

Copper Flat Mine Discharge Permit DP-1840 Application

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WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS



Outline

- 1. Site Experience and Qualifications
- 2. Key References
- 3. Hydrogeologic Setting for DP-1840
- 4. Copper Flat Open Pit
- 5. Waste Rock Stockpiles 2&3
- 6. Tailings Impoundment
- 7. Summary





Expertise

Education

- ✓ B.S. Geology from Sul Ross State University, 1985
- ✓ M.S. Geology from Northern Arizona University, 1991

Professional Certifications and Registrations

- ✓ American Institute of Professional Geologists CPG-9590
- ✓ Texas Professional Geoscientist PG-5302

Relevant Experience

- √ 28+ years as Hydrogeologist-Geochemists at JSAI
- ✓ Copper Rule Technical Advisory Committee
- ✓ Experience with Copper Flat property 1992 to current



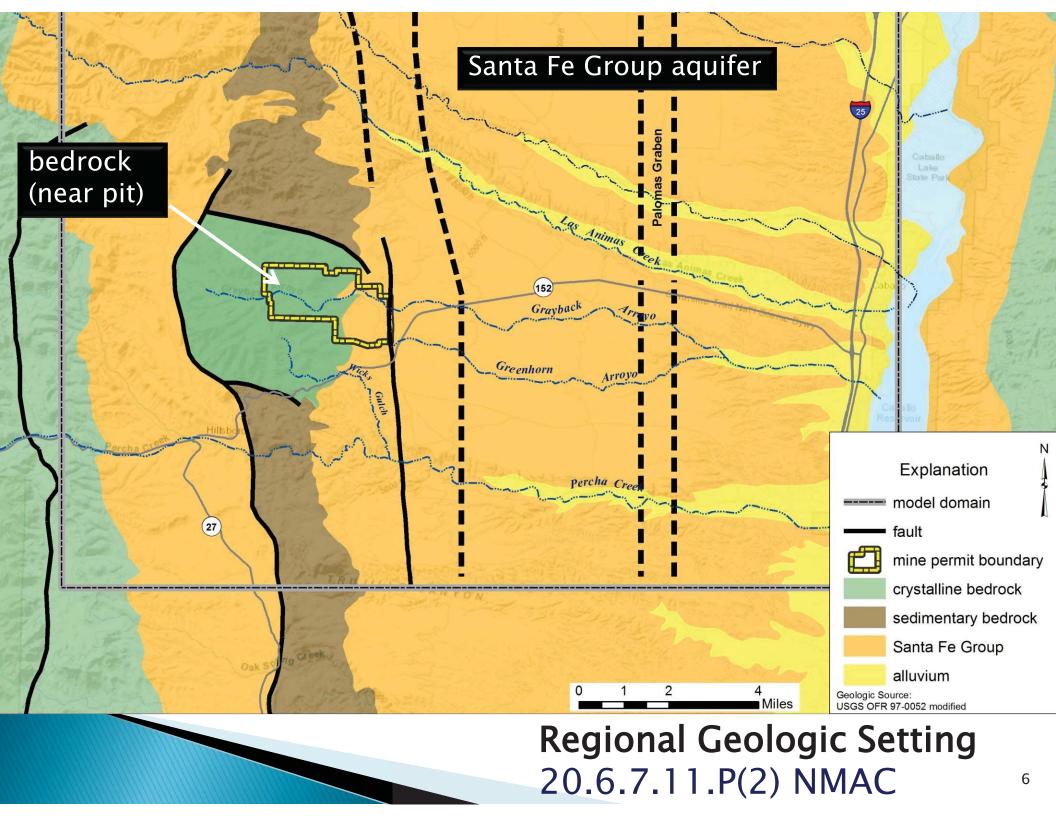
Key References

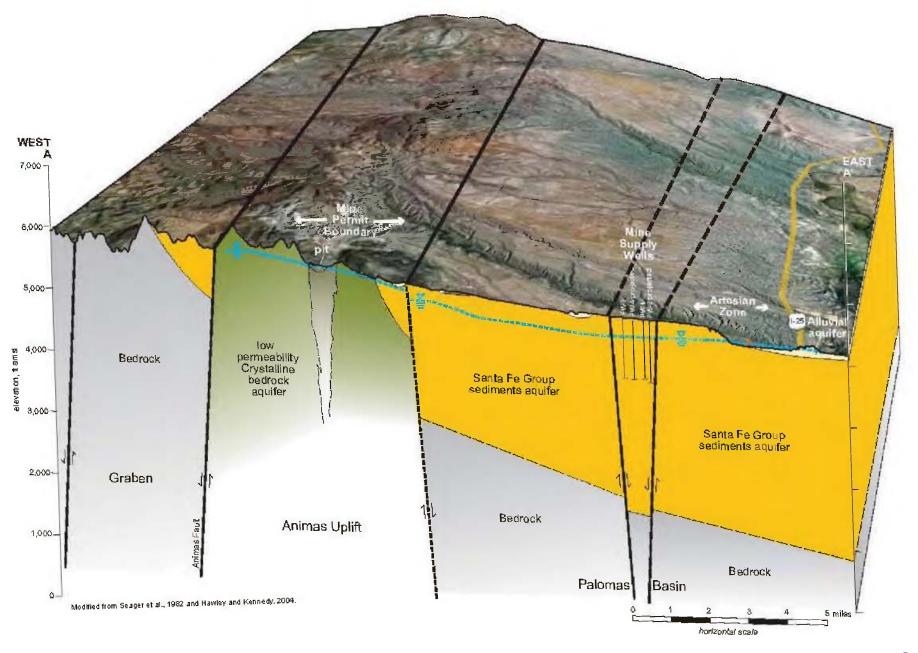




HYDROGEOLOGIC SETTING AND CONCEPTUAL MODEL







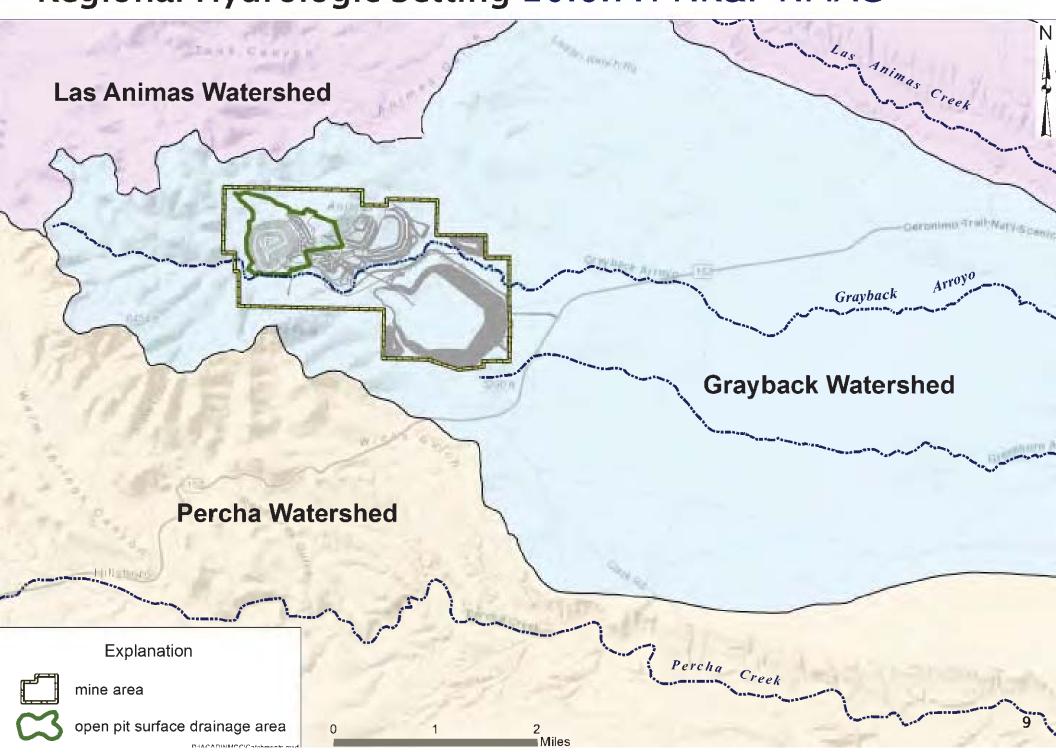
Regional Geologic Setting 20.6.7.11.P(2) NMAC



