December 19, 2014

FARO MINE COMPLEX

2014 Annual Pit Slope Stability Inspection

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REPORT

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Units of Measure

Unit	Definition
No.	number
cm	centimetre
m	metre
mm	millimetre
m/d	metres per day
masl	metres above sea level

1.0 INTRODUCTION

1.1 Project Scope

The Faro Mine Complex is located approximately 350 kilometres northeast of Whitehorse, Yukon (Plate 1). The former zinc mining complex consists of the Faro Mine and the Vangorda Plateau Mine.

This report summarizes the observations made and discussions held with site staff during the site visit carried out by Golder Associates (Golder) between August 19 and 22, 2014. In particular, the following items are covered by this report.

- The Faro Pit, Grum Pit, and Vangorda Pit are described, including the mine site history and the pit geology.
- Faro Creek Diversion, Grum Creek Diversion Channel and Vangorda Creek Diversion Flume are described, and current conditions as they relate to pit slope stability are discussed.
- The stability performance of the Faro Pit is discussed, including a discussion of the North and South Instabilities on the east wall of the pit.
- The stability performance of the Grum Pit is discussed, including a discussion of the instability zone on the east wall of the pit.
- The 2014 Faro Pit stability monitoring data (reference pins and monitoring survey points) and 2012 Grum Pit monitoring data (monitoring pins) are reviewed and discussed. Observations on the current monitoring program and the monitoring procedures are also discussed.
- A visual comparison of annual photos of the Faro Pit and Grum Pits is presented.
- The stability performance of the Vangorda Pit is discussed.
- Recommendations are provided with respect to improvements to the current Faro Pit and Grum Pit monitoring programs and procedures.
- In addition, recommendations are provided regarding a study to look at alternative monitoring methods to address the safety concerns and the deficiencies of the current monitoring system.

1.2 Project Background

The Faro Mine was active from 1969 to 1992, and consists of the Faro Pit and the associated waste and water containment facilities. The Vangorda Plateau Mine was active from 1986 to 1998, and consists of the Grum and Vangorda Pits and the associated waste and water containment facilities.

Plate 1: Faro Mine Location

(Faro Mine Remediation Project 2014, Internet Site)

In 1998, all mining was halted at the Faro Mine Complex when the mining operator was placed into receivership. The Government of Canada took over the care and maintenance of the site from 1998 until March 1, 2009. The Faro Mine Complex was managed for the Government by Deloitte & Touche Inc., the court-appointed interim receiver, from 1998 to March 1, 2009. On March 1, 2009, the Government of Yukon (YG) took over the care and maintenance responsibilities of the site, and Denison Environmental Services provided ongoing care, maintenance, and environmental protection services on behalf of YG until March 2012. As of April 1, 2012, Tlicho Engineering and Environmental Services Ltd. (TEES) has been contracted to provide care & maintenance services of the facility on behalf of YG.

As the care and maintenance providers of the Faro Mine Complex, YG has retained Golder Associates Ltd. (Golder) to carry out the 2014 pit slope inspection to assess the stability conditions of the Faro, Grum and Vangorda Pits. Golder has previously carried out slope stability reviews for the Faro Pit from 2002 to 2010, for the Grum Pit in 2009, and for all three pits in 2012. CH2M HILL carried out the 2013 annual pit slope inspection (CH2M HILL 2013).

2.0 SITE GEOLOGY

The ore bodies of the Faro, Grum and Vangorda deposits lie along the western margin of the Selwyn Basin, in sedimentary and volcanic/plutonic rocks that have been variably metamorphosed and have undergone several phases of deformation. The walls of the three pits have been excavated in the Mt. Mye Formation and the overlying Vangorda Formation. The geologic descriptions below are summarized from Curragh Resources (1986, 1987).

- The Vangorda Formation consists of mostly soft, highly fissile, calcareous phyllites. At a higher metamorphic grade (amphibolite facies), the calcareous phyllite is transformed to calc-silicate rocks. This unit also includes, to a lesser degree, mafic meta-igneous rocks occurring as highly foliated chlorite phyllite and carbonated chlorite phyllites that are widespread near the ore zones. An important mineralized sulphide zone is associated with a basal carbonaceous member of this formation, with the carbonaceous rocks being soft, highly sheared and gouged immediately below this zone. Elsewhere, these rocks are described to exist as moderately hard, highly fractured, black siliceous phyllites.
- The Mt. Mye Formation consists of schists, and predominantly grey, non-calcareous, weakly carbonaceous phyllite. The phyllites are interlayered with black carbonaceous phyllite and schists. Amphibolite is a minor rock type in the formation. A white, calc-silicate and marble marker horizon is located about 500 to 700 metres below the top of the Mt. Mye Formation. The formation has a minimum thickness of 2,000 metres, but the base has not been exposed.

3.0 FARO PIT AND FARO CREEK DIVERSION CHANNEL

3.1 Description

The Faro Pit is an inactive open pit mine, roughly elliptical-shaped with the major axis striking northwest–southeast, as shown in Figure 1. The pit is approximately 1,675 metres long and approximately 975 metres wide at the crest (Faro Mine Remediation Project 2011). Mining in the Faro Pit was completed in 1991. Photographs of the existing pit are presented in Appendix A.

Since mining operations were discontinued, a pit lake has accumulated at the bottom of the pit. Due to water quality issues, the pit water requires treatment before it can be released to the environment. Water pumping and treatment facilities are operated at the site to control the water elevation in the pit and to treat the water. The water elevation as of August 14, 2014 was at 1,152 metres above sea level (masl, NAD 83).

The pit is partially located within the Faro Creek Valley. The Faro Creek Diversion Channel (FCDC) and Faro Valley Interceptor (FVI) were originally built as part of the mine development to divert the Faro Creek and surface runoff water from north of the pit area around the southeast side of the Faro Pit and the south side of the mill site, as shown in Figure 1. The diversion channel and valley interceptor collect the majority of the water from upstream of the waste dumps and the Faro Pit, and direct it in a southeasterly direction to the north fork of Rose Creek. These facilities divert clean water away from the pit, and reduce the amount of water that could flow to the pit and would have to be treated. The diversion channel is located immediately behind the crest of the east wall of the pit, and behind the two large instability zones on the east wall. The diversion channel will have to be relocated if excessive ravelling or additional instability develops at the crest of the east wall. A slope stability monitoring program has been established at the crest of the east wall in an attempt to provide as much advance warning as possible of any potential instability that would require implementation of the diversion channel relocation plan.

3.2 Geology

The mined-out ore body in the Faro Pit consists of en-echelon sulphide lenses striking northwest–southeast and generally dipping moderately toward the southwest. These rocks are contained within metamorphosed, interbedded, non-calcareous phyllites, schist and calc-silicate rocks of the Vangorda and Mt. Mye Formations. Rocks immediately adjacent to the sulphide lenses have undergone intensive alteration, and are essentially massive, featureless muscovite/kaolinite clay envelopes. The east wall was excavated along the footwall of the sulphide lenses, i.e., the ore body.

The Big Indian Fault is the most dominant structural feature observed in the east wall (Figure A-1 in Appendix A). This fault strikes roughly north–south and dips toward the west at an inclination of approximately 60 degrees. The west boundary of the north–south trending band of calc-silicate rock in the east wall is defined by the Big Indian Fault.

A thin layer of glacial till covers the bedrock in the area. The till layer varies in thickness from less than a metre up to 100 metres on the north side of the Faro Pit.

A previous review by Golder of geologic cross sections (Golder 2011) indicated the presence of shallow to moderate, westerly dipping strata, and other north–south trending, westerly dipping faults. Smaller, east–west trending faults were also previously noted on geologic plans.

3.3 Previous Pit Slope Stability Performance

The east wall of the Faro Pit experienced ongoing slope instability during and immediately following mining, and two large-scale pit slope failures have occurred in the east wall. These are generally described as the "North Instability" and "South Instability" Zones. Figure 1 and Figure A-1 in Appendix A show the location and extents of these instability zones. Both instabilities occurred along the southwesterly dipping foliation in a slow, on-going deformation process (Golder 2011). To date, both instability zones have exhibited little change from year to year, with only localized crest loss, raveling and erosion. This has resulted in oversteepened head scarps in the till at the crest of the east wall.

Because there was a concern that the potential ongoing instability in the east wall could threaten the integrity of the FCDC, the stability conditions of the east wall were assessed by Golder in September 2002 (Golder 2002). In 2003, remedial works were carried out on the FCDC in an effort to reduce seepage losses, and some adjustments were made to the channel geometry. The road located behind the east wall crest and along the west side of the FCDC was also adjusted and levelled, and a safety berm was constructed along the road. Although some water in the FCDC still continues to seep into the ground, the volume is likely minimal, particularly in comparison to the volume of groundwater that naturally seeps through the rock from the total catchment on the slope behind the east wall. Therefore, the seepage is not a concern with respect to slope stability. Lining the ditch could marginally reduce the volume of water that flows to the pit and needs to be treated. However, the volume of the seepage would need to be quantified to justify the expense of lining the ditch. The ditch was previously lined with plastic, but the sun and the wind has deteriorated the plastic, and very little remains in the bottom of the ditch.

Golder has continued to assess the east wall of the Faro Pit and review the monitoring data periodically since 2005 (Golder 2006, 2007, 2008a, 2008b, 2009, 2011, and 2013). Following the 2005 assessment, recommendations for a slope monitoring program were presented in the Golder site visit report (Golder 2006). The recommended slope stability monitoring procedures were put in place along the east wall of the Faro Pit. The most recent site visit and monitoring data review was carried out by CHM2 HILL in 2013. CHM2 HILL reported that no significant changes to the instability zones were observed (CHM2 HILL 2014).

The 2014 stability conditions of the Faro Pit east wall are discussed in the following section.

3.4 2014 Observations

During the 2014 site visit, the North and South Instability Zones were inspected for cracks and ponded water. The following areas were also inspected, and photographs are provided in Appendix A:

- behind the crest of the east wall;
- behind the backscarps of the instability zones;

- the road behind the crest;
- accessible benches on the slope;
- accessible monitoring points and reference pins; and
- sections of the Faro Creek Diversion Channel.

The following observations were made during the visual inspection of the pit slopes:

- No recent cracks were observed either behind the crest of the east wall or behind the backscarps of the instability zones.
- No cracks were observed along the road behind the crest of the east wall.
- No recent cracks were observed behind the North Instability Zone.
- No recent cracks were observed in the South Instability Zone (Figure A-3).
- Cracks were observed in the till at the sound end of the South Instability Zone (Figure A-4). Some of these cracks had been observed in 2012, but it is possible that new cracks have also developed in this area.
- The till and rock on the northwest side of the pit are slowly raveling and toppling (Figure A-5).
- There is ponded water behind the small dam (Figure A-6) as was observed and reported in 2012.
- The FCDC was conveying water at the time of the site visit. The side slopes appeared to be in good condition and no cracks or offsets in the geometry were observed. The FCDC appears to be diverting the majority of the water away from the crest of the east wall (Figure A-7).
- The minimum distance between the crest of the east wall instability and the FCDC remains in the middle of the North Instability Zone. The crest regression monitoring pins 15354 and 15355 indicate that this area is experiencing crest regression on the order of 0.5 to 2.0 metres since 2008, as discussed in report section 3.4.2.
- The monitoring pins and regression pins that were observed appear to be in poor to good condition (Figure A-8). These are discussed further in Section 3.4.2 of this report.
- The north and northwest rock slopes are exhibiting adequate stability performance. Only localized raveling is occurring on these slopes, mainly in the altered zones. These zones appear to be raveling into talus slopes at angle of repose (Figure A-9). No stability concerns with these walls were identified during the site visit.
- The south side of the pit consists of waste material on the southwest side, benches excavated in rock on the southeast side with waste material on top, and an access ramp in between. The rock benches on the southeast side are raveling into talus slopes at angle of repose. Some bench crests are still visible, but it appears that waste material from above has also raveled onto some portions of the slope, leaving portions that are unbenched and at angle of repose. The waste material on the southwest side is at angle of repose and the waste dump slopes do not exhibit bulging at the toe or the face (Figure A-9). No stability concerns with these walls were identified during the site visit.

- Seepage and water flow into the pit was observed to the north of the North Instability Zone. The water appears to be emanating from the overburden/bedrock contact (Figure A-10) and may be coming from the ponded water behind the crest. Compared to the 2012 photo, there appears to be little difference in the size and shape of the gullies, indicating minimal erosion.
- There is a large berm at the crest of the east wall, on the east side of the access road, behind the south instability zone. A ditch at the toe of the berm, whether by intention or not, is collecting rainwater and surface flow from the road that should be draining into the FCDC on the opposite side, and water is likely infiltrating into the slope (Figure A-11).
- The access road to the pump facility on the west side in pit (Figure 1) has a well-constructed barrier at the end of the road to prevent vehicles and personnel from entering the pit lake (Figure A-10). However, there is no such barrier at the end of the Zone 2 access road (Figure A-10).
- There are areas of rockfall hazard on the west side of the Zone 2 access road (Figure 1) to the pit bottom (Figure A-12). To turn a vehicle around, one must drive directly beneath the unprotected slope at the bottom of the ramp.

3.4.1 Photograph Comparison

Figures A-13 and A-14 in Appendix A show comparison photographs from 2012 and 2014 of the North and South Instability Zones, respectively. Several features in each instability zone were identified in both photographs and compared. No significant differences in the crest, backscarp, or slide material were noted between the 2012 and 2014 photographs.

3.4.2 Monitoring Data Review

A slope monitoring program was implemented at the Faro Pit in 2006, with the following components.

- Crest Regression Monitoring: Reference pins have been installed behind the crest of the east wall along the FCDC in order to provide fixed reference points for measurement of the shortest distance to the crest of the wall. The periodic measurement of distances provides a means to assess crest recession rates. These measurements are primarily carried out by staff on site twice a year.
- Survey Monitoring Points: Survey monitoring points have been established closer to the crest of the east wall in order to provide monitoring of fixed points to assess displacement and ground movements in the areas that have a greater potential for deformation. In addition, survey monitoring points have also been installed uphill beyond the FCDC in natural ground to serve as control points. The periodic monitoring of survey points can provide indications of overall stability conditions as well as information on instability mechanisms should instability develop. The surveying of these monitoring points has been carried out by Yukon Engineering Services (YES), typically once per year.

In addition, site personnel have been carrying out visual inspections of the Faro Pit, and photographs are taken of the walls on a monthly basis.

The reference pin and monitoring point locations are shown on Figure 1, and the monitoring data are discussed in the following section.

3.4.2.1 Monitoring Program Terminology

In the past, there has been some confusion regarding the terms for the various monitoring components. To maintain consistency, the following definitions have been applied.

- Reference pin or bar: An object, such as a mill rod or railroad spike, installed near the crest to serve as a fixed reference point to measure the distance from the crest.
- Survey monitoring point: An object installed on the crest or slope that is surveyed periodically using conventional surveying techniques to determine the UTM grid coordinates of the monitoring points, to detect any deformation in the slope.
- Survey monitoring prism: A permanent survey prism installed at the crest or on the slope that can be surveyed remotely using conventional surveying techniques.

3.4.2.2 Crest Regression Monitoring

The purpose of the reference pins is to physically measure the rate of erosion or retreat of the crest of the wall, in order to determine if and when the FCDC may be undercut at some time in the future. Nine reference pins have been installed just behind the crest of the slope, and the distance from the crest to each individual pin is measured on a regular basis.

Coordinates were provided for reference pins 15351, 15352, 15353, 15354, 15355, and 15356, which were installed in 2008. The locations of these reference pins are shown in Figure 1 and summarized in Table 1.

Coordinates were requested for reference pins 15717, 15737, and 15742, which were installed in 2011. However, YES indicate they do not have the coordinates for these pins. Reference pins 15717 and 15737 were reportedly installed on either side of reference pin 15355. Reference pin 15742 was reportedly installed near reference pin 15354.

Table 1: Location of 2008 Faro Pit Reference Pins

Reference Pin No.	Installation Coordinates (UTM NAD 27)		Bearing of Distance Measurements from Reference Pin to Pit Crest (Azimuth)	Initial Distance Measurements (m) (July, 2008)
	Northing	Easting		
15351	6,914,799.449	585,229.770	235º	11.19
15352	6,914,849.439	585,204.524	245º	11.25
15353	6,915,216.929	585,064.654	240º	17.41
15354	6,915,241.231	585,025.422	235º	8.06
15355	6,915,292.340	584,978.739	220º	5.59
15356	6,915,336.758	584,936.761	225º	17.55

TEES measure the distance from the crest to each pin twice a year, usually in May and September. In previous years, other contractors (Golder, YES and CH2M HILL) have made their own measurements and/or have reported the data collected by TEES. It appears that there is confusion as to the names and locations of some of the pins, based on conflicting information in different consultant's reports. For example, Klohn Crippen Berger (2014) reported that in September 2010, the identification tag for reference pin 15353 was destroyed, and that in 2011 YES tagged this reference pin with another identification tag, No. 13908. However, CH2M HILL (2014) report measuring reference pin 15353 in 2013. The photo of reference pin 15353 in CH2M HILL's 2013 site visit report was however identified as pin 15342 in a similar photo in Golder's 2012 report. Similarly, CH2M HILL indicates that the distance from the closest gully to the berm is 3.5 metres at the location of 15342 (which they reference as 15353); however the measurement provided by TEES of reference pin 15342 is approximately 6.4 metres, which is consistent with Photograph A-2 in CH2M HILL's 2013 report. It is important that the pins should be clearly marked in the field with the correct number.

Plate 2 shows a plot of the relative change in distance for each reference pin by date. The relative change in distance is defined as the difference between the current distance and the initial distance, and a negative distance indicates that the distance from the crest to the pin is decreasing. Because of the confusion with the pins, only the measurements provided by TEES have been plotted. The data from pins 15353 and 13908 and have been plotted together, assuming they are in fact the same pin.

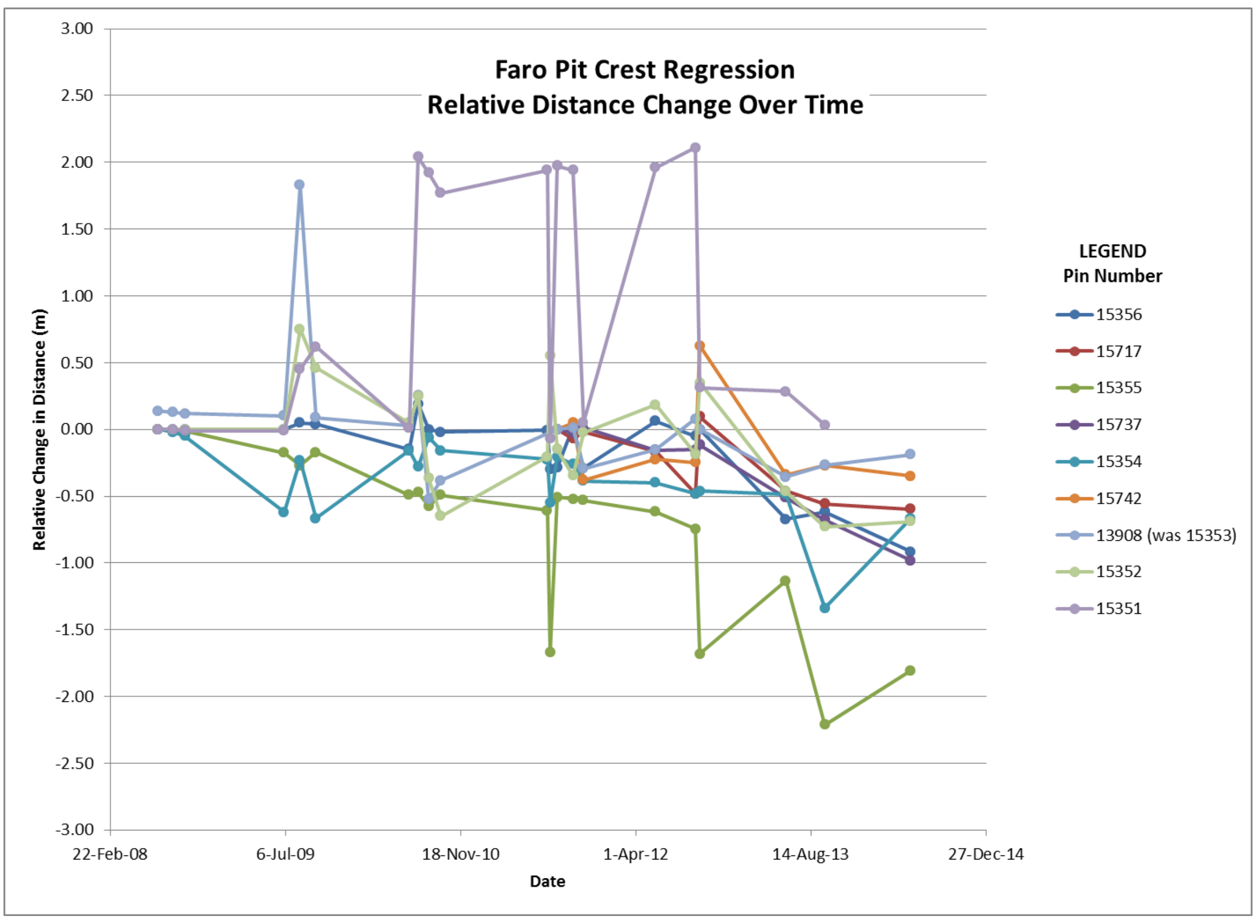

Plate 2: Relative Change in Distance, Faro Crest Regression Monitoring

The plot highlights the potential issues with the accuracy and methodology used to measure the reference pins, even after improvements in 2013. As previously recommended, additional points should be added behind or in front of each pin so that the measurement is taken along the same bearing each time, regardless of the person taking the measurement.

Plate 3 shows a 5-point rolling average to reduce the variability in the data. From this plot it is evident that there is a trend of decreasing relative distance for the majority of the reference pins to the crest, which indicates that crest regression is occurring. Crest regression appears to be occurring to a higher degree near reference pins 15354 and 15355. The measurements for these pins indicate crest loss of 0.5 and 2.0 metres, respectively. Pins 15353 and 15355 are near gullies that drain into the pit (Figure 1) and pin 15354 is in between these two pins. All three pins are located behind the steepest backscarps in the till and are also the closest to the access road.

Pins 15742 and 13908 appear to indicate minor crest regression of less than half a metre. Pin 15351 does not appear to have reliable data that can be interpreted.

