Copper Flat Project- New Mexico Mining and Minerals Division Hearing

Testimony of Tom Myers, PhD., on behalf of Turner Ranch Properties and Hillsboro Pitchfork Ranch

Truth or Consequences, NM

October 2018

RANCHES
EXHIBIT
8

Overview

- Pit dewatering and long-term drawdown will have a huge impact on the hydrologic balance of the groundwater in the area.
- Pit dewatering will dry the alluvium in the Grayback Arroyo and impact the hydric soils and riparian vegetation.
- Production pumping for the mine will substantially decrease water inflow to the Caballo Reservoir portion of the Rio Grande, and decrease flow in Las Animas Creek and from flowing well near Las Animas and Percha Creek
- Long-term water quality in the pit lake will violate surface water standards and be of too poor quality for wildlife and aquatic life beneficial uses.
- The lack of a liner system under the waste rock piles, which is based on the largely unsupported assumption that the underlying andesite bedrock is very low permeability, will allow contaminated seepage into the groundwater.
- The failure to consider leaks from the tailings storage facility ignores the potential for large amounts of contaminated seepage into groundwater.
- These factors will significantly impact the Ladder Ranch and the Hillsboro Pitchfork Ranch.

- References herein are provided at the end of this presentation

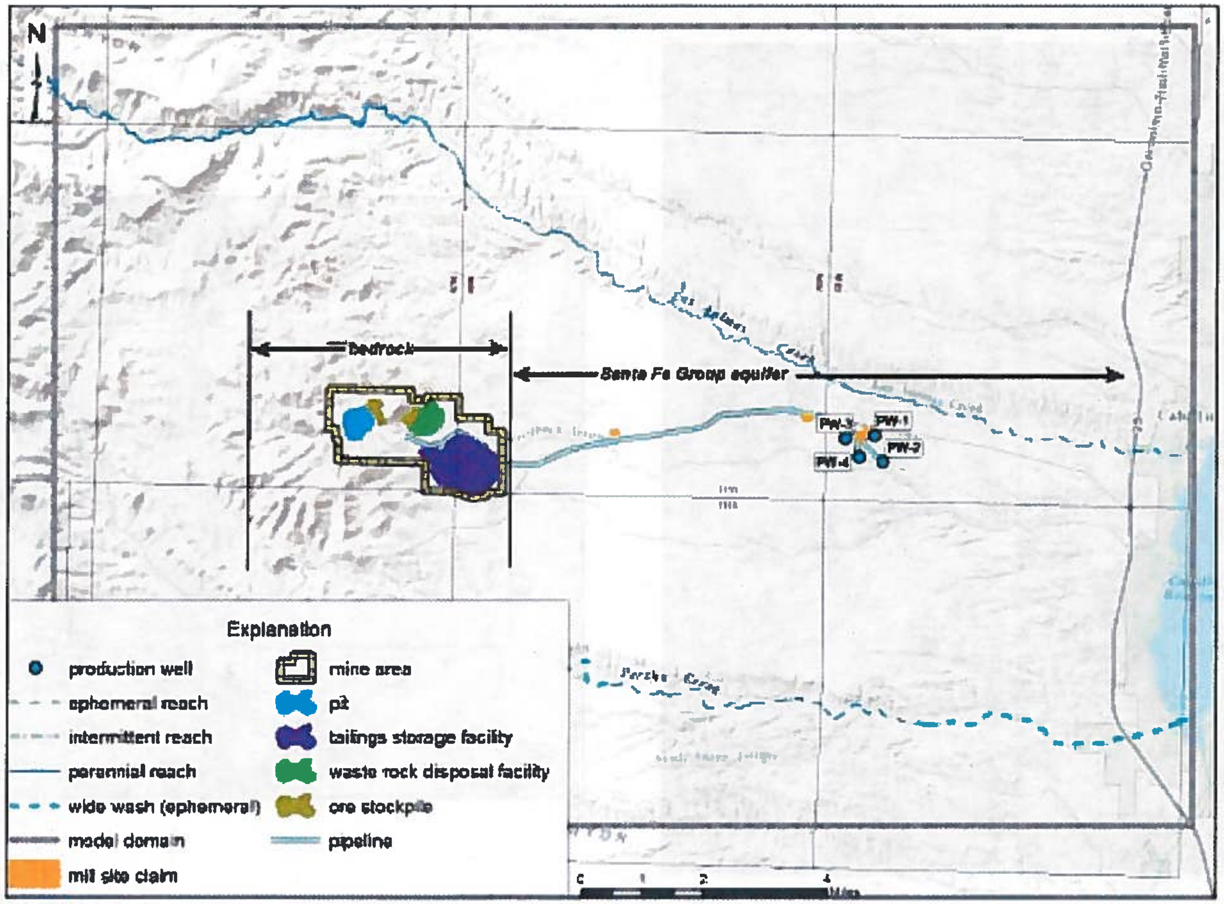
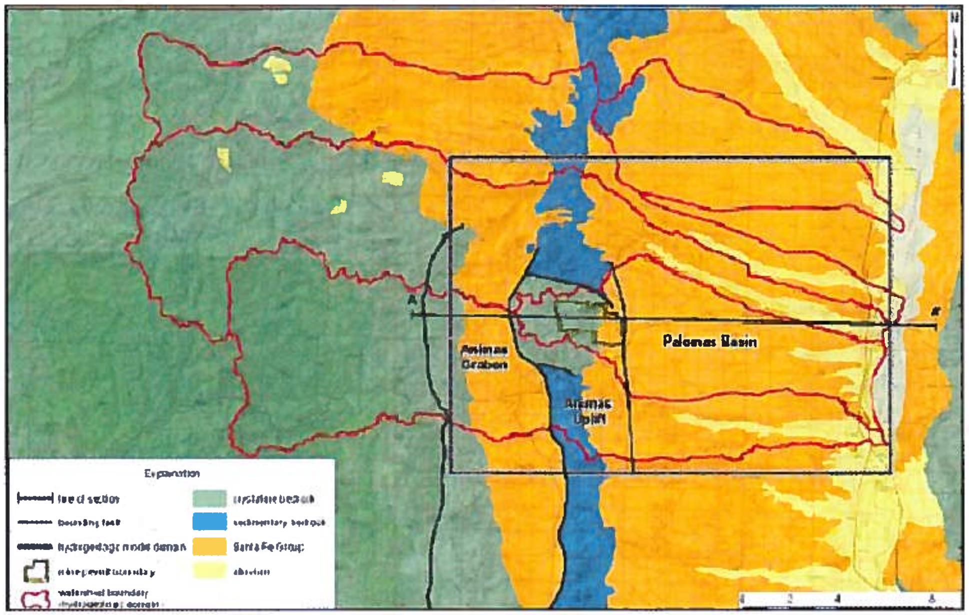


Figure 1.1. Map showing New Mexico Copper Corporation proposed mine facilities, mine area, and the affected area evaluated, Sierra County, New Mexico.

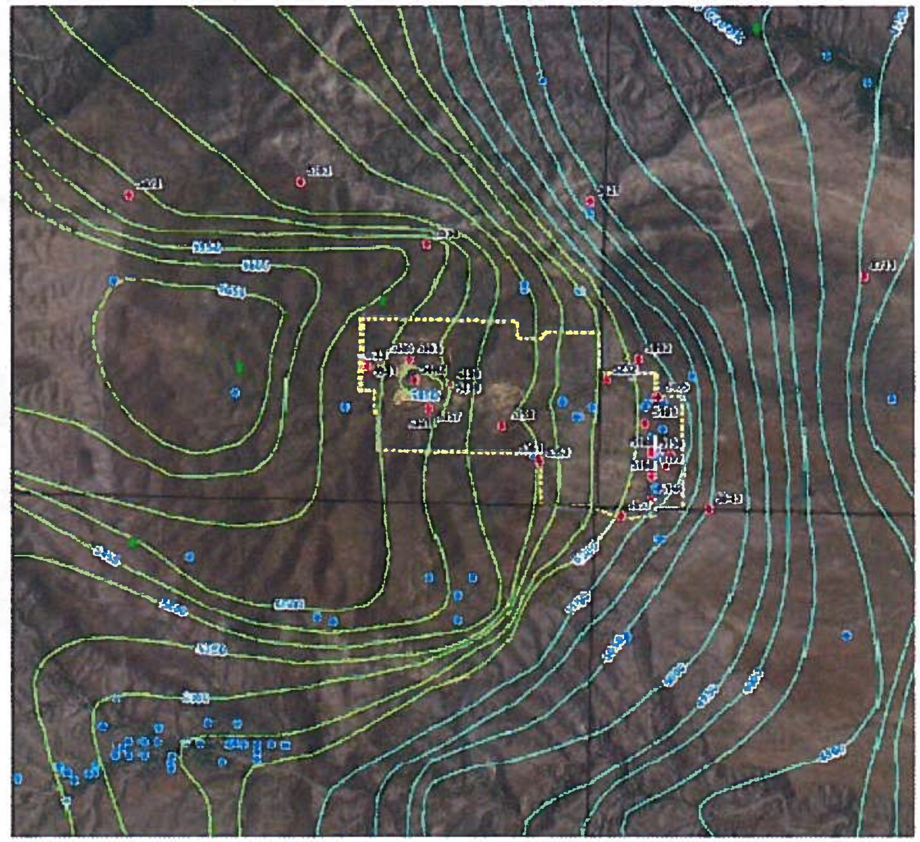
Jones and Finch 2018

Pit dewatering and long-term pit lake development will have large effects on the hydrologic balance of the pit area

