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Iron	µg/L		300	995	630	924	570	928
Nickel	µg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Lead	µg/L	10	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium	µg/L		2000	<2000	<2000	<2000	<2000	<2000
Zinc	µg/L		3.0	5.0	7.5	4.4	5.3	6.1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to QC (DW)

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Quality Assurance

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

AGAT WORK ORDER: 11M553448

PROJECT NO: L-10-1411

ATTENTION TO: MARC HUBERT

SAMPLED BY:Marc Hubert

SAMPLING SITE:Sept-Iles

Trace Organics Analysis

RPT Date: 2011-11-29			DUPLICATE			REFERENCE MATERIAL				METHOD BLANK			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Additional Inorganic analyses															
Petroleum hydrocarbons C10 - C50	1	MR	2370	2370	0.0%	< 100	95%	70%	130%	NA	70%	130%	NA	70%	130%

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Quality Assurance

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE
PROJECT NO: L-10-1411
SAMPLED BY:Marc Hubert

AGAT WORK ORDER: 11M553448
ATTENTION TO: MARC HUBERT
SAMPLING SITE:Sept-Iles

Water Analysis

RPT Date: 2011-11-29

PARAMETER	Batch	Sample Id	DUPLICATE			REFERENCE MATERIAL				METHOD BLANK			MATRIX SPIKE		
			Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total metals															
Arsenic	1128	2952228	< 1.0	< 1.0	0.0%	< 1.0	86%	80%	120%	97%	90%	110%	96%	80%	120%
Cadmium	1128	2952228	< 0.8	< 0.8	0.0%	< 0.8	95%	80%	120%	99%	80%	120%	100%	80%	120%
Chromium	1128	2952228	< 10	< 10	0.0%	< 10	95%	80%	120%	93%	80%	120%	94%	80%	120%
Copper	1128	2952228	< 3.0	< 3.0	0.0%	< 3.0	96%	80%	120%	97%	80%	120%	92%	80%	120%
Iron	1128	2952228	995	1050	5.4%	< 300	100%	80%	120%	96%	80%	120%	103%	80%	120%
Nickel	1128	2952228	< 2.0	< 2.0	0.0%	< 2.0	93%	80%	120%	95%	80%	120%	96%	80%	120%
Lead	1128	2952228	< 1.0	< 1.0	0.0%	< 1.0	95%	80%	120%	97%	80%	120%	NA	80%	120%
Sodium	1128	2952228	< 2000	< 2000	0.0%	< 2000	89%	80%	120%	104%	90%	110%	109%	80%	120%
Zinc	1128	NA	NA	NA	0.0%	< 3.0	98%	80%	120%	101%	80%	120%	96%	80%	120%
Dissolved metals															
Arsenic (dissoved)	1128	2953758	2.4	2.5	4.1%	< 1.0	100%	80%	120%	89%	80%	120%	NA	80%	120%
Cadmium (dissolved)	1128	2953758	< 0.8	< 0.8	0.0%	< 0.8	99%	80%	120%	98%	80%	120%	102%	80%	120%
Chromium (dissolved)	1128	2953758	< 10	< 10	0.0%	< 10	99%	80%	120%	97%	80%	120%	87%	80%	120%
Copper (dissolved)	1128	2953758	< 3.0	< 3.0	0.0%	< 3.0	100%	80%	120%	94%	80%	120%	100%	80%	120%
Iron (dissolved)	1128	2953758	< 300	< 300	0.0%	< 300	107%	80%	120%	103%	80%	120%	99%	80%	120%
Nickel (dissolved)	1128	2953758	3.8	3.8	0.0%	< 2.0	107%	80%	120%	90%	80%	120%	95%	80%	120%
Lead (dissolved)	1128	2953758	< 1.0	< 1.0	0.0%	< 1.0	95%	80%	120%	93%	80%	120%	NA	80%	120%
Sodium (dissolved)	1128	2953758	31200	34600	10.3%	< 2000	107%	80%	120%	99%	80%	120%	109%	80%	120%
Zinc (dissolved)	1128	2953758	< 3.0	< 3.0	0.0%	< 3.0	100%	80%	120%	98%	80%	120%	107%	80%	120%
Inorganic analyses															
Chloride	1	2952228	2.16	1.77	19.8%	< 1	99%	80%	120%	95%	80%	120%	109%	80%	120%
Conductivity	1	2952228	23	24	4.3%	< 10	107%	80%	120%	104%	80%	120%	NA	80%	120%
pH	1	2952228	5.42	5.34	1.5%		96%	80%	120%	98%	90%	110%	NA	0%	0%
Sulfate (WW)	1	2952228	2.97	2.47	18.4%	< 20	96%	80%	120%	100%	90%	110%	116%	80%	120%
Additional Inorganic analyses															
Alcalinity	1	NA	NA	NA	0.0%	< 5.0	98%	80%	120%	99%	80%	120%	94%	80%	120%
Fluoride	1	2952228	< 0.1	< 0.1	0.0%	< 0.1	81%	80%	120%	83%	80%	120%	99%	80%	120%
Total Phosphorous (WW)	1	2952228	< 0.4	< 0.4	0.0%	< 0.4	91%	80%	120%	98%	80%	120%	93%	80%	120%

