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Technical Memorandum

To:	Kathy Arnold	**From:**	Mike Thornbrue
Company:	Rosemont Copper Company	**Date:**	April 13, 2010
Re:	Rosemont Surface Water Quality Baseline Analysis	**Doc #:**	112/10-320828-5.3
CC:	David R. Krizek, P.E. (Tetra Tech)		

1.0 Introduction

This Technical Memorandum provides a comparison of the stormwater monitoring data and Synthetic Precipitation Leaching Procedure (SPLP) data collected for the Rosemont Copper Project (Project) against applicable surface water quality standards (SWQS). Stormwater samples have been collected during the past two storm seasons to provide information on baseline conditions for stormwater. The Project site has been subject to historical mining activity. Current activity at the Project site includes monitoring revegetation test plots and general site maintenance.

The surface water quality standards are defined in Arizona Administrative Code (A.A.C.) Title 18, Chapter 11. The applicable SWQS for the Project are based on designated use standards, taking into consideration the recent designation of Davidson Canyon as an outstanding Arizona water (OAW) and have been calculated, based on the hardness of the water, using the methods outlined in A.A.C. R18-11 Appendix B.

2.0 Applicable Surface Water Quality Standards

Applicable SWQS associated with the wash in Barrel Canyon include:

- Aquatic and Wildlife (ephemeral) (A&We); and
- Agricultural Livestock Watering (AgL).

Applicable SWQS associated with the reaches near or downstream of the OAW section of Davidson Canyon include:

- Aquatic and Wildlife (A&W) Acute exposure;
- Aquatic and Wildlife (ephemeral) (A&We);

- Agricultural Livestock Watering (AgL);
- Fish Consumption (FC);
- Full Body Contact (FBC); and
- Aquatic and Wildlife (warm water) (A&Ww).

These SWQS were compared with baseline stormwater sampling data collected by Rosemont Copper Company (Rosemont) and to SPLP data from samples of the dry stack tailings and waste rock materials. The A&Ww Acute exposure standard was used in the comparison since chronic exposure typically requires constant, or prolonged, contact with a substance and acute exposure mimics stormwater flow which is intermittent.

In A.A.C. R18-11, Davidson Canyon is broken into four (4) segments. The first segment, from the Headwaters to the unnamed spring at 31^{o} 59' 00" N and 110^{o} 38' 46" W, is subject to standards similar to Barrel Canyon. The remaining three (3) segments, from the unnamed spring to the confluence with Cienega Creek, were used to determine the remaining SWQS. The area of Davidson Canyon that was designated an OAW is approximately ten (10) miles downstream of the confluence of Davidson and Barrel.

The detection limits for the laboratory analysis were based on SWQS that were calculated using an assumed water hardness value based on the local geology. However, the hardness value was lower than expected. Therefore, some detection limits are higher than the SWQS causing uncertainty in the results. Detection limits associated with stormwater sampling at the Project site will be reduced to provide meaningful data.

3.0 Results

3.1 Baseline Stormwater Sampling Data

The baseline stormwater sampling data was collected near the proposed location of the Compliance Point Dam (identified as RP2 in Table 1) and upstream of the Compliance Point Dam near the center of the proposed Dry Stack Tailings Facility (identified as Junction, Junction 1, and Factory 125 in Table 1). The data was compared with the A&We Acute standards and the AgL calculated for Barrel Canyon as shown in Table 1.

The results indicate that the baseline stormwater at the Project site exceeds the SWQS for:

- Arsenic (total) 0.22 mg/L to 0.45 mg/L vs. AgL of 0.20 mg/L;
- Cadmium (total) 0.039 mg/L to 0.053 mg/L vs. AgL of 0.05 mg/L;
- Copper (dissolved) 0.022 mg/L to 0.0497 mg/L vs. A&We of 0.02062 mg/L;
- Copper (total) 0.17 mg/L to 29.0 mg/L vs. AgL of 0.50 mg/L; and
- Lead (total) 0.14 mg/L to 6.5 mg/L vs. AgL of 0.10 mg/L.