Existing conditions



Jones et al 2014, Figure 4.1



Jones et al 2014, Figure 5.1

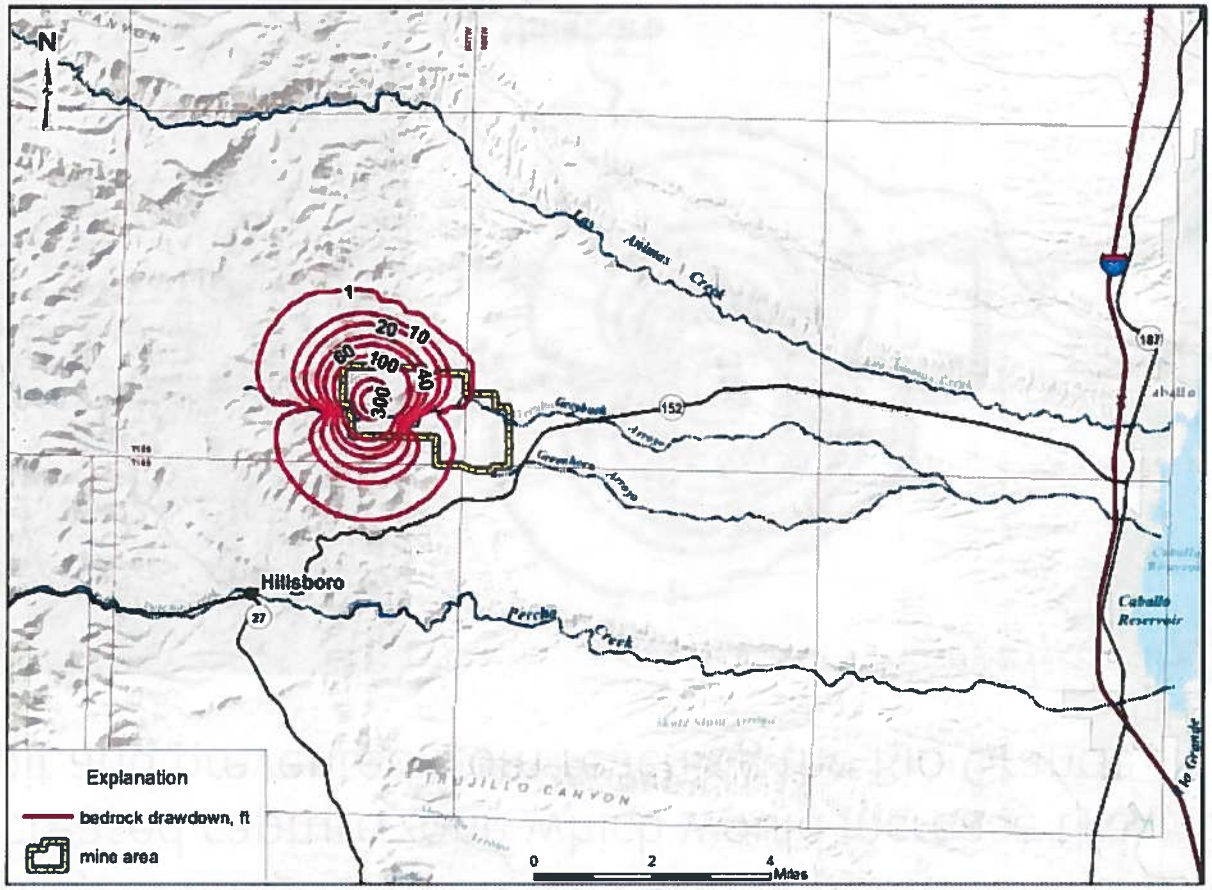
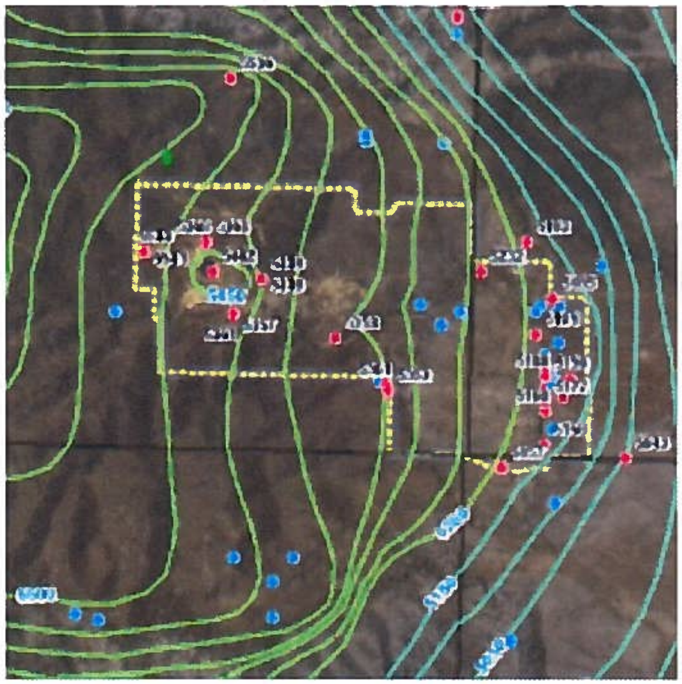
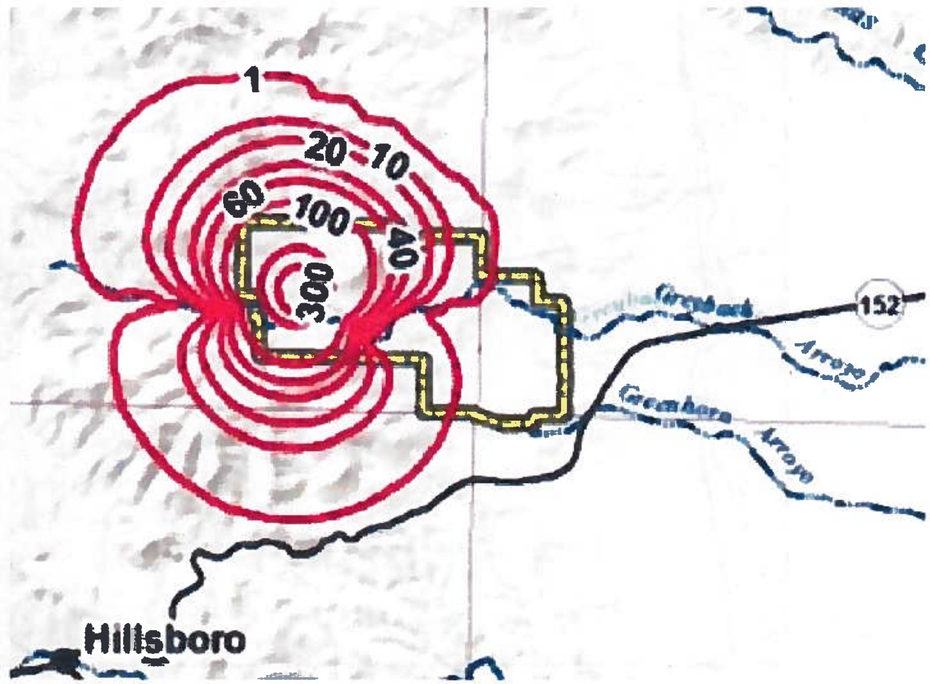


Figure 3.12. Projected end-of-mining groundwater drawdown in the crystalline bedrock.

Superimpose project drawdown on the existing potentiometric surface to show much increased capture zone which would increase the groundwater drawn to the pit and prevented from reaching the Rio Grande





Evaporation from the pit lake is lost to the aquifer, and the hydrologic balance

- Existing pit lake loses an average 20 af/y
- Future pit lake would lose around 93 af/y
- Additional loss from the aquifer of 73 af/y

- NMCC has not attempted to minimize this loss

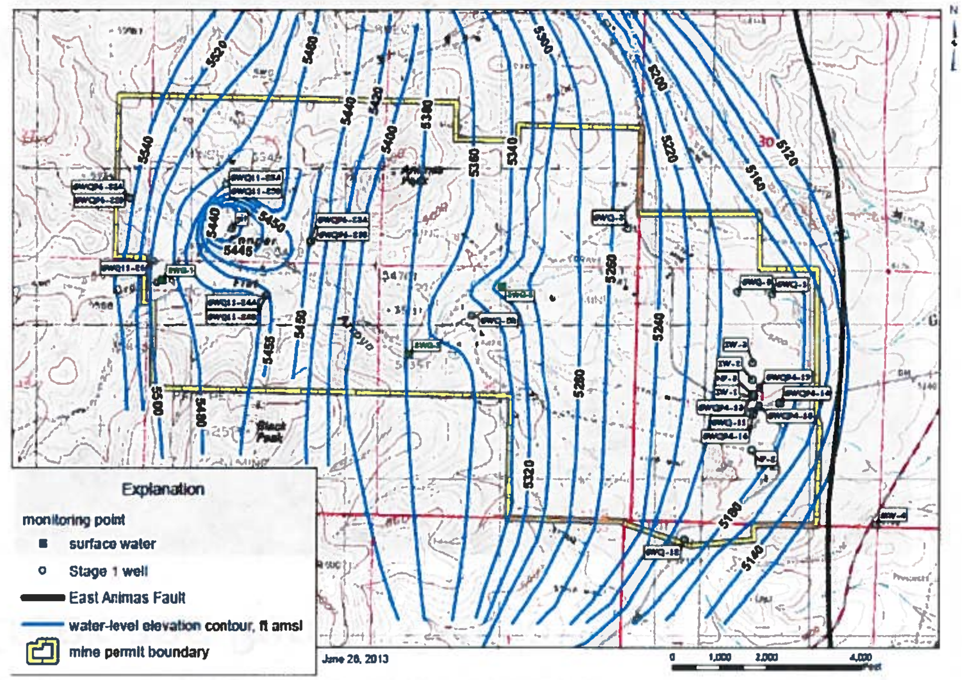
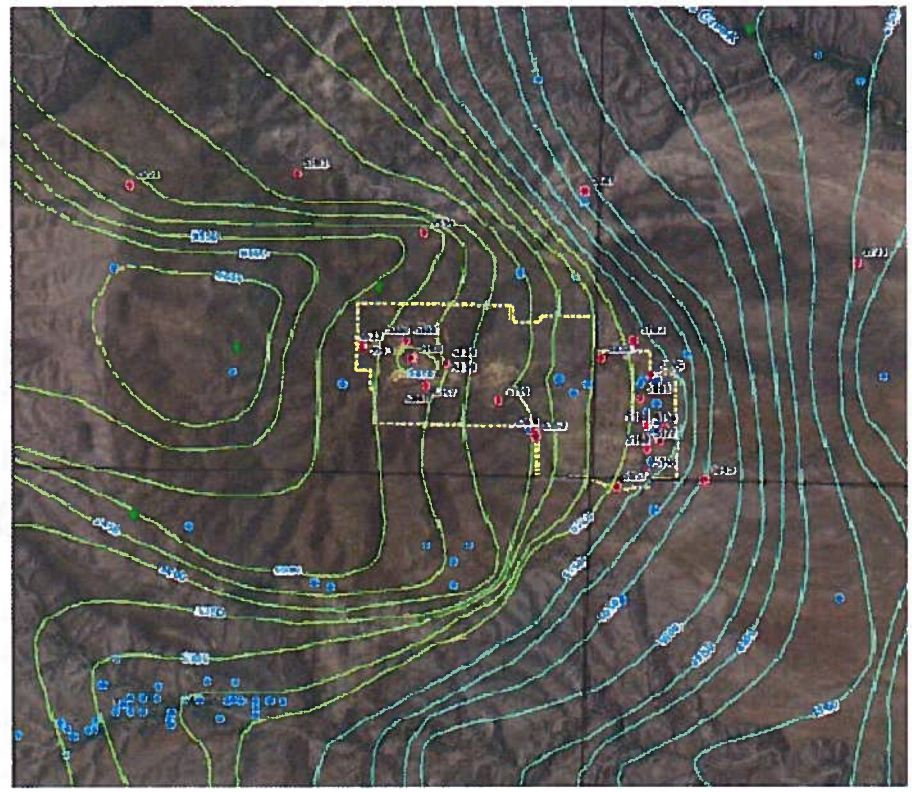


Figure 5. Water-level elevation contour map for Stage 1 Abatement Plan. 2nd Quarter 2013. Copper Flat Mine, Sierra County, New Mexico.