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Method Summary

CLIENT NAME: JOURNEAUX ASSOC (DIV. DE LAB JOURNE

AGAT WORK ORDER: 11M553448

PROJECT NO: L-10-1411

ATTENTION TO: MARC HUBERT

SAMPLED BY:Marc Hubert

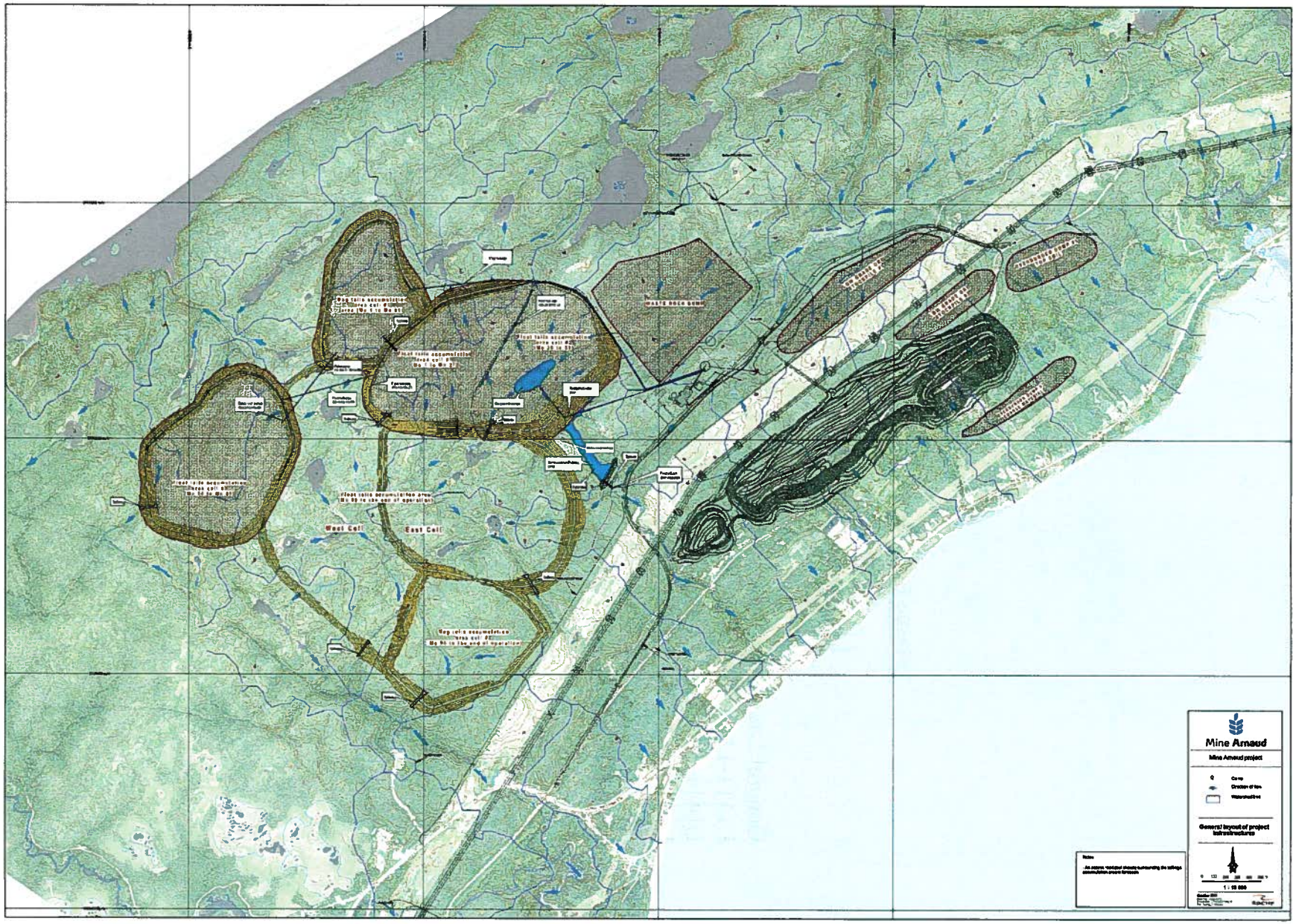
SAMPLING SITE:Sept-Iles

PARAMETER	DATE PREPARED	DATE ANALYZED	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis					
Petroleum hydrocarbons C10 - C50	2011-11-28	2011-11-28	ORG-100-5104F	MA.400-Hyd. 1.1	GC/FID
Water Analysis					
Alcalinity	2011-12-13	2011-12-13	INOR-101-6000F	SM 2320B 21éd. 2005	PC TITRATE
Fluoride	2011-11-28	2011-11-28	INOR-101-6004	SM 4110B 21éd. 2005	ION CHROMATOGRAPH
Total Phosphorous (WW)	2011-12-15	2011-12-15	INOR-101-6048F	MA.300-NTPT 1.1	AQ-2 DISCRETE ANALYZER
Total Phosphorus (DW&SW)	2011-12-15	2011-12-15	INOR-101-6048F	MA.300-NTPT 1.1	AQ-2 DISCRETE ANALYZER
Arsenic (dissoved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Cadmium (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA-SW 846 Met. 3050 et 6020	ICP/MS
Chromium (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Copper (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Iron (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP-MS