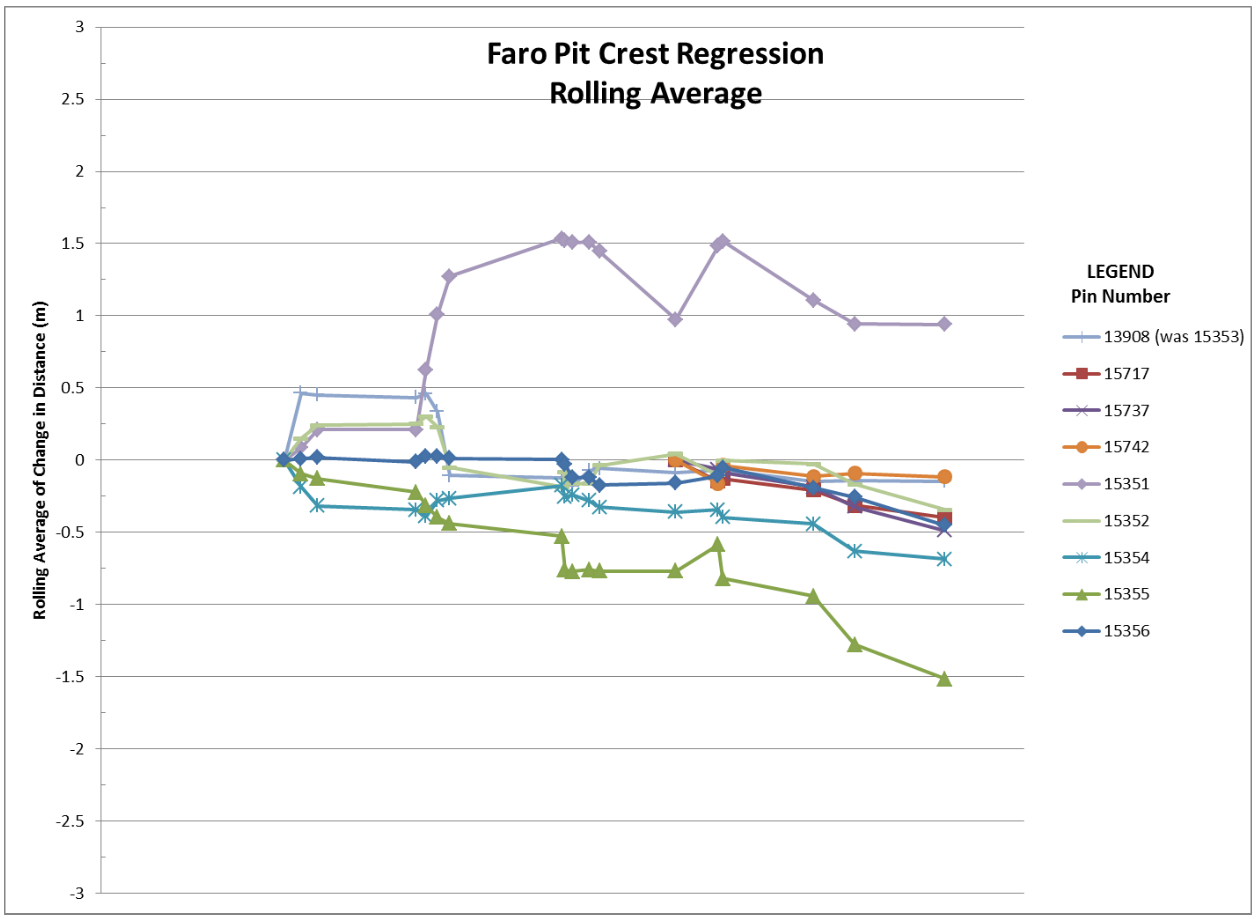

Plate 3: 5-Point Rolling Average of Faro Regression Monitoring Data

3.4.2.3 Survey Monitoring Points

Seven monitoring points were installed behind the crest of the Faro Pit east wall within the area of greater potential for ground deformation. In addition, two monitoring points were installed uphill of the FCDC. These latter monitoring points are located in an area that is not expected to exhibit deformation, and can be used as baseline monitors to determine the accuracy of the monitoring system. The periodic monitoring of all survey points is expected to provide indications of overall stability conditions.

Survey monitoring points were installed in August 2006, when initial readings were taken. Since the initial installation of monitoring points, no additional monitoring points have been installed. All existing monitoring points were recently surveyed in September 2014.

The location of the survey monitoring points is shown in Figure 1 and is summarized in Table 2. Relative displacement graphs and wander plots of the monitoring point data are presented in Figures D-1 to D-9 in Appendix D.

The relative displacement graphs show the change in vertical, horizontal and total displacement from year to year. If the vertical displacement shows a downward trend, this would indicate that the monitoring point is moving downward (or the survey station is moving upward). If the horizontal displacement shows an increasing or decreasing trend, this would indicate that the monitoring point is moving in the horizontal plane, and the wander plot should be checked to determine the direction of movement.

The wander plots show the relative change in northing and easting of the prisms. The relative change is defined as the change from the current survey to the original survey. If the points in the wander plots show a "star-shaped" pattern that hovers around the origin, it typically indicates that the point is not moving and is simply reflecting the accuracy of the monitoring system. Conversely, if the wander plot shows a linear pattern from point to point, it typically indicates that the prism is exhibiting displacement in a given direction.

Table 2: Faro Pit Survey Monitoring Point Locations

Survey Prism	Initial Installation Coordinates		
	Northing	Easting	Elevation
13872	6915376.00	584838.73	1289.09
13873	6915330.14	584922.20	1298.26
13874	6915302.30	584972.86	1297.44
13875	6915262.94	585078.53	1303.92
13876	6915108.37	585074.49	1281.13
13877	6915066.79	585200.63	1300.46
13878	6915002.33	585128.77	1280.65
13879	6914854.63	585228.55	1275.00
13880	6914786.53	585240.53	1269.17

The wander plots in Appendix D exhibit a degree of accuracy varying between 30 and 40 mm in the east–west direction, and 25 to 50 mm in the north–south direction. This range of accuracy is slightly larger than most mine pit slope surveying systems. Accuracies on the order of 25 to 30 mm can typically be achieved at active mines where surveys of fixed monitoring prisms are being carried out on a weekly or monthly basis. At the Faro Pit, removable survey prisms are attached once a year to carry out the survey and these likely decreases the accuracy of the surveys. Nevertheless, the degree of accuracy at Faro is considered to be appropriate for the large scale deformation that the monitoring of survey points is intended to detect.

Notwithstanding the above, it appears that some or all of the surveys taken in October 2013 were outside the typical range of accuracy. The displacement graphs for monitoring points 13872, 13873, 13874, and 13875, in particular, show a large change in vertical displacement between October 2012 and October 2013, but in 2014 the vertical displacements return to a level similar to that from 2012. Likewise, the wander plots for these prisms show a large jump between points 10 and 11 (which represent the 2012 and 2013 surveys, respectively) and large jump back for the following survey in 2014 (point 12). It has been previously recommended that the survey data be plotted as soon as possible to be able to detect any issues with the data. As this does not appear to have been done in 2013, the survey was not corrected.

The review of the monitoring data indicates that, with the possible exception of prisms 13874, 13875 and 13876, none of the monitoring points are exhibiting displacements beyond the accuracy of the monitoring system. The three monitoring points that exhibit possible displacement are discussed below, in order of the magnitude of displacement. Figure D-10 shows the total cumulative displacement vectors in plan view for these three monitoring points.

Monitoring point 13875 is located at the crest of the east wall on the far side of the road. This monitoring point exhibits a total cumulative displacement of about 92 mm from installation in 2006 to 2014. The plot of total vertical displacement in Figure D-4 exhibits a degree of variability, but it appears that about 60 mm of negative vertical displacement have occurred since installation. The plot of total horizontal displacement indicates approximately 70 mm of positive horizontal displacement over the same time period. The horizontal displacement appears to show an increasing trend since 2010; however, it is unclear if there is an increasing trend in the vertical displacement. The overall displacement direction is toward 241° azimuth, with a plunge of minus 40 degrees. This trend can be seen in last five surveys shown on the wander plot (points 8 to 12) that are progressively moving away from the origin. As shown in Figure D-10, the overall trend direction is to the southwest and out of the slope, and so is considered to be plausible displacement. In 2012, Golder noted this trend and questioned the accuracy of the 2012 survey (point 10 on the wander plot). Golder recommended that the subsequent survey (point 11) be plotted immediately to confirm if actual displacement was occurring. It does not appear that this recommendation was carried out, and CH2M HILL do not mention this monitoring point in the 2013 report.

Of concern is the fact that monitoring point 13875 was installed in an area that was considered to be stable, and was intended to be a stable reference point to determine the accuracy of the monitoring system. Similarly, monitoring point 13877 was installed in another area considered to be stable. If the signs of displacement evident for monitoring point 13875 were due to some kind of survey error, it is expected that the same signs would be evident for monitoring point 13877. However, this is not the case. The displacement graph and wander plot for monitoring point 13877 indicate very little change, except for the October 2013 survey, which may not be a reliable survey. Given these considerations, it would appear that actual displacement is occurring near monitoring point 13875. However, the magnitude and velocities are small and may be reflecting slow, creeping deformation. Assuming the pin has not been deliberately or accidentally moved, it has moved about 92 mm in 8 years, which averages to about 10 mm (1 cm) per year.

Monitoring point 13876 is located at the backscarp of the north instability. This monitoring point exhibits a total cumulative displacement of about 82 mm. The overall average displacement direction is toward 181° azimuth, with a plunge of minus 62 degrees. This trend can be seen in the wander plot in Figure D-5 (points 8 to 12, excepting 11). As shown in Figure D-10, the overall trend direction is to the south, which is plausible if related to localized deformation at the backscarp.

Monitoring point 13874 is located at crest of the east wall, to the north of the north instability. This monitoring point exhibits a total cumulative displacement of about 70 mm. The wander plot for this monitoring point (Figure D-3) appears to be more erratic, but there is a possible displacement trend. The overall average displacement direction is toward 238° azimuth, with a plunge of minus 51 degrees, which is out of the slope to the southwest. This trend can be seen in the wander plot (points 9, 10 and 12) as well as in Figure D-10.

Monitoring points 13874 and 13875 are relatively close to each other and the displacement trends are similar, which could indicate that the area where they are located is exhibiting slow deformation. Monitoring point 13876 is farther away, and may be reflecting only localized movement.

The following considerations follow from the review of the monitoring point data.

- The survey accuracy in 2013 appears to be beyond the usual range exhibited by the monitoring data in previous years. The wander plots presented in the 2013 review (CH2M HILL 2014) show the majority of points moving to the northwest with a magnitude greater than previous surveys; however, this was not investigated or discussed in the 2013 report.
- It is likely that the survey data were not plotted until much later, and so the potential error in the survey was not detected in time to correct it.
- The displacements evident in monitoring points 13874, 13875 and 13876, although small, highlight the importance of continued monitoring of the slope, as well as the importance of a timely review of the data. This applies equally to the Grum Pit instability zone.

3.4.2.4 Pit Lake Level

Plate 4 shows the change in the Faro Pit lake level from January 2004 to August 2014. The pit lake levels have historically fluctuated between 1,141 and 1,143 masl. However, in April 2013 pit lake levels rose beyond the historical maximum due to suspension of water treatment because of safety issues with the plant. As of August 11, 2014, the pit lake level is at approximately 1,151 masl, which is 7 metres above the maximum recommended elevation of 1,144 masl, and 1 metre above the estimated elevation of the lowest contact between overburden and bedrock at approximately 1,150 masl (Klohn Crippen Berger 2014). There is a concern that pit water could seep into the overburden and contaminate groundwater. As well, rising water levels have the potential to destabilize the pit slopes. However, the current recommended maximum water level is based overburden seepage issues and not on pit slope stability concerns. YG has indicated that it is in the process of resolving the water treatment suspension and intends to pump the pit lake back down to appropriate levels as soon as practicable.

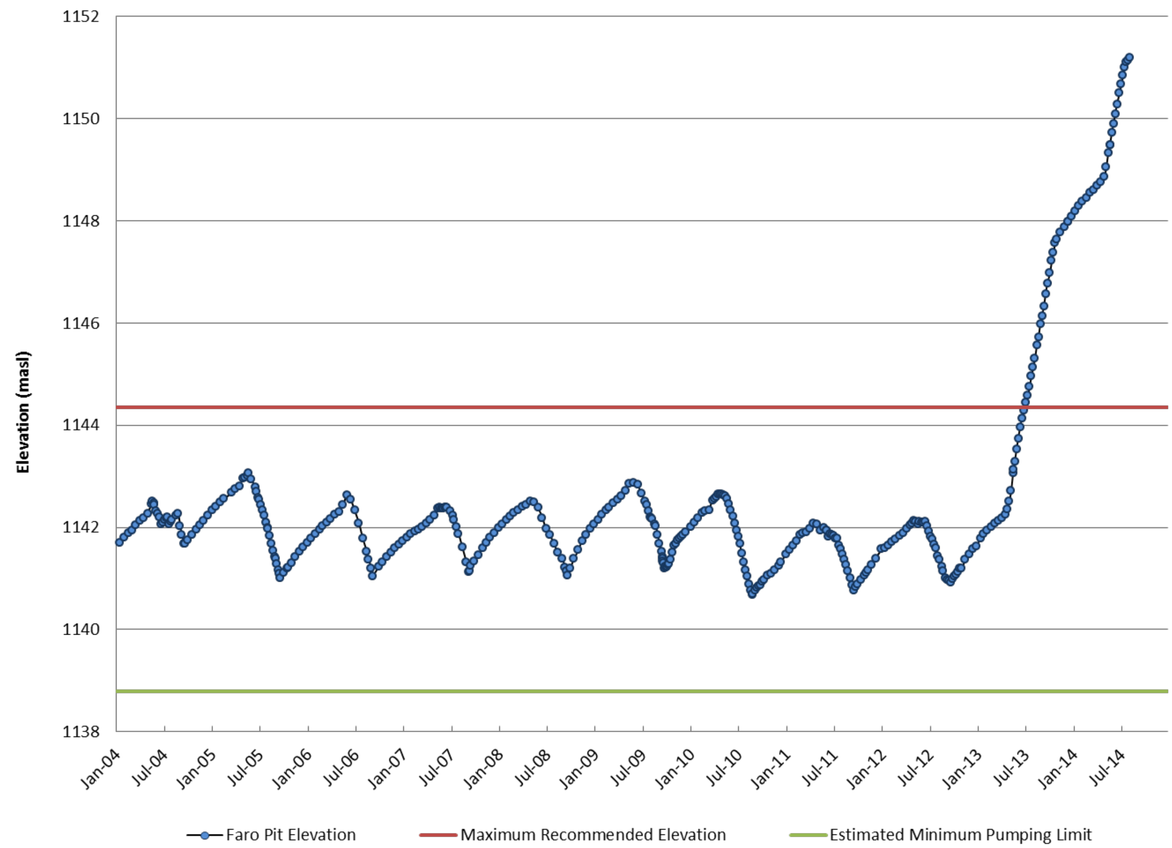

Plate 4: Faro Pit Lake Levels to August 11, 2014

3.5 Faro Pit Recommendations

- Monitor the water in the ditch on the east side of the berm on the east wall during the spring and fall. If large amounts of ponded water are observed, grade the ditch so that the water will flow along the ditch and not form large ponds of water that could infiltrate into the slope.

- There is no easy way to remove the ponded water behind the dam in the northwest corner of the pit unless it is pumped. The water level in this pond should be visually monitored during the spring and fall. If drainage is not occurring and water levels are rising then it should be pumped. Include this recommendation in the Emergency Response Plan and have a pump available for emergency pumping.

- Construct a berm at the end of the Zone 2 access road to prevent someone from driving or falling into the pit lake, similar to the one at the end of the west access road. If this road is used to access the lake itself, erect a moveable barrier such as a construction barrier.

- Construct berms on south side of the Zone 2 access road where rockfall hazards exist. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform of rockfall hazard and required setback distance.

- With respect to the crest regression pins, the frequency of the monitoring should be increased from twice yearly to monthly, because of the importance of the FCDC behind the crest. The monitoring pins can continue to be surveyed once per year.
- Repair any damaged wooden marker structures over the crest regression pins and replace missing tags on the pins. Ensure that all the reference pins are tagged correctly so that the various contractors are able to refer to the correct pins when taking measurements and reporting data. In addition, it is recommended that YG ensure that there is documentation of the coordinates of all the monitoring points and pins so they may be plotted correctly in reference maps by contractors. If any coordinates are missing, YES should survey them as soon as practicable.
- As previously recommended, the monitoring point survey data should be plotted as soon as possible to determine if there is an error with the survey so that the monitoring points can be re-surveyed if necessary before they are covered with snow. Considering that the monitoring points are only surveyed once a year, not reviewing the data in a timely manner could result in significant displacement of the slope not being detected in a timely manner.

4.0 GRUM PIT

4.1 Grum Pit Description

The Grum Pit is oval in shape, with the long axis trending northwest–southeast, as shown in Figure 2. The pit is approximately 850 metres long and approximately 700 metres at its widest point. The east wall represents the main slope of the mined pit. The crest of the east wall is located at approximately 1,300 masl. The pit bottom is currently flooded, but a bathymetry survey conducted by Laberge Environmental Services indicates a minimum pit floor elevation of 1,134 masl (Golder, 2009).

Mining at the Grum Pit was carried out intermittently from 1990 to 1998, and the pit is currently inactive. The water level in the pit has been continuously rising.

The Grum Pit has been excavated mainly in calcareous phyllites and schists of the Vangorda Formation, with minor exposures of sulphides, and minor post-metamorphic gabbro dykes.

In terms of distinct geologic structures, several faults are reported to exist within the Grum deposit. The main structural features include the following (Golder 2010).

- Faults that truncate the deposit on the northwest and southeast sides, and would not be exposed in the pit. The main off-set displacements within the deposit are associated with these moderately dipping (35 to 45 degree) structures. In the vicinity of these faults, the surrounding rocks vary from intact rock that is similar to the enclosing phyllites to approximately 3 to 10 meter thick zones of gouge and fractured rock.
- A steep, northwest dipping fault set that trends approximately 060˚ azimuth, and intersects the deposit with a down drop of approximately 60 meters to the northwest.
- A north–south striking fault which juxtaposes the Mount Mye phyllite member with the Vangorda phyllite member (CHM2 HILL 2014).
- Smaller faults mapped underground and later in the pit, trend on average 080˚ azimuth and are steeply-dipping.
- Joints mapped underground and on surface tend to strike 060˚ azimuth and dip sub-vertically.

The main drainage in the area of the Vangorda Plateau is the Vangorda Creek. The Grum Pit is located to the north of this creek, and most of the area in the vicinity of the pit prior to mining drained to the Grum Creek, a secondary tributary flowing into Vangorda Creek. Apparently, the pit area prior to mining was not intersected by well-defined drainage, but it was described to be generally wet, and a shallow lake, the Doal Lake, was located within the current pit area. As part of the mining development, surface water was subsequently diverted around the Grum Pit via the Grum Interceptor Ditch (Figure 2). Since mining operations ceased in 1998, water from groundwater flow, surface run-off and precipitation has accumulated in the pit, forming the existing pit lake. The current water level is at approximately the 1,217 meter elevation.

The stability performance of the rock walls has reportedly been adequate. However, the east wall of the Grum Pit was excavated through a bedrock paleo-valley infilled with glacial till reaching thicknesses of 100 metres. Layers of sand and gravel were also encountered within the till (Golder 2010). This thick overburden soil sequence was exposed in the pit slopes on the east wall of the Grum Pit, and large-scale slope instability developed within these sediments. Apparently, the slope instability occurred during the temporary mine shut down from late 1996 to mid-1997, when mining, dewatering operations, and slope overburden slope depressurization were suspended. Water flow at the base of the till was reportedly considered to have caused the overburden instability (Deloitte & Touche 2002). Golder provided a review of the stability of the east wall in 2009 (Golder 2010). Recommendations for monitoring the instability zone were also provided.

Between the time of failure and the 2009 site visit, the limits of the instability zone expanded to the south and north, as well as extending to the east and to the upper portion of the pit wall (Golder 2010).

The stability conditions of the Grum Pit east wall are discussed in the following section.

4.2 2014 Observations

During the 2014 site visit, the crest of the east wall of the Grum Pit was inspected for recent cracks and ponded water. The following areas were inspected, and photographs are provided in Appendix B:

- behind the crest of the east wall;
- behind the backscarp of the instability zone;
- the road behind the crest;
- the North and South Arrays of reference bars; and
- the Grum Pit Interceptor Ditch.

The following observations were made during the visual inspection of the pit slopes:

- With respect to overall stability, the instability zone (Figure B-1 in Appendix B) has remained relatively unchanged since the 2012 site visit based on field observations and a photo comparison.
- Some small regressive failures have occurred in the till at the crest, as shown in Figure B-2.
- Fresh cracks were observed to the south of the south array of reference bars (Figure B-3).
- The distance from the north corner of the chain link fence surrounding the substation to the edge of the pit was measured at about 2.3 metres; however the edge was not approached and this distance was estimated visually from the edge of the fence. The fence is also deformed, which may be related to slope displacements (Figure B-4).
- The ground in front of reference bar GP-N3 has dropped further since the 2012 site visit (Figure B-5). The displacement is about 60 cm in vertical distance.
- Fresh cracks were also observed to the north of the instability zone, at the crest.
- Active raveling and slumping on the east wall was reported by TEES in October 2013 but was not observed during the site visit.

- The pit lake level was observed to be higher than in previous years.
- Minimal ponded water was observed behind the crest. However, this may be due, in part, to a dryer year. Ponded water can still occur in wetter years and is still a concern due to seepage of water into the slope.
- The reference bars in the North and South Arrays appear to be in good condition, with the exception of GP-S4, which has fallen over. TEES are apparently still measuring to this reference bar. The monitoring data are discussed further in Section 4.2.2 of this report.
- The Grum Pit Interceptor Ditch appears to be in fair to good condition (Figure B-6). The ditch was mostly dry. The south end is overgrown with vegetation.
- The north, south and west walls are exhibiting adequate overall stability. Based on the photographs and visual inspection, only localized raveling of the bedrock is occurring on these slopes, and the bench crests are mainly intact (Figure B-7).
- However, some localized planar failure is occurring in the northwest corner of the pit, where the slope is developing into a talus slope at angle of repose (Figure B-8). This zone is not directly beneath a working area or ramp and so is not an immediate hazard. However, at the end of the access ramp into the pit, there is an area of rockfall near two power poles. This area does not have berms in place for rockfall protection (Figure B-8).
- In the southwest corner of the pit, where the west ramp into the pit begins, a portion of the slope appears to be slumping (Figure B-9), which could affect the access road over the long-term.
- The north slope above the Grum Slot Cut is also slowly eroding and raveling. A power pole is precariously near the edge, in an area that does not appear to be stable over the long term (Figure B-10).

4.2.1 Photograph Comparison

Figures B-11 to B-13 in Appendix B show comparison photographs from 2012 and 2014 of the instability zone. Several features in each instability zone were identified in both photographs and compared. It is evident from the photographs that slumping and raveling continue to occur in the oversteepened backscarp at the crest. However, no significant changes were noted in the lower portion of the slope.

A review of photographs taken by TEES personnel on site during their routine visual inspections also highlighted the following observation. Figure B-14 shows seepage beneath a portion of the access road on the southeast side. The photograph was taken on July 16, 2014. The area beneath the seepage appears to be eroded. It is possible that this area could develop instability and the access road could be impacted.

4.2.2 Monitoring Data Review

A slope monitoring program has been implemented on the east wall of the Grum Pit, with the following components.

- Crest Regression Monitoring: Reference bars have been installed in two locations behind the crest of the east wall to serve as fixed reference points for measurement of the distance between the bars and the shortest distance between the first bar and the crest of the wall. The reference bars have been installed in linear arrays behind the instability zone, and are referred to as the North Array and the South Array.