Due to uncertainty based on the high detection limits (DL), it is possible that the baseline stormwater at the Project site may also exceed the A&We standards for:

- Cadmium (dissolved) DL = 0.03 mg/L to 0.05 mg/L for four (4) of nine (9) samples vs. A&We of 0.0117 mg/L to 0.0259 mg/L;
- Selenium (total) DL = 0.1 mg/L to 0.25 mg/L for eight (8) of nine (9) samples vs. the A&We of 0.033 mg/L; and
- Silver (dissolved) DL = 0.005 mg/L to 0.05 mg/L for seven (7) of ten (10) samples vs. the A&We of 0.00091 mg/L to 0.00403 mg/L.

As previously stated, the detection limits for future samples will be lowered to eliminate uncertainty and provide more accurate data for comparison with the SWQS.

3.2 Average Waste Rock SPLP data

Table 2 presents a comparison of the averaged waste rock SPLP data with the applicable surface water standards.

The results indicate that the QMP waste rock may exceed the A&Ww Acute exposure criteria for copper (260% of the SWQS) within the Davidson Canyon OAW reach. The baseline stormwater sampling data, however, exceeded the same standard in five (5) of the nine (9) samples analyzed (185% to 638% when compared against the Davidson Canyon OAW SWQS). Also, QMP is not expected to be exposed within the Waste Rock Storage Area as the majority of the material will be used to produce Overliner Drain Fill for the Heap Leach Pad which is isolated from stormwater discharge by complete capture.

The results also indicated that detection limits were not low enough to provide a reliable comparison for:

- Selenium DL = 0.04 mg/L vs. the Barrel Canyon A&W Acute SWQS of 0.033 mg/L.

Any future samples, as necessary, will be evaluated with lower detection limits.

3.3 Tailings SPLP Data

The Tailings SPLP data was compared with all of the SWQS to show the potential impact of tailings on stormwater quality. Because the tailings are encapsulated by waste rock, this comparison is made for informational purposes only. There are four (4) tailings samples (May 2006, February 2007, June 2007, and July 2008) that have SPLP testing data.

As shown in Table 3, the May 2006 sample had higher detection limits than the other samples and therefore cannot be accurately compared in the case of arsenic, cadmium, lead, mercury, and selenium.

With lowered detection limits, the February 2007, June 2007, and July 2008 samples indicated that the tailings may exceed the A&W Acute exposure limits for:

- Selenium (total) DL = 0.04 mg/L vs. the Barrel Canyon A&W Acute SWQS of 0.033 mg/L; and
- Silver (dissolved) DL = 0.005 mg/L to 0.01 vs. the Barrel Canyon A&W Acute SWQS of 0.00258 mg/L.

Any future samples, as necessary, will be evaluated with lower detection limits.

4.0 Summary and Conclusion

The designation of Davidson Canyon as an OAW occurs approximately ten (10) miles downstream of the Project site. Therefore any stormwater runoff from the Project site would be significantly diluted, or otherwise influenced, prior to reaching Davidson Canyon. Baseline stormwater sampling at the Project site exceeds the SWQS for dissolved copper, total copper, total arsenic, total cadmium, and total lead.

The waste rock SPLP data indicated that dissolved copper for the QMP material is higher than the SWQS for the Davidson Canyon OAW reach. However, the baseline stormwater sampling data showed similar results in five (5) of the nine (9) samples analyzed when compared to the Davidson Canyon OAW SWQS. Additionally, the tailings SPLP data did not indicate any exceedance of the SWQS.

Further evaluation of future SPLP data for the waste rock is warranted to eliminate the uncertainty caused by high detection limits for total selenium.

