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Memo

To:	Kevin Mather	**Date:**	September 8, 2011
Company:	JDS Mining Ltd.	**From:**	Victor Muñoz, Maritz Rykaart
Copy to:	Calvin Goldschmidt	**Project #:**	1CH008.33
Subject:	Doris North Project: Tail Lake Tailings Deposition Plan		

1 Introduction

Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Company (NMC) is currently in the process of constructing their Doris North Project (Project) in the Kitikmeot region of Nunavut, Canada

Tailing deposition for the Project will be sub-aqueous deposition in Tail Lake. A permanent final water cover at closure of 2.3 m must be maintained which means that with a final water level in Tail Lake of 28.3 m the maximum tailings elevation will be 26.0 m.

This memo provides preliminary recommendations for deposition of tailings to ensure the minimum water cover is maintained, using a tailings deposition model.

2 Design Approach

2.1 Key Assumptions

The following key assumptions apply to the analysis presented:

- Bathymetry for Tail Lake as presented in Figure 1 is based on the 2006 survey completed by Golder Associates (Golder 2006). The stage capacity curve is presented in Figure 2.
- Tailings solids content of 50%.
- Tailings solids deposition rate of 800 T/day.
- Tailings dry density of 1.286 T/m³.
- Tailings slurry deposition rate 1,637 m³/day.
- Initial tailings deposition beach slope angle ranging between 5% and 15%, with profiles as defined by Blight (1998).
- Two seasons was evaluated; with ice (winter) and without ice (summer). Based on an ice growth model developed for the Project, the summer season is estimated to be 65 days long and the winter season 300 days long.

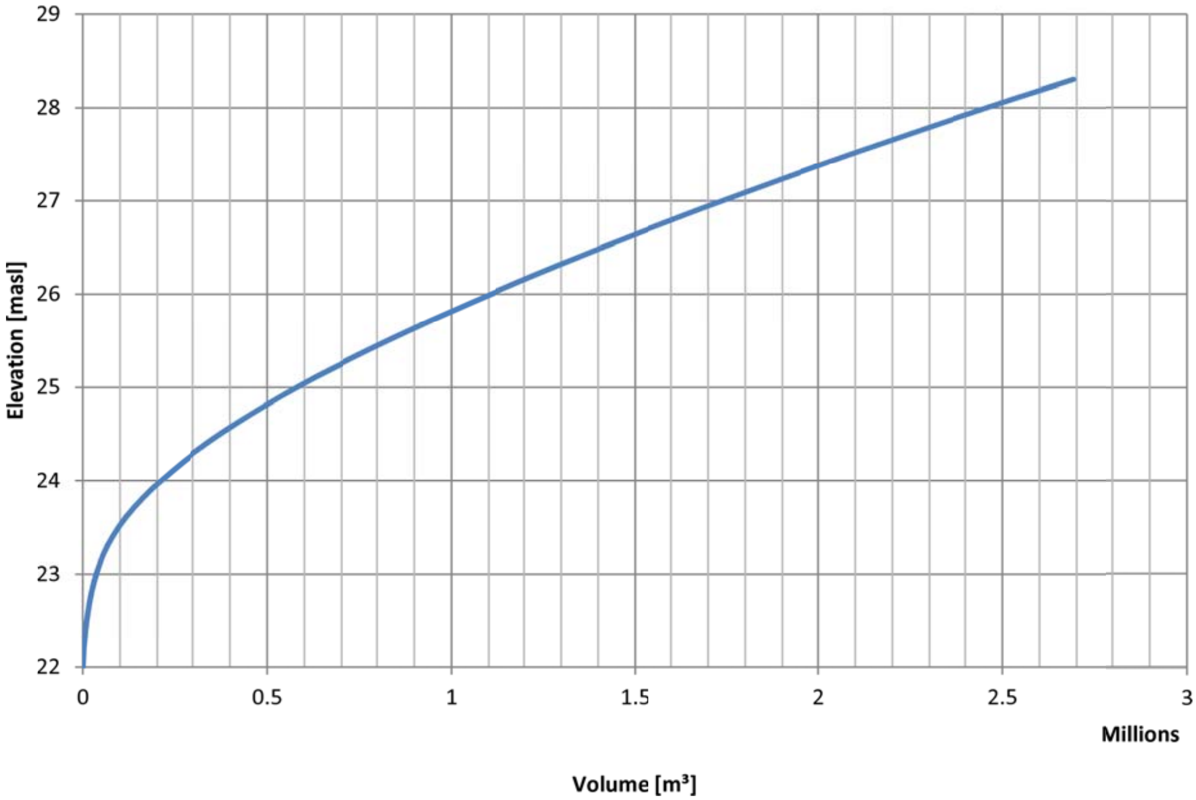

Figure 2: Stage Capacity Curve for Tail Lake up to Elevation 28.3 m

2.2 Deposition Modeling

Tailings deposition modeling was done using Rift TD by Rift Software. Rift is a three dimensional digital terrain model developed to model sub-aerial and subaqueous tailings deposition.