Nickel (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Lead (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Sodium (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Zinc (dissolved)	2011-11-28	2011-11-28	MET-101-6105	EPA SW 846 Met. 3050 et 6020	ICP/MS
Chloride	2011-11-28	2011-11-28	INOR-101-6004F	SM 4110B 21éd. 2005	ION CHROMATOGRAPH
Conductivity	2011-11-28	2011-11-28	INOR-101-6016F	MA.115-Cond. 1.0 r3	EC METER
pH	2011-11-28	2011-11-28	INOR-101-6021F	SM 4500-H+ B 21éd. 2005	PC TITRATE
Sulfate (WW)	2011-11-28	2011-11-28	INOR-101-6004F	SM 4110B 21éd. 2005	ION CHROMATOGRAPH
Sulfate (DW&SW)	2011-11-28	2011-11-28	INOR-101-6004F	SM 4110B 21éd. 2005	ION CHROMATOGRAPH
Arsenic	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP-MS
Cadmium	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP/MS
Chromium	2011-11-28	2011-11-28	MET-101-6104F	EPA SW-846 6020	ICP/MS
Copper	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP/MS
Iron	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP-MS
Nickel	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP/MS
Lead	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP/MS
Sodium	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP-MS
Zinc	2011-11-28	2011-11-28	MET-101-6105F	EPA SW-846 6020	ICP/MS

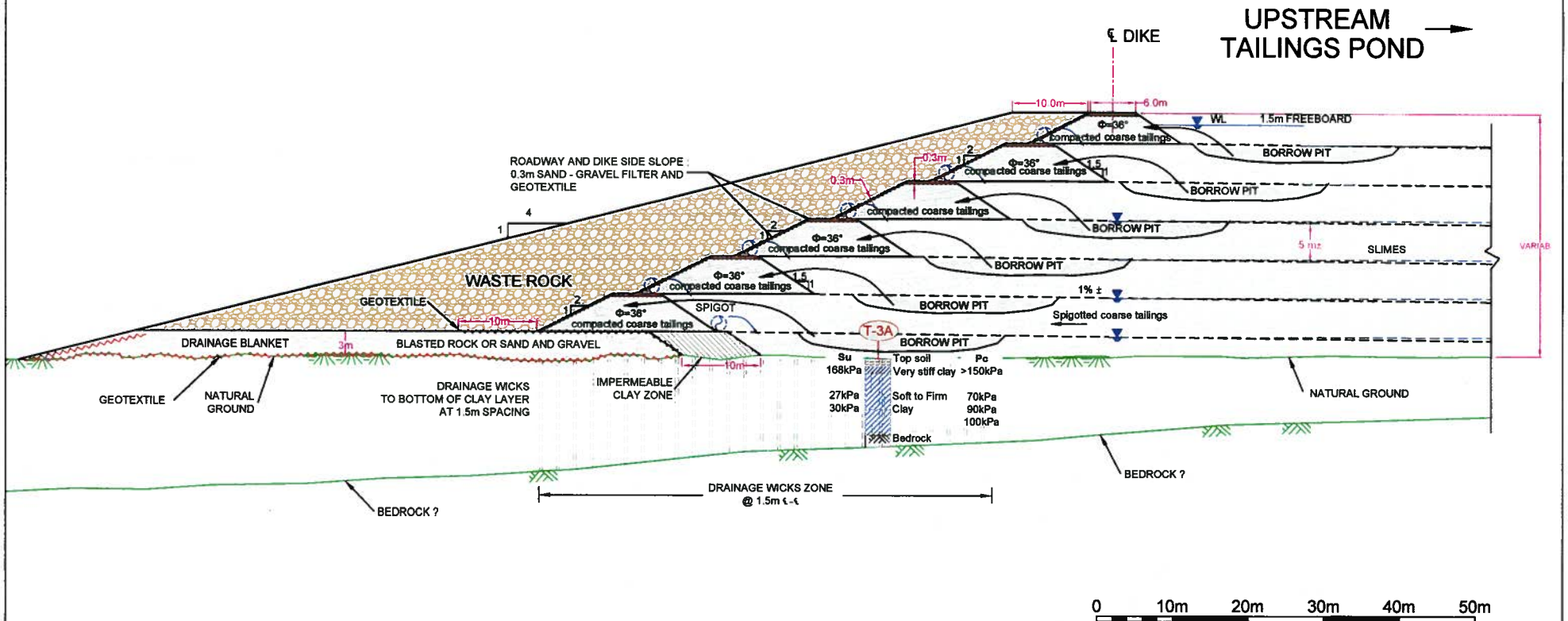
Tailngs Impoundment Area (December 2011)