- Survey Monitoring Points: Golder recommended the installation of survey monitoring points at the crest and on the slope of the instability zone (Golder 2013). Of the 14 recommended survey points, four were installed in 2013 by Yukon Engineering Services (YES). YES is also carrying out the annual surveying of the monitoring points.

In addition, TEES staff is carrying out visual inspections of the Grum Pit, and photographs are taken of the walls on a monthly basis.

The reference bar arrays and monitoring point locations are shown in Figure 2, and the monitoring data are discussed in the following section.

4.2.2.1 Crest Regression Monitoring

The installation coordinates and the initial distance measurement data are presented in Table 3, below (Brodie Consulting Ltd. 2010). Note that the coordinate system is in WGS 84.

Table 3: Location of Grum Pit Reference Bars

Reference Bar No.	Installation Coordinates (WGS 84)			Initial Distance Measurements (m)	
	Northing	Easting	Elevation (m)	(June, 2010)	
GP-S1	N 62°15'59.8"	W 133°12'47.8"	1294	4.00	Distance from crest to Bar 1
GP-S2	N 62°15'59.9"	W 133°12'47.5"	1295	5.56	Distance between Bar 1 and Bar 2
GP-S3	N 62°16'00.1"	W 133°12'47.5"	1313	7.81	Distance between Bar 2 and Bar 3
GP-S4(1)	N 62°16'00.2"	W 133°12'46.1"	1308	15.63	Distance between Bar 3 and Bar 4
GP-N1	N 62°16'04.6"	W 133°12'52.0"	1305	4.00	Distance from crest to Bar 1
GP-N2	N 62°16'04.6"	W 133°12'51.7"	1304	5.38	Distance between Bar 1 and Bar 2
GP-N3	N 62°16'04.4"	W 133°12'52.5"	1312	5.23	Distance between Bar 2 and Bar 3
GP-N4	N 62°16'04.7"	W 133°12'51.0"	1303	6.13	Distance between Bar 3 and Bar 4
GP-N5	N 62°16'04.7"	W 133°12'50.9"	1305	6.26	Distance between Bar 4 and Bar 5
GP-N6	N 62°16'04.8"	W 133°12'50.1"	1308	5.74	Distance between Bar 5 and Bar 6

Notes:

1) Bar GP-S4 was installed in July 2010, and the first reading in July is reported.

After the installation of the reference bars in 2010 and the initial distance measurement, distance measurements have been subsequently carried out by TEES staff on site. TEES personnel measure the distance from the crest to the first bar and the distance between each subsequent bar. Initially, measurements were taken about once a week, until October 2010 when the measurement frequency was changed to once a month.

The purpose of the reference bars is to provide short-term monitoring of the stability of the crest of the back-scarp in the event of new cracks developing behind the crest of the Grum Pit east wall. The procedure carried out in the Grum Pit is slightly different than the procedure used for the reference pins in the Faro Pit. In the Faro Pit, measurements are made from the crest to each reference pin along a pre-defined bearing to determine if regressive failure at the crest is occurring. A decrease in distance indicates a loss of crest.

In the Grum Pit, the distance from the crest to the first bar is measured. Then, the distance from the first bar to the second bar is measured, and so on along the array, as indicated in Table 3. The purpose of measuring from the crest to the first bar is to determine if any regressive failure at the crest is occurring. The purpose of measuring the distances between the remaining bars is to determine if any tension cracks located behind the crest are increasing in width. However, no cracks were observed behind the crest until September 2012, when a crack was observed in the vicinity of the north array, at the location of reference bar GP-N3. This crack has increased in size and TEES personnel have since discontinued measuring from the crest to reference bars GP-N1 and GP-N2 for safety reasons. The distances between reference bars GP-N3, GP-N4, GP-N5 and GP-N6 continue to be measured.

Plots of the relative change in distance for both the North and South Arrays are presented in Plate 5 and Plate 6, respectively.

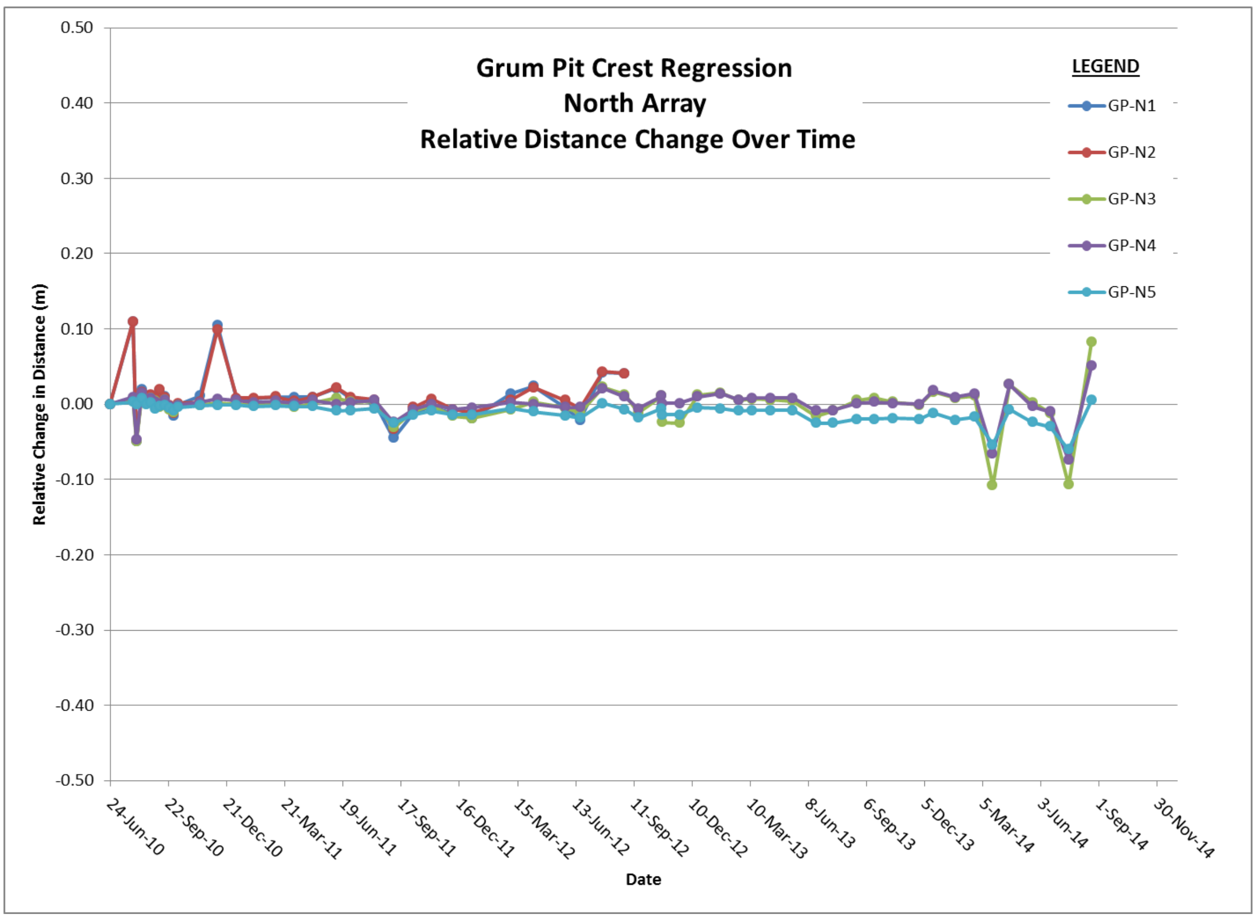

Plate 5: Grum Pit Crest Regression, North Array, Relative Change in Distance over Time

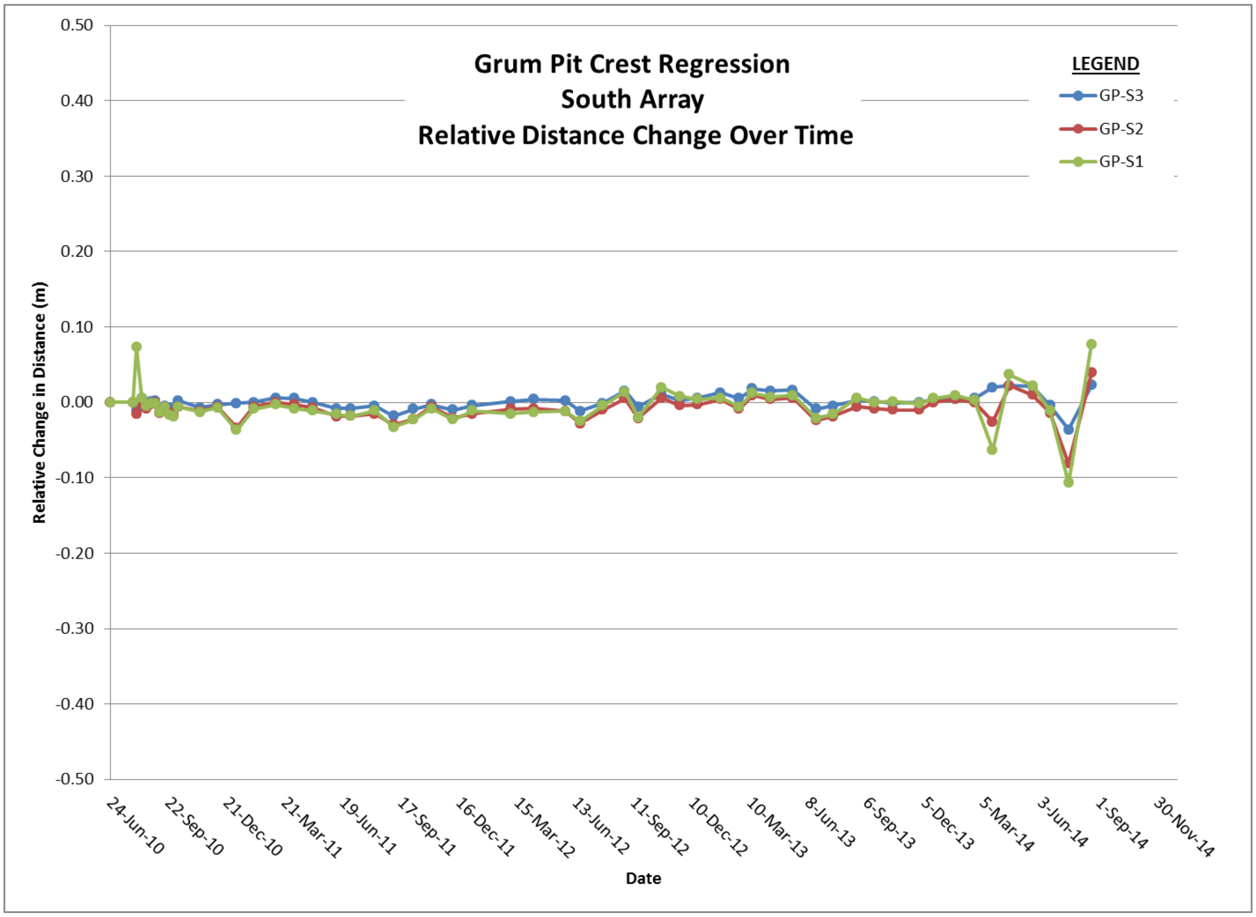

Plate 6: Grum Pit Crest Regression, South Array, Relative Change in Distance over Time

The plots indicate very little change in distance, with some minor variations in the measurements in 2014. When comparing to the plot of the Faro data, it is evident that the accuracy in measurement is significantly better in the Grum Pit. One likely reason is that having several bars in an array provides a reference to measure along the same bearing each time, while at the Faro Pit there is no reference point for measuring along the same bearing.

Although the measurement data do not indicate much change is occurring at the crest of the east wall, this is not likely the case, for the following reasons.

- The photo comparison and TEES personnel reports indicate otherwise.
- Cracks were observed during the site visit, some of which appeared to be fresh cracks.
- The tension crack at GP-N3 has shown an increase in displacement since 2012, but this does not show up in the data because measurements are no longer being taken from the crest to GP-N3.
- It is possible that little to no crest loss has occurred at the South Array, but other areas of the crest are exhibiting crest loss and instability based on the photographs and field observations.

4.2.2.2 Survey Monitoring Points

After the 2009 and 2012 site visits, Golder recommended the installation of monitoring prisms to monitor the overall stability of the east wall (Golder 2010, 2013). CH2M HILL (2013) report that their personnel marked locations in the field for 14 survey monitoring points to be installed by YES. Of the 14 monitoring points, three were installed at the crest of the instability zone and one monitoring point was installed at the south end of the instability zone, as shown in Figure 2. Table 4 presents the initial coordinates of the monitoring points.

Table 4: Grum Pit Monitoring Point Initial Location Coordinates

Survey Monitoring Point	Northing (m)	Easting (m)	Elevation (masl)
YG13-304-MP005	6905130	592758.5	1,296.41
YG13-304-MP006	6905026	592743.7	1,288.58
YG13-304-MP007	6904933	592677	1,270.92
YG13-304-MP008	6905006	592673.4	1,251.34

Note: Coordinate system is Universal Trans Mercator NAD83 CSRS Coordinates, HT2.0 Geoid

The remaining 10 monitoring points were planned to be installed in 2014. However, due to safety concerns related to allowing personnel on the instability zone, they were not installed.

The four monitoring points that were installed in 2013 were again surveyed by YES in September 2014. Relative displacement graphs and wander plots of the monitoring point data are presented in Figures D-11 to D-14 in Appendix D. Although there are only two readings per monitoring point, a comparison of the displacement graphs and wander plots indicates the following.

- Monitoring points MP005 to MP007 exhibit little to no displacement (Figures D-11 to D-13).
- However, monitoring point MP008 exhibits a total displacement of 192 mm since 2013 (Figure D-14).

The vertical downward displacement of monitoring point MP008 is on the order of 165 mm, and the horizontal displacement is on the order of 99 mm. The wander plot indicates a displacement trend toward the northwest. This monitoring point is the only monitoring point located on the slope rather than at the crest of the east wall (Plate 7). It is not likely that the monitoring point was deliberately or accidentally moved because the method of installation (CH2M HILL 2013) would make it difficult to move the monument. Either the monitoring point is exhibiting real displacement of a portion of the slope that is slumping to the northwest, or there is an error in the survey. The surveys of the other Grum monitoring points appear to be reliable, but it is possible that while the prism was being set up on this particular point, the accuracy was compromised. It will require further surveys to determine whether the displacement is actually occurring. As with the Faro monitoring point data, it is recommended that the Grum survey data be plotted as soon as possible so that a survey can be repeated to confirm the accuracy if necessary.

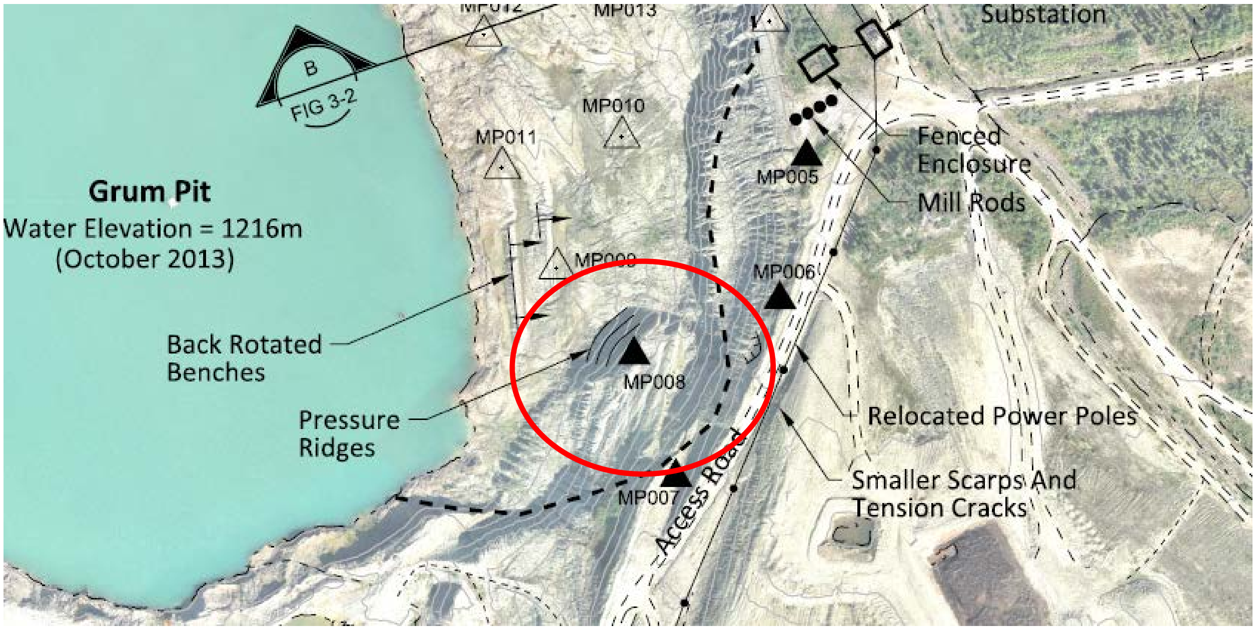

Plate 7: Grum Pit Monitoring Point MP008 Location

(CH2M HILL 2014)

4.2.2.3 Pit Lake Level

Plate 8 shows the change in the Grum Pit lake level from January 2004 to August 2014. The Grum Pit lake level was reported to be at 1,186 masl in early 2004 and at 1,205 masl by mid-2009 (Golder 2010). As of September 2012, the water elevation was at approximately 1,212 masl. As of August 11, 2014, the pit lake level is at approximately 1,217 masl, which is 6 metres above the maximum recommended elevation of 1,211 masl, and 1 metre above the estimated elevation of the lowest contact between overburden and bedrock at approximately 1,216 masl (Klohn Crippen Berger 2014). In the Grum Pit, rising water levels have the potential to seep into the overburden and contaminate groundwater as well as to destabilize the old slide debris along the east wall. The pit overflow elevation is located on the south side of the pit, where the access ramp enters the pit, at approximately 1,230 masl.

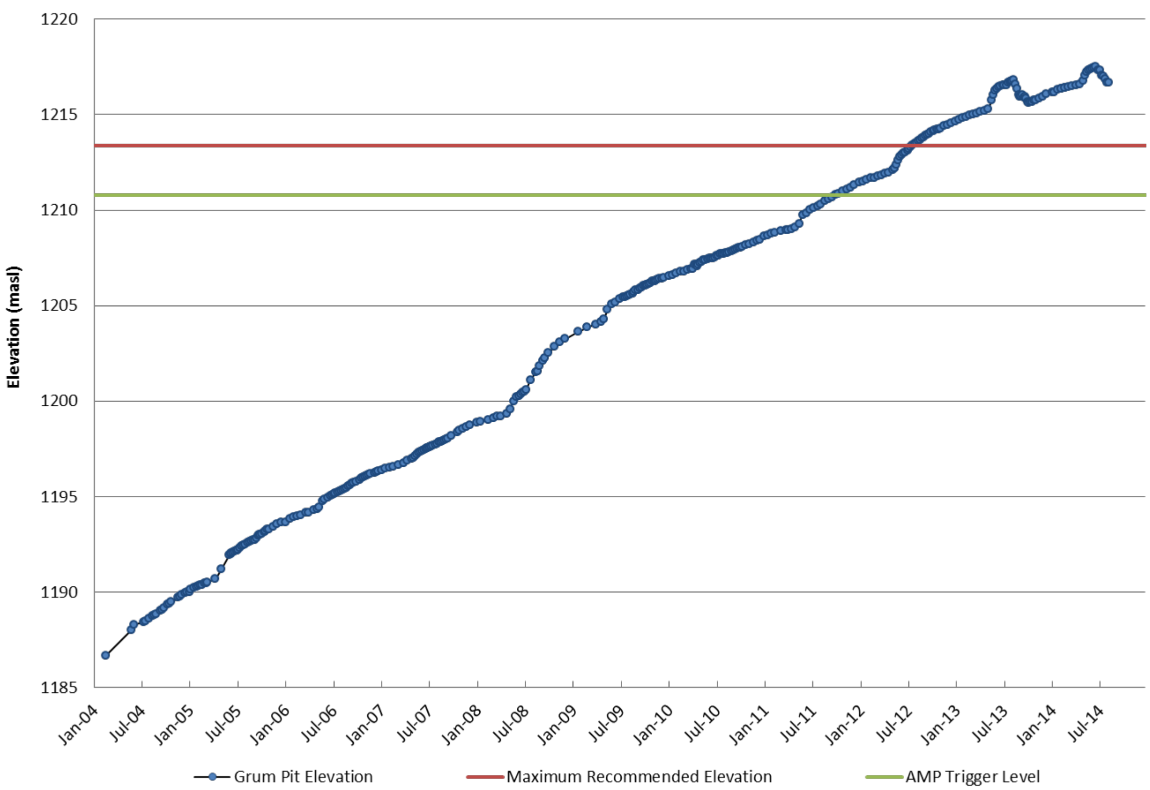

Plate 8: Grum Pit Lake Levels to August 11, 2014

Because pit lake levels fluctuate due to pumping water in and out of the pit, an important consideration for pit slope stability is the rate at which the lake level rises and falls. Rapid increases or decreases in the lake level should be avoided. Rapid changes in water levels can contribute to slope instability because an unsteady state is created in the groundwater conditions. As the groundwater adjusts to a new equilibrium, hydrodynamic pressures can create forces within a slope that can destabilize it.

In the Grum Pit, there is overburden material in the slump zone and the water level is relatively high compared to the wall heights. Therefore, in this pit, a rapid increase or decrease in the pit lake level could potentially impact the stability of the old slide debris within the east wall failure zone. The rate of drawdown that could induce instability would depend on the total decrease in water level, and on the permeability of the failure debris, which has not been quantified. Furthermore, slope stability analyses would be required to quantify the water level and the rate of decrease of the water level that could cause instability. Consequently, it is not possible to predict the drawdown rate that would cause instability at this time. Therefore, it is recommended that any significant or rapid pit dewatering be preceded by an assessment of the slope stability of the failure material if personnel or equipment will be in the pit during or immediately following the pit dewatering. The rock slopes on the east side of the Faro Pit are not expected to be as sensitive to changes in the water level as the slide debris in the Grum Pit.

The rate of increase of the lake level in the Grum Pit is less than 0.01 metre per day, which does not present a concern with respect to pit slope stability. However, if a situation arises where rapid drawdown of the pit lake is required, a qualified geotechnical engineer should first be consulted.

4.3 Grum Pit Recommendations

- Continue to monitor the instability zone for overall instability. The monitoring pins should continue to be read once per year by YES. The frequency of the readings of the crest regression pins can be reduced from once per month to twice yearly, as there is no critical infrastructure near the crest of the Grum Pit east wall.
- Visually monitor the area that appears to be slumping in the southwest corner of the pit, and take periodic photographs from the same location to determine if there is continued displacement.
- Construct a berm at the end of the access ramp into the pit, in the area of rockfall near the power poles. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform workers of rockfall hazard and required setback distance.
- Relocate the power pole on the north slope above the Grum Slot Cut to a more stable location.
- Repair reference bar GP-S4.
- If large areas of ponded water are observed behind the crest of the east wall, grade the area to minimize ponded water and infiltration into the slope as well as to control runoff onto the slope face.
- Clear the vegetation from the south end of the Grum Interceptor Ditch.