The model uses user supplied deposition points (i.e. location and number of discharge points) to evaluate how tailings will be dispersed within the lake basin, using input variables that include deposition beach angles, tailings characteristics and lake geometry. The following basic elements were considered in the deposition modeling:

- Only one winter and one summer season has been modelled. Once general agreement on the deposition strategy has been reached life-of-mine modeling will be done.
- To facilitate more efficient analysis, a symmetrical discharge pattern was initially selected (this could be optimized at a later stage).
- Deposition modeling does not take into account the dynamic Tail Lake water balance. A stagnant water elevation of 28.3 m was adopted and a fixed 2 m thick icepack in the winter season.
- Four scenarios were modelled for both summer and winter seasons evaluating 1, 2, 3 and 4 pipe simultaneous discharge points. This implies that for multiple discharge scenarios the flow for each pipe is reduced proportionately.
- Even though the maximum tailings elevation is 26.0 m, deposition modeling allows for tailings to be higher to maximize deposition efficiency. Operational methods would have to be adopted to spread tailings over time.
- The sub-aqueously placed tailings will form a unique beach profile defined by the tailings physical properties, the deposition system and environmental factors. Blight (1998) reported several dimensionless beach profiles which remain the primary basis for tailings deposition modeling.

- Different summer and winter beach profiles are used in the modeling as illustrated in Figures 3 and 4.
- The summer beach profile was equivalent to that proposed by Blight (1998) for “deposition under water”.
- The winter beach profile was modified from that proposed by Blight (1998) to account for the fact that in all likelihood confined mounding under the ice can be expected. The lack of data pertaining tailings deposition under ice necessitated this modification.
- A literature search, as well as consultation with operating mines confirmed that generally there is no agreement regarding the initial beach slope angle formed in a sub-aqueously deposited tailings cone. Blight (1998) reports values ranging between 3° and 26°, with the variability being dependant on deposition method and flow rate. Costello (2008) reports an angle of 11.3° (20%) for sub-aqueously placed tailings, whilst the British Dam Society (1991) suggests an angle of 2° (1:30). Personal communication with Michel Julien, author of Julien *et al*. (2006), suggests that an angle of 2.3° (4%) is probably most appropriate. Given this broad range of data, SRK evaluated initial beach slope angles ranging between 5° and 15°.