Based on the location of the Davidson Canyon OAW designation, and the results of the baseline stormwater sampling data, including the results of the SPLP analysis, the tailings and waste rock are not expected to cause further degradation of the existing surface water quality at the Project site.

TABLES

Table 1. Barrel Canyon Stormwater Water Quality Criteria by Designated Use

PARAMETER	7/1/09 RP2 mg/L	7/21/09 RP2 mg/L	9/4/09 RP2 mg/L	9/6/09 RP2 mg/L	A&We Acute (mg/L)	AgL (mg/L)
Average Hardness					88	
Arsenic (dissolved)	0.01	0.029	<0.1	<0.01	**0.44**	
Arsenic (total)	**<0.300**	**0.45**	NT	**0.34**		**0.20**
Cadmium (dissolved)	<0.0020	<0.003	**<0.03**	<0.003	**0.02014**	0.05
Cadmium (total)	**<0.200**	**0.053**	NT	0.039		**0.05**
Total Chromium (dissolved)	<0.0050	<0.010	<0.10	<0.010		
Total Chromium (total)	<0.500	<0.500	NT	0.26		**1.00**
Copper (dissolved)	**0.0497**	**0.032**	**<0.10**	**0.022**	**0.02062**	
Copper (total)	**8.53**	**29**	**9.1**	0.17		**0.50**
Lead (dissolved)	<0.0020	<0.010	<0.1	<0.01	**0.11855**	
Lead (total)	**4.64**	**6.5**	**3.8**	**0.25**		**0.10**
Mercury (dissolved)	<0.0002	NT	NT	NT	**0.005**	
Mercury (total)	<0.0020	NT	NT	NT		**0.01**
Nickel (dissolved)	<0.0050	<0.010	<0.10	<0.010	**3.732**	
Nickel (total)	<0.500	0.56	0.29	<0.08		
Selenium (total)	**<0.200**	**<0.250**	NT	**<0.25**	**0.033**	0.05
Silver (dissolved)	<0.0010	**<0.0050**	**<0.05**	<0.002	**0.00258**	
Silver (total)	<0.100	<0.05	NT	<0.02		
Zinc (dissolved)	<0.05	<0.05	<0.5	<0.05	**0.998**	
Zinc (total)	3.6	NT	NT	9.9		**25.0**

Notes: A&We Acute = Aquatic and Wildlife (ephemeral) Acute Exposure

AgL = Agricultural Livestock Watering

Water samples were not analyzed for hardness - value represents average hardness calculated from all other sampling locations.

Indicates an exceedance of a SWQS.

NT - Not tested for listed parameter

Lowest Applicable SWQS

Bold Values Indicate that the detection limit was above the SWQS.

Table 1. Barrel Canyon Stormwater Water Quality Criteria by Designated Use

PARAMETER	7/1/09 Junction mg/L	7/21/09 Junction mg/L	9/4/09 Junction mg/L	9/6/09 Junction mg/L	A&We Acute (mg/L)	AgL (mg/L)
Average Hardness					114	
Arsenic (dissolved)	NT	0.029	<0.10	<0.010	**0.44**	
Arsenic (total)	<0.150	**0.22**	NT	<0.10		**0.20**
Cadmium (dissolved)	NT	<0.0030	**<0.030**	<0.0030	**0.0259**	0.05
Cadmium (total)	**<0.100**	<0.030	NT	<0.030		**0.05**
Total Chromium (dissolved)	NT	<0.010	<0.10	<0.010		
Total Chromium (total)	<0.250	0.16	NT	<0.10		**1.00**
Copper (dissolved)	NT	**0.043**	**<0.10**	<0.010	**0.02632**	
Copper (total)	**1.12**	**8.3**	NT	<0.10		**0.50**
Lead (dissolved)	NT	<0.010	<0.10	<0.010	**0.15715**	
Lead (total)	**0.421**	**1.8**	NT	**0.14**		**0.10**
Mercury (dissolved)	NT	NT	NT	NT	**0.005**	
Mercury (total)	<0.0002	NT	NT	NT		**0.01**
Nickel (dissolved)	NT	<0.010	<0.10	<0.010	**4.646**	
Nickel (total)	<0.250	0.19	NT	<0.10		
Selenium (total)	**<0.100**	**<0.25**	NT	**<0.25**	**0.033**	0.05
Silver (dissolved)	NT	**<0.0050**	**<0.050**	<0.0010	**0.00403**	
Silver (total)	<0.050	<0.050	NT	<0.0050		
Zinc (dissolved)	NT	**<0.050**	**<0.50**	**<0.050**	**1.243**	
Zinc (total)	0.93	5.4	NT	<0.50		**25**

