

**ROSEMONT MINE OUTDOOR LIGHTING &
PIMA COUNTY OUTDOOR LIGHTING CODE
TECHNICAL MEMO**

**ROSEMONT PROJECT
M3-PN08036**

Prepared for

ROSEMONT COPPER COMPANY

December 2009



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ATTACHMENTS

- 000-EL-201 - Site General, Electrical, Area & Road Lighting, Designation**
- 000-EL-202 - Site General, Electrical, Pima Co. Outdoor Ltg. Code, Lighting Compliance Plan**



1 Background

The 2006 Pima County Outdoor Lighting Code is the Code in effect regulating the amount of light permitted outdoors within the City of Tucson and Pima County. The Code describes several Lighting Areas that are centered on the various astronomical telescope facilities located within Pima County. The Rosemont Mine is within an area of Pima County that is the most restrictive Lighting Area of the Code, namely, Area 'E1a.' The maximum amount of light within the Area 'E1a' is 18,000 lumens per acre for Low Pressure Sodium (LPS) type outdoor lighting and 3,000 lumens per acre for High Pressure Sodium (HPS) type outdoor lighting with an additional restriction of 3,000 lumens per lamp maximum for HPS.

The mine is exempt from complying with the Pima County Outdoor Lighting Code, however, Rosemont Copper plans to operate within the intent of the Pima County Outdoor Lighting Code as long as mine safety and operations are not compromised. To these ends, the mine outdoor lighting design was given special attention, and the results are discussed below.

2 Design Approach and Results

The entire mine site is regulated by the Mine Safety and Health Act (MSHA, or "Em-Sha"). Similar to the Occupational Safety and Health Act, MSHA establishes requirements for providing mine workers with a safe and healthy working environment. Part of that attempt includes requirements for lighting within the mine property to offer a well lit and safe working area. More specific impact of the MSHA regulations is included later in this Memo.

2.1 Roadway and Parking Lots

The use of outdoor lighting is primarily for safety, especially at a mine site. On roadways and in parking lots, lighting allows earlier driving decisions by enabling the vehicle operators to understand the driving challenge facing them at the immediate moment. This lighting also allows pedestrians to better avoid hazards on the ground in their path of travel while they are close to roads. As a result, the roadway lighting on mine access and circulation roads was designed for an average illumination of 0.5 foot candle (fc).

All roadway and designated parking lot lighting was designed using LPS fixtures and a maximum of 6:1 ratio between the average illumination and the minimum illumination on the surface of the road or parking lot. Lithonia "Visual Roadway Tool" outdoor lighting software was utilized to establish parameters of lamp wattage, mounting height of the light fixture above the road, position of the light fixture with respect to the road edge ("Set-back") and distance between lights ("Light Span"). To achieve 0.5 fc, light fixtures were found to require a Light Span of 123 feet on the two-lane Haul Truck Roads, within the Ore Processing Area, alternating sides of the road with adjacent locations. For the Light Truck Roads, spans of approximately 225 feet were calculated to be appropriate with lights on one side of the roadway. Parking lots were designed using the same software.

2.2 Mine Process Area

The primary purpose of area lighting, especially around process buildings, is for safety. These areas tend to have pedestrian traffic intermingled with activities which are conducive to elevated hazards in the working environment. For this reason, HPS lighting was selected for use around these buildings.

2.3 Mine Pit

The mine pit area is the most hazardous of all the operational areas of the facility. As such, movement within the mine is highly regulated and visibility at the operational areas is critical. Using data developed over the years, the manufacturers of the shovels and drills recommend the use of HPS lighting to meet the needs of mine safety and operational visibility. The HPS lamps are, therefore, concentrated around the large shovels and the areas they are working. There will be a total of three (3) shovels (all three could be working at the same time), three (3) drills, and two (2) loaders. Each shovel will have lighting consisting of as many as 19-35 watt HPS, 4-400 watt HPS and 6-1000 watt HPS lights. The three drills will have a total of approximately 582,000 lumens of light from various sized lamps. This lighting is necessary to keep night operations as safe as possible at these large machines. Total lighting from HPS lamps in the Pit is 4,205,250 lumens.

Two major access roads are associated with the Pit operations near the boundary of the Ultimate Pit Limit, and intersect on the South-East quadrant of the Pit. The tabulation of lumens of LPS lighting for the Mine Pit includes lumens to illuminate this important and potentially hazardous intersection.