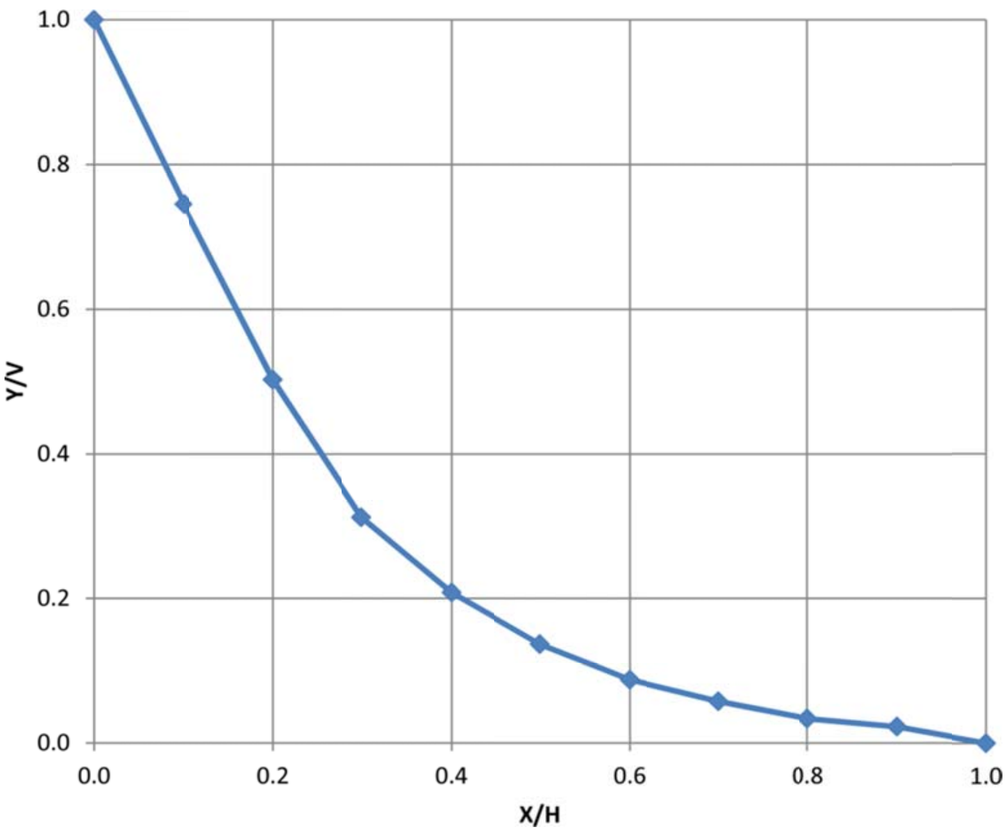

Figure 3: Summer Season Beach Profile Modelled

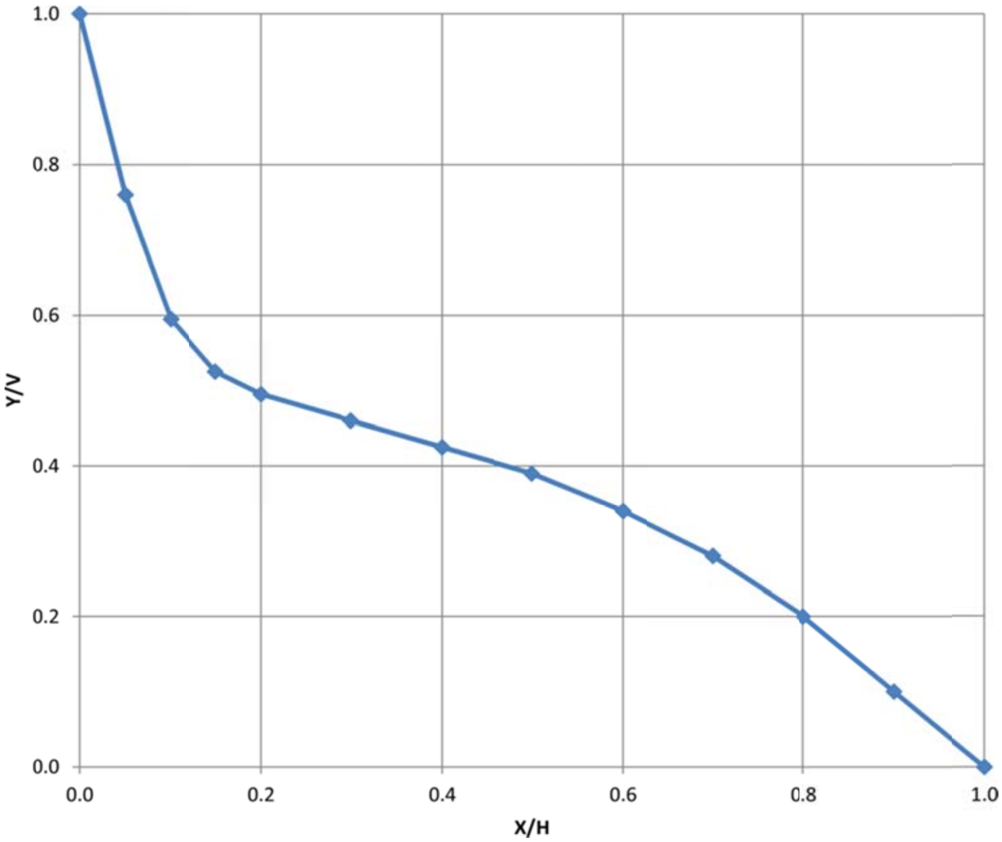

Figure 4: Winter Season Beach Profile Modelled

3 Results

3.1 Base Case

Given the challenges associated with thick lake ice, the deepest section of Tail Lake was selected for winter deposition. The winter deposition strategy is schematically presented in Figure 5, and a summary of the analysis data is presented in Table 1. Summer deposition can be done in the shallower section of the lake as illustrated in Figure 6 and Table 2.

For both seasons, four scenarios were evaluated ranging from a single pipe to a set of four pipes simultaneously depositing tailings. For winter deposition, the deposition points are spaced 85 m apart and for summer season 30 m. Depending on the number of deposition points operating, the time until the deposition location has to be changed is listed in Tables 1 and 2 respectively. For example, for a two-pipe winter deposition, the two pipes must be relocated every 72 days which means that over the 297 day winter season, four pipe relocations are required. Similarly, for a four pipe summer deposition, the set of four pipes must be moved every 13 days, requiring 5 moves for the 65 day season.

To maximize efficiency of the deposition system each deposition cone is allowed to exceed the maximum allowable tailings elevation of 26.0 m. An operational strategy must be employed to level the tailings during the operational stage of the Project. The deposition point spacing can be further optimized to ensure that the material balance of cones over 26.0 m closely matches the available open space between those cones.

Table 1: Summary of Base Case Winter Deposition

Discharge Point Spacing (m)	Number of Pipes	Number of Days Between Required Moves	Number of Moves per Season	Season Length (days)	Volume (m³)	
					Inter-cone volume below elevation 26 m	Cone volume above elevation 26 m
85	4	144	2	287	7,552	3,155
	3	99	3	298		
	2	72	4	287		
	1	33	9	296		

Table 2: Summary of Base Case Summer Deposition

Discharge Point Spacing (m)	Number of Pipes	Number of Days Between Required Moves	Number of Moves per Season	Season Length (days)	Volume (m³)	
					Inter-cone volume below elevation 26 m	Cone volume above elevation 26 m
30	4	13	5	65	4,461	1,904
	3	9	7	64		
	2	7	10	65		
	1	3	20	62		

3.2 Sensitivity Analysis

To demonstrate the effect that the initial beach angle has on the analysis a series of sensitivity analyses were run with the beach angle set at 5, 10 and 15 degrees. These results for the winter and summer seasons respectively are illustrated in Figures 7 and 8. Table 3 and 4 summarize the analysis data.

