Technical Memorandum

To:	David Krizek	**From:**	Erik Nelson, P.E.
Company:	Rosemont Copper Company	**Date:**	June 25, 2012
EA No.:	110253		
Re:	Conceptual Design of Heap Leach Pump Back Riser Pipe		
CC:			

1.0 Introduction

Engineering Analytics Inc. has prepared this Technical Memorandum to present a conceptual design for a riser pipe that will allow Rosemont to install a pump back system to remove treated water from the Rosemont heap leach Treatment Basin 2 after the treatment cell has been buried by waste rock and/or tailings. Our scope of work also included the evaluation of materials that could be used to construct the riser pipe. In addition, our scope included the preparation of this Technical Memorandum.

It is our understanding that treated water meeting Arizona Aquifer Water Quality Standards (AWQS) would be allowed to flow into and out of the riser pipe and infiltrate into the ground. Treated water not meeting AWQS would be pumped out and further treated or used in the process circuit.

2.0 Analyses and Conceptual Access Pipe Configurations

Riser pipe diameters of 4 and 6 feet were evaluated. The approximate location of the treatment basins are shown on Figure 1.

The pipe load calculations assumed that the backfill material around the pipe will consist of either waste rock or dry stack tailings (for the barrel alternative). The properties for the waste rock and the dry stack tailings were obtained from the AMEC report dated April 15, 2009. The soils properties obtained from the AMEC report are a friction angle of 38° and a unit weight of 125 pcf for the waste rock and 28° and 110 pcf for the dry stack tailings.

2.1 Vertical

Coulomb's active earth pressure equation was used to calculate the horizontal load on the pipe. The lateral earth pressure at the bottom of the riser pipe was calculated for a depth of 600 feet. This maximum tailings/waste rock depth was obtained from conversations with Rosemont personnel and a review of the site plans. The maximum lateral earth pressure was calculated at the bottom of the riser pipe for both waste rock and dry stack tailings backfill material. The results of these calculations are presented below in Equations 1 and 2. The concrete pipe design manual states that *"The maximum allowable depth of a typical precast concrete manhole with regard to lateral earth pressures is in excess of 300 feet or, for all practical purposes, unlimited* (American Concrete Pipe Association, 2000)." The use of precast concrete manhole would be a cost effective means to install a vertical access riser from Treatment Basin 2. During final design additional reinforcing or nesting of the deeper manhole sections may be required to withstand the lateral earth pressure. The use of a 600 foot vertical concrete pipe column for access will require the installation of a reinforced concrete foundation pad at the base of the riser pipe. We anticipate that the pad will be on the order of 12 inches thick. If this option is selected, the actual pad thickness and re-bar layout will be determined during final design. A conceptual drawing of the vertical riser is provided in Figure 2.

Waste Rock Backfill:

Eq. (1) $$P_a = K_a \gamma H = 0.2168 * 125 \frac{lb}{ft^3} * 600 ft = 16{,}260 \frac{lb}{ft^2}$$

Where: $K_a = Coulomb\ Active\ Earth\ Presssure\ with\ wall\ friction\ of\ \frac{2}{3}\varphi, \varphi = 38^o$

$\gamma = 125 \frac{lb}{ft^3}$

$H = 600\, ft$

Dry Stack Tailings Backfill:

Eq. (2) $$P_a = K_a \gamma H = 0.3213 * 110 \frac{lb}{ft^3} * 600 ft = 21{,}205 \frac{lb}{ft^2}$$

Where: $K_a = Coulomb\ Active\ Earth\ Presssure\ with\ wall\ friction\ of\ \frac{2}{3}\varphi, \varphi = 28^o$

$\gamma = 110 \frac{lb}{ft^3}$

$H = 600\, ft$

2.2 Discussion

The earth pressures and the vertical pipe orientation allow for the potential to use precast manholes for vertical access. These manhole riser sections could be installed without the need for a specialty contractor on site. They can be lowered into place with onsite equipment each time the waste rock/tailings elevation needs to be increased. Gravel would need to be placed around the riser to help distribute loads and to avoid point loads against the side of the riser. During final design additional reinforcement may need to be added to the lower sections of the manhole to resist the lateral earth pressures. Alternately larger diameter manhole sections could be placed over the inner manhole section (nested) and the annular space filled with concrete or

gravel. The number of sections that would require this additional reinforcement would be determined during final design.