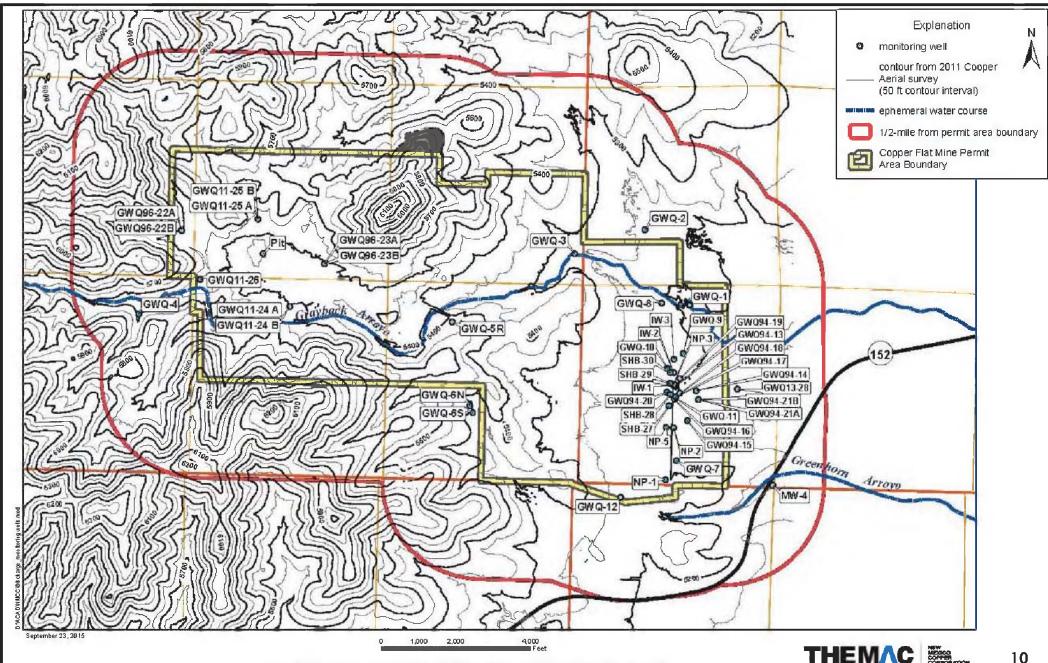
Regional Geology

- Structure
 - Rio Grande Rift with south-north trending faults
 - Animas Uplift contains crystalline bedrock
- Crystalline Bedrock
 - Cretaceous-age andesite volcano
 - Very low permeability
- Santa Fe Group Sediments
 - Unconsolidated sediments consisting of clay, silt, sand, and gravel
 - Variable permeability

Regional Hydrologic Setting 20.6.7.11.K&P NMAC



Wells and Surface Water within ½ Mile of Permit Area 20.6.7.11. J(7,9) NMAC



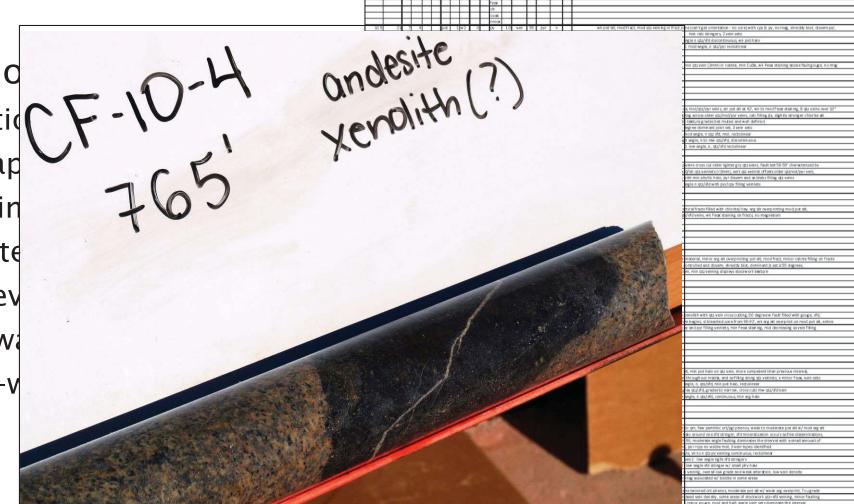
Site Hydrogeologic Characterization

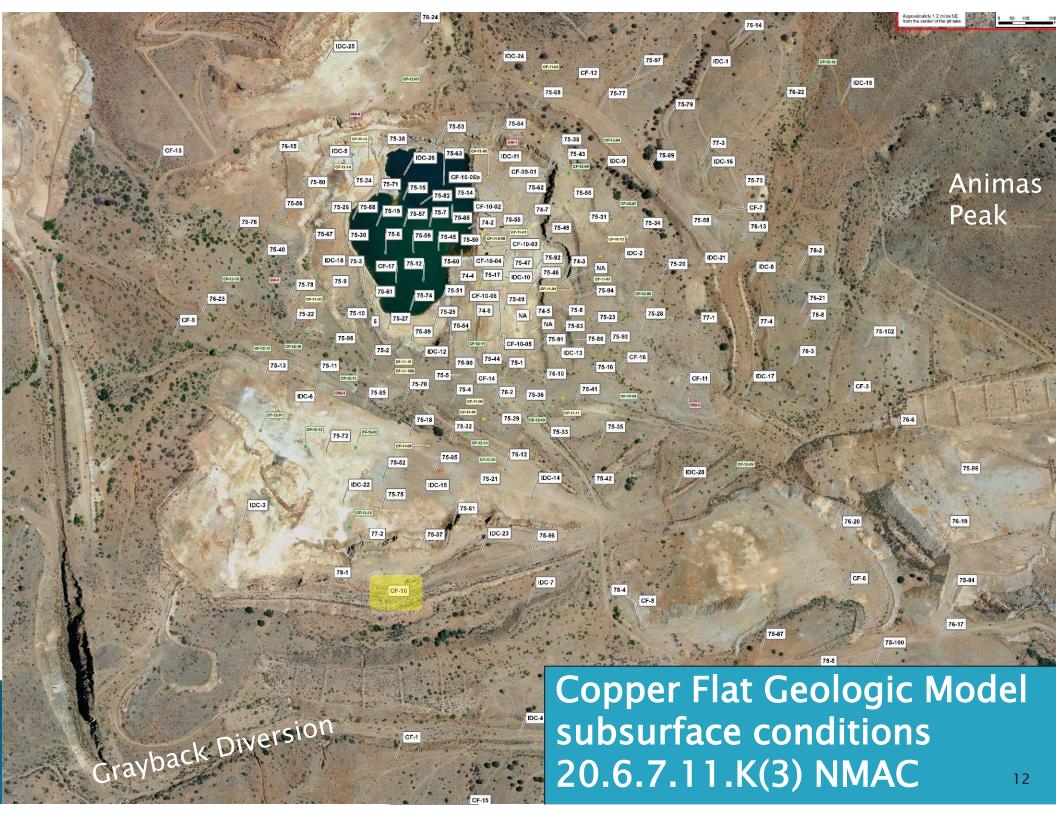


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- 3							pot		1			bio							broken rock zone fr 8-11', v min arg alt on wk pot alt.		
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40 years o

- ✓ Exploration
- ✓ Field map
- ✓ Monitorin
- ✓ Aquifer te
- ✓ Water-lev
- ✓ Groundwa
- ✓ Surface-v





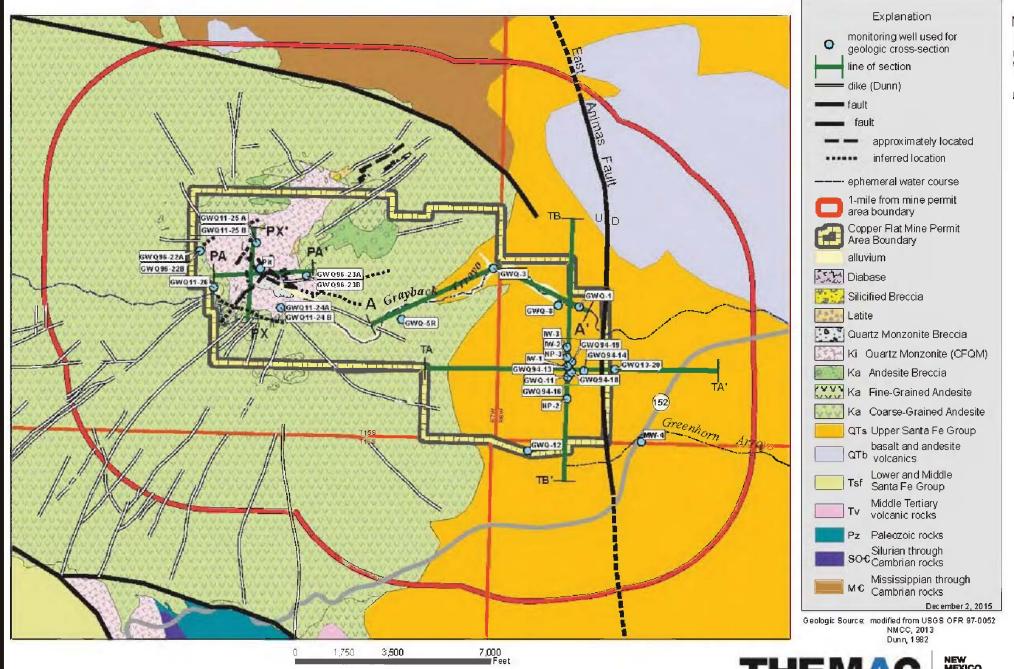


Figure 11K-2a. Geologic map within 1-mile of the Copper Flat Mine Area permit boundary, Sierra County, New Mexico.