Table 3: Summary of Winter Deposition as a Function of Beach Angle

Discharge Point Spacing (m)	Initial Beach Slope Angle	Number of Pipes	Number of Days Between Required Moves	Number of Moves per Season	Season Length (days)	Volume (m³)	
						Inter-cone volume below elevation 26 m	Cone volume above elevation 26 m
85	5	2	98	3	295	10,459	4,695
	10	2	72	4	287	7,552	3,155
	15	2	45	6	271	20,709	1,338

Table 4: Summary of Summer Deposition as a Function of Beach Angle

Discharge Point Spacing (m)	Initial Beach Slope Angle	Number of Pipes	Number of Days Between Required Moves	Number of Moves per Season	Season Length (days)	Volume (m³)	
						Inter-cone volume below elevation 26 m	Cone volume above elevation 26 m
30	5	4	14	5	69	2,250	1,322
	10	4	13	5	65	4,461	1,904
	15	4	11	5	56	6,661	1,427

These results suggest that depending on the initial beach slope angle, for a set configuration of deposition points, the amount of time between moves can range quite widely.

4 Conclusions

The analysis presented here provides some preliminary guidance to determine an optimal discharge strategy of sub-aqueous tailings deposition in Tail Lake. This analysis cannot be completed in isolation with the action pump and piping design of the tailings management system. Once further trade-off analysis of the pump and piping system has been completed, further optimization of the deposition modeling can be done.

Notwithstanding further optimization, it should be acknowledged that the deposition modeling is dependent on a large number of factors which cannot be accurately measures or determined. The only real test of the system would be operational monitoring once deposition starts. Furthermore, given the shallow depth of the lake it should be acknowledged that operational management may be required to ensure the tailings are properly spread to the required elevations.

Regards

SRK Consulting (Canada) Inc.

Victor Muñoz S. M. Eng
Consultant

Maritz Rykaart, Ph.D., P.Eng.
Principal

5 References

Blight, G. (1998). Tailings beaches formed in air and water. Tailings and Mine Waste, 27-34.

British Dam Society. (1991). The Embankment Dam (Extract). Telford, Thomas Limited.

Costello, M., Van Kesteren, W., Myers, D., Nesler, D., Horton, J., Rowson, J., et al. (Dec 2008). Tremie/Diffuser as a Tool to Dredge and Place Tailings. OSRF.

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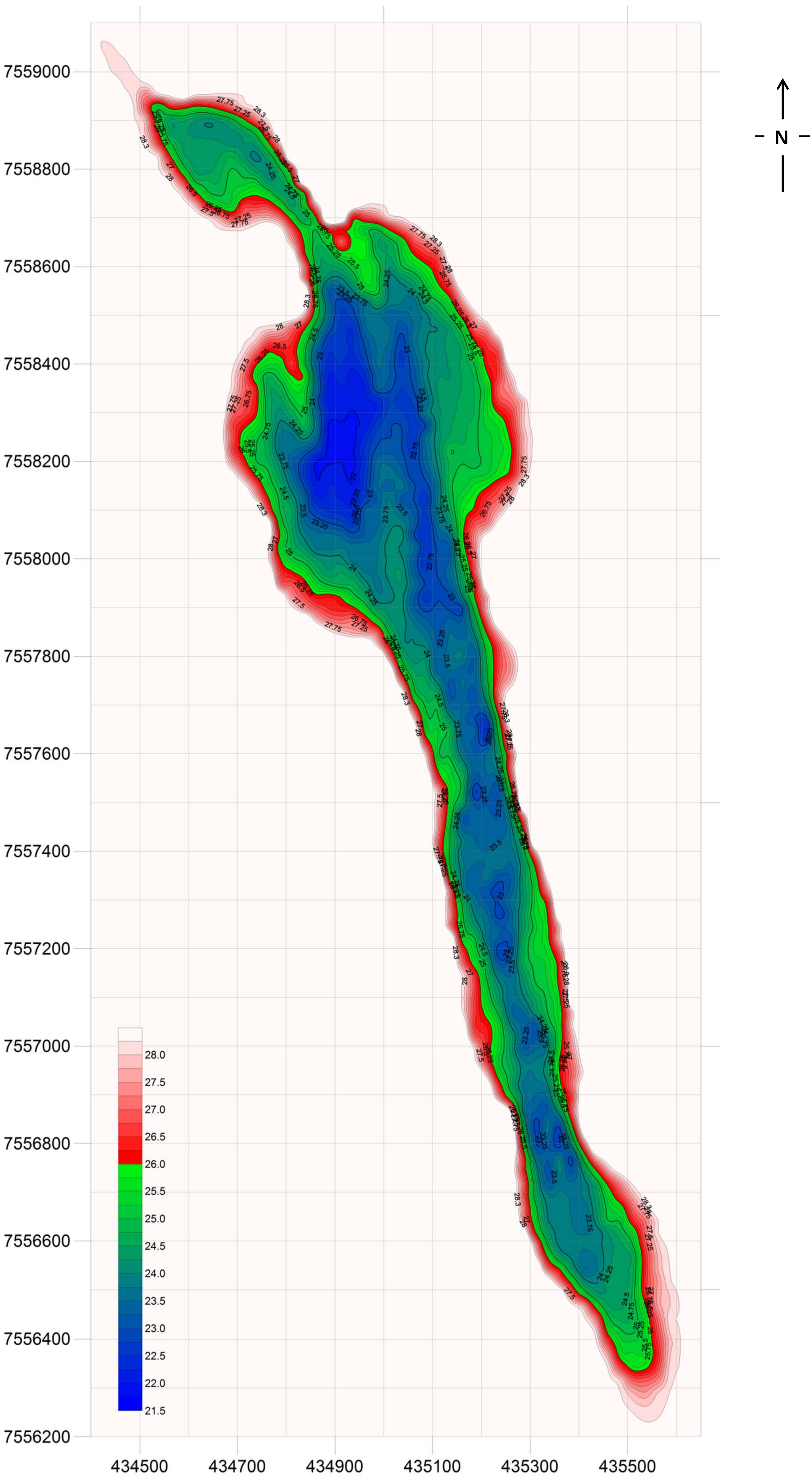
Julien, M. (2010, October 8). Personal Communication related with report "Performance and Monitoring of the Loivicour Mine Tailings Disposal Area". (V. Muñoz, Interviewer).