Layout Plans and Typical Dam Sections

General Layout of Project Infrastructure (Roche, October 2011)
L1411-12 rev.B Dike – Type 1 Typical Section (JA, December 2011)
L1411-13 rev.B Dike – Type 2 Typical Section (JA, December 2011)
L1411-14 rev.B Dike – Type 3 Typical Section (JA, December 2011)
L1411-15 rev.A Dike – Type 3 Typical Section (JA, December 2011)
L1411-16 rev.A Dike – Tailings Feasibilty Study (JA, December 2011)


Mine Arnaud
Mine Arnaud project
General layout of project infrastructures
West Cell
East Cell

DIKE - TYPE 1
TYPICAL SECTION

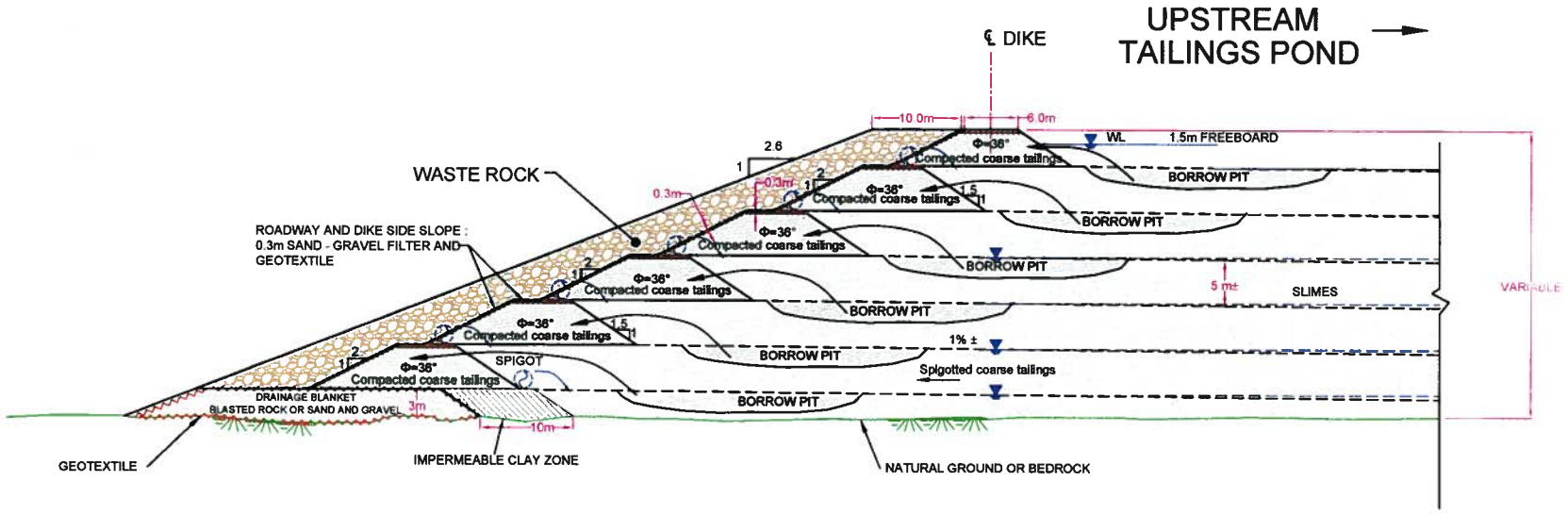


NOTE: UNLESS OTHER WISE SPECIFIED, ALL DIMENSIONS ARE IN METERS.

PRINTED DATE: 20112151027:49

CLIENT: Roche / Ausenco Sandwell	PROJECT: DIKE - TYPE 1 TYPICAL SECTION FEASIBILITY STUDY ARNAUD MINE SEPT-ILES, QUEBEC	SCALE: 1 : 500	JOURNEAUX ASSOC.
DATE: 15-12-2011	PROJECT No.: L-10-1411	DRAWN BY: SE	801, Bencroft, Pointe-Claire, QC H9R 4L6 T 514.630.4997 • F 514.630.8937 info@journeauxassoc.com
		PROJECTED BY: NS	
		APPROVED BY: NS	DRAWING No.: L1411-12 FIGURE No.: --- REV.: B