NEW MEXICO COPPER CORPORATION

Hydrologic Information 20.6.7.11.K(3) NMAC

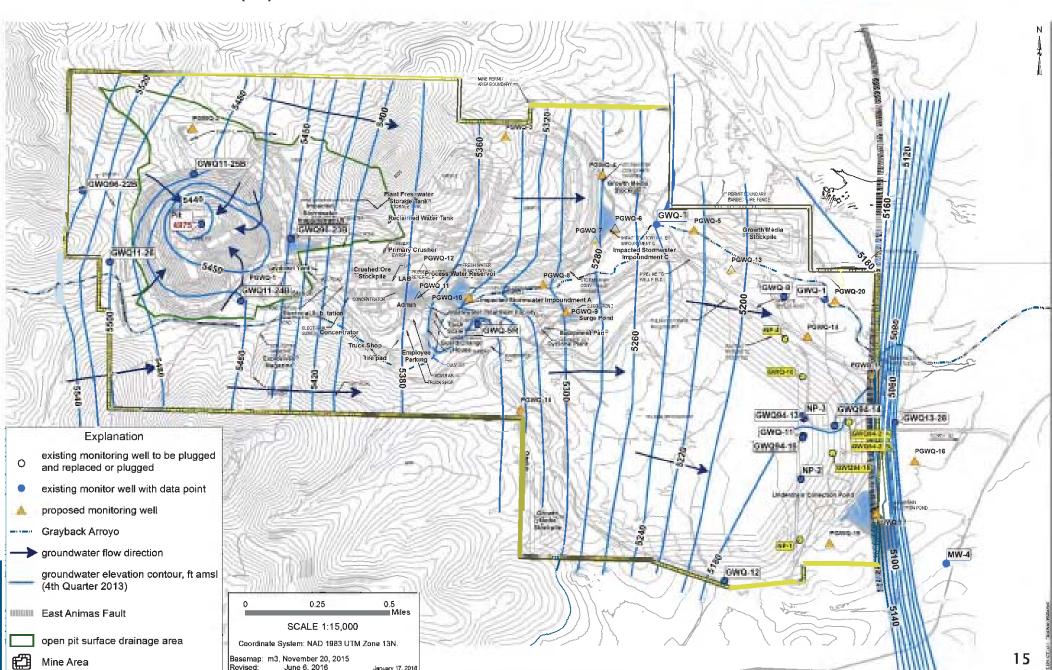


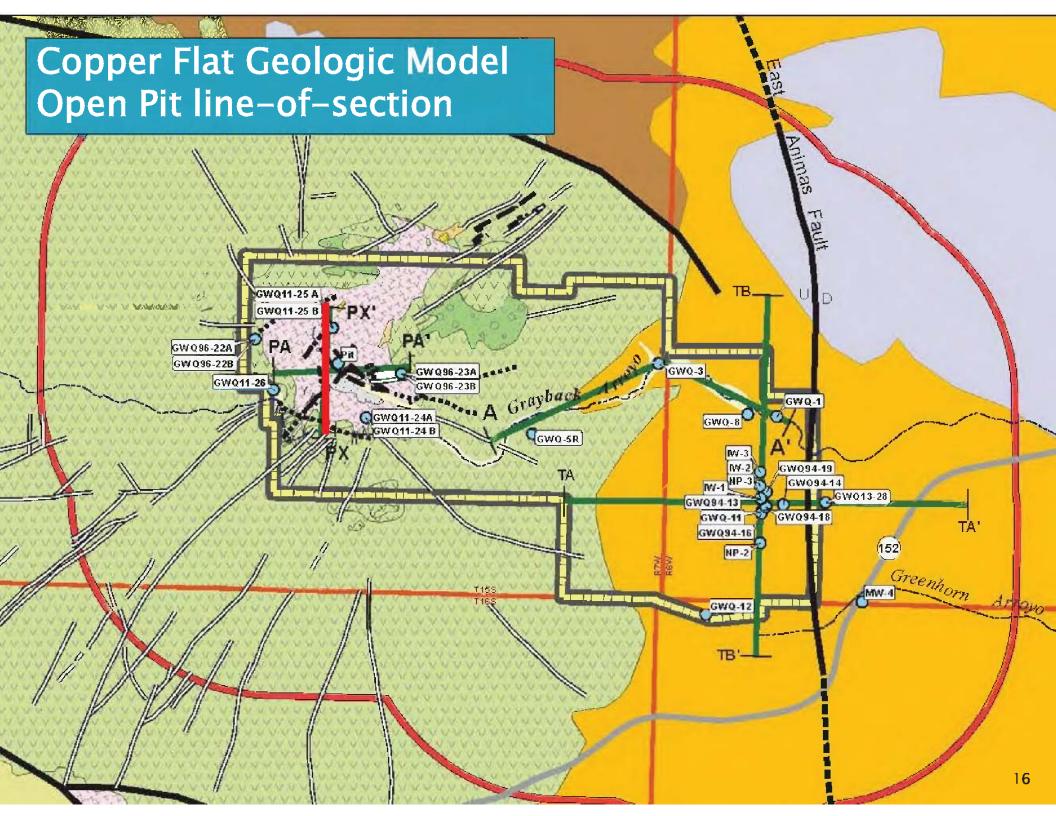
Hydraulic Conductivity Properties of Water Bearing Units Beneath the Copper Flat Mine Permit Area

water bearing zone	Range of Hydraulic Conductivity (ft/day)	Range of Hydraulic Conductivity (cm/s)	wells included in test range	model input hydraulic conductivity (ft/day)	source of information
Crystalline Bedrock Aquifer (Andesite)	0 to 0.0027	0 to 9.5x10 ⁻⁷	GWQ96-22 GWQ96-23 GWQ-5R	0.002 L2 0.001 L3 0.001 L4	JSAI May 2014 JSAI August 2014
Crystalline Bedrock Aquifer (Quartz Monzonite)	0.02 to 0.14	7.1x10 ⁻⁶ to 4.9x10 ⁻⁵	GWQ11-24 GWQ11-25 GWQ-1 GWQ-7 GWQ-9	0.002 L2 0.001 L3 0.001 L4	JSAI May 2014 JSAI August 2014
Santa Fe Group Quaternary Alluvial Aquifer	1.0 to 4.7 3.8	3.5x10 ⁻⁴ to 1.7x10 ⁻³ 1.3x10 ⁻³	GWQ94-17 GWQ94-28 GWQ94-16	0.20 to 10.0 L2 0.20 L3 0.05 L4 24.00 L1	JSAI May 2014 JSAI August 2014 JSAI May 2014 JSAI August 2014