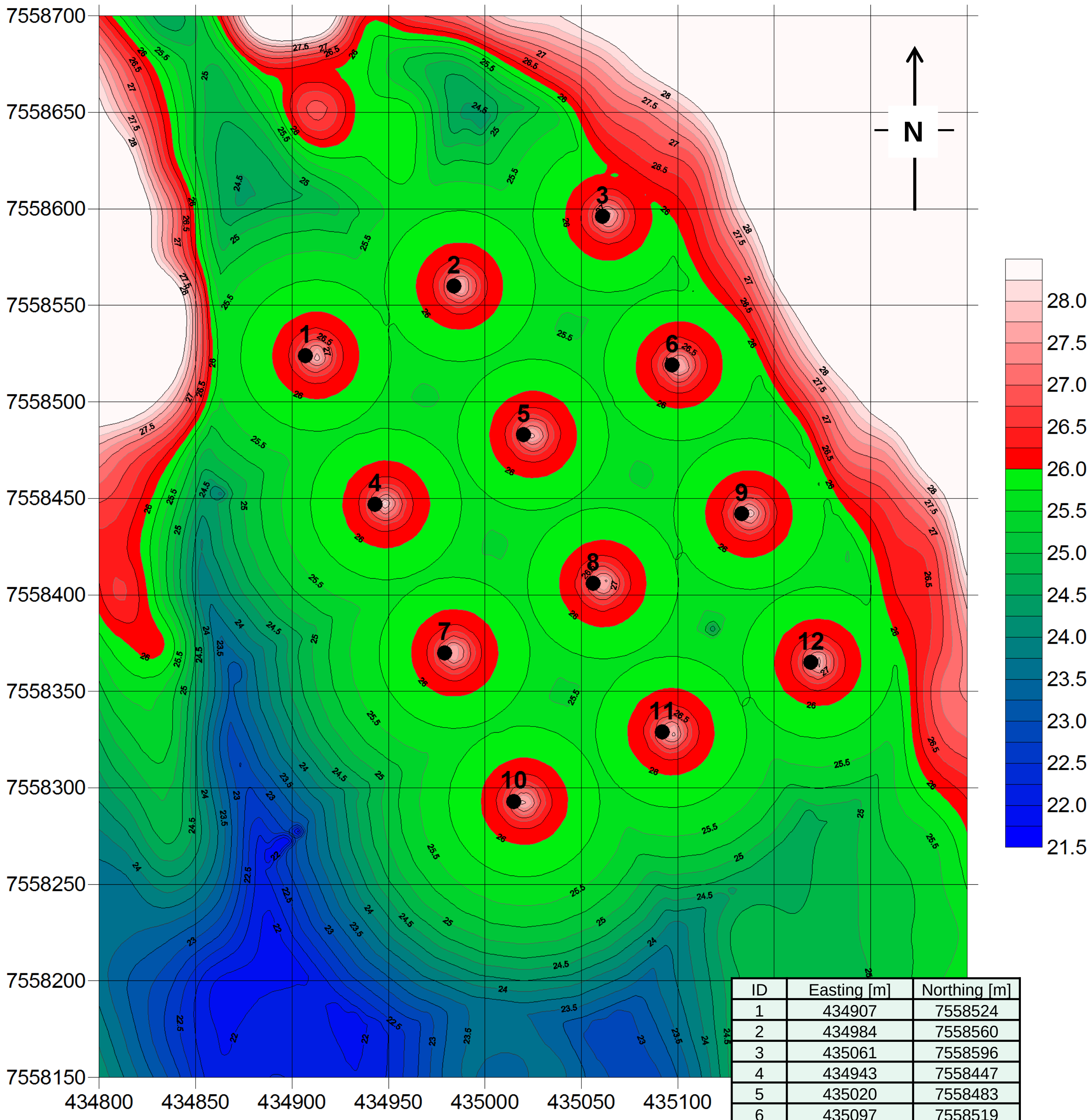
Julien, M., Lemieux, M., Cayouette, J., & Talbot, D. (2006). Performance and Monitoring of the Louvicourt Mine Tailings Disposal Area.

