Pogo DSTF Construction and Maintenance Plan

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Pogo Drystack Tailings Facility Construction and Maintenance Plan Revisions			
Revision #	**Date**	**Change**	**By**
3	November 2011	This document replaced DSTF OMS Manual Revision 2 prepared by AMEC in December 2007	Pogo
4	May 2014	Update documents including the information on new diversion ditch construction as-built and DSTF closure study	Pogo

Table of Contents

List of Tables

List of Figures

List of Drawings

List of Appendices

1.0 INTRODUCTION

1.1 Objective

Sumitomo Metal Mining Pogo LLC (Pogo) is the operator of the Pogo gold mine, located 38 miles northeast of Delta Junction, Alaska.

The Dry Stack Tailings Facility (DSTF) has been in operation since February 2006. As of end of 2013, about 7.1 million tons (Mt) of material was placed at DSTF, which included 4.6 Mt tons of flotation tailing and 2.5 Mt of waste rock. The capacity of the original facility was estimated to be about 7.5 Mt, and was expanded to 20 Mt by constructing new diversion ditch in September 2013.

The DSTF was originally designed by AMEC (AMEC, 2004a), and the Operating, Maintenance and Surveillance (OMS) Manual was issued in January 2006 by AMEC as a guiding document for the construction of the DSTF. Subsequently, it was revised and issued as revision two in December 2007 (AMEC, 2007). Pogo updated the OMS Manual and issued as Construction and Maintenance Plan (“Plan”) in November 2011, reflecting the information from DSTF Expansion Preliminary Study (SRK, 2011a) and the field compaction test conducted in March 2011 (SRK, 2011b). Pogo updated the Plan in May 2014 including the as-built design of new diversion ditch (SRK, 2014a), updated stability evaluation (SRK, 2014b), and the DSTF year-by-year plan based on the draft life of mine plan as of end of year 2013.

This Plan provides practical steps to construct and maintain the DSTF as designed. It should be noted that the water quality, hydrology, and geochemical monitoring plans were omitted from this Plan and is described in the Pogo Mine Monitoring Plan (Pogo, 2013).

1.2 Document Control and Responsibility

The Environmental Manager is responsible for the preparation and administration of this Plan. Any revisions or updates to the Plan shall be submitted to Alaska Department of Natural Resources (ADNR).

The Maintenance Manager is responsible for the construction of the DSTF. The site specific Standard of Procedure (SOP) will be established in accordance with this Plan and will be informed to all relevant personnel.

The Environmental Manager is responsible to implement the monitoring and inspection required by this Plan, and to report to the relevant agencies.

2.0 FACILITY DESCRIPTIONS

2.1 Major Components

Figure 1 shows the plan view of the DSTF as of September 2013. The major components of DSTF include:

- Flow-Through Drains;
- Starter Berm and Toe Berm;
- Shell Area;
- General Placement Area (GPA); and,
- Diversion Ditch.

2.1.1 Flow-Through Drains

All runoff in and around the DSTF is directed to the Recycle Tailings Pond (RTP) by means of a network of drains. Flow-through drains are constructed in the existing stream valleys within the DSTF area to augment the existing drainage courses and allow them to pass runoff under the stack. The drains are extended upstream of the existing stream as the elevation of GPA rises.

Figure 2 shows the cross-section of the flow-through drains. The rock fill used in the flow-through drains is between 12 inch and 36 inch in size, and covered with a filter material to prevent fines migrating in from the dewatered flotation tailings. The rock fill is placed at about 1H:1V, resulting in a drain base width of 21 ft, crest width of 9 ft and height of 6 ft.

The filter of flow-through drain consists of two layers: Filter 1 and Filter 2. The sand (0.04 inch to 0.2 inch in size) should be used for Filter 1, and the gravel (0.2 inch to 4 inch in size) should be used for Filter 2.

The corresponding flow capacity of the flow-through drains are calculated to be approximately 120 times the daily average flow of 0.47 cfs (200 gpm) measured at the United States Geological Survey gauge on Liese Creek, and this is approximately equivalent to a 1:10,000-year/24-hour storm event with no allowance for freeboard and without the benefits of the diversion ditch (AMEC, 2004a).

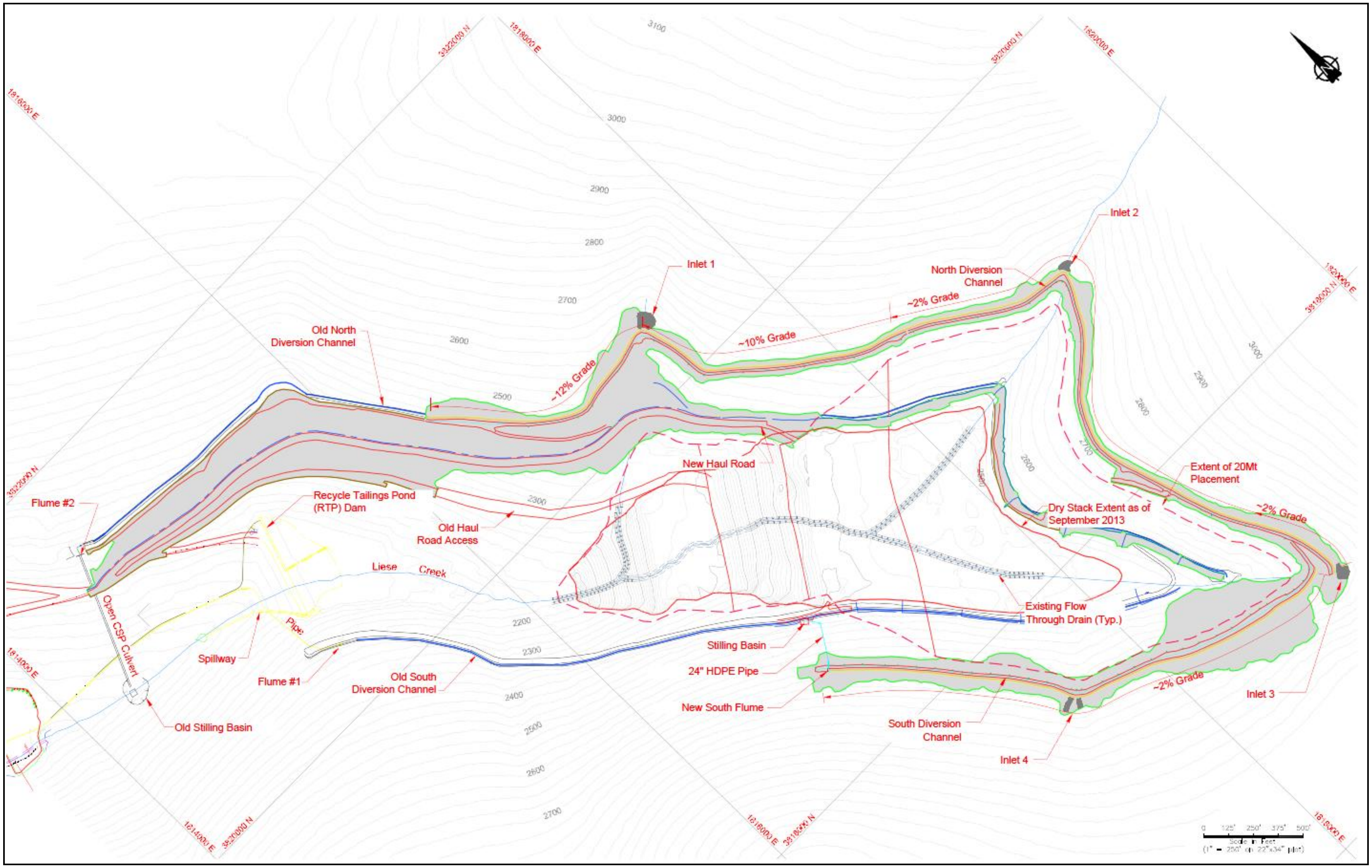


Figure 1: General Configuration of DSTF as of September 2013

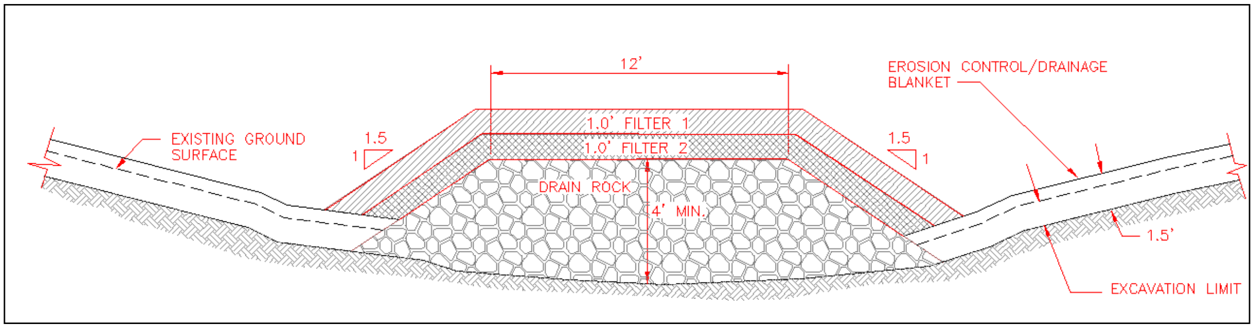


Figure 2: Typical Cross Section of Flow-Through Drain

2.1.2 Starter Berm and Toe Berm

The starter berm was constructed as the initial containment for the GPA with the material from nearby colluvium excavations. The toe berm, downstream of the starter berm was constructed of non-mineralized rock and acts as a foundation of the shell area. The toe berm was extended to downstream before the construction of the second and third shell.

2.1.2 Shell Area

There are three shells on the DSTF. The first shell (Shell 1) was constructed using non-mineralized rock only to a width of 100 ft on the 3:1 slope. The haul road has been constructed on the Shell 1. The second shell (Shell 2) and third shell (Shell 3), which has been constructed since 2010, is a composite shell which consists of non-mineralized rock and dewatered flotation tailings. Non-mineralized rock is placed at the face slope to a width of 20 feet, and then the dewatered flotation tailings are placed inside of the non-mineralized rock and compacted (see **Figure 3**). The width of the Shell 2 and Shell 3 is about 180 ft and 150 ft, respectively.

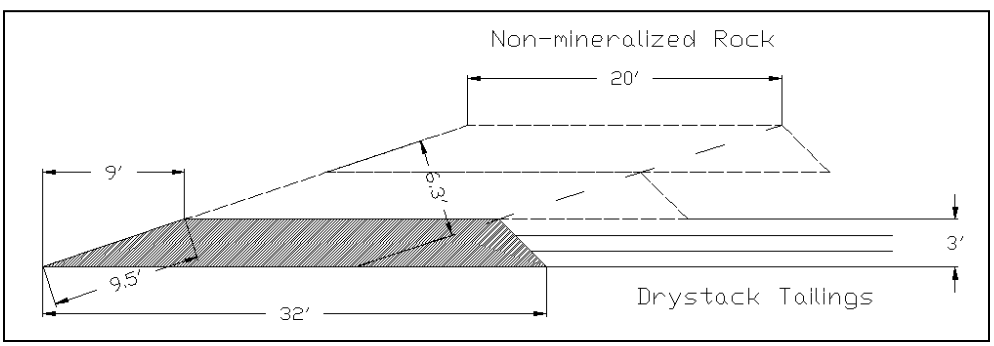


Figure 3: Typical Cross Section of Shell 2 and Shell 3

2.1.3 General Placement Area (GPA)

Dewatered flotation tailings and mineralized development rock is co-disposed in the General Placement Area (GPA). The mineralized rock is encapsulated in the tailings to minimize the oxidation of any sulfide minerals present. The mineralized rock may not be placed within 50 ft from the perimeter of DSTF.

The non-mineralized waste rock is placed at the perimeter of DSTF to allow any runoff from precipitation that bypasses the diversion ditch above the site to flow into the flow-through drains. All flows or seepage from the DSTF is collected in the RTP.

2.1.4 Diversion Ditch

The diversion ditch aims to intercept the “non-contact” surface water from areas unaffected by mine development. In order to expand the capacity of DSTF to 20Mt, a new diversion ditch was constructed in 2013.

The new north diversion ditch is about 5,850 feet long and runs from Inlet 3 at an elevation of 2,750 feet amsl into the existing north diversion ditch at an elevation of about 2,404 feet amsl. The remaining 2,049 feet of existing north diversion ditch connects to Flume #2 at an elevation of 2,158 feet amsl. Flume #2 is composed of a 750 feet-long, 60-inch diameter open CSP culvert. It discharges into Liese Creek about 700 feet downstream of the RTP Dam.

The new south diversion ditch is about 2,654 feet long and ranges in elevation from about 2,716 to 2,661 feet amsl. The new south diversion ditch connects to the existing ditch at about elevation 2,499 feet amsl via a 342-foot, 24-inch diameter HDPE pipe with intake and outlet structures. The discharge capacity of New South Flume is estimated to be 27 cfs (SRK, 2013a). The 2,329 feet-long existing south diversion ditch connects to Flume #1 at an elevation of 2,195 feet amsl. The water from the south diversion ditch discharges into the spillway via a 427-foot, 20-inch diameter HDPE pipe. The discharge capacity of Flume #1 is estimated to be 20 cfs (AMEC, 2006).

The diversion ditch is designed to intercept a one in 200-year, 24-hour precipitation event (4.6 inches within 24 hours). Minimum one foot of freeboard was incorporated into the design. The estimated design flow (200-year, 24-hour precipitation event) for post-expanded conditions calculated by SRK is 78 cfs at Flume #2 (north diversion ditch), 24 cfs at the New South Flume, and 34 cfs at Flume #1 (south diversion ditch), respectively (SRK 2013b).

2.2 Environmental Management

2.2.1 Water Management

The diversion ditch was constructed around the DSTF to divert surface, and near surface, runoff around the DSTF, so that such water becomes “non-contact.” The diverted water is routed to the Liese Creek downstream of the RTP.

Runoff down gradient of the diversion ditch and DSTF seepage are considered “mine-contacted.” These waters are routed to a flow-through drain and into the RTP.