Groundwater Elevation Contours 20.6.7.11.P(1) NMAC

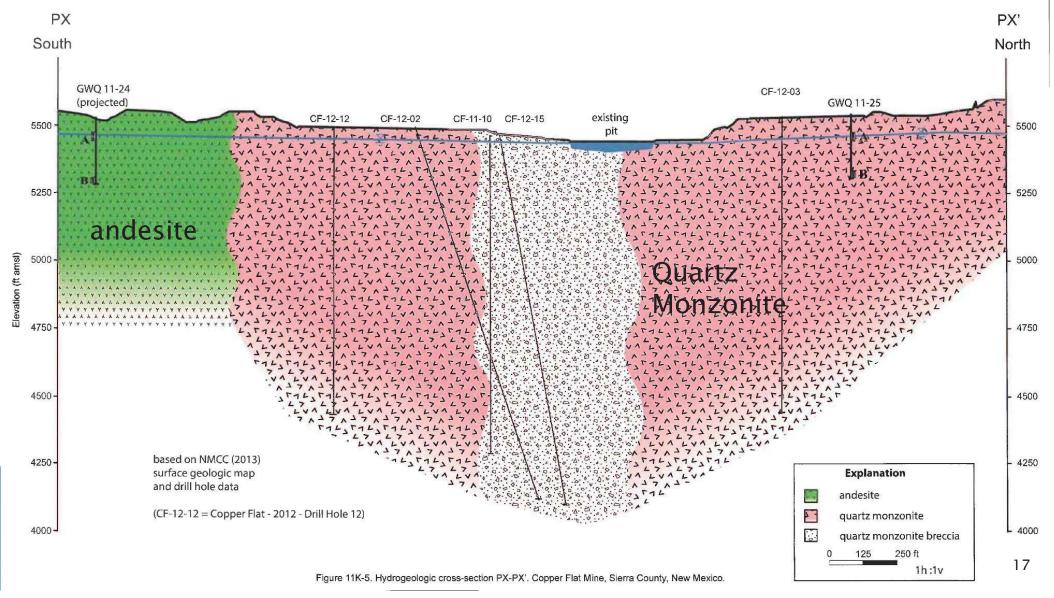


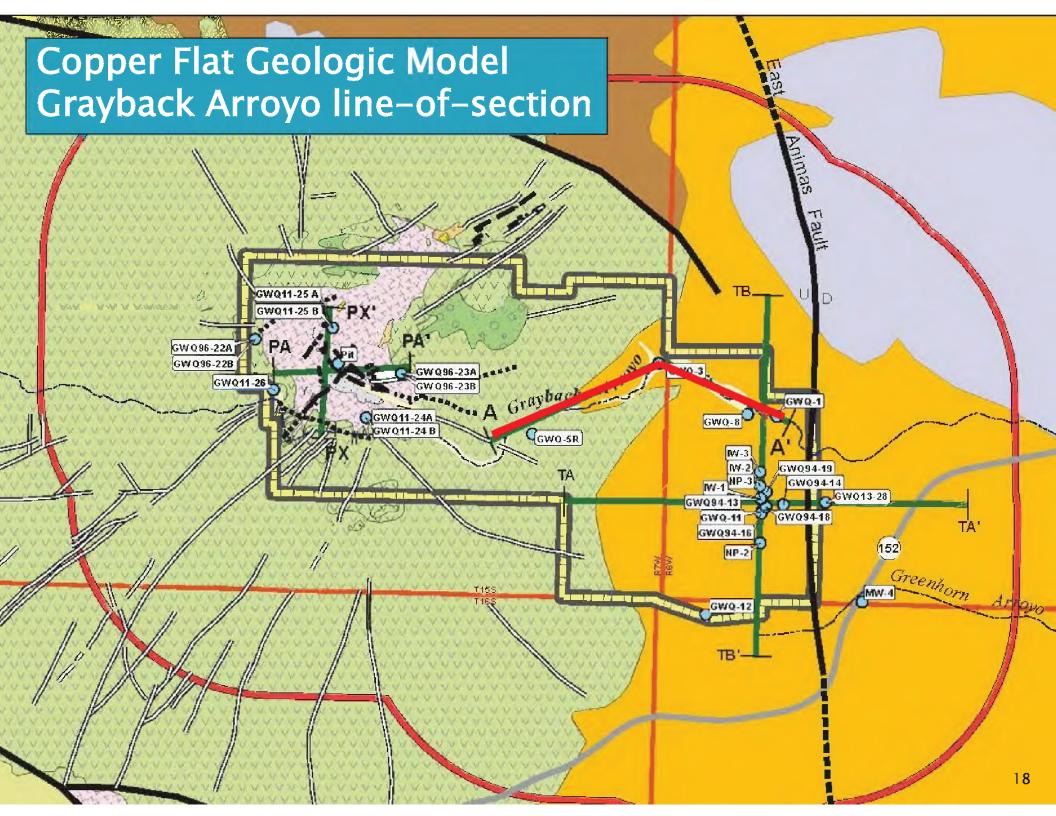




Copper Flat Open Pit Hydrogeologic Cross-Section

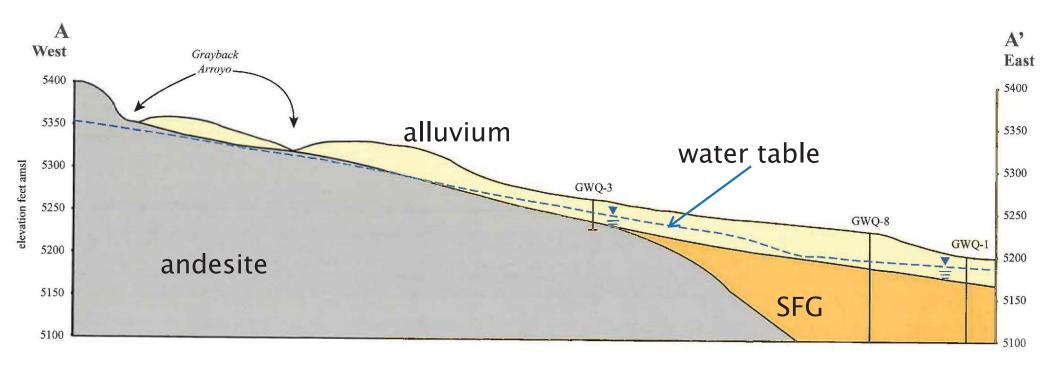


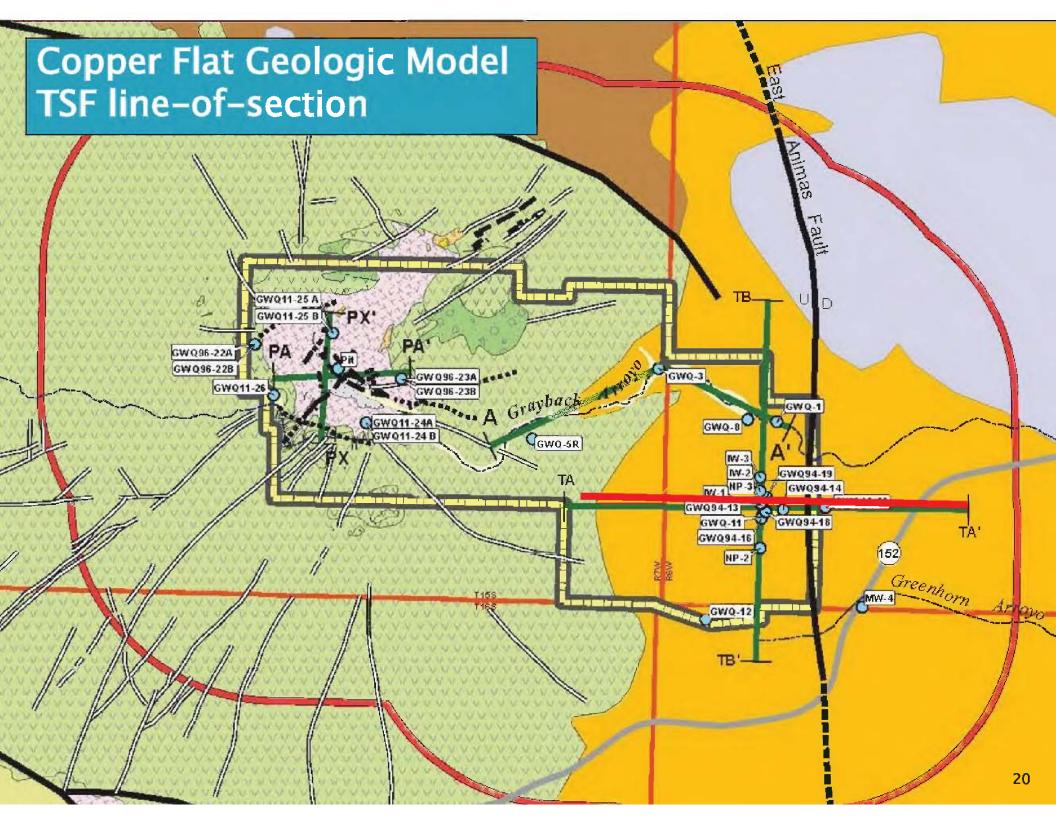




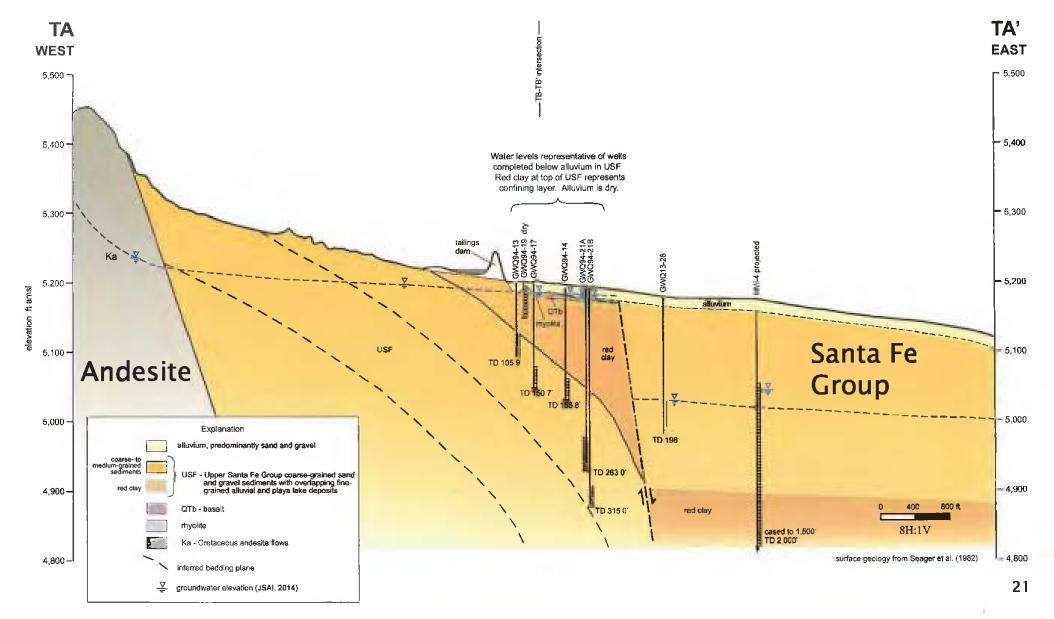
Grayback Arroyo Hydrogeologic Cross-Section





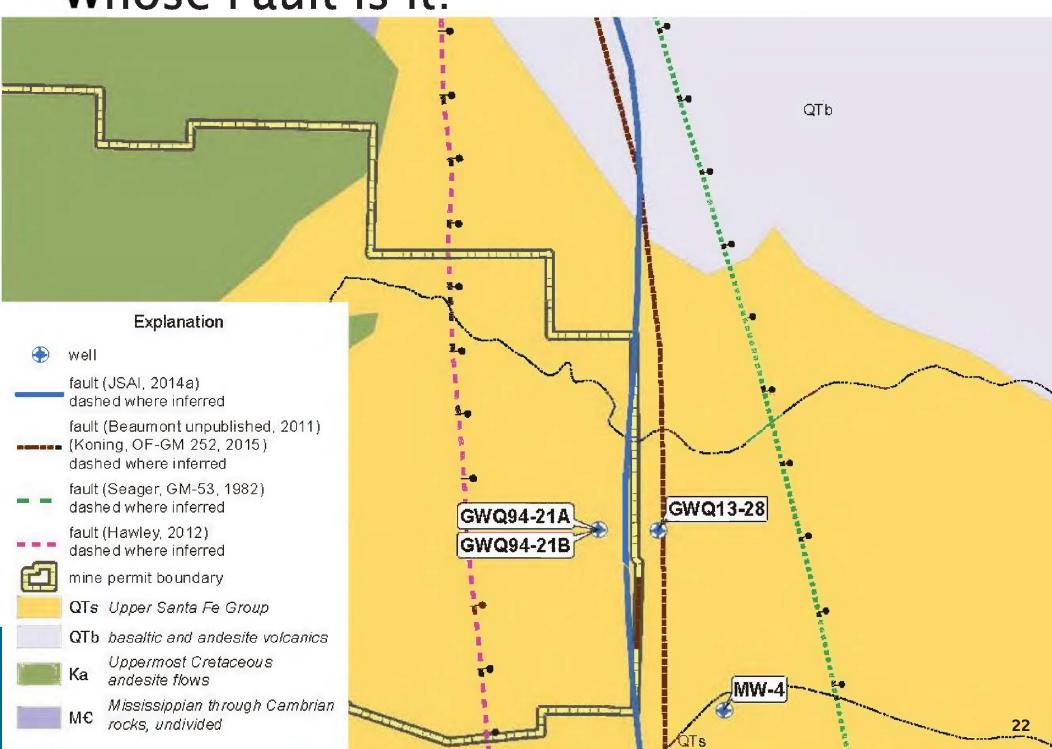


Tailings Storage Facility Hydrogeologic Cross-Section



JSAI

Whose Fault is it?