Dewatering the pit and development of the pit lake will divert groundwater flow from Las Animas Creek and Percha Creek

- Current potentiometric surface shows gradient for flow away from the pit area to the creeks.
- Drawdown will decrease the gradient and thereby the flow



Dewatering and Pit Lake Development will Upset the Hydrologic Balance

- Drawdown will vastly expand the capture zone and decrease groundwater flow to the Palomas Basin and Caballo Reservoir
- Pit lake evaporation will cost the basin an additional 73 af/y
- Dewatering will divert flow from Las Animas Creek and Percha Creek

Dewatering will affect groundwater flow through the Grayback Arroyo alluvium thereby dewatering hydric soils and limiting water for riparian vegetation

- Existing groundwater levels in the underlying andesite are higher than in the alluvium of the Grayback Arroyo (JSAI, 2013, p 9)
- See crenulations in the contour
- GWQ-5R is an example
- Dewatering would lower this water level and eliminate a source of groundwater to the alluvium

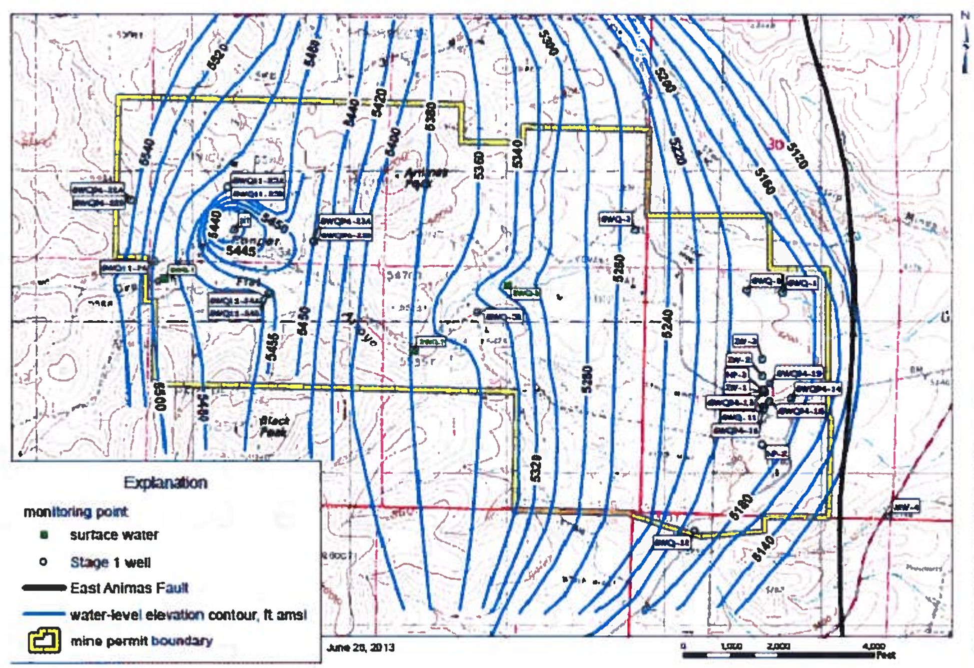


Figure 5. Water-level elevation contour map for Stage 1 Abatement Plan, 2nd Quarter 2013, Copper Flat Mine, Sierra County, New Mexico.

Project water supply pumping will significantly reduce the groundwater flow to the Rio Grande system

Projected water supply pumping would remove almost 74,000 af of groundwater over 25 years for construction, startup, operations, rapid fill, and reclamation. The majority would be used for production during the 11.5 years of operation, with production pumping exceeding 6000 af/y and 2200 af for six months during rapid fill

Table 2.1. Projected water-supply pumping

component	unit	result
pumping duration (includes construction, operation, reclamation)	years	23.0
average pumping rate over full project duration	gpm	2,180
summer maximum pumping rate	gpm	4,224
winter minimum pumping rate	gpm	3,388
water removed from aquifer over pumping duration	ac-ft	73,856
average annual pumping rate over pumping duration	ac-ft/yr	3,211
maximum annual withdrawal rate	ac-ft/yr	6,095

gpm - gallons per minute ac-ft/yr - acre-feet per year

Table 2.2. Projected water-supply pumping (acre-feet per year)

year	production wells	operation	construction	startup	rapid fill	reclama-tion
1	132	0	132	0	0	0
2	673	0	233	440	0	0
3	6,081	6,081	0	0	0	0
4	6,087	6,087	0	0	0	0
5	6,071	6,071	0	0	0	0
6	6,088	6,088	0	0	0	0
7	6,078	6,078	0	0	0	0
8	6,086	6,086	0	0	0	0
9	6,090	6,090	0	0	0	0
10	6,095	6,095	0	0	0	0
11	6,095	6,095	0	0	0	0
12	6,090	6,090	0	0	0	0
13	6,093	6,093	0	0	0	0
14	5,472	2,621	0	0	2,200	651
15	321	0	0	0	0	321
16	97	0	0	0	0	97
17	97	0	0	0	0	97
18	50	0	0	0	0	50
19	24	0	0	0	0	24
20	15	0	0	0	0	15
21	10	0	0	0	0	10
22	6	0	0	0	0	6
23	5	0	0	0	0	5
24	0	0	0	0	0	0
25	0	0	0	0	0	0
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total	73,856	69,575	365	440	2,200	1,276

Jones and Finch 2018

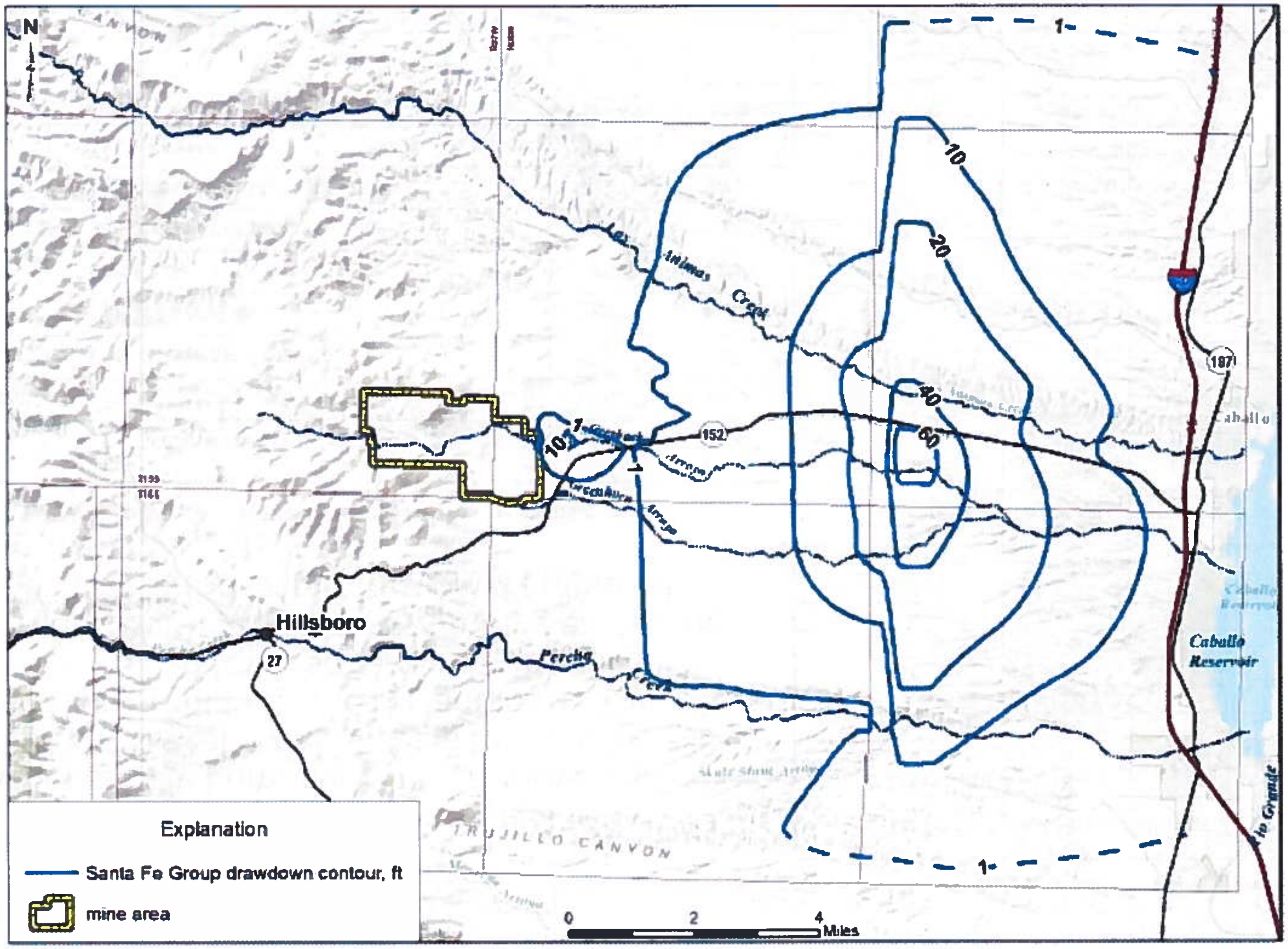


Figure 3.1. Projected end-of-mining groundwater drawdown in the SFG aquifer.

Jones and Finch 2018

The pumping will upset the balance of groundwater flow in the Palomas Basin and discharge into the Caballo Reservoir

- Ten-foot drawdown extends about 10 miles north-south
- Most drawn from aquifer storage, but pumping also draws from north of Palomas Graben and there is a significant reduction in discharge from the aquifer, with the major impacts occurring over 30 years.

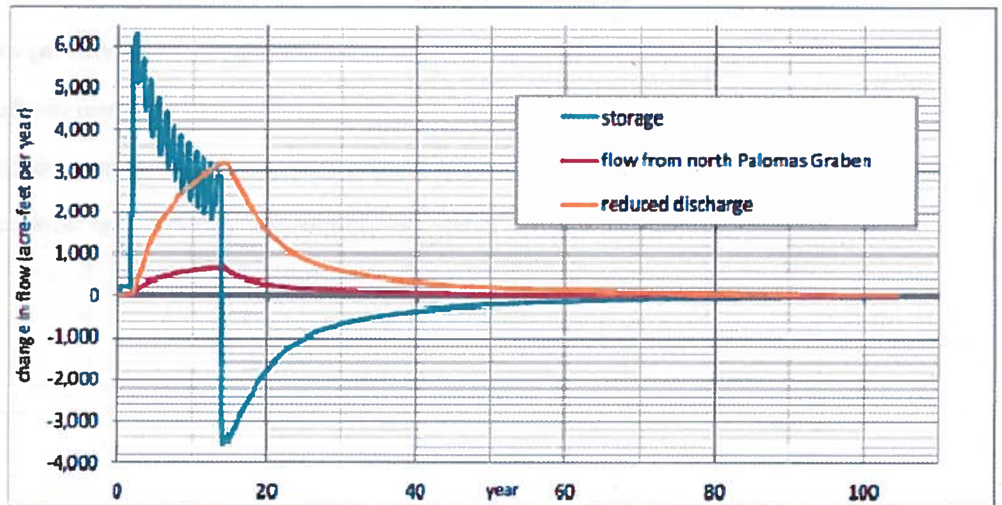


Figure 3.2. Projected sources of water pumped.