DIKE - TYPE 2
TYPICAL SECTION



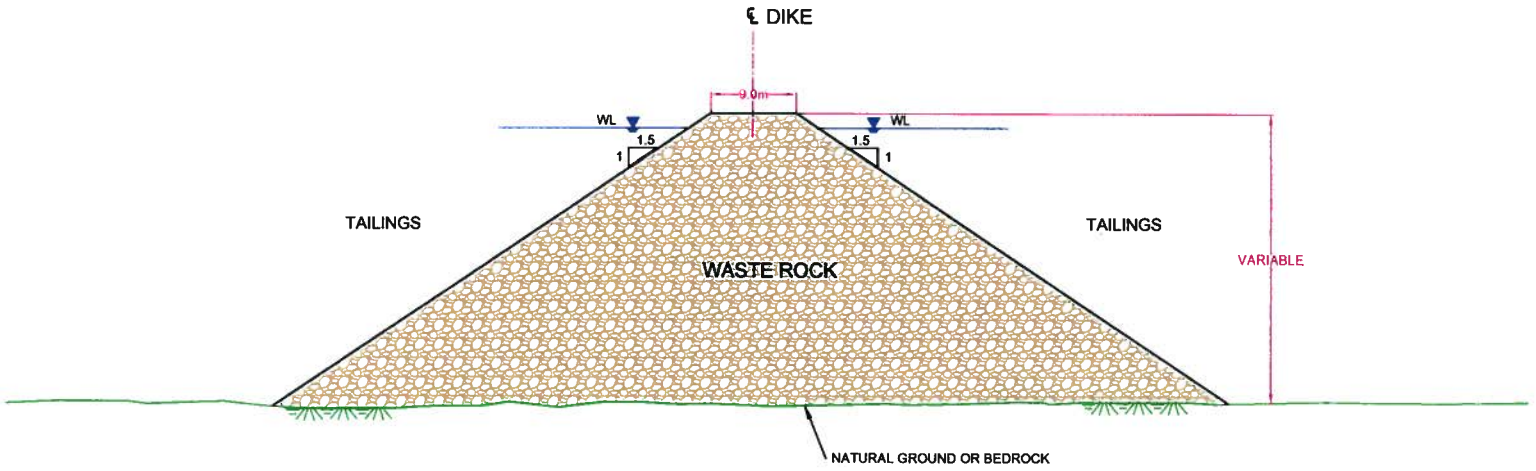
0 10m 20m 30m 40m 50m

Échelle/Scale 1:500

NOTE: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN METERS.

CLIENT: ROCHE Ausenco Sandwell	PROJECT: DIKE - TYPE 2 TYPICAL SECTION FEASIBILITY STUDY ARNAUD MINE SEPT-ILES, QUEBEC	SCALE: 1:500	JOURNEAUX ASSOC.
DATE: 30-11-2011	PROJECT No.: L-10-1411	DRAWN BY: SE	801, Bancroft, Pointe-Claire, QC H9R 4L6 T 514.630.4997 • F 514.630.8937 info@journeauxassoc.com
		PROJECTED BY: NS	
		APPROVED BY: NS	DRAWING No.: L1411-13 FIGURE No.: --- REV.: B