5.0 VANGORDA PIT

5.1 Vangorda Pit Description

The Vangorda Pit is located approximately 2 kilometres southeast of the Grum Pit. Mining in the Vangorda Pit began in 1990 and was completed in 1996. Mining activities were suspended from 1993 to late 1994.

The Vangorda Pit is oval in shape, with the long axis trending northwest–southeast, as shown on Figure 4. The widest and deepest part of the pit is on the northwest side. The pit is approximately 1,115 metres long, approximately 350 metres across at its widest point, and has a maximum of depth of 150 metres. The southeast side of the pit is narrower and shallower, with a width of approximately 200 metres and a depth of approximately 50 metres (Deloitte & Touche Inc. 2002).

The Vangorda Creek initially flowed from east to west across the thickest part of the ore body. The creek was subsequently diverted around the northeast and north side of the pit in a flume that consists of a 2.4 metre diameter half-round culvert placed into an open channel lined with rip rap. This diversion is called the Vangorda Creek Diversion Channel (Figure 4).

Water enters the pit via three gullies. One gully is located on the east wall, and two gullies are located in the northwest corner of the pit.

The Vangorda Pit is currently inactive and inundated to 1,085 masl as of August 2014. Water from the Grum Pit has been periodically pumped to the Vangorda Pit for water treatment. A pump barge pumps water from the Vangorda Pit to the water treatment plant. No monitoring instrumentation has been installed in the Vangorda Pit.

A full description of the engineering geology of the Vangorda Pit is provided in Golder (2013). The Vangorda ore zone consists of one major sulphide horizon located approximately 50 to 120 metres beneath the basal carbonaceous member of the Vangorda Formation, and the pit walls are comprised of phyllites and schists of the Mount Mye and Vangorda Formations. Regionally, the strata dip northeast and southwest; however local bedding may dip to the northwest. The rocks exposed in the pit wall are of variable strength. In the northwest wall, the rocks range from dark grey to black, low-strength, graphitic schists to light grey, strong, relatively massive and competent schists (SRK 2003). The sulphide-bearing rock exposed in the pit is subject to oxidation and is observed to be highly oxidized in some walls. Iron staining is evident to some degree on all the pit walls.

A till blanket overlies the bedrock; it is up to 30 metres thick on the northwest side of the pit and thins out to the southeast. A steep normal fault truncates the deposit at the northwest end (Curragh Resources 1986).

The 2002 Deloitte & Touche Inc. report indicates that the Vangorda Pit slopes experienced local instability, particularly in the northwest corner of the pit. This area is characterized by carbonaceous phyllites and is adjacent to several faults. The localized wall failures were reportedly related to a pit expansion. The northeast walls and the slot area walls have historically exhibited adequate stability performance.

5.2 2014 Observations

During the 2014 site visit, portions of the crest on each side of the Vangorda Pit were inspected for new cracks and ponded water. The four pit walls were also visually inspected from the crest and from the bottom of the access road that leads into the pit. The following areas were inspected, and photographs are provided in Appendix C:

- portions of the pit crest perimeter;
- the roads behind the crest and the access road into the pit;
- sections of the Vangorda Creek Diversion Channel; and
- the walls were inspected from the bottom of the access road.

The following observations were made during the visual inspection.

- The north, west, south and east walls are exhibiting adequate stability performance with respect to overall stability (Figures C-1, C-2, C-5, and C-6, respectively). Compared to the 2012 photographs, no significant changes in the slope morphology were observed.
- The benches in competent rock in the north wall (Figure C-1) are in good condition, with mostly intact bench crests and adequate catchment. The slope excavated in the weak, graphitic schist has slowly raveled into a talus slope with no catchment remaining.
- Seepage was not observed in the northwest wall below the road bed and diversion channel, but seepage has been reported in previous years.
- The rock benches in the west wall do not exhibit much change from previous years (Figure C-2). However, the till slope continues to ravel and slough over time (Figure C-3), which is over-steepening the slope.
- The rock in the south and east walls is of moderate quality and the benches are slowly raveling into a talus slope. Although some bench crests remain intact, there are areas where bench crests have been lost entirely and catchment is limited (Figures C-5 and C-6).
- As with the till on the west side, the till slopes on the east wall are over-steepened and sloughing (Figure C-7), but do not present a concern to personnel as there is catchment in the benches below and personnel are not working above or below this slope.
- No recent cracks or ponded water were observed at the crest of the pit, except for a small pond on the northwest side of the pit in the till (Figure C-8 in Appendix C).
- No recent cracks were observed in, or near, the roads around the crest of the pit.
- No recent cracks were observed near the Vangorda Creek Diversion Channel. However, portions of the flume are in disrepair and are leaking, and water is flowing along the rip rap channel located beneath the flume (Figure C-8). We understand the YG is in the process of repairing or replacing the flume.

- Water is flowing or being discharged into the pit in several locations, as follows, and as shown in Figure C-9.
  - In the centre of the northeast wall, some water flows into the pit from the original Vangorda Creek bed. However, the majority of the water is pumped from the creek to the diversion channel. The pump is activated when a certain water level is reached.
  - Surface water run-off from the southwest access road and water pumped from the Little Creek Pond is discharging into the pit in the northwest corner of the pit. The discharge is slowly eroding the rock.
  - Emergency water discharge from the booster pump is discharged into the Vangorda Pit on the southwest side of the pit.
- Rockfall continues to be a concern along the in-pit access road. HDPE pipe is located along the west side of the road and electric cables have also been installed near the slope, indicating that workers have been working beneath this slope in areas where there is inadequate rockfall protection (Figure C-10). There is a small ditch at the toe of the slope that provides some catchment, but rocks were observed beyond the ditch, indicating that it is not adequate to catch all the falling blocks. Large boulders were also observed at the toe of the slope in the southeast corner of the pit where there is no berm (Figure C-10).

5.2.1 Pit Water Level

Plate 9 shows the change in the Vangorda Pit lake level from January 2005 to August 2014. The plot shows that lake levels have remained well below the maximum recommended elevation except on two occasions in June of 2008 and June of 2009. The Vangorda Pit lake level was measured at 1,085 masl on August 11, 2014. This is 7 metres below the maximum elevation of 1091.8 masl.

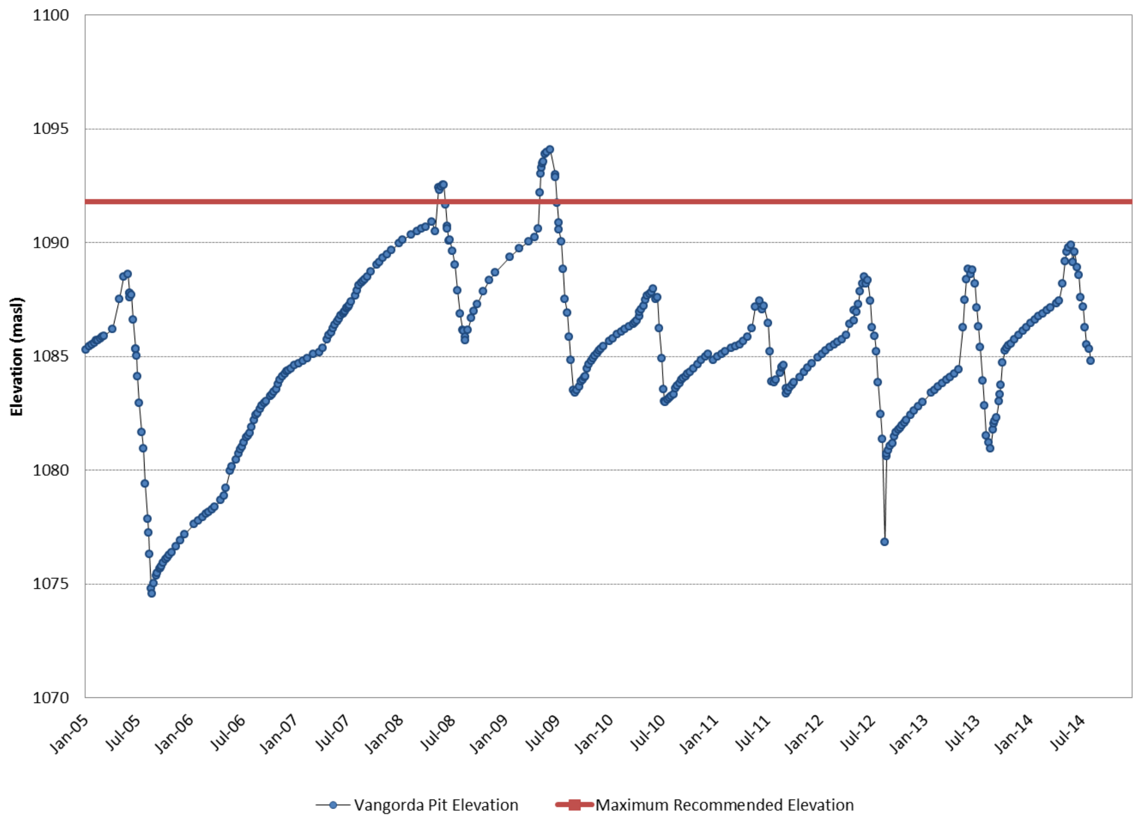

Plate 9: Vangorda Pit Lake Levels to August 11, 2014

5.3 Vangorda Pit Recommendations

- Cracks were observed in 2013 and 2014 in the face and at the crest of the till slope in the northwest corner of the pit that had not been observed in 2012. The care and maintenance contractor should carry out a periodic visual assessment of the cracks to determine if there are any significant changes in the size or intensity of the cracks, and complete a visual assessment any time personnel will enter the pit. If the cracks increase in size or intensity, it is recommended that a geotechnical engineer review the stability of the slope.
- If there are significant changes in the condition of the till slope, retain a geotechnical engineer to carry out a full stability assessment, which may require field investigations and stability analyses.
- Repair or replace the Vangorda Flume as soon as practicable to limit the amount of water that is seeping into the slope on the north side.
- As recommended in 2012, construct a berm on the west side of the access road and in the southeast corner to provide rockfall protection to personnel working near the slope. Conversely, deepen the ditch at the toe of the slope so that it acts not only as a drainage ditch but also a catch-ditch for falling rocks. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform of rockfall hazard and required setback distance.

6.0 COMMENTS ON CURRENT SLOPE STABILITY MONITORING SYSTEM

The current slope monitoring system is intended to monitor the following:

- crest regression occurring at the backscarps of the instability zones on the east walls of the Faro and Grum Pits;
- overall stability of the Faro east wall instability zones; and
- stability of the backscarp and the slide material below the backscarp of the instability zone on the east wall of the Grum Pit.

The current monitoring system consists of taking frequent measurements of reference bars or pins and carrying out an annual survey of monitoring points installed at the crest of the east walls of both the Faro and Grum Pits.

Site personnel have expressed concerns regarding their safety with respect to accessing the crest of the slopes to measure the distance from the crest to the reference pins or bars. Consequently, we recommend that the monitoring system and methodology be reviewed, to manage this safety concern. There are alternative methods of monitoring the crest regression that would not require personnel to access the crest of the wall. We understand that YG is considering authorizing a study to assess alternative monitoring methods.

In addition, Golder previously recommended installing permanent prism monuments on the slide failure debris at the base of the failure backscarp along the east wall of the Grum Pit. Fourteen monitoring points were scheduled to be installed in 2013, but only four were installed. Of these, only one monitoring point is located on the slide debris itself, and the other three are located at the crest of the backscarp. The slide debris requires monitoring because of the risk of remobilization of this material. If a remote monitoring system were implemented, it would not require site personnel or contractors having to access the slide debris, and the slide debris could be monitored from the safety of the west side of the pit or even remotely. These alternatives should be part of the study to assess alternative monitoring methods for the pits.

It is also recommended that the slope stability monitoring program be included in the existing Emergency Response Plan, to give site personnel a basic understanding of the signs of slope instability and a framework for the communication of and response to these hazards. The preparation of this portion of the Emergency Response Plan can be included in the study of the alternative monitoring methods.

It must be reiterated that regardless of the monitoring system in place, and whether or not it requires access to the east wall, without a timely and thorough review of the monitoring data, significant changes in the stability of the slope may not be detected in sufficient time to enact the emergency response plan or remedial actions. Three monitoring points in the Faro Pit are currently exhibiting possible deformation. This apparent deformation could accelerate and expand at some point in the future. It is the combination of an appropriate monitoring system with a timely and thorough data review that allows the monitoring system to provide adequate warning of conditions that warrant a response.

7.0 SUMMARY OF OBSERVATIONS AND RECOMMENDATIONS

Based on the observations and monitoring data from the 2014 inspection, the slopes of the Faro, Grum and Vangorda Pits are exhibiting adequate stability with respect to overall slope stability. The recommendations for each pit are summarized in Table E-1 in Appendix E. The recommendations have been grouped into risk categories corresponding to high, medium and low, to assist with planning.

Based on the results of the current pit slope inspection and data review, the frequency of the site visits to carry out a visual pit slope stability inspection can be reduced to every two to three years, and should continue to be carried out by a geotechnical engineering consultant. A site visit by a geotechnical engineering consultant may also be required when site visual observations and/or monitoring data indicate significant signs of pit slope instability.

A review of all of the pit slope monitoring data should continue to be carried out on an annual basis by a qualified geotechnical engineer.

8.0 CLOSURE

We trust this report satisfies your current requirements, and we appreciate this opportunity to continue to provide our support to the Yukon Government. If you have any questions or require further assistance, please do not hesitate to contact us.

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JJR/AVC/ls/kp

\\golder.gds\gal\burnaby\final\2014\dynamics numbers - mining division\1410944\1410944-002-r-rev0-6000\1410944-002-r-rev0-6000-faro mine complex 2014 annual pit slope stability inspection 19dec_14.docx

REFERENCES

Faro Mine Remediation Project, 2011. *FMRP Location*. Available at: http://www.faromine.ca/mine/location.html. Accessed September 16, 2014.

CH2M HILL. 2014. *Faro Mine Complex 2013 Pit Wall Stability Inspection*. Prepared for Government of Yukon. Submitted March 26, 2014.

Curragh Resources. 1986. *Geology and reserves sections from Faro, Vangorda and Grum mine plans*. Energy, Mines and Resources Property File Collection, ARMC001951. Available at: http://data.geology.gov.yk.ca/Reference/53442. Accessed September 26, 2014.

Curragh Resources. 1987. *The Vangorda Plateau Project, Summary of Geology, Pit Design, Metallurgy and Infrastructure.* March 1987.

Deloitte & Touche Inc. 2002. *Anvil Range Mine Complex, 2002 Baseline Environmental Information.* Prepared for Anvil Range Mining Corporation, produced by Gartner Lee Limited. Submitted May 2002.

Klohn Crippen Berger. 2014. *Faro Mine Complex 2013 Annual Geotechnical Review – Draft*. Prepared for Yukon Government. Submitted March 31, 2014.

Golder Associates Ltd. 2002. *Faro Creek Diversion Channel Short-term Stability Review, Faro YT.* Report submitted December 16, 2002.

Golder Associates Ltd. 2006. *Faro Pit Slope Movement Monitoring.* Report submitted February 8, 2006.

Golder Associates Ltd. 2007. *Review of 2006 Pit Slope Monitoring Data, Faro Pit*. Report submitted April 24, 2007.

Golder Associates Ltd. 2008a. *Review of 2007 Pit Slope Monitoring Data, Faro Pit.* Report submitted March 14, 2008.

Golder Associates Ltd. 2008b. *2008 Faro Pit Slope Movement Monitoring.* Report submitted December 10, 2008.

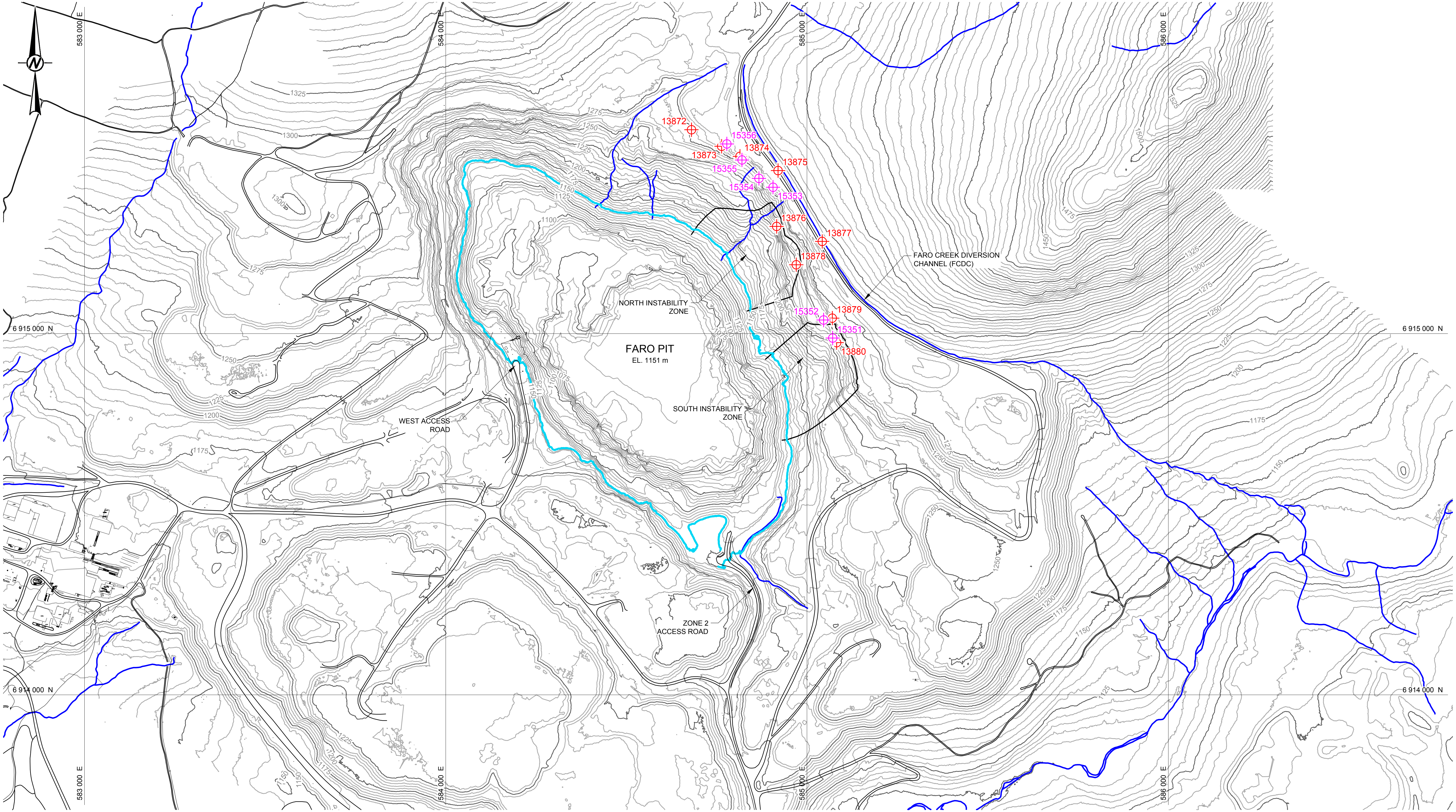
Golder Associates Ltd. 2009. *2009 Faro Pit Slope Movement Monitoring.* Report submitted November 3, 2009.

Golder Associates Ltd. 2010. *Phase 1A Geotechnical Slope Stability Assessment of the East Wall of the Grum Pit, Faro Mine, Yukon.* Report prepared for Faro Project Management Team, Government of Yukon. Submitted March 23, 2010.

Golder Associates Ltd. 2011. *2010 Faro Pit Slope Stability Monitoring Data Review*. Report prepared for Denison Environmental Services. Submitted February 23, 2011.

Golder Associates Ltd. 2013. *Faro Mine Complex Annual Pit Slope Stability Inspection*. Report prepared for Yukon Government. Submitted February 7, 2013.

SRK Consulting. 2003. *Engineering Analysis of Vangorda Pit Wall Stability.* Prepared for Deloitte & Touche Inc. Sumbitted April 2003.



LEGEND

- 13880 MONITORING POINT
- 15356 REFERENCE PIN
- WATER COURSES
- APPROXIMATE PIT WATER LEVEL
- INSTABILITY ZONE

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE SYSTEM IS NAD 83, UTM.
3. CONTOURS SHOWN ARE AT 5 m INTERVAL.

REFERENCE

1. CONTOUR DATA PROVIDED BY GOVERNMENT OF YUKON, DATED: SEPTEMBER 18, 2014, FILE: Faro_pit_50cm_contours.dwg.

0 250 500
1:10,000 METRES

CLIENT

YUKON GOVERNMENT

CONSULTANT

YYYY-MM-DD	2014-12-10
PREPARED	TAK
DESIGN	JJR
REVIEW	AVC
APPROVED	AVC

PROJECT

YG FARO MINE COMPLEX
2014 PIT SLOPE STABILITY INSPECTION

TITLE

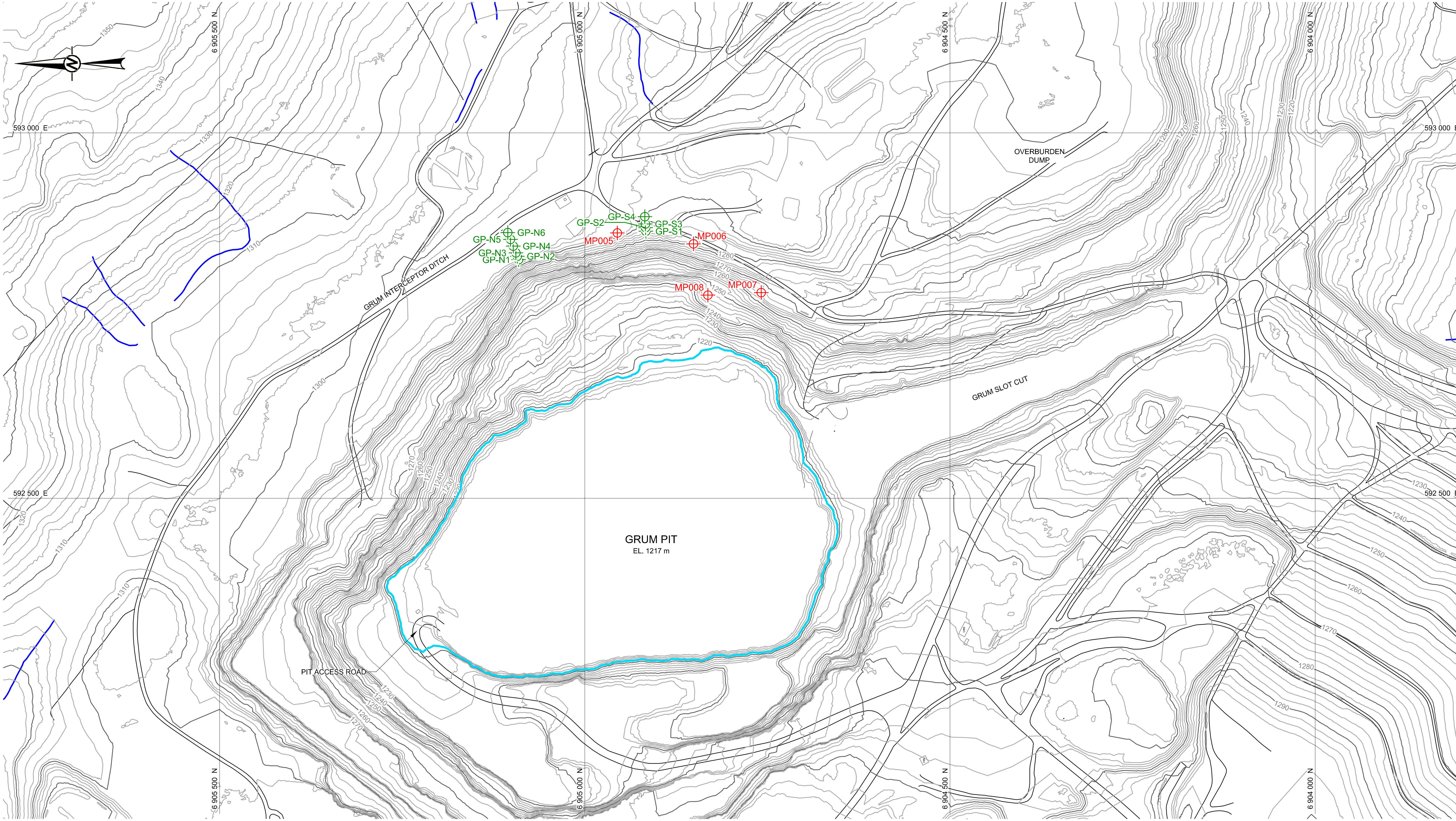
FARO PIT AND MONITORING POINT LOCATIONS

PROJECT No.	PHASE	Rev.	FIGURE
1410944	6000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

Path: \\golder.gds\gal\Burnaby\CAD-GIS\Client\Government_of_Yukon\YG_Faro_Mine\99_PROJECTS\1410944\6000\02_PRODUCTION\ | File Name: 1410944_6000_Fig 1.dwg



LEGEND

MP008 MONITORING POINT

GP-N6 REFERENCE PIN

WATER COURSES

APPROXIMATE PIT WATER LEVEL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE SYSTEM IS NAD 27, UTM.
3. CONTOURS SHOWN ARE AT 2 m INTERVAL.