Pre-Discharge TDS 20.6.7.11.G NMAC

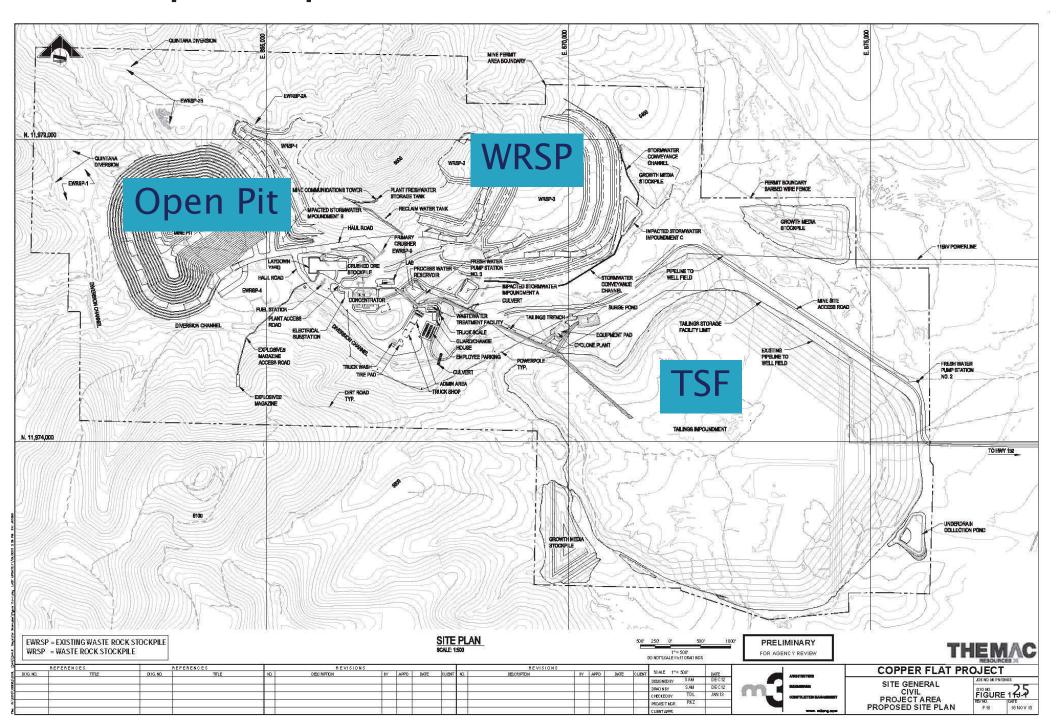
		Explanation N				
	F	monitoring well				
Aquifer	Sub-Aquifer	Pre-Discharge Concentration (mg/l)	Wells Sampled	Sample Date (m/yr)	Well Locations	contour from 2011 Cooper Aerial survey (50 ft contour interval) phemeral water course
	Grayback Alluvial Up-gradient of Ore	317-905	GWQ11-26	4/2013- 10/2013	1/2-mile from permit area boundary Copper Flat Mine Permit Area Boundary	
Quaternary	Grayback Alluvial Down-gradient of Ore	868-1,260	GWQ-3 ¹ GWQ-5 ²	9/1976-2/1982	Down-Gradient of the ore body	Area Boundary
Alluvial	Alluvial Fan and Fluvial deposits in the Upper Santa Fe Group	354-840	SHB-27 ³ SHB-28 ³ SHB-29 ³ SHB-30 ³ NP-5	9/1976-2/1982	In the vicinity of the current TSF	
Santa Fe Group	NA	350-650	GWQ-1 GWQ-2 GWQ-7 GWQ-8 GWQ-9 GWQ-10 GWQ-11 NP-1 NP-2 NP-3	6/1976-2/1982	In the vicinity of the current TSF down-gradient of the ore body	094-19 094-13 094-13 094-13 094-13 V094-14 GW094-14 GW094-21B W094-21B W094-21A MW-4
	Andesite	500-798	GWQ96-22A GWQ96-22B GWQ-4	6/1981-1/2013	Up-gradient of the ore body;	
Crystalline Bedrock	Andesite	496-920	GWQ-5R GWQ96-23A GWQ96-23B	7/1996- 10/2013 ⁶	Down-gradient of ore body	
	Quartz Monzonite ^{4,5}	2,280-4,400	GWQ11-24A GWQ11-24B GWQ11-25B	1/2010- 10/2013 ⁶		THEMAC DOWN SHOMAKER & ASSOCIATES, INC.



Permit Area Hydrogeology

- Geologic Model
 - Detailed understanding of rock type distribution
 - Mapped faults and structures
- Aquifer Characteristics
 - Groundwater elevations and direction of flow
 - Permeability of rock units
- Baseline Water Quality
 - Over 40 years of water-quality data

Site Map of Proposed Facilities 20.6.7.11. J(1) NMAC





Copper Flat Open Pit

Monitoring 20.6.7.28 NMAC
Closure 20.6.7.33 NMAC
Post Closure 20.6.7.35 NMAC

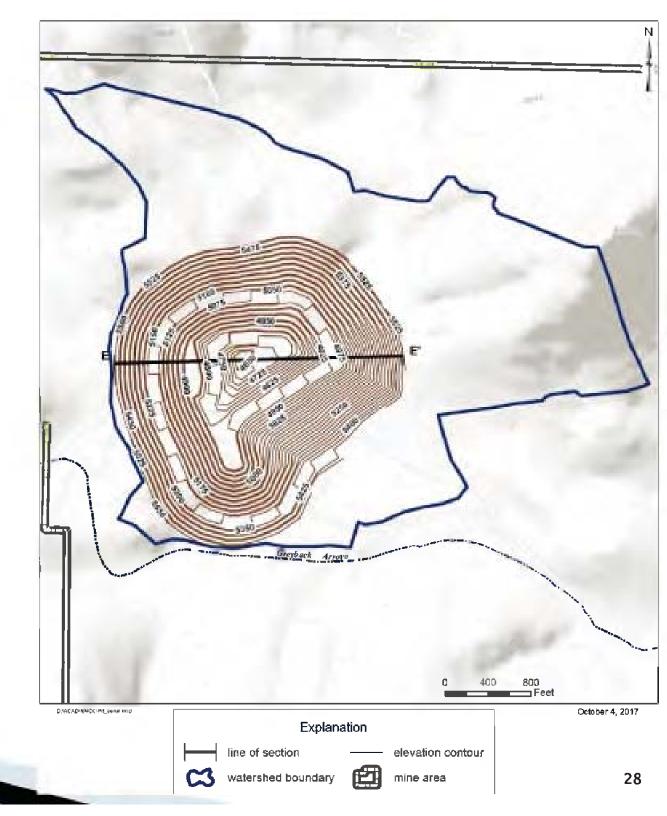


Open Pit Surface Drainage Area

20.6.7.7.B(42) NMAC

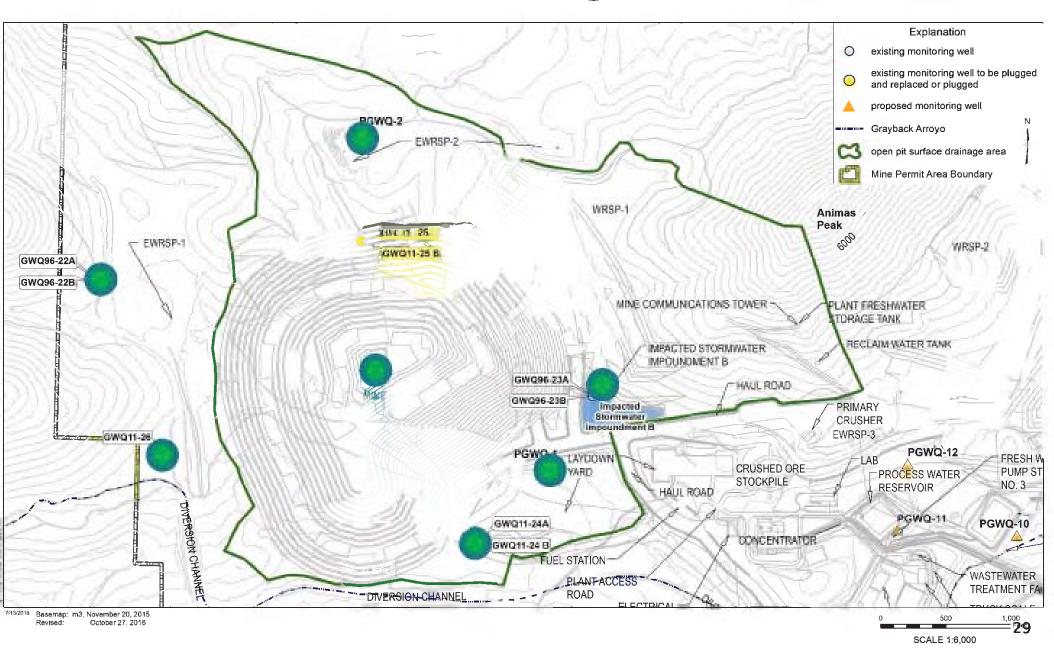
Area in which storm water drains into open pit and cannot feasibly be diverted by gravity outside the pit perimeter, and the underlying groundwater is hydrologically contained by pumping or evaporation of water from the open pit.