DIKE - TYPE 3
PERVIOUS DIKE
TYPICAL SECTION



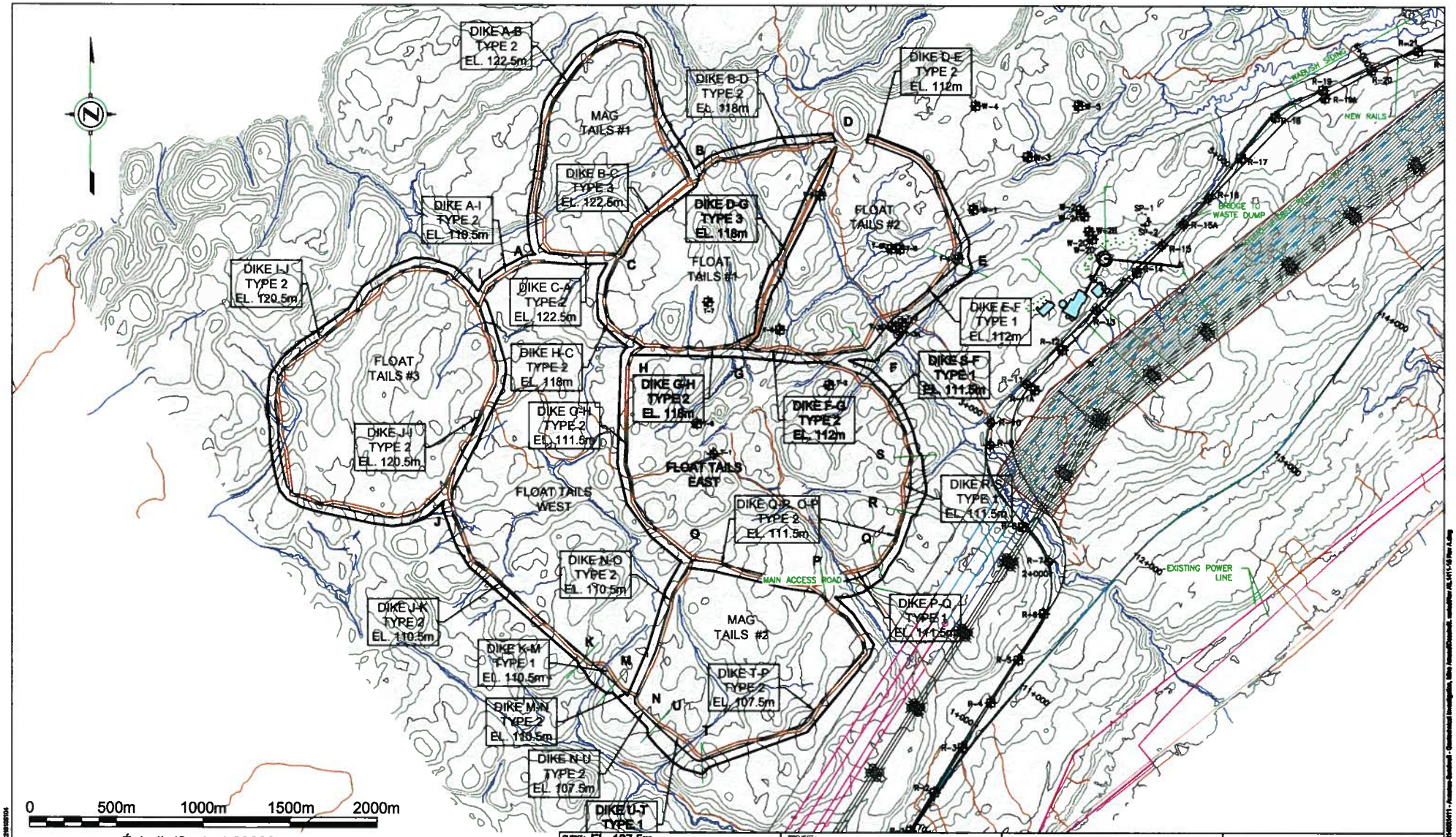
0 10m 20m 30m 40m 50m

Échelle/Scale 1:500

NOTE: UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN METERS.

PRINTED DATE: 20111201111007

CLIENT: Ausenco Sandwell / ROCHE	PROJECT: DIKE - TYPE 3 TYPICAL SECTION FEASIBILITY STUDY ARNAUD MINE SEPT-ILES, QUEBEC	SCALE: 1 : 600	JOURNEAUX ASSOC.
		DRAWN BY: SE	801, Bancroft, Pointe-Claire, QC H9R 4L6 T 514-630-4997 • F 514-630-8937 info@journeauxassoc.com
		PROJECTED BY: NS	
		APPROVED BY: NS	
DATE: 30-11-2011	PROJECT No.: L-10-1411	DRAWING No.: L1411-14	FIGURE No.: --- REV.: B



BACKGROUND PLAN : ACAD-121848-Rail-Diversion-Detailed
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN METERS

CLIENT: EL. 107.5m

Ausenco Sandwell
ROCHE

PROJECT:
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:20000
DRAWN BY :	SE
PROJECTED BY :	NS
APPROVED BY :	NJ

DATE: 14-12-2011
PROJECT No. : L-10-1411

JOURNEAUX ASSOC.
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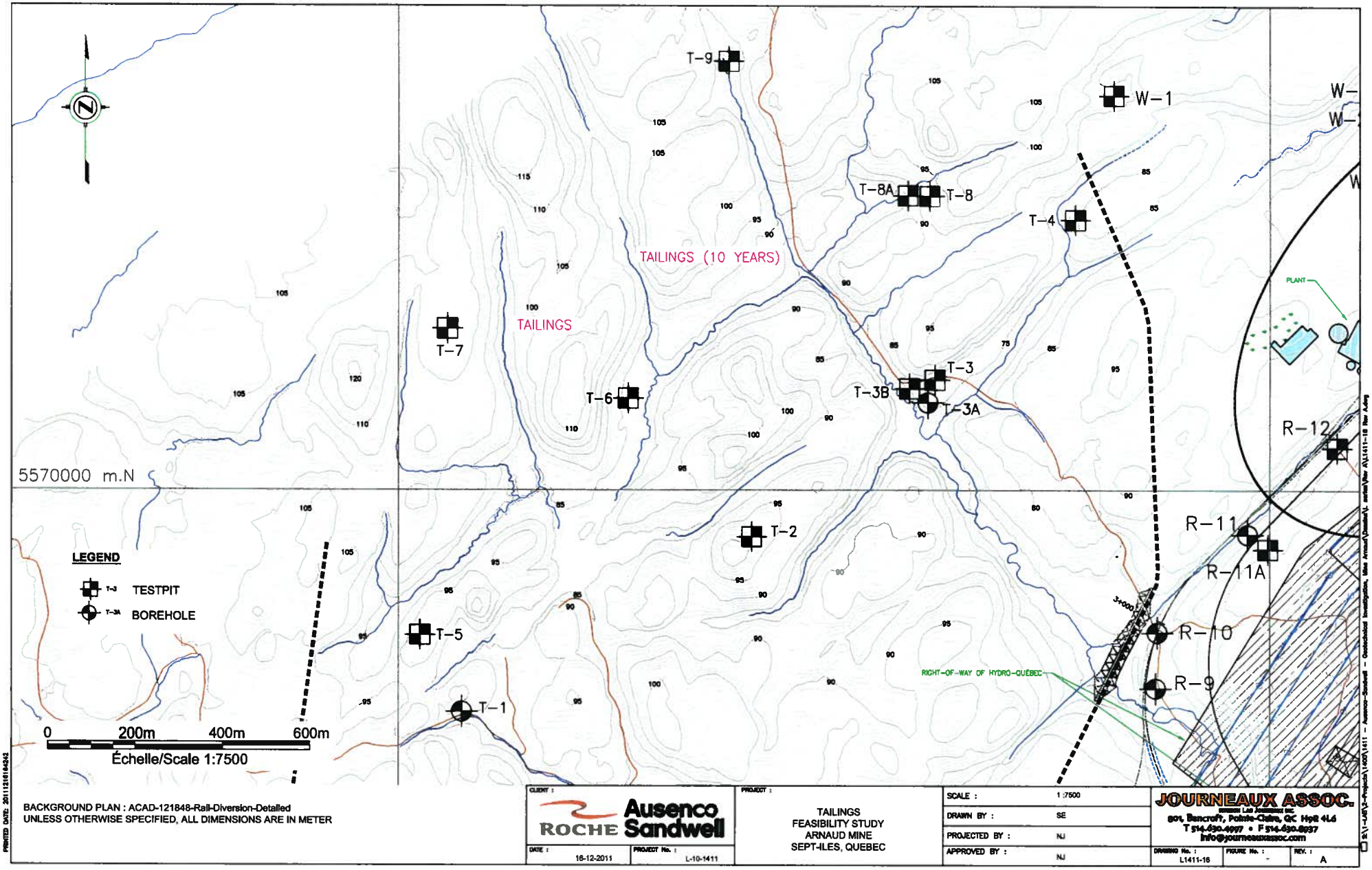
info@journeauxassoc.com

