Kuipers & Associates, LLC

Technical Review Comments on October 2021 CCP update for MMD Permit No. SF002RE, LAC Minerals (USA) LLC Cunningham Hill Mine

New Mexico Mining and Minerals Division Public Hearing Santa Fe, NM November 2, 2022

James R. Kuipers P.E., Kuipers & Associates

On behalf of

Friends of Santa Fe County

Cunningham Hill Mine October 2021 CCP Update

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- Comments Outline
  - Clarification of scope of Pit Waiver
  - Post-closure requirements
    - Elimination/minimization where possible
    - Financial assurance where not
  - Pit stability/mass wasting
    - Safety
    - Impacts on stormwater diversions/source controls
    - Other impacts to water quality
  - Pit lake
    - Water quality
    - Water inputs/outputs/levels
  - Waste rock
    - Covers
    - ARD treatment
  - Climate
    - Climate change
    - Stormwater events
  - Long-term monitoring, maintenance, replacement
  - Financial Assurance

Clarification of Scope of Pit Waiver

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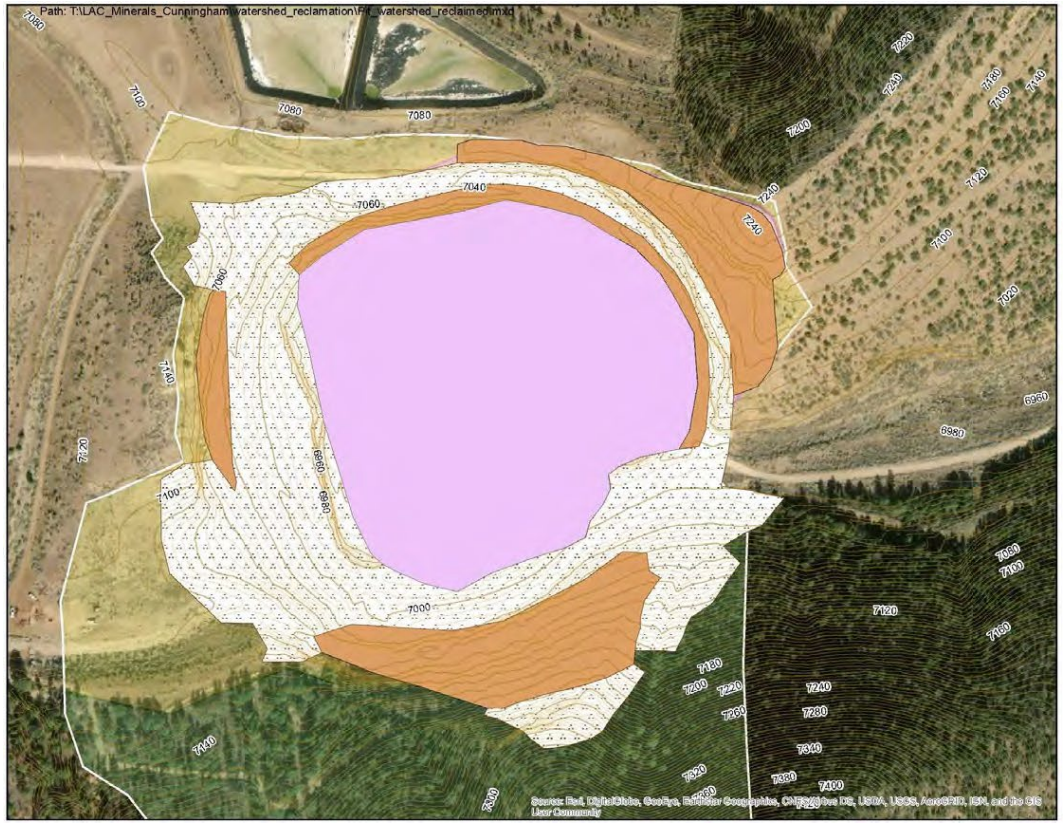
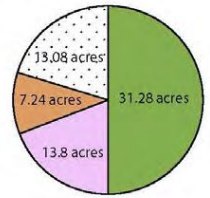
NMMA Section 69-36-11B(3) requires that "the closeout plan specifies incremental work to be done within specific time frames that, if followed, will reclaim the physical environment of the permit area to a condition that allows for the reestablishment of a self-sustaining ecosystem on the permit area following closure, appropriate for the life zone of the surrounding areas unless conflicting with the approved post-mining land use; provided that for purposes of this section, **upon a showing that achieving a post-mining land use or self-sustaining ecosystem is not technically or economically feasible or is environmentally unsound, the director may waive the requirement to achieve a self-sustaining ecosystem or post-mining land use for an open pit or waste unit if measures will be taken to ensure that the open pit or waste unit will meet all applicable federal and state laws, regulations and standards for air, surface water and ground water protection following closure and will not pose a current or future hazard to public health or safety.**" (bold and underline added)