Notes: A&We Acute = Aquatic and Wildlife (ephemeral) Acute Exposure

AgL = Agricultural Livestock Watering

Water samples were not analyzed for hardness - value represents average hardness calculated from all other sampling locations.

Indicates an exceedance of a SWQS.

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Lowest Applicable SWQS

Bold Values Indicate that the detection limit was above the SWQS.

Table 1. Barrel Canyon Stormwater Water Quality Criteria by Designated Use

PARAMETER	7/23/09 Junction 1 mg/L	A&We Acute (mg/L)	AgL (mg/L)
Average Hardness		43	
Arsenic (dissolved)	<0.010	**0.44**	
Arsenic (total)	0.043		**0.20**
Cadmium (dissolved)	<0.0030	**0.01117**	0.05
Cadmium (total)	0.0033		0.05
Total Chromium (dissolved)	<0.010		
Total Chromium (total)	0.040		**1.00**
Copper (dissolved)	**0.043**	**0.01165**	
Copper (total)	**2.6**		**0.5**
Lead (dissolved)	<0.010	**0.06078**	
Lead (total)	**0.49**		**0.1**
Mercury (dissolved)	NT	**0.005**	
Mercury (total)	NT		**0.01**
Nickel (dissolved)	<0.010	**2.235**	
Nickel (total)	0.044		
Selenium (total)	<0.025	**0.033**	0.05
Silver (dissolved)	**<0.0050**	**0.00091**	
Silver (total)	<0.0050		
Zinc (dissolved)	<0.050	**0.597**	
Zinc (total)	1.4		**25**

Notes: A&We Acute = Aquatic and Wildlife (ephemeral) Acute Exposure

AgL = Agricultural Livestock Watering

Water samples were not analyzed for hardness - value represents average hardness calculated from all other sampling locations.

Indicates an exceedance of a SWQS.

NT - Not tested for listed parameter

Lowest Applicable SWQS

Bold Values Indicate that the detection limit was above the SWQS.

Table 1. Barrel Canyon Stormwater Water Quality Criteria by Designated Use

PARAMETER	7/9/08 Factory 125 mg/L	7/11/08 Factory 125 mg/L	A&We Acute (mg/L)	AgL (mg/L)
Average Hardness[1]			88	
Arsenic (dissolved)	< 0.10	< 0.1	**0.44**	
Arsenic (total)	< 0.10	< 0.10		**0.20**
Cadmium (dissolved)	**< 0.05**	**< 0.05**	**0.02014**	0.05
Cadmium (total)	< 0.050	< 0.050		**0.05**
Total Chromium (dissolved)	< 0.1	< 0.1		
Total Chromium (total)	< 0.10	< 0.10		**1.00**
Copper (dissolved)	**< 0.1**	**< 0.1**	**0.02062**	
Copper (total)	0.17	**4.3**		**0.50**
Lead (dissolved)	**< 0.15**	**< 0.15**	**0.11855**	
Lead (total)	**0.25**	**1.2**		**0.10**
Mercury (dissolved)	NT	NT	**0.005**	
Mercury (total)	NT	NT		**0.01**
Nickel (dissolved)	< 0.08	< 0.08	**3.732**	
Nickel (total)	< 0.08	0.08		
Selenium (total)	**< 0.1**	**< 0.10**	**0.033**	0.05
Silver (dissolved)	**< 0.02**	**< 0.02**	**0.00258**	
Silver (total)	< 0.02	< 0.020		
Zinc (dissolved)	< 0.5	< 0.5	**0.998**	
Zinc (total)	0.6	2.9		**25.0**