REFERENCE

1. CONTOUR DATA PROVIDED BY GOVERNMENT OF YUKON, DATED: SEPTEMBER 21, 2012.

0 100 200

1:5,000 METRES

CLIENT

YUKON GOVERNMENT

CONSULTANT

Golder Associates

YYYY-MM-DD	2014-12-10
PREPARED	TAK
DESIGN	JJR
REVIEW	AVC
APPROVED	AVC

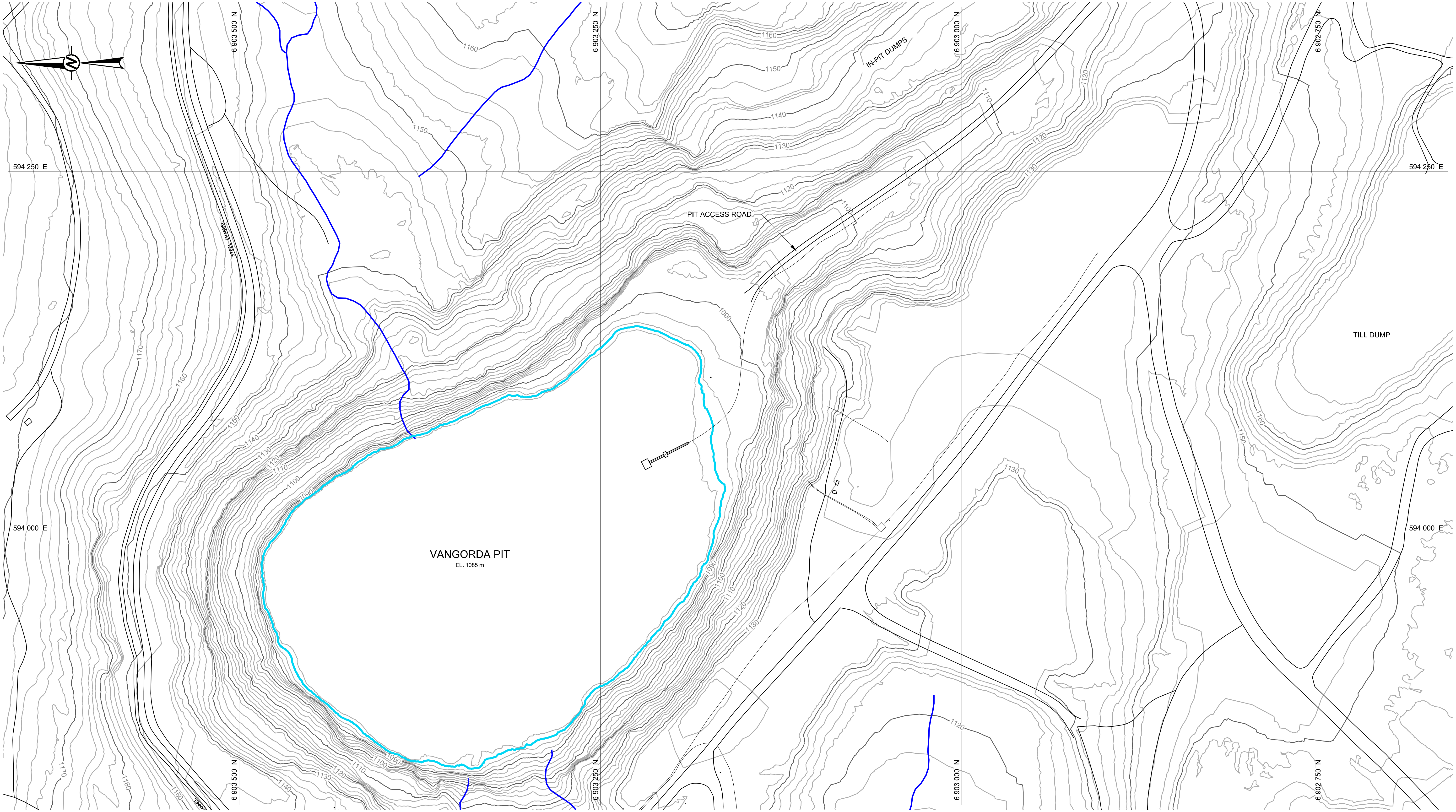
PROJECT

YG FARO MINE COMPLEX
2014 PIT SLOPE STABILITY INSPECTION

TITLE

GRUM PIT AND MONITORING POINT LOCATIONS

PROJECT No.	PHASE	Rev.	FIGURE
1410944	6000	0	2



LEGEND

- WATER COURSES
- APPROXIMATE PIT WATER LEVEL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE SYSTEM IS NAD 27, UTM.
3. CONTOURS SHOWN ARE AT 2 m INTERVAL.

REFERENCE

1. CONTOUR DATA PROVIDED BY GOVERNMENT OF YUKON, DATED: SEPTEMBER 21, 2012.

0 50 100
1:2,500 METRES

CLIENT

Yukon Government

YUKON GOVERNMENT

CONSULTANT

Golder Associates

YYYY-MM-DD	2014-12-10
PREPARED	TAK
DESIGN	JJR
REVIEW	AVC
APPROVED	AVC

PROJECT

YG FARO MINE COMPLEX
2014 PIT SLOPE STABILITY INSPECTION

TITLE

VANGORDA PIT

PROJECT No.	PHASE	Rev.	FIGURE
1410944	6000	0	3

APPENDIX A

Faro Pit Photographs

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

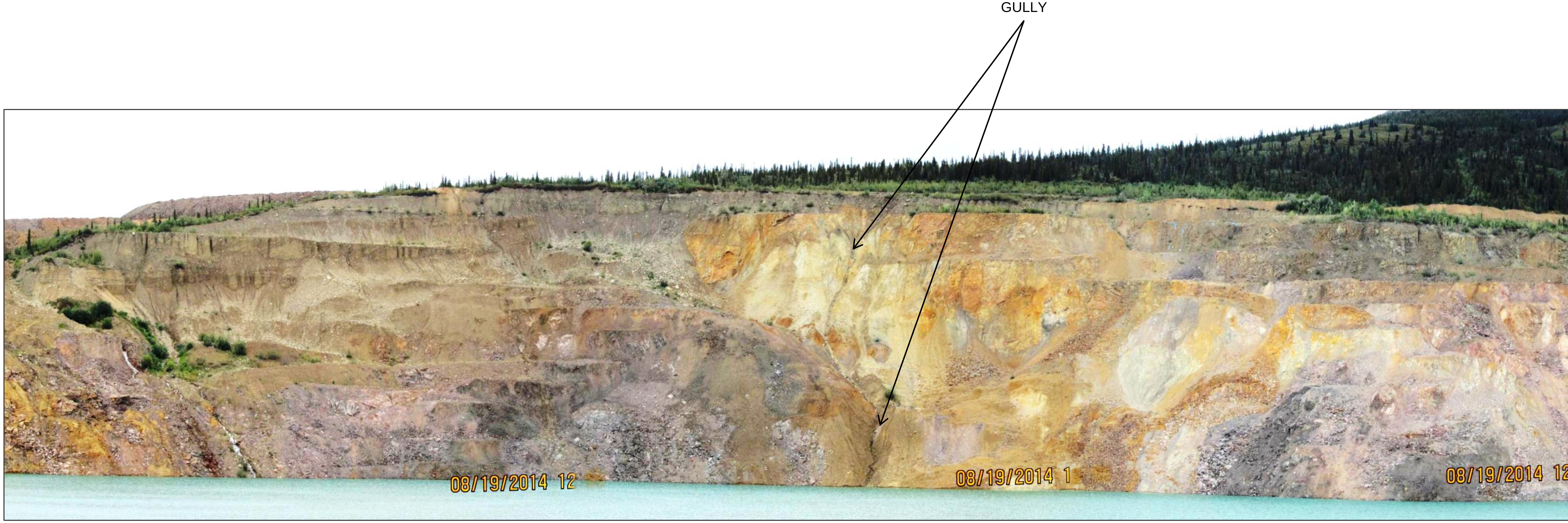
CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
Golder Associates

TITLE
FARO PIT EAST WALL

FIGURE No.
A-1



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
Golder Associates

TITLE
NORTH INSTABILITY ZONE

FIGURE No. A-2

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
SOUTH INSTABILITY ZONE
VIEW FROM BEHIND BACKSCARP

FIGURE No.
A-3

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

YUKON GOVERNMENT

CONSULTANT

Golder Associates

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

CRACKS IN TILL TO THE SOUTH OF THE SOUTH INSTABILITY ZONE

FIGURE No. A-4

TILL SLOWLY ERODING AND RAVELING

TILL SLOWLY ERODING AND RAVELING

BACKSCARP SLUMPING

ROCK TOPPLING

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE: NORTHWEST WALL – RAVELING AND TOPPLING

FIGURE No. A-5

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
PONDED WATER BEHIND CREST OF NORTHEAST SLOPE

FIGURE No. A-6

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

Yukon Government

YUKON GOVERNMENT

CONSULTANT

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PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

FARO CREEK DIVERSION CHANNEL

FIGURE No.
A-7

PRESUMABLY 13908
(REPLACED 15353?)

13908?
PIN IS VISIBLE, BUT TAG IS MISSING

15742? COULD NOT FIND TAG OR PIN, AND
STRUCTURE IS COLLAPSED

15342
STRUCTURE IN GOOD CONDITION

15342
PIN AND TAG IN GOOD CONDITION

15357
PIN AND TAG IN GOOD CONDITION

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE: MONITORING POINTS AND REGRESSION BARS

FIGURE No. A-8

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

NORTH AND NORTHWEST WALL

SOUTHWEST WALL

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
NORTH AND WEST WALLS

FIGURE No.
A-9

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

SEEPAGE AND SURFACE RUNOFF

BERM AT END OF WEST ACCESS ROAD

NO BERM AT END OF ZONE 2 ACCESS ROAD

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

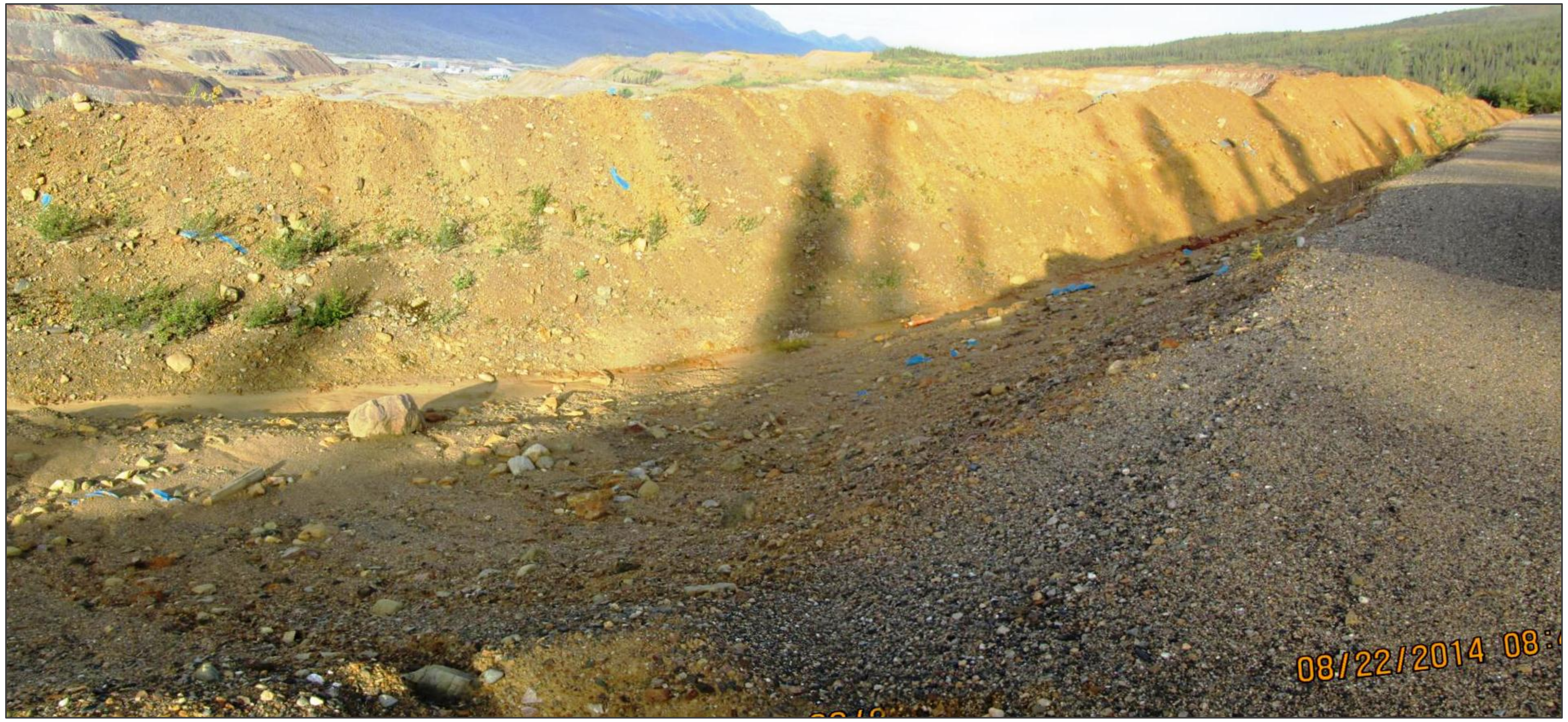
CONSULTANT: Golder Associates

PROJECT: 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE: FARO PIT OBSERVATIONS

FIGURE No. A-10



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
WATER IN DITCH AT CREST OF EAST WALL

FIGURE No.
A-11

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
AREAS OF ROCKFALL HAZARD
WEST SLOPE - ZONE 2 ACCESS ROAD

FIGURE No.
A-12

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

ESTIMATED 2014 PIT LAKE LEVEL

2012 PHOTOGRAPH

2014 PHOTOGRAPH

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
NORTH INSTABILITY ZONE
PHOTO COMPARISON

FIGURE No. A-13

2012 PHOTOGRAPH

2014 PHOTOGRAPH

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE: SOUTH INSTABILITY ZONE
PHOTO COMPARISON

FIGURE No. A-14

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

APPENDIX B

Grum Pit Photographs

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT

TITLE
GRUM PIT EAST WALL

FIGURE No. B-1

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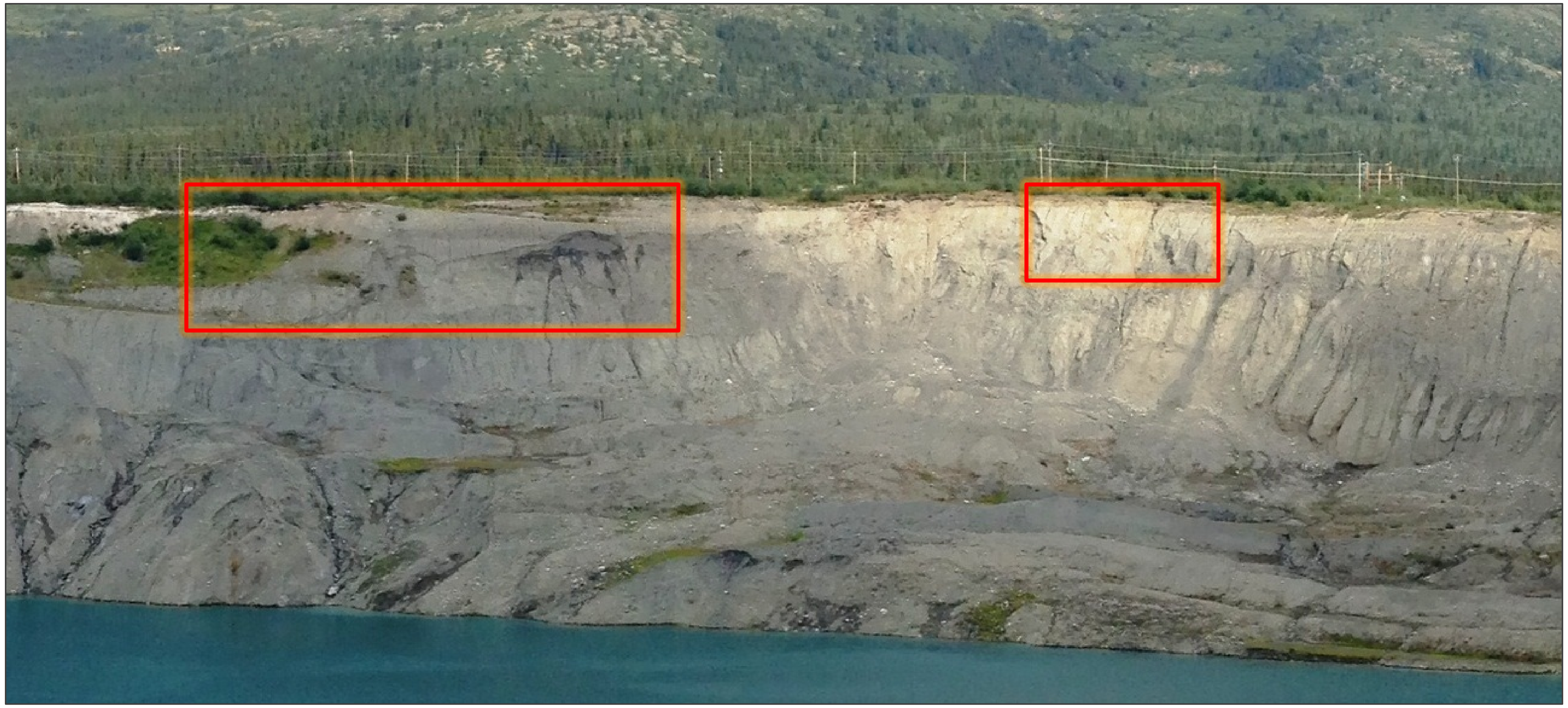

2013 PHOTOGRAPH
(COURTESY OF TEES)

2014 PHOTOGRAPH

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
SMALL FAILURES SINCE 2013

FIGURE No.
B-2

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

YUKON GOVERNMENT

CONSULTANT

Golder Associates

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

CRACKS IN TILL TO THE SOUTH OF THE INSTABILITY ZONE

FIGURE No. B-3

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
Golder Associates

TITLE
CHAIN LINK FENCE NEAR SOUTH ARRAY

FIGURE No.
B-4

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

CRACK IN 2014

CRACK IN 2012

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE:

AREA OF DEFORMATION AT GP-N3

FIGURE No. **B-5**

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
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PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
GRUM INTERCEPTOR DITCH

FIGURE No.
B-6

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

NORTH WALL

WEST AND NORTH WALL

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
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PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
GRUM PIT NORTH AND WEST WALLS

FIGURE No.
B-7

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
NORTHWEST CORNER OF GRUM PIT

FIGURE No.
B-8

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
SLUMPING AREA IN SOUTHWEST CORNER

FIGURE No. **B-9**

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

NORTH SLOPE ABOVE GRUM SLOT CUT

FIGURE No. B-10

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

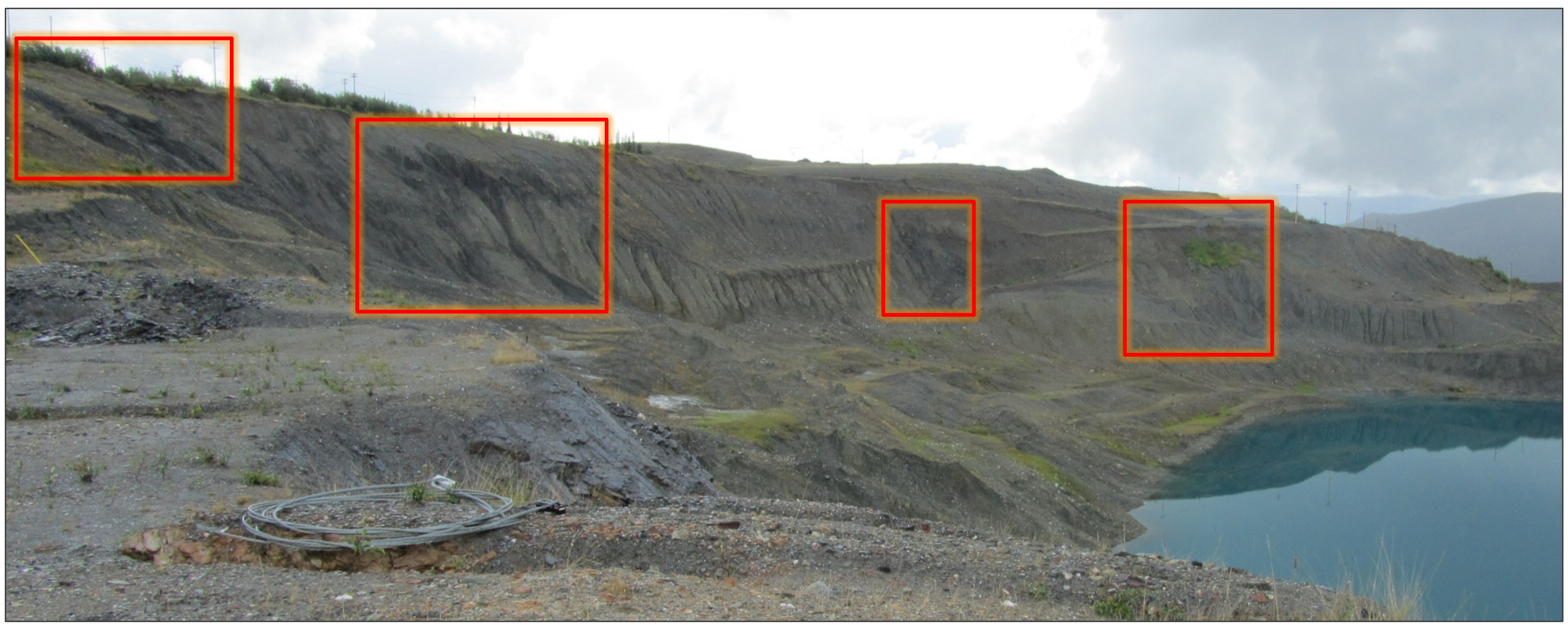
CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
INSTABILITY ZONE PHOTO COMPARISON
VIEW FACING EAST