2.2.2 Sedimentation Control

The flotation tailings erosion translates into a sediment load in the RTP, thus specific sedimentation control measures are used to keep erosion to a minimum:

- The slope of each shell is covered with non-mineralized rock, which minimizes the erosion of dewatered flotation tailings;
- The surface of GPA has two percent slopes to the nearest perimeter of GPA to limit erosion on the tailings; and
- The materials dumped on the DSTF are compacted as soon as possible.

2.2.3 Dust Control

Tailings have the potential to create dust, especially when they have been frozen or desiccated by the sun. Best management practices are used to control dust during dry stack operations such as; compacting the tailings, controlling traffic on the compacted flotation tailings, and limiting the use of equipment to active placement area(s) only. Summer moisture from rainfall assists in keeping the surface moisture content within an acceptable range although prolonged periods of warm weather with low humidity may require building silt fences around non-active placement areas.

3.0 CONSTRUCTION DESIGN CRITERIA

3.1 Placement Schedule

The placement schedule was updated based on the as-built survey data from September 2013 and the life of mine plan issued in February 2014. **Table 1** shows the placement schedule between 2014 and 2019. Major assumptions used for scheduling are as follows:

- Dry densities of the compacted materials are assumed based on the in-situ measurements and engineering judgments. The calculated volume using the tonnage record and the assumed dry densities shows good correlation with the surveyed volume. As of September 2013, the surveyed volume of DSTF was about 127.6 million cubic feet (ft^3). The calculated volume from the tonnage record was 122.7 million ft^3. The discrepancy between these volumes is about 3.8%.

  <u>Assumed material dry densities for scheduling:</u>

  - Dewatered flotation tailings (compacted): 105 lb/ft^3 or 19.0 ft^3/ton; and
  - Waste rock (compacted): 125 lb/ft^3 or 16.0 ft^3/ton.

- It is assumed that the Shells won't be constructed by 2019.
- All waste rocks including mineralized rock and non-mineralized rock excavated at the underground mine will be placed at the DSTF.

Drawings 1 - 7 are the year-by-year drawings for the DSTF between September 2013 and 2019.

Table 1: Material Placement Schedule at the DSTF

Year		2006 - 2013	2014	2015	2016	2017	2018	2019	Total
Production									
Ore Milled	ton	-	920,706	920,832	920,753	920,960	900,643	515,093	5,098,987
Waste Rock Excavated	ton	-	735,468	574,949	542,135	611,724	543,122	241,592	3,248,990
Tailings Backfilled in Underground	ton	-	373,195	376,379	380,115	380,296	366,351	209,052	2,085,389
Material Placed at DSTF									
Drystack Tailings	ton	-	547,511	544,453	540,638	540,664	534,292	306,041	3,013,598
Waste Rock	ton	-	735,468	574,949	542,135	611,724	543,122	241,592	3,248,990
Total	ton	-	1,282,979	1,119,402	1,082,773	1,152,388	1,077,414	547,633	6,262,588
Cumulative Tonnage at DSTF									
Drystack Tailings	ton	4,592,177	5,139,688	5,684,141	6,224,778	6,765,442	7,299,734	7,605,774	-
Waste Rock	ton	2,463,536	3,199,004	3,773,953	4,316,088	4,927,812	5,470,934	5,712,526	-
Total	ton	7,055,713	8,338,693	9,458,094	10,540,867	11,693,254	12,770,668	13,318,301	-
Shell Area									
Drystack Tailings	ton	-	-	-	-	-	-	-	-
Waste Rock	ton	-	-	-	-	-	-	-	-
Total	ton	-	-	-	-	-	-	-	-
General Placement Area									
Drystack Tailings	ton	-	547,511	544,453	540,638	540,664	534,292	306,041	3,013,598
Waste Rock	ton	-	735,468	574,949	542,135	611,724	543,122	241,592	3,248,990
Total	ton	-	1,282,979	1,119,402	1,082,773	1,152,388	1,077,414	547,633	6,262,588
End of Year Crest Elevation of GPA	**ft**	**2,505**	**2,524**	**2,539**	**2,551**	**2,564**	**2,576**	**2,582**	

3.2 Tailings Characterization

Laboratory tests of the flotation tailings were carried out in 2009 by Golder Associates. In addition, a compaction test was carried out in March 2011 to evaluate the influence of the frozen flotation tailings on compaction. SRK conducted additional geotechnical tests using the Shelby Tube samples collected from piezometer drill holes. **Table 2** summarizes the geotechnical properties of flotation tailings obtained by these tests.

3.3 Development Rock Characterization

It is assumed that development rock placed and compacted will have a dry in-place density of approximately 125 lb/ft^3 (2.00 t/m^3). No geotechnical laboratory test was carried out using the development rock. The geotechnical characteristics of the development rock were estimated based on typical published values and engineering judgment for use in design.

3.4 Structural Stability Evaluation

The stability of the 20 Mt DSTF was previously studied by AMEC using the conceptual design (AMEC, 2004a). SRK updated the construction design for the 20 Mt DSTF (see **Drawing 8**), and evaluated its structural stability considering the variability of pseudo-static loadings, phreatic surfaces, and strength parameter (friction angle) of materials (SRK, 2011a). SRK updated slope stability evaluation as a part of DSTF Closure Study, considering the additional geotechnical tests and monitoring information on the phreatic surface obtained from piezometer holes (SRK, 2014b). This section summarizes the results of stability evaluation.

Table 2: Geotechnical Properties of Flotation Tailings

Parameters	Properties	Testing Method	Information Source
Specific Gravity	2.56	ASTM D854-06	2011 Compaction Test
Optimum Moisture Content	15% - 16%	Standard Proctor (ASTM D-698)	2011 Compaction Test
Maximum Dry Density	109 lb/ft^3 (1.74 t/m^3)	Standard Proctor (ASTM D-698)	2011 Compaction Test
Shear Strength (Saturated)	Effective Friction Angle 34.4 degree[(1)] Cohesion - 63 psf	Triaxial Compression Test (CU- Test) (ASTM D-4767)	Golder Associates (2009)
Shear Strength (Saturated)	Effective Friction Angle 34.4 - 35 degree[(2)] Cohesion - 0.7 psf	Triaxial Compression Test (CU- Test) (ASTM D-4767)	SRK (2014)
Direct Shear Strength (90% Compaction)	Friction Angle - 37 degree Cohesion – 140 psf	Direct Shear Test (ASTM D-3080)	2011 Compaction Test
Direct Shear Strength (95% Compaction)	Friction Angle - 39 degree Cohesion – 90 psf		
Direct Shear Strength (100% Compaction)	Friction Angle - 41 degree Cohesion – 60 psf		
Hydraulic Conductivity (saturated)	1E-07 m/s	Tri-axial Saturated Hydraulic Conductivity (ASTM D-5084-90) Flexible Wall Permeability (ASTM D-5084-Method C)	Golder Associates in 2009 2011 Compaction Test

Notes:

1. Dry densities of specimens for triaxial tests were 101 – 102 pcf (93 – 94% of maximum dry density).
2. Triaxial testing indicated the following with respect to excess pore pressure generation in tailings (SRK, 2014b):
   1) For low confining pressures (near 5 psi) the samples under triaxial compression generally seemed to preserve volume with little to no contraction, dilation, or generation of excess pore pressure; and
   2) At higher confining pressures (over 120 psi), the soil under triaxial compression generally showed an initial contractive behavior (i.e., increasing excess pore pressure) for axial deformations between 2% and 5%, with dilatant behavior (i.e., decreasing excess pore pressure) for higher deformations.

3.4.1 Design Criteria

The design criteria used for the stability analysis were specified in the original design report (AMEC, 2004a). Stability analysis of embankment slopes requires assessment of the structure's ability to withstand the effects of self-weight (static) and earthquake induced (pseudo-static) loading conditions under both operating and closure conditions. In the original design report, it was considered the minimum allowable factor of safety (FoS) under static loading conditions during operations and closure conditions to be 1.5. During pseudo-static conditions, the minimum allowable FoS was selected as 1.1.

3.4.2 Seismic and Excess Pore Pressure Analysis Parameters

Seismic design criteria were developed for the Pogo site during completion of the project's Feasibility Study (Teck-Pogo, 2004) and reiterated in the RTP Dam Design Report (AMEC, 2004b). In summary, the peak ground acceleration (PGA) of 0.2 g (i.e., 20% of acceleration due to gravity) has a recurrence interval of 2,475 years at the site, and represents the Maximum Design Earthquake (MDE) for the project (AMEC, 2004b). The PGA was reduced by half to 0.1 g for input to the slope stability model as a horizontal acceleration. The one-half reduction in PGA for slope stability analysis accounts for the duration of ground acceleration necessary to damage earth and rock structures (the PGA is an instantaneous acceleration) as well as the attenuation provided by earth and rock structures (AMEC, 2004b; SRK, 2014b).

Vertical acceleration can be a considerable component of earthquake ground motion, especially in close proximity to a seismic source. The ratio of peak vertical to peak horizontal ground acceleration generally decreases with increasing distance from the seismic source. Based on engineering judgment and literature review, a vertical ground acceleration 0.7 times horizontal ground acceleration was selected for the sensitivity analysis (AMEC, 2014b).

SRK (SRK, 2014b) evaluated the sensitivity of the pseudostatic stability model to excess pore pressure with the B-bar coefficient of the computer program SLIDE (Version 5.026), which can be varied from 0 (no excess pore pressure from vertical stress change) to 1 (excess pore pressure equals vertical stress change). B-bar coefficients of 1 were assumed for the compacted tailings, GPA, and interface materials. B-bar coefficients of 0 were assumed for rock shell and flow-through drain, starter berm and toe berm, overburden, and bedrock materials.

3.4.3 Material Strength Parameters

AMEC (AMEC, 2004a) modeled the shells with moderate shear strength and GPA with no shear strength, whereas SRK (SRK, 2011a; SRK, 2014b) modeled the shells and GPA with moderate shear strengths due to operational compaction of GPA.

AMEC (AMEC, 2004a) reduced the laboratory-obtained shear strength (tangent of effective friction angle) by 20% for use in the slope stability analysis to simulate a “direct shear stress path”. SRK (SRK, 2011a) utilized a 20% reduction in effective friction angle to evaluate sensitivity of the slope stability analysis to shear strength.

ADNR questioned the methodology for the shear strength reduction of AMEC (AMEC, 2004a) and considered the effective friction angle reduction of SRK (SRK, 2011a) to be arbitrary. In response to these concerns, Pogo collected geotechnical parameters and samples from the sonic boreholes drilled in the DSTF for laboratory index and shear strength test. **Table 3** summarizes the material parameters used in the stability analysis conducted by SRK (SRK, 2014b).

Table 3: Material Properties Used for Stability Analysis (SRK, 2014b)

Material	**Bulk Unit Weight** (pcf)[4]	**Saturated Unit Weight** (pcf)[4]	**Friction Angle** (degrees)
Compacted Tailings[1]	118	128	34
General Placement Area[1,2]	118/125	128/135	34
Rock Shell	125	135	38
Flow-through Drain	125	135	38
Starter Berm and Toe Berm	125	130	32
Overburden	125	130	32
Bedrock	156	156	40
Interface [3]	118	128	varies

Notes:

1. Nonlinear shear strength envelope was also analyzed based on triaxial shear test result for tailings Sample 10838/10839 Comp (SRK, 2014b).
2. Unit weights were varied between tailings and waste rock values for general placement area (GPA) materials.
3. “Interface” material type created to facilitate analysis of non-circular failure surfaces at boundaries between material types (see Section 2.4). The bulk and saturated unit weights are minimum values for materials present at the interface. The shear strengths are assumed to be the same as the weaker material at the interface.
4. Pounds per cubic foot

3.4.4 Phreatic Surface

One significant difference among three stability analyses conducted by AMEC and SRK was the assumed phreatic surface:

1. AMEC (AMEC, 2004a) assumed a phreatic surface 10 ft below the original ground surface;
2. SRK (SRK, 2011b) performed a sensitivity analysis, using the AMEC phreatic surface, a phreatic surface at the original ground surface, and a phreatic surface within the DSTF up to 50 ft above the original ground surface.
3. SRK (SRK, 2014b) assumed the phreatic surface presented in **Figure 4** based on the following observations:
   - The SB-1 deep vibrating wire piezometer (VWP) has consistently reported positive pore pressures since shortly after installation in October 2012; pore pressures measured through October 2013 have ranged up to 6 psi, indicating a maximum recorded phreatic surface elevation of 2,317.5 ft. In addition, wet material was encountered in the bottom 5 ft of the SB-1 borehole during drilling in October 2012.
   - Water discharges from the flow-through drain at the toe of the DSTF; therefore, the phreatic surface was assumed to project from the measured elevation in SB-1 (at the starter berm) downgradient to the top of the flow-through drain at the DSTF toe.
   - Water enters the flow-through drain upgradient of the DSTF. Furthermore, the deep VWP in GP-1 and RR-1 reported negative pore pressures or pore pressures near 1 psi. Therefore, the phreatic surface was assumed to project from the measured elevation in SB-1 upgradient to the flow-through drain, and follow the top of the drain upgradient to the highest elevation on the DSTF section.
   - Given these observations, the phreatic surface at SB-1 was set to 2,330 ft for this analysis, which corresponds to the crest of the starter berm (from data supplied by Pogo) and is approximately 12 ft higher than the maximum measured pore pressure in SB-1, as of October 22, 2013.