Notes: A&We Acute = Aquatic and Wildlife (ephemeral) Acute Exposure

AgL = Agricultural Livestock Watering

Water samples were not analyzed for hardness - value represents average hardness calculated from all other sampling locations.

Indicates an exceedance of a SWQS.

NT - Not tested for listed parameter

Lowest Applicable SWQS

Bold Values Indicate that the detection limit was above the SWQS.

A&W Acute, AgL, FC, FBC, and A&Ww Acute standards were calculated based on the hardness value. The hardness value was lower that expected based on local geology. This resulted in the some detection limits being higher that the standards calculated using hardness. These detection limits have since been reduced.

Table 2. Rosemont Waste Rock - Average SPLP Data Comparison

PARAMETER	Waste Rock Samples													Surface Water Quality Standards						
														Barrel Canyon		Davidson Canyon OAW Reach				
	Abrigo	Andesite	Arkose	Bolsa	Colina	Earp	Epitaph	Escabrosa	Horquilla	Martin	Over-Burden	QMP	Concha	A&We Acute (mg/L)	AgL (mg/L)	FC (mg/L)	FBC (mg/L)	A&Ww Acute (mg/L)		AgL (mg/L)
																		Acute	Chronic [N1]	
Antimony	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			0.640 T	0.747 T	**0.088 D**	0.030 D	NA
Arsenic	0.01	0.02	0.015	0.009	<0.02	<0.02	0.008	<0.02	<0.02	<0.02	0.03	0.008	<0.003	0.440 D	0.200 T	0.080 T	**0.030 T**	0.340 D	0.150 D	0.200 T
Barium	0.002	0.003	0.007	0.003	0.019	0.006	0.015	0.002	0.017	0.003	0.063	0.019	0.0182				**98.0 T**			
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002			**0.084 T**	1.867 T			
Cadmium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.02014[HC]	0.05	0.084 T	0.700 T	**0.00695[HC]**	0.00051[HC]	0.05
Total Chromium	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006		**1.00**					**1.00**
Copper	<0.01	<0.01	0.008	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.031**	<0.01	0.2062[HC]	0.500 T		1.30 T	**0.01191 [HC]**	0.00803[HC]	0.500 T
Fluoride	0.26	0.29	0.26	0.25	1.28	0.42	0.93	0.42	0.51	0.30	0.32	0.30	<0.1				**140.0**			
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0075	0.02	<0.01	<0.01	0.11855[HC]	0.100 T		0.015 T	**.05617 [HC]**	0.00219[HC]	0.100 T
Manganese																	**130.67**			
Mercury	0.0002	<0.0002	0.0003	0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.005 D	0.010 T		0.280 T	**0.0024 D**	0.00001 D	0.010 T
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	3.732[HC]		0.511 T	28.0 T	**0.420HC**	0.04668[HC]	
Selenium	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**<0.04**	**0.033 T**	0.050 T	0.667 T	4.667 T		0.002 T	0.050 T
Silver														**0.00258[HC]**		8.0 T	4.667 T	**0.00258[HC]**		
Zinc	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.010	<0.01	<0.01	0.998[HC]	25.0 T	5.106 T	280.0 T	**0.1052[HC]**	0.1052[HC]	25.0 T

Notes: A&W Acute = Aquatic and Wildlife Acute Exposure
AgL = Agricultural Livestock Watering
FC = Fish Consumption
FBC = Full Body Contact
A&Ww = Aquatic and Wildlife (warm water)

Indicates an exceedance of a SWQS.