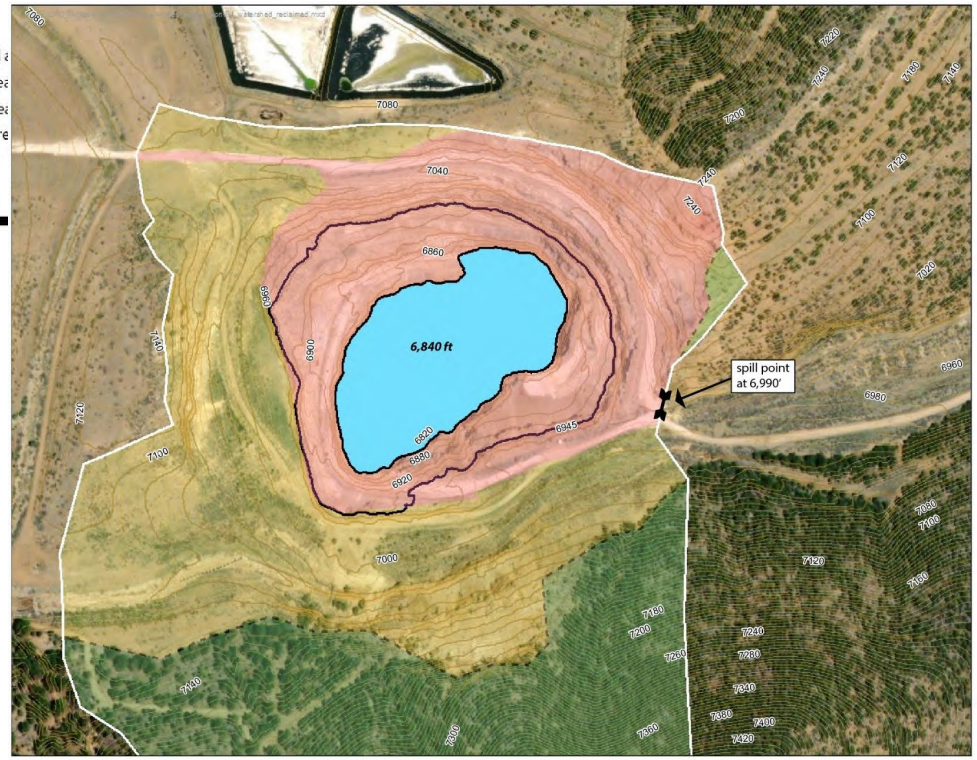


Reclamation Project

Fig 9. Map showing 1996 reclamation plan for Cunningham hill Mine open pit. This map is a digitized version of a map from WESTEC Report No. 1138.

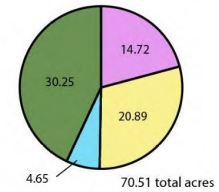
Watershed total area	70.51 acres
Undisturbed area	31.28 acres
Revegetated area	13.08 acres
Un-reclaimed area	7.24 acres
Open pit water body surface area	13.8 acres
Total area reclaimed	26.88 acres





Cunningham Hill Mine Reclamation Project

Watershed total area	70.51 acres
Undisturbed area	30.25 acres
Reclaimed area	20.89 acres
Un-reclaimed area	14.72 acres
open pit pool	4.65 acres



Explanation

- Watershed total area
- Undisturbed area
- Reclaimed area
- Disturbed area, unreclaimed
- open pit water surface area (6,840 amsl)

N

0 62.5125 250 375 500 Feet

Post-Closure Requirements

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Elimination/minimization where possible, but site specific challenges:

- Engineered source controls
- Water treatment
- Uncertainty in future outcomes

Financial assurance provisions

- Source control monitoring and maintenance
- 25-years water quality meeting standards without maintenance
- Assumption water quality standards not met for period of financial assurance (e.g., 100 or 500 years).