Copper Flat Open Pit Surface Drainage Area

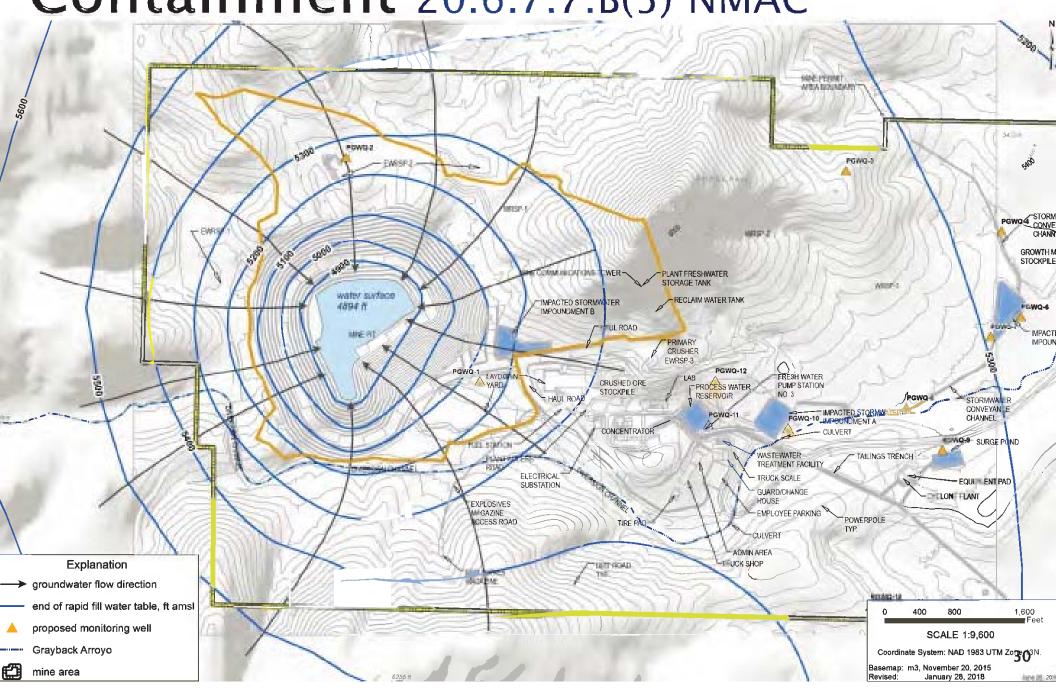


Open Pit Surface Drainage Area and Groundwater Monitoring

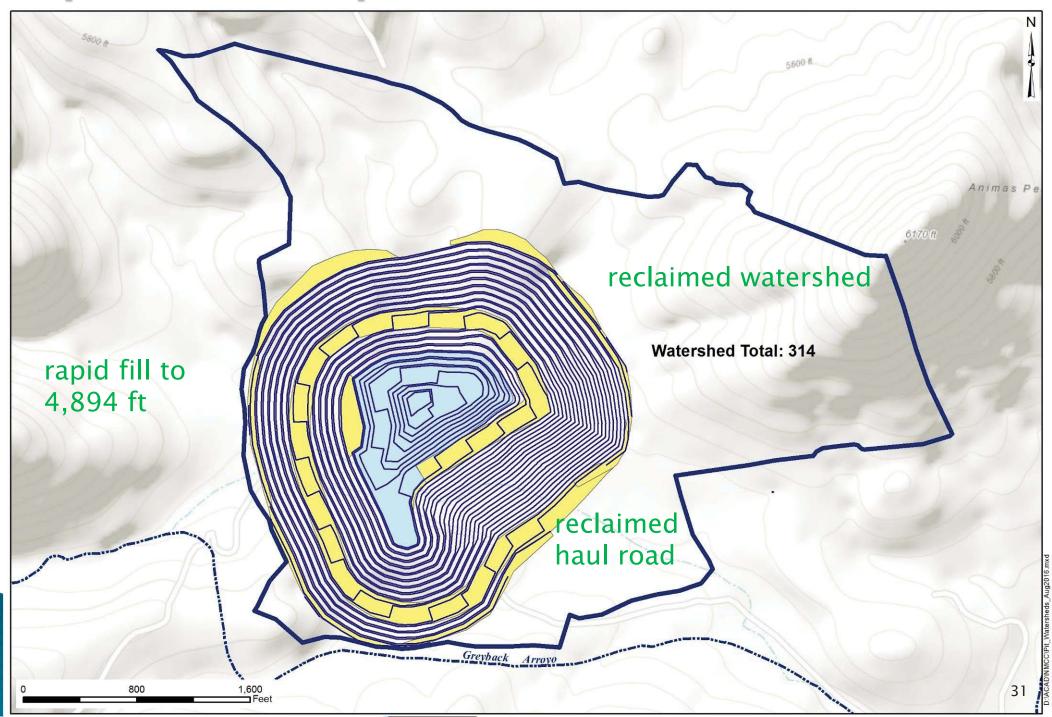




Area of Open Pit Hydrologic Containment 20.6.7.7.B(5) NMAC



Open Pit Rapid Fill Reclamation

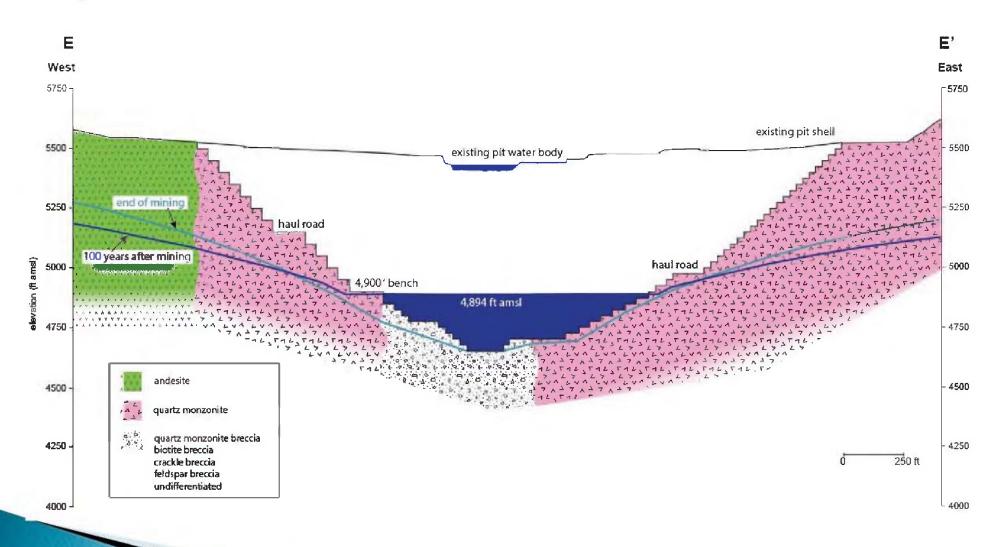


Hydrologic Sink Open Pit Closure Requirements 20.6.7.33.D NMAC

- Rapid fill with low TDS alkaline groundwater
- Rapid fill to steady-state conditions for maintaining hydrologic evaporative sink
- Steady-state open pit water level for maintaining hydrologic evaporative sink is 435 ft below current pit water level (which is also a hydrologic evaporative sink)
- Evaporation from 22-acre water surface will maintain hydrologic sink conditions









Open Pit Water Budgets

	Existing pit	Future pit
water level (ft amsl)	5,433	4,894
water surface area (acres)	5	22
catchment surface area (acres)	230	314
water balance (acre-feet per year)		
precipitation and runoff	18	57
groundwater inflow	7	36
Total In	25	93
Evaporation Out	25	93