DRAWING No. : L1411-15
FIGURE No. : -
REV. : A - DEC14/11



BACKGROUND PLAN : ACAD-121848-Rail-Diversion-Detailed
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN METER

CLIENT : Ausenco Sandwell / ROCHE
DATE : 16-12-2011
PROJECT No. : L-10-1411

PROJECT :
TAILINGS
FEASIBILITY STUDY
ARNAUD MINE
SEPT-ILES, QUEBEC

SCALE :	1:7500
DRAWN BY :	SE
PROJECTED BY :	NJ
APPROVED BY :	NJ

JOURNEAUX ASSOC.
801, Bancroft, Pointe-Claire, QC H9R 4L6
T 514.630.4997 • F 514.630.8937
info@journeauxassoc.com

DRAWING No. : L1411-16
FIGURE No. : -
REV. : A

PRINTED DATE: 20111216194243

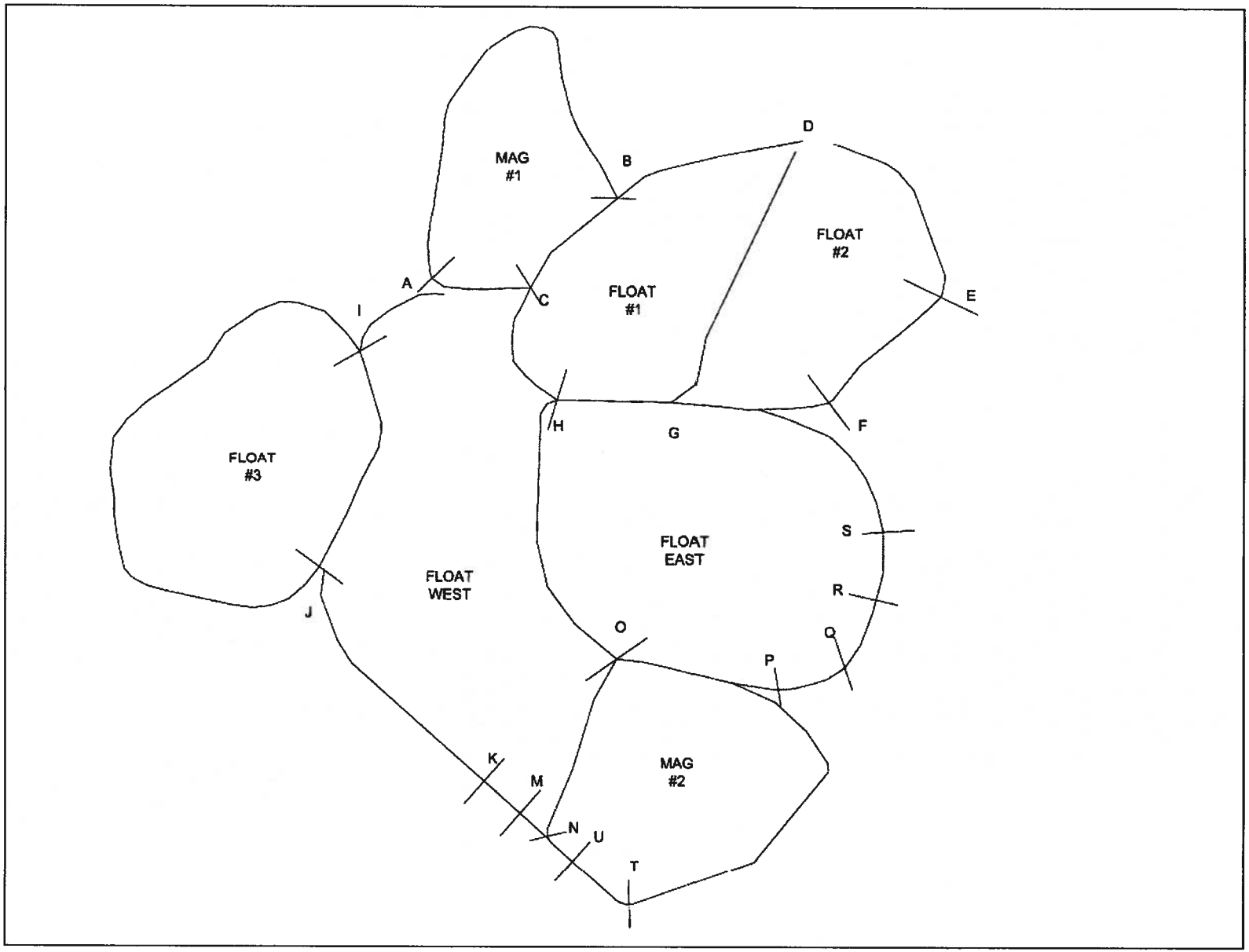
S:\L-10\P\3-Projects\1400\1411 - Ausenco-Sandwell - Geotechnical Investigation, Mine Arnaud\Dessin\L-series\Mxd AU\1411-16 Rev A.dwg