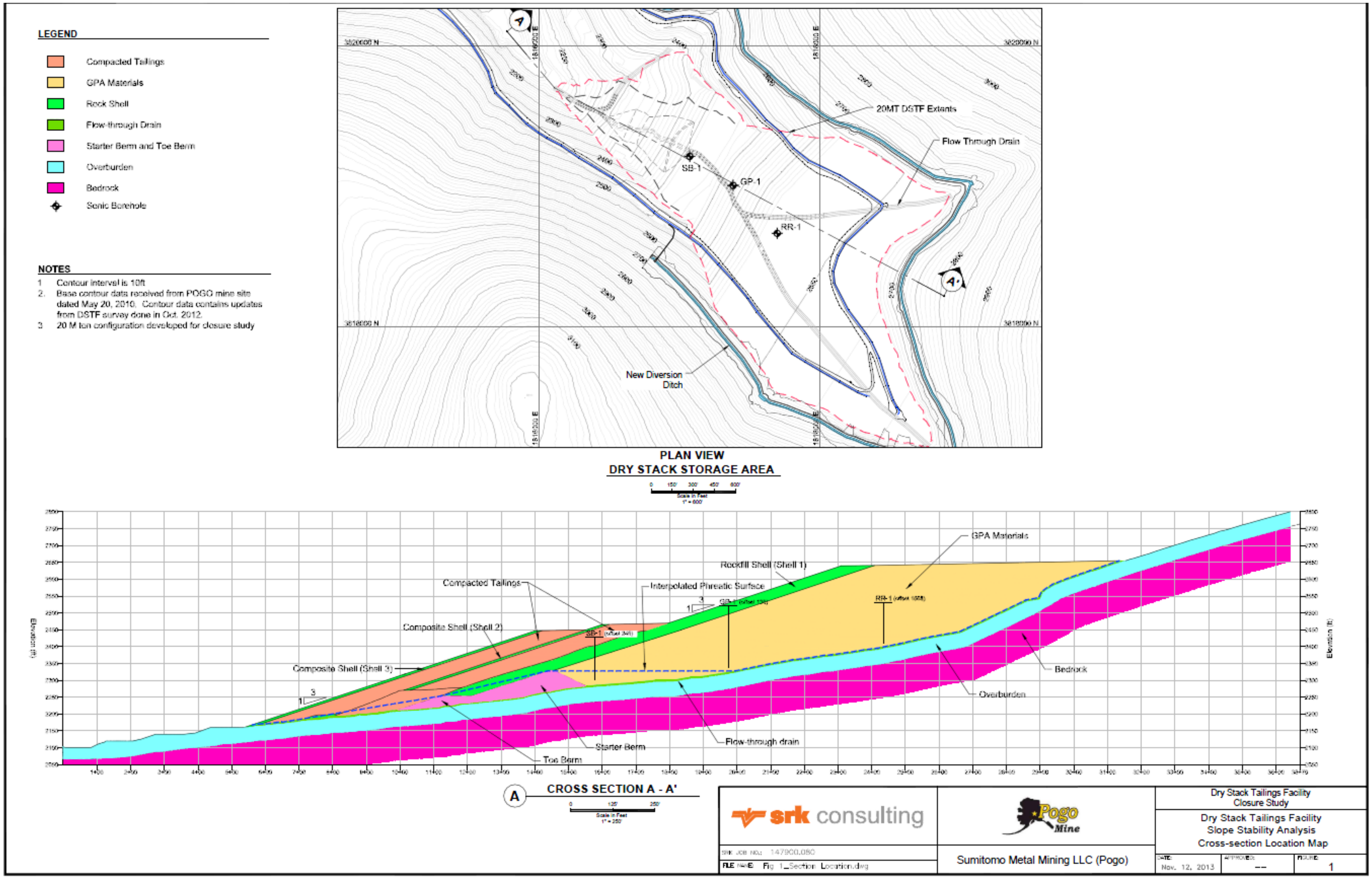


Figure 4: Phreatic Surface Used for Stability Analysis (SRK, 2014b)

3.4.5 Stability Analysis

The slope stability analysis was performed using the computer program SLIDE (Version 5.026). SLIDE is a two-dimensional, slope stability analysis program for evaluating the FoS of circular or non-circular failure surfaces in a defined slope. SLIDE analyzes the stability of slip surfaces using vertical slice, limit equilibrium methods (e.g., Bishop, Janbu, Spencer, etc.). Individual slip surfaces can be analyzed, or random search methods can be applied to locate the critical slip surface for a given slope. Spencer's method was used as it considers both force and moment equilibrium.

The potential failure surfaces through the shells, GPA, and native soil layers were evaluated in SLIDE using the circular failure mode, while failure surfaces along the rock shell/flotation tailings interfaces and flow-through drain/DSTF interface were evaluated using the non-circular (block) failure mode. Both circular failure and block failure modes were evaluated for static and pseudostatic conditions.

There were four potential block failure planes evaluated in this study and they are described as follows:

- Block failure plane 1: the failure surface is between the non-mineralized waste rock in Shell 1 and the underlying tailings of the general placement area;
- Block failure plane 2: the failure surface is between the non-mineralized waste rock in Shell 2 and the underlying compacted tailings;
- Block failure plane 3: the failure surface is between the non-mineralized waste rock in Shell 3 and the underlying compacted tailings; and
- Block failure plane 4: the failure surface is between the DSTF and the flow-through drain.

The results of the slope stability analysis are summarized in **Table 4** and show that the predicted stability of the critical cross-section satisfies the minimum allowable FoS for both static (1.5) and pseudostatic (1.1) conditions. **Table 4** shows the lowest FoS resulting from the different material parameters listed in **Table 3**, analyzed phreatic surfaces in **Figure 4,** and seismic/excess pore pressure parameters. Results of the analysis show minimal sensitivity of the pseudostatic model to vertical acceleration or excess pore pressure, i.e., less than 5% difference in FoS relative to scenarios with horizontal acceleration only and drained conditions (SRK, 2014b).

Table 4: Results of DSTF Slope Stability Evaluations

Section A-A'	Circular Failure Surface		Noncircular Failure Surface	
	FoS - Static	FoS - Seismic	FoS - Static	FoS - Seismic
Circular Failure	1.77	1.22	--	--
Block Failure Plane 1	--	--	2.40	1.72
Block Failure Plane 2	--	--	2.14	1.56
Block Failure Plane 3	--	--	2.02	1.47
Block Failure Plane 4	--	--	2.21	1.50

3.4.6 Liquefaction Analysis

SRK (SRK, 2014b) conducted the liquefaction analysis using a simplified procedure published by Youd *et al* (2001). The simplified procedure to evaluate the liquefaction resistance of soils requires two variables: (1) the seismic demand on a soil layer, termed the cyclic stress ratio (CSR); and (2) the capacity of the soil to resist liquefaction, termed the cyclic resistance ratio (CRR). The FoS against liquefaction can be obtained by dividing CRR by CSR. CSR is a function of peak horizontal acceleration at the ground surface, total vertical overburden stress, effective vertical overburden stress, and the sample depth. The simplified procedure using SPT data was adopted to determine CRR in the liquefaction analysis for the Pogo DSTF materials.

The potential for liquefaction can exist only when loose, granular soil is saturated and subjected to vibration, e.g., earthquake ground motions. Among the soil samples collected from the three boreholes drilled in the 2012, only one sample, which was approximately 97 ft below ground surface (bgs) at SB-1, was below the established water table and was therefore used for liquefaction analysis. The result of the liquefaction analysis indicates the sampled soil from SB-1 has a FoS of 2.3 against liquefaction. Given the scope of observations in this study and the results of this analysis, liquefaction of the DSTF materials during the MDE is considered unlikely.

4.0 COMPACTION TEST IN MARCH 2011

The previous DSTF OMS Manual describes that "windrows of tailings have to be dozed down and spread within 1 hour" during winter conditions. However, it is not practical to implement this rule.

In order to evaluate the influence of frozen dewatered flotation tailings on the compaction and to establish appropriate compaction procedures during winter season, a compaction test was conducted in March 2011. A technical memorandum was provided by SRK (SRK, 2011b). This section summarizes the results of this test.

4.1 Methodology

Four different scenarios were tested on site to assess the potential impact of time lags between the dumping of tailings material into heaps on the surface of the DSTF and subsequent spreading of that material under freezing conditions. The four time lags tested were 1, 2, 3, and 7 days between the time tailings were dumped on the surface of the DSTF and when material was spread into one foot thick lifts and then compacted with a vibratory roller. Air temperature measured during the test period was between -9 and 27 degrees F.

At each site when the specified time had elapsed dumped materials were spread using a CAT D7 track type dozer to create a one foot thick lift that was approximately 30 ft by 60 ft. Each pad was then subjected to three different of compaction passes (four, six and eight passes) with a CAT CS 563 vibratory compactor (approximately 12 tons operating weight).

The following field measurements and laboratory tests were conducted:

- Soil temperature measurements using a handheld infrared gauge;
- In-situ density and water content measurements using nuclear densometer (ASTM D6938-10);
- Sand cone test (ASTM D1556-07);
- Standard Proctor (ASTM D698-07);
- Moisture content (ASTM D2216); and
- Direct shear test (ASTM D3080).

4.2 Results

4.2.1 Soil Temperatures and Frost Penetration

Table 5 summarizes the soil temperature recorded on site. Measured soil temperatures indicate increased frost penetration depth with increased exposure time to freezing conditions. Frost penetration depth ranged from approximately 3 inches from the surface of dumped tailings piles after one day exposure to depths in excess of 3 ft in material heaped for the seven day test. After seven days it is estimated that up to two-thirds (by volume) of tailings material dumped is frozen.

Table 5: Summary of Soil Temperature of Dumped Tailings Piles

Trial	Surface Temp (°F)	3' Depth Temp (°F)	5' Depth Temp (°F)
1 Day Trial	31	72	n/a
2 Day Trial	15	36	n/a
3 Day Trial	10	35	42
7 Day Trial	7	30	n/a(1)

Note: 1 Completely frozen at depth and unable to excavate for temperature measurement.

4.2.2 Material Properties and Field Density Measurements

Table 6 summarizes the material properties of tailings material placed during the test program. The results show the specific gravity and Standard Proctor values are very consistent and indicative of a well-controlled process in which the filtered tailings are produced. Moisture content results near the surface of dumped tailings steadily decreased with increased exposure time.

Table 7 summarizes field density testing results from the nuclear densometer. It indicates a general trend of increasing in situ density as the number of compaction passes increased. Nuclear densometer results also show that compacted density achieved tended to decrease with increasing exposure time. **Table 7** shows that the heaps exposed three days or less meet 90% Standard Proctor with a minimum four compaction passes, and one day and two days duration heaps meet 95% Standard Proctor with a minimum six compaction passes.

Table 6: Laboratory Tests Results – Material Properties

Trial	Moisture Content			Specific Gravity	Standard Proctor	
	Surface	6" below surface	3' below surface		Maximum Dry Density (pcf)	Optimum Moisture Content (%)
1 Day	17.9	n/a	17.9	2.56	109.3	15.0
2 Days	20.2	n/a	17.7	2.56	109.3	15.3
3 Days	13.9	16.5	17.2	2.54	109.3	15.7
7 Days	10.5	19.7	16.8	2.55	107.9	16.3

Table 7: Field Density Measurements

Duration of Pile Exposure	Compaction Effort Trial	Nuclear Densometer		% to Maximum Dry Density
		Density (pcf)	Moisture (%)	
1 Day	4 Passes	102.0	16.2	93.3
	6 Passes	105.4	15.4	96.4
	8 Passes	105.1	16.7	96.2
2 Days	4 Passes	102.3	16.8	93.6
	6 Passes	103.7	16.1	94.9
	8 Passes	106.4	16.7	97.3
3 Days	4 Passes	98.4	16.8	90.0
	6 Passes	100.6	16.9	92.0
	8 Passes	102.7	17.1	94.0
7 Days	4 Passes	90.0	15.5	83.4
	6 Passes	87.8	15.3	81.4
	8 Passes	86.4	15.6	80.1

4.2.3 Shear Strength

Table 8 shows the results of direct shear tests. The tests were completed on remoulded samples compacted to 90, 95, and 100% Standard Proctor compaction effort. The laboratory results showed a general increase in material friction angle along with compaction effort, and adequate shear strength can be developed in the dewatered flotation tailings at 90% Standard Proctor compaction in comparison with the design criteria of 32 degree in friction angle of dewatered flotation tailings.

Table 8: Summary of Direct Shear Results

Sample Compaction Effort	Average Dry Density of Specimen (pcf)	Average Cohesion (psf)	Average Friction Angle (degree)
90%	99.0	140	37
95%	105.1	90	39
100%	109.9	60	41

4.2.4 Major Findings from Compaction Test in March 2011

This section summarizes the major findings obtained from the compaction test conducted in March 2011.

- Dewatered flotation tailings can be placed in the DSTF within the limits of both GPA and Shell during winter conditions once the appropriate construction procedures are consistently followed.
- Adequate shear strength which exceeds the design criteria can be developed in the dewatered flotation tailings at 90% Standard Proctor compaction.
- To achieve 90% Standard Proctor compaction effort during winter/freezing conditions, dewatered flotation tailings should be spread within three days of placement and compacted with a minimum of four passes using a 12-ton compactor.

5.0 CONSTRUCTION PROCEDURES

This section describes the construction procedures of the DSTF.

5.1 General Placement Area

Materials are placed on the GPA year-round. This section describes the construction procedures for the GPA including Shell 1 and associated structures.

5.1.1 Shell 1 Construction

The first shell (Shell 1) has been constructed using non-mineralized rock since the commencement of operation. Shell 1 has a width of 100 ft on the 3:1 slope. Non-mineralized rock is dampened and spread into 3-ft loose lift. Then the lift is compacted with three passes of a D7 Dozer.

A temporary single lane haul road may be constructed on the slope of Shell 1.

5.1.2 Flow-Through Drain and Perimeter Preparation

The flow-through drain along the creek will be extended upward as necessary. The specifications of the flow-through drain are described in Section 2.1.1.

The trees, shrubs, and topsoil along the perimeter of DSTF are removed and non-mineralized rock is placed on the slope surface at a thickness of approx. 1 ft. This layer works as water drainage to route the run-off water on the GPA into the flow-through drain.

5.1.3 Dewatered flotation Tailings Placement

The dewatered flotation tailings is dumped 15-ft apart, and then spread into maximum 12-inch loose lift. Compaction then proceeds with a <u>minimum of four passes</u> of a smooth drum roller having a minimum 12-ton equivalent weight.

<u>Operation During Winter Conditions</u>

During winter season (October to May), some additional work is required:

- Windrows of dewatered flotation tailings have to be dozed down and spread <u>within three days</u>; and

- The placement area needs to be regularly cleared to prevent build-up of snow and ice.