The two loaders in the Pit cannot utilize HPS or LPS lamps because of the very rugged service conditions. HPS and LPS lamps are designed to be operated in a stationary position and relatively free of vibration. The lights mounted on the loaders use a xenon light source and contribute approximately 78,000 lumens of white light to the total light on the Mine property.

In addition, there are two support areas, a re-fueling site and an explosives storage facility, associated with the Pit, but outside the Pit boundary. LPS lamps are used to light these two areas, and account for 28,600 lumens of LPS light.

Historically, this lighting has been shown to be required while operating mine shovels, drills, and loaders at night and still be able to maintain a safe work area.

The 400 watt and 1000 watt HPS lamps do exceed the 3,000 lumens per lamp criteria, but the total lumens per acre is met, as shown later in this memo.

2.4 Entry Road

The Main Entry Road is approximately 16,000 feet long from the Truck Scale to Highway 83, about 3 miles. At the previously established 225 feet per light, the entry road will require 72-90 Watt LPS fixtures.

Light Emitting Diode (“LED”) lamps were considered for the Entry Road. It is unclear to the Engineer that the spectrum emitted by yellow LED’s is satisfactory for use in the ‘E1a’ area as defined by the Pima County Outdoor Lighting Code. In addition, research indicates that the efficiency of the LED lamp is only half the efficiency of the LPS lamp. For these reasons, the LPS source was chosen.

2.5 Leach Pads

Lighting on the Leach Pads is portable lighting and is not addressed by the Code. This lighting is typically on for approximately one hour each night.

2.6 Results

Total acreage of the Rosemont Mine Site: 4,415 acres

High Pressure Sodium Lamp Lumens

Maximum Lumens per Acre:	3,000
Total HPS lumens allowed @ 3,000 lumens/acre:	13,245,000
Current Total Lumens proposed:	6,590,250
Current Total Per-Cent of Maximum Allowed:	49.8%
Current Proposed Average Lumens per Acre:	1,493

Low Pressure Sodium Lamp Lumens

Maximum Lumens per Acre:	18,000
Total LPS lumens allowed @ 18,000 lumens/acre:	79,470,000
Current Total Lumens proposed:	7,736,300
Current Total Per-Cent of Maximum Allowed:	9.7%
Current Proposed Average Lumens per Acre:	1,753

Xenon Lamp Lumens

Maximum Lumens per Acre:	No limit established
Total Xenon lumens allowed:	No limit established
Current Total Lumens proposed:	78,000
Current Total Per-Cent of Maximum Allowed:	No limit established
Current Proposed Average Lumens per Acre:	18