3.0 Concrete and Pipe Compatibility

Type V Portland cement is recommended for the concrete foundation base. If the sulfate concentration exceeds 10,000 ppm, Type 5 cement should be used along with a pozzolan.

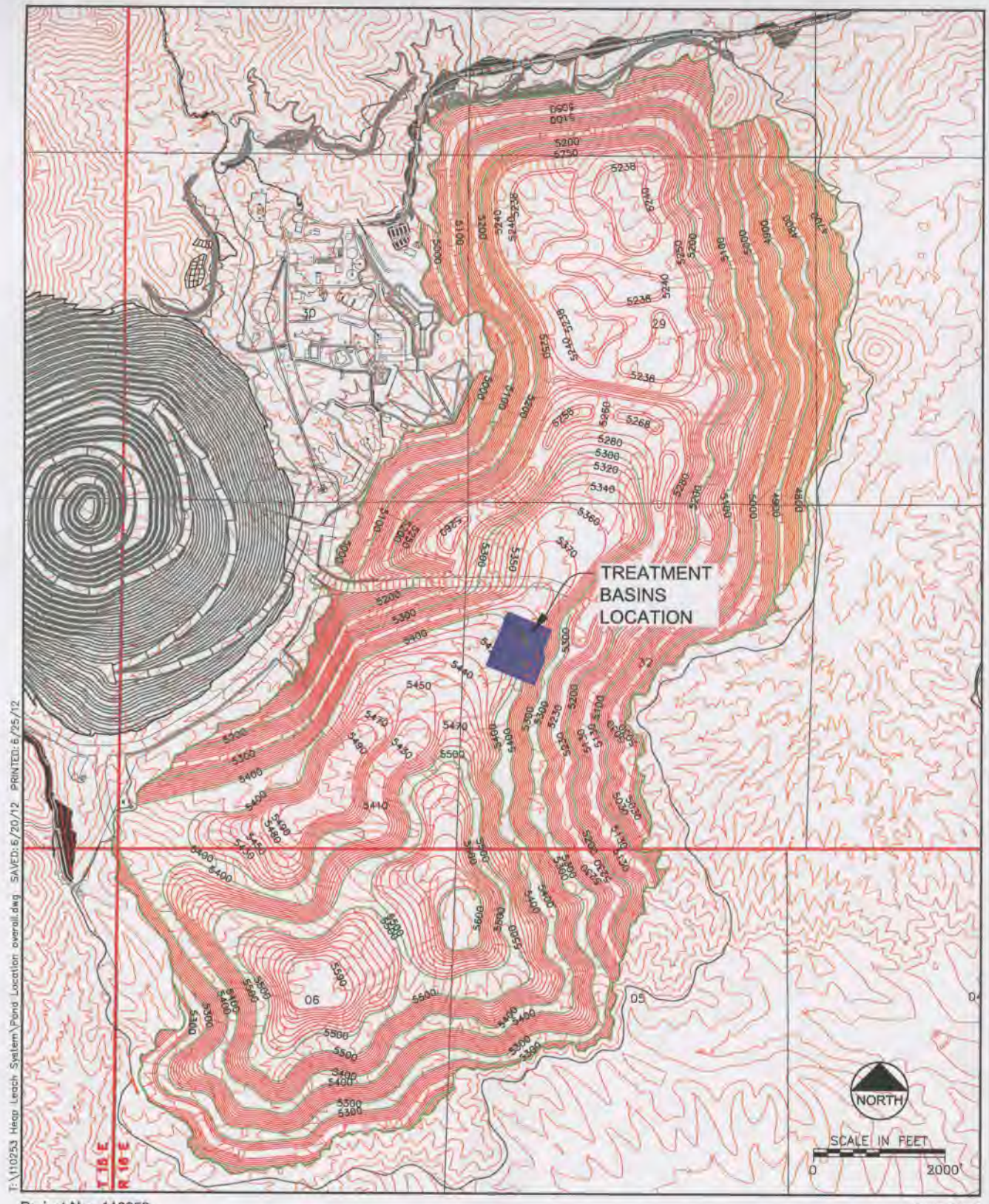

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FIGURE 1
TREATMENT BASIN LOCATION
HEAP LEACH PUMP BACK SYSTEM
PHASED TAILINGS ALTERNATIVE