Jones and Finch 2018

Reduction in flow breaks down as shown here

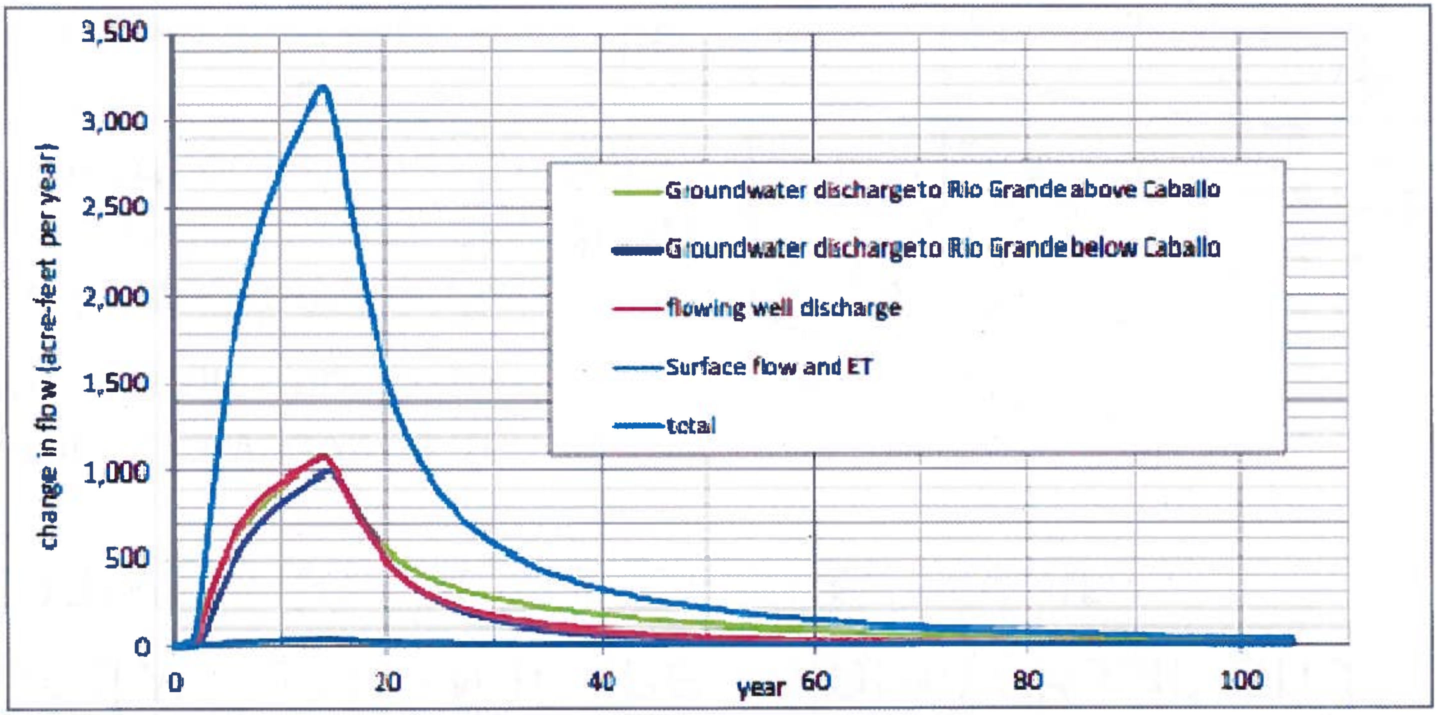


Figure 3.3. Projected reductions in discharge.

Jones and Finch 2018

Pumping substantially changes the hydrologic balance in the Rio Grande system

- Total cumulative change from mining through three months after the rapid pit refill would be 73,987 af.
- Reduction to groundwater in storage: 42,813 af
- Cumulative discharge reduction to the Rio Grande
  - Above Caballo Dam: 8878 af
  - Below Caballo Dam: 7504 af
  - Reduction to flowing wells: 9007 af
- Finch and Jones 2018, Table 3.1

Reductions due to pumping will remove about 15% of the discharge from the Palomas Basin to the Rio Grande

- Total annual discharge to the Rio Grande system from the project area averages 19,373 af/y
- Total loss to surface flow and evapotranspiration will peak at more than 3000 af/y.
- About 15% of the discharge to surface water
- Substantial impact to surface flows in the basin
- No evidence that agreement with Jicarilla Apache Nation would adequately offset this loss

Table 3.5. Estimated water balance

	runoff and recharge (ac-ft/yr)	
	Las Animas Creek	11,509
	Percha Creek	7,874
	Grayback and Greenhorn Arroyos	201
	Copper Flat open pit	1
	total	19,585
	discharge (ac-ft/yr)	
Palomas Basin	Lower Las Animas Creek	4,263
	Lower Percha Creek	840
	discharge to Rio Grande and Caballo Reservoir	11,850
	total	16,953
Animas Uplift Animas Graben	Upper Animas Creek	600
	Upper Percha Creek	1800
	Copper Flat open pit	20
	total	2,420

ac-ft/yr - acre-feet per year

Jones et al 2014

Pit lake water quality will exceed standards for some parameters, from SRK (2018)

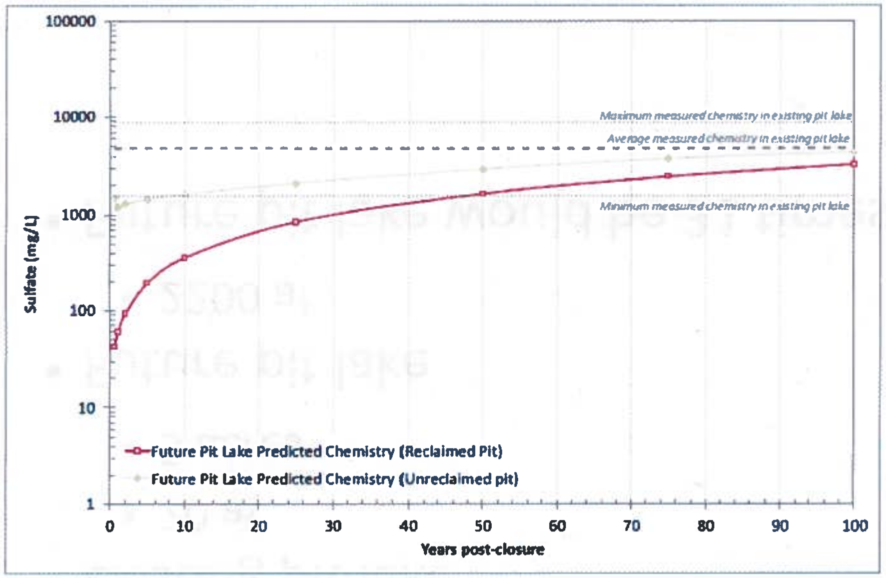


Figure 6-15: Time-series Plot of Predicted Sulfate for the for the Reclaimed Pit Model

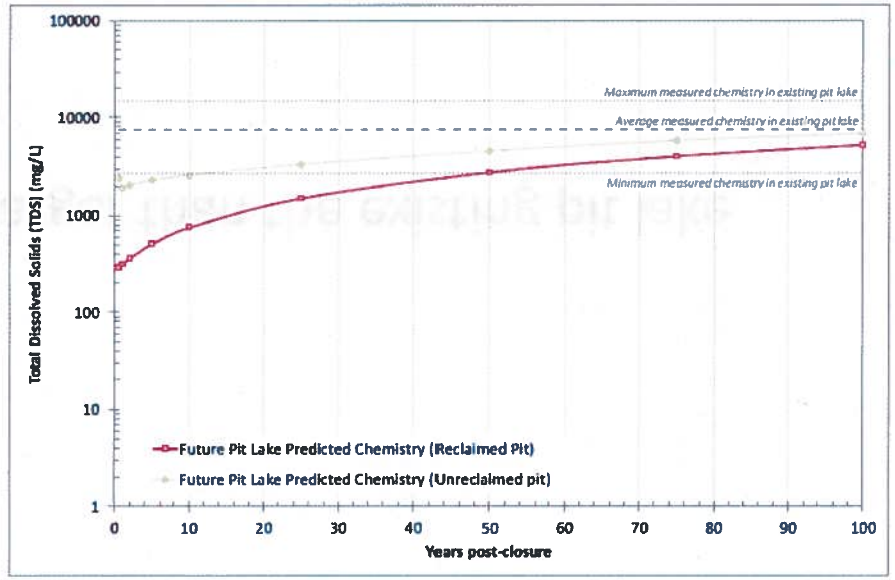


Figure 6-16: Time-series Plot of Predicted TDS for the for the Reclaimed Pit Model

Parameter	Warmwater aquatic life (ug/l) Chronic/acute	Livestock watering	Wildlife habitat	Pit lake at 100 years
Cadmium	1.22/5.38	50		15
Mercury		10	0.7	0.9
Lead	11/280	100		49
Manganese	2618/4738			8230
Zinc	428/564			920
Selenium	5/20		5	33

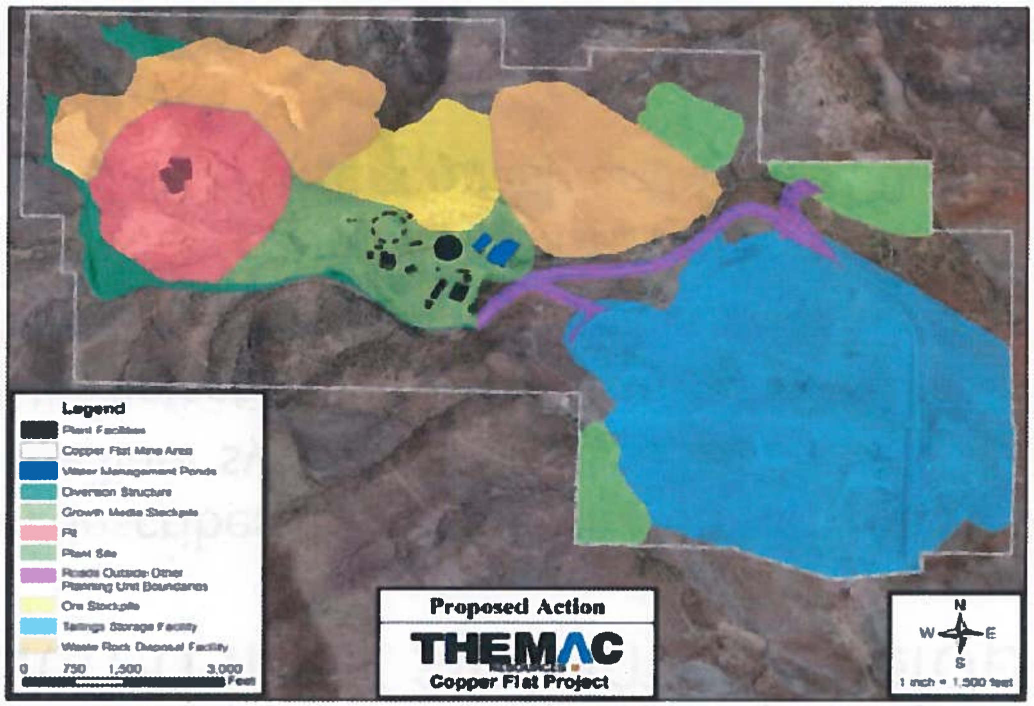
Surface water quality standards from DEIS