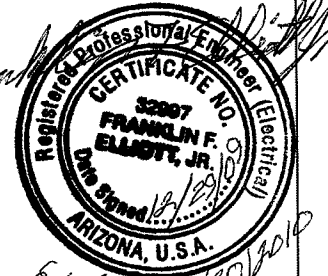
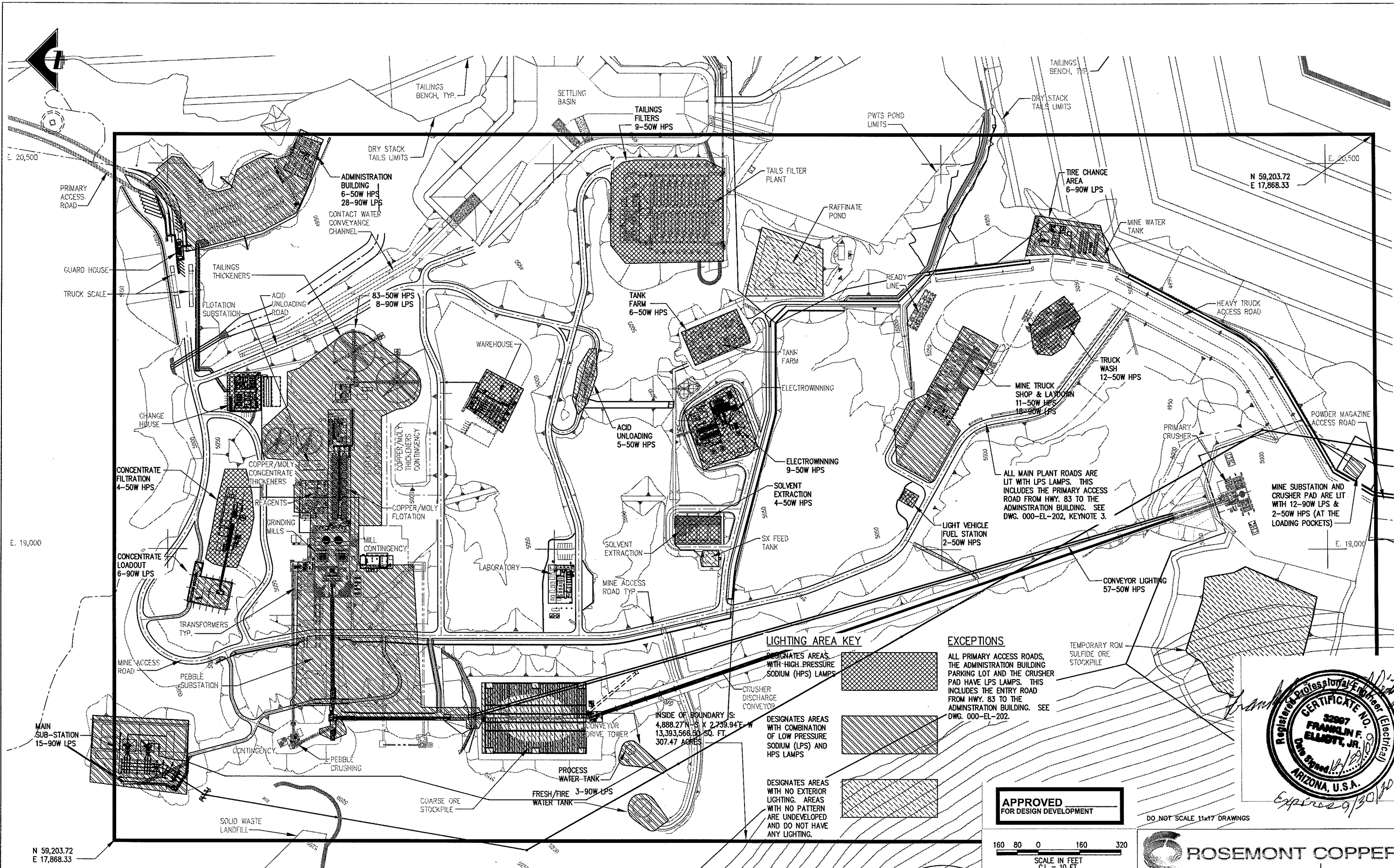
Drawings 000-EL-201 and 000-EL-202, attached, are provided as a guide to the Mine Areas discussed.

3 Conclusions

LPS type outdoor lighting is a very attractive light (lamp) source to use in pursuit of compliance with the Pima County Outdoor Lighting Code. M3 recommends very careful use of LPS type outdoor lighting at the mine site for the following reasons.

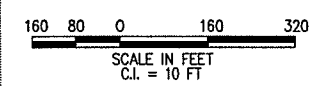
A concern in using LPS lighting is that of a potential safety hazard, which could occur if personnel are injured, are bleeding, and the first responders cannot see by the color of the liquid that it is blood. LPS light masks all colors, and especially reds. All colors appear gray under LPS lighting. To address that issue, the more hazardous locations that require frequent visits by mine personnel have been provided with the better color-rendering lighting of the HPS lamp.

The total lumens as presented in this Report are based on preliminary design information available at the time the report was written. Final actual total lumens may vary slightly from these values as the design of the mine is completed. Nevertheless, Rosemont Copper has a commitment to make every effort to remain compliant with the Pima County Outdoor Lighting Code as final design decisions are made. Further, Rosemont Copper is working with heavy equipment manufacturers and lighting manufacturers to identify light sources and shielding methods to further limit any light pollution.