Operation in Wet Conditions

During rainy periods, the dewatered flotation tailings may become difficult to compact if water is allowed to infiltrate. In order to minimize the adverse effect on compaction, the following actions may be taken:

- Keep tailings placement area as small as possible;
- Prior to placement of tailings in this small area, the saturated and softened surface will be scraped off;
- If the tailings cannot be compacted immediately, then they will not be spread at all, but left in a pile. If the tailings remain in a pile, the rain will generally only penetrate the outer shell of the pile; and
- Once dewatered flotation tailings placement in the area is complete, the tailings surface will be smooth, free of water traps, and graded to allow water to run off the surface.

5.1.4 Mineralized Rock Placement

The mineralized rock needs to be encapsulated in the dewatered flotation tailings and the following procedures applied:

- The mineralized rock won’t be placed within 50 ft from the perimeter of DSTF;
- The mineralized rock is dumped and then spread into 3-feet loose lift. Compaction then proceeds with minimum three passes of a D7 dozer; and
- Once three lifts are placed, the mineralized rock will be covered with two one-foot dewatered flotation tailings layers before placing another lift of mineralized rock.

5.2 Shell Area

This section describes the construction procedures for Shell 2 and Shell 3 which consist of non-mineralized rock and dewatered flotation tailings.

5.2.1 Construction Period

The previous DSTF OMS Manual (AMEC, 2007) prescribed that the Shell would be constructed during a typical four month summer construction period. However, compaction test conducted in March 2011 confirmed that the dewatered flotation tailings can be compacted appropriately during winter/freezing conditions once the appropriate construction procedures are consistently followed. Therefore, it is now planned to construct the Shells year-round.

5.2.2 Flow-Through Drain and Toe Berm

The flow-through drain and toe berm for the Shell 2 and Shell 3 have already been constructed. In case additional shell will be constructed, the flow-through drain and toe berm will be sufficiently advanced. The specifications of the flow-through drain are described in Section 2.1.1.

The toe berm is constructed using non-mineralized rock and acts as a foundation for the shells.

5.2.3 Shell Construction Procedures

Shell 2 and Shell 3 are composite shells which consist of compacted dewatered flotation tailings and non-mineralized rock placed on the slope surface of the shells. The construction procedures for these shells are as follows:

- Non-mineralized rock is used to form a crest of the shells. Non-mineralized rock is dumped on the slope side of the shells and then spread into 3-ft loose lift. Compaction then proceeds with a minimum of three passes of a D7 dozer. The crest of non-mineralized rock will have a width of 20 ft on the 3:1 slope; and
- The dewatered flotation tailings are dumped 15-ft apart within the crest, and then spread into maximum 12-inch loose lift. Compaction then proceeds with a minimum of six passes of a smooth drum roller having a minimum 12-ton equivalent weight. Though adequate shear strength can be developed in the dewatered flotation tailings with a minimum of four passes compaction, six passes compaction is applied for Shell construction to minimize the variability of operation.

Operation during Winter Condition

During winter season (October to May), some additional work is required:

- Between November and February, the windrows of dewatered flotation tailings have to be dozed down and spread within one day;

- In October and March to May, the windrows of dewatered flotation tailings have to be dozed down and spread within three days; and
- The placement area needs to be regularly clear to prevent build-up of snow and ice.

Operation in Wet Conditions

During rainy periods, the dewatered flotation tailings may become difficult to compact to achieve the target density if water is allowed to infiltrate. In order to minimize the adverse effect on compaction, the following actions may be taken:

- Prior to placement of dewatered flotation tailings, the saturated and softened surface will be scraped off;
- Windrows of dewatered flotation tailings have to be dozed down and compacted as soon as possible; and
- If the amount of rainfall begins to reach extreme levels (more than 0.5 inches in 24 hours), placement of dewatered flotation tailings in the shell area will be suspended.

6.0 MONITORING

6.1 Geotechnical Monitoring

The compaction of dewatered flotation tailings at the Shells is important for overall stability of the DSTF and to ensure volume capacity. It is necessary to achieve a nominal 90% Standard Proctor of the dry density to secure the designed shear strength. The construction procedures for GPA and Shells aim to compact the dewatered flotation tailings to achieve a minimum of 90% Standard Proctor of the dry density. The geotechnical monitoring will verify compaction of the dewatered flotation tailings during the construction of Shell 2 and Shell 3 for adherence to design standards.

There is no specific monitoring requirement for the dewatered flotation tailings placement at GPA, because it can be deduced from the monitoring results at the Shell, and cumulative compaction effort by piling up the lifts can be expected at GPA.

6.1.1 Geotechnical Monitoring for Shell Construction

During construction of Shell 2 and Shell 3, the QA/QC program shown in **Table 9** will be implemented.

The location of densometer readings and grab samples will be documented using handheld GPS and indicated on a site plan, and included with the data collected for the QC program. If QC testing is completed by an independent third party technician and soils testing laboratory, only the sand cone testing indicated in the proposed QA plan will be completed at a frequency of every 80,000 tons of tailings placed and compacted within each shell. If QC testing is completed by Pogo personnel, QA testing will be carried out by an independent certified technician and soils testing laboratory.

The results of geotechnical monitoring will be recorded using the data sheet shown in **Appendix A**.

In case the average of in-situ dry densities is less than the target (90% of Standard Proctor), that layer of dewatered flotation tailings will be re-compacted until the target dry density will be achieved.

6.2 Annual Survey

A detailed survey of DSTF will be conducted annually in September. The survey data will be compared with the year-by-year plan. If a significant discrepancy is identified, the plan may be updated.

Table 9: Geotechnical Monitoring Items during Shell Construction

QA/ QC	Test Description	ASTM Method	Test Frequency	Test Procedures	Target
Quality Control Program	In-situ Nuclear Densometer	D6938-10	Every 20,000 tons of tailings placed in each shell	Performed on material placed and compacted in all areas within 24 hours prior to test day. Maximum testing spacing of 30 ft to a target depth of 12 inches. Test density results should be reported in pcf and moisture content in %. Compare results to laboratory Standard Proctor test results.	Avg. Density of 98.1 pcf or 90% Standard Proctor
	Standard Proctor	D698-07		Completed for three equally spaced grab samples from each test area.	N/A
	Moisture Content	D2216		Completed for three equally spaced grab samples from each test area.	N/A
	Grain Size Distribution	D422		Completed for three equally spaced grab samples from each test area.	Verify tailings consistency
Quality Assurance Program(1)	In-situ Nuclear Densometer	D6938-10	Every 80,000 tons of tailings placed in each shell	Performed on material placed and compacted in all areas within 24 hours prior to test day. Maximum testing spacing of 30 ft to a target depth of 12 inches. Test density results should be reported in pcf and moisture content in %. Compare results to laboratory Standard Proctor test results.	As above
	Sand Cone Test(1)	D1556-07		One test for every ten densometer tests completed.	Consistency with ASTM D6938-10 results
	Standard Proctor	D698-07		Completed for three equally spaced grab samples from each test area.	As above
	Moisture Content	D2216		Completed for the three samples collected for the Proctor test.	As above
	Grain Size Distribution	D422		Completed for the three samples collected for the Proctor test.	As above

Note: 1. QA tests, apart from the Sand Cone Test, are not required if the QC program is conducted by a certified, independent lab.

6.3 Vibrating Wire Piezometers

In October of 2012, a subsurface investigation of the DSTF was performed to evaluate the geotechnical, thermal, hydrogeological, and geochemical characteristics of the facility (SRK, 2014c). Three sonic boreholes (SB-1, GP-1, and RR-1) (see **Figure 5** and **Table 10**) were vertically drilled in the following locations:

- immediately up-gradient of the starter berm (SB-1);
- in a portion of the GPA where tailings was expected to comprise a significant fraction of the stratigraphy (GP-1); and,
- in a portion of the GPA where mineralized red rock was expected to comprise a significant portion of the stratigraphy (RR-1).

RST vibrating wire piezometers (VWP) were installed in each of the three boreholes to determine the presence and extent of saturated zones within the DSTF and to monitor changes in pore pressure. DSTF temperatures were also measured using thermistors located within each VWP sensor. The installation depth of each sensor is presented in **Table 11**.

The data should be downloaded at a minimum of twice per year; once following the freshet, and once just prior to the onset of winter. The second downloading event is also an opportunity to check the condition of the datalogger and battery.

6.4 Reporting

The results of the monitoring described in this section will be reported in the quarterly monitoring reports and annual monitoring report.

Table 10: Summary of DSTF Piezometer Drill holes

Drillhole	Description	Easting	Northing	Collar Elevation (ft asl*)	Drilled Depth (ft)	Dip (°)
SB1	Starter berm	1817073	3819217	2,408	106.5	90
GP1	General placement	1817382	3819010	2,486	147	90
RR1	'Red Rock' area	1817696	3818669	2,509	97	90

Note: 1 *ft asl – feet above sea level.

Table 11: Summary of Vibrating Wire Piezometer Installation

Drillhole	Drilled Depth (ft)	Details of Vibe Wire Sensor		
SB-1	106.5	Depth: 25 fbgl* Elev. 2383 ft Range: 0.7 Mpa Vibe wire SN: VW22850 Datalogger SN: 2639 Logger channel: VW2, Therm2	Depth: 104. 5 fbgl Elev. 2303.5 ft Range: 0.7 Mpa Vibe wire SN: VW22851 Datalogger SN: 2639 Logger channel: VW1, Therm1	
GP-1	147	Depth: 63 fbgl Elev. 2423 ft Range: 0.7 Mpa Vibe wire SN: VW22852 Datalogger SN:2640 Logger channel: VW1, Therm 1	Depth: 137 fbgl Elev. 2349 ft Range: 0.7 Mpa Vibe wire SN: VW22853 Datalogger SN: 2640 Logger channel: VW2, Therm 2	
RR-1	97	Depth: 2 fbgl Elev. 2507 ft Range: 0.7 Mpa Vibe wire SN: VW23152 Datalogger SN: 2640 Logger channel: VW5, Therm 5	Depth: 61 fbgl Elev. 2448 ft Range: 0.7 Mpa Vibe wire SN: VW22854 Datalogger SN: 2640 Logger channel: VW3, Therm 3	Depth: 94 fbgl Elev. 2415 ft Range: 0.7 Mpa Vibe wire SN: VW22855 Datalogger SN: 2640 Logger channel: VW4, Therm 4

Note: 1 *fbgl – feet below ground level.

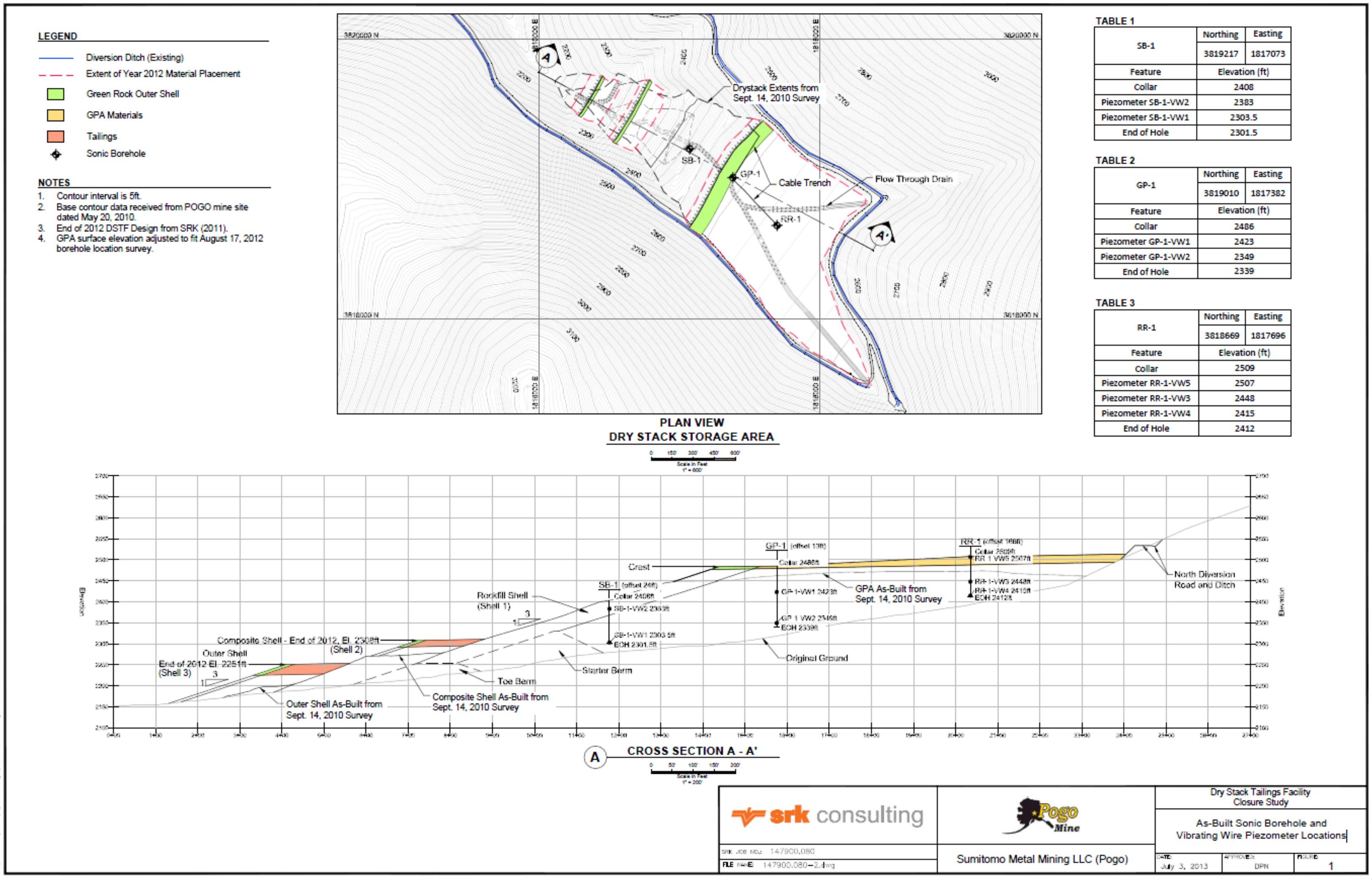


TABLE 1

SB-1	Northing	Easting
	3819217	1817073
Feature	**Elevation (ft)**	
Collar	2408	
Piezometer SB-1-VW2	2383	
Piezometer SB-1-VW1	2303.5	
End of Hole	2301.5	

TABLE 2

GP-1	Northing	Easting
	3819010	1817382
Feature	**Elevation (ft)**	
Collar	2486	
Piezometer GP-1-VW1	2423	
Piezometer GP-1-VW2	2349	
End of Hole	2339	

TABLE 3

RR-1	Northing	Easting
	3818669	1817696
Feature	**Elevation (ft)**	
Collar	2509	
Piezometer RR-1-VW5	2507	
Piezometer RR-1-VW3	2448	
Piezometer RR-1-VW4	2415	
End of Hole	2412	

Figure 5: As-Built Sonic Borehole and Vibrating Wire Piezometer Locations (SRK, 2014b)

7.0 INSPECTION

7.1 Weekly Inspection

Environmental personnel will conduct visual inspection of the DSTF on a weekly basis. Environmental personnel will look for any unusual physical conditions paying particular attention to:

- Any ponding of water on DSTF;
- Evidence of deformation on the slope of the shell; and
- Evidence of excessive erosion or seepage of the slope of the shell.