Inappropriate to compare pre- and Post-mine pit lakes due to size difference

- Existing pit lake
  - 70 af
  - 5 acres
- Future pit lake
  - 2200 af
- Future pit lake would be 31 times larger than the existing pit lake

Tailings Storage Facility and Waste Rock Stockpiles will be a Source of Contamination

Figure 2-2. Mine Layout – Proposed Action



Source: NMCC 2015

Well constructed liner systems develop leaks

- NMCC application describes the tailings impoundment, underdrain, and the liner system.
  - No discussion of the potential for leaks or estimates of leak rates.
  - The PHCC report estimates flow through pin-hole leaks.
- Significant leaks and tears have been observed to occur frequently (Beck et al 2009, Breitenbach and Smith 2006, Giraud and Bonaparte 1989).
- Neither the application nor Jones and Finch (2018) estimates the amount of potential leaks or consider their fate.

NMCC proposes not to use a liner under the waste rock because of claims that the andesite permeability affecting seepage into the ground is less than 10^{-6} cm/s.

1. Pressure injection test showing low permeability was misinterpreted and not representative
2. Seven supply wells developed in andesite indicate that andesite conductivity is high enough to produce a water supply
3. Well GWQ96-22A shows changes in chemistry that could only occur with substantial groundwater flow
4. Mine dewatering during 1982 operations show the conductivity of the central bedrock core is 66 to 110 times the rate assumed for the bedrock
5. Scale effects of conductivity measurements suggest the conductivity would be three orders of magnitude higher than assumed
6. Waste rock seepage reaches the ground surface in a manner more conducive to infiltration than occurs during natural events.

Pit-Area Pressure Injection Test in GWQ-5R

- Standard Lugeon Test
- Conductivity required to maintain injection rate of 1 liter per minute per meter of open interval
  - Lugeon unit equal to 1.3×10^{-5} cm/s
- Pressure injection test completed at 64 to 100 feet bgs and below the water table
  - not representative of conditions at ground surface on which the waste rock will be stored
- Once fluid entered fractures, it flowed at rates that would result in 0.04 to 0.1 Lugeon units
- Injection rate was relatively constant for head varying from 200 to 300 feet indicates that the flow was laminar
- Permeability from 5.2×10^{-7} to 1.3×10^{-6} cm/s

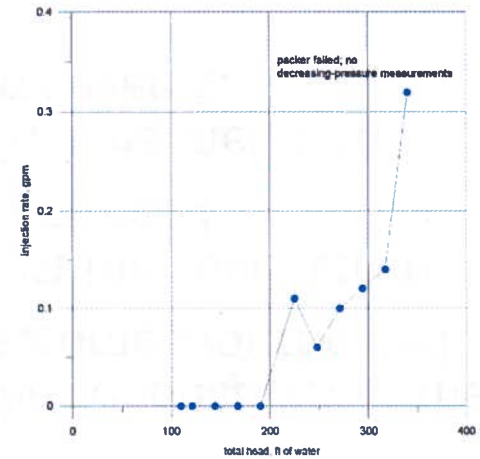


Figure 2 Pressure injection test, New Mexico Copper GWQ-5-R, Zone 1 (64-100 ft), Series 1, August 31, 2011

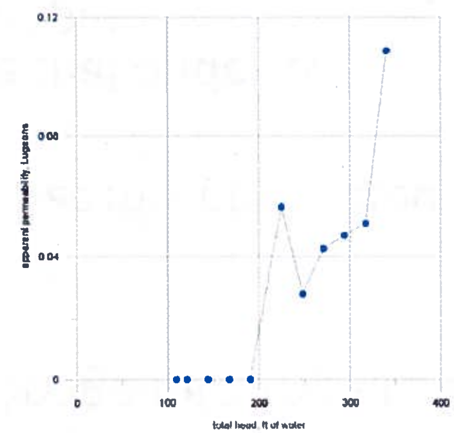


Figure 3 Apparent permeability from pressure injection test, New Mexico Copper GWQ-5-R, Zone 1 (64-100 ft), Series 1, August 31, 2011

Figures from Shomaker 2011

NMCC ignores seven andesite water supply wells

- Table 2 in JSAI (2011)
- Supply wells GWQ-4, GWQ-6(N), GWQ-6(S), Pague, Dolores, Paxton Wells, and LRG-4156 developed in andesite.
- All less than 150 feet deep
- Three are less than 50 feet deep (Pague, Dolores, Paxton Well).

Table 2. Summary of wells and well data for the Stage 1 Abatement Plan area of investigation, Copper Flat Mine, Sierra County, New Mexico

well name	well type	facility area	year drilled	casing diameter (inches)	total depth (ft bmp)	screen interval (ft bgl)	measuring-point elevation (2011 survey) (ft amsl)	geologic unit	depth to water measurement date	depth to water (ft bmp)	water-level elevation (ft amsl)
GWQ-1	supply	background region	1972	12 x 14	401	na	5,191.24	Santa Fe Group	6/15/1981	72.00	5,123.24
GWQ-2	supply	background region	1932	8	200	na	5,227.44	Santa Fe Group	11/19/1982	60.00	5,167.44
GWQ-3	supply	waste rock pile	1932	40 x 43	33	na	5,253.80	alluvium/andesite	8/20/2011	18.71	5,235.09
GWQ-4	supply	background region	1948	5	138	na	5,565.85	andesite	11/30/1982	14.00	5,550.85
GWQ-5R	monitoring	waste rock pile	2011	4	128	in progress	[illegible]	andesite	8/20/2011	94.91	[illegible]
GWQ-6(N)	supply	background region			85		5,399.36	andesite	6/9/1981	24.95	5,374.41
GWQ-6(S)	supply	background region					5,382.77	andesite			
GWQ-7	supply	tailings impoundment	1932	8	200	na	5,181.00	Santa Fe Group	6/15/1981	77.00	5,104.00
GWQ-8	supply	background region	1931	8	157	na	5,216.94	Santa Fe Group	11/18/1982	60.00	5,148.94
GWQ-9	supply	tailings impoundment	1971	14 x 16	767	na	5,208.13	Santa Fe Group	4/19/1972	60.00	5,148.13
GWQ-10	monitoring	tailings impoundment	1981	3	120	na	5,211.20	Santa Fe Group	9/27/2010	21.10	5,190.10
GWQ-11	monitoring	tailings impoundment	1981	3	70	na	5,196.44	alluvium/Santa Fe Group	5/4/2011	20.02	5,176.42
GWQ-12	monitoring	tailings impoundment	1981	3	117	na	5,237.28	Santa Fe Group	5/4/2011	79.71	5,157.57
GWQ94-13	monitoring	tailings impoundment	1994	5	106	74 to 104.5	5,201.47	Santa Fe Group	5/4/2011	13.02	5,187.85
GWQ94-14	monitoring	tailings impoundment	1994	5	179	127.5 to 157.5	5,192.69	Santa Fe Group	5/4/2011	6.42	5,186.27
GWQ94-15	monitoring	tailings impoundment	1994	5	149	112 to 142	5,183.07	Santa Fe Group	5/4/2011	4.02	5,179.19
GWQ94-16	monitoring	tailings impoundment	1994	5	46	25 to 45	5,197.41	alluvium	5/4/2011	21.76	5,175.65
GWQ94-17	monitoring	tailings impoundment	1994	5	151	120 to 150	5,198.13	Santa Fe Group	9/27/2010	18.11	5,180.02
GWQ94-18	monitoring	tailings impoundment	1994	4	31	10 to 30	5,194.83	alluvium	10/15/1994	dry	
GWQ94-19	monitoring	tailings impoundment	1994	4	43	10 to 40	5,203.36	alluvium	9/27/2010	53.22	5,151.14
GWQ94-20	monitoring	tailings impoundment	1994	4	318	288 to 318	5,201.49	Santa Fe Group	1/27/2010	14.05	5,187.44
GWQ94-21A	monitoring	tailings impoundment	1996	2	263	213 to 263	5,192.71	Santa Fe Group	11/7/1994	4.54	5,188.17
GWQ94-21B	monitoring	tailings impoundment	1996	2	315	295 to 315	5,192.22	Santa Fe Group	11/7/1994	3.85	5,188.37
GWQ96-22A	monitoring	pit/waste rock pile	1996	2	244	134 to 244	5,596.17	andesite	8/28/2011	54.63	5,541.54
GWQ96-22B	monitoring	pit/waste rock pile	1996	2	360	340 to 360	5,595.95	andesite	8/28/2011	54.99	5,541.16
GWQ96-23A	monitoring	pit/waste rock pile	1996	2	101	50 to 100	5,480.84	monzonite	8/28/2011	40.71	5,440.13
GWQ96-23B	monitoring	pit/waste rock pile	1996	2	251	158 to 250	5,480.70	monzonite	8/28/2011	46.87	5,444.83
GWQ11-24A	monitoring	pit/waste rock pile	2011	2	93	60 to 93	[illegible]	andesite	8/28/2011	49.96	[illegible]
GWQ11-24B	monitoring	pit/waste rock pile	2011	2	250	230 to 250	[illegible]	andesite	8/28/2011	56.60	[illegible]
GWQ11-25A	monitoring	pit/waste rock pile	2011	2	103	78 to 100	5,532.09	monzonite	8/28/2011	50.91	[illegible]
GWQ11-25B	monitoring	pit/waste rock pile	2011	2	242	222 to 242	5,532.09	monzonite	8/28/2011	62.90	[illegible]
IW-1	monitoring	tailings impoundment	1982	4	40	to 40	5,198.90	alluvium	6/24/2010	dry	
IW-2	monitoring	tailings impoundment	1982	4	46	to 45	5,200.81	alluvium	5/4/2011	39.81	5,160.00
IW-3	monitoring	tailings impoundment	1982	4	45	to 45	5,213.17	alluvium	6/24/2010	dry	
NP-1	monitoring	tailings impoundment	1981	4	106	to 106	5,188.25	Santa Fe Group	5/4/2011	30.6	[illegible]
NP-2	monitoring	tailings impoundment	1981	4	110	to 110	5,192.54	Santa Fe Group	5/4/2011	32.92	5,159.62
NP-3	monitoring	tailings impoundment	1981	4	100	to 100	5,199.71	Santa Fe Group	5/4/2011	12.00	5,187.71
NP-4	monitoring	tailings impoundment	1981	4	117	to 117	5,223.73	Santa Fe Group	5/4/2011	35.22	5,188.51
NP-5	monitoring	tailings impoundment	1981	4	39	34 to 39	5,198.81	basalt	5/4/2011	22.61	5,176.18
MW-4	supply	background region	1975	6	1,500	123 to 1,500	[illegible]	Santa Fe Group	6/9/1981	121.27	[illegible]
Pague	supply	background region			26		5,550.81	andesite	5/4/2011	11.69	5,539.12
Dolores	supply	background region			36		5,197.51	andesite	11/10/1982	29.7	5,167.81
Paxton Well	supply	background region	1953	40 x 40	30		5,500.00	andesite	11/10/1982	7.6	5,492.40
LRG-4156	supply	background region	1956	6	130		5,431.06	andesite	1956	60	5,371.06
LRG-4158	supply	background region	1955	6	190	na	5,533.03	limestone	11/11/2010	47.01	5,486.02
McCravey-G	supply	background region	1951	8	401	na	5,201.53	Santa Fe Group	11/15/1982	40	5,161.53
LRG-4159	supply	background region	2002	6	203	5 to 203	5,718.30	andesite	11/4/2010	11.56	5,706.14

ft bmp - feet below measuring point
italic measuring-point elevations are estimated
ft bgl - feet below ground level
na - not available
ft amsl - feet above mean sea level