FIGURE No.
B-11

2012 PHOTOGRAPH



2014 PHOTOGRAPH

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

YUKON GOVERNMENT

CONSULTANT

PROJECT 1410944/6000

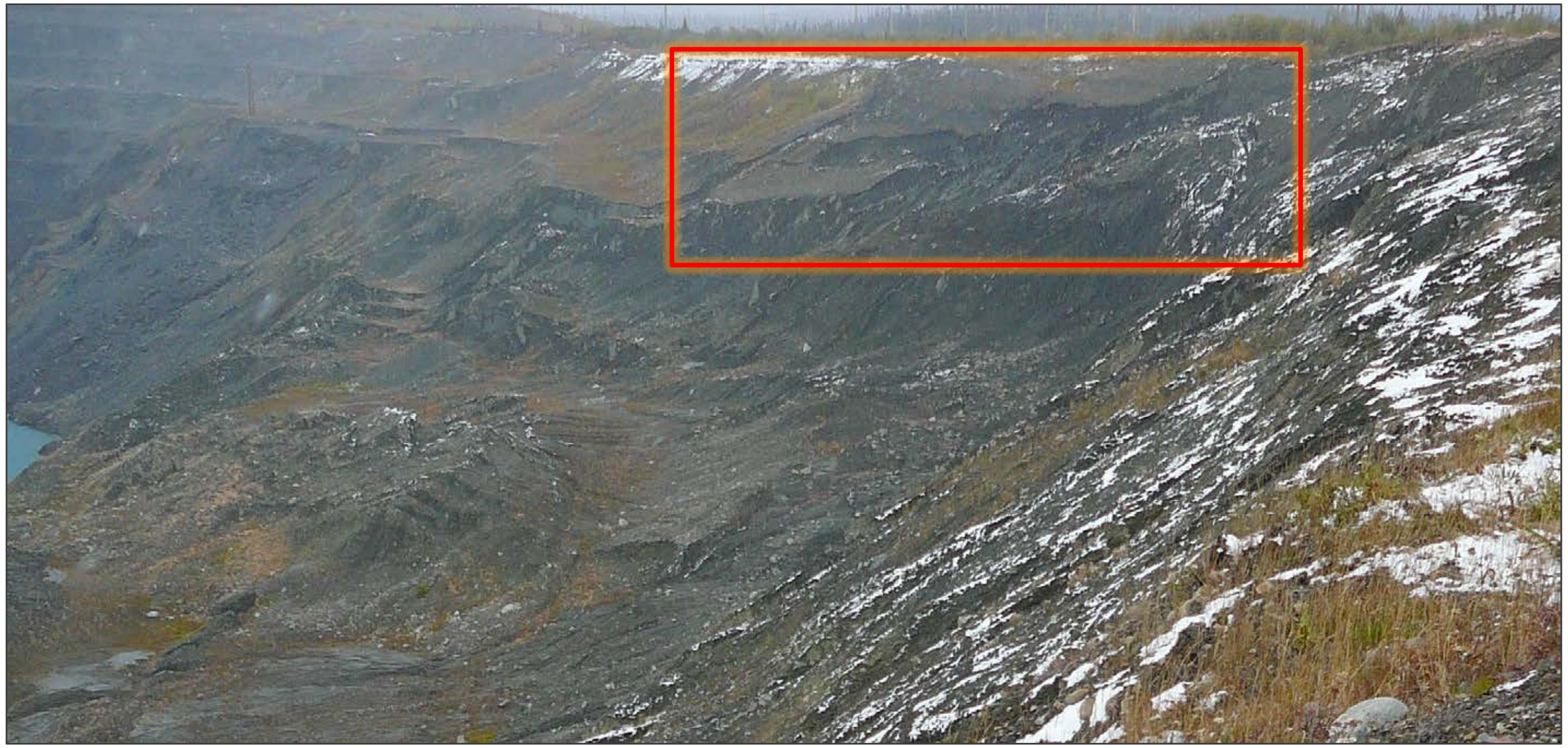
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

INSTABILITY ZONE PHOTO COMPARISON
VIEW FACING SOUTH

FIGURE No. B-12

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



2012 PHOTOGRAPH

2014 PHOTOGRAPH

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
INSTABILITY ZONE PHOTO COMPARISON
VIEW FACING NORTH

FIGURE No. B-13

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

YUKON GOVERNMENT

CONSULTANT

Golder Associates

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

SEEPAGE IN SLOPE SOUTH OF INSTABILITY ZONE

FIGURE No. B-14

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

APPENDIX C

Vangorda Pit Photographs

TALUS SLOPE IN WEAK, GRAPHITIC SCHIST

BENCHES INTACT IN MORE COMPETENT SCHIST

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE: NORTH WALL

FIGURE No. C1

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
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FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
WEST WALL

FIGURE No. C2

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

2012 PHOTO

2014 PHOTO

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
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FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
MATERIAL SLOUGHING OFF TILL SLOPE

FIGURE No. C3

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
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PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
CRACKS IN TILL SLOPE, NORTHWEST WALL

FIGURE No. C4

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
SOUTH WALL AND ACCESS ROAD

FIGURE No.
C5

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT

YUKON GOVERNMENT

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PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE

EAST WALL

FIGURE No.
C6

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

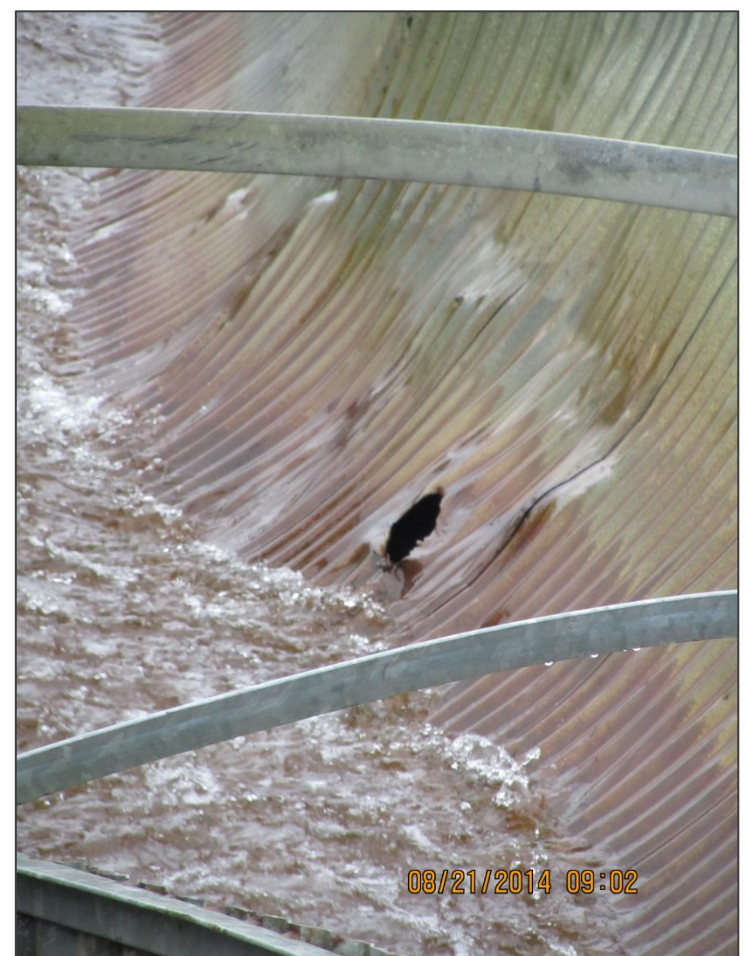
TITLE
TILL SLOPES ON EAST WALL

FIGURE No.
C7

SMALL POND ON NORTHWEST SIDE OF PIT CREST

WATER FLOWING BENEATH VANGORDA FLUME

CONDITION OF VANGORDA FLUME



TEAR IN VANGORDA FLUME

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

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Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
VANGORDA FLUME AND PONDED WATER

FIGURE No.
C8

ORIGINAL VANGORDA CREEK CHANNEL.

DISCHARGE ON NORTHWEST WALL

EMERGENCY DISCHARGE ON SOUTHWEST WALL

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

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FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
AREAS OF WATER FLOW AND DISCHARGE

FIGURE No. C9

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices

CABLES AT TOE OF SLOPE

POWER POLE AND CABLES NEAR SLOPE, AREA WITH NO BERM OR DITCH

EQUIPMENT NEAR SLOPE

BOULDERS AT TOE OF SLOPE
SOUTHEAST SIDE

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

CONSULTANT: Golder Associates

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

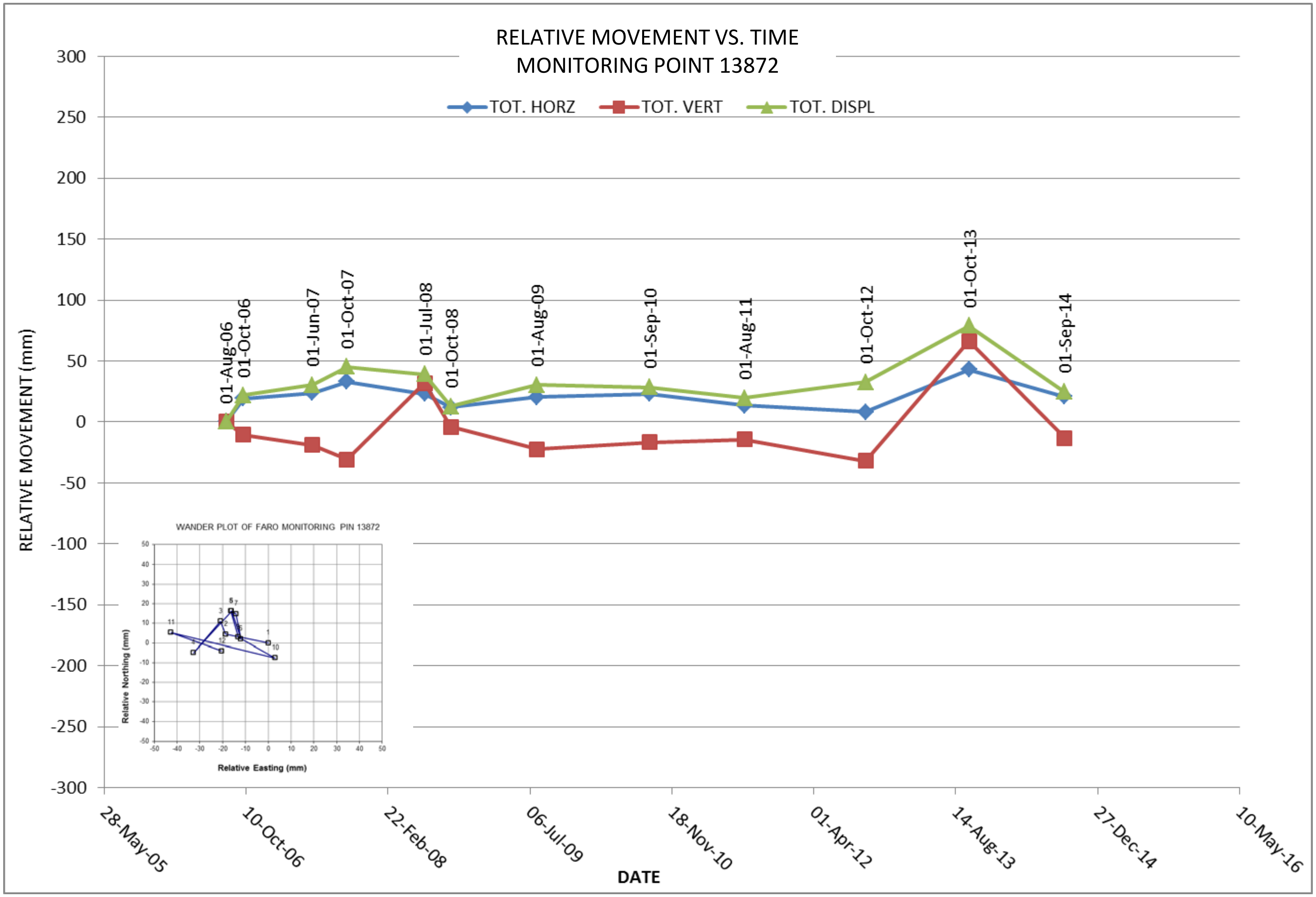
TITLE: AREAS OF ROCKFALL HAZARD

FIGURE No. C10

APPENDIX D

Monitoring Data

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

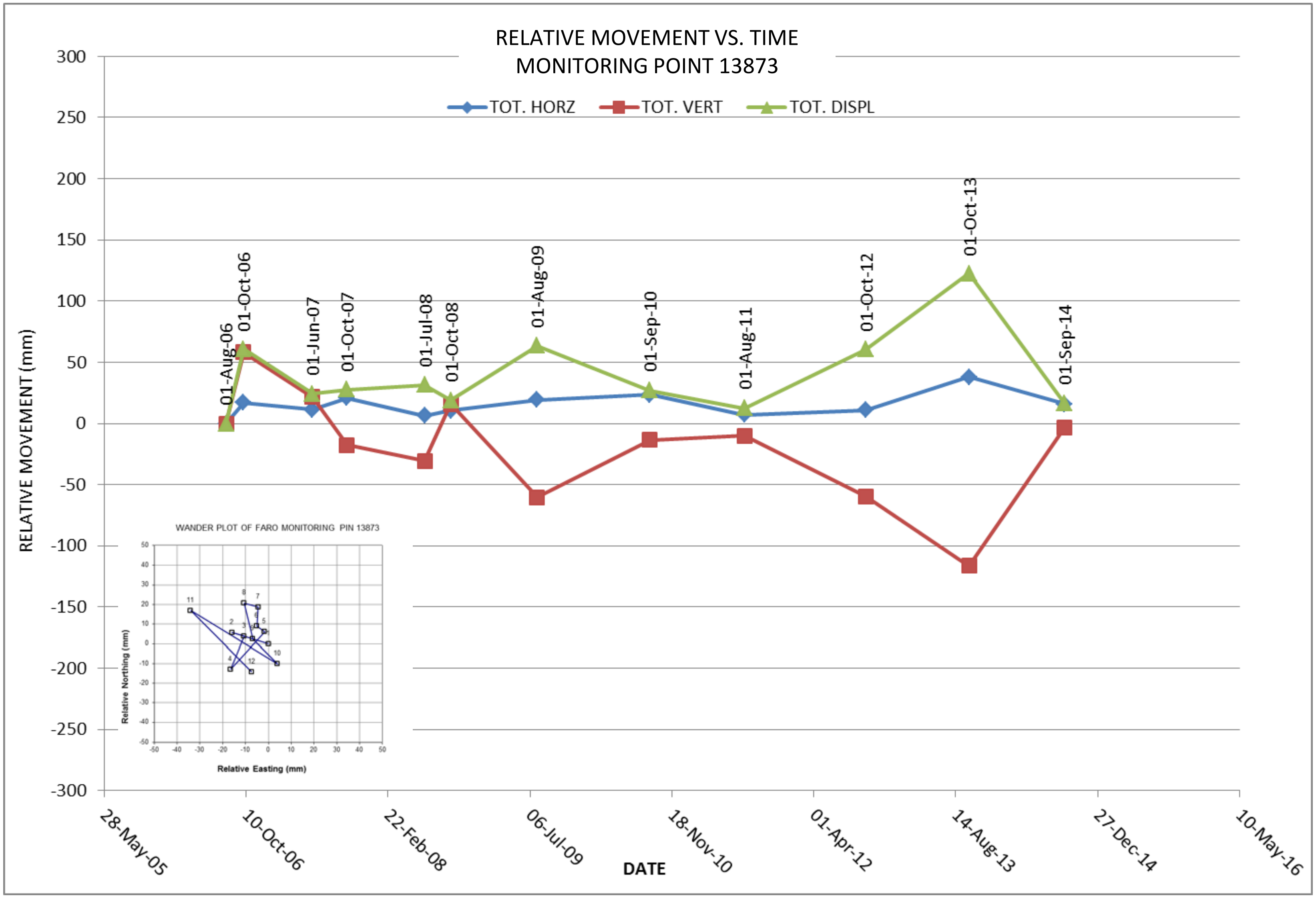
PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
Golder Associates

TITLE
FARO MONITORING POINT 13872

FIGURE No.
D-1

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT

Yukon Government

YUKON GOVERNMENT

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT

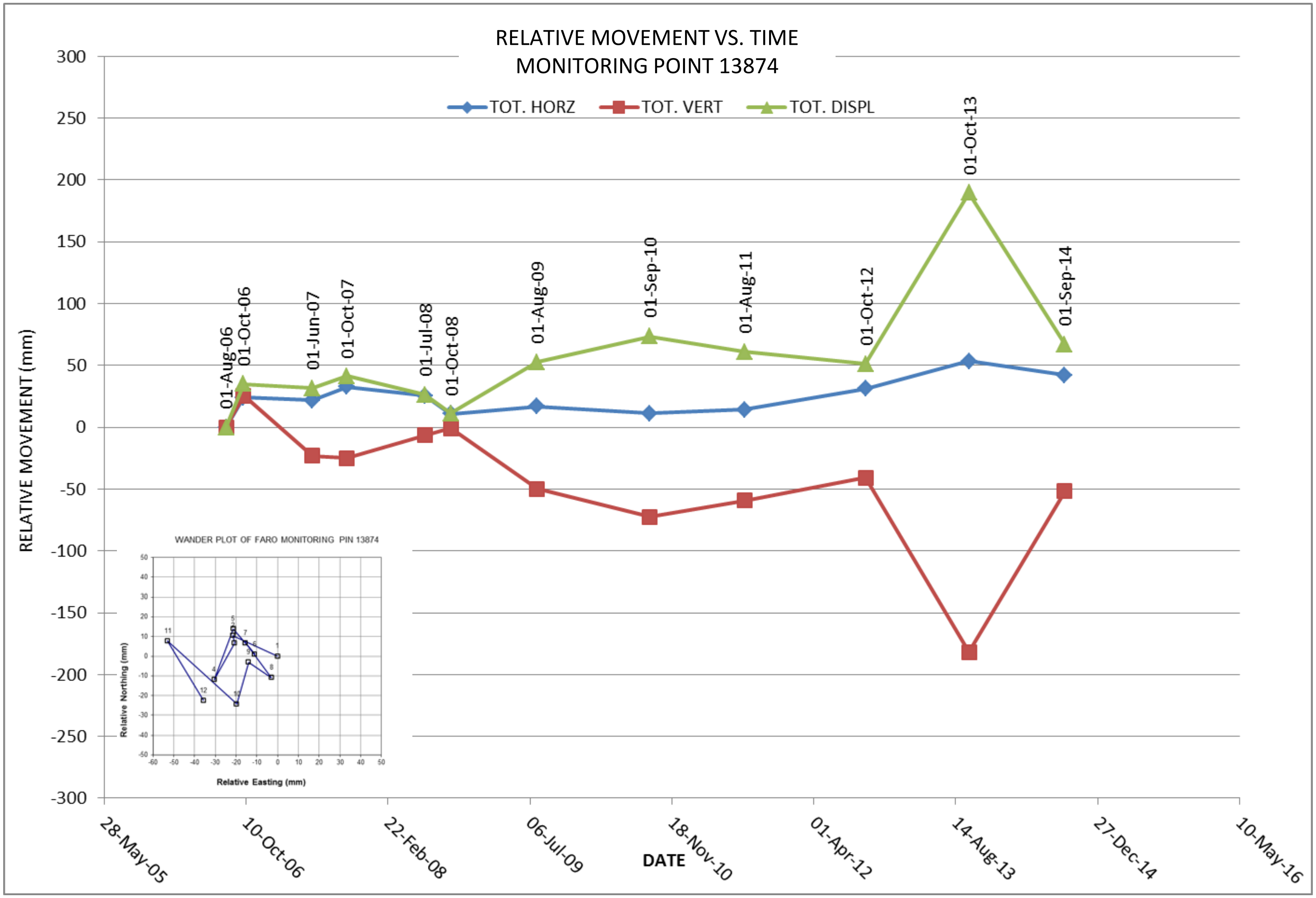
Golder Associates

TITLE

FARO MONITORING POINT 13873

FIGURE No.
D-2

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

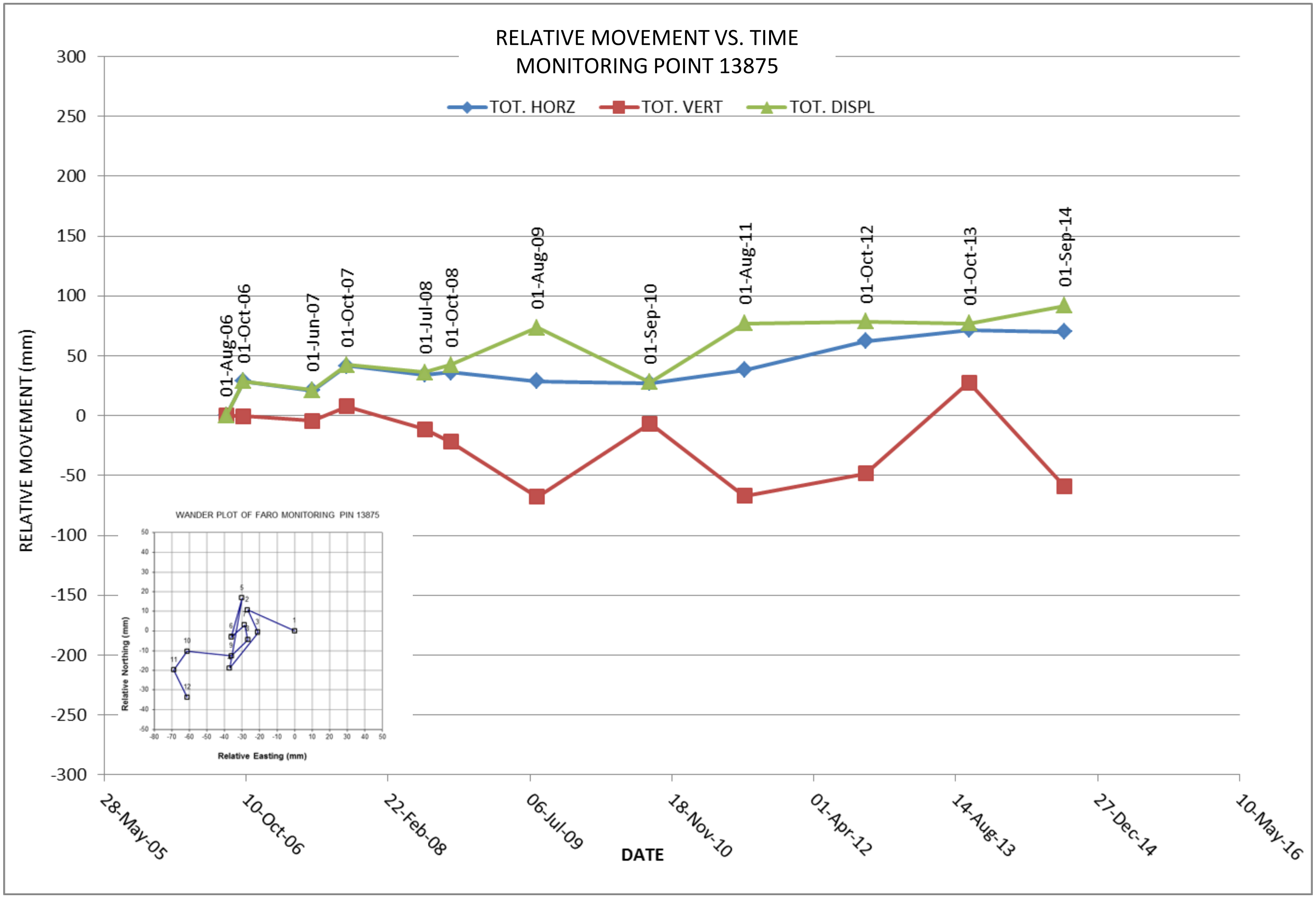
CLIENT
Yukon Government
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
FARO MONITORING POINT 13874