Figures



Note:
Coordinate System NAD 83, Zone 13.

srk consulting	NEWMONT NORTH AMERICA	Tailings Deposition Plan		
		Tail Lake Bathymetry		
Job No: 1CH008.033	**HOPE BAY MINING LTD.**	Date: August 2011	Approved: VM	Figure: 1
Filename: Figure 1_20110830.ppt				



ID	Easting [m]	Northing [m]
1	434907	7558524
2	434984	7558560
3	435061	7558596
4	434943	7558447
5	435020	7558483
6	435097	7558519
7	434979	7558370
8	435056	7558406
9	435133	7558442
10	435015	7558293
11	435092	7558329
12	435169	7558365

Notes:
1. Coordinate System NAD 83, Zone 13.
2. Initial slope angle 10°.

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Tailings Deposition Plan

Winter Season

Job No: 1CH008.033

Filename: Figure 5_20110830.ppt

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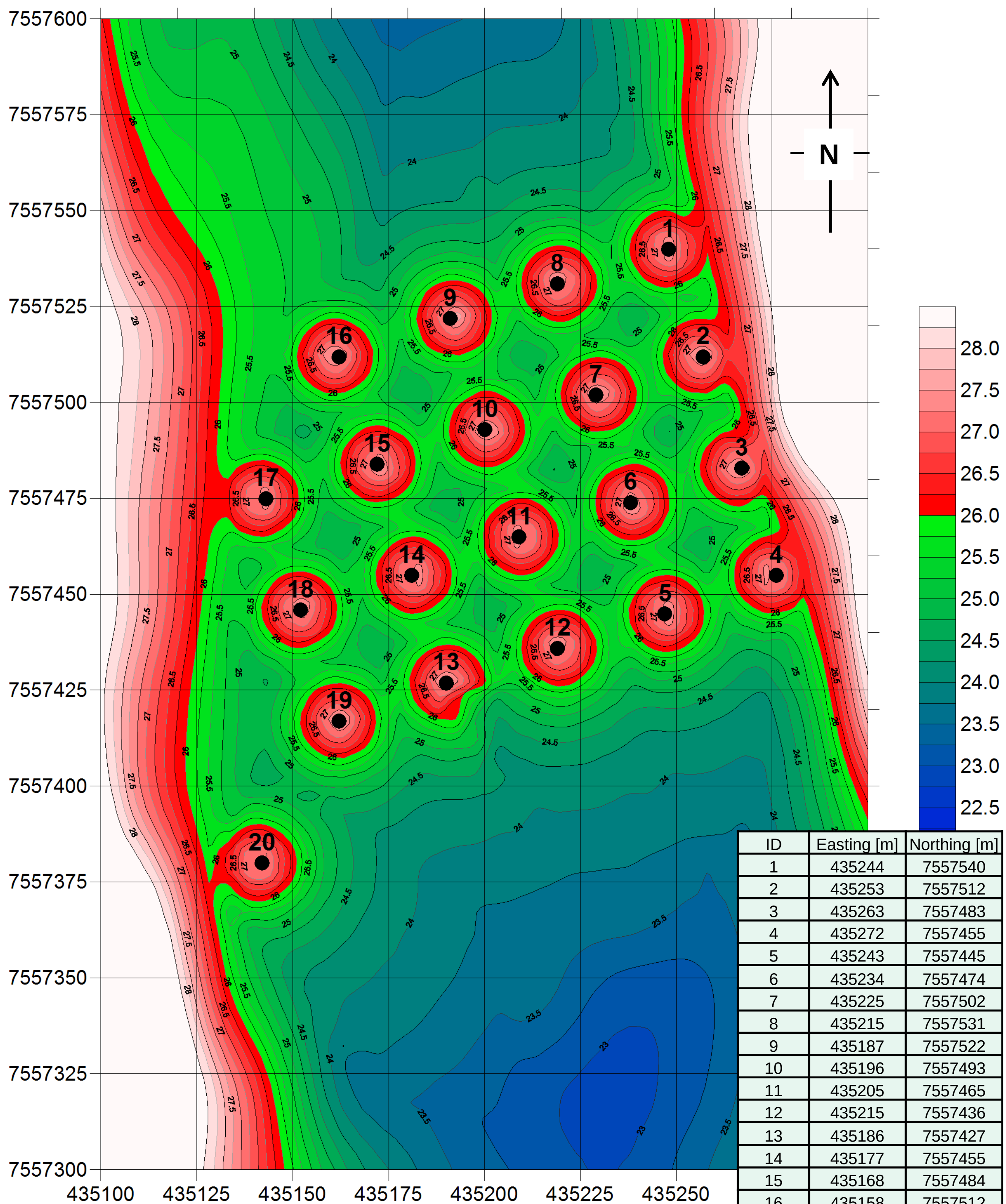
Date: August 2011