Pit stability/mass wasting

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Safety

- Worker/regulator safety
  - monitoring/awareness
- Public safety
  - exclusion/enforcement

Impacts on stormwater diversions/source controls

- Robust designs
- Monitoring, maintenance and replacement

Other impacts to water quality

- Exposure of mineralized material
- Change in pit capacity/level

Pit stability/mass wasting

Montana Tunnels Pit Highwall Unravelling. (Photo by Christopher Boyer)

Pit stability/mass wasting

Cunningham Hill Mine Open Pit (JSAI Photo from CCP)

Pit Lake - Water quality

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Table 3. Summary of AP-27 groundwater and surface-water quality standards and monitoring results

constituent	unit	AP-27 groundwater discharge Standard	surface water trigger level	Livestock Watering Standard	Wildlife Habitat Standard	Limited Aquatic Life - Acute Standard	Open Pit water body (4 ft depth) [2] May 2021	comment
alkalinity	mg/L		<20				37	
pH	S.U.	6 to 9					7.6	
chloride	mg/L	250					23.8	
sulfate	mg/L	1,200 b					**1,570**	
TDS	mg/L	2,000 b					**2,340**	
conductance	µS/cm		6,300				2,670	
aluminum [1]	mg/L	5				10.07	<0.40	
arsenic	mg/L	0.01		0.2		0.34	<0.125	
boron	mg/L	0.75		5.0				
cadmium [1]	mg/L	0.005		0.05		0.0065	0.000527	
chlorine residual	mg/L				0.011	0.019	<0.0002	January 2020 lab analysis
chromium III [1]	mg/L					1.77		total chromium is less than Cr III standard
chromium VI	mg/L					0.016	na	need lab analysis
chromium	mg/L	0.05		1.0			<0.030	
cobalt	mg/L	0.2 b		1.0			0.0469	
copper [1]	mg/L	1		0.5		0.05	0.04	January 2020 lab analysis
iron	mg/L	1					<0.50	
lead [1]	mg/L	0.002		0.1		0.28	<0.0075	January 2020 lab analysis
manganese [1]	mg/L	4.0 b				4.738	2.23	
mercury	mg/L	0.002			0.01	0.0014	<0.00020	
molybdenum	mg/L	1				7.920	<0.008	January 2020 lab analysis
nickel	mg/L	0.2				1.51	0.0237	January 2020 lab analysis
selenium	mg/L	0.05		0.05	0.005	0.02	<0.0030	
silver [1]	mg/L	0.05				0.035	na	need lab analysis
vanadium	mg/L			0.1			<0.005	January 2020 lab analysis
zinc [1]	mg/L	10		25		0.564	0.164	

b AP-27 groundwater discharge standard
red indicates exceedance of applicable standard
CHMRP - Cunningham Hill Mine Reclamation Project

TDS - total dissolved solids
mg/L - milligrams per liter
µS/cm - microsiemens per centimeter

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS

Pit Lake - Water inputs/outputs/levels

The expected steady-state Open Pit water levels is 6,800 with the potential for the pool level to rise to 6,840 ft amsl (Fig. 6). The observed rise in Open Pit water levels over the last 10 years has been at an average rate of 0.8 ft/yr (Fig. 7).