APPROVED
FOR DESIGN DEVELOPMENT

DO NOT SCALE 11x17 DRAWINGS



REFERENCES		REFERENCES		REVISIONS				REVISIONS				SCALE: AS NOTED		
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT
000-CI-002	CIVIL GENERAL SITE PLAN													
000-EL-202	LIGHTING COMPLIANCE PLAN													
				2	NEW BACKGROUND, REVISED AREAS	FE	FE	29 DEC 09						
				1	NEW BACKGROUND, REVISED LIGHT LEVELS	FE	FE	18 JUN 09						
				0	IDENTIFIED LIGHTING AREAS AND LEVELS	FE	FE	15 MAY 09						

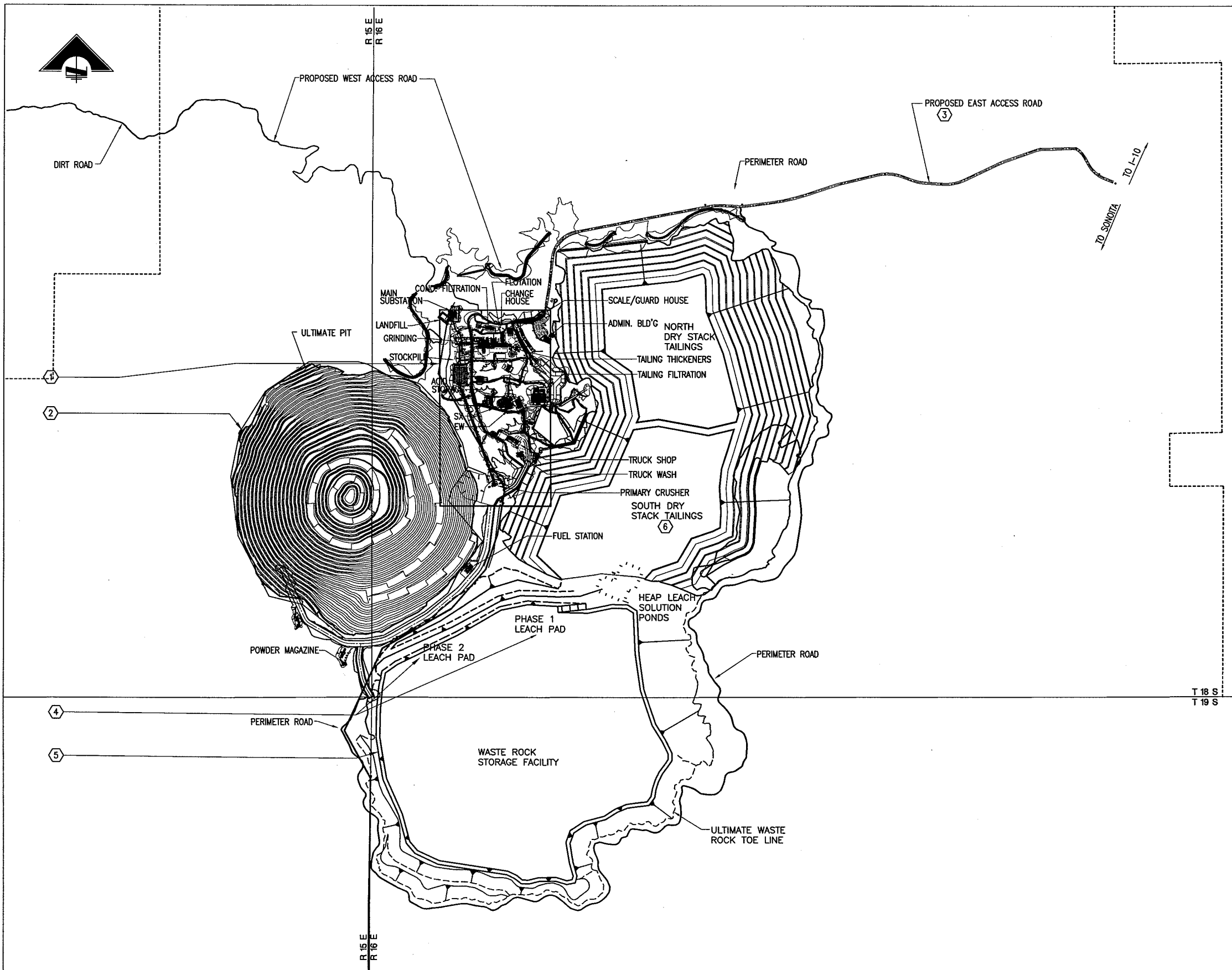
m3 ARCHITECTURE
ENGINEERING
CONSTRUCTION
MANAGEMENT

Tucson, Arizona
Tel. (520) 293-1488 FAX No. (520) 293-8177

ROSEMONT PROJECT

SITE GENERAL ELECTRICAL AREA & ROAD LIGHTING DESIGNATION

JOB NO. M3 PN-08036
 DWG. NO. 000-EL-201
 REV. NO. 2 DATE 29 DEC 09



LUMENS PER ACRE TABLE

HIGH PRESSURE SODIUM

ENTRY ROAD	0 LUMENS
ORE PROCESSING	1,560,000 LUMENS
DRY STACK CONVEYOR	825,000 LUMENS
MINE PIT	4,205,250 LUMENS
LEACH FIELDS	0 LUMENS
TOTAL	6,590,250 LUMENS
LUMENS/ACRE =	6,590,250 LUMENS
	4,415 ACRES
LUMENS/ACRE =	1,493 LUMENS/ACRE
CODE LIMIT:	3,000 LUMENS/ACRE