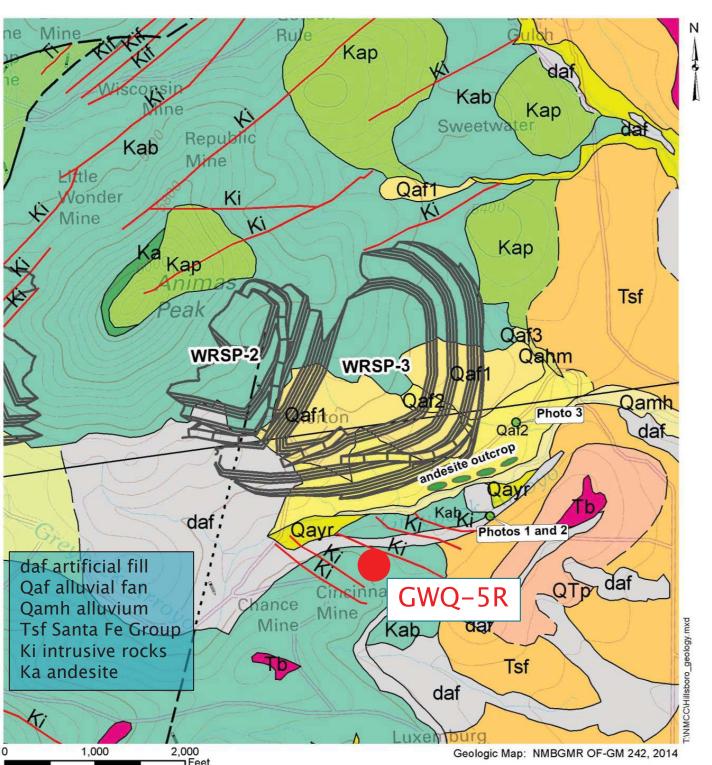
WASTE ROCK STOCKPILES 2&3



20.6.7.21.B(1) NMAC

20.6.7.28 NMAC

20.6.7.33 NMAC

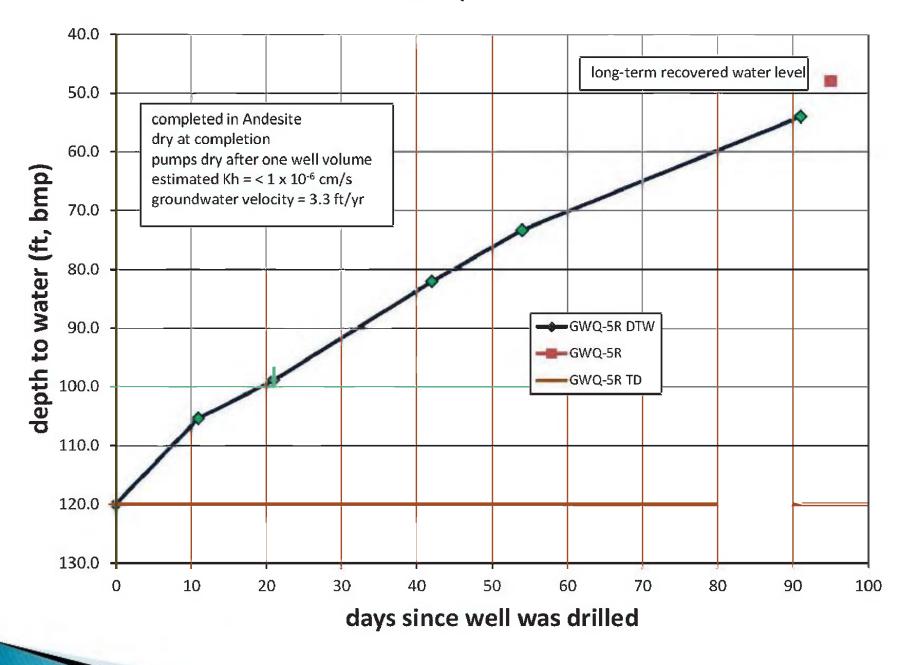


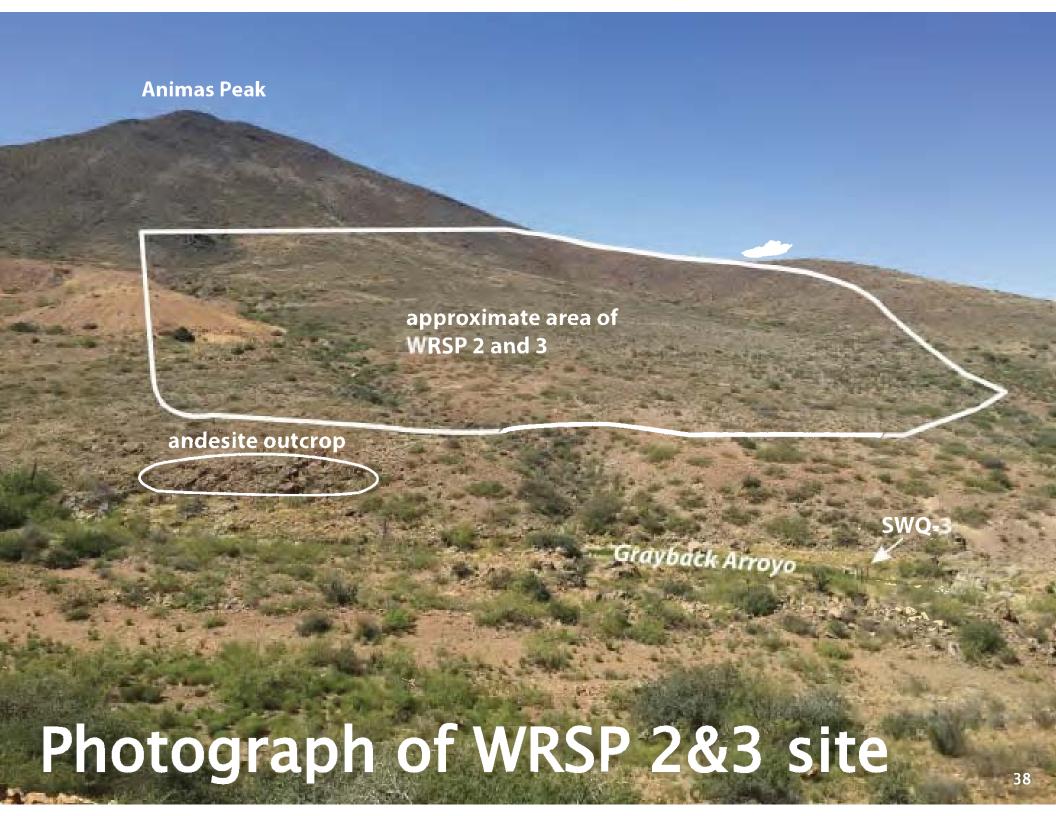


Aquifer Evaluation

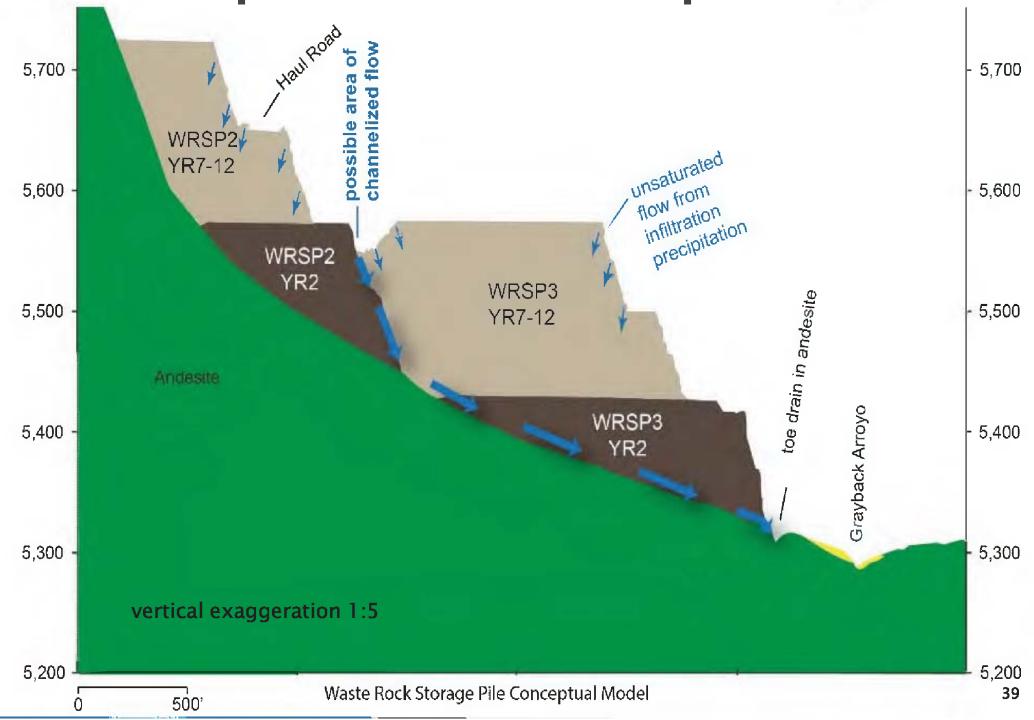
Aquifer characteristics and the hydrogeologic controls on the movement of leachate from waste rock stockpiles and groundwater impacted by the waste rock stockpiles based on actual field data 20.6.7.21.B(1)(d)(vi)

GWQ-5R





WRSP Operational Conceptual Model



Protection of Groundwater During Operations (20.6.7.21.D NMAC)