The results of inspections will be documented using the designated form (see **Appendix B**). If any unusual situation is found, it will be reported to the Maintenance Manager and Environmental Manager.

7.2 Occasional Inspection

The DSTF will be inspected by Environmental personnel after extreme rainfall (two inches within 24 hours) or an appreciable earthquake (felt by site personnel).

8.0 REFERENCES

AMEC, 2004a, Drystack Tailings Facility Geotechnical Design Report.

AMEC, 2004b, RTP Dam Design Report.

Teck-Pogo, 2004, Pogo Project Final Feasibility Study

AMEC, 2006, RTP Dam 2004-2005 As-built Report

AMEC, 2007, Pogo Mine Drystack Tailings Facility OMS Manual – Revision Two.

SRK, 2011a, Pogo Drystack Tailings Facility Expansion Preliminary Study.

SRK, 2011b, Pogo Mine – Findings of Winter Field Program and Preliminary Recommendations for Dry Stack Storage Facility Construction and QA/QC Procedures.

Pogo, 2013, Pogo Mine Monitoring Plan.

SRK, 2013a, South Diversion Flume, As-Built Hydraulic Capacity.

SRK, 2013b, DSTF Diversion Ditches Design Calculations

SRK, 2014a, Dry Stack Tailings Facility Expansion – Final As-Built Report for Diversion Channels.

SRK, 2014b, DSTF Closure Study – Slope Stability Analysis.

SRK, 2014c, DSTF Closure Study – DSTF Vibrating Wire Piezometers.

Appendix A

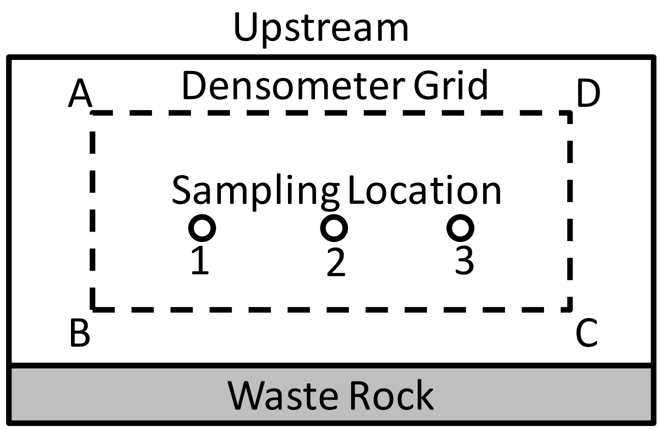
DSTF Shell Geotechnical Monitoring Data Sheet

Pogo Mine DSTF Shell Geotechnical Monitoring Data Sheet

Date Tested		Reported by	
Shell No.		Elevation (ft)	
Date Compacted			

GPS Coordinates (degree)		
Nuclear Densometer Grid		
A	N:	W:
B	N:	W:
C	N:	W:
D	N:	W:
Sampling Location		
1	N:	W:
2	N:	W:
3	N:	W:

Map



Moisture Content / Standard Proctor Test (Three samples per monitoring)				
Sample No.	**1**	**2**	**3**	**Average**
Moisture Content (%)				
Maximum Dry Density (pcf)				
Optimum Moisture Content (%)				

Nuclear Densometer (30 ft grid, Target Depth: 12 inch)			
Number of measurements			
Items	**Minimum**	**Maximum**	**Average**
Moisture Content (%)			
Dry Density (pcf)			
% of Standard Proctor			

Sand Cone Test (One test for every ten densometer measurements) (QA Program)							
Test Hole No.	**1**	**2**	**3**	**4**	**5**	**6**	**Average**
Moisture Content (%)							
Dry Density (pcf)							

Notes: All lab test reports should be attached to this data sheet.

Appendix B

Weekly Inspection Form

Sumitomo Metal Mining Pogo LLC

Dry Stack Weekly Inspection

Inspection Information

Location: Drystack

Inspection Date: ____________ Time: _______

Inspector: ____________________________

Status: ____________

Comments:

Inspection Criteria	Y	N	Inspection Findings	Corrective Actions	Date Actions Completed
Free of Unusual Cracks	☐	☐			
Free of Bulging	☐	☐			
Free of Signs of Settlement	☐	☐			
Free of Seepage	☐	☐			
Free of Erosion	☐	☐			

Inspection Instructions

Inspection Certification

Authorized Signature

Date

Appendix C

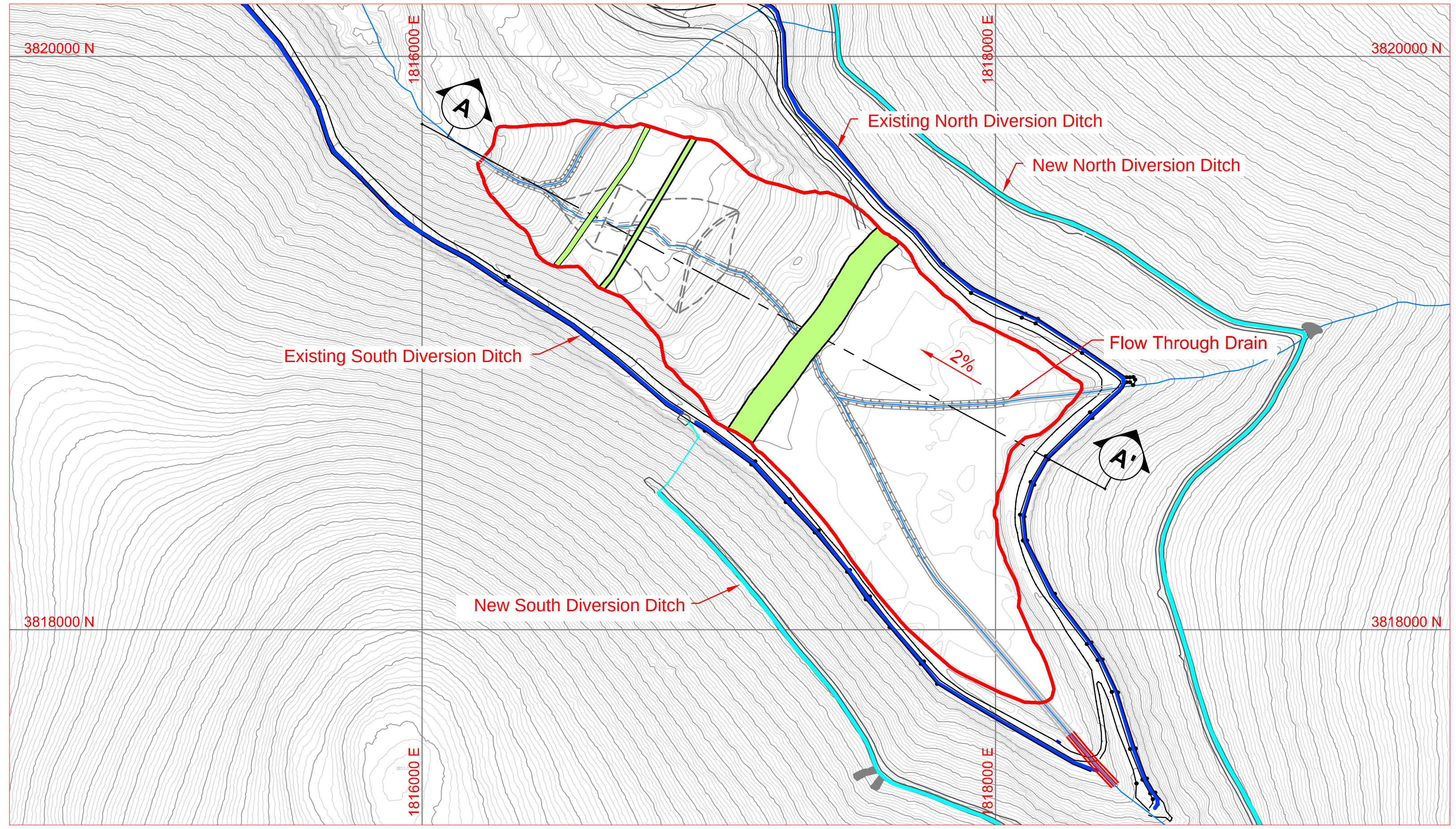
Drawings

LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of September 2013 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

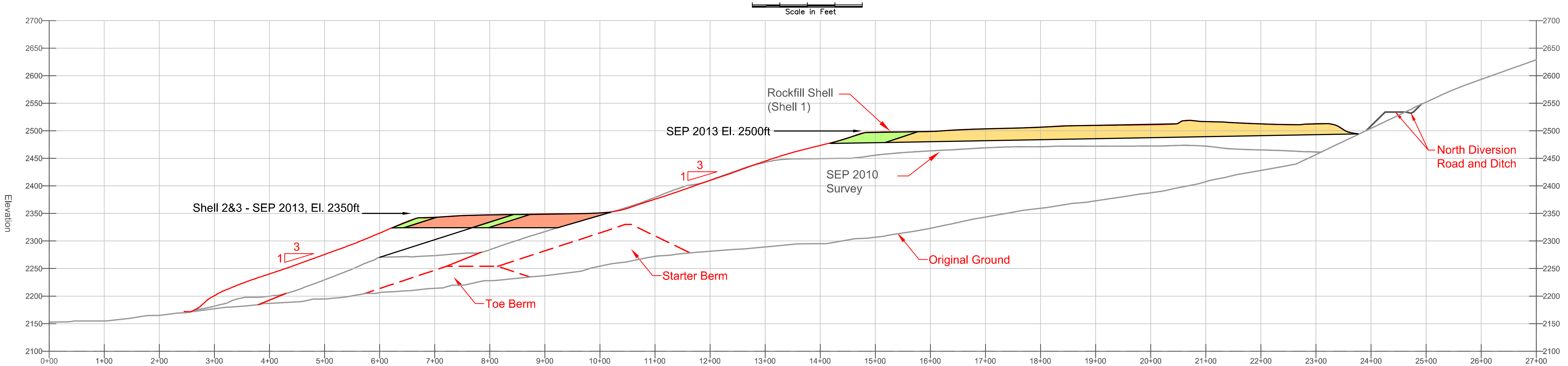
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



(A) CROSS SECTION A - A'

0 50' 100' 150' 200'
Scale in Feet

	POGO MINE — SUMITOMO METAL MINING POGO LLC — MINING DONE RIGHT	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4
		Dry Stack Tailings Facility Plan and Section September 2013 As-built
FILE NAME: 201405 DSTF Year by Year Plan_SEP2013.dwg	Sumitomo Metal Mining Pogo LLC	DATE: May 2014 · APPROVED: MU · DRAWING: 1

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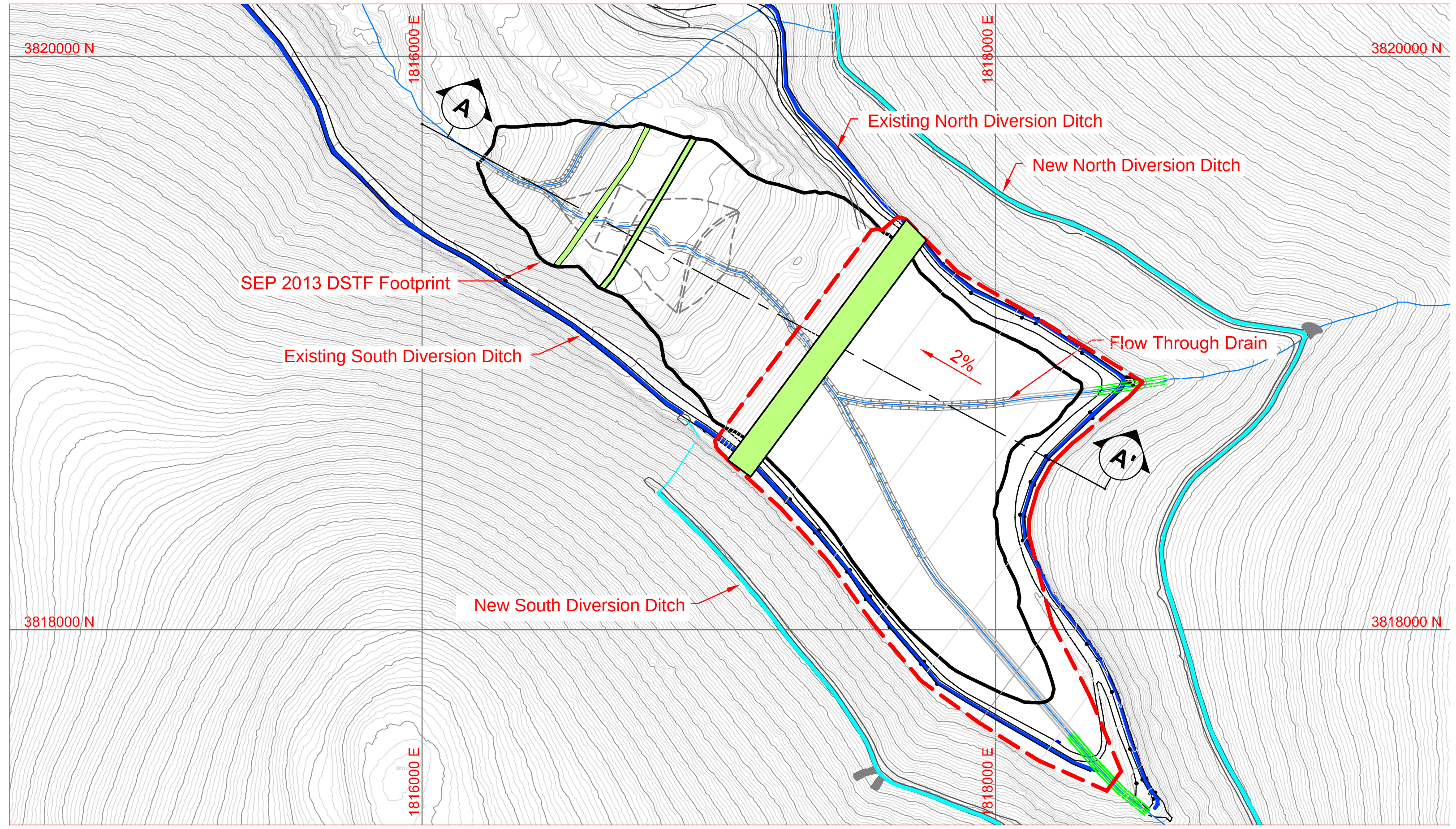
LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2014 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