- Well GWQ96-22, developed in andesite west of the pit, shows a 27% change in TDS and about 50% in sulfate
- Water chemistry could occur only with substantial movement of groundwater through the formation.

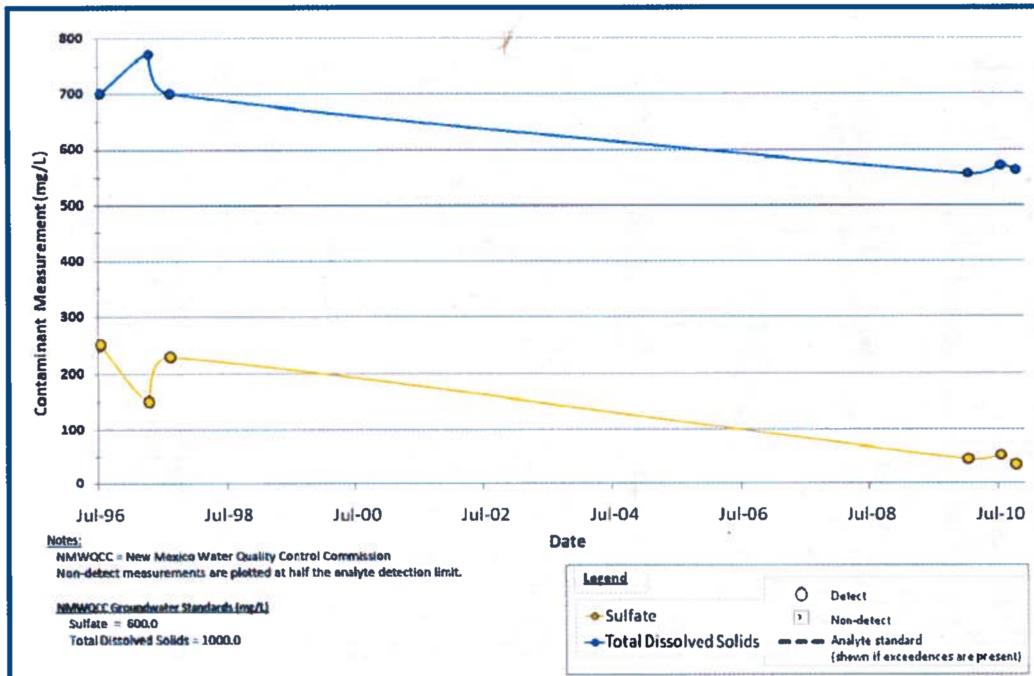


Figure 8-22
Trends in Sulfate and Total Dissolved Solids in Well GWQ96-22A

Interra 2012

Low permeability of andesite not reflected in observed 1982 mine dewatering

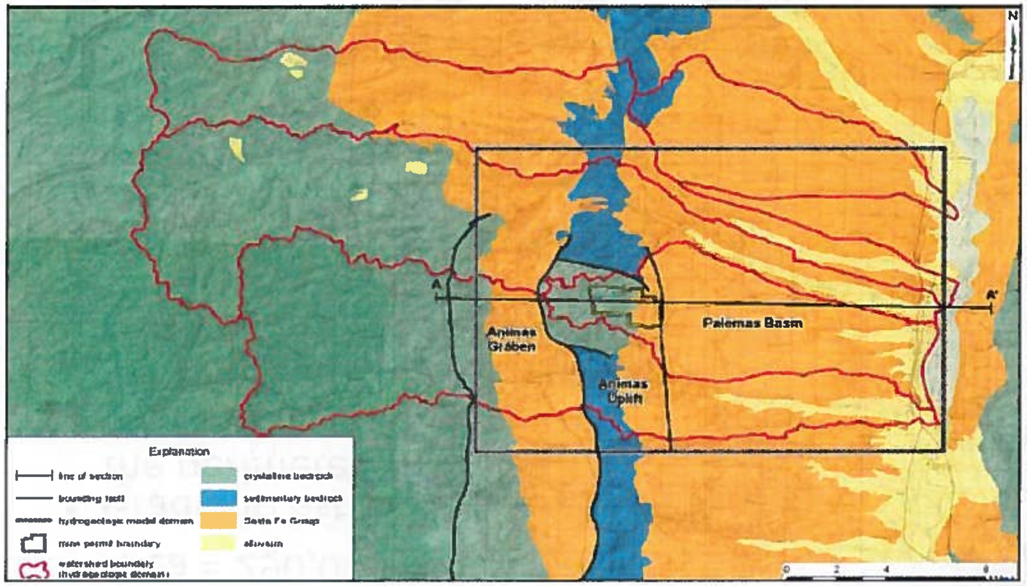


Figure 4.1. Hydrogeologic zones.

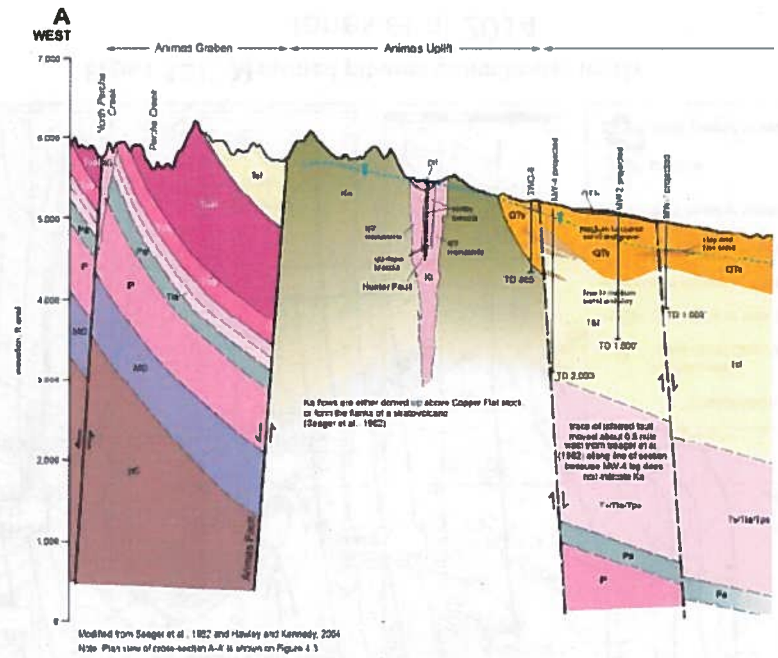


Figure 4.2. Hydrogeologic zones, west-to-east cross-section.

Jones et al (2014)

5 to 14 acre pit lake since 1982 has evaporated 16 to 45 gpm (Jones et al 2014, p 42)
6 to 10 gpm estimated groundwater inflow

Based on dewatering, effective K much higher than the assumed rate

- Area for flow to Pit lake
  - about 500' by 500' on map,
  - perimeter about 2000 ft,
  - depth for flow to lake about 20 feet
- Area = 290,000 ft^2
- Gradient: estimate of gradient through the perimeter of the pit
  - East, 5 ft in 500 ft, or 0.01
  - West, 10 ft in 300 ft, or 0.0333
  - North, 10 ft in 400 ft, or 0.025
  - South, 10 ft in 600 ft, or 0.0167
- Average gradient = 0.02125

Dewatering (gpm)	ft3/day	K (ft/d)	K (cm/s)
6	1154	0.18	6.6E-05
10	1924	0.31	1.1E-4

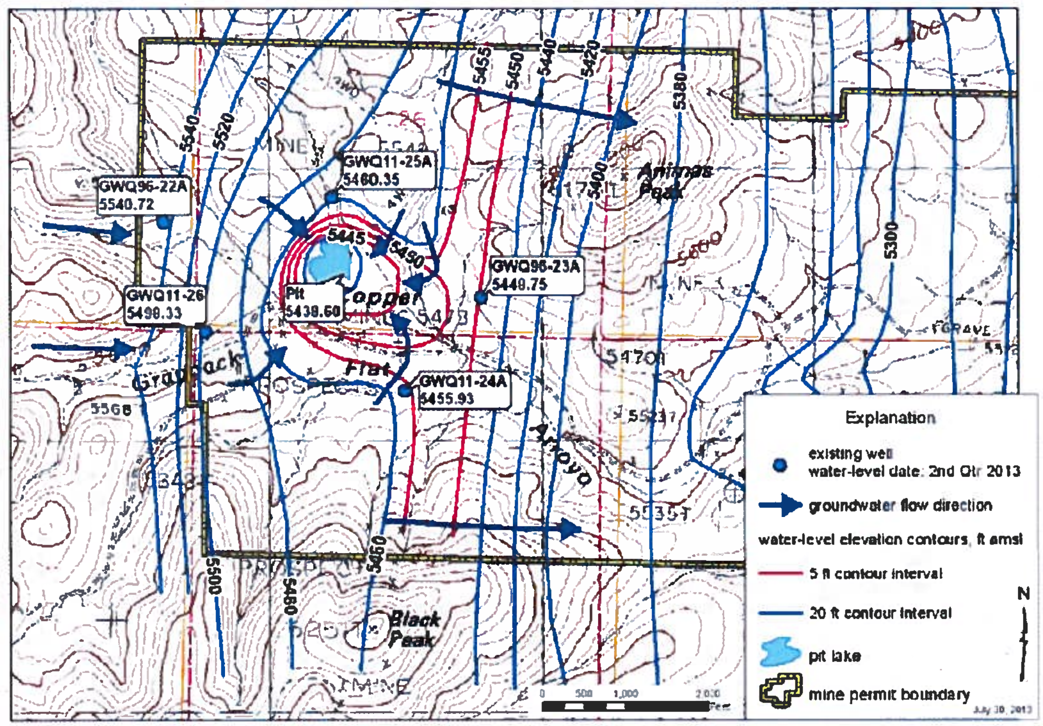


Figure 5.21. Measured pit-area groundwater levels.