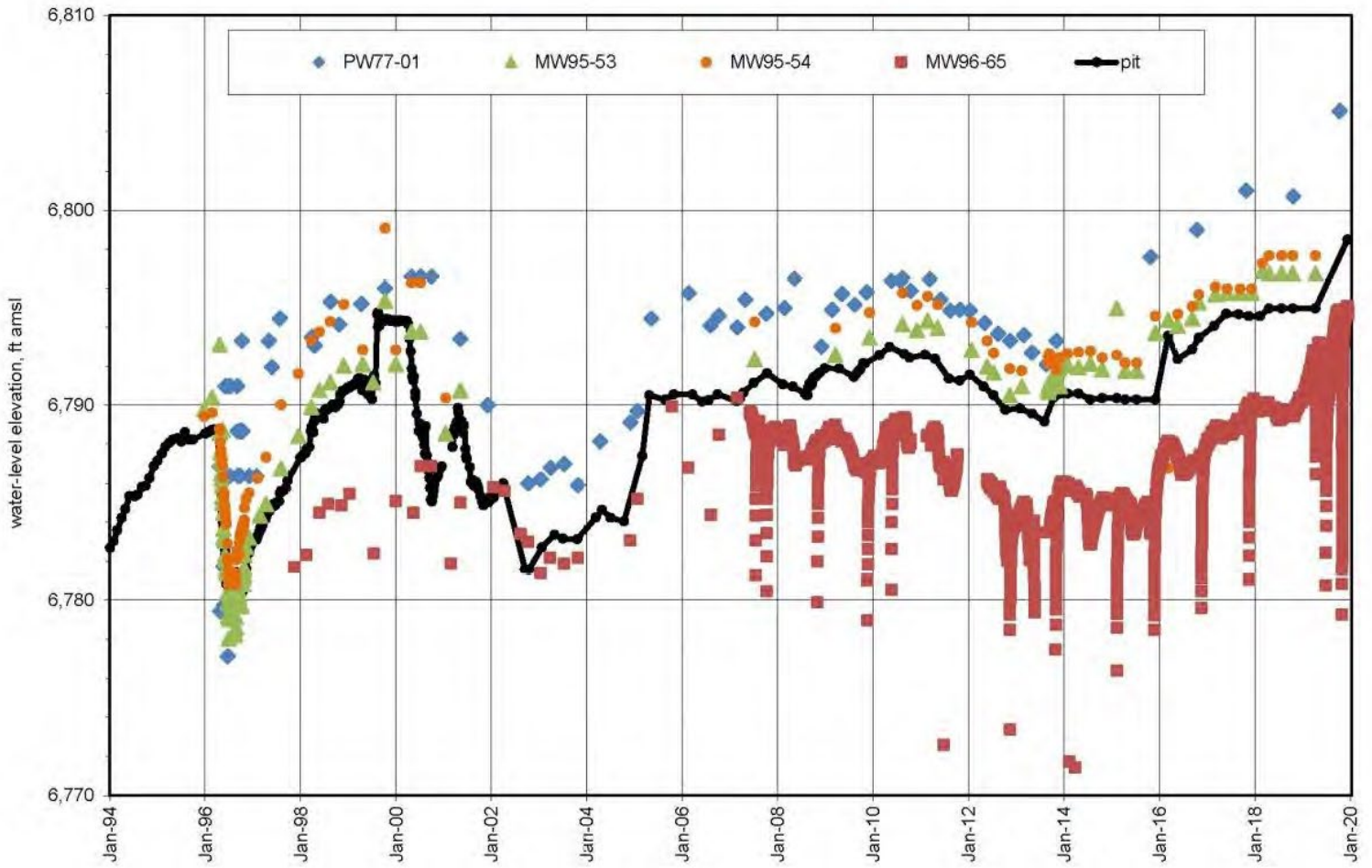

Figure 7. Graph showing observed water levels at the Open Pit and nearby monitoring wells, from 1994 through 2019.

Waste Rock - Covers

- Waste rock pile is covered by a 12 inch layer of waste rock mixed with lime and a cover consisting of six to eight inches of subsoil, and 10 to 12 inches of growth medium composed of a sandy-clay loam material.
- The waste rock pile reclamation was completed in 1996.
- Between 2011 and 2016 "… significant improvements were made to shed stormwater runoff and reduce the potential for cover erosion" and "… stormwater diversion features also assisted with reducing infiltration and generation of ARD"
- East Groin stormwater channel investigation of infiltration and repairs conducted in 2019.
- In response to increased waste rock leachate flows observed in the spring of 2019, a waste rock pile cover evaluation was conducted that identified cover material erosion, storm-water benches not promoting good drainage, and the poor condition of the East Groin Drainage Channel GCL.
- In 2021 LAC proposed to repair locations where rills have locally eroded cover material to minimize erosion and reestablish vegetation and to conduct repairs to the East Ground drainage.