Approved: VM

Figure: **5**



ID	Easting [m]	Northing [m]
1	435244	7557540
2	435253	7557512
3	435263	7557483
4	435272	7557455
5	435243	7557445
6	435234	7557474
7	435225	7557502
8	435215	7557531
9	435187	7557522
10	435196	7557493
11	435205	7557465
12	435215	7557436
13	435186	7557427
14	435177	7557455
15	435168	7557484
16	435158	7557512
17	435139	7557475
18	435148	7557446
19	435158	7557417
20	435138	7557380

Notes:
1. Coordinate System NAD 83, Zone 13.
2. Initial slope angle 10°.

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Tailings Deposition Plan

Summer Season

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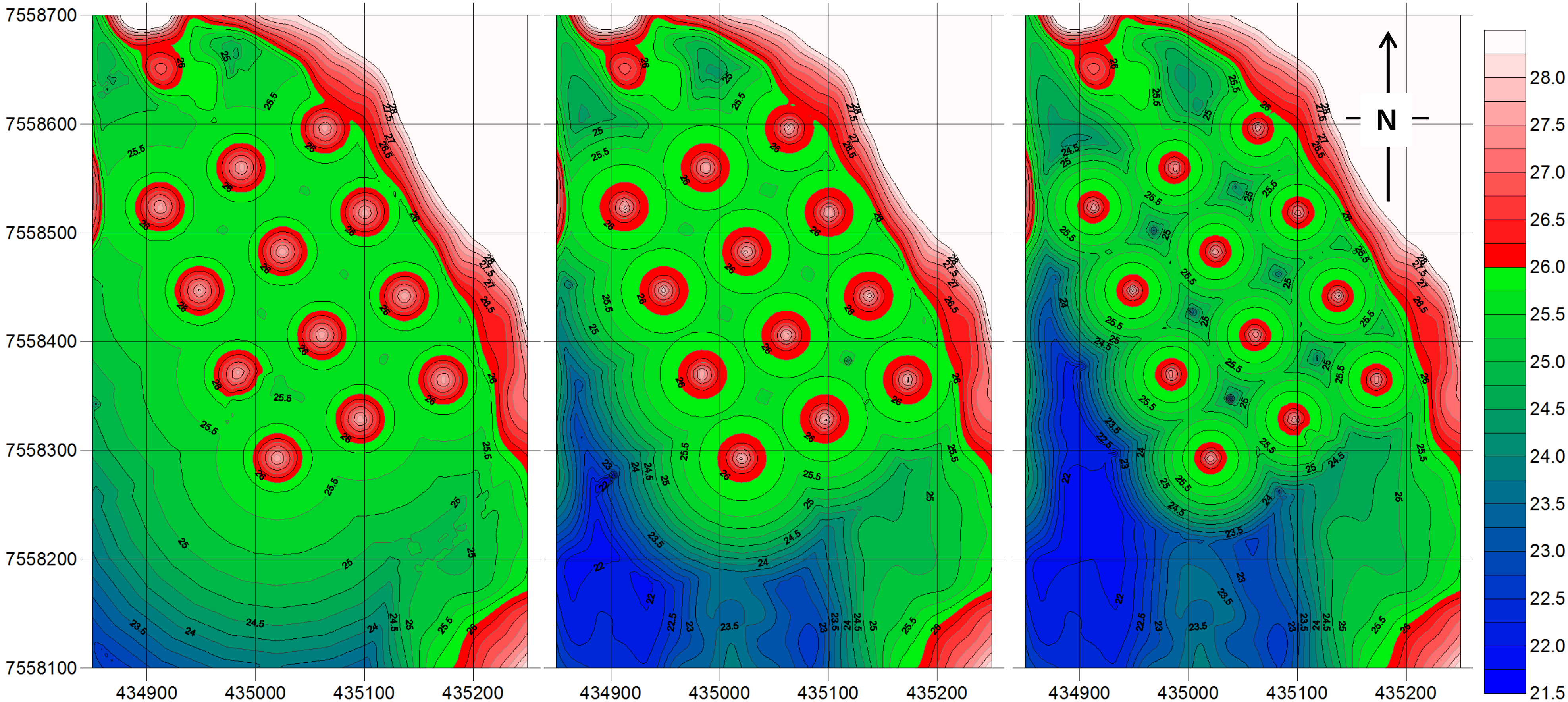
Date: August 2011