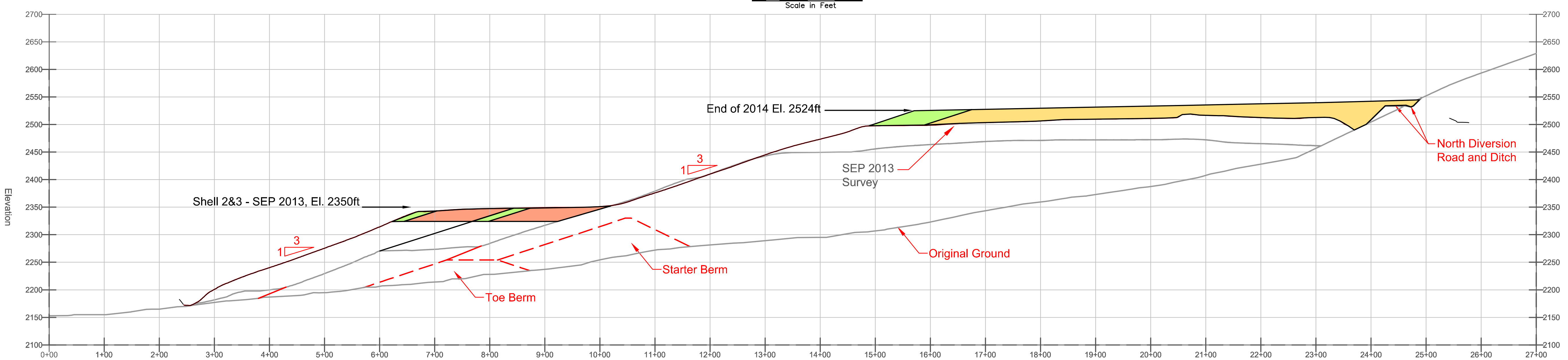
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A **CROSS SECTION A - A'**

0 50' 100' 150' 200'
Scale in Feet

	POGO MINE SUMITOMO METAL MINING POGO LLC MINING DONE RIGHT	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4
		Dry Stack Tailings Facility Plan and Section End of 2014
FILE NAME: 201405 DSTF Year by Year Plan_2014.dwg	Sumitomo Metal Mining Pogo LLC	DATE: May 2014 / APPROVED: MU / DRAWING: 2

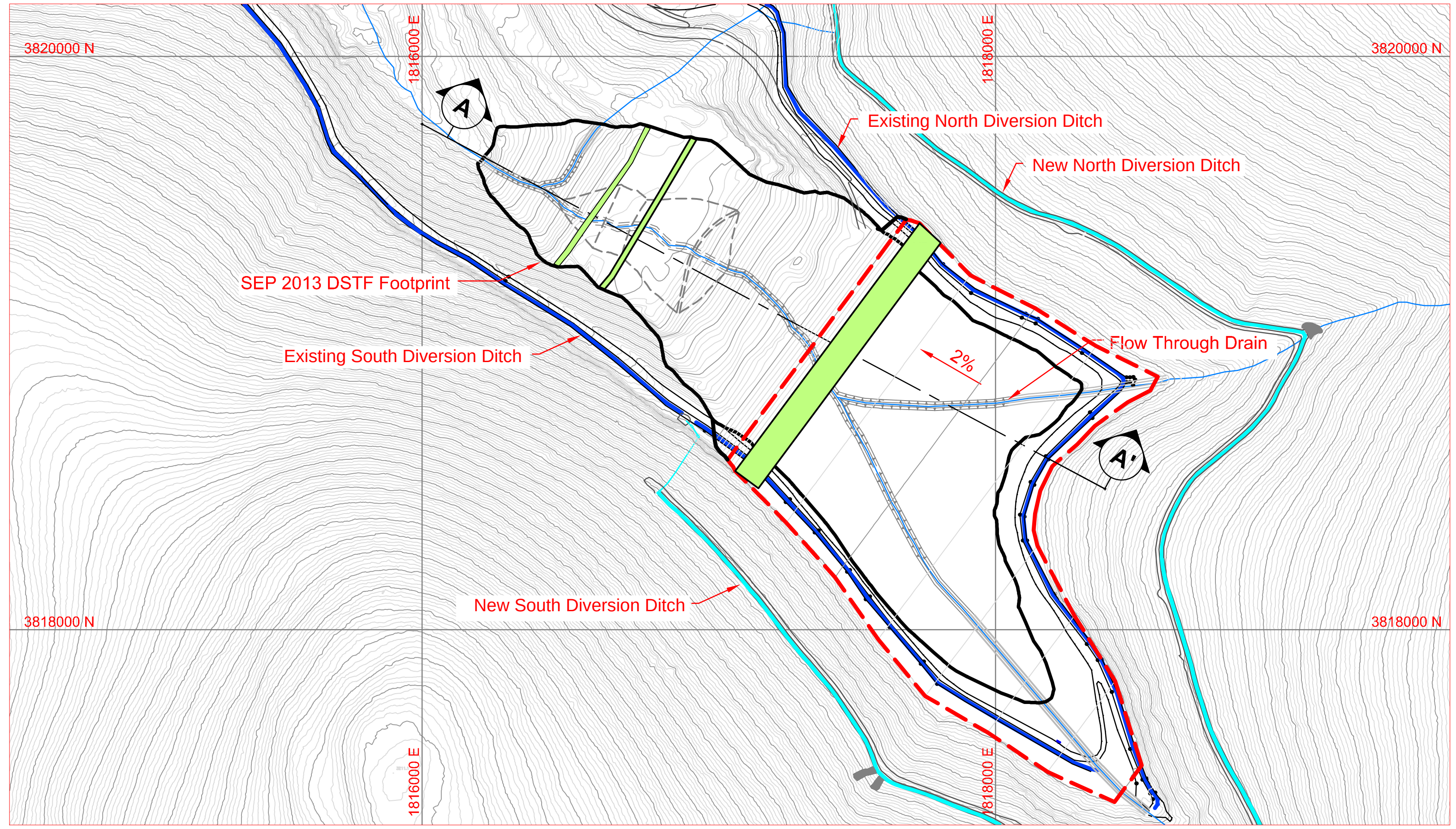
G:\Environmental\DSTF Management 2013 -\DSTF C&M Plan\201405 DSTF C&M Plan Rev 4\Drawings\AutoCAD Drawings\201405 DSTF Year by Year Plan_2014.dwg

LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2015 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

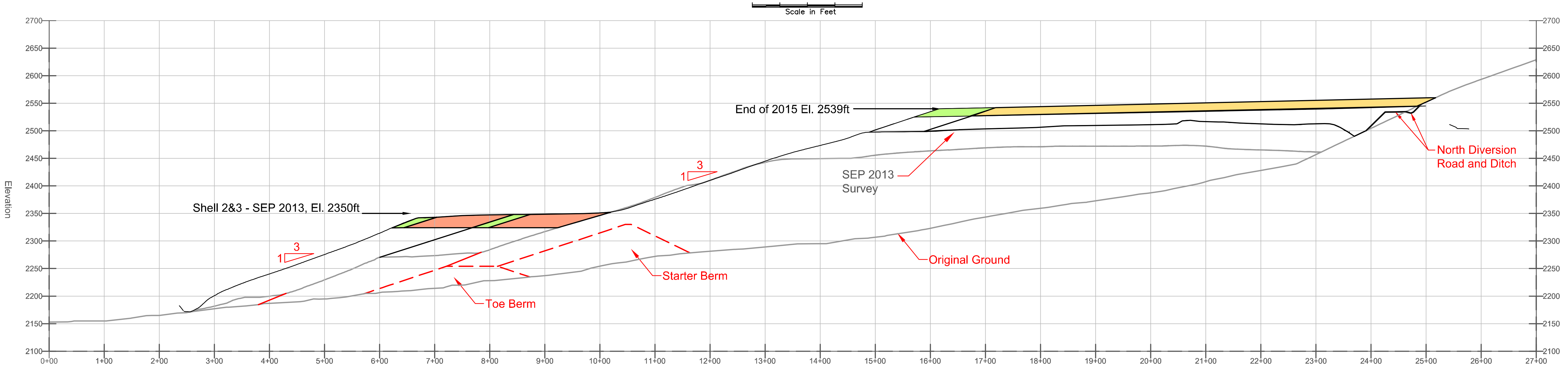
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A CROSS SECTION A - A'

0 50' 100' 150' 200'
Scale in Feet

FILE NAME: 201405 DSTF Year by Year Plan_2015.dwg	POGO MINE · SUMITOMO METAL MINING POGO LLC · MINING DONE RIGHT Sumitomo Metal Mining Pogo LLC	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4 Dry Stack Tailings Facility Plan and Section End of 2015 DATE: May 2014 · APPROVED: MU · DRAWING: 3

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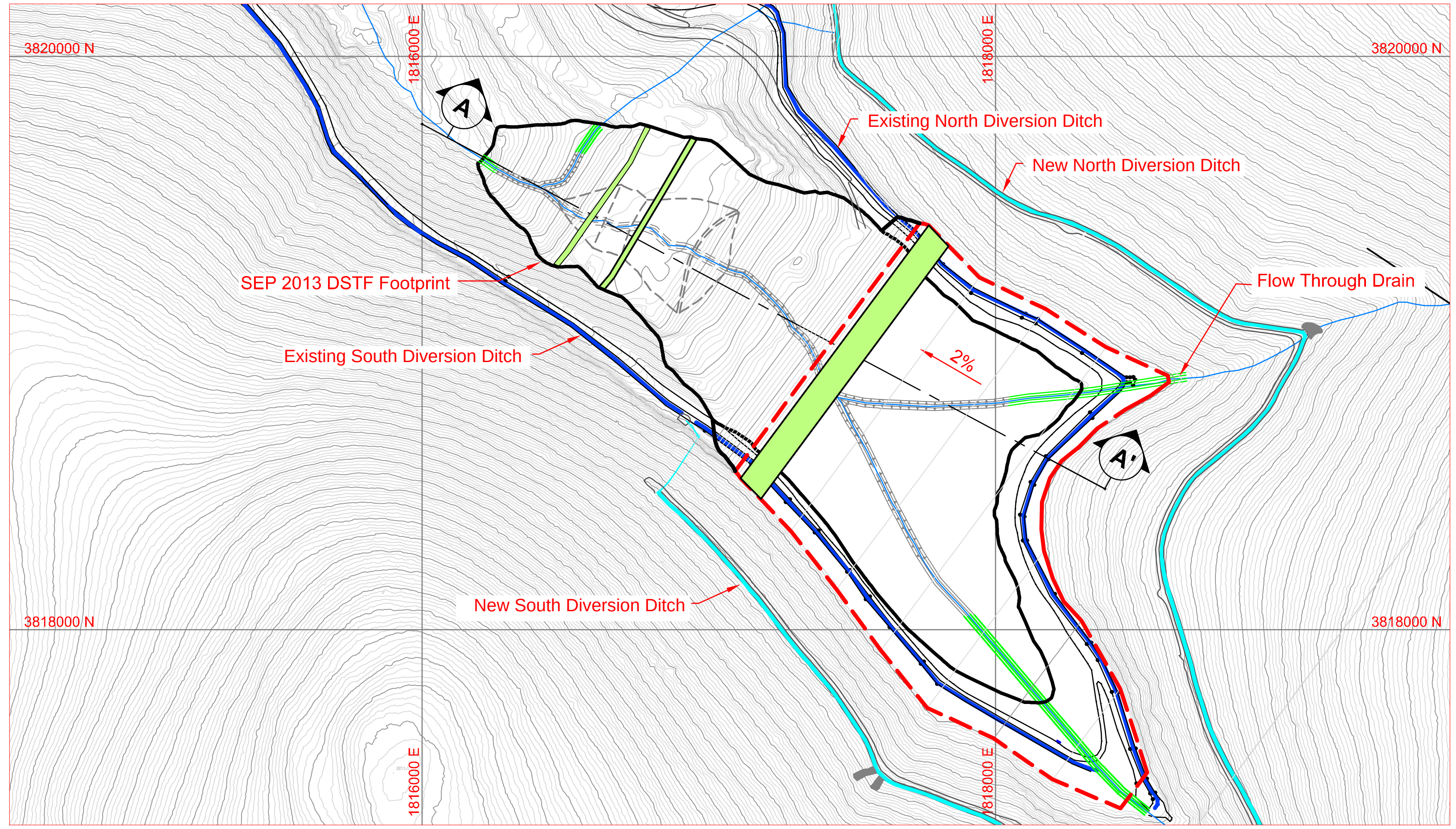
LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2016 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