LOW PRESSURE SODIUM

ENTRY ROAD	1,029,600 LUMENS
ORE PROCESSING	3,646,500 LUMENS
DRY STACK CONVEYOR	2,574,000 LUMENS
MINE PIT	486,200 LUMENS
LEACH FIELDS	0 LUMENS
TOTAL	7,736,300 LUMENS
LUMENS/ACRE =	7,736,300 LUMENS
	4,415 ACRES
LUMENS/ACRE =	1,753 LUMENS/ACRE
CODE LIMIT:	18,000 LUMENS/ACRE

XENON

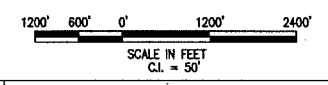
MINE PIT	78,000 LUMENS
LUMENS/ACRE =	78,000 LUMENS
	4,415 ACRES
LUMENS/ACRE =	18 LUMENS/ACRE
CODE LIMITS:	NONE ESTABLISHED

- KEYNOTES:**
- FOR DETAILS OF ORE PROCESSING AREA LIGHTING, REFER TO DRAWING 000-EL-201. 3,646,500 TOTAL LUMENS LPS 1,560,000 TOTAL LUMENS HPS
 - PIT LIGHTING 486,200 LUMENS LPS 4,205,250 LUMENS HPS 78,000 LUMENS XENON
 - ENTRY ROAD 1,029,600 LUMENS LPS 0 LUMENS HPS
 - LEACH PAD LIGHTING 0 LUMENS LPS 0 LUMENS HPS
- (ALL LEACH PAD LIGHTING IS PORTABLE AND IS ON FOR LIMITED TIME PERIODS)
- NO LIGHTING FOR WASTE ROCK STORAGE FACILITY.
 - DRY STACK TAILINGS 2,574,000 LUMENS LPS 825,000 LUMENS HPS
- GENERAL NOTES:**
- REFER TO LUMENS PER ACRE TABLE FOR PIMA COUNTY OUTDOOR LIGHTING CODE COMPLIANCE CALCULATION.
 - BASIS OF LUMENS PER ACRE CALCULATION: TOTAL PROJECT ACREAGE = 4,415



APPROVED
FOR DESIGN DEVELOPMENT

DO NOT SCALE 11x17 DRAWINGS



REFERENCES		REFERENCES		REVISIONS					REVISIONS					SCALE: AS NOTED				
DWG. NO.	TITLE	DWG. NO.	TITLE	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	NO.	DESCRIPTION	BY	APP'D	DATE	CLIENT	DATE		
000-CI-002	CIVIL GENERAL SITE PLAN															DESIGNED BY	FE	APR 09
000-EL-201	AREA AND ROAD DESIGNATION															DRAWN BY	FE	APR 09
				2	NEW BACKGROUND, REVISED AREAS	FE	FE	29 DEC 09								CHECKED BY	FE	DEC 09
				1	NEW BACKGROUND, REVISED LIGHT LEVELS	FE		18 JUN 09								PROJECT MGR	HUSS	DEC 09
				0	IDENTIFIED LIGHTING AREAS AND LEVELS	FE		15 MAY 09								CLIENT APPR.		

3 ARCHITECTURE
ENGINEERING
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MANAGEMENT

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ROSEMONT PROJECT

SITE GENERAL ELECTRICAL

PIMA CO. OUTDOOR LTG. CODE LIGHTING COMPLIANCE PLAN

JOB NO. M3 PN-08036
DWG NO. **000-EL-202**
REV NO. 2 DATE 29 DEC 09

File: P:\2008\06036\TO BE ISSUED\EL\000EL202.dwg LAST UPDATE: DEC 29, 2009 @ 2:11 PM BY: mm1571 LAST REV: P1 PLOT SCALE: 1:1.0