Waste Rock - Covers

INSPECTION REPORT - Cunningham Hill Mine September 14, 2022

Waste Rock - Covers

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The primary components of a **preventative maintenance approach** consist of the following being done on a consistent annual basis:

A. Maintaining the site vegetative cover including fertilizing and restoring the vegetative cover if necessary. Note: While this may be considered contradictory to MMD requirements for a self-sustaining ecosystem for a 12-year period, once MMD requirements are fulfilled this should be performed to fulfill NMED requirements as a means to address potential water quality issues.
B. Repairing surficial erosion and sloughing on perimeter slopes as it occurs including addressing any rilling observed.
C. Maintaining stormwater run-on and run-off conveyances and detention areas and conducting repairs as necessary to maintain intended function.
D. Repairing damage caused by wildlife or grazing animals, invasion of noxious weeds, drought or wildfire, or depletion of soil characteristics.
E. Repairing site roads including run-off controls and culverts on an as needed basis and in particular after significant storm events.
F. Repairing and/or replacing fencing, signs, locks and any damage caused by trespass or other unauthorized use.

Waste Rock – ARD Treatment

Evaporation

Requires long-term monitoring, maintenance and replacement

Climate – Climate Change

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It is expected that total annual precipitation will decrease in places like the Southwest, heavier rainfall events and periodic annual precipitation may become more intense.

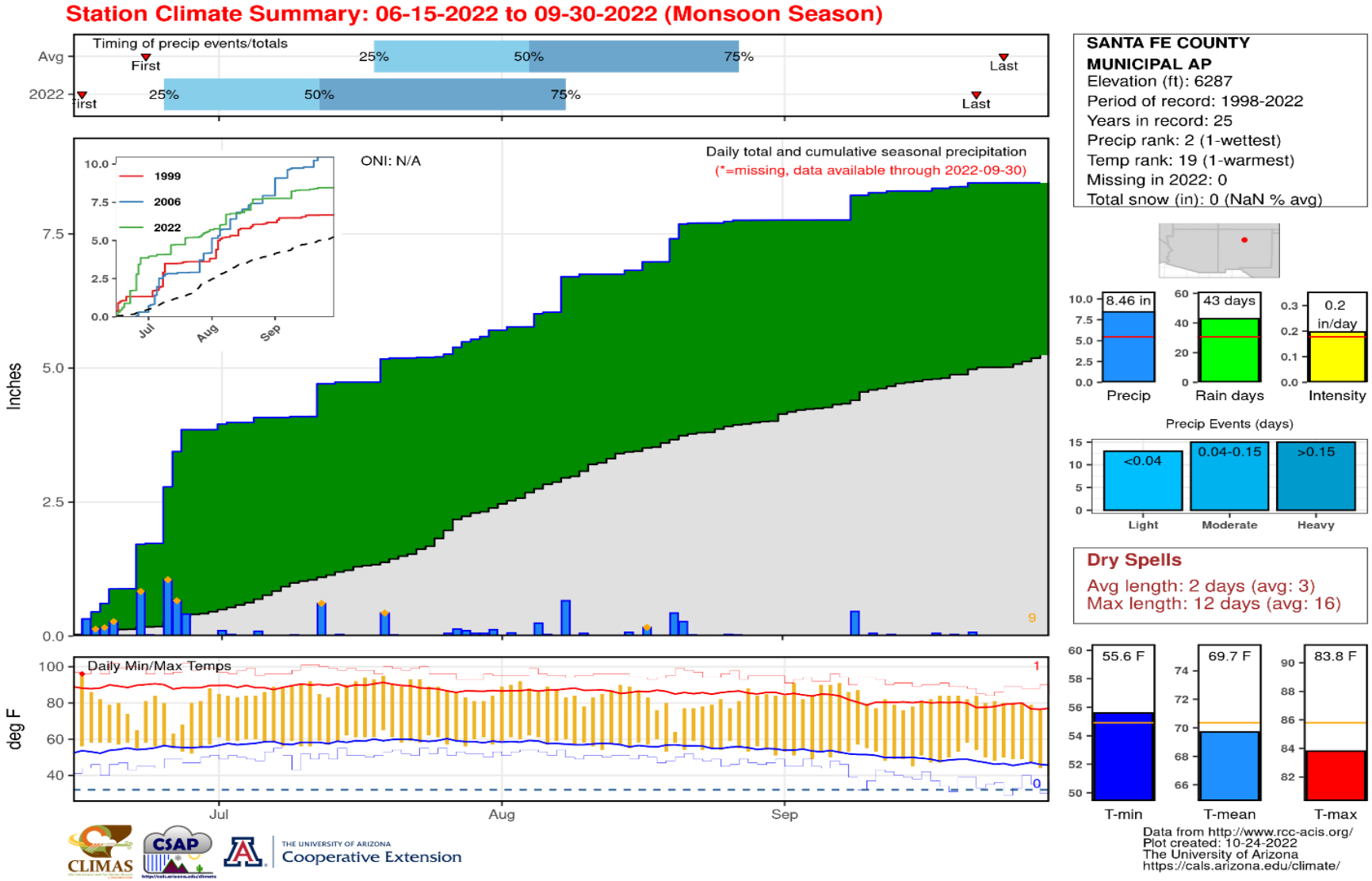
-Climate Change and New Mexico's Water Resources: A 50-Year Outlook, New Mexico Bureau of Geology and Mineral Resources