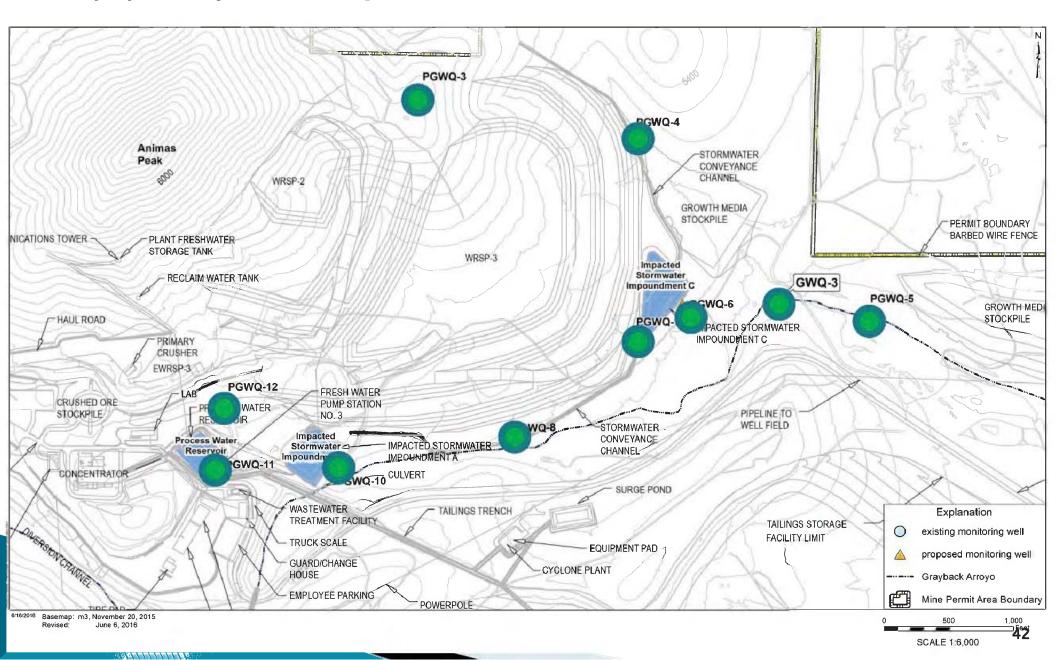
- Storm water diverted away from WRSP
- Low moisture content and high negative soil porewater pressure of the coarse-grained waste rock prevents downward migration of surface infiltration
- Toe drain allows for capture of impacted storm water
- ▶ Andesite permeability is less than 1×10^{-6} cm/s
- Infiltration through WRSP is not expected during the operation period – consistent with 30 years of observations from existing WRSPs on–site

Protection of Groundwater After Reclamation (20.6.7.33-35 NMAC)

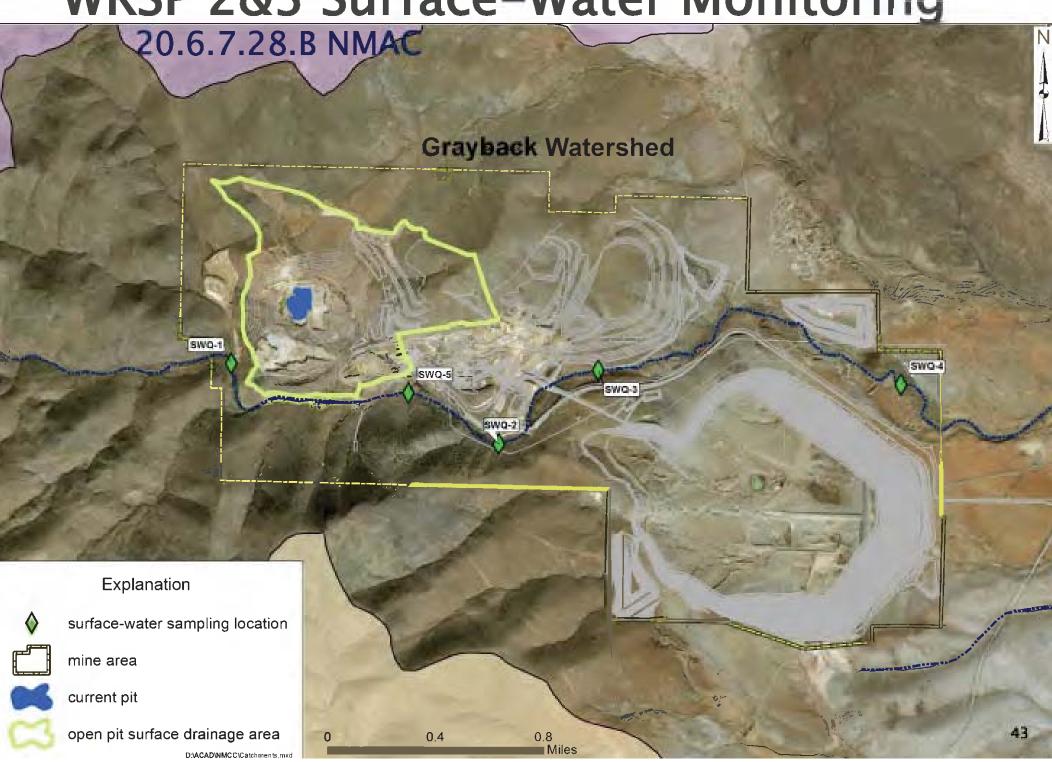
- Storm water diverted away from WRSP
- Installation of 36-in.-thick store-and-release cover system
- Vadose zone modeling indicates discharge to groundwater will be nil when considering:
 - Limited time between operations and reclamation for development of conditions for net infiltration
 - Store and release cover system
 - Low permeability of andesite

WRSP 2&3 Groundwater Monitoring

20.6.7.28.B NMAC



WRSP 2&3 Surface-Water Monitoring





Tailings Storage Facility



20.6.7.22(4)(d)(vi) NMAC

20.6.7.28 NMAC

TSF Aquifer Evaluation 20.6.7.22.B(4)(vii) NMAC



TSF aquifer evaluation considered potential liner leak, water quality of seepage, and groundwater mixing and transport calculations

Table 3.6. Potential tailings liner leakage

B_c	0.21
\mathbf{h}_{w}	1.5 ft
L_{s}	1 ft
$a_{\rm d}$	1.0 cm ²
K_s	$1 \mathrm{x} 10^{-6} \ \mathrm{cm/s}$
q	0.0009 gpm/acre
total flow	0.5 gpm

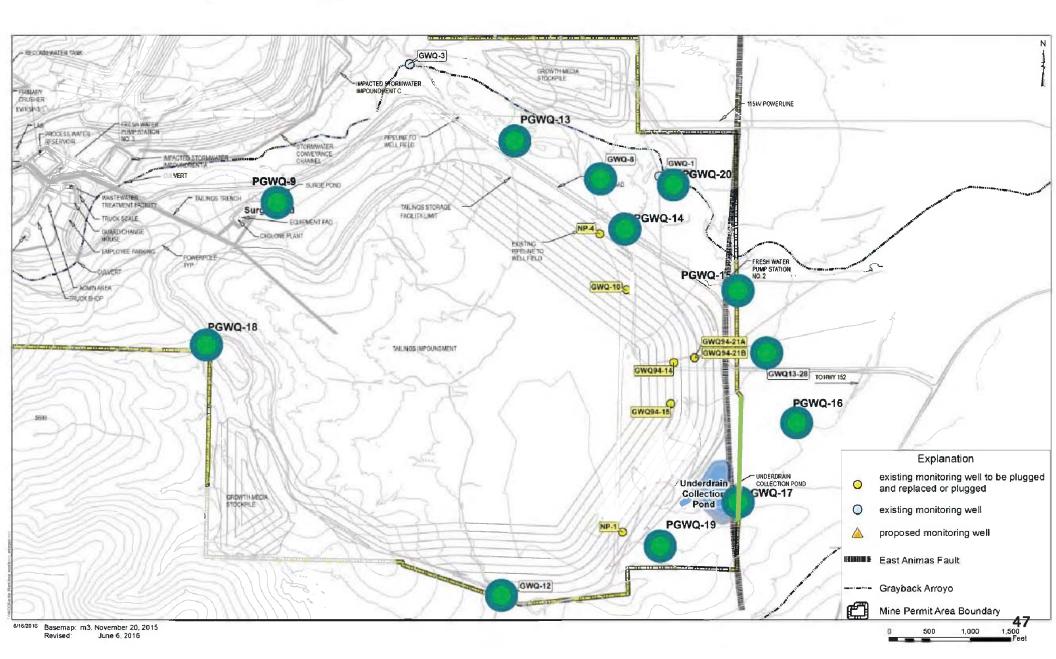


TSF Aquifer Evaluation

- The projected rate of potential leakage from the liner is insignificant (0.5 gpm).
- The hydraulic gradient will be reduced as a result of the reduced recharge from the liner in the TSF footprint.
- Groundwater beneath the TSF will have a low travel velocity.
- Potential leakage, if percolates to groundwater, will blend or remain beneath the TSF for hundreds of years.

TSF Groundwater Monitoring







JSAI

Summary

- There is high confidence in the understanding of the hydrogeologic setting and groundwater protection measures due to the abundance of site data and detailed evaluations.
- Copper Rule (20.6.7 NMAC) requirements were considered for aquifer evaluation and monitoring for each proposed facility.
- Operational and post mining conditions are considered for groundwater protection measures.
- Groundwater and surface-water monitoring plan is designed to protect from potential discharges.
- In my professional opinion, NMCC DP-1840 is compliant with the Copper Rule 20.6.7 NMAC.