Jones et al 2014

K=Q/(Ai) Darcy's Law

Scale effects: effective conductivity increase as the scale of the measurement increases from the lab to regional scale

- Heterogeneities control the scale dependency of K
  - preferred flow pathways are more frequently encountered as larger blocks of subsurface are tested
  - Media fractures are both primary fluid pathways and storage locations
- Fracture flow systems have the largest variability of conductivity with measurement volume.
- 10^{-6} cm/s = 10^{-8} m/s --- 1 m^3
- Relation becomes horizontal at 500 m^3 and 10^{-5} m/s
- Based on this relation, effective conductivity could be 1000 times greater than assumed K
- Area beneath waste rock pile would include numerous preferred pathways and higher K than one borehole

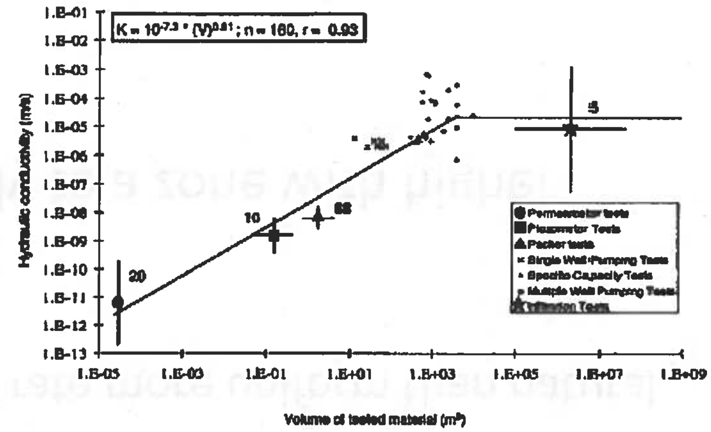


Figure 6. Relationship of hydraulic conductivity to scale of measurement in the Racine Formation of the carbonate aquifer of southeastern Wisconsin. Permeameter, piezometer, packer, and passive infiltration tests were plotted as geometric means with 95% confidence intervals; pumping tests and specific capacity data as single values. Number of observations are given adjacent to means. Passive infiltration tests are derived from the infiltration of Lake Michigan water into the Racine Formation due to the construction of a sewage tunnel. The regression line is derived from all individual values (n = 160) below the infiltration scale. The 95% confidence interval about the slope is 0.91 ± 0.06, and r is the correlation coefficient.

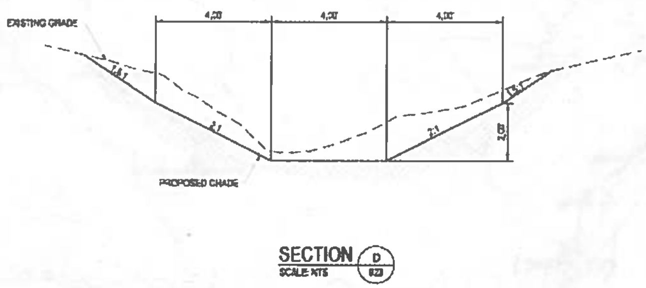
Schulze-Makuch et al (1999)

Seepage through ground surface beneath waste rock much higher than natural recharge

- Precipitation enters unreclaimed waste rock and flows through to ground surface
  - Seepage rock reaches ground surface at a rate more uniform than natural precipitation
  - Seepage would pond at ground surface
- Seepage enters ground or flows laterally to a zone with higher infiltration capacity
  - or it reports to edge of waste rock
- Average infiltration for the waste rock area based on area average which would be highly affected by a few fracture/higher conductivity zones.

Unlined ditches as a source

- Stormwater ditches from waste rock are not lined and are potential sources



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Impoundment Design Report
November 2015

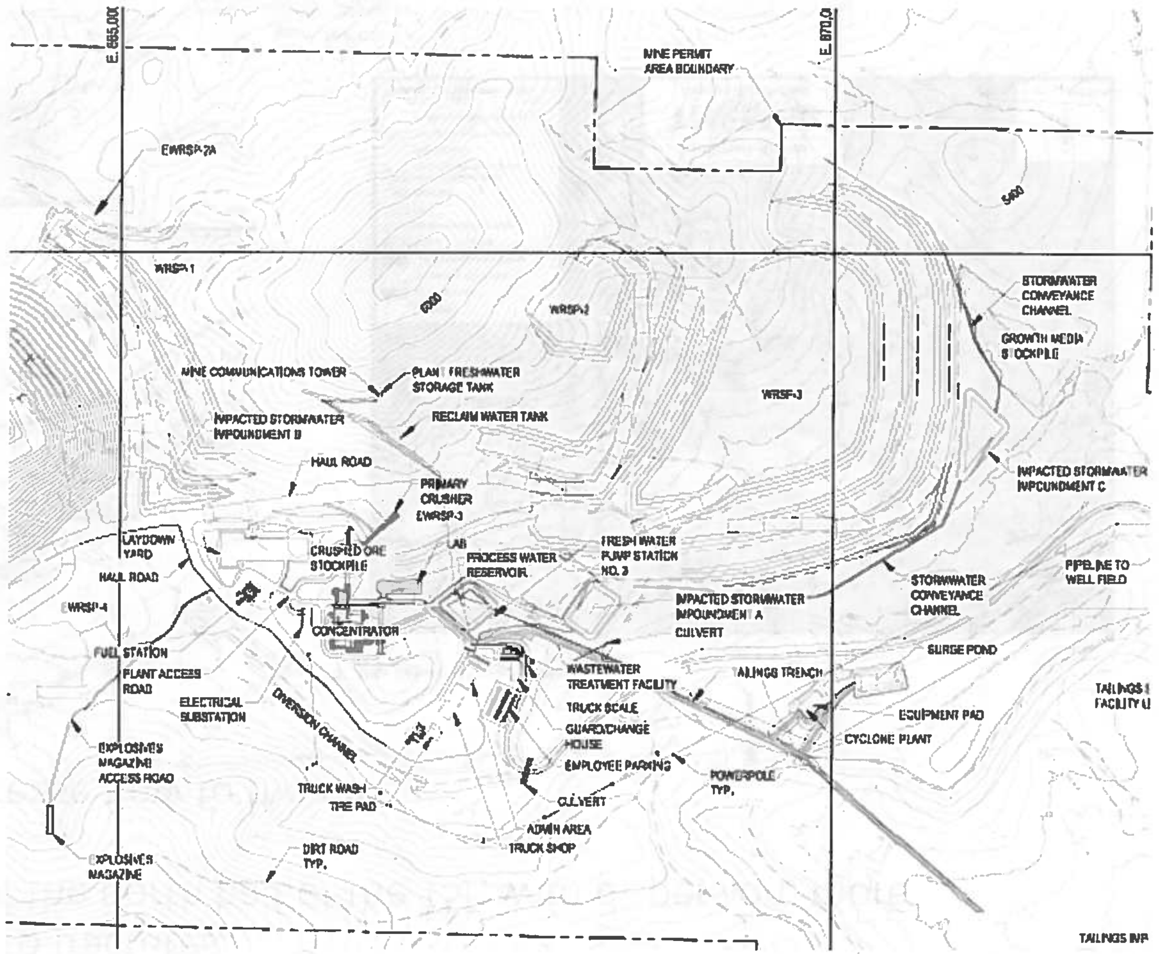
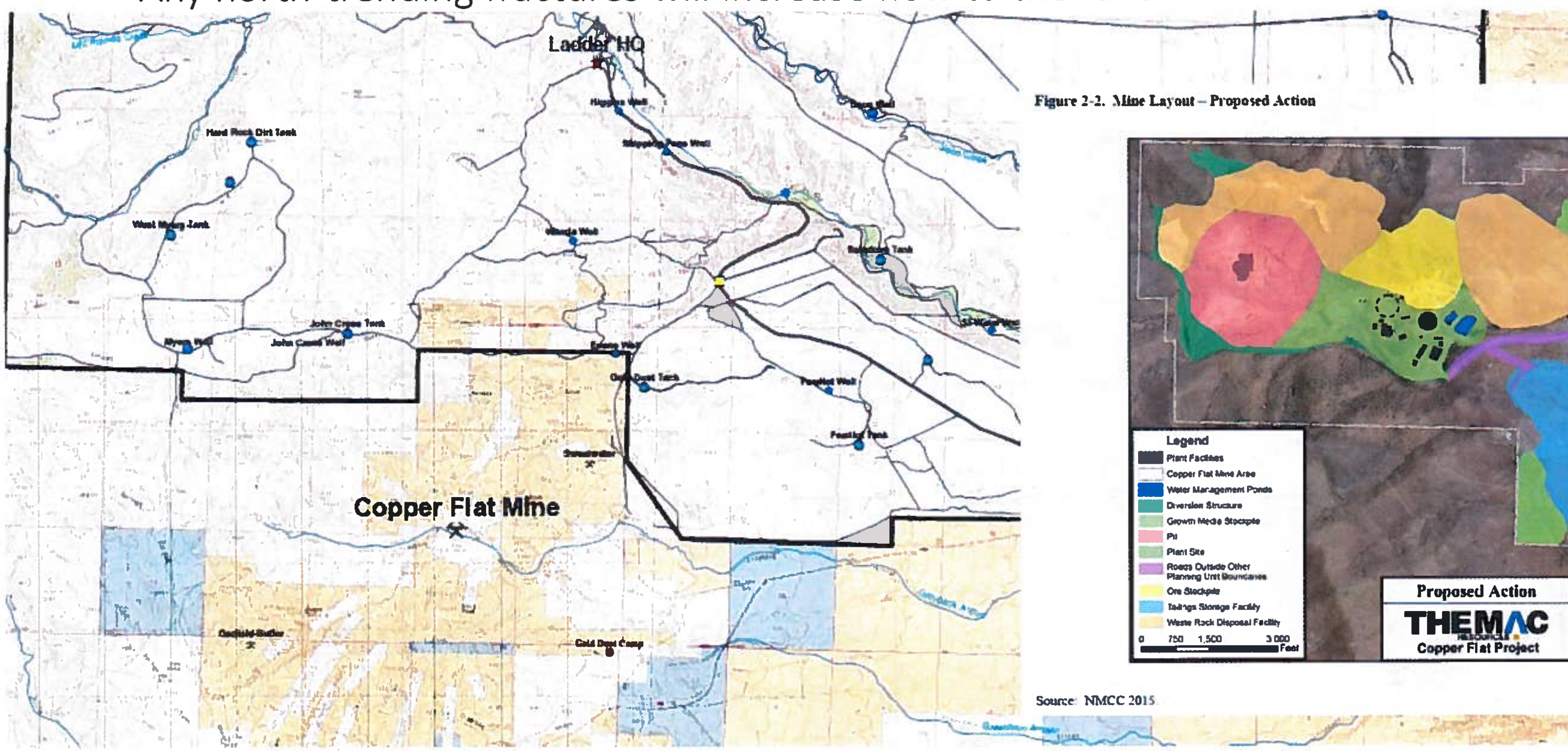


Figure 11J-1: Stormwater conveyance channel to Impacted Stormwater Impoundment C about a mile in length

Contaminants from both waste and tailings source could reach and cross the Ladder Ranch boundary due to dispersion and due to fractures.