Tailngs Impoundment Area (December 2011)

Volume Estimations

Figure of Dam Locations and Identification
Table of Volume Calculations

Figure of Dam Locations and Identification



15-12-2011

JOURNEAUX ASSOC.
DIVISION LAB JOURNEAUX INC.

Table of Volume Calculations

TAILINGS PARK DIKES
TOTAL QUANTITIES
ARNAUD MINE
05/12/2011

NO CONTINGENCY ADDED IN THE ESTIMATES

TYPE	SECTION		CREST ELEVATION (m)	MATERIAL QUANTITY						
				DRAINAGE BLANKET (m^3)	CLAY (m^3)	WASTE ROCK (m^3)	SAND AND GRAVEL (m^3)	COARSE TAILINGS (m^3)	GEOTEXTILE (m^2)	FOOTPRINT (m^2)
1	E-F	FLOAT TAILS #2	112.0	131869	21969	356302	9231	197145	128629	57321
1	K-M	FLOAT TAILS WEST	110.5	39228	6840	94648	2679	55251	38437	17237
1	P-Q	FLOAT TAILS EAST	111.5	64896	10158	194166	5200	104303	65555	27812
1	R-S	FLOAT TAILS EAST	111.5	57126	9282	161166	4494	88022	57859	24688
1	U-T	MAG TAILS #2	107.5	66374	10377	195258	5266	106814	66759	28437
2	A-B	MAG TAILS #1	122.5	219608	70500	287851	16858	352342	280167	111155
2	C-A	MAG TAILS #1 - FLOAT WEST	122.5	44968	14436	93980	5504	115036	67221	22761
2	B-D	FLOAT TAILS #1	118.0	80647	25890	143204	8387	175288	113889	40820
2	D-E	FLOAT TAILS #2	112.0	89675	28788	83442	4887	102137	108642	45389
2	F-G	FLOAT TAILS #2 - FLOAT TAILS EAST	112.0	69602	22344	145228	8505	177766	102587	35229
2	G-H	FLOAT TAILS #1 - FLOAT TAILS EAST	118.0	50584	16239	85967	5035	105228	69408	25603
2	H-C	FLOAT TAILS #1 - FLOAT TAILS WEST	118.0	60238	19338	77319	4528	94642	74600	30490
2	J-I	FLOAT TAILS #3 - FLOAT WEST	120.5	102982	33060	200154	11722	244997	149094	52125
2	I-J	FLOAT #3	120.5	294966	94692	573402	33581	701870	433698	149298
2	A-I	FLOAT TAILS WEST	110.5	49379	15852	45694	2676	55932	56103	24993
2	J-K	FLOAT TAILS WEST	110.5	123083	39513	142131	8324	173974	148032	62299
2	M-N	FLOAT TAILS WEST	110.5	16886	5421	32126	1881	39323	23807	8547
2	N-O	FLOAT TAILS WEST - MAG TAILS #2	110.5	85899	27576	168367	9860	206089	124596	43478
2	O-H	FLOAT TAILS WEST - FLOAT TAILS EAST	111.5	132082	42402	167963	9837	205594	167041	66854
2	O-P	FLOAT TAILS EAST - MAG TAILS #2	111.5	72536	23286	81649	4782	99941	86205	36714
2	Q R	FLOAT TAILS EAST	111.5	33343	10704	53511	3134	65500	46096	16877
2	S-F	FLOAT TAILS EAST	111.5	83591	26835	164916	9658	201864	120936	42310
2	T-P	MAG TAILS #2	107.5	170453	54720	217298	12726	265982	216566	86275
2	N-U	MAG TAILS #2	107.5	14672	4710	27774	1627	33997	20685	7426
3	B-C	MAG TAILS #1 - FLOAT TAILS #1	122.5	-	-	349923	-	-	-	34584
3	D-G	FLOAT TAILS #1 - FLOAT TAILS #2	118.0	-	-	681481	-	-	-	70275
		TOTAL		2154686	634932	4824921	190384	3969037	2766611	1168997

15-12-2011

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