FIGURE No.
D-3



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

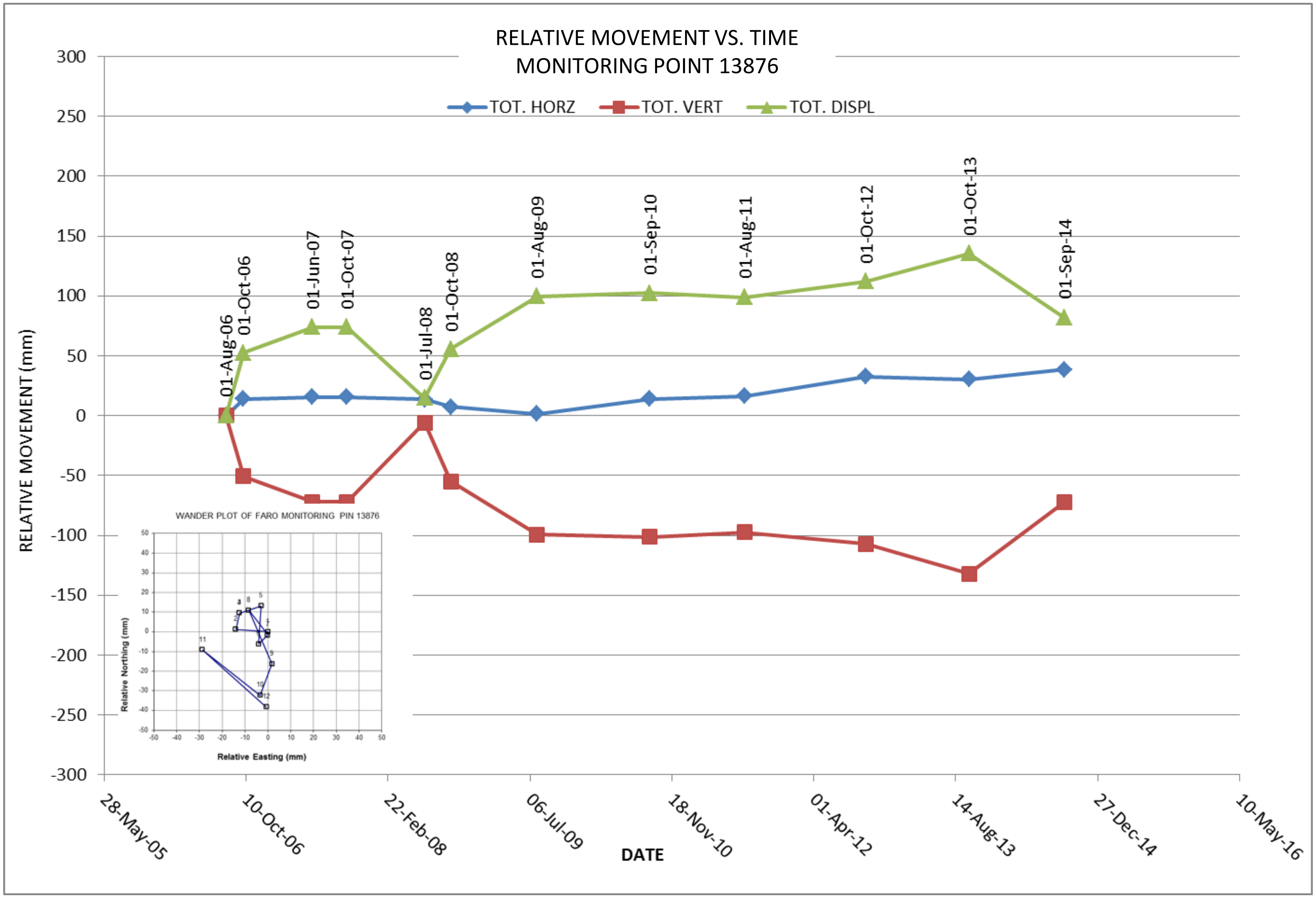
CLIENT: YUKON GOVERNMENT

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT: Golder Associates

TITLE: FARO MONITORING POINT 13875

FIGURE No. D-4



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

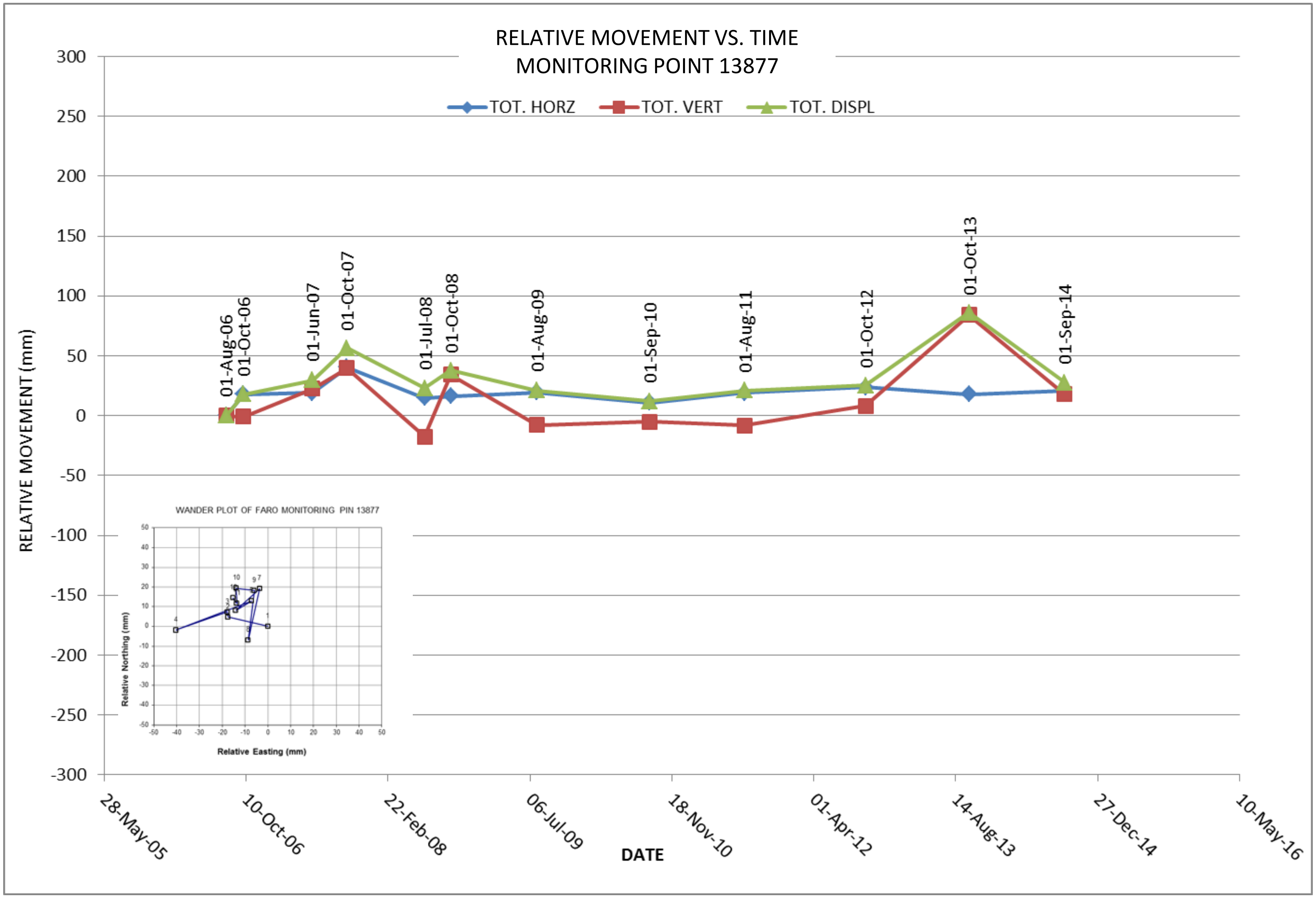
PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
Golder Associates

TITLE
FARO MONITORING POINT 13876

FIGURE No.
D-5

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
Yukon Government
YUKON GOVERNMENT

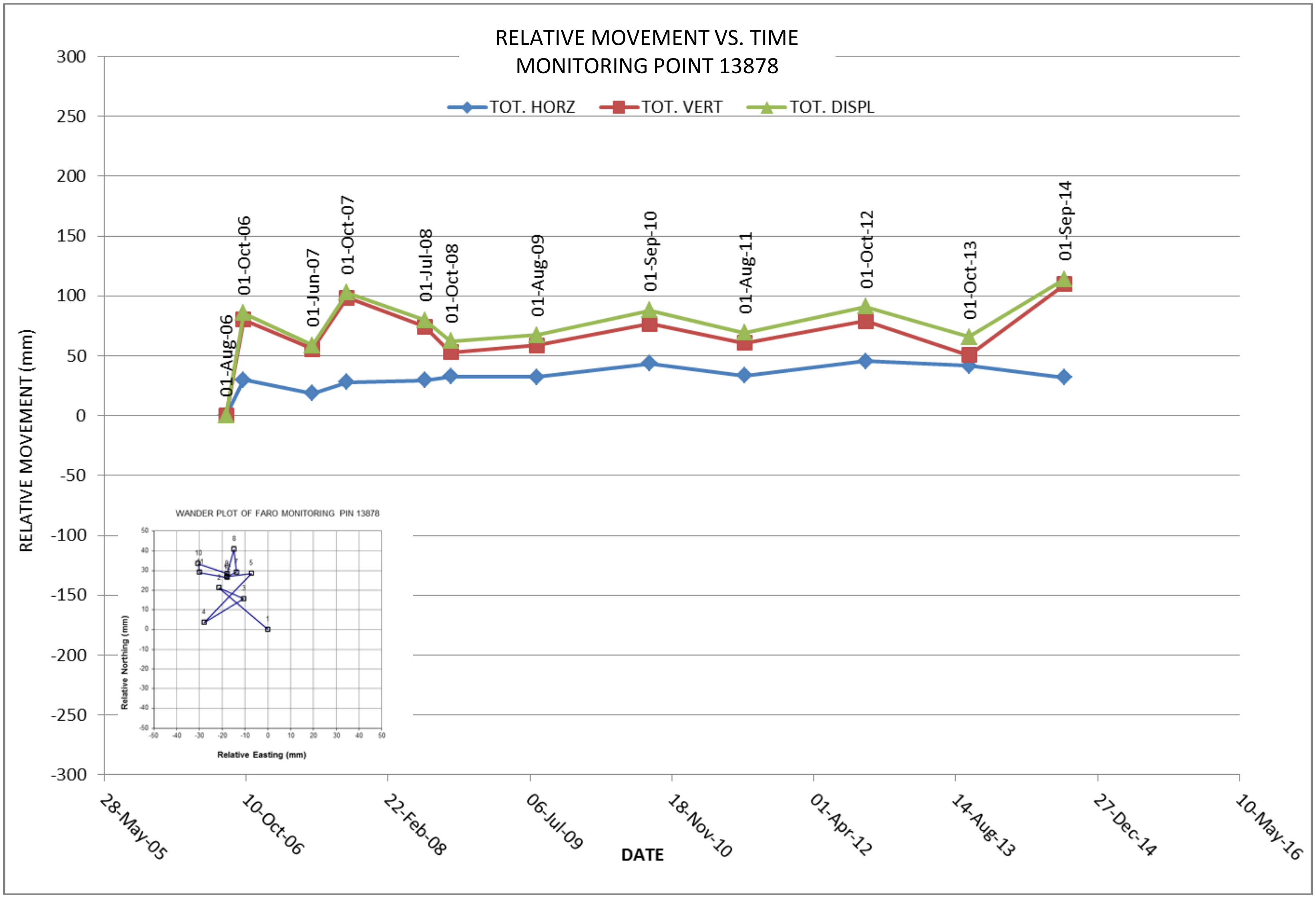
CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
FARO MONITORING POINT 13877

FIGURE No.
D-6

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT

YUKON GOVERNMENT

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

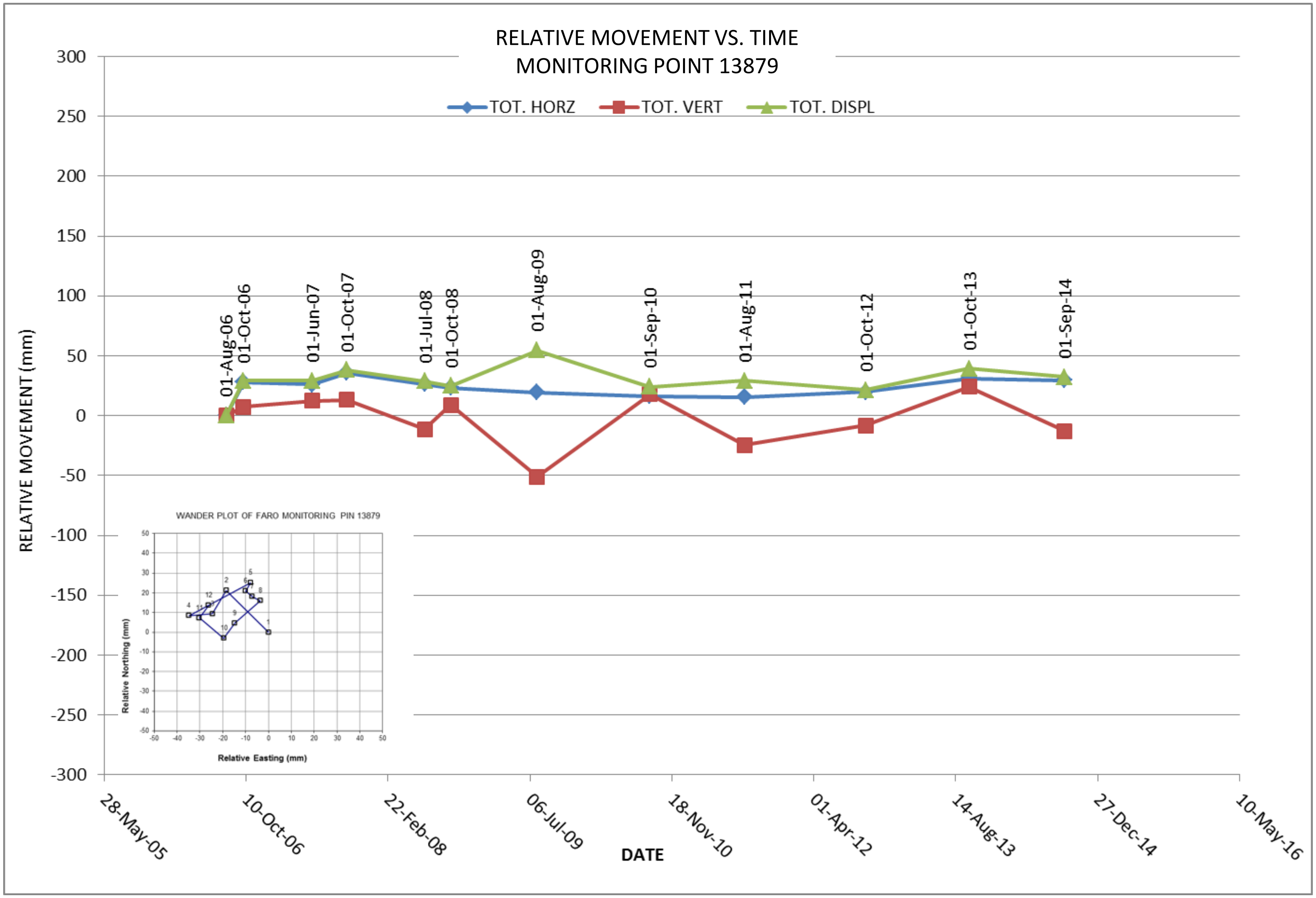
CONSULTANT

Golder Associates

TITLE

FARO MONITORING POINT 13878

FIGURE No.
D-7



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT
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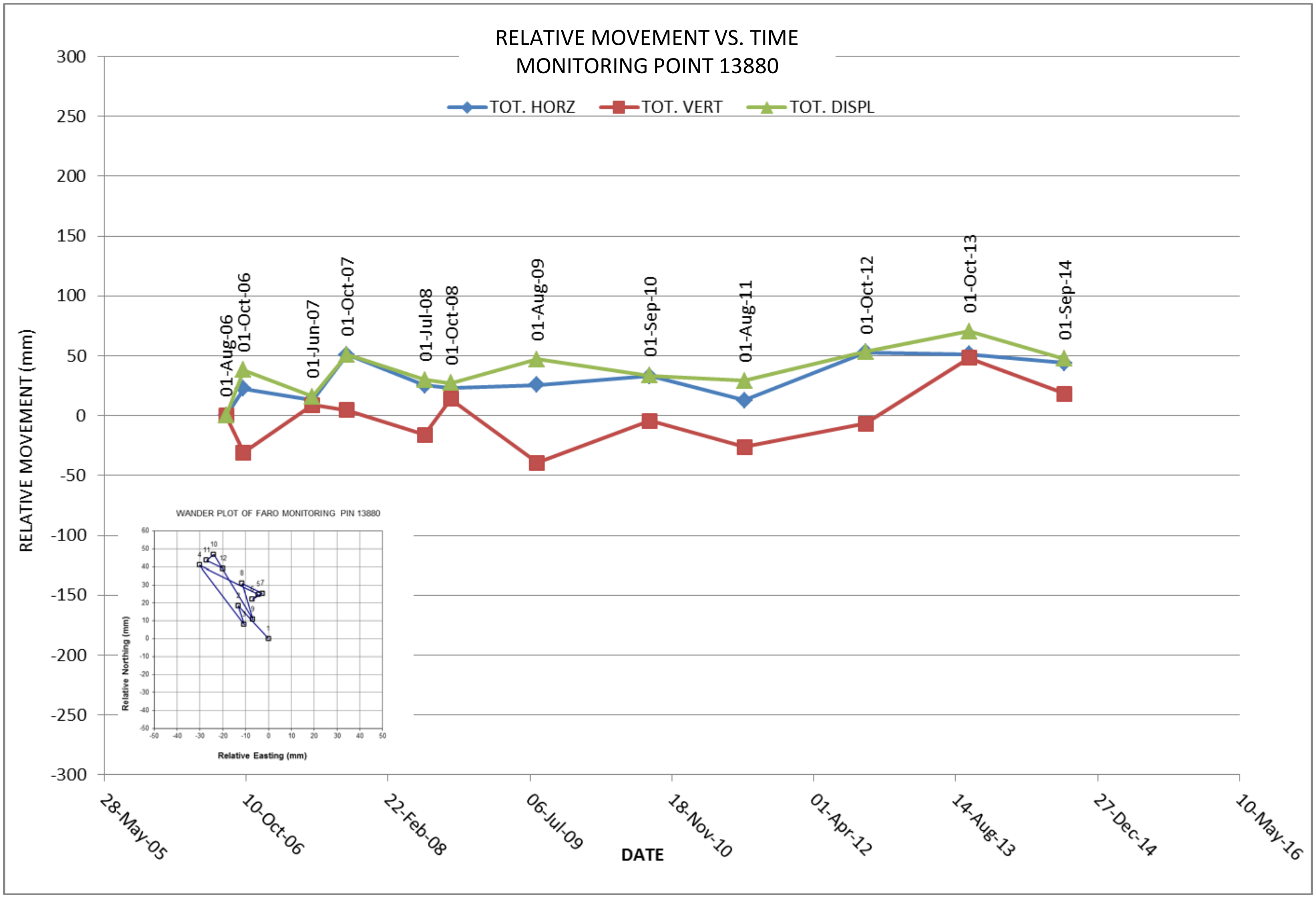
TITLE
FARO MONITORING POINT 13879

FIGURE No.
D-8

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC	
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW	

CLIENT

YUKON GOVERNMENT

PROJECT 1410944/6000

FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT

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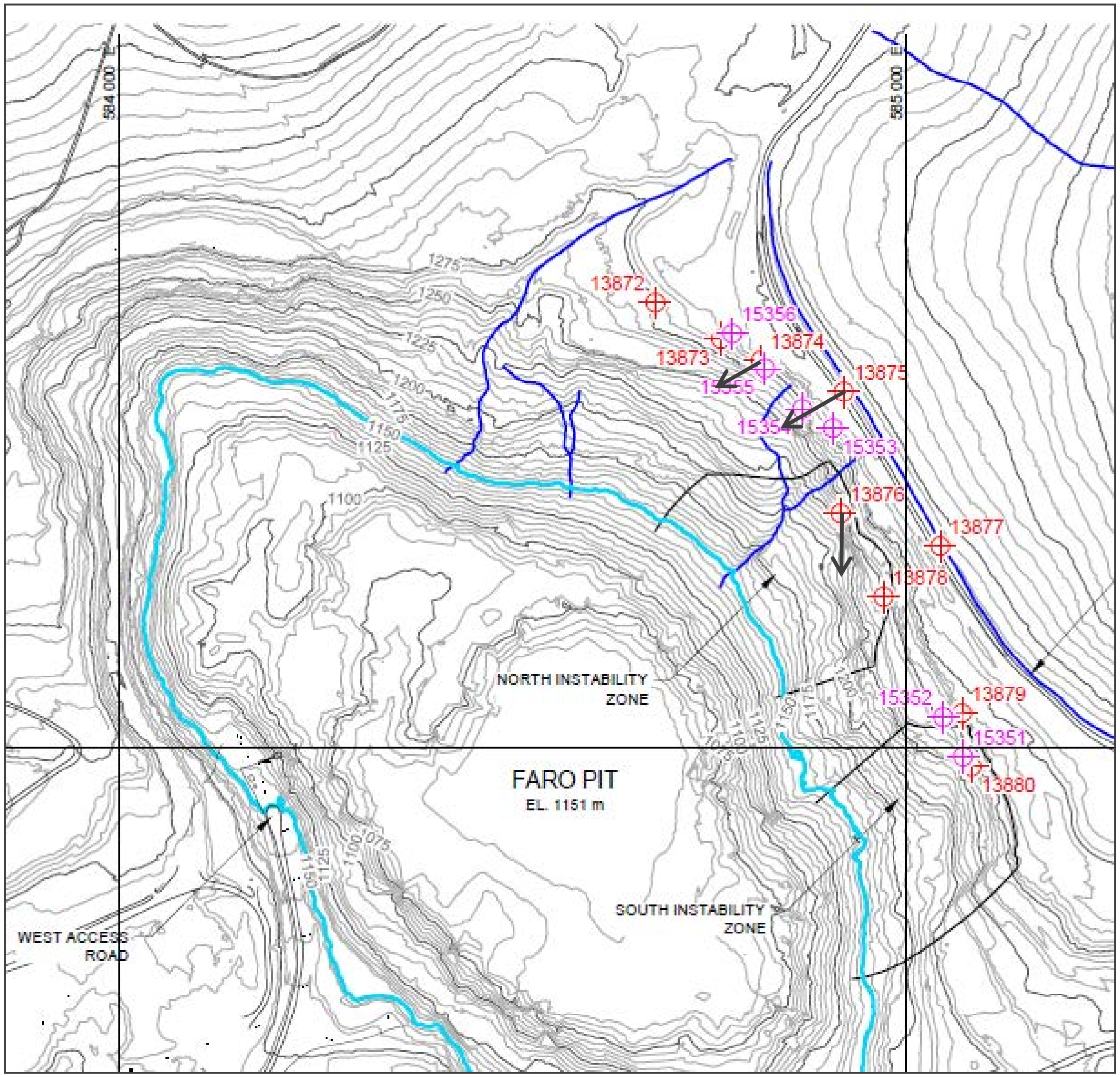
TITLE

FARO MONITORING POINT 13880

FIGURE No.
D-9

MONITORING POINT	TOTAL CUMULATIVE DISPLACEMENT (mm)	NET AZIMUTH (deg.)	NET PLUNGE (deg.)
13874	66.9	237.7	-50.8
13875	91.8	241.2	-40.4
13876	81.7	180.9	-62.0



NOTES:
1. FIGURE NOT TO SCALE.
2. DISPLACEMENT VECTOR LENGTHS ARE APPROXIMATELY 10X MAGNITUDE OF ACTUAL TOTAL CUMULATIVE DISPLACEMENT WITH RESPECT TO SCALE OF DRAWING.

REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT: YUKON GOVERNMENT

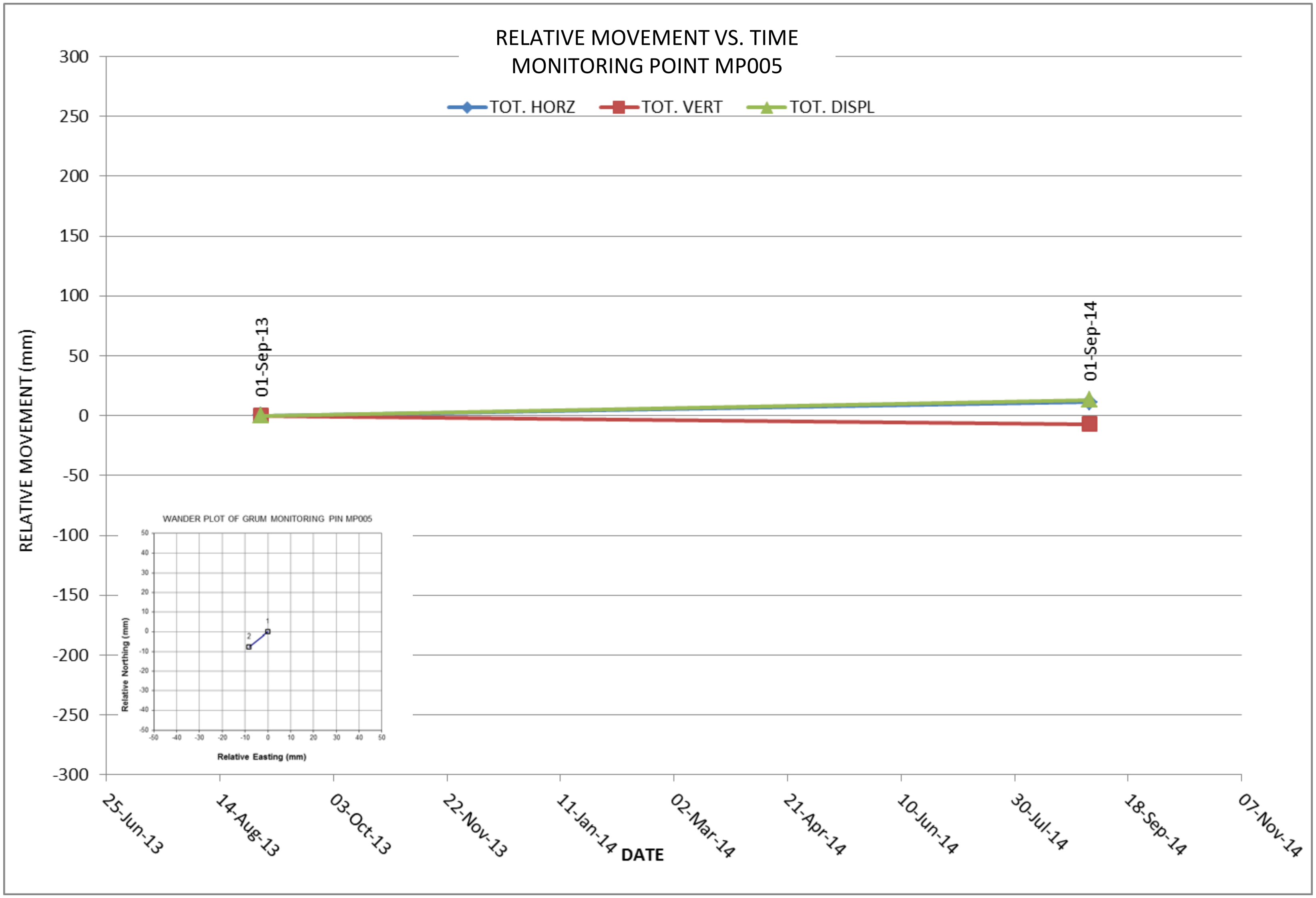
CONSULTANT: Golder Associates

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE:
TOTAL CUMULATIVE DISPLACEMENT VECTORS
FARO MONITORING POINTS 13874, 13875, & 13876

FIGURE No. D-10

O:\Active_2014\1426\1410944 YG 2014 Faro Pit Slopes\07 Deliverables\Rev. 0\Appendices



0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC
REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW

CLIENT
YUKON GOVERNMENT

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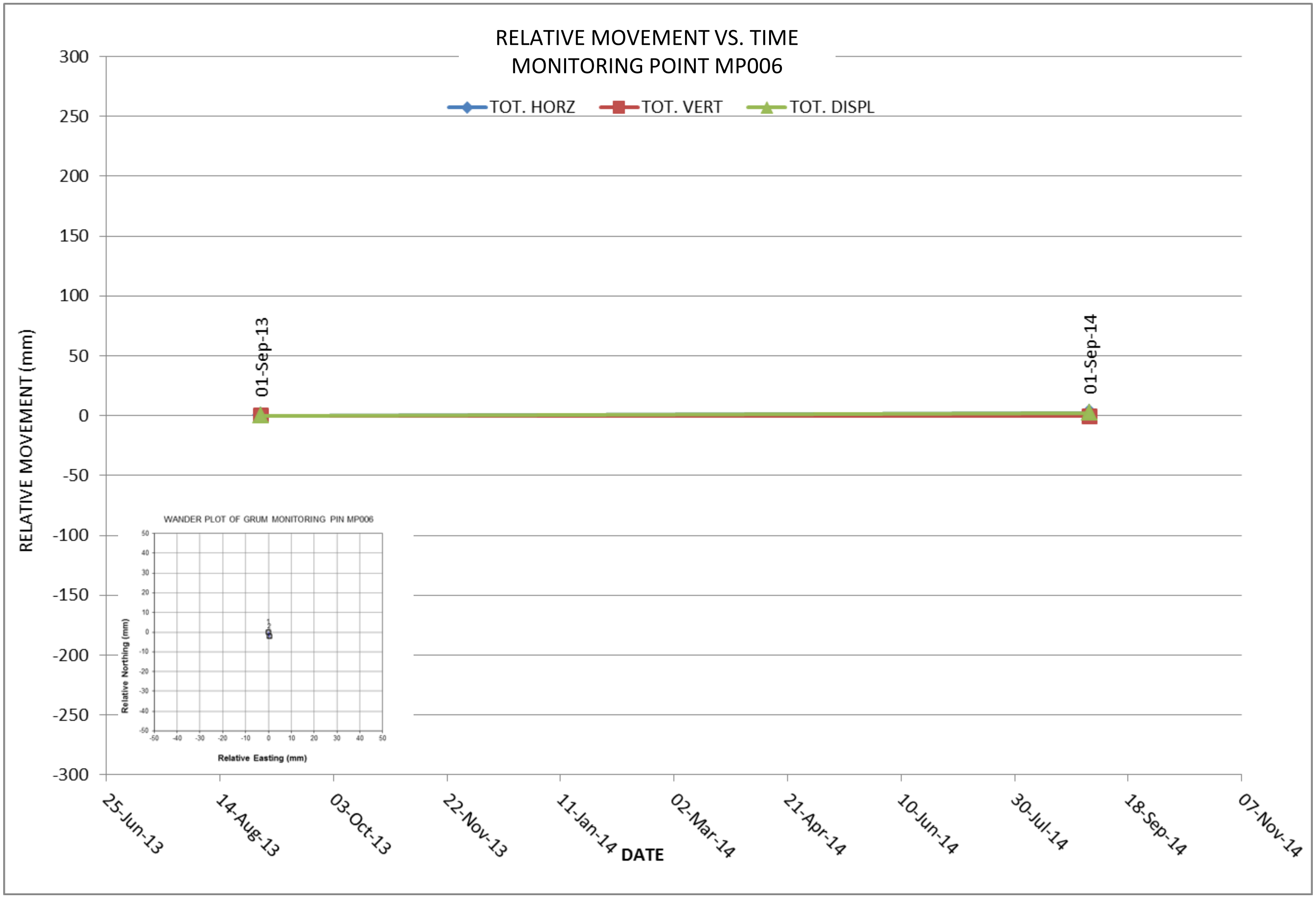
PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
GRUM MONITORING POINT MP005

FIGURE No.
D-11



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

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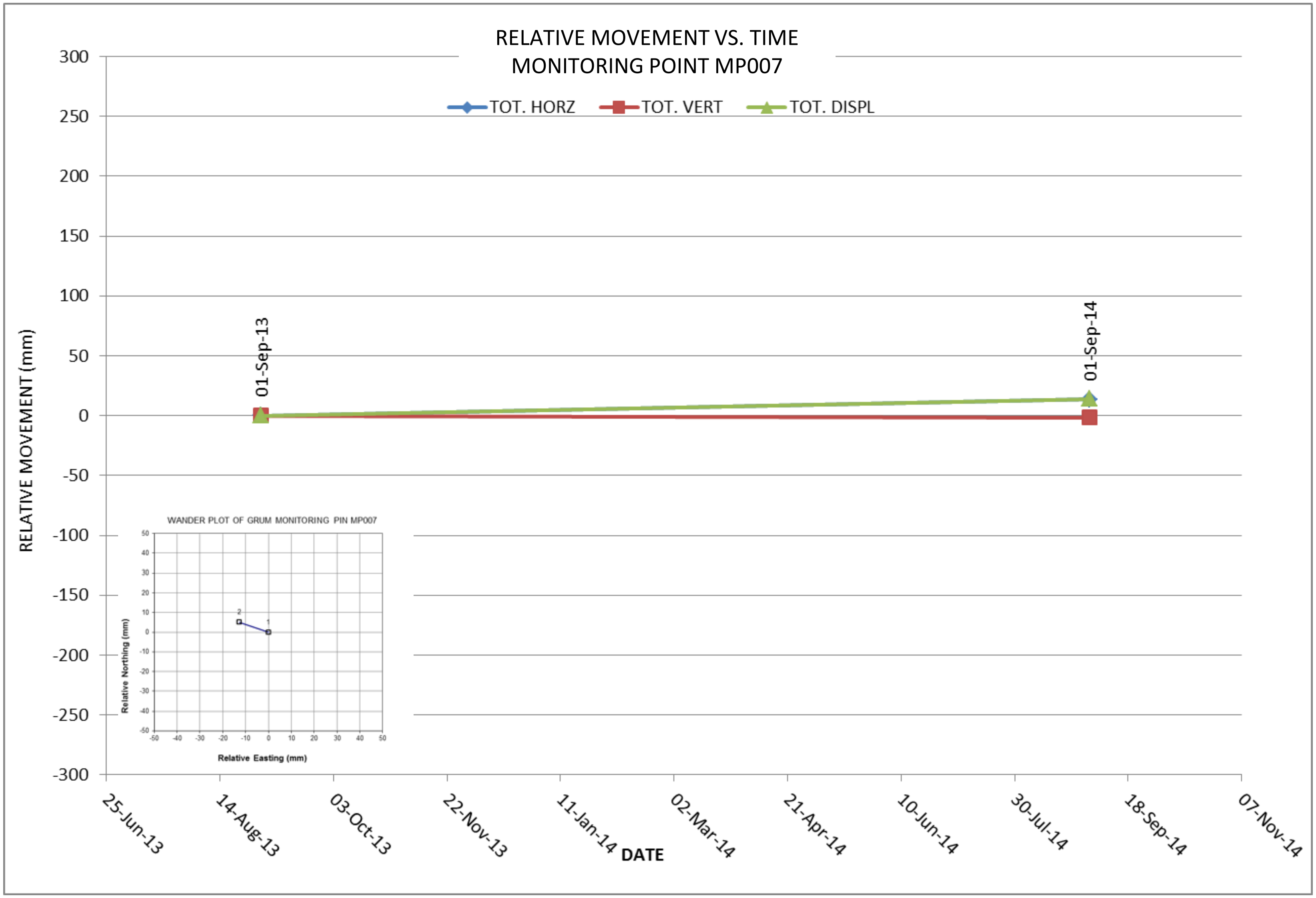
TITLE
GRUM MONITORING POINT MP006

FIGURE No.
D-12



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

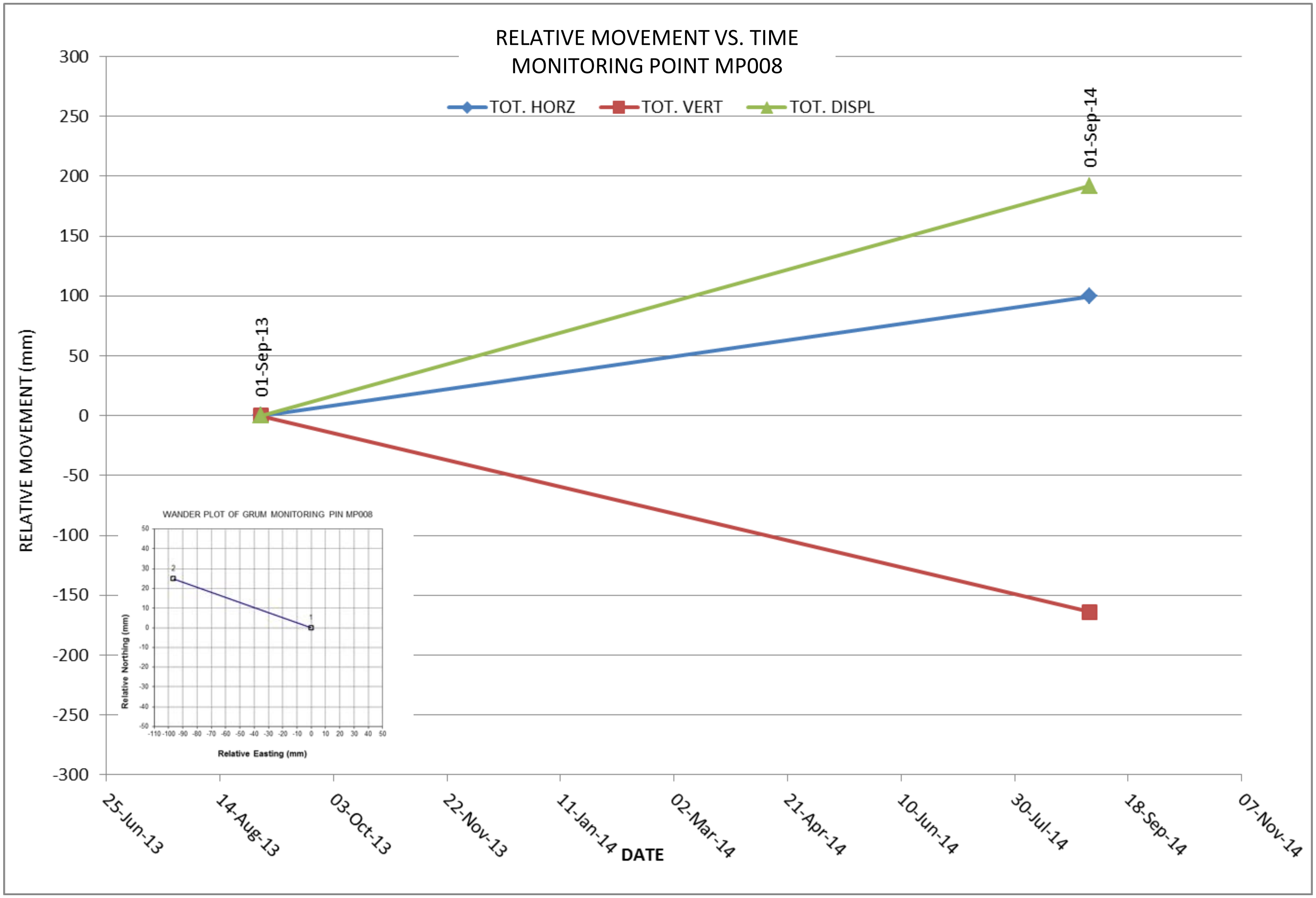
CLIENT: YUKON GOVERNMENT

PROJECT: 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

CONSULTANT: Golder Associates

TITLE: GRUM MONITORING POINT MP007

FIGURE No. D-13



REV	DATE	DESCRIPTION	DRW	DES	CHK	RVW
0	16/SEP/14	FIGURE	JJR	JJR	AVC	AVC

CLIENT
YUKON GOVERNMENT

CONSULTANT
Golder Associates

PROJECT 1410944/6000
FARO MINE COMPLEX
2014 PIT SLOPE INSPECTION

TITLE
GRUM MONITORING POINT MP008

FIGURE No.
D-14

APPENDIX E

Summary of Recommendations

Table E-1: Summary of Faro Mine Complex 2014 Pit Slope Inspection Recommendations

Pit	Recommendation	Level of Importance and Timeframe for Action
Faro	■ Construct a berm at the end of the Zone 2 access road to prevent someone from driving or falling into the pit lake, similar to the one at the end of the west access road. If this road is used to access the lake itself, erect a moveable barrier such as a construction barrier.	High - Short Term
	■ Construct berms on south side of the Zone 2 access road where rockfall hazards exist. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform of rockfall hazard and required setback distance.	High - Short Term
	■ With respect to the crest regression pins, the frequency of the monitoring should be increased from twice yearly to monthly, because of the importance of the FCDC behind the crest.	High - Short Term
	■ As previously recommended, the monitoring point survey data should be plotted as soon as possible to determine if there is an error with the survey so that the monitoring points can be re-surveyed if necessary before they are covered with snow. Considering that the monitoring points are only surveyed once a year, not reviewing the data in a timely manner could result in significant displacement of the slope not being detected in a timely manner.	High - Long Term
	■ Repair any damaged wooden marker structures over the crest regression pins and replace missing tags on the pins. Ensure that all the reference pins are tagged correctly so that the various contractors are able to refer to the correct pins when taking measurements and reporting data. In addition, it is recommended that YG ensure that there is documentation of the coordinates of all the monitoring points and pins so they may be plotted correctly in reference maps by contractors. If any coordinates are missing, YES should survey them as soon as practicable.	Medium - Short Term
	■ The water level in the pond behind the dam in the northwest corner of the pit should be visually monitored during the spring and fall. If drainage is not occurring and water levels are rising then it should be pumped. Include this recommendation in the Emergency Response Plan and have a pump available for emergency pumping.	Medium - Long Term
	■ Monitor the water in the ditch on the east side of the berm on the east wall during the spring and fall. If large amounts of ponded water are observed, grade the ditch so that the water will flow along the ditch and not form large ponds of water that could infiltrate the slope.	Medium - Long Term
Grum	■ Construct a berm at the end of the access ramp into the pit, in the area of rockfall near the power poles. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform of rockfall hazard and required setback distance.	High - Short Term
	■ Relocate the power pole on the north slope above the Grum Slot Cut to a more stable location.	High - Short Term
	■ Continue to monitor the instability zone for overall instability. The monitoring pins should continue to be read once per year by YES. The frequency of the readings of the crest regression pins can be reduced from once per month to twice yearly, as there is no critical infrastructure near the crest of the Grum Pit east wall.	High - Long Term
	■ Visually monitor the area that appears to be slumping in the southwest corner of the pit, and take periodic photographs from the same location to determine if there is continued displacement.	High - Long Term
	■ Repair reference bar GP-S4.	Medium - Short Term
	■ If large areas of ponded water are observed behind the crest of the east wall, grade the area to minimize ponded water and infiltration into the slope as well as to control runoff onto the slope face.	Medium - Long Term
	■ Clear the vegetation from the south end of the Grum Interceptor Ditch.	Low - Long Term
Vangorda	■ Cracks were observed in 2013 and 2014 in the face and at the crest of the till slope in the northwest corner of the pit that had not been observed in 2012. Carry out a periodic visual assessment of the cracks to determine if there are any significant changes in the size or intensity of the cracks. Carry out a visual assessment any time personnel will enter the pit. If the cracks increase in size or intensity, it is recommended that a geotechnical engineer review the stability of the slope.	High - Short Term
	■ As recommended in 2012, construct a berm on the west side of the access road and in the southeast corner to provide rockfall protection to personnel working near the slope. Conversely, deepen the ditch at the toe of the slope so that it acts not only as a drainage ditch but also a catch-ditch for falling rocks. If no rockfall protection is constructed, a minimum setback distance of 10 metres is recommended for any work carried out in the area. Install a sign to inform of rockfall hazard and required setback distance.	High - Short Term
	■ If there are significant changes in the condition of the till slope on the west side of the pit, retain a geotechnical engineer to carry out a full stability assessment, which may require field investigations and stability analyses.	High - Long Term
	■ Repair or replace the Vangorda Flume as soon as practicable to limit the amount of water that is seeping into the slope on the north side.	High - Long Term

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