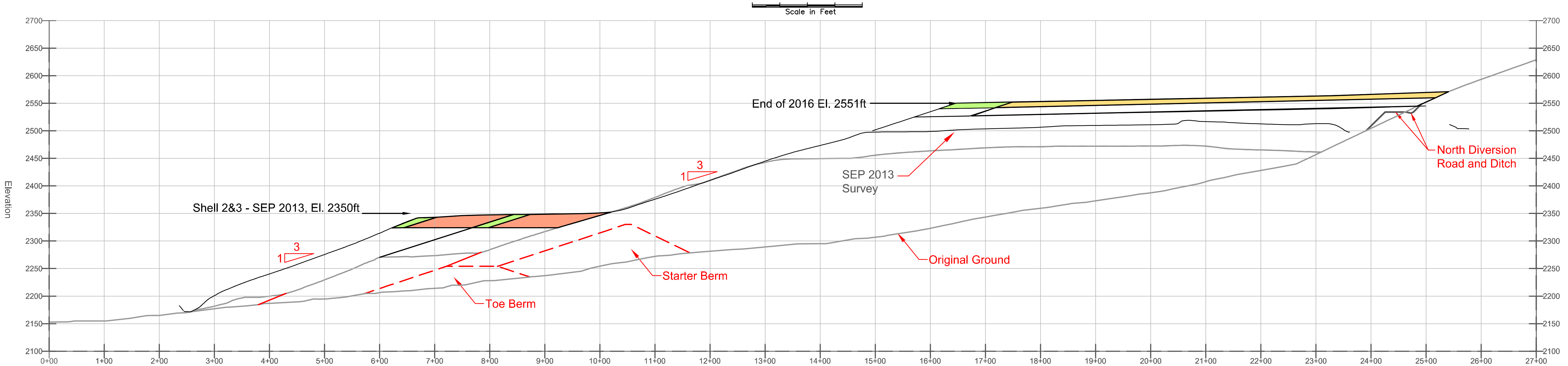
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A **CROSS SECTION A - A'**

0 50' 100' 150' 200'
Scale in Feet

	POGO MINE SUMITOMO METAL MINING POGO LLC MINING DONE RIGHT	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4
		Dry Stack Tailings Facility Plan and Section End of 2016
FILE NAME: 201405 DSTF Year by Year Plan_2016.dwg	Sumitomo Metal Mining Pogo LLC	DATE: May 2014 / APPROVED: MU / DRAWING: 4

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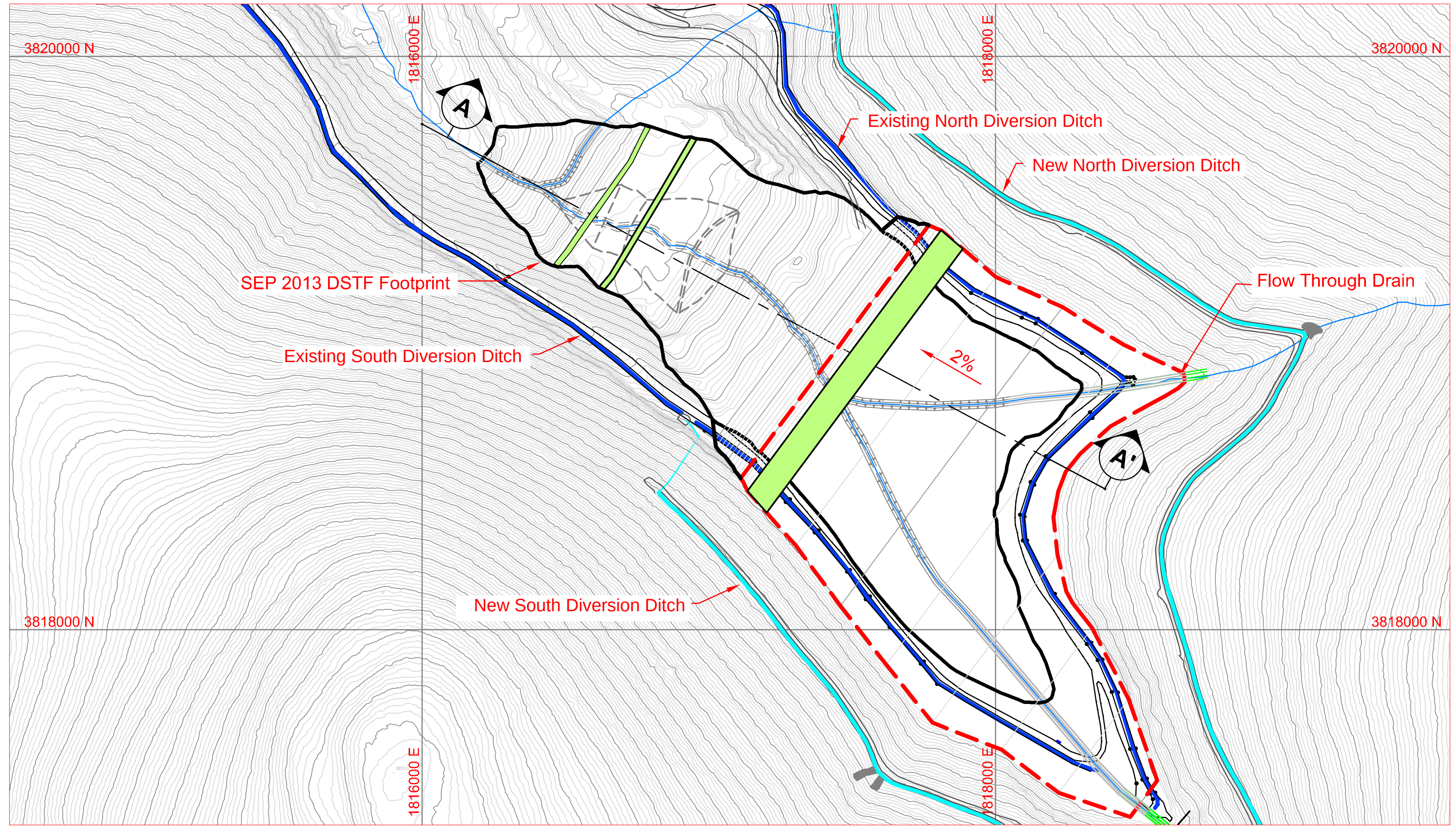
LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2017 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

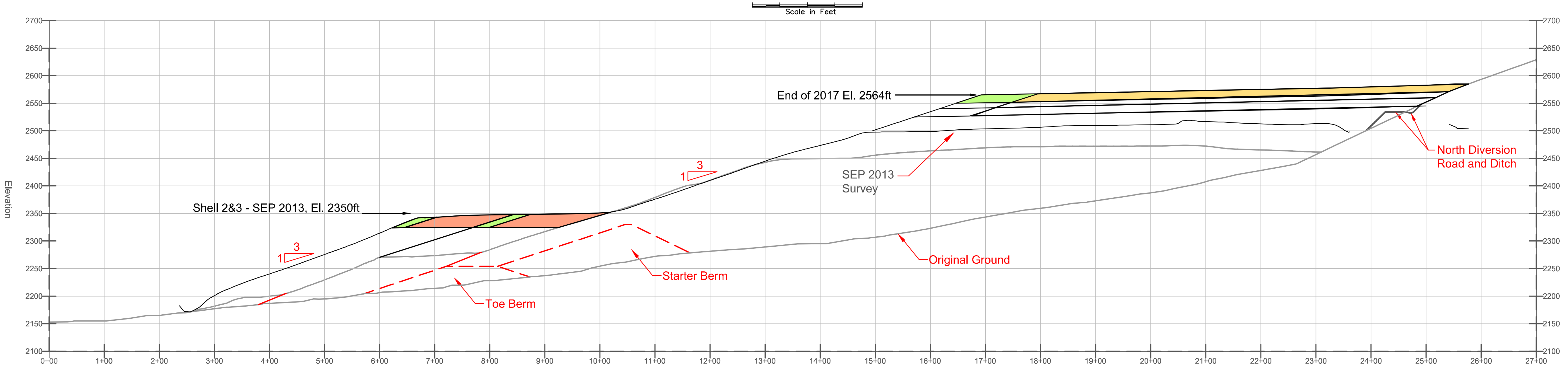
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A CROSS SECTION A - A'

0 50' 100' 150' 200'
Scale in Feet

FILE NAME: 201405 DSTF Year by Year Plan_2017.dwg	POGO MINE · SUMITOMO METAL MINING POGO LLC · MINING DONE RIGHT Sumitomo Metal Mining Pogo LLC	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4 Dry Stack Tailings Facility Plan and Section End of 2017 DATE: May 2014 · APPROVED: MU · DRAWING: 5

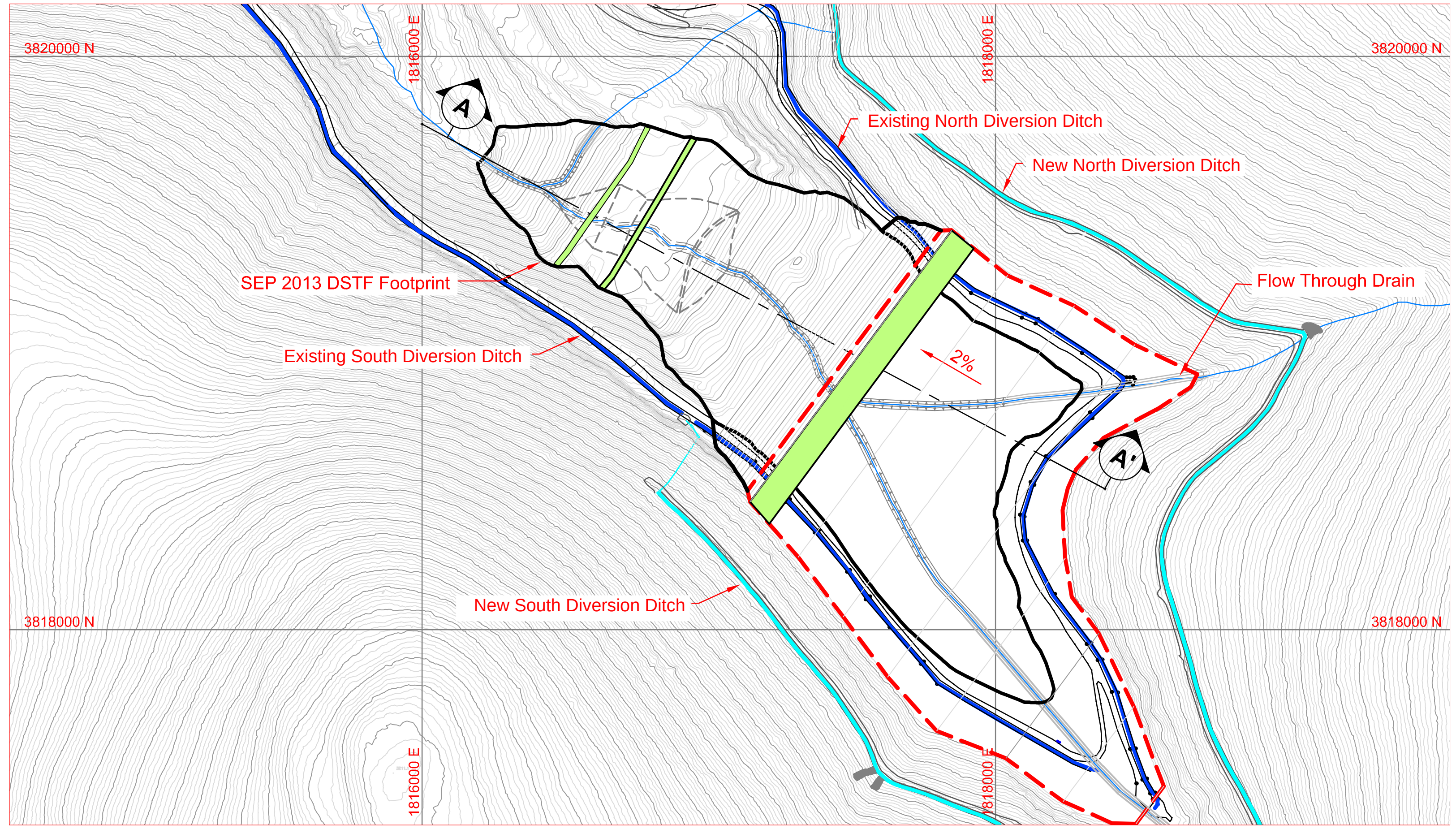
G:\Environmental\DSTF Management 2013 -\DSTF C&M Plan\201405 DSTF C&M Plan Rev 4\Drawings\AutoCAD Drawings\201405 DSTF Year by Year Plan_2017.dwg

LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2018 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

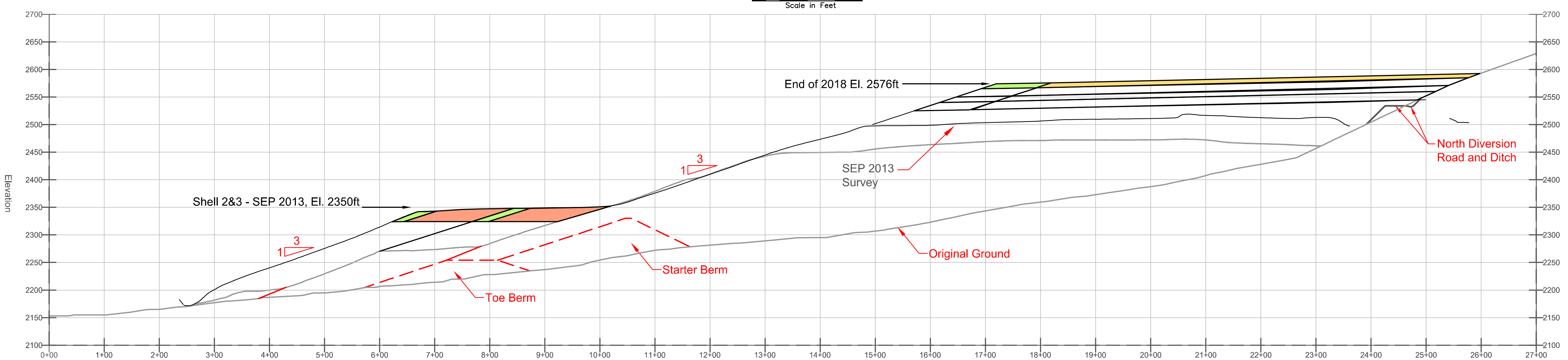
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A **CROSS SECTION A - A'**