Lowest Applicable SWQS

Bold Values Indicate that the detection limit was above the SWQS.

NT - Not tested for listed parameter
D - Dissolved
T - Total recoverable

[HC]Standard was calculated by averaging hardness values from stormwater samples collected from Barrel Canyon.

[N1]Standard should not apply to stormwater flow.

A&W Acute, AgL, FC, FBC, and A&Ww Acute standards were calculated based on the hardness value. The hardness value was lower that expected based on local geology. This resulted in the some detection limits being higher that the standards calculated using hardness. These detection limits have since been reduced.

Table 3. Rosemont Tailings SPLP Data Comparison

PARAMETER	Samples				Standards						
	May 2006	Feb. 2007	June 2007	July 2008	Barrel Canyon		Davidson Canyon OAW Reach				
	Tailings (mg/L)	Tailings (mg/L)	Tailings (mg/L)	Tailings (mg/L)	A&W Acute (mg/L)	AgL (mg/L)	FC (mg/L)	FBC (mg/L)	A&Ww (mg/L)		AgL (mg/L)
									Acute	Chronic [N1]	
Antimony	NT	<0.02	<0.02	0.004			0.640 T	0.747 T	**0.088 D**	0.030 D	NA
Arsenic	**<1.0**	<0.003	<0.003	0.009	0.440 D	0.200 T	0.080 T	**0.030 T**	0.340 D	0.150 D	0.200 T
Barium	<10	<0.002	0.0032	0.051				**98.0 T**			
Beryllium	NT	NT	<0.002	<0.002			**0.084 T**	1.867 T			
Cadmium	**<0.5**	<0.002	<0.002	<0.002	0.02014[HC]	0.05	0.084 T	0.700 T	**0.00695[HC]**	0.00051[HC]	0.05
Total Chromium	<1.0	<0.006	<0.006	<0.006		1.00					**1.00**
Copper	NT	<0.01	<0.01	<0.01	0.2062[HC]	0.500 T		1.30 T	**0.01191 [HC]**	0.00803[HC]	0.500 T
Fluoride	NT	1.25	1.29	2.05				**140.0**			
Lead	**<1.0**	<0.0075	<0.0075	<0.0075	0.11855[HC]	0.100 T		**0.015 T**	0.05617 [HC]	0.00219[HC]	0.100 T
Manganese	NT	<0.004	<0.004	0.007				**130.67**			
Mercury	**<0.01**	<0.0002	<0.0002	<0.0002	0.005 D	0.010 T		0.280 T	**0.0024 D**	0.00001 D	0.010 T
Nickel	NT	NT	<0.01	NT	3.732[HC]		0.511 T	28.0 T	**0.420[HC]**	0.04668[HC]	
Selenium	**<0.5**	**<0.04**	**<0.04**	**<0.04**	**0.033 T**	0.050 T	0.667 T	4.667 T		0.002 T	0.050 T
Silver	NT	**<0.01**	**<0.005**	**<0.005**	**0.00258[HC]**		8.0 T	4.667 T	**0.00258[HC]**		
Zinc	NT	<0.01	<0.01	<0.001	0.998[HC]	25.0 T	5.106 T	280.0 T	**0.1052[HC]**	0.1052[HC]	25.0 T

Notes: A&W Acute = Aquatic and Wildlife Acute Exposure
AgL = Agricultural Livestock Watering
FC = Fish Consumption
FBC = Full Body Contact
A&Ww = Aquatic and Wildlife (warm water)

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[HC]Standard was calculated by averaging hardness values from stormwater samples collected from Barrel Canyon.

[N1]Standard should not apply to stormwater flow.

A&W Acute, AgL, FC, FBC, and A&Ww Acute standards were calculated based on the hardness value. The hardness value was lower that expected based on local geology. This resulted in the some detection limits being higher that the standards calculated using hardness. These detection limits have since been reduced.