Approved: VM

Figure: 6



Initial Slope Angle: 5°
Max. Elevation 27.88 [masl]

Initial Slope Angle: 10°
Max Elevation 28.30 [masl]

Initial Slope Angle: 15°
Max Elevation 28.30 [masl]

Note:
Coordinate System NAD 83, Zone 13.

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NORTH AMERICA

Job No: 1CH008.033 Filename: Figure 7_20110830.ppt	HOPE BAY MINING LTD.	Tailings Deposition Plan **Winter Season** **Sensitivity Analysis – Initial Slope Angle**

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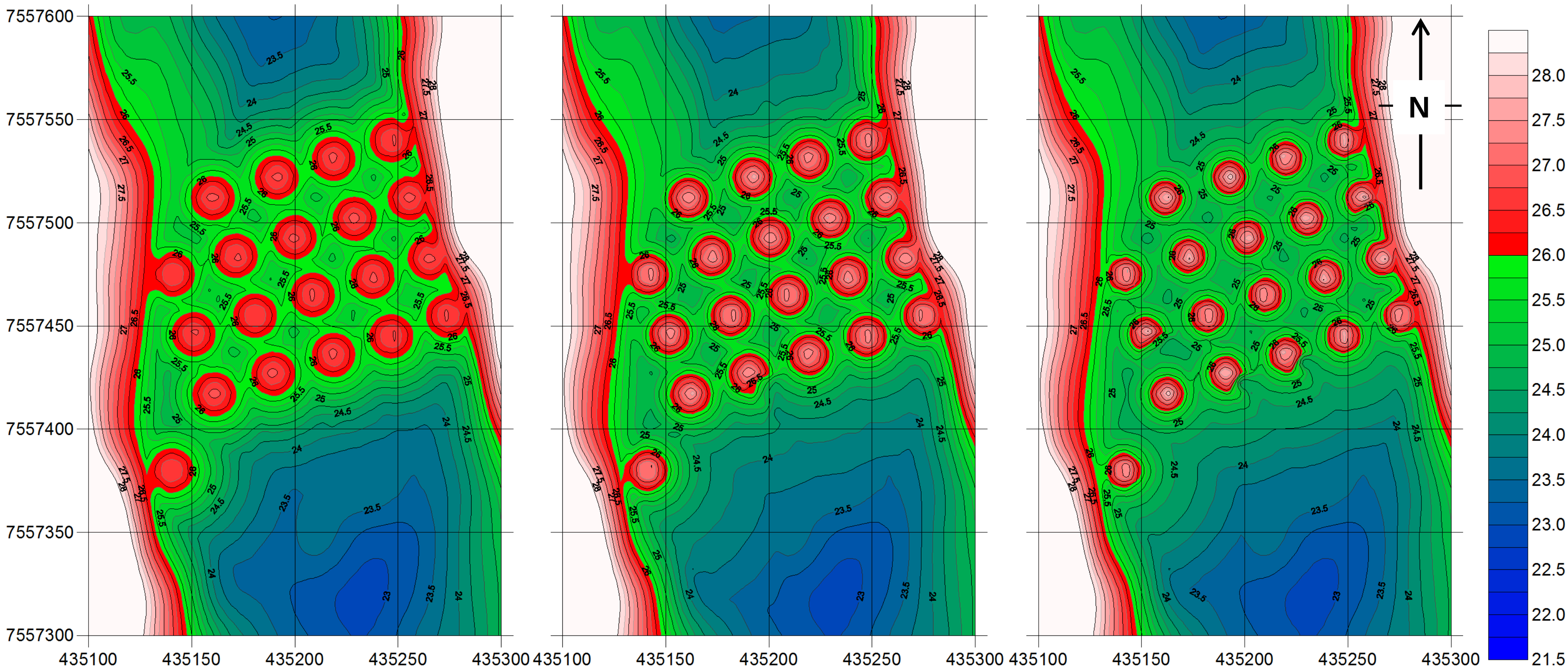

Initial Slope Angle: 5°
Max. Elevation 27.04 [masl]

Initial Slope Angle: 10°
Max. Elevation 27.88 [masl]

Initial Slope Angle: 15°
Max Elevation 28.30 [masl]

Note:
Coordinate System NAD 83, Zone 13.

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Tailings Deposition Plan

Summer Season
Sensitivity Analysis – Initial Slope Angle

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