Less than half a mile downgradient of the north half of the TSF, with dispersion, more contaminants will reach the ranch

Any north-trending fractures will increase flow to the ranch



The pit lake will draw groundwater from surrounding private land, including the Ladder Ranch and Hillsboro Pitchfork Ranch.

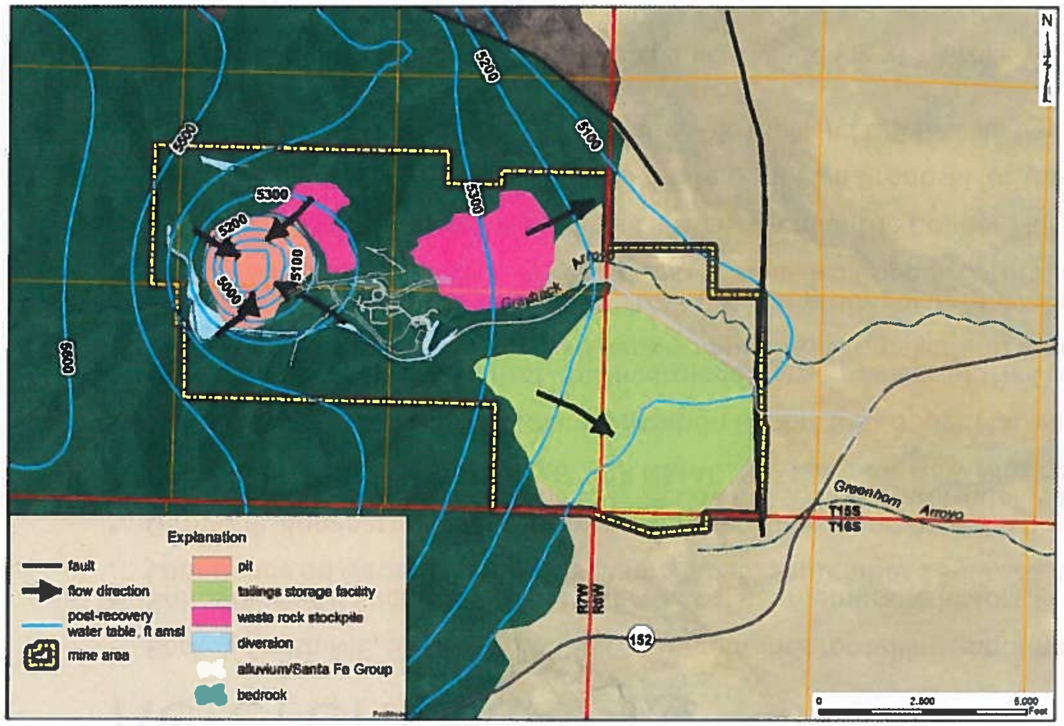


Figure 3.17. Proposed mine facilities and projected post-mining groundwater elevation.

- GW contours show that groundwater will flow toward the pit from off the permit area.

Jones and Finch, 2018

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Table 2. Summary of wells and well data for the Stage 1 Abatement Plan area of investigation, Copper Flat Mine, Sierra County, New Mexico

well name	well type	facility area	year drilled	casing diameter (inches)	total depth (ft bmp)	screen interval (ft bgl)	measuring-point elevation (2011 survey) (ft amsl)	geologic unit	depth to water measurement date	depth to water (ft bmp)	water-level elevation (ft amsl)
GWQ-1	supply	background region	1972	12 + 14	401	na	5,195.24	Santa Fe Group	6/15/1981	72.00	5,123.24
GWQ-2	supply	background region	1932	8	500	na	5,227.44	Santa Fe Group	11/15/1982	60.00	5,167.44
GWQ-3	supply	waste rock pile	1932	40 x 43	33	na	5,252.60	alluvium/andesite	9/29/2011	18.71	5,233.89
GWQ-4	supply	background region	1948	5	150	na	5,565.85	andesite	11/10/1982	35.00	5,530.85
GWQ-5R	monitoring	waste rock pile	2011	4	120	in progress	*5,410.00*	andesite	9/29/2011	98.91	*5,311.09*
GWQ-6(N)	supply	background region			85		5,395.36	andesite	6/9/1981	26.95	5,368.41
GWQ-6(S)	supply	background region					5,382.77	andesite			
GWQ-7	supply	tailings impoundment	1932	8	500	na	5,181.60	Santa Fe Group	6/15/1981	77.00	5,104.60
GWQ-8	supply	background region	1931	8	157	na	5,216.94	Santa Fe Group	11/15/1982	68.00	5,148.94
GWQ-9	supply	tailings impoundment	1971	14 + 16	767	na	5,208.13	Santa Fe Group	4/15/1972	60.00	5,148.13
GWQ-10	monitoring	tailings impoundment	1981	3	120	na	5,213.29	Santa Fe Group	9/27/2010	23.19	5,190.10
GWQ-11	monitoring	tailings impoundment	1981	3	70	na	5,196.44	alluvium/Santa Fe Group	5/4/2011	20.02	5,176.42
GWQ-12	monitoring	tailings impoundment	1981	3	137	na	5,237.28	Santa Fe Group	5/4/2011	79.71	5,157.57
GWQ94-13	monitoring	tailings impoundment	1994	5	106	74 to 104.5	5,200.47	Santa Fe Group	5/4/2011	13.02	5,187.45
GWQ94-14	monitoring	tailings impoundment	1994	5	159	127.5 to 157.5	5,192.69	Santa Fe Group	5/4/2011	6.42	5,186.27
GWQ94-15	monitoring	tailings impoundment	1994	5	149	112 to 142	5,183.07	Santa Fe Group	5/4/2011	4.92	5,178.15
GWQ94-16	monitoring	tailings impoundment	1994	5	46	25 to 45	5,197.41	alluvium	5/4/2011	21.76	5,175.65
GWQ94-17	monitoring	tailings impoundment	1994	5	151	120 to 150	5,198.13	Santa Fe Group	9/27/2010	10.11	5,188.02
GWQ94-18	monitoring	tailings impoundment	1994	4	51	10 to 50	5,194.83	alluvium	10/15/1994	dry	
GWQ94-19	monitoring	tailings impoundment	1994	4	53	10 to 50	5,203.36	alluvium	9/27/2010	52.22	5,151.14
GWQ94-20	monitoring	tailings impoundment	1994	4	338	288 to 338	5,203.49	Santa Fe Group	1/27/2010	18.05	5,185.44
GWQ94-21A	monitoring	tailings impoundment	1996	2	263	213 to 263	5,192.71	Santa Fe Group	11/7/1994	4.58	5,188.13
GWQ94-21B	monitoring	tailings impoundment	1996	2	315	285 to 315	5,192.22	Santa Fe Group	11/7/1994	3.95	5,188.27
GWQ96-22A	monitoring	pit/waste rock pile	1996	2	244	174 to 244	5,596.17	andesite	8/28/2011	54.63	5,541.54
GWQ96-22B	monitoring	pit/waste rock pile	1996	2	380	340 to 380	5,595.95	andesite	8/28/2011	54.59	5,541.36
GWQ96-23A	monitoring	pit/waste rock pile	1996	2	101	50 to 100	5,489.84	monzonite	8/28/2011	40.71	5,449.13
GWQ96-23B	monitoring	pit/waste rock pile	1996	2	251	150 to 250	5,489.70	monzonite	8/28/2011	40.87	5,448.83
GWQ11-24A	monitoring	pit/waste rock pile	2011	2	90	60 to 90	*5,514.80*	andesite	8/28/2011	49.86	*5,464.94*
GWQ11-24B	monitoring	pit/waste rock pile	2011	2	250	230 to 250	*5,514.80*	andesite	8/28/2011	56.69	*5,458.11*
GWQ11-25A	monitoring	pit/waste rock pile	2011	2	100	70 to 100	*5,532.00*	monzonite	8/28/2011	50.91	*5,481.09*
GWQ11-25B	monitoring	pit/waste rock pile	2011	2	242	222 to 242	*5,532.00*	monzonite	8/28/2011	62.90	*5,469.10*
IW-1	monitoring	tailings impoundment	1982	4	49	to 49	5,198.99	alluvium	6/24/2010	dry	
IW-2	monitoring	tailings impoundment	1982	4	46	to 45	5,208.01	alluvium	5/4/2011	39.01	5,169.00
IW-3	monitoring	tailings impoundment	1982	4	45	to 45	5,213.17	alluvium	6/24/2010	dry	
NP-1	monitoring	tailings impoundment	1981	4	106	to 106	5,188.75	Santa Fe Group	5/4/2011	30.8	5,157.95
NP-2	monitoring	tailings impoundment	1981	4	110	to 110	5,192.54	Santa Fe Group	5/4/2011	32.92	5,159.62
NP-3	monitoring	tailings impoundment	1981	4	100	to 100	5,199.73	Santa Fe Group	5/4/2011	12.02	5,187.71
NP-4	monitoring	tailings impoundment	1981	4	117	to 117	5,225.73	Santa Fe Group	5/4/2011	35.22	5,190.51
NP-5	monitoring	tailings impoundment	1981	4	39	24 to 39	5,198.81	basalt	5/4/2011	22.63	5,176.18
MW-4	supply	background region	1975	6	1,500	123 to 1,500	*5,125.00*	Santa Fe Group	6/9/1981	123.27	5,001.73
Pague	supply	background region			26		5,550.81	andesite	5/4/2011	11.69	5,539.12
Dolores	supply	background region			56		5,397.51	andesite	11/10/1982	29.7	5,367.81
Paxton Well	supply	background region	1932	40 x 40	30		5,500.00	andesite	11/10/1982	7.6	5,492.40
LRG-4156	supply	background region	1956	6	150		5,431.06	andesite	1956	60	5,371.06
LRG-4158	supply	background region	1955	6	150	na	5,533.03	limestone	11/11/2010	47.01	5,486.02
McCravey-G	supply	background region	1931	8	500	na	5,201.53	Santa Fe Group	11/15/1982	40	5,161.53
LRG-4159	supply	background region	2002	6	200	5 to 200	5,719.70	andesite	11/4/2010	13.56	5,706.14

ft bmp - feet below measuring point
Italic measuring-point elevations are estimated

ft bgl - feet below ground level
na - not available

ft amsl - feet above mean sea level