Table 1. POINT PRECIPITATION FREQUENCY ESTIMATES, NOAA Atlas 14, Volume 1, Version 5 GOLDEN Station ID: 29-3592 Location name: Sandia Park, New Mexico, USA*

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
24-hr	**1.27** (1.16-1.39)	**1.58** (1.45-1.75)	**1.98** (1.81-2.17)	**2.29** (2.09-2.51)	**2.71** (2.46-2.97)	**3.03** (2.75-3.32)	**3.37** (3.04-3.68)	**3.70** (3.32-4.04)	**4.16** (3.71-4.53)	**4.51** (4.00-4.91)
7-day	**1.97** (1.81-2.15)	**2.45** (2.26-2.68)	**3.01** (2.77-3.29)	**3.46** (3.17-3.77)	**4.05** (3.70-4.41)	**4.49** (4.10-4.89)	**4.95** (4.50-5.38)	**5.40** (4.89-5.87)	**5.99** (5.40-6.52)	**6.44** (5.77-7.02)
30-day	**3.69** (3.42-3.98)	**4.59** (4.26-4.96)	**5.57** (5.17-6.02)	**6.30** (5.84-6.80)	**7.23** (6.69-7.80)	**7.90** (7.30-8.52)	**8.55** (7.89-9.21)	**9.18** (8.44-9.90)	**9.95** (9.13-10.7)	**10.5** (9.61-11.4)
60-day	**5.23** (4.88-5.61)	**6.51** (6.06-6.99)	**7.81** (7.27-8.39)	**8.74** (8.14-9.39)	**9.90** (9.20-10.6)	**10.7** (9.93-11.5)	**11.5** (10.6-12.3)	**12.2** (11.2-13.1)	**13.0** (12.0-14.0)	**13.6** (12.5-14.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

Climate – Climate Change



Climate – Stormwater Events

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- The CHM CCP describes storm water benches and conveyance channels in addition to other engineered features where stormwater design criteria are both applicable and critical as suggested by our comments on climate.
- However, with the exception of the Open Pit outflow channel, which according to the CCP is designed to carry the 100-year, 24-hour storm event, the CCP does not identify the storm design criteria for the reclamation that has been completed or for reclamation that is planned.
- Current design standards such as 1 in 100 year storm events are grossly inadequate to protect public safety as well as to ensure the mining facilities are not impacted by stormwater resulting in both property loss as well as potential water quality impacts as well as impacts to reclamation post-closure.
- LAC should use/MMD-ED should require at least a 200-yr/24-hour design storm event and preferably a 500 yr/24-hour design storm event.

Long-term monitoring, maintenance, replacement

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- NMED responsibility
- Tasks need to be clearly articulated
- Include all tasks relevant to AP-27, DP-55
  - Combine and include in CCP
- Conservative approach – assume reasonable worst case
- Need to address all factors potentially impacting water quality
  - Including long-term revegetation
  - Cover preventative maintenance
  - Stormwater features
  - ARD pond replacement and sludge disposal
- Contingency plan for both anticipated and unanticipated circumstances

Financial Assurance

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NMED requirements and guidance?

- AP-27 Provisions
- MMD Rules and Guidance

Conservative approach

- Assume reasonable worst case re maintenance and replacement schedules
- Assume high inflation/low return
  - Net discount rate 2%
- Assume long time period
  - 500-years versus 100-years
- Include funding for contingencies

Reduce FA when results on the ground suggest no longer necessary

- 25 years water quality
- 100 years maintenance