0 50' 100' 150' 200'
Scale in Feet

	POGO MINE SUMITOMO METAL MINING POGO LLC MINING DONE RIGHT	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4
		Dry Stack Tailings Facility Plan and Section End of 2018
FILE NAME: 201405 DSTF Year by Year Plan_2018.dwg	Sumitomo Metal Mining Pogo LLC	DATE: May 2014 · APPROVED: MU · DRAWING: 6

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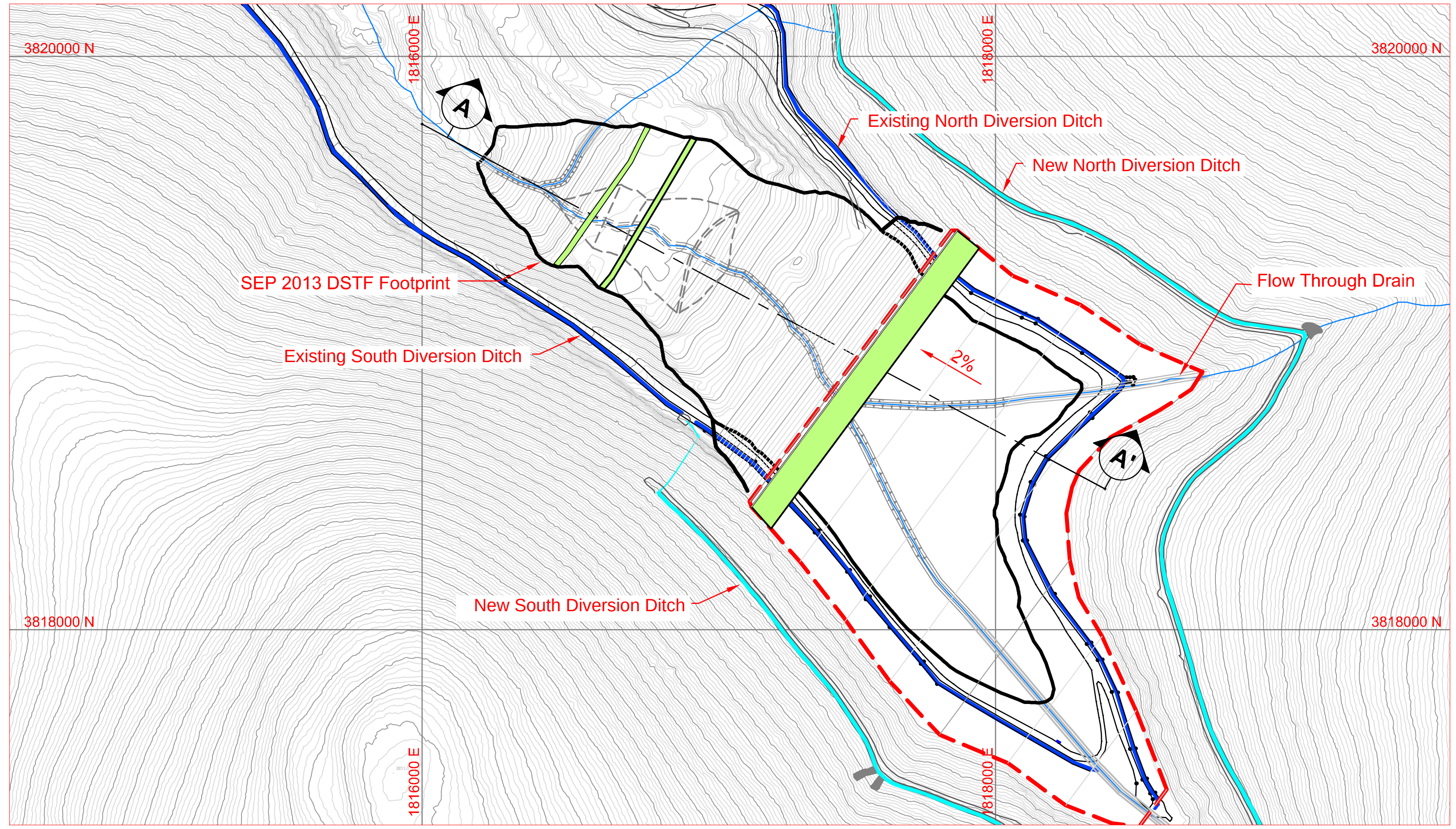
LEGEND

- Existing Diversion Ditch
- New Diversion Ditch
- Extent of End of 2018 Material Placement
- Flow-through Drain Extension
- Green Rock Outer Shell
- GPA Materials
- Dry Stack Tailings

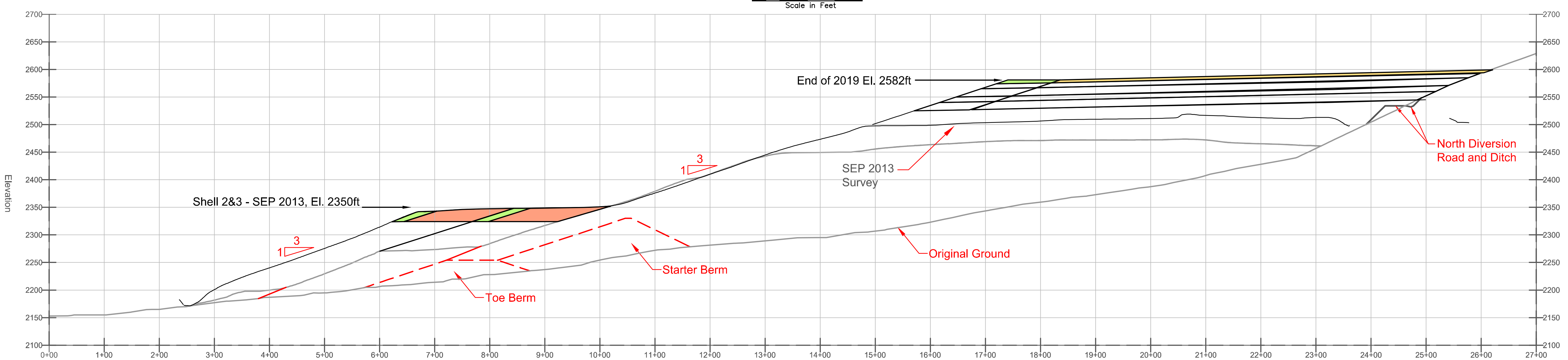
NOTES

1. Contour interval is 5ft.
2. Base contour data received from POGO mine site dated May 20, 2010.



PLAN VIEW
DRY STACK STORAGE AREA

0 150' 300' 450' 600'
Scale in Feet



A CROSS SECTION A - A'

0 50' 100' 150' 200'
Scale in Feet

	POGO MINE — SUMITOMO METAL MINING POGO LLC — MINING DONE RIGHT	Pogo Dry Stack Tailings Facility Construction & Maintenance Plan Revision 4
		Dry Stack Tailings Facility Plan and Section End of 2019
FILE NAME: 201405 DSTF Year by Year Plan_2019.dwg	Sumitomo Metal Mining Pogo LLC	DATE: May 2014 / APPROVED: MU / DRAWING: 7

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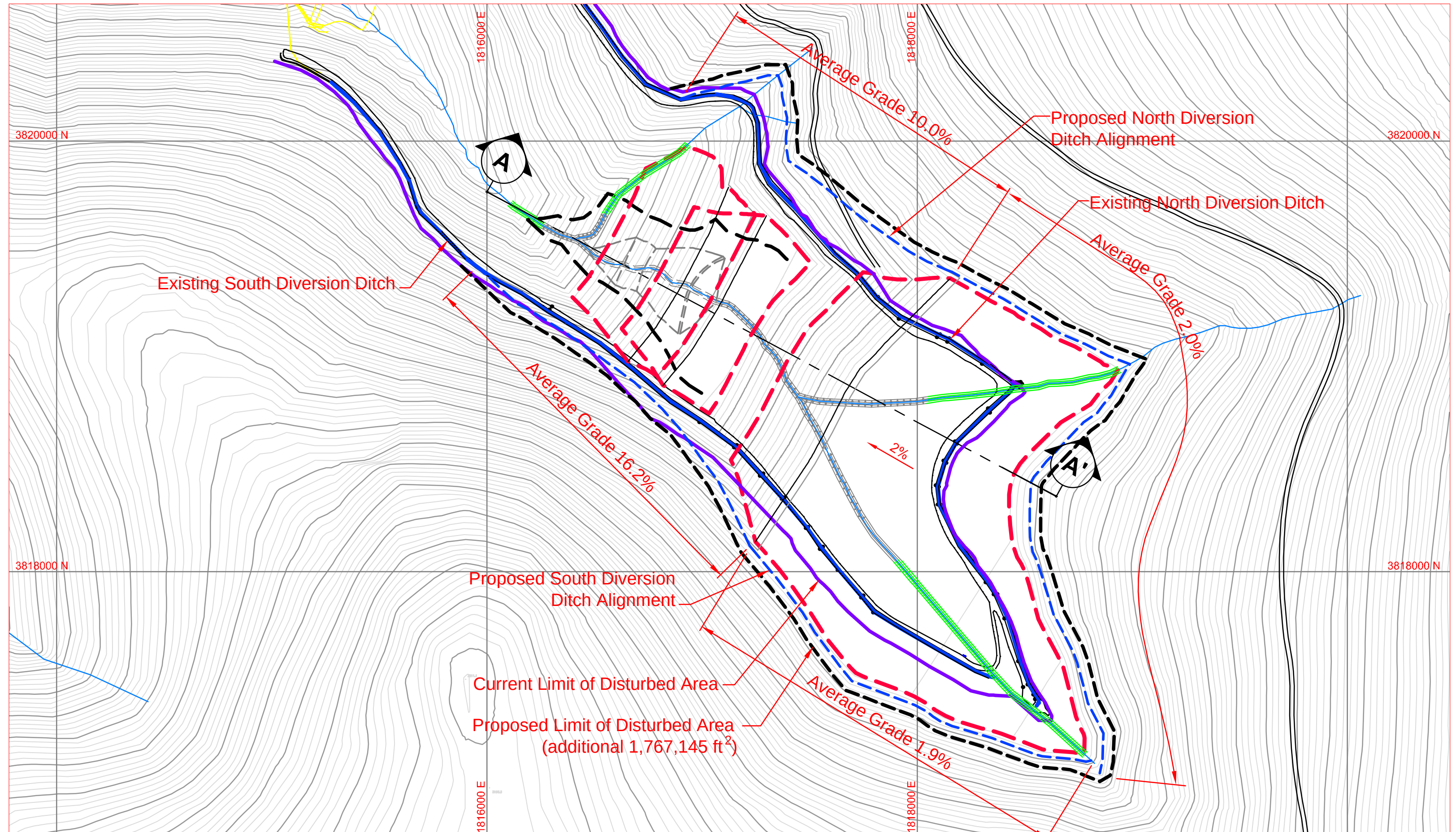
LEGEND

- Existing Diversion Ditch
- Proposed Diversion Ditch
- Extent of Year 2030 Material Placement
- Rock Drain Extension Required for 20Mt
- Green Rock Outer Shell
- GPA Materials
- Tailings

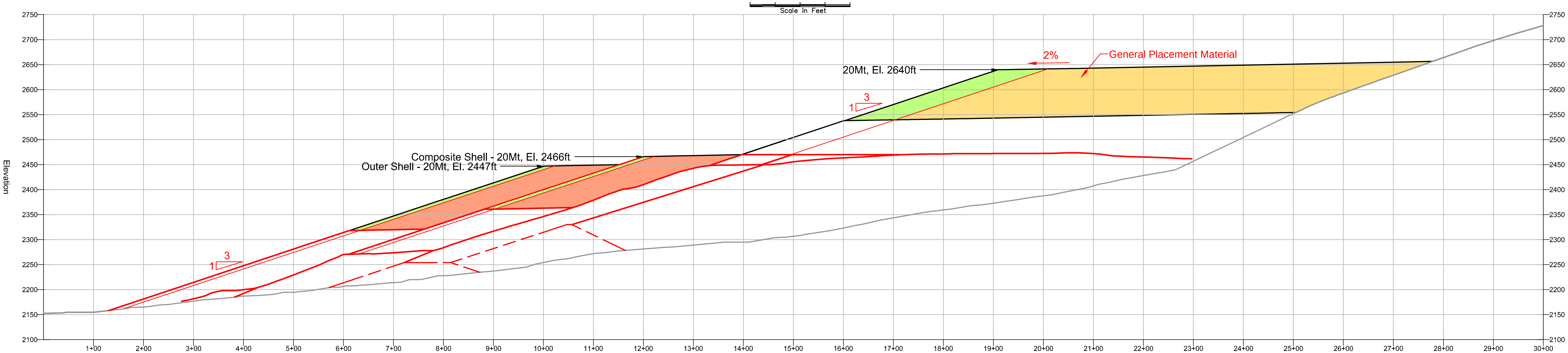
NOTES

1. Contour interval is 10ft.
2. Base contour data received from POGO mine site dated May 20, 2010.
3. 20 M ton configuration developed for assessment of proposed ultimate configuration.



PLAN VIEW
DRY STACK STORAGE AREA

0 200' 400' 600' 800'
Scale in Feet



A CROSS SECTION A - A'

0 50' 100' 150' 200'
Scale in Feet

srk consulting

POGO MINE
SUMITOMO METAL MINING POGO LLC
MINING DONE RIGHT

Dry Stack Tailings Facility
Construction & maintenance Plan Revision 4

Dry Stack Storage Facility
Plan and Section
20 million Tons Facility

SRK JOB NO.: 1CS021.000			
FILE NAME: 201405 DSTF 20Mt Facility.dwg	POGO MINE	DATE: May 2014	APPROVED:	DRAWING: 8