NOTES:
- RISER PIPE SHOULD BE BEDDED IN MINUS 1" GRAVEL (MINIMUM 1' THICK)
- PROVIDE A 12" REINFORCED CONCRETE FOUNDATION PAD FOR THE VERTICAL RISER PIPE

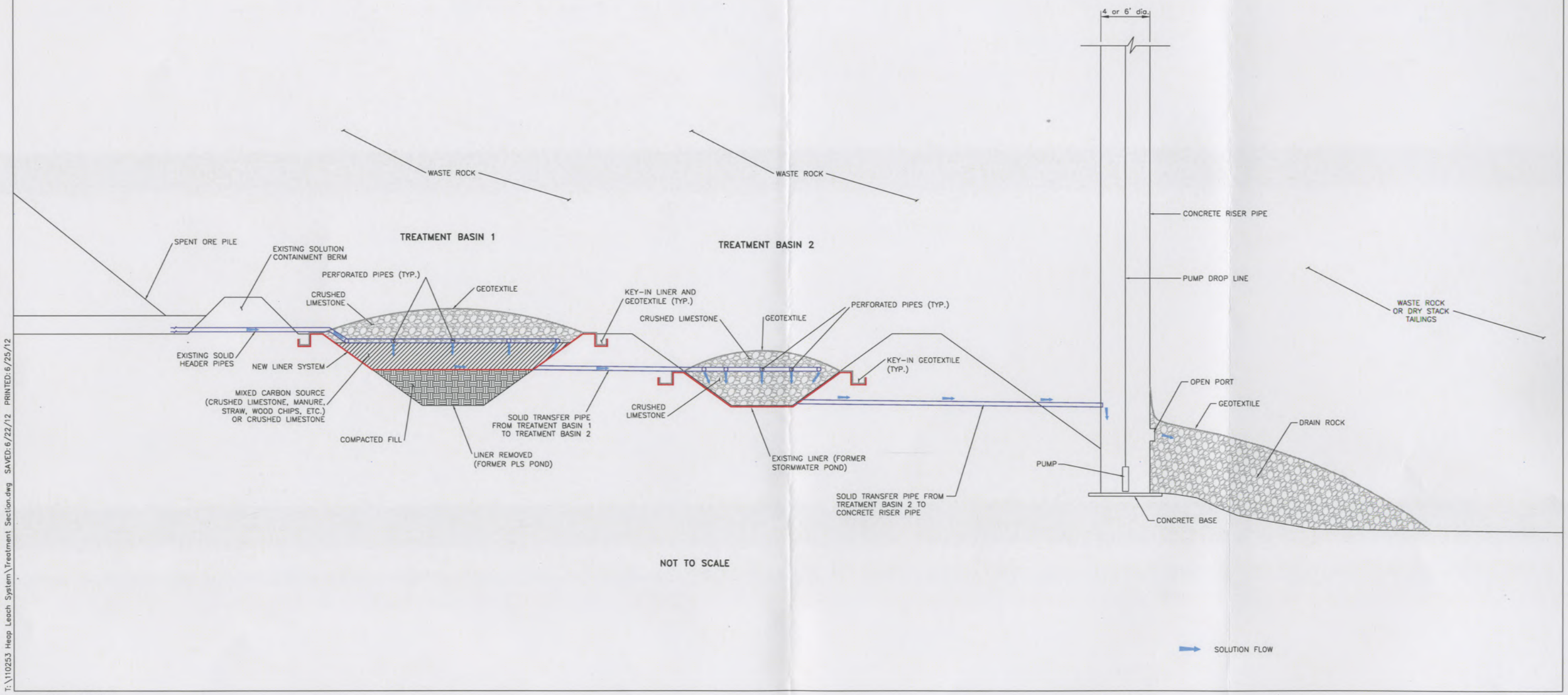

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FIGURE 2
DRAIN-DOWN TREATMENT CONCEPT WITH RISER PIPE
ROSEMONT COPPER PROJECT